

EARTHDATA Data Discovery ▾ DAACs ▾ Community ▾ Science Disciplines ▾

ORNL DAAC
DISTRIBUTED ACTIVE ARCHIVE CENTER
FOR BIOGEOCHEMICAL DYNAMICS

Sign in

About Us Get Data Submit Data Data Management Tools

[DAAC Home](#) > [Get Data](#) > [Field Campaigns](#) > [NACP \(North America\)](#) > Data Set Documentation

NACP Woody Vegetation Characteristics of 1,039 Sites across North Slope, Alaska, V2

Get Data

Documentation Revision Date: 2017-02-28

Data Set Version: V2

Summary

This data set provides the results of (1) field measurements of woody vegetation (shrubs) at 26 diverse sites across the North Slope of Alaska during 2010 and 2011, (2) field-based statistical estimates of site shrub structural characteristics, (3) high-resolution panchromatic satellite imagery-based estimates of field site shrub characteristics using the Canopy Analysis with Panchromatic Imagery (CANAPI) model, and (4) adjusted CANAPI estimates of shrub characteristics at 1,013 selected sites widely distributed across the North Slope.

A site characterization file is included with the assigned physiognomic vegetation class, which was one of the criteria for the selection of the 1,013 CANAPI sites, and with the sources of the high-resolution imagery used to obtain CANAPI estimates. The CANAPI crown detection algorithm (Chopping, 2011) is also provided as a companion file.

As part of a NASA-funded research project to map changes in tall shrub (taller than 0.5 m) abundance in Arctic tundra, a 3-week field campaign was carried out in 2010 and 2011 on the North Slope of Alaska to statistically survey shrub structural characteristics at 26 sites. The field data presented include genus, crown height, crown radius, and spatial coordinates of all shrubs sampled at each 250 x 250-m site. These measurements were correlated with raw CANAPI structural estimates and the derived regression coefficients were applied to adjust CANAPI estimates for the field sites and additional sites across the North Slope. Together, the field measurements and image-based CANAPI estimates allowed the construction of a robust and extensive data resource of tall shrub characteristics at 1,039 tundra sites (Duchesne et al., 2016).

User Note: This data set is an updated version of:

Duchesne, R.R., M.J. Chopping, and K.D. Tape. 2015. NACP Woody Vegetation Characteristics of 1,039 Sites across the North Slope, Alaska. ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1270>

Users of version 1 should download the updated data files. Changes and additions are described below in Section 8.

There are five *.csv files and one companion *.txt file included in the Version 2 data set.

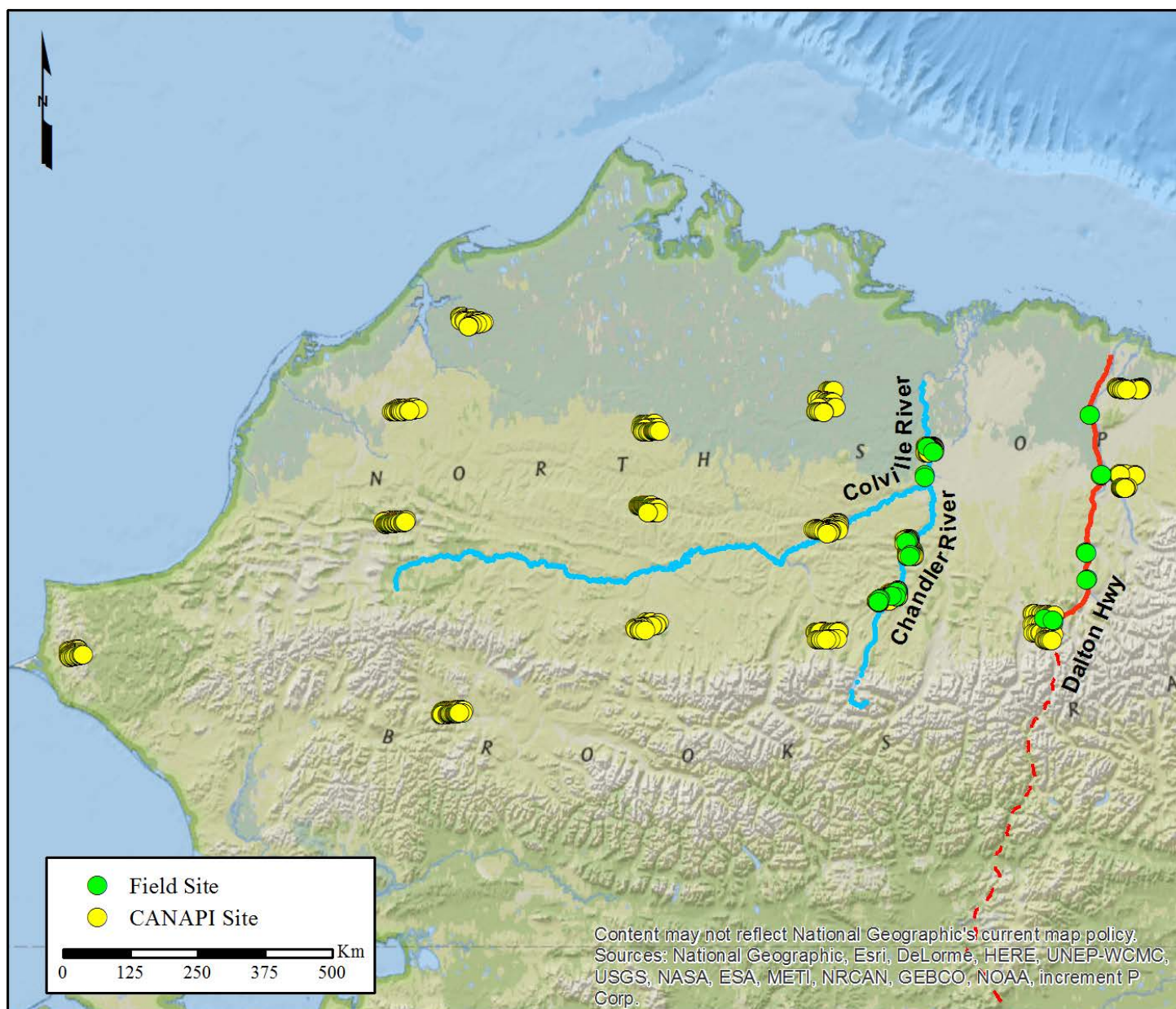


Figure 1. Locations of the 26 field sites and the 1,013 selected CANAPI sites, North Slope, Alaska

Citation

Duchesne, R.R., M.J. Chopping, and K.D. Tape. 2017. NACP Woody Vegetation Characteristics of 1,039 Sites across North Slope, Alaska, V2. ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1365>

Table of Contents

1. [Data Set Overview](#)
2. [Data Characteristics](#)
3. [Application and Derivation](#)
4. [Quality Assessment](#)
5. [Data Acquisition, Materials, and Methods](#)
6. [Data Access](#)
7. [References](#)
8. [Data Set Revisions](#)

1. Data Set Overview

This data set provides the results of (1) field measurements of woody vegetation (shrubs) at 26 diverse sites across the North Slope of Alaska during 2010

and 2011, (2) field-based statistical estimates of site shrub structural characteristics, (3) high-resolution panchromatic satellite imagery-based estimates of field site shrub characteristics using the Canopy Analysis with Panchromatic Imagery (CANAPI) model, and (4) adjusted CANAPI estimates of shrub characteristics at 1,013 selected sites widely distributed across the North Slope.

A site characterization file is included with the assigned physiognomic vegetation class, which was one of the criteria for the selection of the 1,013 CANAPI sites, and with the sources of the high-resolution imagery used to obtain CANAPI estimates. The CANAPI crown detection algorithm (Chopping, 2011) is also provided as a companion file.

As part of a NASA-funded research project to map changes in tall shrub (taller than 0.5 m) abundance in Arctic tundra, a 3-week field campaign was carried out in 2010 and 2011 on the North Slope of Alaska to statistically survey shrub structural characteristics at 26 sites. The field data presented include genus, crown height, crown radius, and spatial coordinates of all shrubs sampled at each 250 x 250-m site. These measurements were correlated with raw CANAPI structural estimates and the derived regression coefficients were applied to adjust CANAPI estimates for the field sites and additional sites across the North Slope. Together, the field measurements and image-based CANAPI estimates allowed the construction of a robust and extensive data resource of tall shrub characteristics at 1,039 tundra sites (Duchesne et al., 2016).

Project: North American Carbon Program (NACP)

The NACP (Denning et al., 2005; Wofsy and Harriss, 2002) is a multidisciplinary research program to obtain scientific understanding of North America's carbon sources and sinks and of changes in carbon stocks needed to meet societal concerns and to provide tools for decision makers. Successful execution of the NACP has required an unprecedented level of coordination among observational, experimental, and modeling efforts regarding terrestrial, oceanic, atmospheric, and human components. The project has relied upon a rich and diverse array of existing observational networks, monitoring sites, and experimental field studies in North America and its adjacent oceans. It is supported by a number of different federal agencies through a variety of intramural and extramural funding mechanisms and award instruments.

This data is an updated version of the following data set:

Duchesne, R.R., M.J. Chopping, and K.D. Tape. 2015. NACP Woody Vegetation Characteristics of 1,039 Sites across the North Slope, Alaska. ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1270>

Related Publication:

Duchesne, R.R., Chopping, M.J. and Tape, K.D. 2016. Capability of the CANAPI algorithm to derive shrub structural parameters from satellite imagery in the Alaskan Arctic. *Polar Record*, 52(2), pp. 124–133. <http://dx.doi.org/10.1017/S0032247415000509>

2. Data Characteristics

Spatial Coverage: North Slope, Alaska

Spatial Resolution: Plots of 250 x 250-m are distributed across the North Slope. See Figure 1.

Temporal Coverage:

The field work was conducted during the summers of 2010 and 2011 -- beginning 2010-07-28 and ending 2011-08-04.

High resolution panchromatic images used for estimating shrub characteristics were from various dates between 2002-07-19 and 2012-06-21.

Temporal Resolution: one-time estimates

Site Boundaries: (All latitude and longitude given in decimal degrees)

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
North Slope, Alaska	-167	-145	71.4	65

Data File Information

Field Shrub Canopy Structure Data

The structural characteristics of woody vegetation (genus, height, crown radius, and geographic location) were surveyed at fourteen 250 x 250-m sites along the Chandler and Colville rivers and at twelve 250 x 250-m sites along the Dalton Highway.

Results are contained in the files:

colville_shrub_data_V2.csv
dalton_shrub_data_V2.csv

Projection Parameters

Projection Type: Universal Transverse Mercator Zone 5N
Spheroid Name: WGS 84
Datum: WGS 84

False Easting: 500000.00
 False Northing: 0.00
 Central Meridian: -153.00
 Scale Factor: 0.999600000000000040
 Latitude of Origin: 0.00

Table 1. Variable descriptions for *colville_shrub_data_V2.csv* and *dalton_shrub_data_V2.csv* data files.

Column	Description	Units/format
Site	Unique identifier of site: The letters describe the name of the expedition, the following 4 digits are the collection year, and the last digits indicate the sites sequence north to south.	
Sp_genus	Scientific genus name up to 25 characters	
Organization	Indicates whether measurements represent an individual shrub or a cluster of shrubs	
Canopy_height	Shrub height from ground to top most branch	Meters
Crown_radius	Shrub crown radius measured as half the distance from the left most branch to the right most branch	Meters
X_coordinate	Shrub location X coordinate	Meters
Y_coordinate	Shrub location Y coordinate	Meters

Sample Data Records:

```
Site,Sp_genus,Organization,Canopy_height,Crown_radius,X_coordinate,Y_coordinate
,Meters,Meters,Meters,Meters
Colville201001,Alnus sp.,Individual,1.32,0.73,558010,7729420
Colville201001,Alnus sp.,Individual,1.34,1.05,558010,7729420
Colville201001,Alnus sp.,Individual,1.27,0.7,558022,7729439
Colville201001,Alnus sp.,Individual,1.18,1.35,558055,7729407
...
Colville201014,Salix sp.,Individual,1.18,0.79,528109,7626599
Colville201014,Salix sp.,Individual,0.7,0.79,528127,7626600
Colville201014,Alnus sp.,Individual,1.05,0.49,528140,7626603
Colville201014,Alnus sp.,Individual,0.87,1.31,528161,7626608
```

Field Estimates Data

This data file contains estimates of mean crown radius, mean shrub height, total number of shrubs, and fractional cover for the 14 sites along the Chandler and Colville rivers and 12 sites along the Dalton Highway that were surveyed using the belt transect method.

Estimates of the structural characteristics of woody vegetation are contained in the file *field_estimates_data.csv*.

Projection Parameters

Projection Type: Alaska Albers Equal Area Conic
 Spheroid Name: WGS 84
 Datum: WGS 84
 False Easting: 0.00
 False Northing: 0.00
 Central Meridian: -154.00
 Standard Parallel 1: 55.00
 Standard Parallel 2: 65.00
 Latitude of Origin: 50.00
 Linear Unit: Meter

Table 2. Variable descriptions for *field_estimates_data_V2.csv*.

Column	Description	Units/format
Site	Unique identifier of site: The letters describe the name of the expedition, the following 4 digits are the collection year, and the last digits indicate the sites sequence north to south.	
Number_of_shrubs_per_unit_area	Estimate of the total number of shrubs at each sampling site. Sites are 250 x 250 meters (6.25 ha).	Count
Canopy_height_mean	Shrub mean height estimated as the average height of all shrubs surveyed.	Meters

Crown_radius_mean	Shrub mean crown radius estimated as the average crown radius of all individual shrubs surveyed.	Meters
Shrub_area_fraction	Shrub fractional cover was estimated by dividing the “sum of all shrub crown area” by the area of the belt transects sampled at each site.	Range 0 to 1
X_coordinate	X_coordinate of site center point	Meters
Y_coordinate	Y_coordinate of site center point	Meters

Sample Data Records:

```
Site,Number_of_shrubs_per_unit_area,Canopy_height_mean,Crown_radius_mean,Shrub_area_fraction,X_coordinate,Y_coordinate
,Meters,Meters,Range_0_to_1,Meters,Meters
Colville201001,18,1.22,1.142,0.001,98250,2190000
Colville201002,760,1.582,1.007,0.063,102500,2187250
Colville201003,365,1.231,0.986,0.026,97750,2172250
Colville201004,810,1.516,1.205,0.097,97750,2171000
...
Dalton201109,870,0.695,0.919,0.118,183000,2082250
Dalton201110,570,0.656,0.529,0.023,189000,2081250
Dalton201111,360,0.63,0.67,0.009,182750,2082000
Dalton201112,0,0,0,0,188500,2081250
```

CANAPI Estimates Data

The adjusted image-based estimates for the 26 field sites and the 1,013 selected sites, using the CANAPI (Canopy Analysis with Panchromatic Imagery) crown detection recognition algorithm (Chopping, 2011), are in the file *canapi_estimates.csv*.

Projection Parameters

Projection Type: Alaska Albers Equal Area Conic
 Spheroid Name: WGS 84
 Datum: WGS 84
 False Easting: 0.00
 False Northing: 0.00
 Central Meridian: -154.00
 Standard Parallel 1: 55.00
 Standard Parallel 2: 65.00
 Latitude of Origin: 50.00
 Linear Unit: Meter

Table 3. Variable descriptions for *canapi_estimates.csv*.

Column	Description	Units/format
Site	Unique identifier of site: Year of collection of high resolution imagery followed by four sequential digits.	
Adj_number_of_shrubs_per_unit_area	Adjusted CANAPI total number of shrubs after applying regression coefficients based on calibrated field measurements. Sites are 250 x 250 meters (6.25 ha).	Count
Adj_crown_radius_mean	Adjusted CANAPI shrub mean crown radius estimate after applying regression coefficients based on calibrated field measurements.	Meters
Adj_shrub_area_fraction	Adjusted CANAPI shrub fractional cover estimate after applying regression coefficients based on calibrated field measurements.	Range 0 to 1
X_coordinate	Center point X coordinate in 250 x 250-m plot	Meters
Y_coordinate	Center point Y coordinate in 250 x 250-m plot	Meters

Sample Data Records:

```
Site,Adj_number_of_shrubs_per_unit_area,Adj_crown_radius_mean,Adj_shrub_area_fraction,X_coordinate,Y_coordinate
,Count,Meters,Range_0_to_1,Meters,Meters
20100001,953,0.8583,0.0653,90000,2120000
20100002,739,0.7538,0.0351,90250,2120000
20100003,631,0.8377,0.0402,89750,2119500
20100004,535,0.9534,0.0523,90250,2119500
...
```

```
20101010,253,0.766,0.013,186500,2068000
20101011,278,0.789,0.016,187500,2068000
20101012,173,0.746,0.008,188000,2068000
20101013,486,0.699,0.02,189000,2068000
```

Vegetation Class and Imagery Source Data

All sites have been assigned a “Physiognomic vegetation class” according to the circumpolar vegetation map of the CAVM Team (2003). Vegetation class diversity was one of the criteria for the selection of the 1,013 sites for CANAPI estimates. Also included in this file is the source of the high resolution imagery used to obtain CANAPI estimates for all sites.

The file containing the physiognomic vegetation class and imagery source data is *CAVM-class_sensor-info.csv*.

Projection Parameters

```
Projection Type: Alaska Albers Equal Area Conic
Spheroid Name: WGS 84
Datum: WGS 84
False Easting: 0.00
False Northing: 0.00
Central Meridian: -154.00
Standard Parallel 1: 55.00
Standard Parallel 2: 65.00
Latitude of Origin: 50.00
Linear Unit: Meter
```

Table 4. Variable descriptions for *CAVM-class_sensor-info.csv*.

Column	Description	Units/format
Site	Unique identifier of site: for field sites -- The letters describe the name of the expedition, the following 4 digits are the collection year, and the last digits indicate the sites sequence north to south. For selected and estimated sites -- Year of collection of high resolution imagery followed by four sequential digits.	
X_coordinate	Center point X coordinate in 250 x 250-m plot	Meters
Y_coordinate	Center point Y coordinate in 250 x 250-m plot	Meters
CAVM_class	Physiognomic vegetation class of sampling sites according to the CAVM Team (B=Barrens, G=Graminoid tundra, S=Erect-shrub tundra, W=Wetland) (CAVM Team. 2003)	
Sensor	Provenance of high resolution imagery used for obtaining CANAPI estimates for the entire reference database	
Acquisition_date	Date of acquisition of high resolution imagery	yyyy-mm-dd

Sample Data Records:

```
Site,X_coordinate,Y_coordinate,CAVM_class,Sensor,Acquisition_date
,Meters,Meters,yyyy-mm-dd
Colville201001,98250,2190000,W,-999
Colville201002,102500,2187250,W,QuickBird,2009-09-05
Colville201003,97750,2172250,S,-999
Colville201004,97750,2171000,S,-999
...
20101010,186500,2068000,G,GeoEye,2010-06-21
20101011,187500,2068000,G,GeoEye,2010-06-21
20101012,188000,2068000,G,GeoEye,2010-06-21
20101013,189000,2068000,G,GeoEye,2010-06-21
```

3. Application and Derivation

The field data reported includes species name, crown height, crown radius, and spatial coordinates of all shrubs sampled at each site. The image-based estimates presented include mean height, mean crown radius, and fractional cover of shrubs at 1,013 sites. Only shrubs taller than 0.5 m were surveyed; the purpose of this data collection was to document the structural characteristics of the woody vegetation taller than 0.5 meters at the field sites, which were used for the training and validation of the empirical-boosted regression tree model that can retrieve shrub cover from bidirectional reflectance data (e.g., from the Earth-orbiting NASA Multiangle Imaging Spectro-Radiometer) and terrain variables. See Duchesne et al. (2016) for details.

4. Quality Assessment

Accuracy of the regression equations used to adjust the CANAPI estimates for each vegetation parameter was assessed and reported in terms of the R-squared and the root mean square error (RMSE).

Table 5. R-squared and the root mean square error (RMSE)

Vegetation Characteristic	R-squared	RMSE
Total number of shrubs	0.54	446 shrubs
Mean crown radius	0.80	0.28 meters
Fractional cover	0.83	0.01

5. Data Acquisition, Materials, and Methods

Field Site Descriptions

The structural characteristics of woody vegetation were surveyed at fourteen 250 x 250-m sites along the Chandler and Colville rivers and at twelve 250 x 250-m sites along the Dalton Highway (Figure 2). Sampling sites are in an altitudinal and latitudinal climatic gradient with the southernmost sites at higher elevations and influenced by the continental climate coming from the Brook Range, and the northernmost sites at much lower elevations, where maritime climate conditions prevail. Details of sampling, image processing, and analyses may be found in Duchesne et al. (2016).

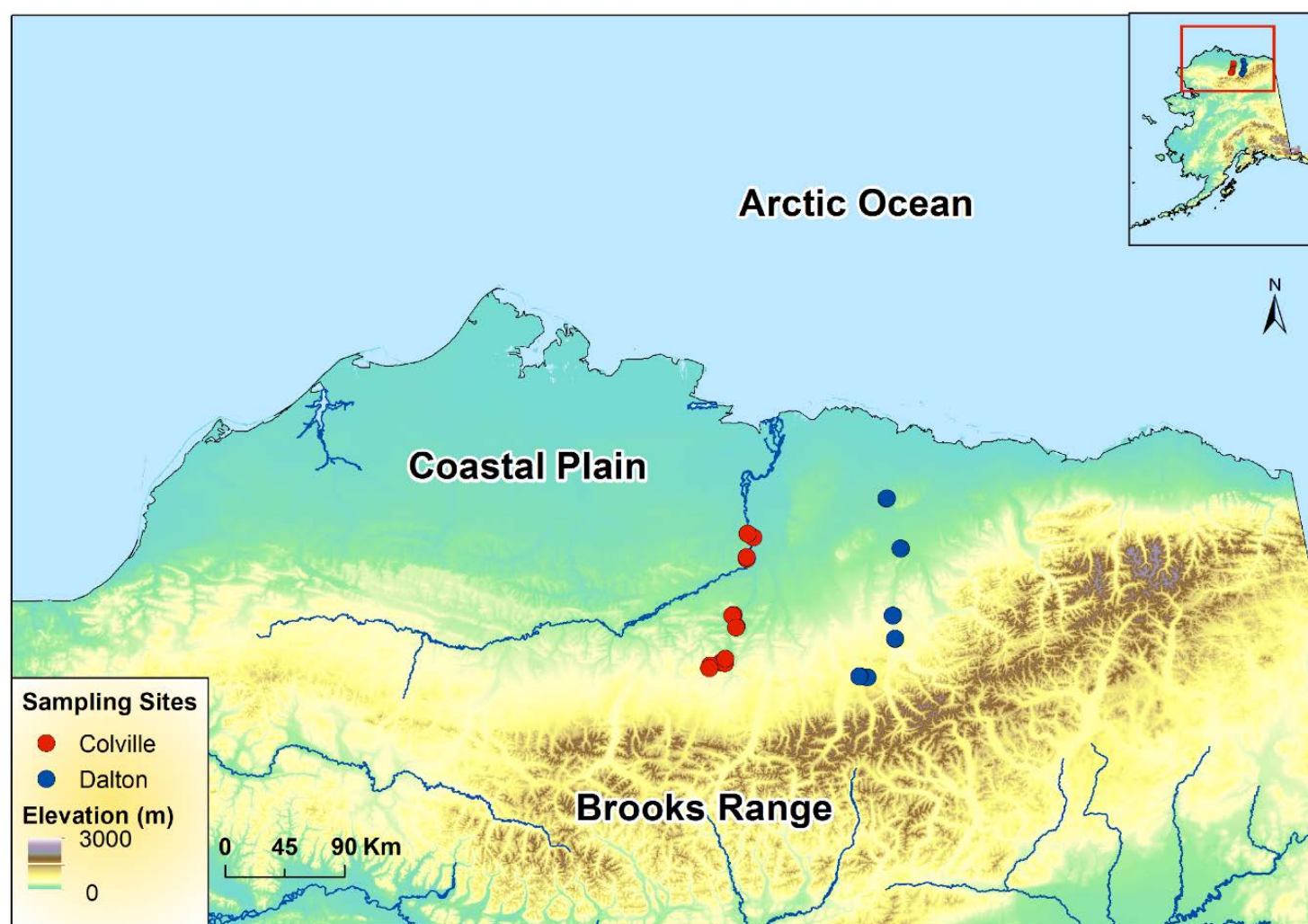


Figure 2. Field Sites: Sampling sites along the Colville and Chandler Rivers (on the left) and sampling sites along the Dalton Highway (on the right). (Source: AlaskaMapped SDMI WCS layers [downloaded file]. Alaska Mapped, Statewide Digital Mapping Initiative.

URL:<http://www.alaskamapped.org/data/arcgis-layer-files/>: [20 February, 2015])

The coordinates and elevation were determined using a Global Positioning System (GPS). Elevation data are +/- 30 m, and horizontal locations +/- 10 m. The X and Y coordinates are the center point in a 250 x 250-m site in standard Albers Conical Equal Area grid for Alaska, Spheroid WGS 84, Datum WGS 84.

Table 6. Field site descriptions. Note that for Site Identifier, Colville and Dalton denote the names of the 2010 and 2011 expeditions, respectively. The following 4 digits are the collection year, and the last digits indicate the site sequence north to south. Site Feature values identify either the river or highway near the field site.

Site Identifier	Site Feature	X Coordinate	Y Coordinate	Elevation (m)	Number of Transects	Sampling Date	Available Photo
Colville201001	Colville River	98250	2190000	94	Not applicable. Entire site surveyed.	08/11/2010-08/12/2010	
Colville201002	Colville River	102500	2187250	96	10	08/10/2010	Figure 6
Colville201003	Colville River	97750	2172250	96	10	08/09/2010	
Colville201004	Colville River	97750	2171000	96	5	08/09/2010	
Colville201005	Chandler River	87750	2128750	150	5	08/05/2010	
Colville201006	Chandler River	86750	2128250	145	10	08/05/2010	
Colville201007	Chandler River	89750	2120000	143	5	08/03/2010	Figure 3
Colville201008	Chandler River	89500	2119000	222	5	08/03/2010	
Colville201009	Chandler River	81500	2095500	249	10	08/02/2010	
Colville201010	Chandler River	81000	2092000	249	5	08/01/2010	
Colville201011	Chandler River	78000	2092500	297	10	07/30/2010-07/31/2010	
Colville201012	Chandler River	70000	2090500	287	5	07/29/2010	
Colville201013	Colville River	69750	2090000	289	10	07/28/2010	
Colville201014	Colville River	69250	2088250	290	10	07/29/2010	Figure 4
Dalton201101	Dalton Highway	203250	2216500	76	5	07/30/2011	
Dalton201102	Dalton Highway	203500	2216750	78	5	07/30/2011	
Dalton201103	Dalton Highway	213750	2178750	203	5	07/29/2011	
Dalton201104	Dalton Highway	214000	2179000	225	5	07/29/2011	
Dalton201105	Dalton Highway	207750	2128250	392	5	07/26/2011	
Dalton201106	Dalton Highway	208250	2128000	392	5	07/26/2011	
Dalton201107	Dalton Highway	209750	2110750	409	5	07/25/2011	
Dalton201108	Dalton Highway	209750	2110250	438	5	07/25/2011	
Dalton201109	Dalton Highway	183000	2082250	790	5	07/22/2011	
Dalton201110	Dalton Highway	189000	2081250	752	5	08/04/2011	
Dalton201111	Dalton Highway	182750	2082000	768	5	07/22/2011	
Dalton201112	Dalton	188500	2081250	n/a	5	08/04/2011	Figure 5



Figure 3. Aerial photograph of the Colville201007 field sampling site and surrounding landscape. The top of the image is north. Photo credit: Ken Tape (University of Alaska, Fairbanks).



Figure 4. Portion of Colville201014 site.



Figure 5. Portion of Dalton201112 site.

Field Sampling and Measurements

The belt-transect method was used to survey 25 out of the 26 field sites. At site Chandler201001, all shrubs across the site were surveyed. Transects were 5-m wide and 250-m long and their number per site varied between 5 and 10 depending on the difficulty of access to the site. The belt transects ran parallel to each other and across the terrain altitudinal gradient (Figure 6).

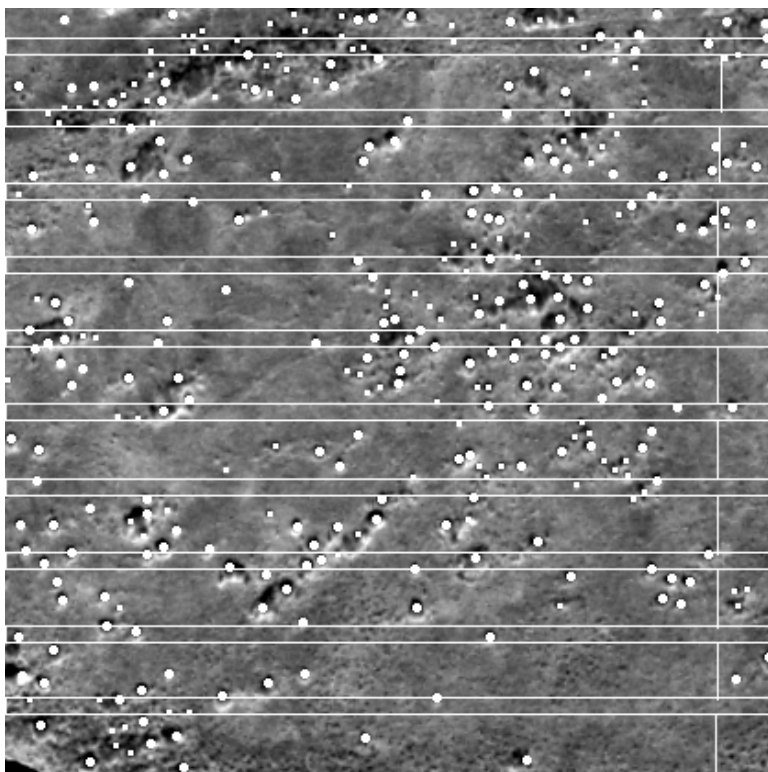


Figure 6. Illustration of potential belt transects placement at field site Colville 201002 (250 m x 250 m). White dots represent shrubs observed in the QuickBird panchromatic subset. Belt transects are 5-m wide by 250-m long and run perpendicular to the terrain slope.

All shrubs taller than 0.5-m within the belt transects were surveyed by taking its photograph next to a measuring rod and recording its GPS coordinates (Figures 7-9). In the lab, the photographs were calibrated to estimate shrub height, defined as the vertical extent of the shrub and measured from its base to the top of its foliage, and crown radius, defined as the horizontal extent of the canopy and measured from the left-most branch to the right-most branch of the shrub.





Figures 7-9. Photographs of surveyed shrubs next to the measuring rod at site Colville 201002. From top to bottom: *Willow* sp., *Alder* Sp., and *Alder* Sp.

Field Site Estimates

The total number of shrubs, mean crown radius, mean shrub height, and fractional cover were estimated for each field site from the survey measurements.

The total number of shrubs was estimated by counting all surveyed shrubs, within the belt transects, sampled at each site.

Mean crown radius was estimated using only those observations where individual shrubs were clearly delimited. For that estimate, clusters of shrubs were not included in the analysis because the boundaries of the shrubs could not be identified. Mean shrub height was estimated using all the observations, both individual and clusters of shrubs.

Fractional cover was estimated by dividing the “sum of all shrub crown area” by the area of the belt transects sampled at each site. To calculate the sum of all crown area, both surveyed individual shrubs and clusters of shrubs were included; a cluster was considered one observation. Since the belt width was 5 m, individual shrubs and clusters that exceeded 5-m wide were adjusted to the maximum width of the belt transect.

CANAPI Shrub Estimates for Field Sites

The high resolution image-based shrub estimates for the field sites were obtained using the CANAPI algorithm in conjunction with high resolution panchromatic scenes for the North Slope of Alaska. Some scenes were purchased for the project while others were accessed through the National Geospatial-Intelligence Agency Commercial Archive Data site (<http://cad4nasa.gsfc.nasa.gov/>) that provides access for NASA Earth Science Investigators. CANAPI is a user-tunable algorithm that uses high resolution panchromatic imagery to identify and trace tree or shrub crowns by locating its crescent-shaped sunlit portion (Chopping, 2011).

CANAPI estimates for the Arctic woody vegetation present some departures from the field site estimates which are based on the survey measurements. For instance, CANAPI tends to underestimate fractional cover when there are clusters of shrubs present in the scene because it is unable to identify individual shrubs. Where vegetation is sparse, CANAPI estimates are very close to field data. On the other hand, mean crown radius CANAPI estimates are often lower in comparison with the field estimates.

Adjustment of CANAPI Estimates

In order to adjust the CANAPI estimates of fractional cover, mean crown radius, and total number of shrubs, regression coefficients were derived by finding the relations between the CANAPI estimates and the corresponding field estimates via simple linear regressions, for 25 field sites. Outliers were omitted from the analysis.

- High R-squared values for fractional cover and mean crown radius (0.83 and 0.80 respectively) suggest that it is appropriate to use the regression coefficients to adjust CANAPI estimates (Figures 10 a and b).
- Since the regression for total number of shrubs had a medium R-squared (0.54), using the regression equation to adjust CANAPI estimates must be done with caution (Figure 10 c).

These regression coefficients were used to adjust new CANAPI estimates obtained for 1,013 sites across the North Slope of Alaska.

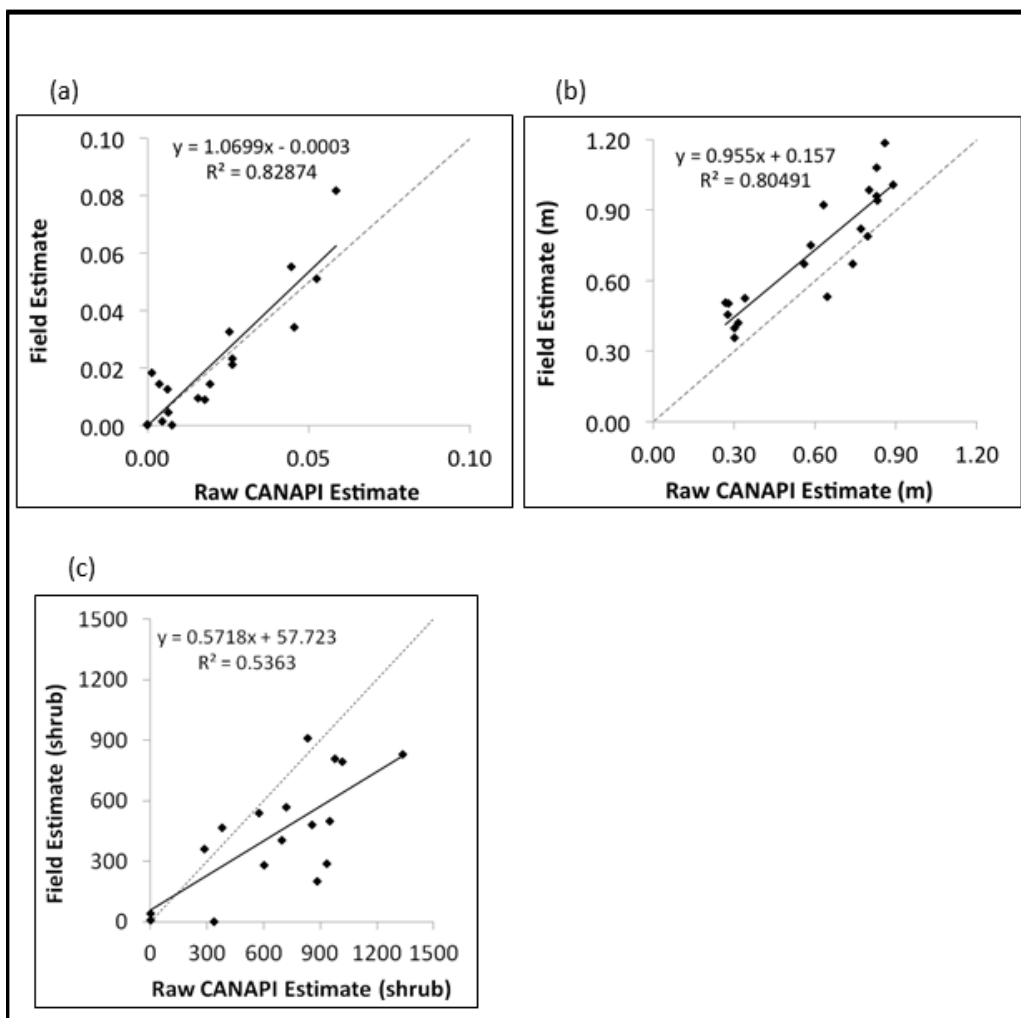


Figure 10. Scatter plots displaying relationships between CANAPI-derived and field estimates for 25 sampling sites: (a) correlation for fractional cover ($R^2 = 0.83$), (b) correlation for mean crown radius ($R^2 = 0.80$), (c) correlation for total number of shrubs ($R^2 = 0.54$)

Expansion of Tall Shrub Characteristics Reference Database

A total of 1,013 sites of 250 x 250-m were selected across North Slope. Sites were explicitly chosen to include representatives from all four physiognomic vegetation classes present in the region (CAVM Team, 2003) and from across the broad latitudinal and longitudinal range of the North Slope (Figure 1). The selection depended first on the availability of high resolution imagery, and then, on a visual assessment of the area to select sites with different degrees of cover from each physiognomic vegetation class.

The CANAPI algorithm was used to obtain total number of shrubs, fractional cover, and mean crown radius estimates for the new 1,013 sites. The estimates were later adjusted using the regression equations obtained in the previous step above. Together, the field measurements and image-based CANAPI estimates allowed the construction a robust and extensive data resource of tall shrub characteristics at 1,039 tundra sites. The adjusted image-based estimates are in the **canapi_estimates.csv** data file.

For the 1,013 new sites, the distribution of the Total Number of Shrubs and the Fractional Cover CANAPI estimates is skewed to the left and therefore the five-number summary is a better measurement of center and spread. In the case of the Mean Crown Radius CANAPI estimates, the values follow a normal distribution and for that reason the mean and the standard deviation are better measurements of center and spread.

Table 7. Fractional Cover and Mean Crown Radius Summary Statistics

	Total Number of Shrubs	Fractional Cover	Mean Crown Radius
Minimum	58	0.000	n.a.
First Quartile	166	0.006	n.a.
Median	292	0.016	n.a.
Third Quartile	611	0.044	n.a.

Maximum	1794	0.399	n.a.
Mean	n.a.	n.a.	0.832 m
Standard Deviation	n.a.	n.a.	0.163 m

CANAPI Model and Software Requirements

A copy of the CANAPI model (Chopping, 2011) is also provided. The file is named [CANAPI_AK.txt](#). This model was developed by Mark Chopping and requires significant user input to obtain reasonable results.

- Any AK-specific modifications were done on a site by site basis. That means that the original code was the same, but the settings were adjusted for each site according to the needs.
- In the particular case of identifying shrubs in the Arctic, CANAPI works best with sub-meter high resolution panchromatic imagery (i.e., GeoEye and QuickBird).

CANAPI requires input information from the high resolution imagery to be used with it including:

- Spatial resolution in meters
- Solar elevation angle in degrees at the time the image was acquired
- Rotation angle so that the shadow cast by the objects faces south

Other settings that are necessary to define are:

- Saturation percentage for image contrast stretch (usually set to 1 but can be larger)
- Lower threshold for sunlit crown isolation (16-bit) (values can range from 50,000 to 65,535)
- Iterations of the watershed algorithm (usually set to 1)
- Particle Analyzer minimum size (usually set to 1)
- Particle Analyzer maximum size (values can range from 75 to 100)
- Radius for median filter (usually set to 1 or 2)
- Limit crown radius maximum, in pixels (for shrubs, it is recommended values less than 5)
- Limit crown area minimum in square pixels (usually set to 1)
- Upper threshold for shadow isolation (usually set to 70 but it could be higher)
- Limit shadow length in meters (for shrubs, a value of 4 works well)
- Convolve matrix (3x3)

Software Requirements:

The CANAPI model runs as a macro in ImageJ v.1.44. The latter is a public domain Java image processing software developed by Wayne Rasband from the National Institute of Mental Health. It is downloadable from <http://imagej.nih.gov/ij/index.html>.

6. Data Access

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

[NACP Woody Vegetation Characteristics of 1,039 Sites across North Slope, Alaska, V2](#)

Contact for Data Center Access Information:

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

7. References

CAVM Team. 2003. Circumpolar Arctic Vegetation Map. (1:7,500,000 scale), Conservation of Arctic Flora and Fauna (CAFF) Map No. 1. U.S. Fish and Wildlife Service, Anchorage, Alaska. ISBN: 0-9767525-0-6, ISBN-13: 978-0-9767525-0-9

Chopping M. (2011). CANAPI: Canopy Analysis with Panchromatic Imagery. *Remote Sensing Letters*, 2(1): 21-29. <http://dx.doi.org/10.1080/01431161.2010.486805>

Denning, A.S., et al. 2005. Science implementation strategy for the North American Carbon Program: A Report of the NACP Implementation Strategy Group of the U.S. Carbon Cycle Interagency Working Group. U.S. Carbon Cycle Science Program, Washington, DC. 68 pp.

Duchesne, R.R., Chopping, M.J. and Tape, K.D. 2016. Capability of the CANAPI algorithm to derive shrub structural parameters from satellite imagery in the Alaskan Arctic. *Polar Record*, 52(2), pp. 124–133. <http://dx.doi.org/10.1017/S0032247415000509>

Duchesne, R.R., M.J. Chopping, and K.D. Tape. 2015. NACP Woody Vegetation Characteristics of 1,039 Sites across the North Slope, Alaska. Data set. ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1270>

Wofsy, S.C., and R.C. Harriss. 2002. The North American Carbon Program (NACP). Report of the NACP Committee of the U.S. Interagency Carbon

Cycle Science Program. U.S. Global Change Research Program, Washington, DC. 56 pp.

8. Data Set Revisions

Changes between Versions 1 and 2 effective December 15, 2016. Users should download the updated files and note the changes to documentation.

Data files:

colville_shrub_data_V2.csv

- Now includes an "Organization" column indicating whether the reported measurement is of an individual shrub or a cluster of shrubs
- 12 additional observations
- Several corrections to previously reported data

dalton_shrub_data_V2.csv

- Now includes an "Organization" column indicating whether the reported measurement is of an individual shrub or a cluster of shrubs
- Site "Dalton201210" corrected to "Dalton201110"
- No other additions or corrections

field_estimates_V2.csv

- Number of shrubs for "Colville201002" site reduced from 1520 to 760
- No other additions or corrections

No changes were made to *canapi_estimates.csv* or *CAVM-class_sensor-info.csv*.

Documentation:

In Table 6. (Section 5, above), the number of transects for "Colville201002" site was corrected from 5 to 10.



[Privacy Policy](#) | [Feedback](#) | [Help](#)



[Home](#)

[About Us](#)

[Who We Are](#)
[Partners](#)
[User Working Group](#)
[Biogeochemical Dynamics](#)
[Data Citation Policy](#)
[News](#)
[Workshops](#)

[Get Data](#)

[Complete Data Set List](#)
[Search for Data](#)
[Field Campaigns](#)
[Validation](#)
[Regional/Global](#)
[Model Archive](#)

[Data Management](#)

[Plan](#)
[Manage](#)
[Archive](#)
[DAAC Curation](#)
[Submit Data](#)

[Tools](#)

[Data Search](#)
[Site Search](#)
[Search by DOI](#)
[WebGIS](#)
[SDAT](#)
[MODIS Land Subsets](#)
[THREDDS](#)

[Help](#)

[FAQs](#)

[Contact Us](#)