SMAPVEX16 Manitoba In Situ Vegetation Data, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

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FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SV16M_V

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

This data set contains various plant characteristics, such as biomass, plant height, plant density, and growth stage.

1.2 File Information

1.2.1 Format

Data are available as Comma-Separated Values (.csv) files.

Location information for the relevant field sites are available in a Keyhole Markup Language zipped (.kmz) files.

Extensible Markup Language (.xml) files with associated metadata are also provided.

1.2.2 File Contents

Crop height data are available in `file SV16M_V_CropHeight_Vers3.csv`. The file contents are described in Table 1; Figure 1 shows the file headers and ten lines of sample data.

Table 1. Crop Height File Contents

Column Headers	Description
SITE_ID	Unique ID of the field site where sampling occurred. Each field had 16 possible sample locations
DATE	Date in 2-digit month, day, and year (MM/DD/YY) format
CROP	Crop grown in the sampled field in 2016
GROWTH_STAGE	Growth stage, measured on the BBCH (Biologische Bundesanstalt, Bundessortenamt and Chemical industry) Scale
CROP_HEIGHT	Average crop height (cm)

SITE_ID	DATE	CROP	GROWTH_STAGE	CROP_HEIGHT
14-2	6/13/16	Corn	14	26
14-11	6/13/16	Corn	13	16
14-14	6/13/16	Corn	14	25
31-2	6/13/16	Wheat	14	25
31-11	6/13/16	Wheat	13	19
31-14	6/13/16	Wheat	13	20
32-2	6/13/16	Wheat	13	23
32-11	6/13/16	Wheat	13	18
32-14	6/13/16	Wheat	14	28
62-2	6/13/16	Wheat	15-22	35

Figure 1. Crop Height Sample Data

Crop density, row direction, row spacing, and seeding date observations are available in file `SV16M_V_CropDensity_Vers3.csv`. The file contents are described in Table 2; Figure 2 shows the file headers and ten lines of sample data.

Table 2. Crop Density File Contents

Column Header	Description
Field ID	Unique ID of the field site where sampling occurred
CROP	Crop grown in the sampled field in 2016
ROW_SPACING	Average distance (cm) between seed rows
ROW_DIRECTION	Row direction (degrees)
SAMPLE_DISTANCE	Distance (m) over which plant counts were taken
PLANT_COUNT	Average number of plants in the sample distance
SEED_DATE	Date crop was seeded, in 2-digit month, day, and year (MM/DD/YY) format

CROP	ROW_SPACING	ROW_DIRECTION	SAMPLE_DISTANCE	PLANT_COUNT	SEED_DATE
Corn	75.7	354	3	12.8	
Wheat	19.4	358	1	36.7	5/3/16
Wheat	19.6	357	1	21.3	5/3/16
Soybeans	51.7	358	3	23.4	5/10/16
Canola	27.1	97	1	25.4	4/30/16
Wheat	25.3	97	1	39.5	
Wheat	19	6	1	56.3	
Soybeans	76.8	98	3	77.2	
Soybeans	39.3	3	3	12.2	5/12/16
Soybeans	38.4	4	3	34.7	5/12/16

Figure 2. Crop Density Sample Date

Crop biomass data are available in file SV16M_V_CropBiomass_Vers3.csv. This file includes the date of sampling, crop sampled, growth stage, plant water content, wet biomass, and dry biomass. The file contents are described in more detail in Table 3.

Table 3. Crop Biomass File Contents

Column Headers	Descriptions
SITE_ID	Unique ID of the field site where sampling occurred; each field had 16 possible sample locations
DATE	Date of sampling, in 2-digit month, day, and year (MM/DD/YY) format
CROP	Crop grown in the sampled field in 2016
GROWTH_STAGE	Growth stage, measured on the BBCH (Biologische Bundesanstalt, Bundessortenamt and Chemical Industry) Scale
PLANT_TYPE	Parts of the plant (e.g. stems, leaves) partitioned and weighed separately
OVEN_DRY_COR	Oven dry correction factor that is applied to air dry weights
PLANT_WATER_CONTENT_PERCT	Plant water content (%)
PLANT_WATER_CONTENT_AREA	Plant water content (kg/m^2)
TOTAL_WET_BIOMASS_WEIGHT	Total net wet biomass weight (kg)
TOTAL_WET_BIOMASS_AREA	Total net wet biomass (kg/m^2)
TOTAL_DRY_BIOMASS_WEIGHT	Total net dry biomass weight (kg)
TOTAL_DRY_BIOMASS_AREA	Total net dry biomass (kg/m^2)

1.2.3 Naming Convention

SV16M_V_CropHeight_Vers3.csv
SV16M_V_CropDensity_Vers3.csv
SV16M_V_CropBiomass_Vers3.csv
SV16M_V_FieldSites.kmz
SV16M_V_Fields.kmz

SV16M_V is an abbreviation for SMAPVEX16 (Soil Moisture Active Passive Validation Experiment 2016) Manitoba In Situ Vegetation Data.

1.2.4 File Size

CSV files range in size between approximately 24 KB and 1.6 MB.

The KMZ files range in size between approximately 10 KB and 29 KB.

1.3 Spatial Information

1.3.1 Coverage

Northernmost Latitude: 49.761171° N
Southernmost Latitude: 49.384076° N
Easternmost Longitude: 97.756264° W
Westernmost Longitude: 98.098417° W

1.3.2 Geolocation

Table 4 provides information on the coordinate reference system for this data set.

Table 4. Coordinate Reference System

Geographic coordinate system	NAD83(CSRS)
Projected coordinate system	NAD83(CSRS) / UTM Zone 14N
Longitude of true origin	-99
Latitude of true origin	0
Scale factor at longitude of true origin	0.9996
Datum	NAD83 Canadian Spatial Reference System
Ellipsoid/spheroid	GRS 1980
Units	meter
False easting	500000
False northing	0
EPSG code	3158
PROJ4 string	+proj=utm +zone=14 +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs
Reference	https://epsg.io/3158

1.4 Temporal Information

1.4.1 Coverage

Data were collected between 13 June 2016 and 21 July 2016.

1.4.2 Resolution

Fields were sampled multiple times and the time between samples varied.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

This data set was collected as part of the 2016 Soil Moisture Active Passive Validation Experiment conducted in the Carman/Elm Creek region of Manitoba, Canada. The experiment was designed to calibrate and increase the accuracy of NASA Soil Moisture Active Passive (SMAP) products. For this data set, plant characteristics were observed to coincide with SMAP satellite overpasses and Passive Active L- and S-band Sensor (PALS) flights.

2.2 Acquisition

Vegetation characteristics were collected from 50 agricultural fields. Each field had 16 possible sampling location. Prior to the campaign, the location of each sample site was assigned using ArcGIS. During the campaign, field crews identified sampling sites using Garmin GPS units. The accuracy of each GPS unit was approximately 3 m.

2.2.1 Row Spacing

Prior to the start of the SMAPVEX16 Manitoba campaign, field crews used a meter stick to measure row spacing (the distance between adjacent crop rows) wherever plant counts were performed. At each plant count location, row spacing was measured twice using the rows to the left and right of the plant count row, for a total of 20 measurements per field. Only the average row spacing for each field is presented in this data set.

2.2.2 Row Direction

Prior to the start of the SMAPVEX16 Manitoba campaign, the direction of planting was measured using a compass with magnetic North as a reference.

2.2.3 Seeding Date

Field crews determined seeding dates by contacting land owners.

2.2.4 Plant Count

Plant count represents the number of plants growing in a row along a set distance; this distance was either 1 m for cereals and canola or 3 m for corn and beans. To determine plant count, field crews lobbed a tennis ball towards a random location in each field. A meter stick was placed on the nearest crop row to where the tennis ball landed. Field crews then counted the number of plants

growing along the length of the meter stick. This methodology was repeated 10 times per field. Only the average plant count is presented in this data set. Plant count was measured once during the campaign.

Growth stage, crop height, and biomass measurements were collected from each field at least once per week during the campaign. Though each field had a total of 16 sampling locations, data were only collected from Sites 2, 3, 10, 11, 13, and 14. Which sites were sampled varied depending on the week; see the following table for more details.

Table 5. Locations of Vegetation Sampling Sites

Dates	Sampling Sites
13 June 2016	2, 11, 14
14 June - 20 June 2016	3, 10, 13
10 July - 16 July 2016	2, 11, 14
17 July - 22 July 2016	3, 10, 13

2.2.5 Growth Stage

Growth stage was estimated from one plant sample per site using the BBCH Scale, for a total of three growth stage estimates per field per week.

2.2.6 Crop Height

At each corn and soybean sampling location, field crews measured the height of 10 plants collected from two rows (5 plants per row) using a metal tape measurer. For other crops (wheat, oats, canola, and alfalfa), 10 randomly selected plants were measured. Height was measured to the uppermost part of the canopy (leaf or fruit) and leaves were left in their natural orientation (not extended). Only the average plant height for each sampling location is presented in this data set.

2.2.7 Biomass

On each sampling date, three biomass samples were removed from each field (one per sampling site). Each sample was collected using one of two methods. For corn and soybean fields, 10 plants were collected from two rows (5 plants per row). For canola, wheat, oats, barley, and any other densely planted crops, a 0.5 m x 0.5 m square was placed over the canopy. Any above ground biomass falling within that square was collected by cutting stems at the soil surface. Any weeds collected alongside crops were discarded. In all cases photos were taken to document the collection process.

Field crews separated biomass samples into specific plant organs based on the crop type (see Table 6). Each sample was placed in its own mesh bag, which was in turn placed in a plastic bag to

minimize water loss. To minimize the impact of sample degradation, wet weights were measured at temporary weighing stations in the field as soon as possible after collection. Mesh and plastic bags were retained for the wet weighing. The pre-determined, average plastic bag weight was then subtracted from the wet weight of the sample.

Table 6. Biomass Sample Segmentation by Crop Type

Crop Type	Sample A	Sample B	Sample C	Sample D
Wheat, oats, barley	Leaves / Stems	N/A	N/A	Heads
Corn	Leaves	Stems	Tassels	Fruit
Canola, soybeans	Leaves	Stems	N/A	Seeds/Pods

After wet weighing, plastic bags were removed. For any sample weighing over 1 kg, plant material was removed from the mesh bag until the total weight of the subsample was at or below 1 kg. If plant material was removed, the subsample was immediately reweighed in its mesh bag to establish a wet weight. Mesh bags and samples were then placed in air drying facilities at the University of Manitoba for approximately two weeks. Bags were periodically weighed until air-dry weights stabilized, signaling that drying was complete.

Since air drying does not remove all water from crops, technicians ground one air-dried sample per field (from Site 13 or 14) using a Wiley Mill until it could pass through a 2 mm sieve. The ground samples were then returned to the air drying room to stabilize for a minimum of 24 hours. Once air-dried weights re-stabilized, ground samples were re-weighed and placed in a plant drying oven at 60°C for 48 hours. Technicians then weighed the oven-dried samples and calculated oven-drying correction factors for each crop type and growth stage. Correction factors represent the ratio of oven-dry weight to air-dry weight. For each sample, this ratio was applied to all air-dry weights to estimate oven-dried biomass from air-dried biomass measurements.

2.3 Processing

Net wet biomass (kg) was calculated by subtracting the weight of the plastic bag used to store each biomass sample from the total weight of the undried sample.

Net dry biomass (kg) was calculated by subtracting the weight of the mesh bag used to store each biomass sample from the total weight of the air-dried sample and then applying an oven-dry correction factor.

Plant water content (kg/m^2) was calculated by subtracting the net dry biomass from the net wet biomass.

Plant water content (%) was calculated by subtracting the net dry biomass from the net wet biomass and dividing by the wet biomass.

2.4 Quality, Errors, and Limitations

During biomass calculations, samples weighing less than 3 g were excluded from oven-drying correction factor calculations. The remaining samples were used to determine if a standard oven-drying correction factor could be applied to the whole data set. A two-tailed t-test, assuming unequal variances, revealed that oven-dry correction factors were statistically different between crops, and between crop organs within the same crop. Therefore, a different mean oven-drying correction factor was calculated and used for each crop's organ samples (leaves, stems, fruit, seeds, heads, etc.).

2.5 Instrumentation

2.5.1 Description

Plant count, row spacing, and crop height were measured with a meter stick.

3 RELATED DATA SETS

SMAP Data | Overview

4 RELATED WEBSITES

SMAP at NASA

SMAPVEX16

5 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

6 August 2018

6.2 Date Last Updated

1 October 2018