

ISO 19131 Annual Crop Inventory – Data Product Specifications

Revision: A

Data product specifications: Annual Crop Inventory

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Data product specifications: Annual Crop Inventory

1. Overview

1.1. Informal description

Agriculture and Agri-Food Canada (AAFC) has been moving towards the development of an operational software system for mapping the crop types of individual fields using satellite observations. Successful crop identification relies on image acquisitions from multiple sensors during key crop phenological stages (reproduction, seed development and senescence).

Multi-temporal optical data are the primary data source for crop classification because the NIR/SWIR channels are vital to crop classification. Over a growing season, at least three optical images are required to successfully identify crops. To the optical data, dual-polarization RADARSAT-2 data is added. In 2009 and 2010 the ScanSAR mode, with its large swath (300 km) and moderate resolution (50 m), was used as it fits the agricultural landscape of the Prairie Provinces. From 2011-present, the finer resolution of the Wide mode (30 m) is used as it is better suited to narrower fields.

Annual crop insurance data are the most accurate, detailed and complete sources of information for crop types in Canada. As such, AAFC cooperates with provincial crop insurance agencies to use their data for the training and validation of satellite data analysis. For provinces where insurance data cannot be accessed, ground-truth information is provided by point observations from AAFC staff or other provincial sources. Each year, AAFC staff collects tens of thousands of points identifying crops across the country. Both these point sources are combined and used as training or reference sites.

The training and validation data used to classify non-agricultural land cover types comes from numerous Land Cover / Land Use products, including the AAFC decadal land cover product. Point data are taken from these products and adjusted (eliminating any that were in transitions areas between classes or in areas of high potential change (i.e. near urban expansion)). What remains is a stable series of known land cover points for the following classes: water, barren, urban, shrubland, wetland, grassland, agriculture (generalized), and forest.

Focusing on the Prairie Provinces in 2009 and 2010, a Decision Tree (DT) based methodology was applied using optical (Landsat-5, AWiFS, DMC) and radar (RADARSAT-2) imagery. The final map had a spatial resolution of 56m.

For the 2011 and 2012 growing season, this activity was extended to all the other provinces (except Newfoundland) in support of a national crop inventory. The final spatial resolution was increased to 30m, to aid in differentiating the smaller fields in the rest of Canada. For 2012, the lack of affordable optical data forced AAFC to rely mostly on RADARSAT-2 data.

In 2013, this activity expanded to include Newfoundland for the first time, and used Landsat-8 as its sole-source of optical imagery. RADARSAT-2 continued to be the source of radar imagery. This combination of optical and radar imagery had been repeated over the agricultural extent of Canada in the subsequent years, until 2016 when Sentinel-2 and Gaofen-1 (2016 and 2017) optical imagery were added.

At present, this approach can consistently deliver a crop inventory that meets the overall target accuracy of at least 85% at a final spatial resolution of 30m.

Note: At the national scale, the crop type legend is not homogeneous. In some provinces, such as Alberta, Saskatchewan and Quebec, we have been able to divide the cereal crops in to sub-categories (Barley, Oats, Wheat, etc.). For other provinces, the cereals class may not have been subdivided. The lack of training sites and, in some cases, the limited availability of spectral data does not allow for the differentiation of cereals into sub-categories with sufficient precision. This results in class discontinuities between provinces.

1.2. Data product specification - metadata

This section provides metadata about the creation of this data product specification

Data product specification – title:	Annual Crop Inventory
Data product specification - reference date:	2009-present
Data product specification - responsible party:	Earth Observation Team of the Science and Technology Branch (STB)
Data product specification – language:	English
Data product specification - topic category:	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;

1.3. Terms and Definitions

- Feature attribute
characteristic of a feature
- Class
description of a set of objects that share the same attributes, operations, methods, relationships, and semantics [UML Semantics]
NOTE: A class does not always have an associated geometry (e.g. the metadata class).
- Feature
abstraction of real world phenomena
- Object
entity with a well-defined boundary and identity that encapsulates state and behaviour [UML Semantics]
NOTE: An object is an instance of a class.
- Package
grouping of a set of classes, relationships, and even other packages with a view to organizing the model into more abstract structures

1.4. Abbreviations

AAFC	Agriculture and Agri-Food Canada
AWiFS	Advanced Wide Field Sensor
DMC	Disaster Monitoring Constellation
DT	Decision-Tree Classifier
NIR/SWIR	Near Infrared/Short-Wavelength Infrared
ScanSAR	Scanning Synthetic Aperture Radar
SPOT	Satellite Pour l'Observation de la Terre
STB	Science and Technology Branch

2. SPECIFICATION SCOPE

This data specification has only one scope, the general scope.

NOTE: The term 'specification scope' originates from the International Standard ISO19131. 'Specification scope' does not express the purpose for the creation of a data specification or the potential use of data, but identifies partitions of the data specification where specific requirements apply.

3. DATA PRODUCT IDENTIFICATION

3.1. Data series identification

Title	Annual Crop Inventory
Alternate Title	AAFC Crop Type Mapping
Abstract	Understanding the state and trends in agriculture production is essential to combat both short-term and long-term threats to stable and reliable access to food for all, and to ensure a profitable agricultural sector. Starting in 2009, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) began the process of generating annual crop type digital maps. Focusing on the Prairie Provinces in 2009 and 2010, a Decision Tree (DT) based methodology was applied using optical (Landsat-5, AWiFS, DMC) and radar (RADARSAT-2) based satellite images. Beginning with the 2011 growing season, this activity was extended to other provinces in support of a national crop inventory. Currently this approach uses Landsat-8, Sentinel-2, and RADARSAT-2 imagery and can consistently deliver a crop inventory that meets the overall target accuracy of at least 85% at a final spatial resolution of 30m (56m in 2009 and 2010).
Purpose	The crop inventory provides fundamental information on the state and changes in Canada's agricultural landscape, and its value is wide-ranging. For example, the 2011 inventory included the identification of acreages that had been too wet to seed earlier in the year. These estimates fell within 3% of figures provided independently by the Provinces. The inventory has also been used to validate the practices of Canadian canola producers who wish to access the European bio-fuel feedstock market, estimated to be worth \$500 million annually.
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	56m pixels (2009, 2010) 30m pixels (2011 – present)
Geographic Description	2009 & 2010 – Prairie Provinces 2011 & 2012 – All of Canada (except Newfoundland) 2013 to present – All of Canada
Supplemental Information	Data is provided in .TIF format and is subdivided in to provincial boundaries.
Constraints	Data are subject to the Government of Canada Open Data Licence: http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope identification	series

3.2. Data product identification

3.2.1. Annual Crop Inventory, 2009

Title	Annual Crop Inventory, 2009
Alternate Title	AAFC Crop Type Mapping in the Prairies 2009
Abstract	In 2009 the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) began the process of generating annual crop inventory digital maps using satellite imagery. Focusing on the Prairie Provinces, a Decision Tree (DT) based methodology was applied using both optical (AWiFS, Landsat-5) and radar (RADARSAT-2) based satellite imagery, and having a final spatial resolution of 56m. Methods were also developed to enhance the optical classification with RADARSAT-2 imagery, addressing issues associated with cloud cover. In conjunction with satellite acquisitions, ground-truth information was provided by provincial crop insurance companies and point observations from our regional AAFC colleagues. The overall process for Crop Inventory Map includes: satellite data acquisition; field data acquisition for classification training and accuracy assessment; and, operational implementation of the classification methodology. The initial methodology was developed in partnership with AAFC Research Branch, and supported in part by the Canadian Space Agency. The long-term objective of this endeavour is to expand from the Prairies and produce an annual crop inventory of the entire agricultural extent of Canada.
Purpose	Annual crop type mapping in the Prairies provinces
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	56m
Geographic Description	Prairie Provinces
Supplemental Information	The overall accuracy of this map for crop classes in the Prairies is: 80% Kappa: 0.73 Citation: Annual Space-Based Crop Inventory for Canada, 2009, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.
Constraints	Data are subject to the Government of Canada Open Data Licence: http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, maps, Geographic data, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.2. Annual Crop Inventory, 2010

Title	Annual Crop Inventory, 2010
Alternate Title	AAFC Crop Type Mapping in the Prairies, 2010
Abstract	In 2010 the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) continued the process of generating annual crop inventory digital maps using satellite imagery. Focusing on the Prairie Provinces, a Decision Tree (DT) based methodology was applied using both optical (AWiFS, Landsat-5, DMC) and radar (RADARSAT-2) based satellite imagery, and having a final spatial resolution of 56m. Methods were also developed to enhance the optical classification with RADARSAT-2 imagery, addressing issues associated with cloud cover. In conjunction with satellite acquisitions, ground-truth information was provided by provincial crop insurance companies and point observations from our regional AAFC colleagues. The overall process for Crop Inventory Map includes: satellite data acquisition; field data acquisition for classification training and accuracy assessment; and, operational implementation of the classification methodology.
Purpose	Annual crop type mapping in the Prairies provinces
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	56 m
Geographic Description	Prairie Provinces
Supplemental Information	The overall accuracy of this map for crop classes in the Prairies is: 85.1% Kappa: 0.82 Citation: Annual Space-Based Crop Inventory for Canada, 2010, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.3. Annual Crop Inventory, 2011

Title	Annual Crop Inventory, 2011
Alternate Title	AAFC Crop Type Mapping, 2011
Abstract	In 2011, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) expanded the process of generating annual crop inventory digital maps using satellite imagery to include British Columbia, Ontario, Quebec, and the Maritime provinces, in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (Landsat-5, DMC) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by provincial crop insurance companies and point observations from our regional AAFC colleagues.
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada (except Newfoundland)
Supplemental Information	Overall accuracies for crop classes are: Prince Edward Island: 67% Nova Scotia: 71% New Brunswick: 88% Quebec: 81% Ontario: 82% Manitoba: 79% Saskatchewan: 87% Alberta: 88% British Columbia: Not evaluated Citation: Annual Space-Based Crop Inventory for Canada, 2011, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.4. Annual Crop Inventory, 2012

Title	Annual Crop Inventory, 2012
Alternate Title	AAFC Crop Type Mapping, 2012
Abstract	In 2012, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) repeated the process of generating annual crop inventory digital maps using satellite imagery to for all of Canada (except Newfoundland), in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (DMC, SPOT) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by provincial crop insurance companies and point observations from our regional AAFC colleagues
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada (except Newfoundland)
Supplemental Information	Overall accuracies for crop classes are: Prince Edward Island: 79% Nova Scotia: 90% New Brunswick: 88% Quebec: 82% Ontario: 76% Manitoba: 85% Saskatchewan: 82% Alberta: 88% British Columbia: 73% Citation: Annual Space-Based Crop Inventory for Canada, 2012, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.5. Annual Crop Inventory, 2013

Title	Annual Crop Inventory, 2013
Alternate Title	AAFC Crop Type Mapping, 2013
Abstract	In 2013, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) repeated the process of generating annual crop inventory digital maps using satellite imagery to for all of Canada, in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (Landsat-8) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by provincial crop insurance companies and point observations from the BC Ministry of Agriculture and our regional AAFC colleagues
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada
Supplemental Information	Overall accuracies for crop classes are: Newfoundland: 98.8% (mainly pasture) Prince Edward Island: 86.6% Nova Scotia: 76.1% New Brunswick: 88.9% Quebec: 85.8% Ontario: 87.0% Manitoba: 85.4% Saskatchewan: 86.5% Alberta: 89.9% British Columbia: 79.2% Citation: Annual Space-Based Crop Inventory for Canada, 2013, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.6. Annual Crop Inventory, 2014

Title	Annual Crop Inventory, 2014
Alternate Title	AAFC Crop Type Mapping, 2014
Abstract	In 2014, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) repeated the process of generating annual crop inventory digital maps using satellite imagery to for all of Canada, in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (Landsat-8) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by provincial crop insurance companies and point observations from the BC Ministry of Agriculture and our regional AAFC colleagues.
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada
Supplemental Information	Overall accuracies for crop classes are: Newfoundland: Not evaluated Prince Edward Island: 81.0% Nova Scotia: 64.4% New Brunswick: 89.1% Quebec: 83.9% Ontario: 87.9% Manitoba: 90.3% Saskatchewan: 85.9% Alberta: 89.4% British Columbia: 88.4% Citation: Annual Space-Based Crop Inventory for Canada, 2014, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.7. Annual Crop Inventory, 2015

Title	Annual Crop Inventory, 2015
Alternate Title	AAFC Crop Type Mapping, 2015
Abstract	In 2015, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) repeated the process of generating annual crop inventory digital maps using satellite imagery to for all of Canada, in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (Landsat-8) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by provincial crop insurance companies and point observations from the BC Ministry of Agriculture and our regional AAFC colleagues
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada
Supplemental Information	<p>Overall provincial accuracies for crop classes are: Newfoundland: Not evaluated Prince Edward Island: 83.7% Nova Scotia: 85.2% New Brunswick: 86.1% Quebec: 87.1% Ontario: 89.6% Manitoba: 90% Saskatchewan: 89.6% Alberta: 88.9% British Columbia: Not evaluated</p> <p>Overall provincial accuracies for non-agriculture land cover are: Newfoundland: 67.4% Prince Edward Island: 75.5% Nova Scotia: 65.1% New Brunswick: 68.0% Quebec: 71.1% Ontario: 71.8% Manitoba: 62.9% Saskatchewan: 68.7% Alberta: 68.6% British Columbia: 70.0%</p> <p>Citation: Annual Space-Based Crop Inventory for Canada, 2015, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.</p>
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.8. Annual Crop Inventory, 2016

Title	Annual Crop Inventory, 2016
Alternate Title	AAFC Crop Type Mapping, 2016
Abstract	In 2016, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) repeated the process of generating annual crop inventory digital maps using satellite imagery to for all of Canada, in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (Landsat-8, Sentinel-2, Gaofen-1) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by: provincial crop insurance companies in Alberta, Saskatchewan, Manitoba, & Quebec; point observations from the BC Ministry of Agriculture, & the Ontario Ministry of Agriculture, Food and Rural Affairs; and data collection supported by our regional AAFC Research and Development Centres in St. John's, Kentville, Charlottetown, Fredericton, Guelph, and Summerland
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada
Supplemental Information	<p>Overall provincial accuracies for crop classes are:</p> <p>Newfoundland: 94.51%</p> <p>Prince Edward Island: 82.44%</p> <p>Nova Scotia: 90.59%</p> <p>New Brunswick: 89.66%</p> <p>Quebec: 91.17%</p> <p>Ontario: 88.98%</p> <p>Manitoba: 92.44%</p> <p>Saskatchewan: 92.26%</p> <p>Alberta: 90.83%</p> <p>British Columbia: 86.27%</p> <p>Overall provincial accuracies for non-agriculture land cover are:</p> <p>Newfoundland: 72.14%</p> <p>Prince Edward Island: 76.96%</p> <p>Nova Scotia:69.04%</p> <p>New Brunswick: 69.90%</p> <p>Quebec: 71.76%</p> <p>Ontario: 73.00%</p> <p>Manitoba: 67.64%</p> <p>Saskatchewan: 69.45%</p> <p>Alberta: 68.54%</p> <p>British Columbia: 72.74%</p> <p>Citation: Annual Space-Based Crop Inventory for Canada, 2016, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.</p>
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.9. Annual Crop Inventory, 2017

Title	Annual Crop Inventory, 2017
Alternate Title	AAFC Crop Type Mapping, 2017
Abstract	In 2017, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) repeated the process of generating annual crop inventory digital maps using satellite imagery to for all of Canada, in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (Landsat-8, Sentinel-2, Gaofen-1) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by: provincial crop insurance companies in Alberta, Saskatchewan, Manitoba, & Quebec; point observations from the BC Ministry of Agriculture, & the Ontario Ministry of Agriculture, Food and Rural Affairs; and data collection supported by our regional AAFC Research and Development Centres in St. John's, Kentville, Charlottetown, Fredericton, Guelph, and Summerland
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada
Supplemental Information	<p>Overall provincial accuracies for crop classes are:</p> <p>Newfoundland: 91.83% Prince Edward Island: 91.61% Nova Scotia: 89.49% New Brunswick: 84.29% Quebec: 90.26% Ontario: 85.36% Manitoba: 93.10% Saskatchewan: 93.71% Alberta: 94.15% British Columbia: 92.79%</p> <p>Overall provincial accuracies for non-agriculture land cover are:</p> <p>Newfoundland: 72.16% Prince Edward Island: 76.33% Nova Scotia: 72.30% New Brunswick: 69.48% Quebec: 72.89% Ontario: 75.88% Manitoba: 70.29% Saskatchewan: 72.20% Alberta: 68.46% British Columbia: 76.93%</p> <p>Citation: Annual Space-Based Crop Inventory for Canada, 2017, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.</p>
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.10. Annual Crop Inventory, 2018

Title	Annual Crop Inventory, 2018
Alternate Title	AAFC Crop Type Mapping, 2018
Abstract	In 2018, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) repeated the process of generating annual crop inventory digital maps using satellite imagery to for all of Canada, in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (Landsat-8, Sentinel-2) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by: provincial crop insurance companies in Alberta, Saskatchewan, Manitoba, & Quebec; point observations from the BC Ministry of Agriculture, & the Ontario Ministry of Agriculture, Food and Rural Affairs; and data collection supported by our regional AAFC Research and Development Centres in St. John’s, Kentville, Charlottetown, Fredericton, Guelph, and Summerland
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada
Supplemental Information	<p>Overall provincial accuracies for crop classes are:</p> <p>Newfoundland: 93.84% Prince Edward Island: 81.92% Nova Scotia: 92.50% New Brunswick: 88.83% Quebec: 92.28% Ontario: 91.99% Manitoba: 94.61% Saskatchewan: 91.65% Alberta: 91.95% British Columbia: 93.09%</p> <p>Overall provincial accuracies for non-agriculture land cover are:</p> <p>Newfoundland: 74.67% Prince Edward Island: 75.21% Nova Scotia: 71.97% New Brunswick: 70.99% Quebec: 73.50% Ontario: 76.02% Manitoba: 70.50% Saskatchewan: 72.79% Alberta: 68.36% British Columbia: 77.04%</p> <p>Citation: Annual Space-Based Crop Inventory for Canada, 2018, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.</p>
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

3.2.11. Annual Crop Inventory, 2019

Title	Annual Crop Inventory, 2019
Alternate Title	AAFC Crop Type Mapping, 2019
Abstract	In 2019, the Earth Observation Team of the Science and Technology Branch (STB) at Agriculture and Agri-Food Canada (AAFC) repeated the process of generating annual crop inventory digital maps using satellite imagery to for all of Canada, in support of a national crop inventory. A Decision Tree (DT) based methodology was applied using optical (Landsat-8, Sentinel-2) and radar (RADARSAT-2) based satellite images, and having a final spatial resolution of 30m. In conjunction with satellite acquisitions, ground-truth information was provided by: provincial crop insurance companies in Alberta, Saskatchewan, Manitoba, & Quebec; point observations from the PEI Department of Environment, Water and Climate Change and data collection supported by our regional AAFC Research and Development Centres in St. John's, Kentville, Charlottetown, Fredericton, and Guelph.
Purpose	An annual national crop type map
Topic Category	Farming; Environment; GeoscientificInformation; imagery; BaseMaps; EarthCover;
Spatial Representation Type	grid
Spatial Resolution	30 m
Geographic Description	Canada
Supplemental Information	<p>Overall provincial accuracies for crop classes are:</p> <p>Newfoundland: 91.00% Prince Edward Island: 89.78% Nova Scotia: 89.10% New Brunswick: 91.90% Quebec: 91.80% Ontario: 85.64% Manitoba: 94.27% Saskatchewan: 91.63% Alberta: 91.29% British Columbia: 89.35%</p> <p>Overall provincial accuracies for non-agriculture land cover are:</p> <p>Newfoundland: 75.70% Prince Edward Island: 86.34% Nova Scotia: 73.97% New Brunswick: 72.49% Quebec: 80.01% Ontario: 74.89% Manitoba: 70.63% Saskatchewan: 72.77% Alberta: 68.77% British Columbia: 76.39%</p> <p>Citation: Annual Space-Based Crop Inventory for Canada, 2019, Centre for Agroclimate, Geomatics and Earth Observation, Science and Technology Branch, Agriculture and Agri-Food Canada.</p>
Constraints	Data are subject to the Government of Canada Open Data Licence : http://open.canada.ca
Keywords	Government of Canada Core Subject Thesaurus (2000-02-01) - Remote Sensing, Satellites, Agriculture, Crops, Crop insurance, Farmlands, Forage crops, Land cover, Geomatics, Geographic Information Systems, Geographic data, maps, Geography
Scope Identification	dataset
Feature Attribute Names	Class(Value)

4. DATA CONTENT AND STRUCTURE

Not Applicable

4.1. Feature-based application schema

Not Applicable

4.2. Feature catalogue – AAFC Crop Type Feature Catalog

Title	AAFC Crop Type Feature Catalog
Scope	series
Version Number	1
Version Date	March 11, 2020
Producer	Agriculture and Agri-food Canada

System-generated attributes (for example, OBJECTID, Shape, Shape Length and Area) are not defined in the feature catalog.

4.2.1. Feature attributes

4.2.1.1. Class(Value)

Name	Class(Value)			
Definition				
Aliases				
Producer	AAFC			
Value Data Type	integer			
Value Domain Type	1 (enumerated)			
Value Domain				
	Feature Attribute Value			
	Label	Code	RGB	Definition
	Cloud	10	0,0,0	Areas unclassified due to cloud, shadow or other image quality factors.
	Water	20	51,51,255	Water bodies (lakes, reservoirs, rivers, streams, salt water, etc).
	Exposed Land / Barren	30	153,102,102	Land that is predominately non-vegetated and non-developed. Includes: glacier, rock, sediments, burned areas, rubble, mines, other naturally occurring non-vegetated surfaces. Excludes fallow agriculture
	Urban / Developed	34	204,102,153	Land that predominantly built-up or developed and vegetation associated with these land covers. This includes road surfaces, railway surfaces, buildings and paved surfaces, urban areas, industrial sites, mine structures, golf courses, etc.
	Greenhouses	35	225,225,225	Greenhouses have been visually identified from satellite imagery
	Shrubland	50	255,255,0	Predominantly woody vegetation of relatively low height (generally +/-2 meters). May include grass or wetlands with woody vegetation, regenerating forest.
	Wetland	80	153,51,153	Land with a water table near/at/above soil surface for enough time to promote wetland or aquatic processes (semi-permanent or permanent wetland vegetation, including fens, bogs, swamps, sloughs, marshes etc).

Label	Code	RGB	Definition
Peatland	85	80,27,80	Wetlands that are commercially harvested for peat.
Grassland	110	204,204,0	Predominantly native grasses and other herbaceous vegetation, may include some shrubland cover.
Agriculture (undifferentiated)	120	204,102,0	Agricultural land, including annual and perennial crops; and would exclude grassland. This class is mapped only if the distinction of sub-agricultural covers (classes 132-199) is not possible.
Pasture / Forages	122	255,204,51	Periodically cultivated. Includes tame grasses and other perennial crops such as alfalfa and clover grown alone or as mixtures for hay, pasture or seed.
Too Wet to be Seeded	130	120,153,246	Agricultural fields that are normally seeded that remain unseeded due to excess spring moisture.
Fallow	131	255,153,0	Plowed and harrowed fields that are left unsown for the growing season
Cereals	132	102,0,0	This class is mapped only if the distinction of sub-cereal covers (classes 133-146) is not possible.
Barley	133	218,227,29	
Other Grains	134	153,204,0	
Millet	135	210,219,37	
Oats	136	209,213,43	
Rye	137	202,206,50	
Spelt	138	195,198,58	
Triticale	139	185,188,68	
Wheat	140	167,179,77	This sub-cereal class is mapped only if the distinction of sub-wheat covers (classes 145-146) is not possible.

	Label	Code	RGB	Definition
	Switchgrass	141	185,198,78	
	Sorghum	142	153,153,0	
	Quinoa	143	233,226,177	
	Winter Wheat	145	128,151,105	
	Spring Wheat	146	146,165,91	
	Corn	147	255,255,153	
	Tobacco	148	152,136,124	
	Ginseng	149	121,155,147	
	Oilseeds	150	94,162,99	This class is mapped only if the distinction of sub-oilseed covers (classes 151-158) is not possible.
	Borage	151	82,174,119	
	Camelina	152	65,191,122	
	Canola / Rapeseed	153	214,255,112	
	Flaxseed	154	140,140,255	
	Mustard	155	214,204,0	
	Safflower	156	255,127,0	
	Sunflower	157	49,84,145	
	Soybeans	158	204,153,51	
	Pulses	160	137,110,67	This class is mapped only if the distinction of sub-pulse covers (classes 162-174) is not possible.
	Other Pulses	161	153,102,51	
	Peas	162	143,108,61	
	Chickpeas	163	182,164,114	
	Beans	167	130,101,74	
	Fababeans	168	163,144,105	
	Lentils	174	184,89,0	
	Vegetables	175	183,75,21	This class is mapped only if the distinction of sub-vegetable covers (classes 176-179) is not possible.
	Tomatoes	176	255,138,138	
	Potatoes	177	255,204,204	
	Sugarbeets	178	111,85,202	
	Other Vegetables	179	255,204,255	

	Label	Code	RGB	Definition
	Fruits	180	220,84,36	This class is mapped only if the distinction of sub-fruit covers (classes 181-190) is not possible.
	Berries	181	208,90,48	This sub-fruit class is mapped only if the distinction of sub-berry covers (classes 182-185) is not possible.
	Blueberry	182	210,0,0	
	Cranberry	183	204,0,0	
	Other Berry	185	220,50,0	
	Orchards	188	255,102,102	
	Other Fruits	189	197,69,59	
	Vineyards	190	116,66,189	
	Hops	191	255,204,153	
	Sod	192	181,251,5	
	Herbs	193	204,255,5	
	Nursery	194	7,249,140	
	Buckwheat	195	0,255,204	
	Canaryseed	196	204,51,204	
	Hemp	197	142,118,114	
	Vetch	198	177,149,79	
	Other Crops	199	116,154,102	
	Forest (undifferentiated)	200	0,153,0	Predominantly forested or treed areas. This class is mapped only if the distinction of sub-forest covers (classes 210-230) is not possible.
	Coniferous	210	0,102,0	Predominantly coniferous forests or treed areas
	Broadleaf	220	0,204,0	Predominantly broadleaf/deciduous forests or treed areas.
	Mixedwood	230	204,153,0	Forest that is a combination of both the coniferous and broadleaf classes

5. REFERENCE SYSTEMS

5.1. Spatial reference system

Projected Coordinate Systems:

```
PROJCS["AAFC_Albers_Conical_Equal_Area",  
GEOGCS["GCS_WGS_1984", DATUM["D_WGS_1984",  
SPHEROID["WGS_1984",6378137.0,298.257223563]],  
PRIMEM["Greenwich",0.0],  
UNIT["Degree",0.0174532925199433]],  
PROJECTION["Albers"], PARAMETER["False_Easting",0.0],  
PARAMETER["False_Northing",0.0],  
PARAMETER["Central_Meridian",-96.0],  
PARAMETER["Standard_Parallel_1",44.75],  
PARAMETER["Standard_Parallel_2",55.75],  
PARAMETER["Latitude_Of_Origin",40.0],  
UNIT["Meter",1.0]]
```

5.2. Temporal reference system

Gregorian calendar

6. DATA QUALITY

6.1. Completeness

6.2. Logical consistency

6.3. Positional accuracy

6.4. Temporal accuracy

To date this approach can consistently deliver a crop inventory that meets the overall target accuracy of at least 85% at a final spatial resolution of 30m (56m in 2009 and 2010). Individual provincial accuracies for each dataset can be found within section 3.2

6.5. Lineage statement

Lineage Statement	Data Series: Over a single growing season, optical (Landsat-5, Landsat-8, AWiFS, DMC, SPOT, RapidEye, Sentinel-2, Gaofen-1) and radar (RADARSAT-2) images are collected in conjunction with ground data provided by AAFC personnel and provincial crop insurance companies. All this data is run through a Decision Tree (DT) algorithm, whose crop map output has an image-based segmentation applied, before a final accuracy assessment is calculated.
Scope	

7. DATA CAPTURE

To create the digital crop inventory, the Earth Observation Team applies a Decision Tree (DT) methodology to optical (Landsat-5, Landsat-8, AWiFS, DMC, SPOT, RapidEye, Sentinel-2, and Gaofen-1) and radar (RADARSAT-2) satellite images that were acquired over a single growing season. The DT algorithm uses the known crop types of certain locations on the ground (gathered by AAFC employees; the BC Ministry of Agriculture; Ontario Ministry of Agriculture, Food and Rural Affairs; PEI Department of Environment, Water and Climate Change; or provided by provincial crop insurance companies) to spectrally differentiate each of the crop types being mapped. These relationships are then applied to the satellite image data to identify the most likely crop type of each field in the study area. An iterative mode filter is then performed to clean up any speckling within the classification, before a final accuracy is assessed.

More than 1500 satellite images, each linked to thousands of ground data points, are required to map Canada's entire agricultural extent annually and validate the resulting product. Hundreds of hours of computer processing time are required to do all the calculations to produce a final high-quality classification.

So far, AAFC can consistently deliver a crop inventory that meets the overall target accuracy of at least 85%. The annual crop inventory maps have already been applied by AAFC, the provinces, researchers and others to address many needs for the sector. AAFC freely shares the crop inventory data, and welcomes feedback from any of our users. For crop specific accuracies please contact: aafc.agri-geomatics-agrogeomatiques.aac@canada.ca

We acknowledge the following contributors:

Agricultural Financial Services Corporation, <http://www.afsc.ca>

BC Ministry of Agriculture, <http://www.gov.bc.ca/agri/>

Canadian Space Agency, <http://www.asc-csa.gc.ca>

Ducks Unlimited Canada, <http://www.ducks.ca/>

Earth Resources Observation & Science (EROS) Center, of the U.S. Geological Survey, <http://eros.usgs.gov>

La Financière agricole du Québec, <http://www.fadq.qc.ca>

Ontario Ministry of Agriculture, Food & Rural Affairs, <http://www.omafra.gov.on.ca/>

PEI Department of Environment, Water and Climate Change, <https://www.princeedwardisland.ca/en/topic/environment-water-and-climate-change>

Manitoba Agricultural Services Corporation, www.masc.mb.ca

Saskatchewan Crop Insurance Corporation, <http://www.saskcropinsurance.com>

Statistics Canada, <http://www.statcan.gc.ca>

8. DATA MAINTENANCE

Data Series: Updated annually
Individual Datasets: Not Planned.

9. PORTRAYAL

Not applicable.

10. DATA PRODUCT DELIVERY

TIF
format name: Tag Interleaved File:
version: 6.0
specification: GeoTIFF is format extension for storing georeference and geocoding information in a TIFF 6.0 compliant raster file by tying a raster image to a known model space or map projection.
languages: eng
character set: utf8

11. METADATA

The metadata requirements follow the Government of Canada's Treasury Board Standard on Geospatial Data (ISO 19115).