

ISO 19131 Crop Rotations in Canada – Data Product Specifications

Revision: B

Data product specifications: Crop Rotations in Canada

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Data product specifications: Crop Rotations in Canada

1. Overview

1.1. Informal description

Crop rotation is an agricultural production and land management practice beneficial to sustainable agriculture in Canada. Agriculture and Agri-Food Canada (AAFC) produces crop rotation data annually showing the crop rotations used within the agricultural extent of Canada for the last four complete growing seasons (based on available data). This data can be used by producers, land managers, and policy makers to assess current rotations to assist in future land management decisions.

Crop rotation data is derived from AAFC's publicly-available annual crop inventory data.

1.2. Data product specification - metadata

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

Data product specification – title:	Crop Rotations in Canada (2016 – 2019)
Data product specification - reference date:	Last four (4) complete growing seasons (2016 – 2019)
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; imageryBaseMapsEarthCover;

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 product identification

Title	Crop Rotations in Canada (2016 – 2019)
Alternate Title	
Abstract	Crop rotation is an agricultural production and land management practice beneficial to sustainable agriculture in Canada. Agriculture and Agri-Food Canada (AAFC) produces crop rotation data annually showing the crop rotations used within the agricultural extent of Canada for the last four complete growing seasons (based on available data). This data can be used by producers, land managers, and policy makers to assess current rotations to assist in future land management decisions. Crop rotation data is derived from AAFC's publicly-available annual crop inventory data.
Purpose	The crop rotation dataset allows for yearly comparison of agricultural crop rotation cycles throughout the agricultural regions of Canada.
Topic Category	Farming; Environment; GeoscientificInformation; imageryBaseMapsEarthCover;
Spatial Representation Type	grid
Spatial Resolution	30m pixels
Geographic Description	All of Canada (agricultural regions only)
Supplemental Information	Data is provided in .TIF format.
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, Geographic data, Geography
Scope identification	series
Feature Attribute Names	CROP# (x4), CROP#_EN (x4), CROP#_FR (x4), ROTATN_EN, ROTATN_FR

3.2. Feature-based application schema

N/A

3.3. Feature catalogue – Crop Rotations in Canada Feature Catalog

Title	Crop Rotations in Canada Feature Catalog
Scope	
Version Number	2
Version Date	June 8, 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.

3.3.1. Feature attributes

3.3.1.1. Value

Name	Value
Definition	Unique integer value representing a specific four-year crop rotation.
Aliases	
Producer	AAFC
Value Data Type	integer
Value Domain Type	1 (enumerated)
Value Domain	

3.3.1.2. Count

Name	Count
Definition	Number of raster cells that represent the raster value.
Aliases	
Producer	AAFC
Value Data Type	integer
Value Domain Type	1 (enumerated)
Value Domain	

3.3.1.3. CROP# (x4); e.g. CROP1, CROP4

Name	CROP# (x4); e.g., CROP1, CROP4
Definition	Integer code defining the classification type for a crop within the rotation. The order of the rotation defines a pattern that can start at any time within a four year crop rotation period. That is, given a rotation such as "Wheat" - "Corn" - "Soybeans" - "Corn", the "Wheat" may have been grown in year 1, 2, 3 or 4 of the rotation but "Corn" was grown before and after it and "Soybeans" were grown between the two years of "Corn".
Aliases	
Producer	AAFC
Value Data Type	integer
Value Domain Type	1 (enumerated)
Value Domain	Refer to the AAFC Annual Crop Inventory Data Product Specifications

3.3.1.4. CROP#_EN (x4); e.g. CROP1_EN, CROP2_EN

Name	CROP#_EN (x4); e.g., CROP1_EN, CROP2_EN
Definition	String value of the classification type for the corresponding CROP# in English.
Aliases	
Producer	AAFC
Value Data Type	text
Value Domain Type	
Value Domain	

3.3.1.5. CROP#_FR (x4); e.g. CROP3_FR, CROP4_FR

Name	CROP#_FR (x4); e.g. CROP3_FR, CROP4_FR
Definition	String value of the classification type for the corresponding CROP# in French.
Aliases	
Producer	AAFC
Value Data Type	text
Value Domain Type	
Value Domain	

3.3.1.6. ROTATN_EN

Name	ROTATN_EN
Definition	String value of the crop rotation combination represented by the unique identifier in English.
Aliases	
Producer	AAFC
Value Data Type	text
Value Domain Type	
Value Domain	

3.3.1.7. ROTATN_FR

Name	ROTATN_FR
Definition	String value of the crop rotation combination represented by the unique identifier in French.
Aliases	
Producer	AAFC
Value Data Type	text
Value Domain Type	
Value Domain	

4. REFERENCE SYSTEMS

4.1. Spatial reference system

```
PROJCS["WGS_1984_Web_Mercator_Auxiliary_Sphere",  
  GEOGCS["GCS_WGS_1984",  
    DATUM["D_WGS_1984",  
      SPHEROID["WGS_1984",6378137.0,298.257223563]],  
    PRIMEM["Greenwich",0.0],  
    UNIT["Degree",0.0174532925199433]],  
  PROJECTION["Mercator_Auxiliary_Sphere"],  
  PARAMETER["False_Easting",0.0],  
  PARAMETER["False_Northing",0.0],  
  PARAMETER["Central_Meridian",0.0],  
  PARAMETER["Standard_Parallel_1",0.0],  
  PARAMETER["Auxiliary_Sphere_Type",0.0],  
  UNIT["Meter",1.0],  
  AUTHORITY["ESRI","102100"]]
```

Horizontal coordinate reference system:

Map projection:

4.2. Temporal reference system

Gregorian calendar

5. DATA QUALITY

5.1. Completeness

All geographic regions within the agricultural extent of Canada are represented and included in the crop rotation years.

5.2. Logical consistency

5.2.1. Conceptual consistency

The conceptual schema was generated by the ArcGIS Combine geoprocessing tool. Some attributes were renamed to be more logical with what they contain.

5.2.2. Domain consistency

All coded values within in each crop type fall within the required range of 10 - 230. All text representations of the numeric codes match the values described in the feature catalogue.

5.2.3. Format consistency

The output format was generated using well-established commercial software, ensuring format consistency.

5.2.4. Topological consistency

During processing each raster was snapped to a single common raster to guarantee pixel alignment during the overlay process.

5.3. Positional accuracy

Source data for the four crop inventory data used different projections and were not aligned to match rasters from different years. The process of re-projection and snapping to a common raster resulted in some rotational shift - up to 15 metres depending on the location - in the source provincial datasets prior to 2014, but guaranteed a coherent and aligned crop rotation product. From a sample of over 27,000 random points situated over the crop rotation dataset, 93% of the points had resulting values that perfectly matched the source provincial datasets for all four years i.e. their values were unaffected by the shift.

5.4. Temporal statement

Four crop inventory years are represented in the crop rotation dataset. Data for each year in the crop rotation match the data from the source annual datasets.

5.5. Thematic accuracy

Accuracy of non-quantitative attributes is dependent on the source datasets. The number of raster cells in the Count attribute was auto-calculated by the ArcGIS 10.4 Reclass tool and presumed to be 100% accurate.

5.6. Lineage statement

5.6.1. Process Steps

Annual provincial crop inventory raster datasets were projected to a common projection and snapped to a common provincial raster i.e. Manitoba 2014.

These provincial rasters were mosaicked together to create one raster for each crop inventory year.

Using the Esri ArcGIS Spatial Analyst Combine tool, the four most recent crop inventory raster datasets were overlaid to produce a unique identifier for each combination of crop inventory values. Each combination represented a different crop rotation whose first crop occurred in the first crop inventory year included.

Those results were analyzed for patterns of order, regardless of which year was the starting year in the crop rotation. For example, the following four records generated by the Combine tool actually represent the same 4-year crop rotation, "Wheat" - "Corn" - "Soybeans" - "Corn".

Year 1 (e.g., 2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)
Corn	Soybeans	Corn	Wheat
Soybeans	Corn	Wheat	Corn
Corn	Wheat	Corn	Soybeans
Wheat	Corn	Soybeans	Corn

The Combine tool's output raster was reclassified based on those patterns and, in the final raster, each combination represents a different crop rotation regardless of start year.

6. DATA CAPTURE

See the Government of Canada's Open Data record for AAFC Annual Crop Inventory for more information regarding the crop inventory data capture.

7. DATA MAINTENANCE

Data Series: Updated annually

Individual Datasets: Not Planned.

8. PORTRAYAL

Not applicable.

9. 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

10. METADATA

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