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# EO-based Habitat Suitability Analysis

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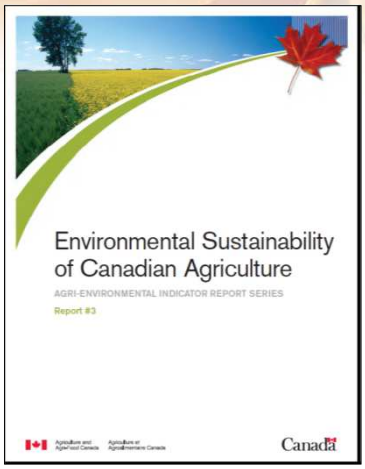
Canada

## Habitat Suitability Analysis




### Agri-Environmental Sustainability Metrics

… provides science-based agri-environmental information that can play a critical role in guiding policy and program design, and can help determine which options will be most effective.

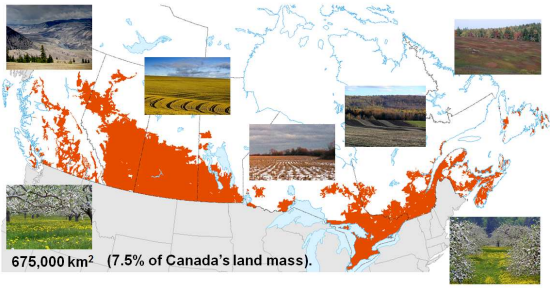
### Wildlife Habitat Availability on Farmland AEI

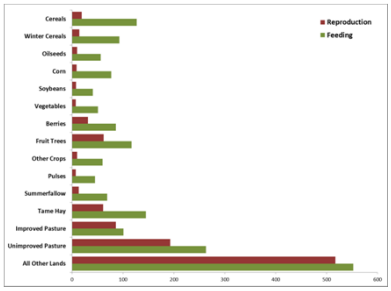
The Wildlife Habitat Availability on Farmland Indicator provides a multi-species assessment of broad-scale trends in the capacity of the Canadian agricultural landscape to provide suitable habitat for populations of terrestrial vertebrates.

# Canada: A Diverse Agricultural Landscape

## The Canadian Agricultural Landscape…

- Comprises cultivated areas, grazing land with associated riparian land, wetlands, woodlands and natural grasslands.
- From a habitat suitability perspective, "non-crop" classes are just as important as crop, grassland & grazing land classes.

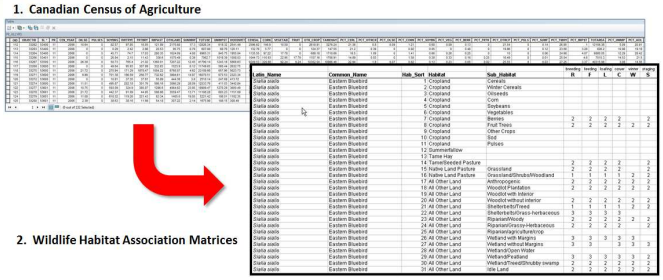

# Habitat Suitability Analysis

- Assessing the capacity of farmland to support wildlife habitats is important to understanding the impact of agriculture on the environment.
- Land covers associated with farmland vary in their ability to support wildlife, with natural & semi-natural cover types of highest value to wildlife.
- The **Wildlife Habitat Availability on Farmland (WHAF) Indicator** was developed by AAFC to measure and report on habitat suitability across Canada's agricultural landscape.
- Until recently, the WHAF Indicator was calculated every five years based on AAFC's interpolated Census of Agriculture (…2001; 2006; 2011).
- The 2012 national operationalization of AAFC's Annual Space-Based Crop Inventory (ACI) means that this indicator can now be calculated annually and with much greater detail.

# WHAF (Based on Census of Agriculture)

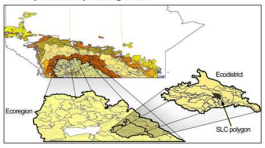
**Old (Census of Ag Based) Methodology** ⇨ Uses **Interpolated Census of Agriculture** values reported for Soil Landscape of Canada (SLC) polygons to estimate the Wildlife Habitat Availability on Farmland indicator.

1. Canadian Census of Agriculture



2. Wildlife Habitat Association Matrices

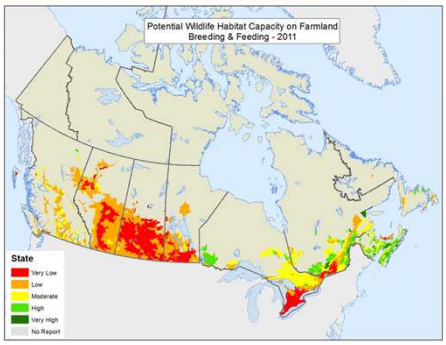
3. Spatial Reporting Unit



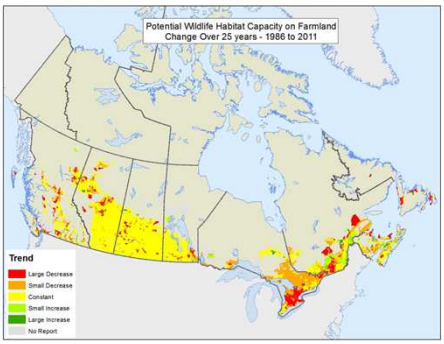

4. Species Distributions

# WHAF (Based on Census of Agriculture)

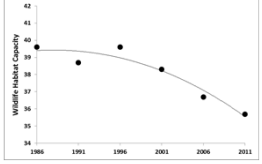
**(a) State**




**(b) Trend**




- The state and temporal trends in the WHAF are generated at SLC level nationally for Canada.



# WHAF (Based on Census of Agriculture)

**Limitations of existing the WHAF Indicator…**

*… the lack of resolution in the COA "All Other Land" category.*

| Latin_Name | Common_Name | Hab_Sort | Habitat | Sub_Habitat | breeding R | feeding F | loafing L | cover C | winter W | staging S |
|---|---|---|---|---|---|---|---|---|---|---|
| *Sialia sialis* | Eastern Bluebird | | Cropland | Cereals | | | | | | |
| *Sialia sialis* | Eastern Bluebird | | Cropland | Winter Cereals | | | | | | |
| *Sialia sialis* | Eastern Bluebird | | Cropland | Oilseeds | | | | | | |
| *Sialia sialis* | Eastern Bluebird | | Cropland | Corn | | | | | | |
| *Sialia sialis* | Eastern Bluebird | | Cropland | Soybeans | | | | | | |
| *Sialia sialis* | Eastern Bluebird | | Cropland | Vegetables | | | | | | |
| *Sialia sialis* | Eastern Bluebird | | Cropland | Berries | 2 | 2 | 2 | 2 | | 2 |
| *Sialia sialis* | Eastern Bluebird | | Cropland | Fruit Trees | 2 | 2 | 2 | 2 | 2 | 2 |
| *Sialia sialis* | Eastern Bluebird | | Cropland | Other Crops | | | | | | |
| *Sialia sialis* | Eastern Bluebird | 1 | Cropland | Sod | | | | | | |
| *Sialia sialis* | Eastern Bluebird | 1 | Cropland | Pulses | | | | | | |
| *Sialia sialis* | Eastern Bluebird | 1 | Summerfallow | | | | | | | |
| *Sialia sialis* | Eastern Bluebird | 1 | Tame Hay | | | | | | | |
| *Sialia sialis* | Eastern Bluebird | 1 | Tame/Seeded Pasture | | 2 | 2 | 2 | 2 | | 2 |
| *Sialia sialis* | Eastern Bluebird | 1 | Native Land Pasture | Grassland | 2 | 2 | 2 | 2 | | 2 |
| *Sialia sialis* | Eastern Bluebird | 1 | Native Land Pasture | Grassland/Shrubs/Woodland | 1 | 1 | 1 | 1 | 2 | 2 |
| *Sialia sialis* | Eastern Bluebird | 1 | All Other Land | Anthropogenic | 2 | 2 | 2 | 2 | 2 | 2 |
| *Sialia sialis* | Eastern Bluebird | 1 | All Other Land | Woodlot Plantation | 2 | 2 | 2 | 2 | 2 | 2 |
| *Sialia sialis* | Eastern Bluebird | 1 | All Other Land | Woodlot with Interior | | | | | | |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Woodlot without interior | 2 | 2 | 2 | 2 | 2 | 2 |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Shelterbelts/Treed | 1 | 1 | 1 | 1 | 2 | 2 |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Shelterbelts/Grass-herbaceous | 3 | 3 | 3 | 3 | | |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Riparian/Woody | 2 | 2 | 2 | 2 | 2 | 2 |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Riparian/Grassy-Herbaceous | 2 | 2 | 2 | 2 | | 2 |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Riparian/agriculture/crop | | | | | | |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Wetland with Margins | 3 | 3 | 3 | 3 | 3 | |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Wetland without Margins | 3 | 3 | | 3 | 3 | 3 |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Wetland/Open Water | | | | | | |
| *Sialia sialis* | Eastern Bluebird | 2 | All Other Land | Wetland/Peatland | 3 | 3 | 3 | 3 | 3 | 2 |
| *Sialia sialis* | Eastern Bluebird | 3 | All Other Land | Wetland/Treed/Shrubby swamp | 2 | 2 | 2 | 2 | 2 | 2 |
| *Sialia sialis* | Eastern Bluebird | 3 | All Other Land | Idle Land | 2 | 2 | 2 | 2 | 2 | 2 |

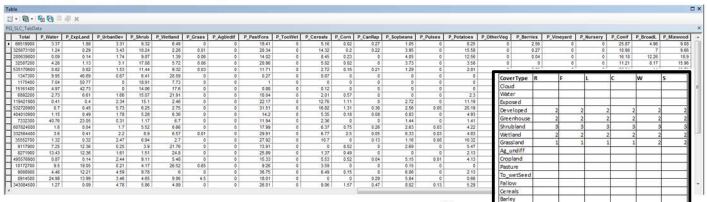
# A New Generation of EO-Based Indicators

- Issues with Census of Agriculture / SLC approach arise because of coarse geographic reporting scale (e.g. hidden effects from counterbalancing).
- AAFC's Annual Space-Based Crop Inventory allows characterization of within-SLC spatial variability to much finer spatial resolutions (field level).
- Changes can be reported for any reporting unit of interest (i.e. is not limited to the SLC reporting scale; can choose any administrative reporting boundaries or user-defined grids).
- Areas of general "Cropland" (cereals, oilseeds, corn) and "All Other Land" classes (pasture, grassland, woodland, wetland, and unimproved pasture, etc) now can be estimated to greater detail than ever before.
- EO-based methodologies better enable AAFC to timely report changes to wildlife habitat on farmland and the identification of key factors and trends (both positive and negative) that are driving them.

# WHAF (Earth Observation Based)

**New (EO-Based) Methodology** ⇨ Using **Earth Observation (EO) Data** to Calculate the Wildlife Habitat Availability on Farmland Indicator.

1. AAFC Annual Crop Type Inventory



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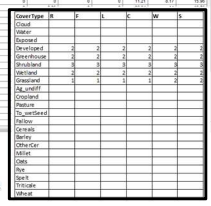
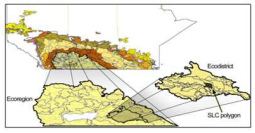


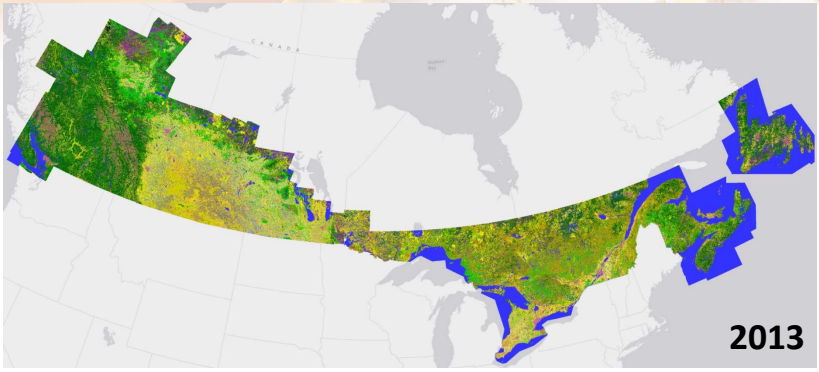
3. Spatial Reporting Unit




4. Species Distributions

# WHAF (Earth Observation Based)

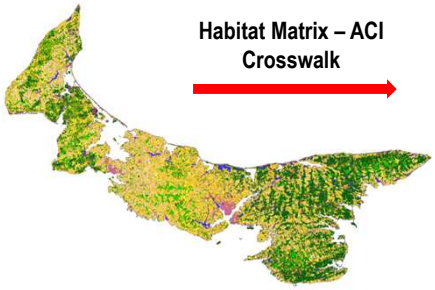
## Annual Space-Based Crop Inventory for Canada




Legend/Légende

- Water/Eau
- Exposed Lands/Sols nus
- Developed/Zones développées
- Shrubland/Arbustes
- Wetlands/Terres humides
- Grassland/Prairies
- PerennialCrops and Pastures/Cultures pérennes et pâturages
- Too Wet to be Seeded/Trop humide pour les semis
- Fallow/Jachère
- Cereals/Céréales
- Barley/Orge (SK/AB)
- Millet/Millet (SK/AB)
- Oats/Avoine (SK/AB)
- Rye/Seigle (SK/AB)
- Triticale/Triticale (SK/AB)
- Wheat/Blé (SK/AB)
- Corn/Maïs
- Oilseeds/Oléagineux
- Borage/Bourrache (SK)
- Camelina/Caméline (ON/AB)
- Canola-Rapeseed/Canola-Colza
- Flaxseed/Graines de lin
- Mustard/Moutarde (Prairies)
- Safflower/Carthame (MB)
- Sunflower/Tournesols
- Soybean/Soja
- Peas/Pois
- Beans/Fèves
- Lentils/Lentilles (SK/AB)
- Vegetables/Légumes
- Fruits/Fruits
- Herbs/Fine Herbes
- Nursery/Pépinière (ON/BC)
- Buckwheat/Sarrasin
- Canary Seed/Alpiste des canaries (Prairies)
- Hemp/Chanvre (Prairies)
- Other Crops/Autres cultures
- Coniferous Forest/Forêt de conifères
- Deciduous Forest/Forêt de feuillus
- Mixed Forest/Forêt de feuillus

# WHAF (Earth Observation Based)



Habitat Matrix – ACI Crosswalk

| ACI_Habitat | Code | FromMatrix | New_VAL |
|---|---|---|---|
| Cloud | 10 | NA - No habitat value - data limita | Cloud |
| Water | 20 | Open Water | Water |
| Exposed Land | 30 | NA * No Habitat Value in New Mat | Exposed |
| Developed | 34 | Anthropogenic | Developed |
| Greenhouses | 36 | Anthropogenic | Greenhouse |
| Shrubland | 50 | No value from Original Matrix - Re | Shrubland |
| Wetland | 80 | Wetland -Margin/No Margin/Peat | Wetland |
| Grassland | 110 | Unimproved Pasture/Grassland/Sl | Grassland |
| Agriculture_undiff | 120 | Other Crops | Ag_undiff |
| Cropland | 121 | Other Crops | Cropland |
| Pasture/Forage/Hay | 122 | Tame Hay/Tame Seeded Pasture | Pasture |
| Too Wet To Seed | 130 | Summerfallow | To_wetSeed |
| Fallow | 131 | Summerfallow | Fallow |
| Cereals | 132 | Cereals | Cereals |
| Barley | 133 | Cereals | Barley |
| Other Cereals | 134 | Cereals | OtherCer |
| Millet | 135 | Cereals | Millet |
| Oats | 136 | Cereals | Oats |
| Rye | 137 | Cereals | Rye |
| Spelt | 138 | Cereals | Spelt |
| Triticale | 139 | Winter Cereals | Triticale |
| Wheat | 140 | Cereals | Wheat |
| Swithcgrass | 141 | Cereals | Switchgras |
| Winter Wheat | 145 | Winter Cereals | Winter_Whe |
| Spring Wheat | 146 | Cereals | Spring_Whe |

# WHAF (Earth Observation Based)

- For each SLC (or reporting unit), species-specific habitat availability (SSHA) can be calculated for breeding and feeding requirements by generating a weighted mean of habitat use based on (a) the relative proportion of cover types used, and (b) the value of that habitat to the species as follows:

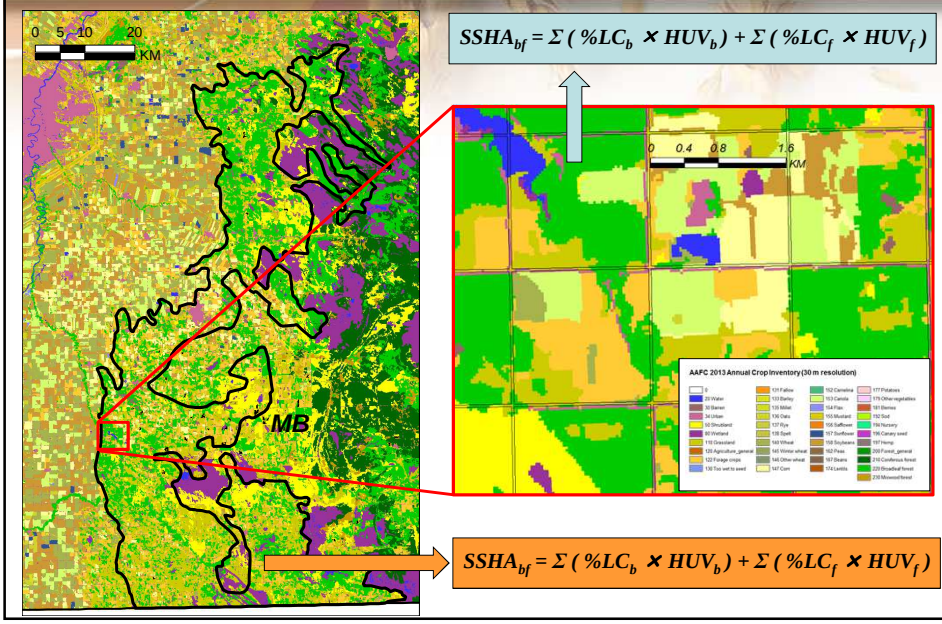
$$SSHA_{bf} = \Sigma\,(\,\%LC_b \times HUV_b\,) + \Sigma\,(\,\%LC_f \times HUV_f\,)$$

*Where:*

$\%LC$ = The percentage of unit occupied by particular land cover category used by the species, and $HUV$ = Habitat Use Value for breeding (b) and feeding (f) (primary = 1, secondary = 0.75, tertiary = 0.25).

- Habitat Capacity based on breeding and feeding is the average of each SSHA for each SLC (or reporting unit).

# WHAF (Earth Observation Based)

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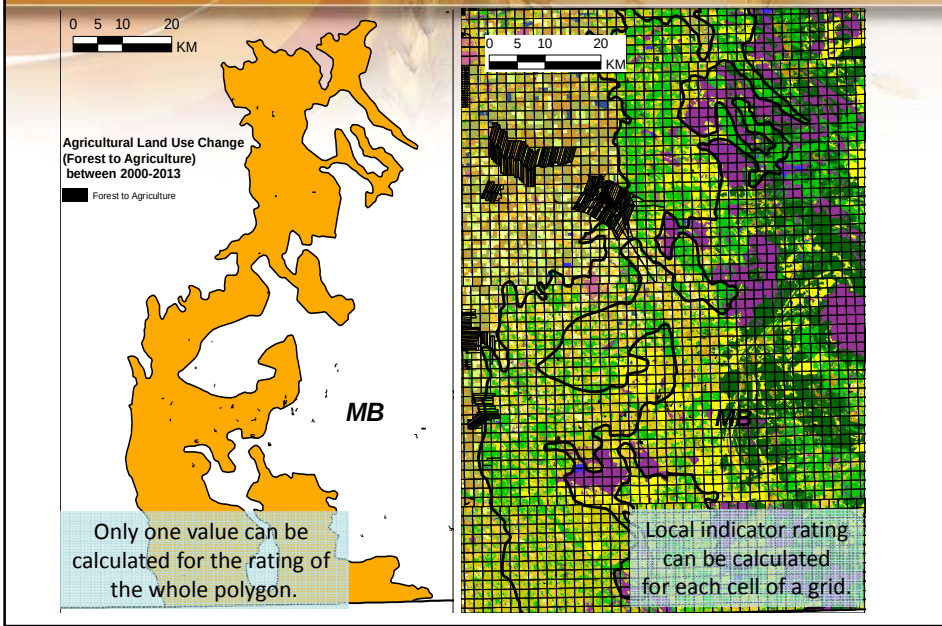
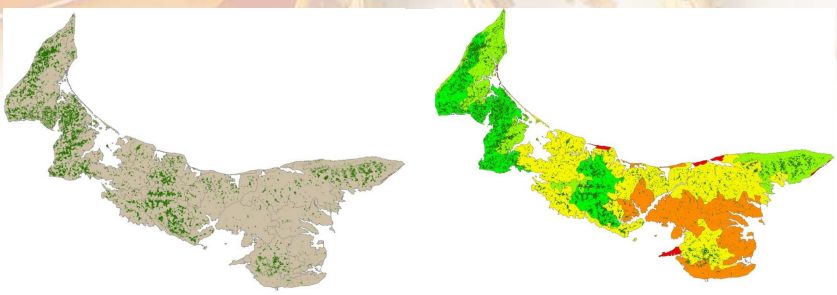
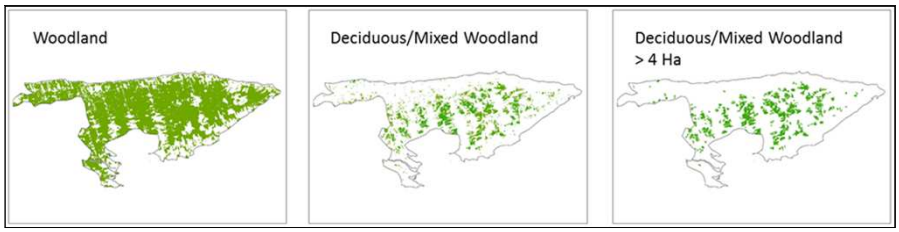
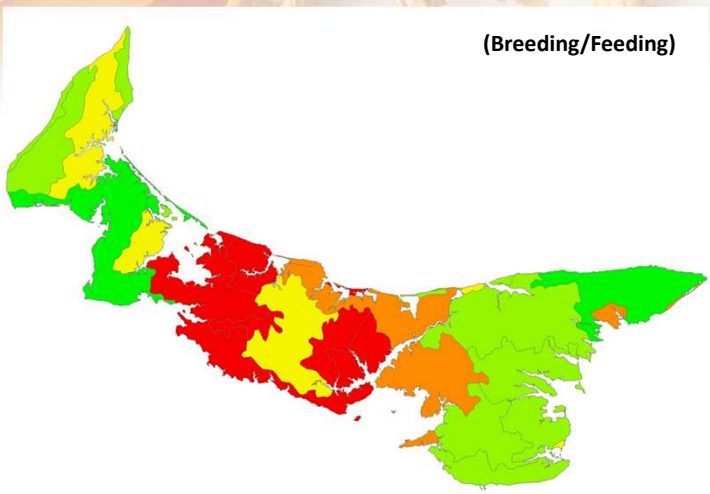


## E.g. Potential Ovenbird Habitat Capacity for PEI






## E.g. Multi-Species Habitat Capacity for PEI



# Summary

- EO-based indicators provide higher resolution “spatially specific” data for analysis and more rigorous estimates of uncertainty to modelers.
- Further engagement of CRSC is required to identify needs of the agriculture sector and ensure indicators are relevant to the sector.
- Ensure new EO-based methods are coherent, complete and consistent, and are able to provide detailed and timely information on landscape state and change as required.
- Explore the application of scalable methodologies to other indicators.
- Further development of the AAFC Agricultural Monitoring Framework to support ongoing indicator activities (an integrated National Monitoring Framework for Canada to support a broad range of policy and program requirements related to the health of Canada’s terrestrial ecosystems).