

South Nation and Elm Creek

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JECAM

Joint Experiment for Crop Assessment and Monitoring

 GROUP ON
EARTH OBSERVATIONS

Site Description

- Location: South Nation watershed, east of Ottawa
 - Site description:
 - Silt loams with poor drainage
 - slopes generally <1%.
 - Climate: cool temperate humid continental
 - Land Use:
 - Livestock, cash crops (corn, soybean, wheat) and forages.
 - crop rotations of cereals-corn-soybean, can be found.
 - conventional tillage
 - Field size: mean field sizes of 4.75 hectares
- Location: Elm Creek, southern Manitoba
 - Site description:
 - sands, coarse loamy, loamy with a strong transition to clayey
 - slopes from 0% to 2%
 - Climate: cool temperate humid continental
 - Land Use:
 - forage, pasture, canola, flaxseed, sunflower, soybean, corn, barley, spring wheat, winter wheat, rye, oats, canary seed, potatoes, field peas.
 - field rotations of cereals alternating with oilseed\pulse.
 - Field size: ranges from 20-30 hectares to 50-60 hectares

Project Objectives

- Crop identification
 - Development of SAR methods for early and end of season mapping using multi-frequency, full and compact polarimetry
- Crop Condition/Stress
 - Development of SAR methods to estimate crop condition and indicators of crop productivity
 - Use of optical indices to quantify beneficial impacts of controlled drainage
- Land Productivity in Response to Management
 - Evaluate the potential for integrating EO and soil attributes to generate site-specific productivity ratings

Earth Observation (EO) Data Received/Used Through JECAM

South Nation (2013)

- 8 TerraSAR-X dual-polarization strip mode
- 15 RapidEye frames

South Nation (2012)

- 6 TerraSAR-X dual-polarization strip mode

In situ Data

South Nation (2012 and 2013)

- Collected on fields under controlled and uncontrolled drainage
- Hemispherical photos for LAI
- SPAD measurements for relative chlorophyll
- crop height
- CROPSCAN reflectance
- phenology
- biomass

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Results – South Nation

1. Radarsat-2 and TerraSar-X for early season crop classification and performance of two speckle filters. The results published in McNairn *et al.* (2014). Best results were obtained when using TerraSar-X data:

- Corn: accurately (>89%) identified by the end of June, six weeks after planting, at a vegetative growth stage (V6 – sixth leaf collar developed).
- Soybeans: accurately identified (>91%) by mid August, at reproductive stage (R5 – seed development is beginning).

2. RapidEye vegetation indices to estimate leaf area index (LAI) and biomass in corn and soybean. Manuscript submitted for publication.

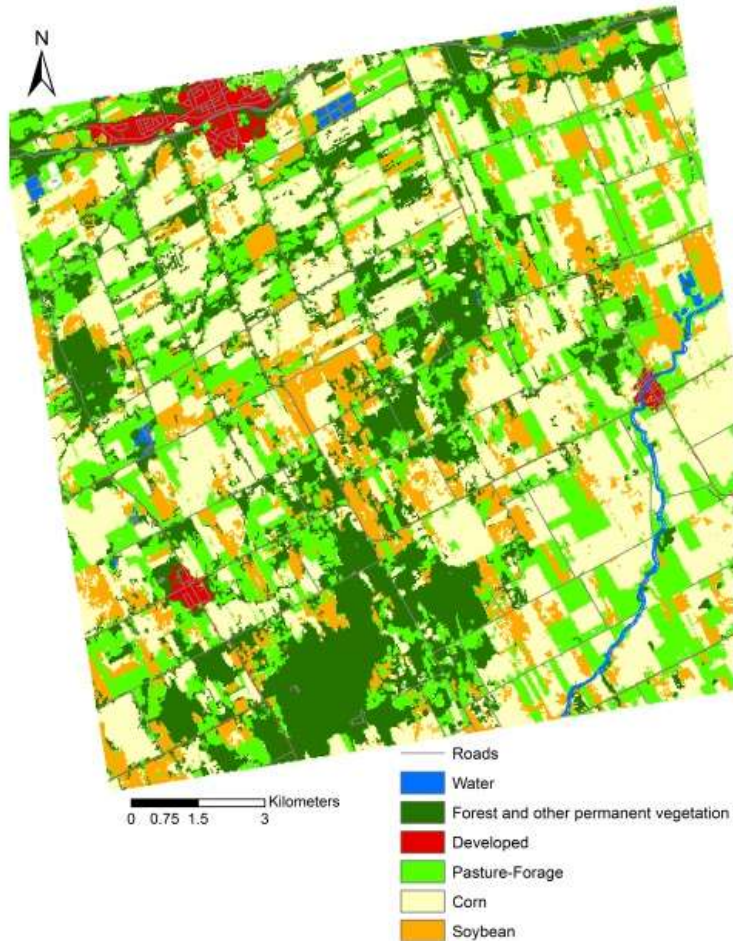
- Most indices showed sensitivity to LAI from emergence to 8 m²/m²; NDVI, red-edge NDVI and green NDVI were insensitive to crop type (r² between 87% and 94%)
- Cumulative vegetation indices performed best for estimation of total dry aboveground biomass, especially for corn (r² between 73% and 97%).

3. Comparison of LAI and biomass from paired fields under controlled and uncontrolled drainage between 2005 and 2013 using vegetation indices derived from RapidEye, Landsat and Spot data.

Kross, A., McNairn, H., Lapen, D., Sunohara, M., Champagne, C. (submitted June 2014). Assessment of RapidEye vegetation indices for estimation of leaf area index and biomass in corn and soybean crops. *International Journal of Applied Earth Observation and Geoinformation*. Under review.

Results – South Nation

Early season crop identification



End of season TerraSAR-X crop classification: Ottawa 2012
Overall accuracy: **97.2%**

Early season: Corn can be identified at V6 or 6th leaf collar stage (about 6 weeks after planting)

McNair, H., Kross, A., Lapen, D., Caves, R., and Shang J. 2014. Earlyseason monitoring of corn and soybeans with TerraSAR-X and RADARSAT-2, *International Journal of Applied Earth Observation and Geoinformation* 28 (2014) 252–259.

Research Plans for Next Growing Season

- South Nation
 - weekly RapidEye images have been requested to complete final year of research
 - LAI, crop height, CROPSCAN reflectance, phenology, biomass
- Manitoba
 - TerraSAR-X (two orbits at 11-day repeats) to develop canola phenology indicator
 - canola phenology
 - 5 RapidEye images (beginning May to end of June)
 - crop height, phenology, fisheye photos, soil samples