

GEO Joint Experiment for Crop Assessment and Monitoring (JECAM):

Research Progress Report

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JECAM Test Site Name: Red River, MB, Canada

Team Leader and Members:

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Use of Information

In addition to the report we would also like to use the information and images you provide to update the jecam.org website. Do you agree to this use of your information: YES

Project Objectives

Have the original objectives for your site changed: NO

Please briefly describe the areas that you are working on from the list below (i.e. topic, general methods, intended operational outcome, if any):

- Crop mapping at 30m pixel resolution
 - 2014 growing season crop inventory maps were created (30m resolution) covering all Manitoba as a part of the Agriculture and Agri-Food Canada annual EO-based national crop inventory program
 - Developing spatial data and very accurate EO-based crop identification at 5m pixel resolution: Testing various EO-statistically-based methods and developing methodologies for highly accurate classification of target crops in different parts within the Manitoba pilot area with various levels of landform homogeneity. A journal paper is submitted for publication related to this component.

- Testing the application of multivariate statistical methods to improve classification of pasture and forage crops from some of the annual target crops within the Manitoba pilot site. Results submitted for publication as a journal paper.
 - Testing, developing and applying geostatistical methodologies for re-allocation of target variables to the Terrestrial Monitoring sampling framework points within the Prairies province based on the results of the pilot sites.
 - Developing spatial databases based on the above methods to estimate value:
 - 1- As discrete data for the location of the samples of the Terrestrial Monitoring Framework, and depending on the variable
 - 2- As continuous spatial data
 - Methods to accurately estimate the area of target major crops based on the stratification of the pilot sites by farming systems are being tested and developed.
- Crop Condition/Stress
 - Collected crop phenology, leaf area index, and biomass over selected fields in 2014 (Figure 3).
 - Soil Moisture
 - With the addition of 3 new stations in 2014, this site currently has twelve automated in situ monitoring stations set up to capture larger scale variation in soil moisture to support calibration and validation of remotely sensed and modelled soil moisture data products. The data from these stations is collected every 15 minutes and transmitted to a central server, where it undergoes a quality control filtering before it is released for distribution.
 - Soil moisture measurements were taken at 5-cm depth weekly over two spring wheat fields, two corn fields, two canola fields and two soybean fields throughout the growing season using a Theta probe.
 - Crop Residue, Tillage and Crop Cover Mapping
 - Nothing for 2014.

Site Description

- Location: Red River and Assiniboine River Basins, Manitoba, Canada (Figure 1)

- Topography: Majority of the soils in the study area is derived from lacustrine-based depositions and is very flat. The northern edge of the study area is more influenced by glacial-till deposition and has lower relief ridge and swale topography.
- Soils: Majority of soils have a clay surface texture as a result of lacustrine deposits. Soils in the southwest region of the study area have sandier surface textures (sands-loamy sands) overlaying heavier clay deposits. Soils in the northern region are generally finer textured loams-clay loams with the occurrence of stones as a result of glacial-till deposits.
- Drainage class/irrigation: Majority of the soils are imperfect to poorly drained. A large network of surface drains is in place to allow the production of annual crops. A limited amount of irrigation exists in the area near Portage la Prairie and Carmen on lands devoted to the production of potatoes and high-value horticultural crops. Tile drainage is installed on a small percentage of land around Carmen on imperfectly drained soils that are used for high value crop production.
- Crop calendar: Early May – early June (seeding), August – early October (harvest)
- Field size : Quarter Section - 64 hectares (160 acres)
- Climate and weather: The study area falls into the Humid Continental climate zone with cold winters and warm summers. Precipitation is distributed throughout the year with the majority of precipitation falling in the spring and summer months.
- Agricultural Crops used: Land is primarily used for the production of annual crops. Primary crops include: wheat, oats, canola, soybeans, and corn. Potato production and other horticultural crops are produced near Carmen and Portage la Prairie. Conventional and minimum tillage systems are used for most annual crop production. The more marginal land in the northern areas is used for forage and pasture production.
- Photograph(s): 1.

Earth Observation (EO) Data Received/Used

Landsat 8, Radarsat2, RapidEye data were acquired during the growing season of 2014.

In situ Data

Presently there are 12 in situ soil moisture monitoring stations in the Red River basin site as indicated in Figure 2. Intensive crop biophysical parameters were measured weekly throughout the growing season in 2014 for spring wheat, corn, soybean, and canola. Results

Crop types map (30 m) resolution was created for the whole area including the JECAM monitoring site for the 2014 growing season. Methods for accurate crop area estimation based

on the annual crop inventory and crop types identified at the location of the sampling framework of the monitoring sections are being developed.

Plans for Next Growing Season

The EO-based 2015 crop inventory map (30 m) resolution will be created for the whole agricultural area (accuracy of crop classes around 85%) covering the JECAM monitoring area. Field work will be done to record crop types for all fields within some of the monitoring sections located in the JECAM monitoring area. Results will be applied to develop methods for very accurate crop area estimations.

Crop conditions will be monitored at weekly time intervals in an area south of the JECAM monitoring site (Figure 1). Methods to derived crop growth stage and harvest status from radar and optical satellites will be developed.

Soil moisture mapping from active and passive microwave is being piloted over this site due to the high quality soil moisture validation available.

Publications

Wiseman, G., McNairn, H., Homaayouni, S., Shang, J. (2014). RADARSAT-2 Polarimetric SAR Response to Crop Biomass for Agricultural Production Monitoring. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, VPP (99):11.

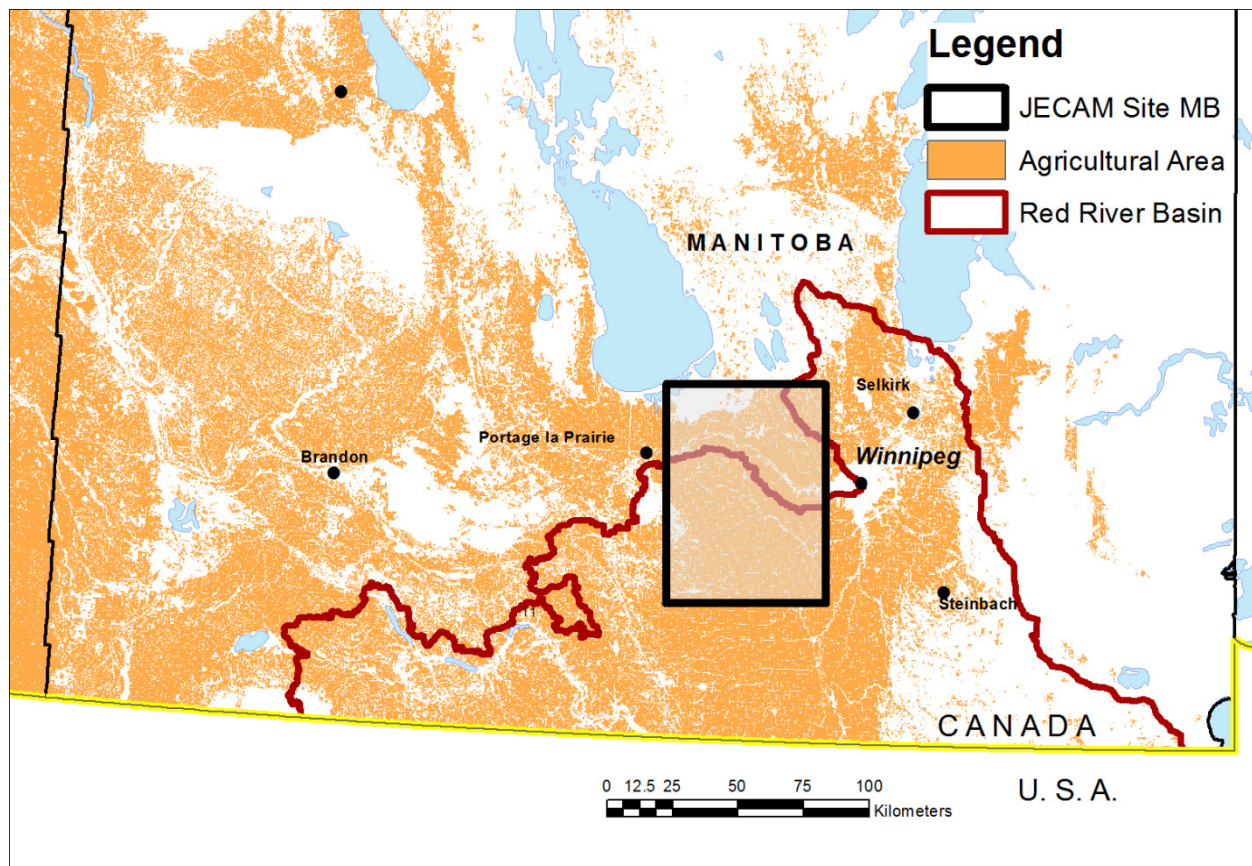


Figure 1- Location of the JECAM monitoring site in Southern Manitoba, Canada.

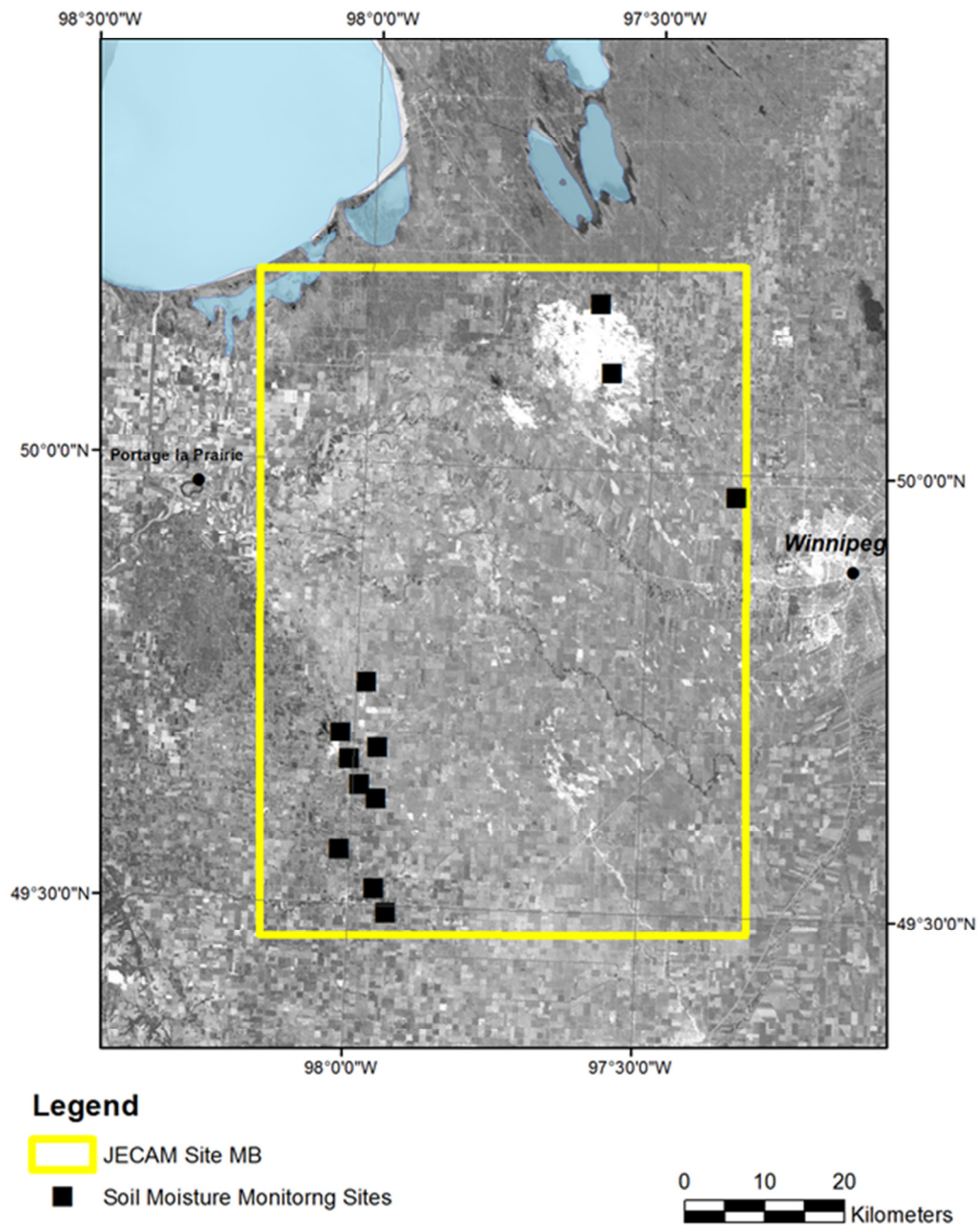
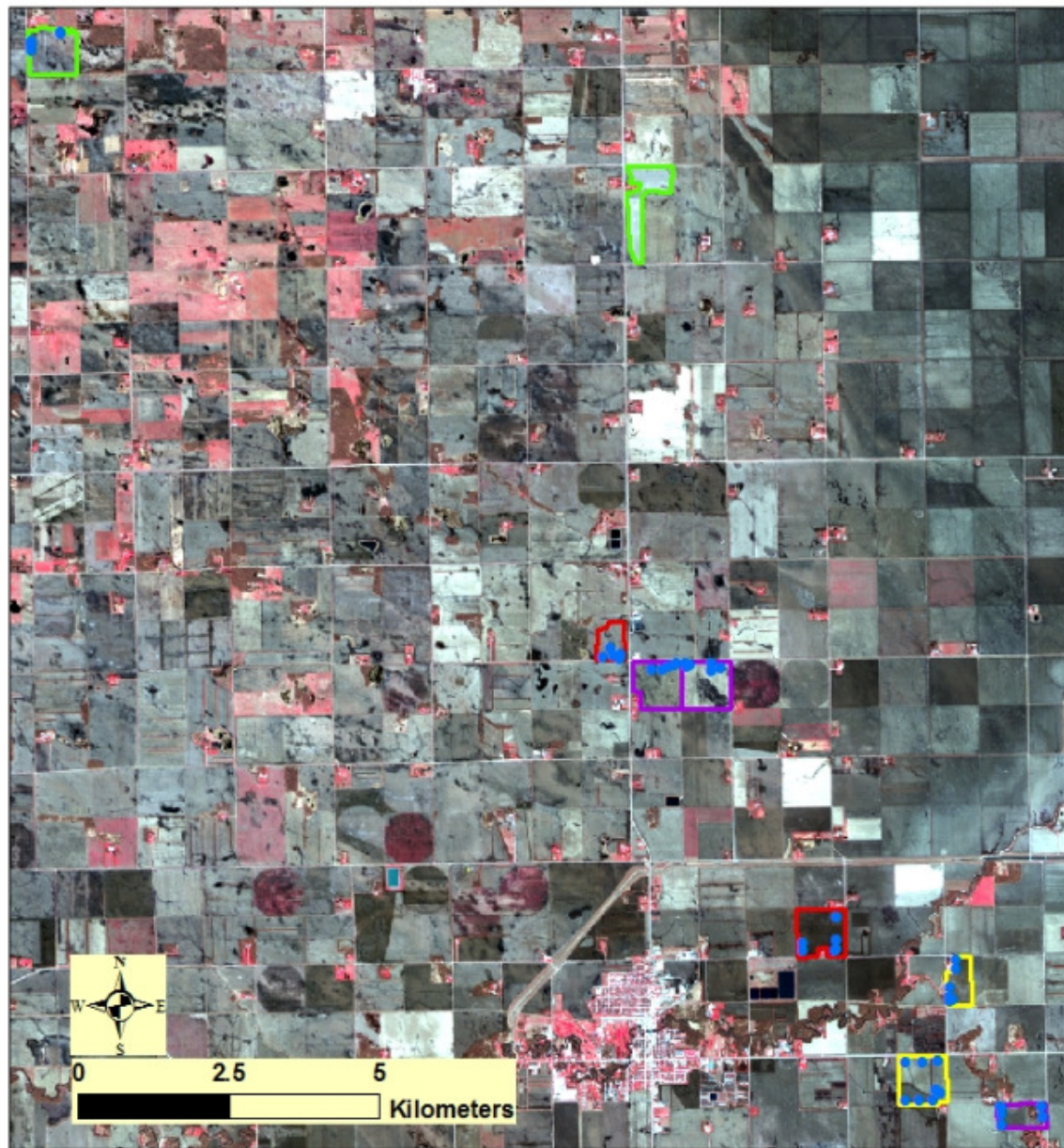


Figure 2- Location of the 12 in situ soil moisture monitoring stations within the JECAM monitoring site in Southern Manitoba, Canada.

Manitoba 2014 Field Locations and Sample points



Legend

- 2014_MB_SamplePoints
- Canola
- Corn
- Soybean
- Wheat

RGB Composite: 5-3-2
Image: RapideEye
Date: May09, 2014

Figure 3. Intensive field sampling distribution of the JECAM monitoring site in Manitoba, Canada.



Figure 4- Example of the general morphology and landscape of the JECAM monitoring site in Manitoba, Canada.