



Agriculture and
Agri-Food Canada

Agriculture et
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Canadian JECAM Site

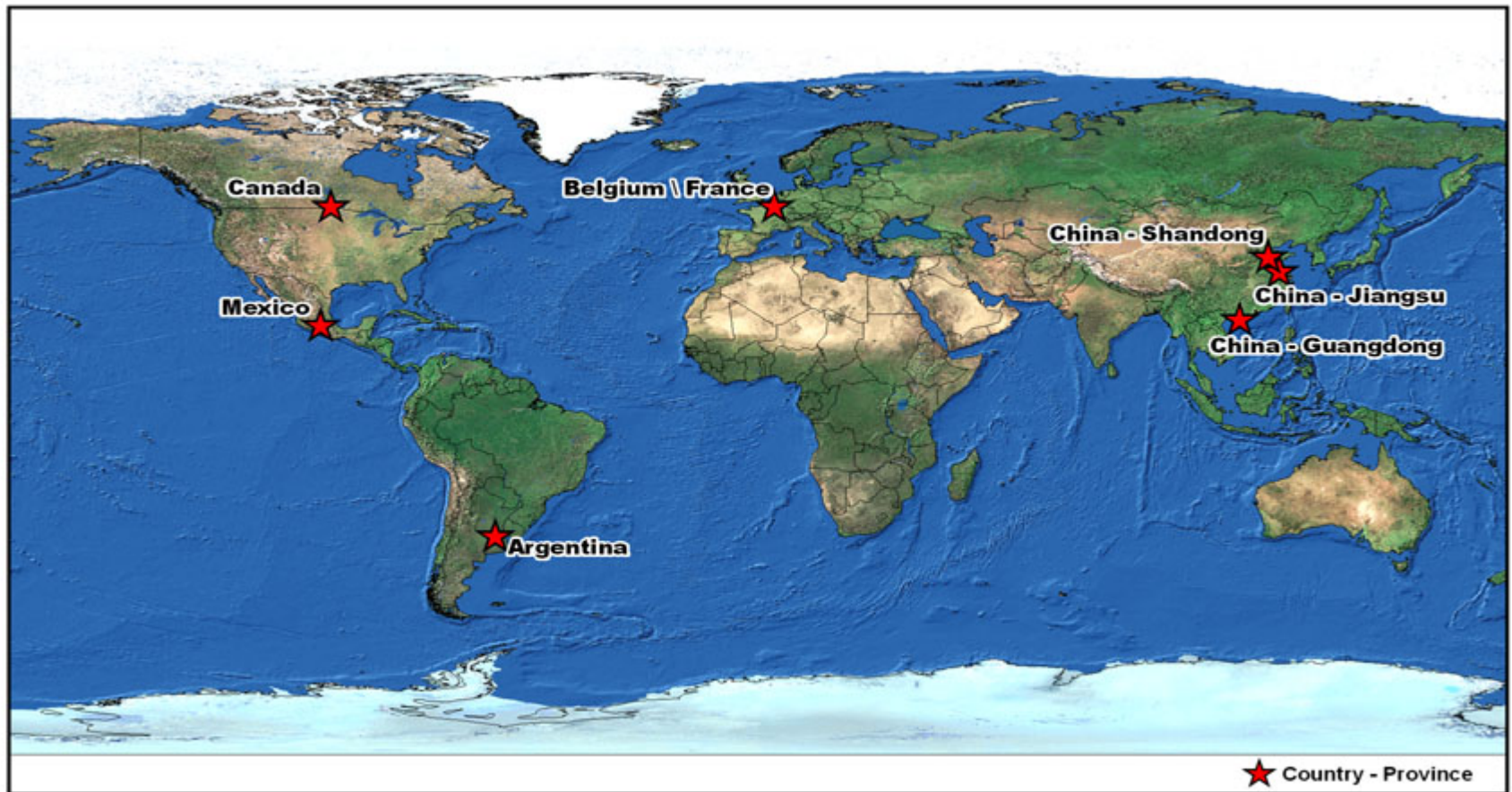
Heather McNairn and Ian Jarvis
Agriculture and Agri-Food Canada

Canada

JECAM

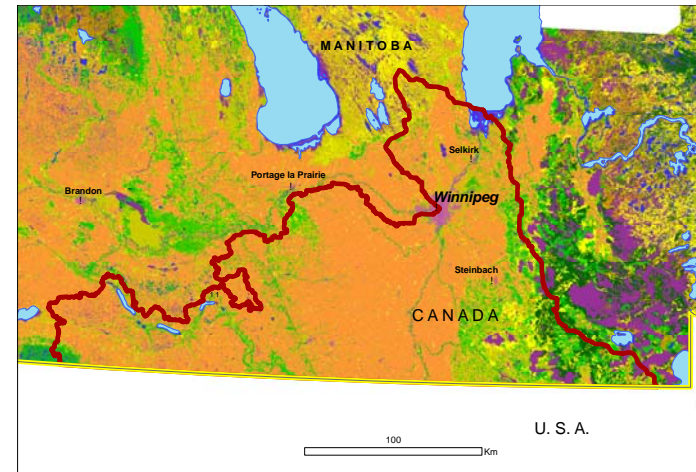
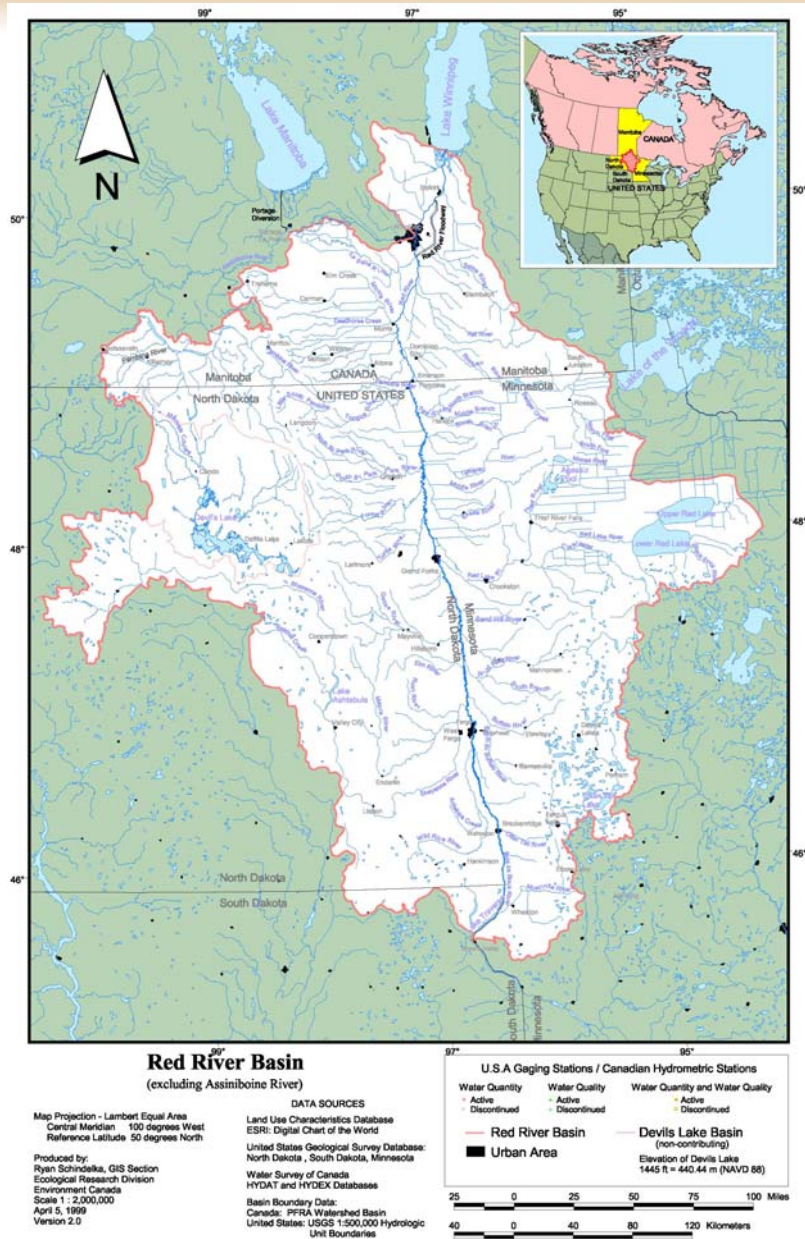
- JECAM: Joint Experiment for Crop Assessment and Monitoring
- An activity under the Agricultural Community of Practice of GEO (Group on Earth Observation)
- AAFC hosts the JECAM Secretariat
- The overarching goal of JECAM is to reach a convergence of approaches, develop monitoring and reporting protocols and best practices for a variety of global agricultural systems
- Set of international “super-sites”
- Negotiations underway with satellite data providers to acquire data over sites for duration of JECAM

Current JECAM Sites



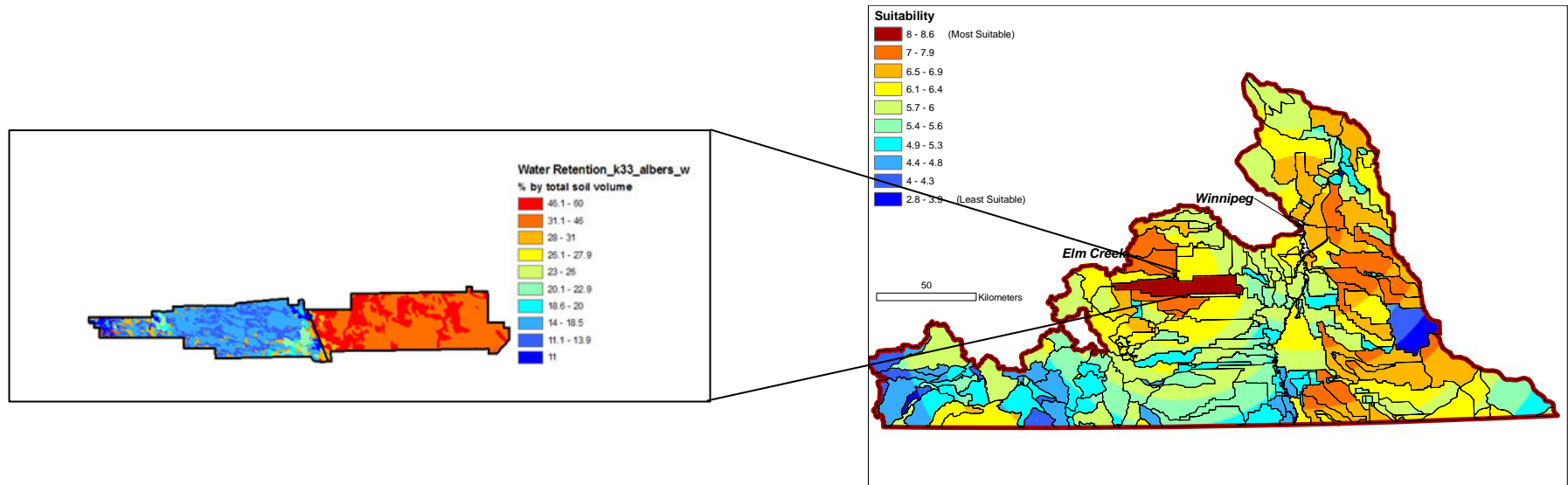
<http://www.umanitoba.ca/outreach/aesb-jecam/index.html>

Red River Watershed



- Approximately 75% of the Red River watershed resides within Minnesota, North Dakota and South Dakota, U.S.A. The remaining 25 % resides within Manitoba, Canada.
- A watershed of extremes in soil moisture.
According to the 2008-2009 Annual Report from the Manitoba Agricultural Services Corporation drought and excessive heat have historically (1960-2007) accounted for 37% of reported crop losses, while excessive moisture was responsible for 36% of losses.
- Largely agricultural land use with wide range of crop and soil conditions

Selection of Sub-Watershed Within Red River Watershed



- Sub-watershed was selected to serve as an intensive research site
- Sub-watershed selection based on geostatistical analysis (Dr. Bahram Daneshfar)
- Selection factors based on soil texture and derived soil variables, and proximity to regional staff
- Brunkild sub-watershed was identified as most suitable based on this analysis
- Excellent contrast in soil properties from west (fine clay soils) to east (coarser and better drained soils)

Characteristics of Brunkild Watershed

Typical Field Size (Area)

- Ranges from 20-30 hectares to 50-60 hectares

Crop Types

- Forage, pasture, canola, flaxseed, sunflower, soybean, corn, barley, spring wheat, winter wheat, rye, oats, canary seed, potatoes, field peas

Typical Crop Rotation

- Cereal crop alternating with Oilseed\Pulse

Crop Calendar

- April\May-September

Soil Texture

- Sands, coarse loamy, loamy with a strong transition to clayey

Landscape Topology

- Flat to gently undulating with slopes from 0% to 2%

Soil Drainage Class

- Poor to imperfectly drained

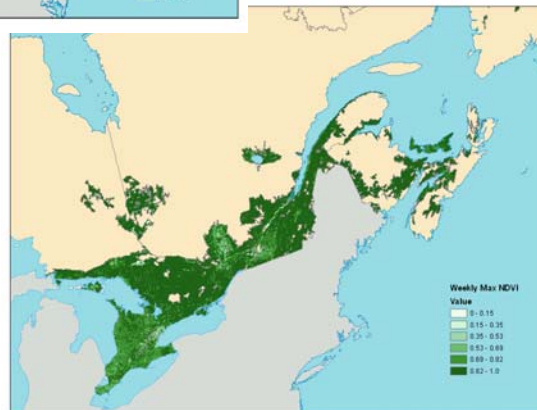
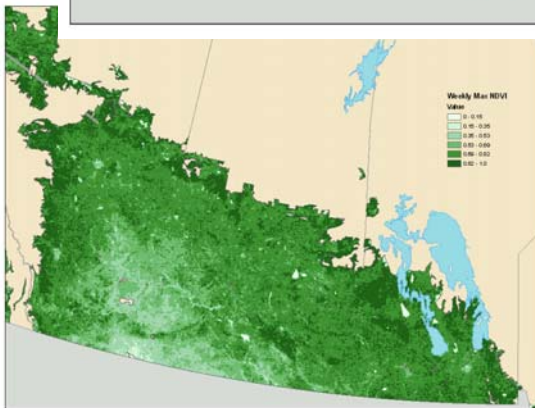
Current Satellite Acquisitions over Brunkild

- MODIS
- ResourceSAT-1 AWiFS
- SPOT-4/5
- Landsat
- AMSR-E
- SMOS
- RADARSAT-1/2
- ALOS Palsar
- TerraSAR-X

EO Activities – Operational

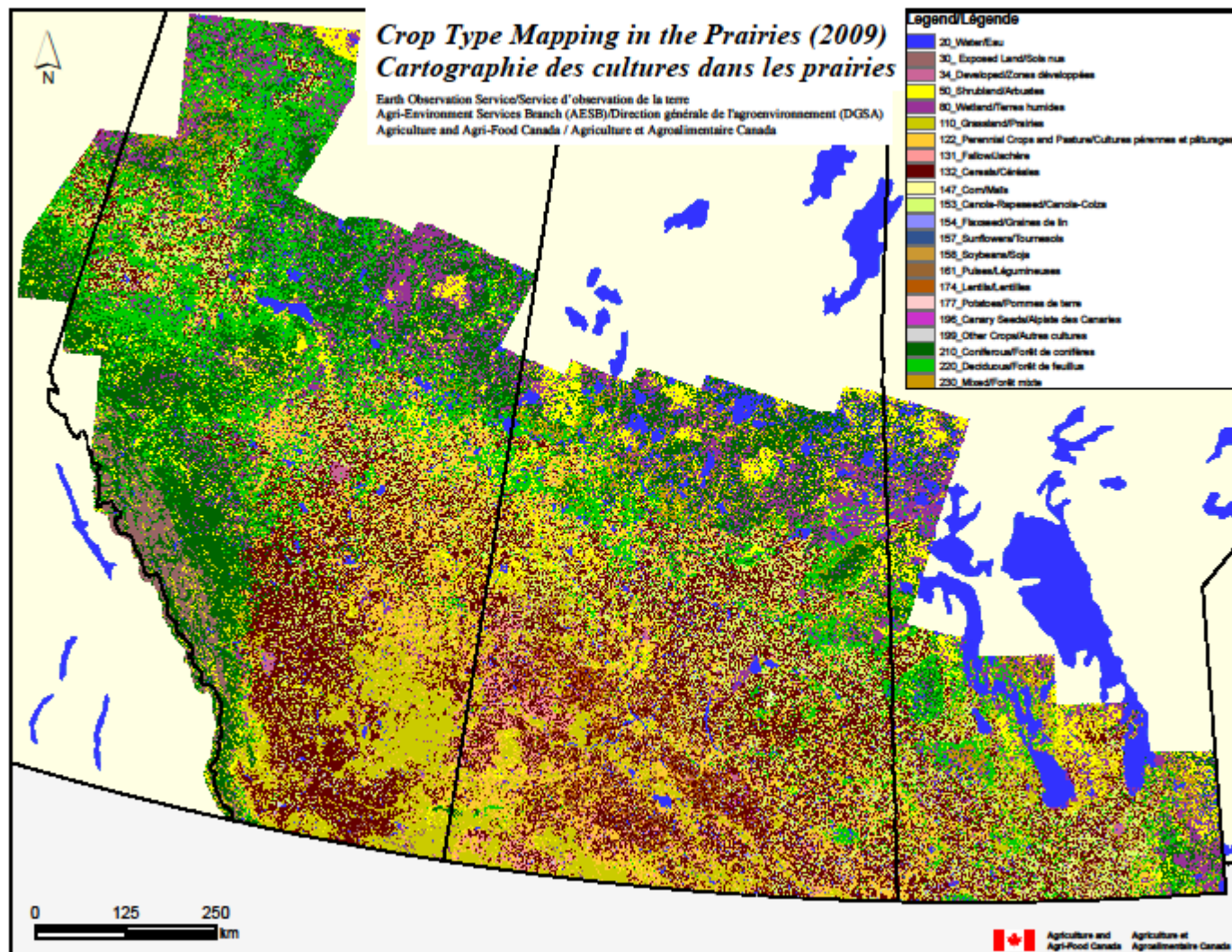


- Weekly MODIS Normalized Difference Vegetation Index (NDVI) products
- Covers entire agricultural extent of Canada



Agri-Environmental Services Branch

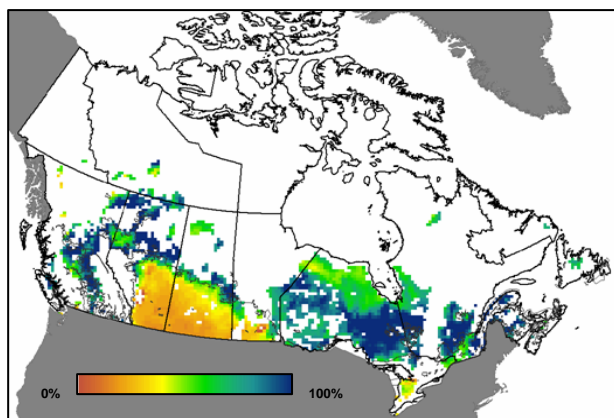
Annual Crop Inventory – Pilot Stage



AMSR-E Soil Moisture – Ready for Piloting

NASA-VUA

(Land Parameter Retrieval Model- LPRM)
- C and X band soil moisture

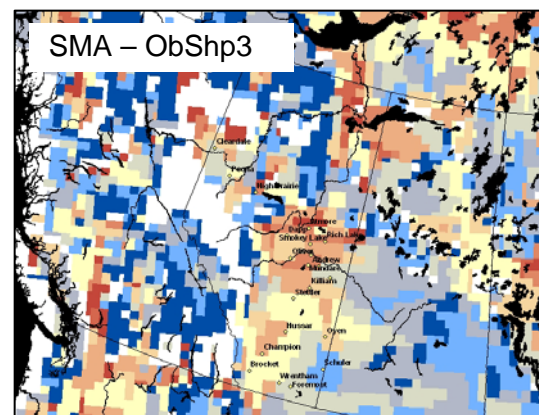
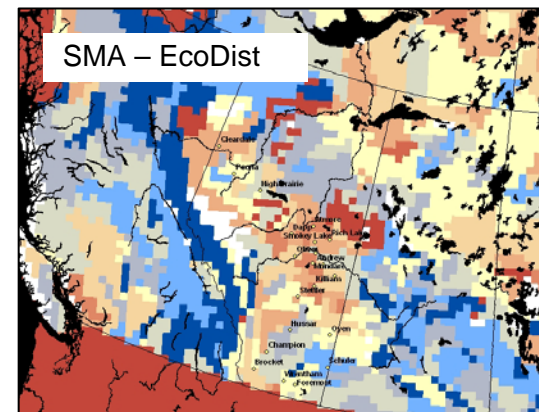


Champagne, C., Berg, A., Belanger, J., McNairn, H., and deJeu, R. 2010. "Evaluation of Soil Moisture Derived from Passive Microwave Remote Sensing Over Agricultural Sites in Canada Using Ground-based Soil Moisture Monitoring Networks" International J. of Remote Sensing, 31 (14): 3669-3690.

C. Champagne, H. McNairn and A.A Berg. "Monitoring Agricultural Soil Moisture Extremes in Canada Using Passive Microwave Remote Sensing", in preparation

LPRM-SMA

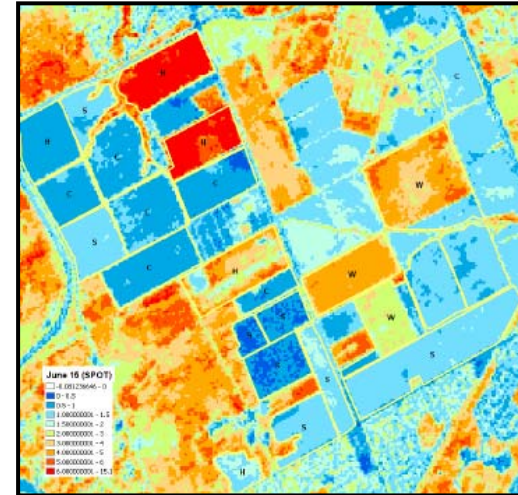
- 0 - 10 % (Extreme Dry)
- 10 - 20 %
- 20 - 30 %
- 30 - 40 %
- 40 - 50 %
- 50 - 60 % (Average)
- 60 - 70 %
- 70 - 80 %
- 80 - 90 %
- 90 - 100 % (Extreme Wet)
- No Data



EO Activities – Ready for Piloting

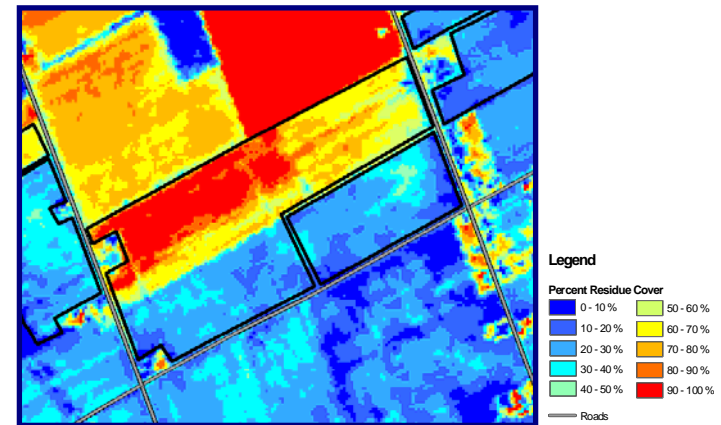
1. LAI Estimates from AWiFS

- satellite programmed from April to October
- entire agricultural extent of Prairies
- need to test SPOT/Landsat method on AWiFS



2. Residue Cover Estimates from AWiFS

- satellite programmed from April to October
- entire agricultural extent of Prairies
- need to test SPOT/Landsat method on AWiFS

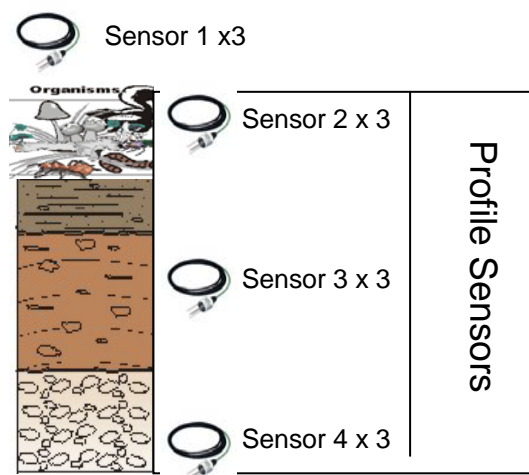


In Development

1. Integration of SAR (X-, C-, and L-Band)
 - crop inventory
 - tillage occurrence
 - LAI
2. Adaptation of AMSR-E soil moisture anomaly index to SMOS
3. Integration of Canadian land cover, crops and soils data to improve soil moisture estimates from passive microwave
4. Field level soil moisture estimates from RADARSAT-2
5. Installation of in situ soil moisture network

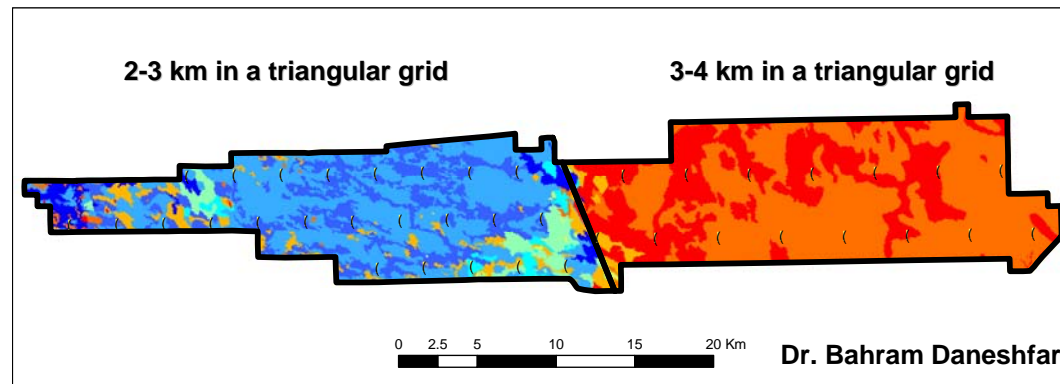
Configuration of In situ sites

- Eastern Ontario development site (3 sites installed this fall)
 - Brunkild implementation site (10 sites to be installed fall 2010 or spring 2011)
 - both networks will be built incrementally and are meant to be operated long term by AESB
 - currently developing land lease agreements with producers
-
- Hydra Probe II Soil Moisture Sensor
 - 12 sensors per site (3 probes at each of 4 depths)
 - nominally 5, 20 50 and 100 cm depths (some sites perhaps down to 120 cm)
 - a rain gauge and piezometer at each site
 - deeper sensors will be left in place; sensors in plough layer may be removed
 - pre-installation calibration as well as site specific calibration based on soil properties (texture, bulk density, organic matter)



Location of sites

- Densest network will be within Brunkild watershed and are being placed according to landscape variability and local producer cooperation
- Next phase would look towards sparser coverage over larger watershed region
- Data will be used for
 - Validating passive and active microwave soil moisture estimates (research phase)
 - Adaptation of soil moisture models (research phase)
 - Once satellite moisture products are being produced routinely, network will serve to adjust/calibrate moisture estimates
 - Modelling sub-surface soil moisture to deeper rooting depths
 - Other activities requiring soil moisture information including yield estimation and risk assessment



Data Availability

- Intent is to provide open access to data
- Eastern Ontario site is developing RTU capability that will eventually be implemented in Brunkild
- Eastern Ontario: Xiaoyuan Geng
- Brunkild: John Fitzmaurice

