


## Wetland mapping using object based classification of Radarsat and Landsat-ETM images for protected areas

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**GEOBIA 2008  
 August 6, 2008**



## Presentation plan

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- Context
- Rationale
- Objectives
- Methodology
- Lac Saint-Pierre study case
  - Wetland mapping
  - Radarsat-2 simulated image
  - Comparison between sensors
- Wetland monitoring
- Recommendations
- Conclusion

## Context

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- Canadian Wetland Inventory (Phase 1, methodology development, completed March 2007)
- Wetland Mapping in Protected Areas is a sub-project of Space for Habitat project (**Environment Canada**)
- *Polarimetric RADARSAT2 for operational monitoring of Wetlands and their environment (Canada Centre for Remote Sensing)*
- Government Related Initiatives Program (GRIP) (*Canadian Space Agency*)






## Rationale

Environment Canada's Canadian Wildlife Service (CWS) identifies important wildlife habitats whose loss would have a direct impact on the Canadian population of one or more wild species:

- National Wildlife Areas (NWA) and Migratory Bird Sanctuaries (MBS) (>140 sites for 11.8 million hectares – 1.5 million of aquatic habitat)
- Ramsar sites (36 sites ~13 million hectares)



Minimum of analysis for maximum result

## Objectives

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- Evaluate the potential of satellite images for wetlands mapping and monitoring for CWS protected areas
  - Adapt CWS-QC wetland mapping method to the conservation objectives of selected protected areas;
  - Compare results obtained from various sensors;
  - Make recommendations on
    - acquisition conditions;
    - data preparation;
    - image analysis.

## Wetland classes

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Bog




Fen



Swamp



Shallow water



Marsh

The Canadian Wetland Classification System (1997)




### Methodology : Object-based classification

Segmentation defines homogeneous groups of pixels (objects) that better represent ecology of wetland compare to a pixel by pixel approach

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### Methodology : Top down approach

Landsat-7 Summer

Radarsat-1 Spring -Fall

Segmentation **first level**

Classification for Segments that fit With the Object of interest (upland and wetland)

High - Open	GLC/Modèle de zones (direction) (panoray) T41	1.00 - 1.00
High - Open	GLC/Modèle de zones (direction) (panoray) T41	1.00 - 1.00
High - Open	GLC/T41	0.16 - 0.27

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### Methodology: Top down approach

Potential wetlands Objects from high level

Segmentation **Second level**

Classification for Segments that fit With the Object of interest (upland and wetland)

High - Open	GLC/Modèle de zones (direction) (panoray) T41	0.16 - 0.27
High - Open	GLC/Modèle de zones (direction) (panoray) T41	0.16
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### Methodology: Geoclassification

Potential wetlands Objects from

High - Open	GLC/Modèle de zones (direction) (panoray) T41	0.16 - 0.27
High - Open	GLC/Modèle de zones (direction) (panoray) T41	0.16 - 0.27
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### Lac Saint-Pierre :Study Site

- Ramsar site since 1998;
- Largest floodplain of the St. Lawrence river (20% of all St. Lawrence wetlands: 14 000 ha);
- 27 species of rare aquatic plants;
- Largest St. Lawrence migratory site;
- Surrounded by agricultural lands, mainly corn and dairy;

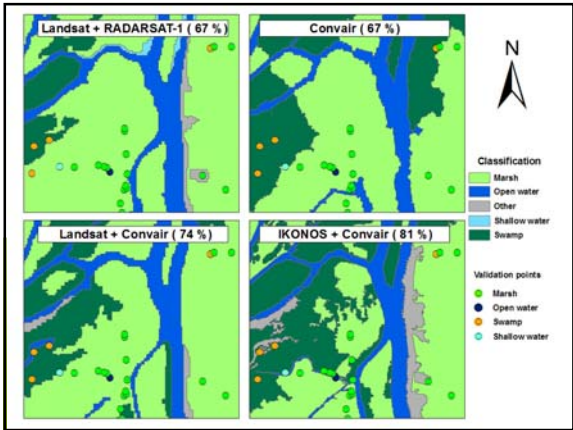
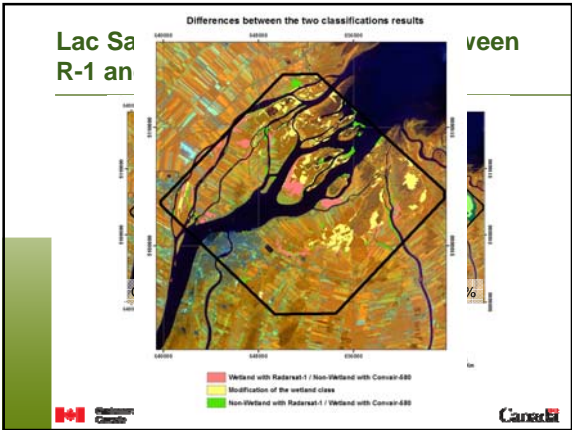
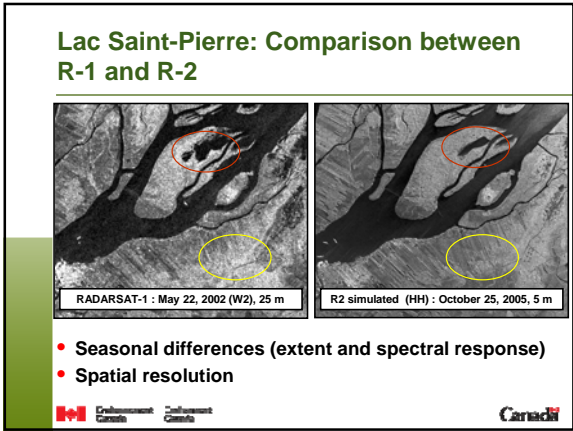
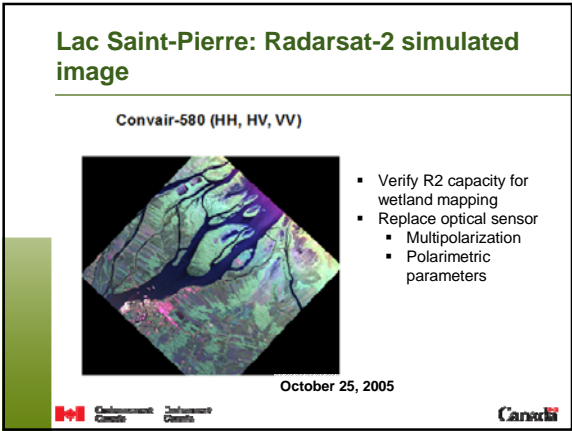
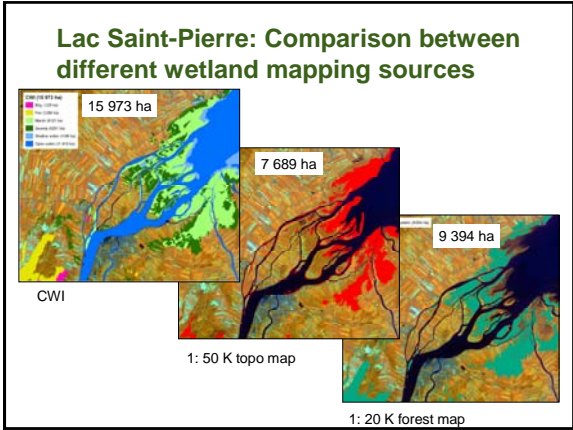
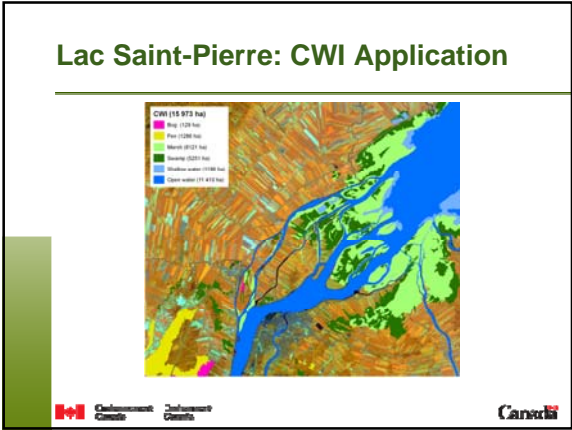
Environment Canada / Environnement Canada

### Lac Saint-Pierre: Raw Images

Landsat-ETM summer image

Radarsat-1 spring image

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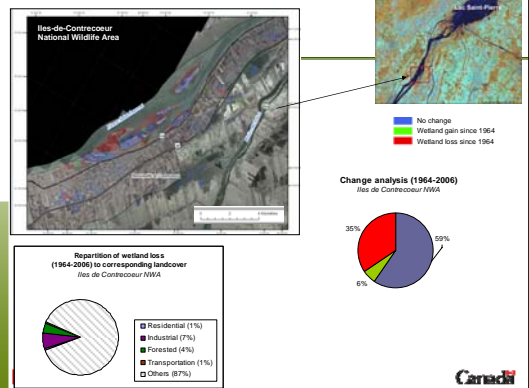


## Wetland monitoring

Wetland maps serve as baseline (reference map) for comparison to historical data, more specifically to identify:

- hot spots (high pressure areas with most wetland loss)
- specific issues related to protected areas (e.g. erosion)
- indicators for remote sensing monitoring

## Wetland changes in Montréal (1964-2006)



## Recommendations

- Polarimetric parameters should be assessed using R2 and Alos images
- In order to improve operationalization of the method, the object-based classification should:
  - use standardized segmentation parameters (scale = unit) to facilitate application to different spatial resolutions.
  - be flexible enough to integrate thematic data (GIS)
  - make better use of membership functions:
    - Fuzzy function to distinguish wetland classes
    - Crisp function to distinguish wetlands and uplands

Note: Recommendations are based on Definiens software usage only. No other segmentation software was tested.

## Conclusion

- Testing of CWI method with R2 simulated image has shown it can be applied to various images acquired in different conditions and is particularly well adapted to wetland mapping and monitoring;
- R2 simulated image was as successful as R1 image in identifying wetlands in the Lac St-Pierre study site;
- Multipolarization of simulated R2 image shown great potential for replacing optical images.