SPACE FOR HABITAT

Space-based monitoring to support EC's wildlife mandate

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Outline

- Experience with object based analysis
- Overview of Space for Habitat project
- Specific objectives & projects
- Potential for collaboration

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Object-based analysis - eCognition

- Cormorant impacts on habitats on western Lake Erie
  - CIR airphotos over time to show decline of forest with increased birds
  - Data was successfully used in Zoocheck v. Environment Canada
- Wildlife habitat in agricultural ecosystems
  - Biodiversity on organic vs conventional farms
  - CIR airphotos to classify small habitat features (hedgerows, woodlots, wetlands)
- Forest structure from high resolution satellite imagery
  - Mapping bird habitat requires knowledge of forest structure
  - Collaboration with Provincial forestry agencies
  - To improve bird habitat modelling, provide solutions for FRI updates

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Project Overview - Space for Habitat

- Funded by Canadian Space Agency (GRIP)
- Collaboration between Wildlife Enforcement, S&T, CWS
- Space-based remote sensing for monitoring and enforcement of Environment Canada's wildlife mandate
- Pilot project to demonstrate proof of concept

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Partnerships

Environment Canada: Wildlife Enforcement, National Wildlife Research Centre, CWS (Mig. Birds & Habitat Programs), CBD Office & Boreal Conservation Initiative.
Canadian Space Agency: Government-Related Initiatives Program.
Natural Resources Canada: Canada Centre for Remote Sensing, Canadian Forest Service.
Parks Canada: Ecological Integrity Branch.
Provincial Governments: ON MNR & BC MoE.
Forest Products Association of Canada.
Nature Canada, Bird Studies Canada.
Canadian Forest Products (BC), Tolko Industries (BC) & Abitibi Consolidated (ON).
Academic links: UBC, UVic, Carleton U, U of A.
International links: Brazil (IBAMA), *Mexico (CONAFOR-PROFEPA), CEC.*

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Vision: A Three-Tiered EO-supported Monitoring System for Wildlife Habitat

To support implementation of Federal wildlife conservation responsibilities and related partner mandates:

Medium Resolution – multi-temporal (MODIS, MERIS)

For prioritization and planning purposes.

Every Five Years Mid-Resolution (SPOT, Landsat)

For more detailed planning, enforcement, conservation actions.

Annual Targeted, Mid- and High-Resolution

For high priority applications, eg. Protected Areas, SAR, High-risk areas, etc.

Links to on-the-ground results and enforcement response is important

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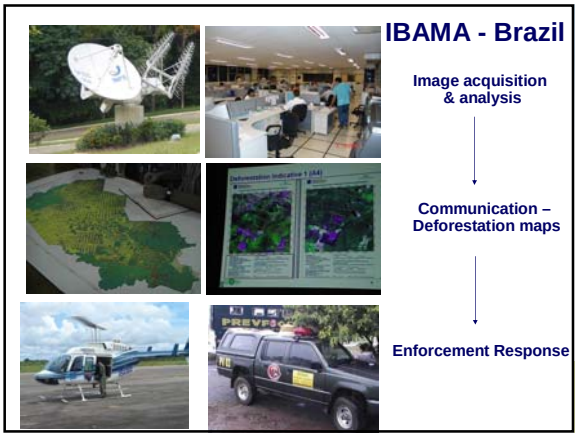
IBAMA - Brazil
Image acquisition & analysis
Communication – Deforestation maps
Enforcement Response


Federal Wildlife Mandate - Legislative Context
3 Acts to protect habitat for Canadian species:
Canada Wildlife Act
Protected Areas – National Wildlife Areas (NWA)
Migratory Birds Convention Act (MBCA)
Incidental Take of nests/individuals during industrial activities
Protected Areas - Migratory Bird Sanctuaries (MBS)
Species at Risk Act (SARA)
Effective protection of Critical Habitat


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Protected Areas
Develop national landcover monitoring plan
Spatial and temporal resolution informed by pilot study
Including data acquisition and analysis protocols
Build effective capacity to use geospatial technologies
Train and equip field officers to use products
Build database of ground/field observations
Investigate applicability of technologies to other enforcement activities
Budget 2008 - $1.1 million (2 years) for geomatics support of enforcement in Protected Areas
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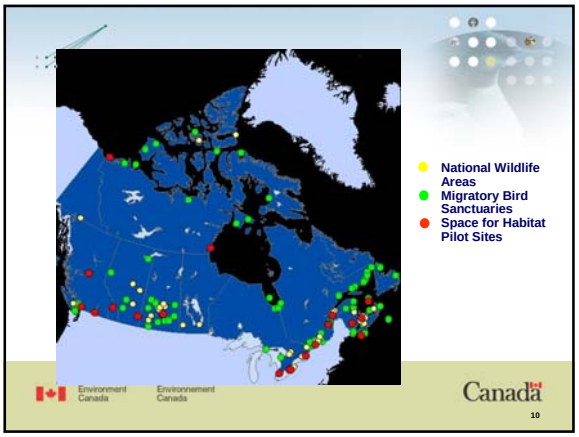
National Wildlife Areas
Migratory Bird Sanctuaries
Space for Habitat Pilot Sites
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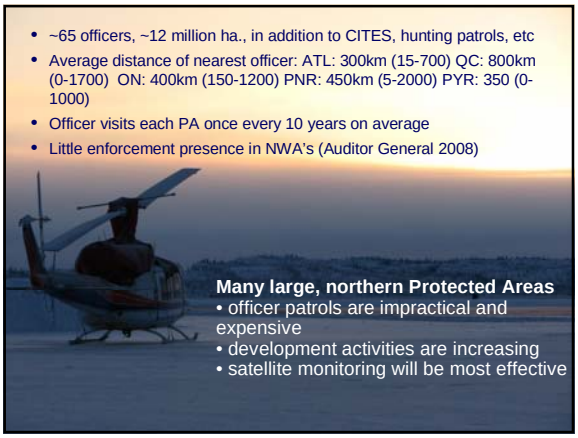
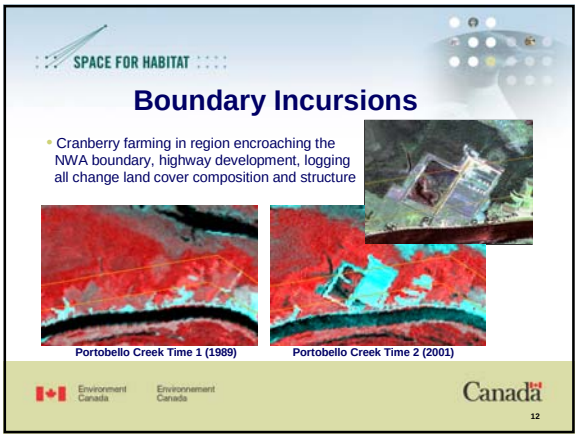

~65 officers, ~12 million ha., in addition to CITES, hunting patrols, etc
Average distance of nearest officer: ATL: 300km (15-700) QC: 800km (0-1700) ON: 400km (150-1200) PNR: 450km (5-2000) PYR: 350 (0-1000)
Officer visits each PA once every 10 years on average
Little enforcement presence in NWA's (Auditor General 2008)
Many large, northern Protected Areas
• officer patrols are impractical and expensive
• development activities are increasing
• satellite monitoring will be most effective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Boundary Incursions
Cranberry farming in region encroaching the NWA boundary, highway development, logging all change land cover composition and structure
Portobello Creek Time 1 (1989)
Portobello Creek Time 2 (2001)
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Geomatics for Wildlife Enforcement Seminar

- Developed 3 day GWE seminar in cooperation with Smithsonian Institute - National Zoological Park
- Intro to GIS, GPS and Remote Sensing – ESRI ArcPad
- Hosted at Carleton University GIS computer labs
- Delivered course May 2007 – refresher course in May 2008.

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Protected Areas – sub-projects

- EO acquisition plan – optical/radar (NWRC)
- Technology transfer – field data collection (NWRC)
- Implement enterprise geospatial data mngt (NWRC)
- Radarsat-2 quad-pol for change detection (Carleton)
- Wetland mapping/classification (M. Grenier, CCRS)
- Biodiversity monitoring of wetlands – RAMSAR (UBC, CFS)

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Migratory Birds Convention Act Incidental Take

- Provinces have mandate for natural resources & land management (forestry, mineral extraction, development etc)
  - Each jurisdiction has different guidelines, regulations, planning requirements
  - Focus on riparian integrity, provincial species, general wildlife habitat provisions
- Environment Canada developing new regulations under MBCA to mitigate & manage incidental take from industrial activities
- S4H evaluating use of space-based monitoring for planning, monitoring and enforcement of new regulations
  - Focus on BCR plans, priority & focal species
  - Working with forestry industry to begin – companies in Ontario & British Columbia

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Advantages of Earth Observation based national system

- **Easily updated – new imagery**
- **Not limited by jurisdiction or ownership**
- **Potential to incorporate cumulative impacts (fire, development, insects, oil and gas etc.)**
- **Incorporate natural and anthropogenic changes**
- **Same data can be used for both habitat models and compliance monitoring**

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REMOTE-SENSING DATA — INPUTS — MAXENT

Topography
Solar radiation
Distance to herbaceous

Forest fragmentation
Mid IR
Distance to water

FRI AND HARVEST DATA — FOREST MANAGEMENT — MODEL SELECTION (AIC)

RECOMMENDATIONS

More snags

70 m buffers

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MBCA – sub-projects

- Priority species modelling at BCR level with EO (NWRC)
- Develop suite of attributes in Bird Conservation Plans to monitor using EO data
- IT Regulatory implementation using EO data – bird conservation plans (NWRC)
- Develop medium resolution protocols for national monitoring (landcover, change, etc) (CCRS, CFS)
- Radarsat-2 (quad-pol) for wetland mapping/classification (CCRS, CWS)
- Airborne LIDAR and Hyperspectral for improved habitat models (UVIC, UBC)
- Modelling waterbird occurrence using EO data – focus on rare birds – model based sampling (CWS, UOttawa)

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Species at Risk Act - Critical Habitat Boreal Caribou

- Ecological niche modelling for predicting woodland caribou habitat – 1km MODIS
  - Model based sampling to improve surveys, population estimates
  - Identify habitat for potential rehabilitation
- Next steps – effective protection, monitoring compliance
- S4H – develop monitoring protocols to maintain integrity of protected Critical Habitat
  - Large areas that may be difficult to monitor on the ground
  - Evaluate management implications for biodiversity

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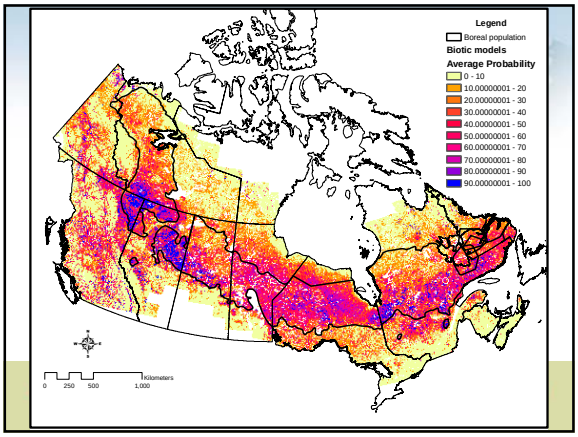

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SARA – sub-projects

- Ecological niche modelling (ENM) for model based sampling (OMNR, CFS)
- ENM vs. RSF – sources of bias, model errors (U Montana)
- Develop change detection protocols to monitor compliance with Critical Habitat (NWRC)

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International Projects

Canada-Mexico partnership – Wildlife Enforcement capacity building

- Jaguar conservation in southern Mexico – habitat modelling/mapping/monitoring
- Monarch Flyway Protection
- Technology transfer – provide GWE for Mexican Wildlife Officers

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Summary

- **Landcover, Landuse, structure – refinements for improved habitat modelling**
- **Change detection – natural vs anthropogenic**
- **Focus on operational use – limitations, standardization, repeatability**

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