



Landscape and green systems planning using MARXAN

Danijela Puric-Mladenovic

d.puric@utoronto.ca

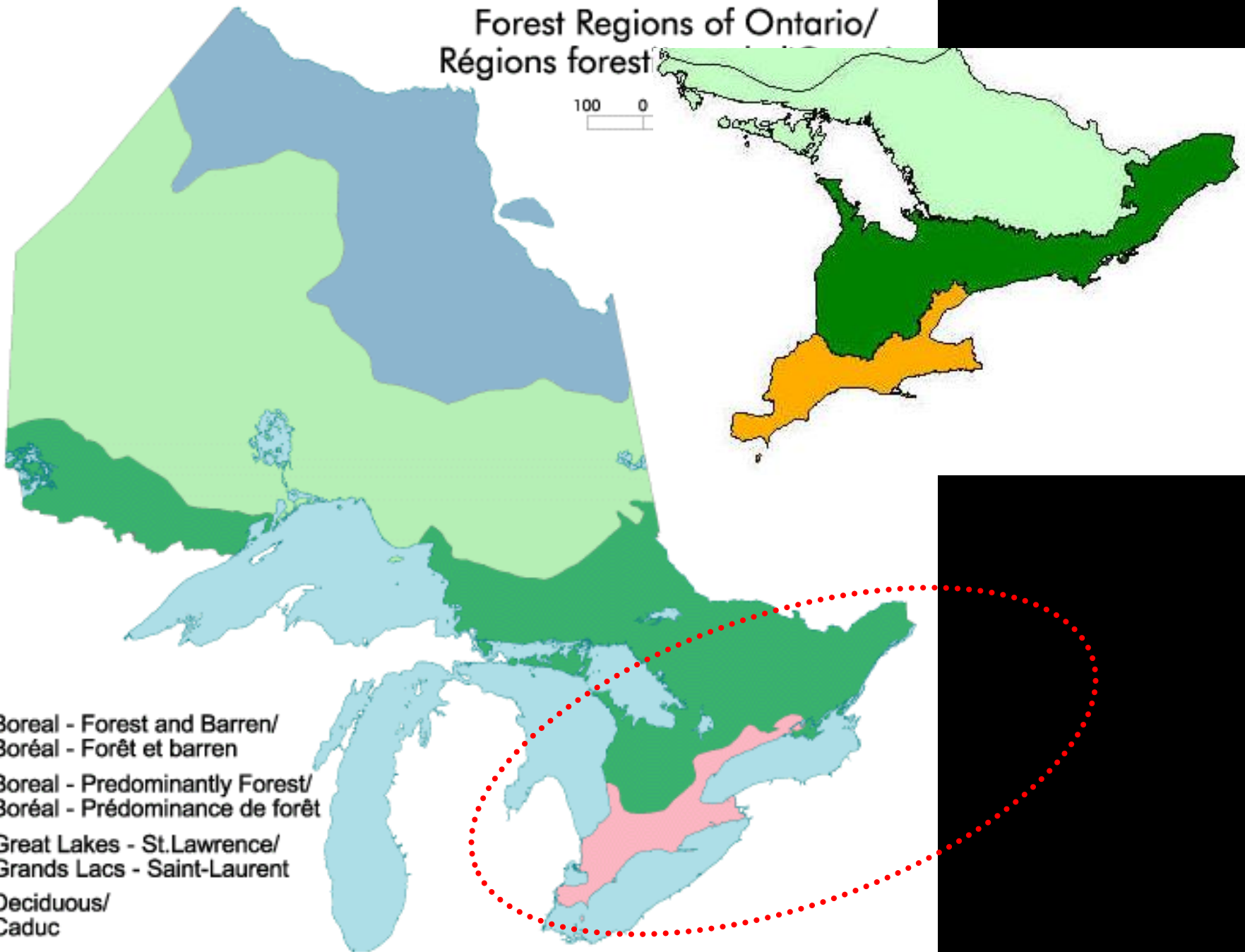
Faculty of Forestry
University of Toronto

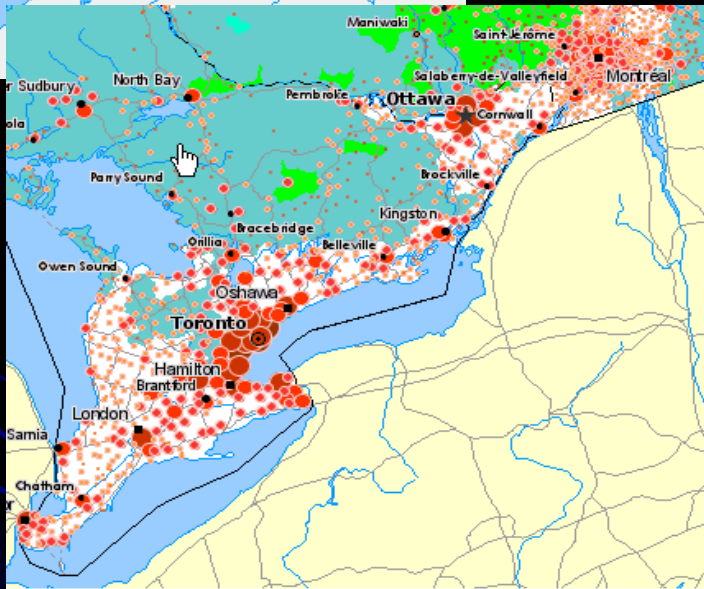
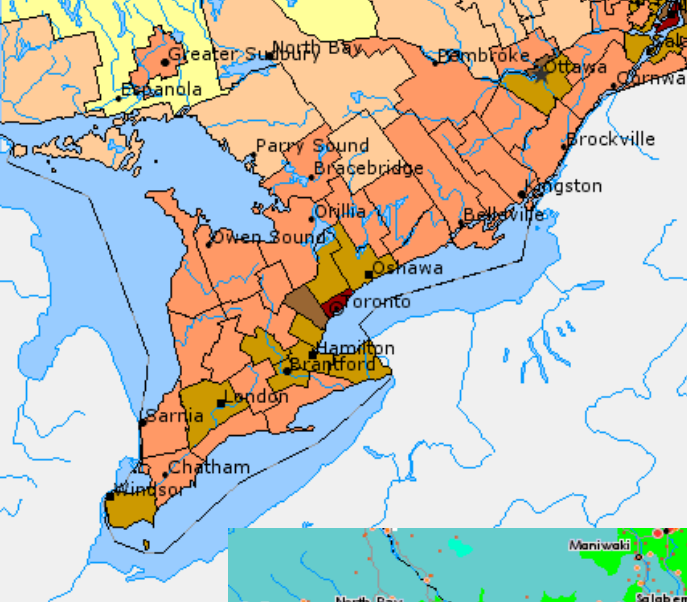
Feb 4th 2015; MARXAN training



Forest Regions of Ontario/ Régions forest

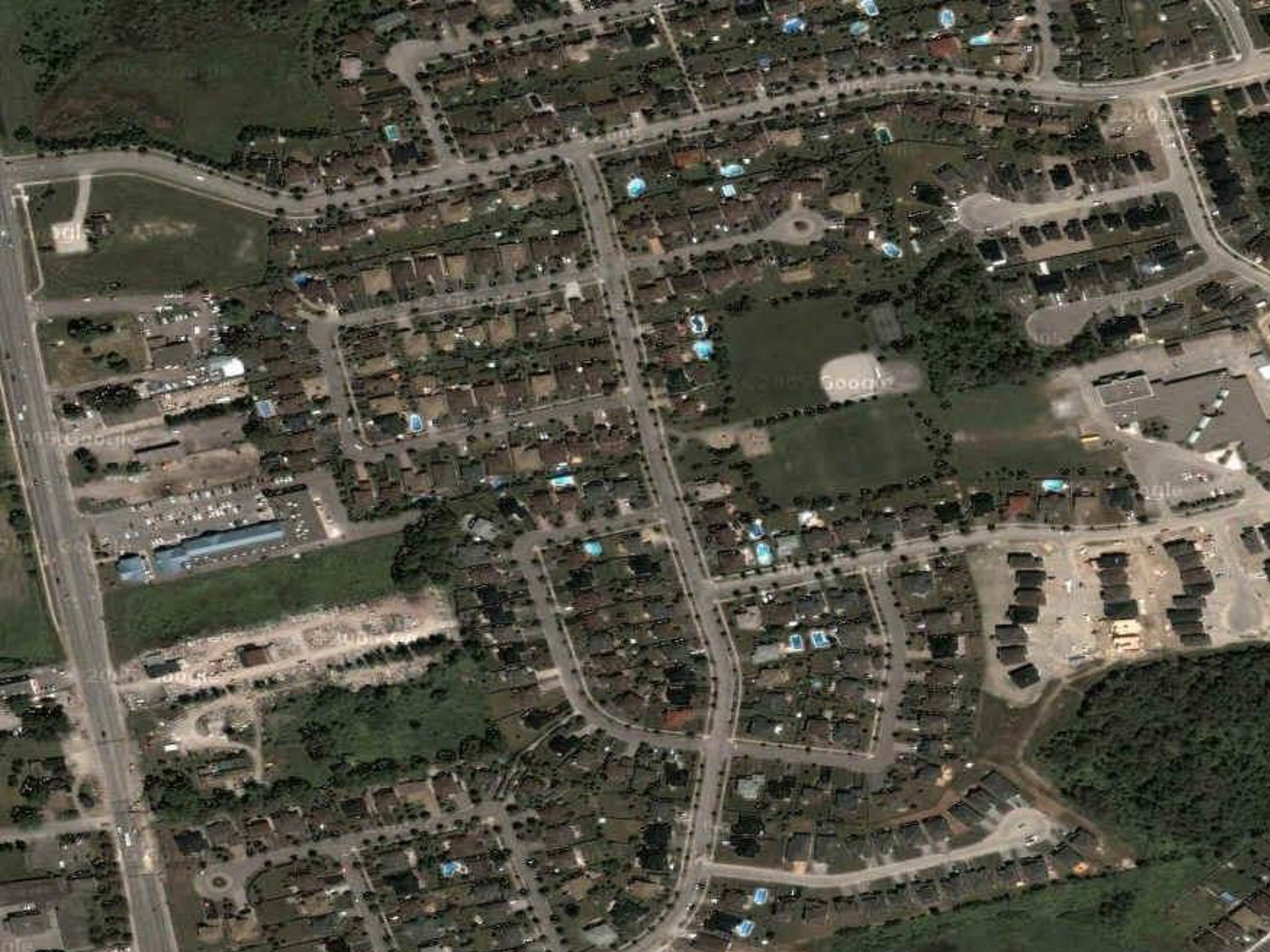
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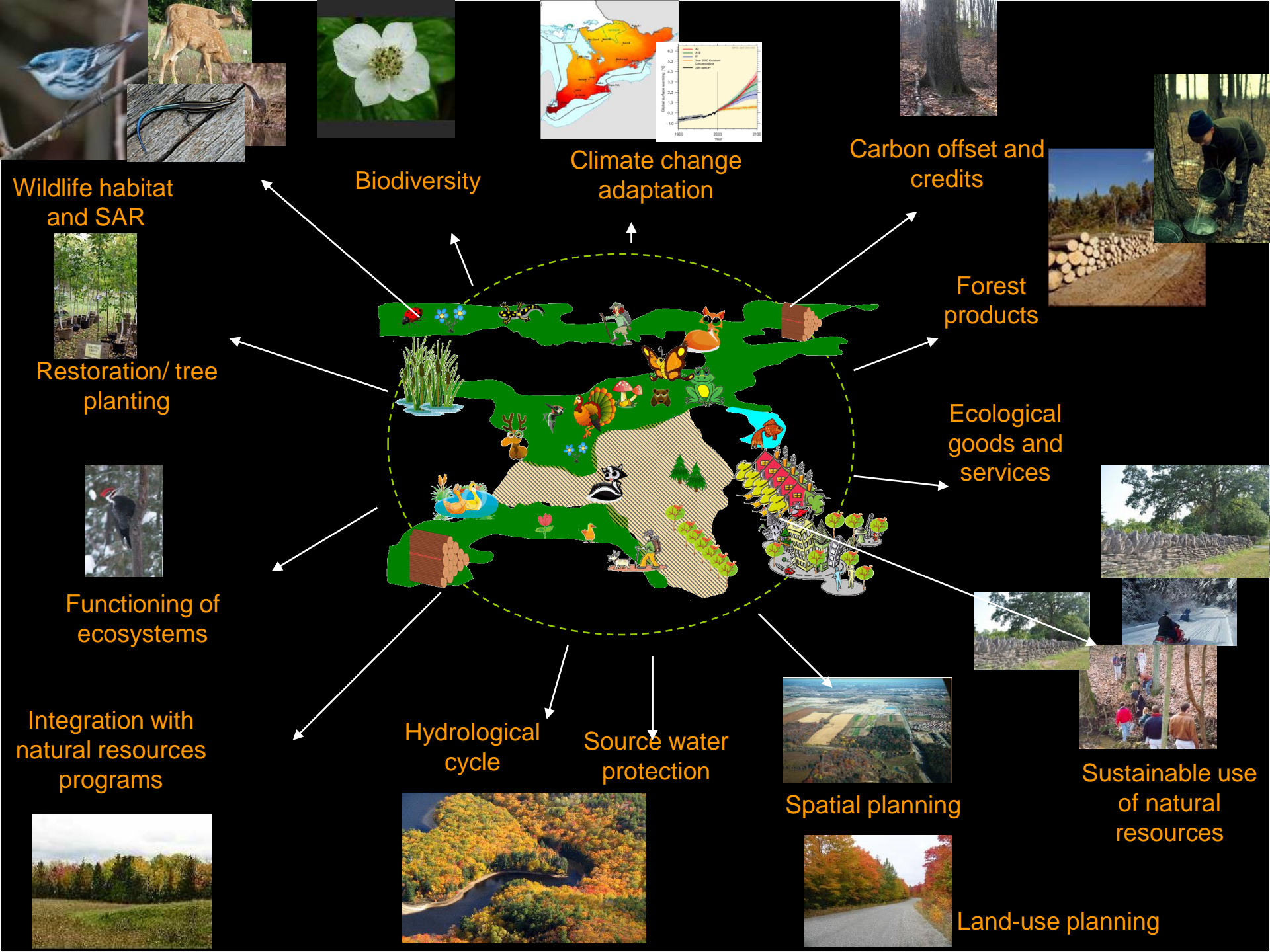




- Most of Ontario's residents live within 200 kilometres of the Canada–United States border
- Nearly 1/2 of Ontario's population lives in the Greater Toronto Area.
- Population projected to grow by about 30% by 2031









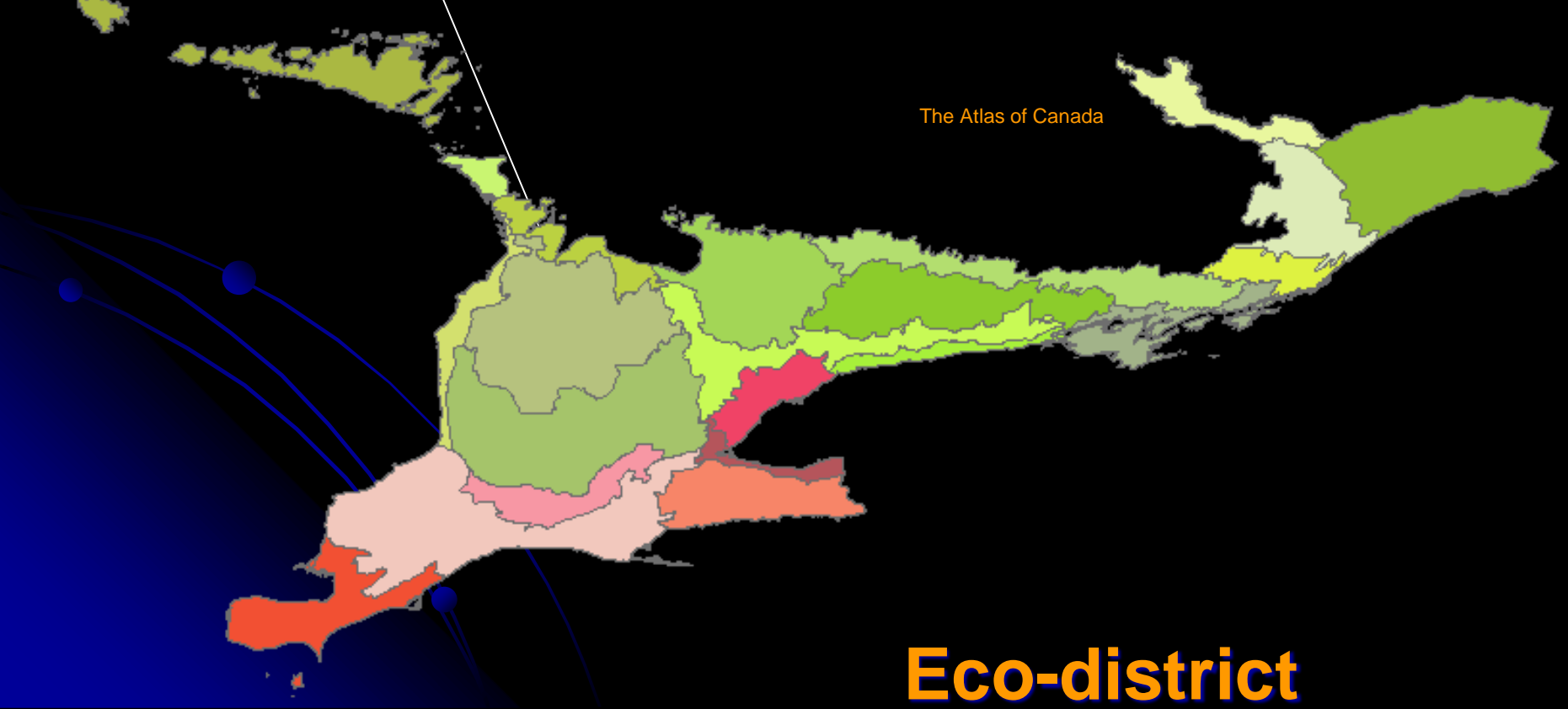


● **Conserve and restore**

Terrestrial eco-zone: Maywood Plains



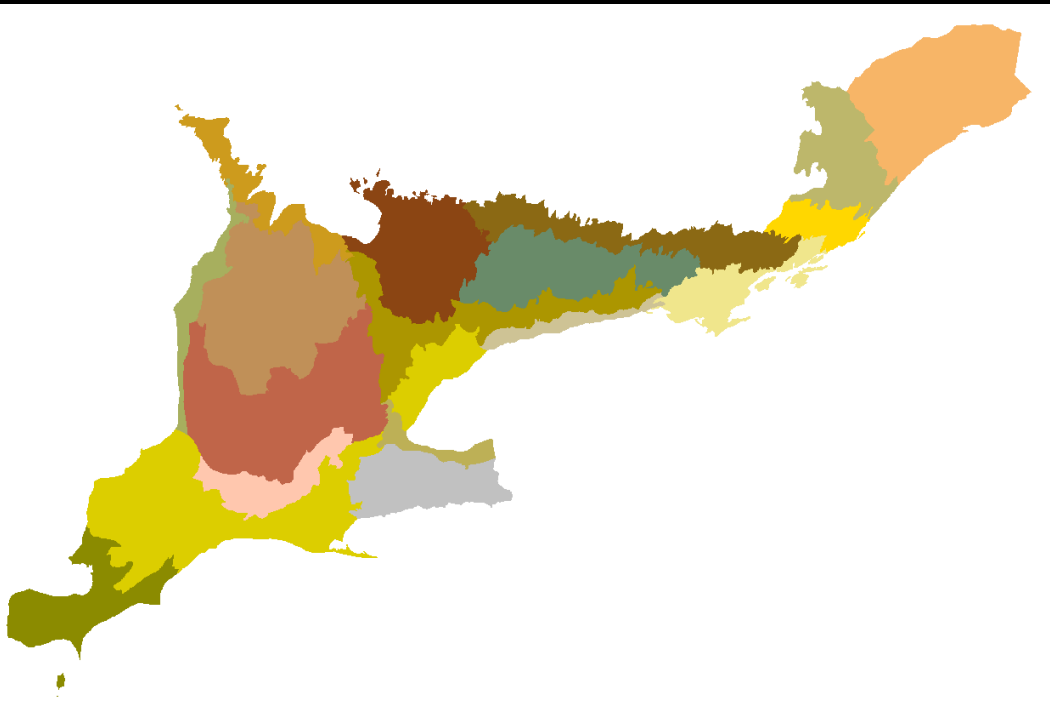
The Atlas of Canada



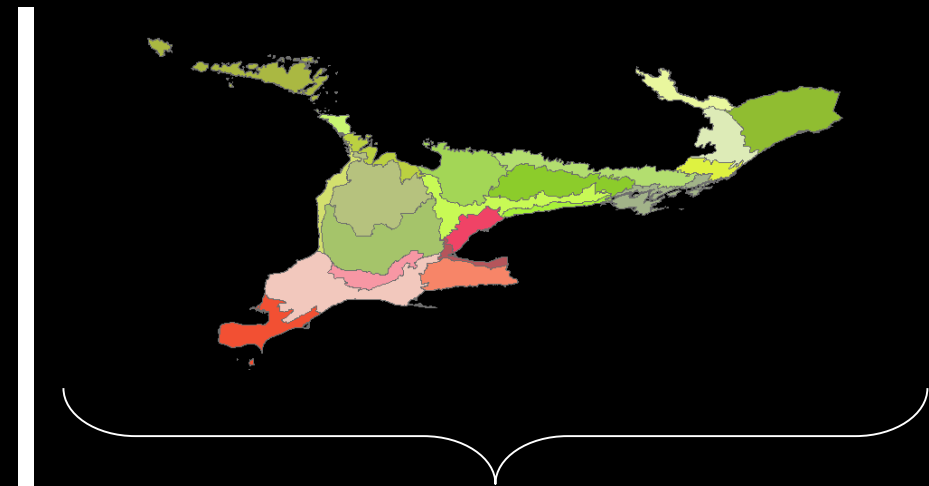
The Atlas of Canada

Eco-district

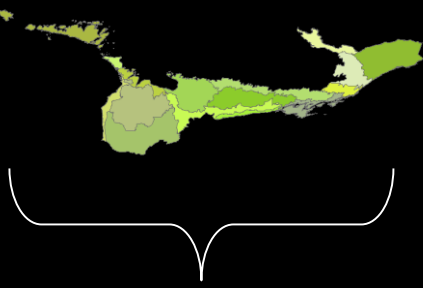
- "Landscape units" in general refer to coherent spatial areas that are characterised by a certain degree of homogeneity concerning certain properties like natural conditions (geology, morphology, soils and climate) or land use.
- Eco-districts



Linking the scales



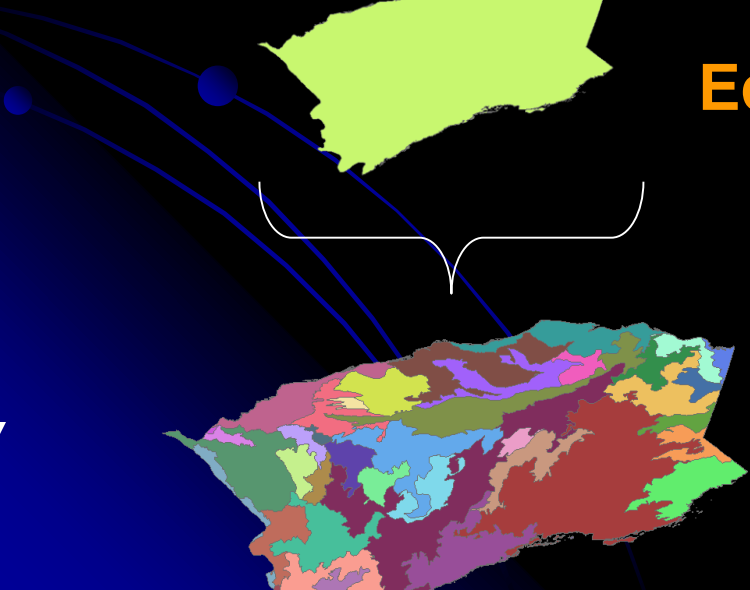
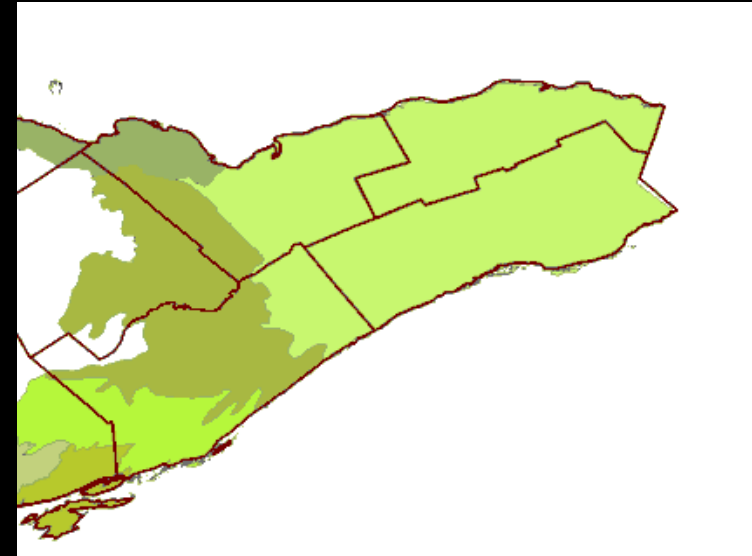
Eco-region



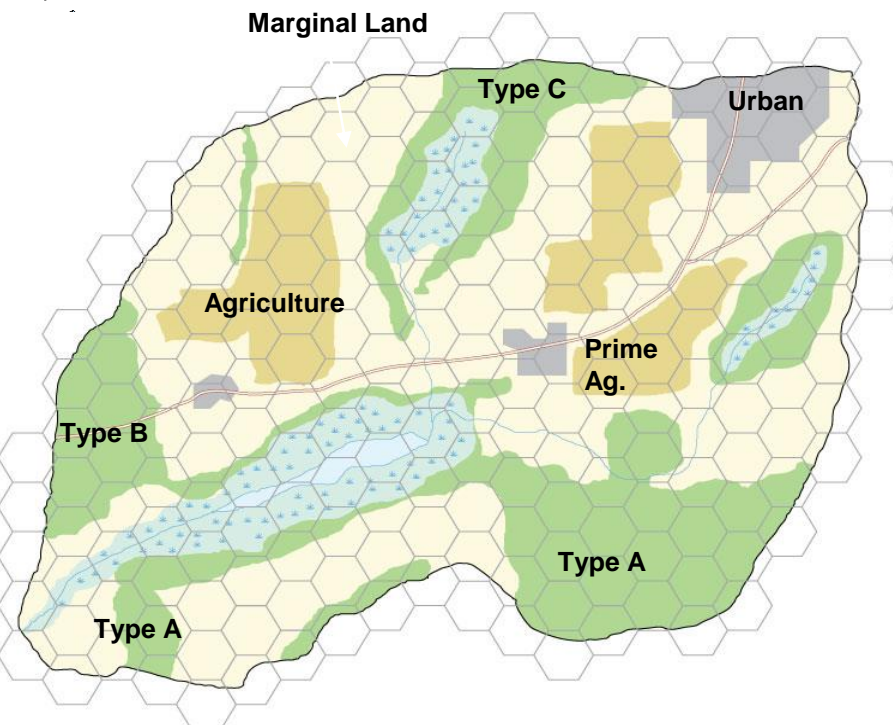
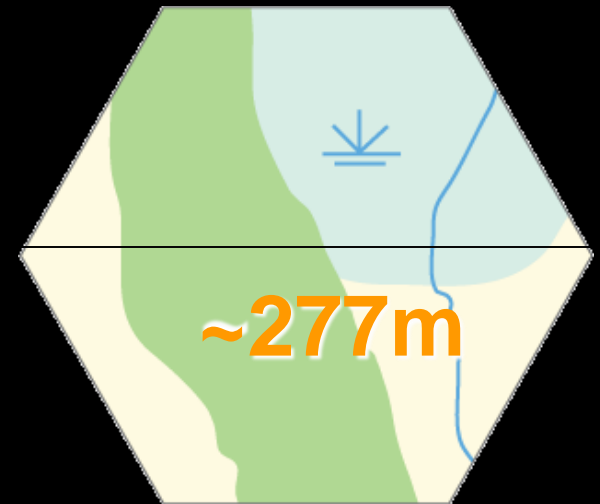
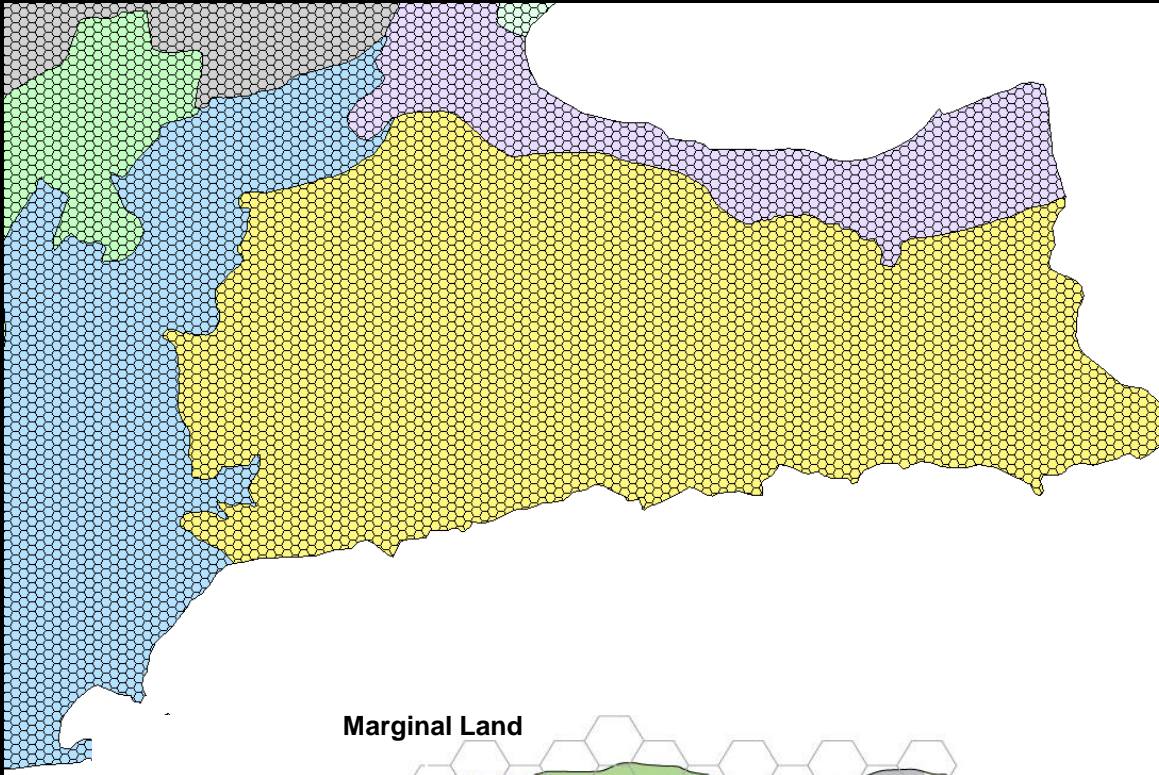
Eco-district



**Soil landscapes
(eco-section)**



**Analysis Units =
5 ha hexagons**



- **Approximates seed dispersal distance ~277m**
- **Wetland /forest species**
- **Manageable # of units**
- **Reasonable computation time**
- **Resolution and scale of spatial data**



**Number of planning units up to
300,000**

“Cost”

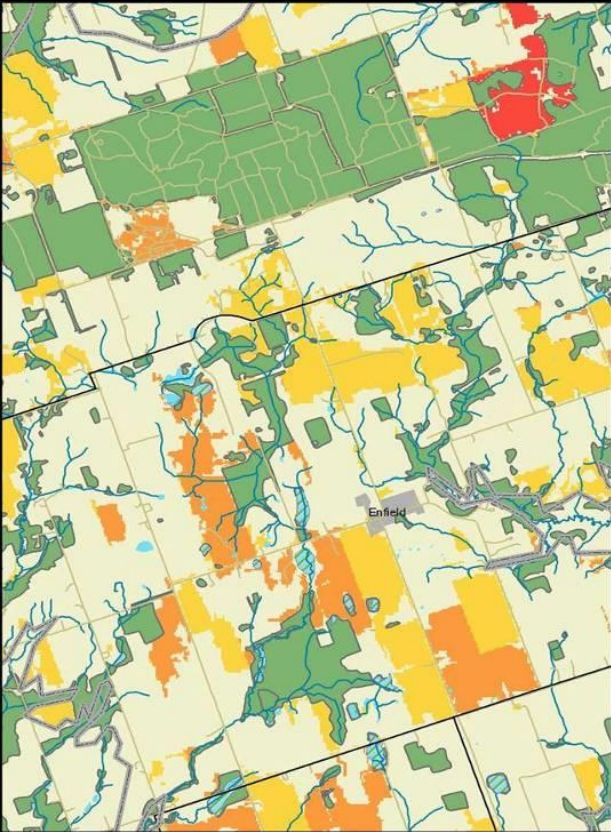
- Amount of active agricultural land
- Future cost values
 - \$ / ha to restore forest, wetlands
 - Cost from planting to maintenance free stage
 - \$/ ha to keep natural areas in conservation statutes
 - Existing and potential carbon storage

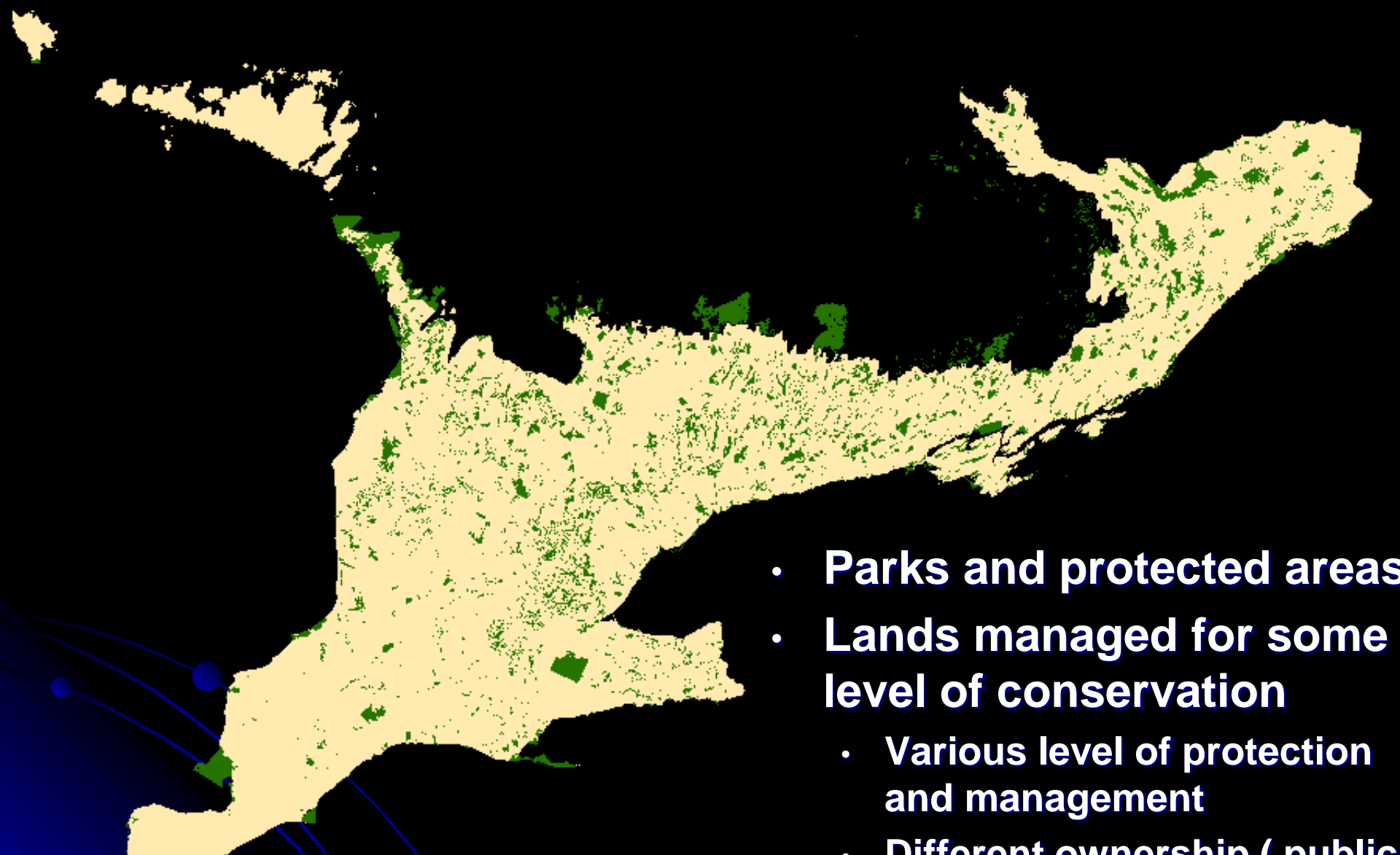


Ha of active agricultural land (green)

Socio-Political Inputs

- Urban areas
- Roads
- Agricultural lands
- Conservation lands
- Aggregate extractions





- Parks and protected areas
- Lands managed for some level of conservation
 - Various level of protection and management
 - Different ownership (public private)

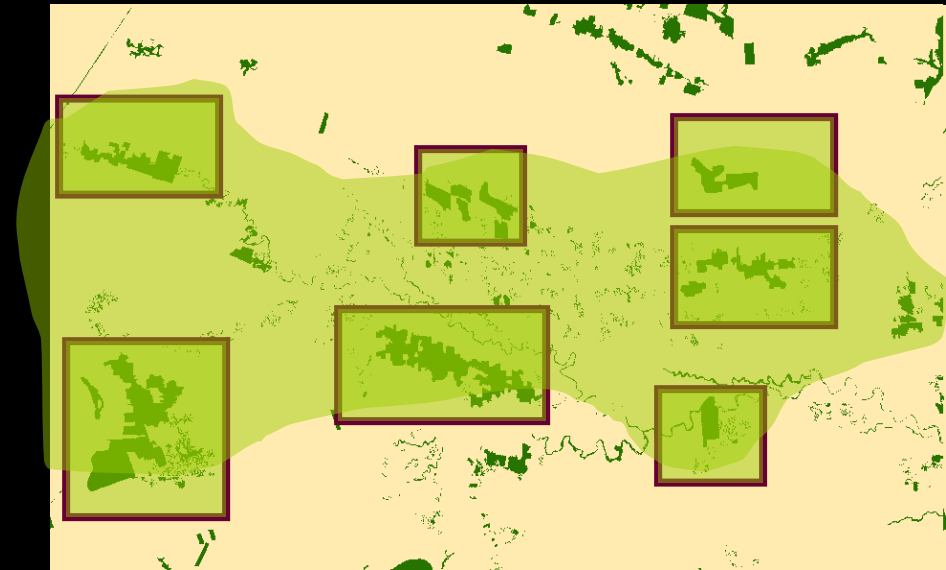
Regulated and Recommended Protected Areas in Ontario.⁵

| Ecozone | Number of Protected Areas | Amount of Land in Protected Areas (hectares) | Proportion of Ecozone Area Protected (percent) |
|---------------------|---------------------------|--|--|
| Hudson Bay Lowlands | 10 | 2,451,176 | 10 |
| Ontario Shield | 545 | 7,147,035 | 11 |
| Mixedwood Plains | 96 | 56,347 | 1 |
| Total | 651 | 9,654,560 | 8.95 |

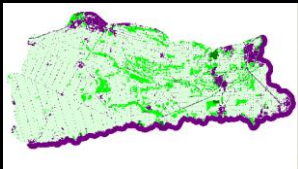

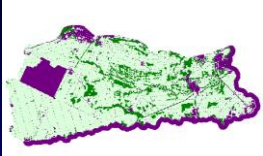


Protected areas and conservation lands

- Building blocks of regional systems
 - Provincial and Federal Parks
 - Numerous other conservation lands



Eco-district 7e5 scenarios

| 7e5 Scenarios | Socio-political inputs | | |
|--|-------------------------------|---|---------------------------|
| | Developed lands & roads | Conservation lands | First Nations lands |
| Scenario 1  | <i>Excluded</i> | <i>Conserved (Parks_ Preferred (PSWs & ANSIs) Available</i> | <i>Available</i> |
| Scenario 2  | <i>Excluded</i> | <i>Available</i> | <i>Available</i> |
| Scenario 3  | <i>Excluded</i> | <i>Conserved</i> | <i>Excluded</i> |

Conservation Objectives (~90 features and targets)

- **Representation**

- Vegetation biodiversity (forest-soil)
- Wetlands
- Grasslands

- **Ecological functions**

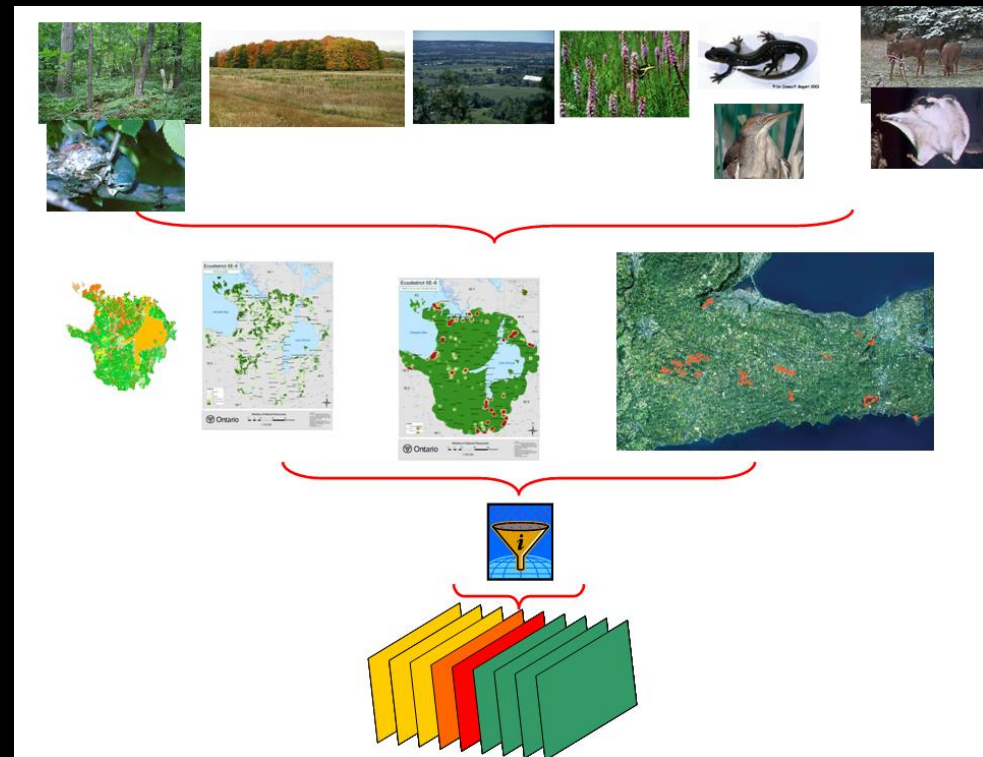
- Landscape and patch functions
- Riparian vegetation
- Headwater areas
- Hydrological functions

- **Species**

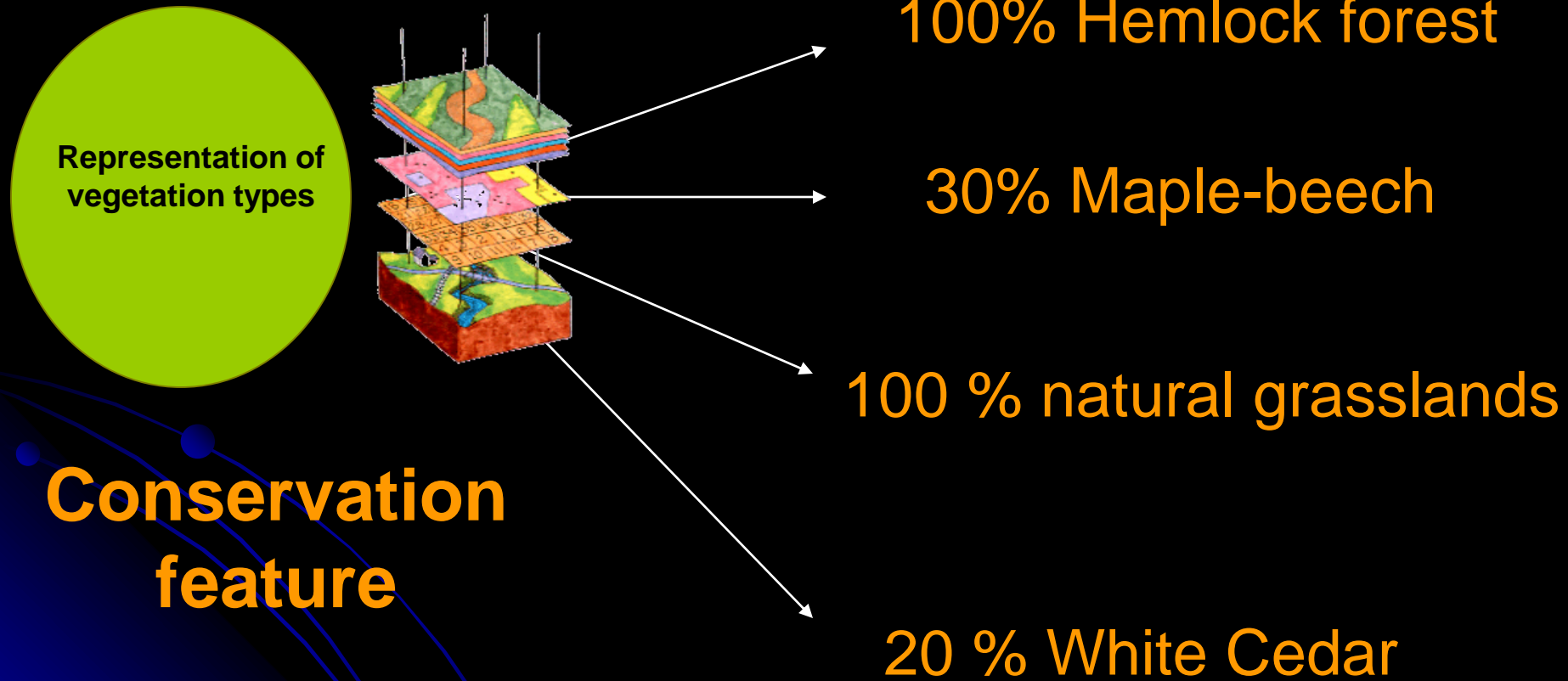
- Species hot-spots
- SAR
- Habitat maps
 - Ovenbird habitat
 - Migratory birds

- **Restoration**

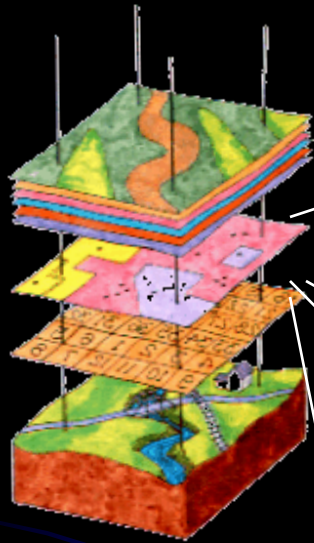
- Riparian areas
- Wetland functional zones



An example of specific conservation features & targets



Specific conservation targets cont.



100% of forest patches ≥ 200

70% of riparian forest along cold waters streams

100% of a species viable populations

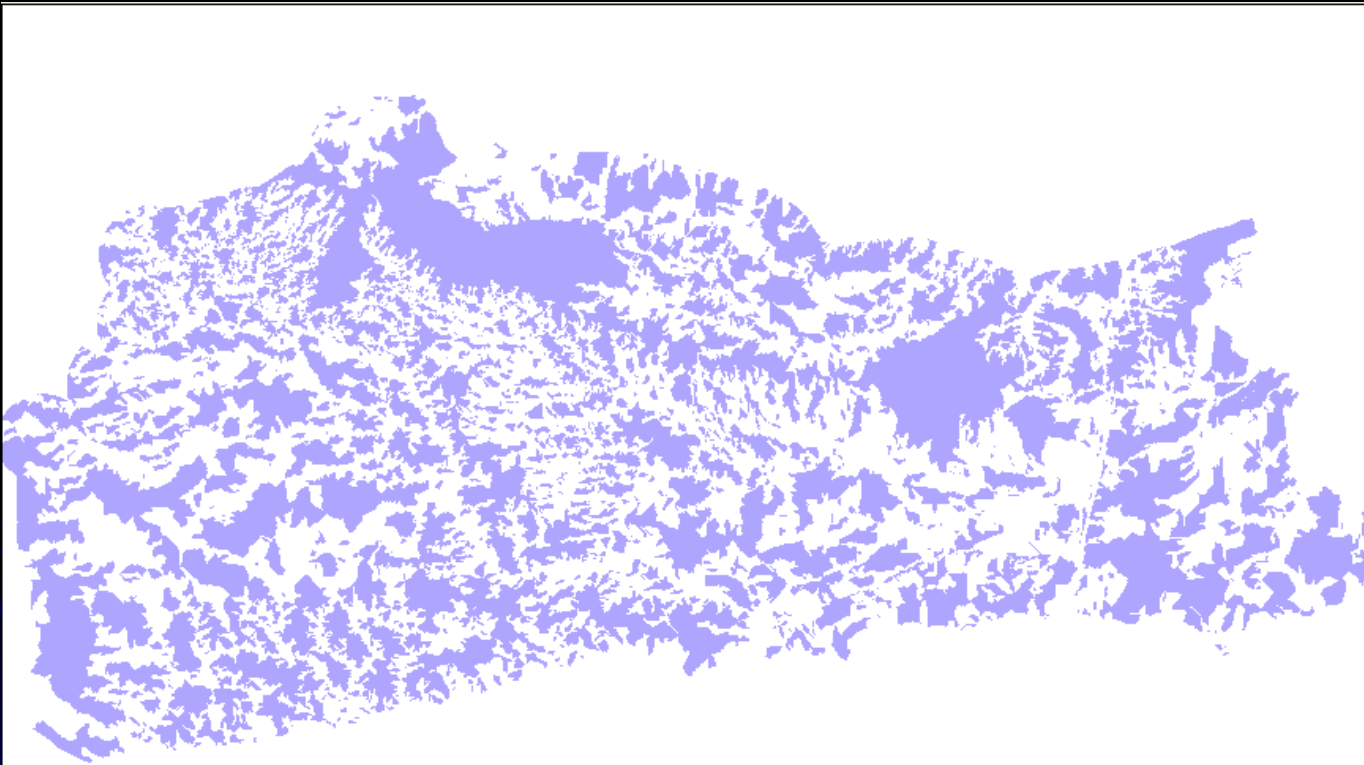
50 % wetlands

50% of stopover habitats for migratory birds

100% ovenbird habitat

100% SAR

Headwater areas



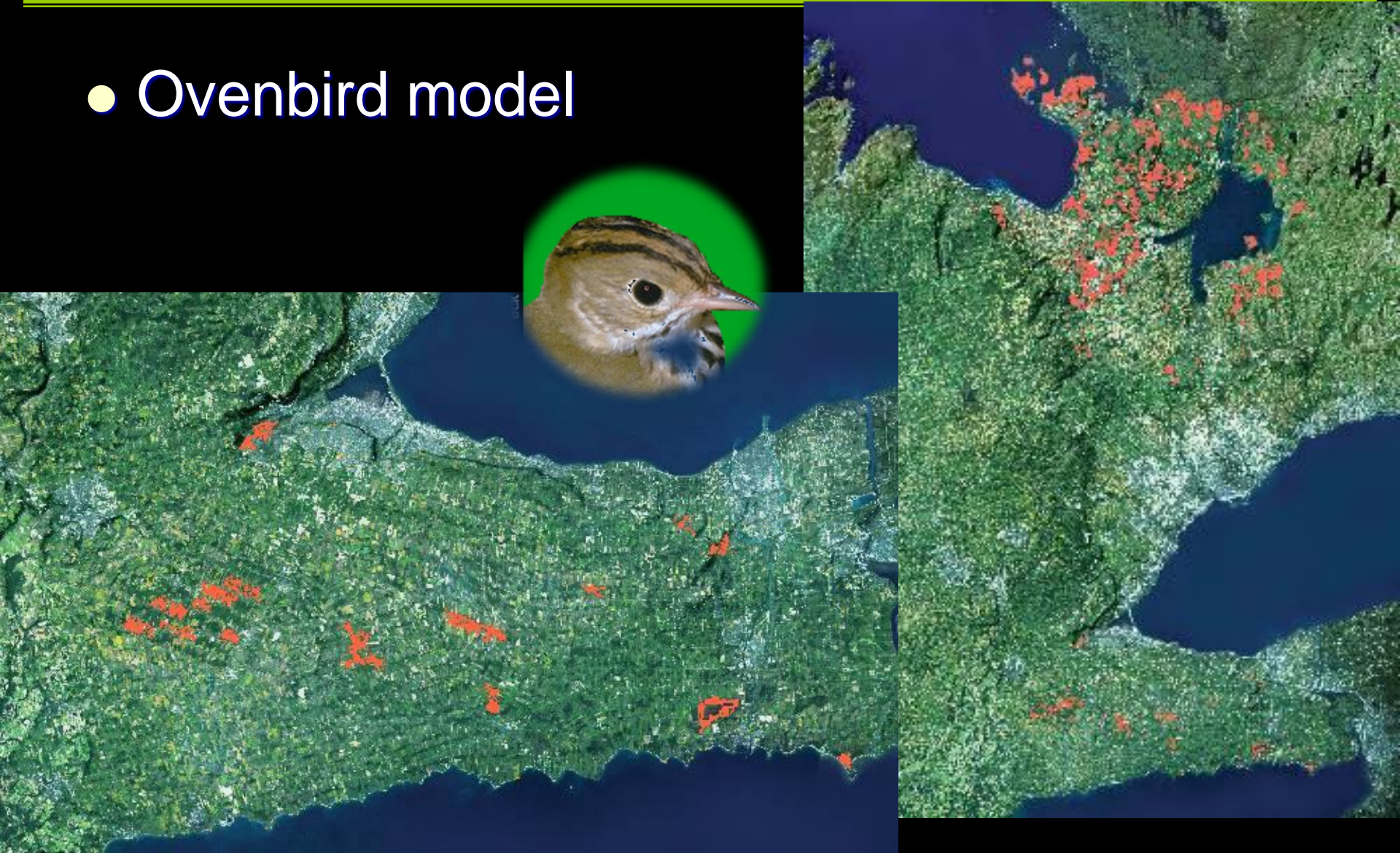
- Headwater areas

Species hot-spots



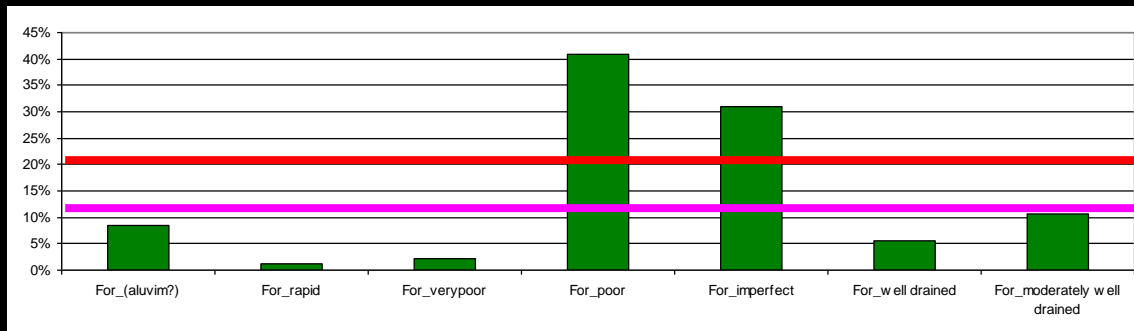
Species habitat models

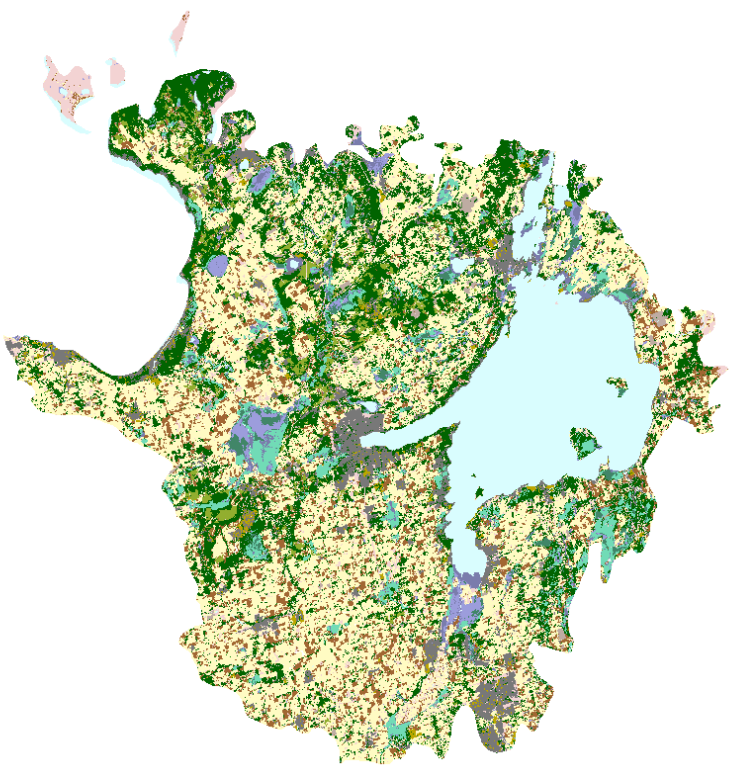
- Ovenbird model



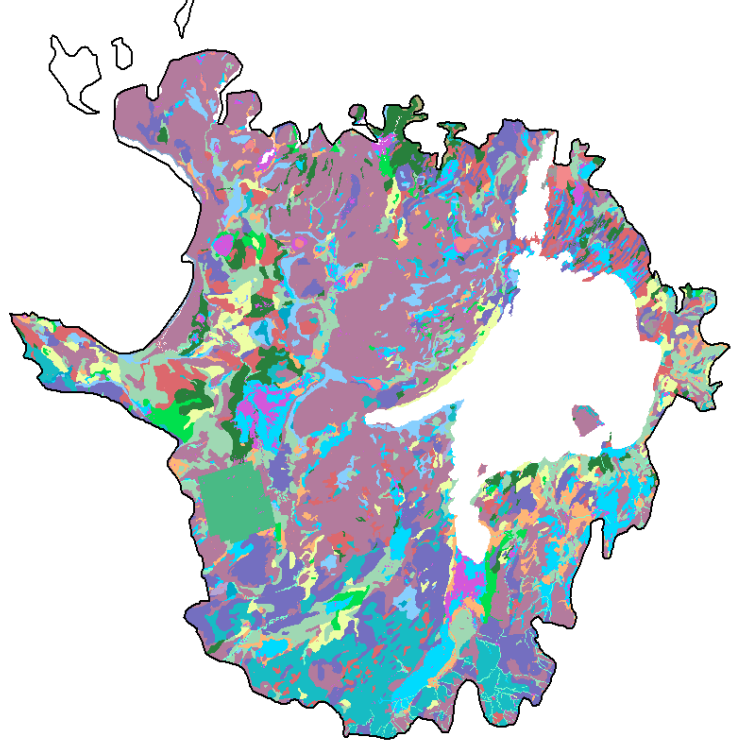
Target setting

- Gap-analysis
- Science based thresholds
- Expert knowledge
- Consensus derived / cumulative knowledge
- Stakeholders





Existing condition



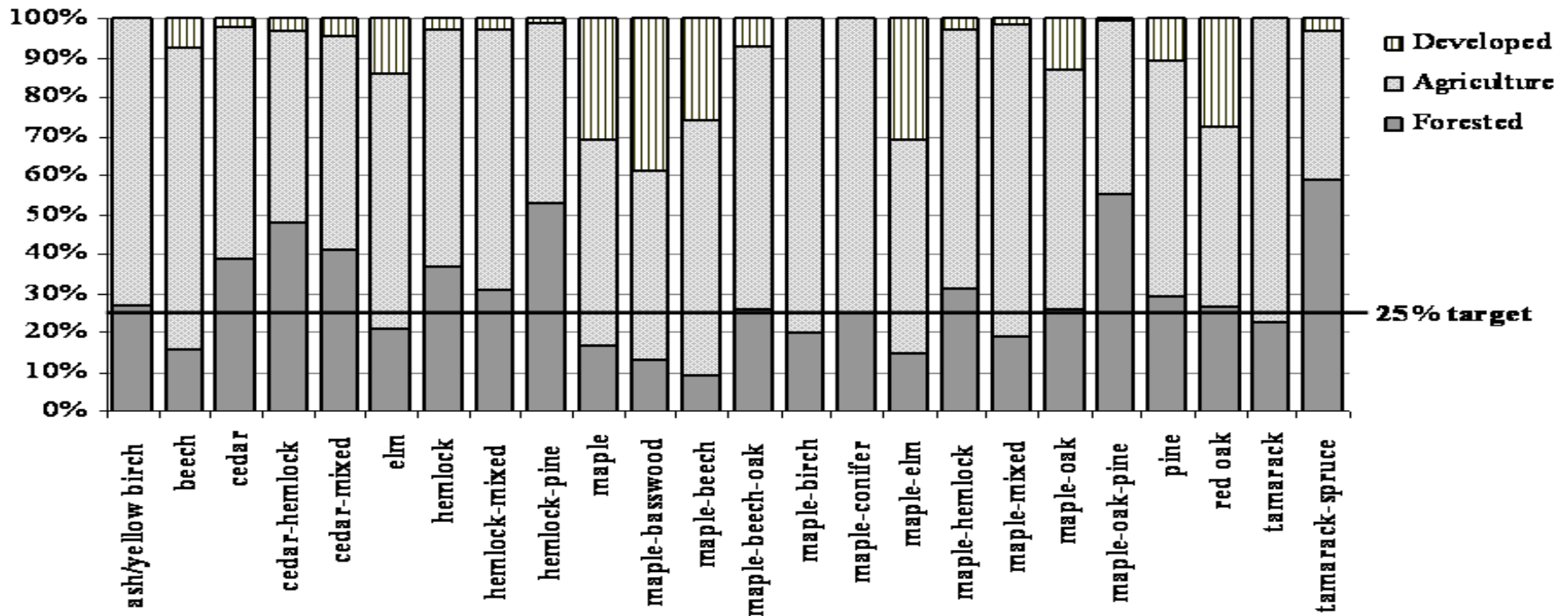
Reference condition

A priori gap-analysis

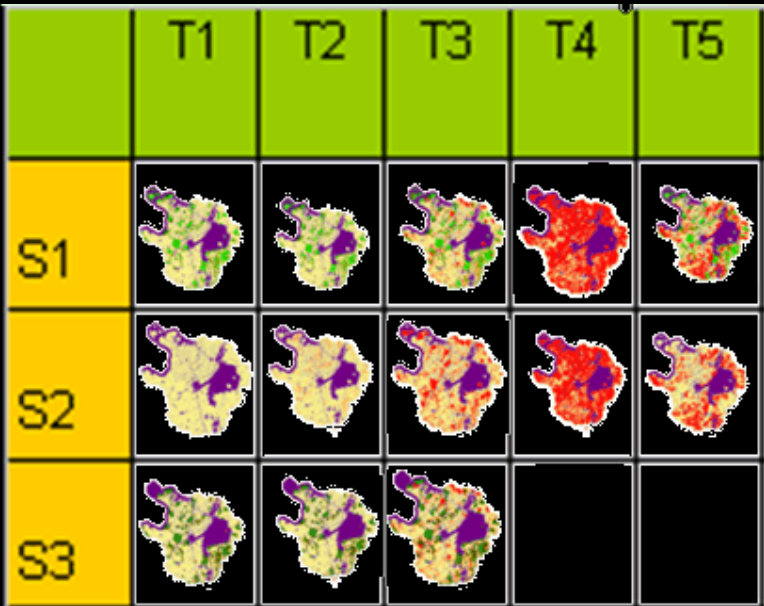


Early scenes from southern Ontario, including (above) men sawing down a tree in 1910, west of Guelph (Ontario Archives),

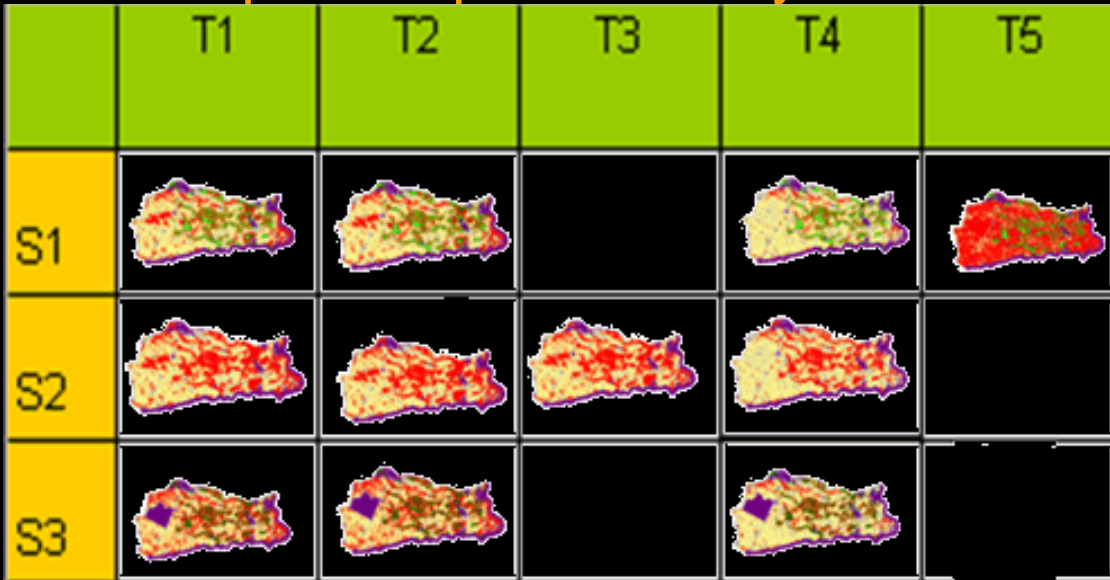
- Representation targets
 - GAP analysis
 - Pre-settlement vegetation



Different options

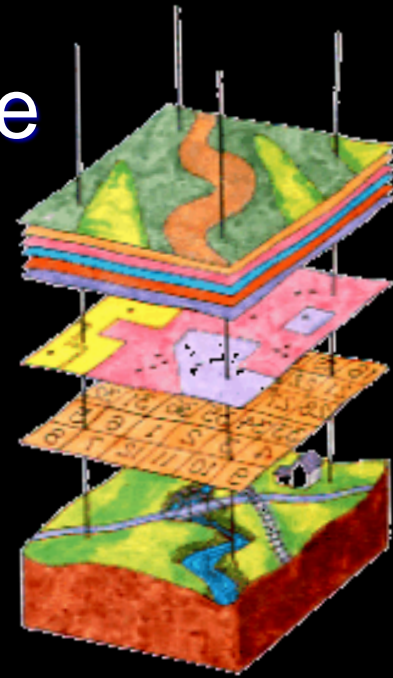


Options quantitatively evaluated



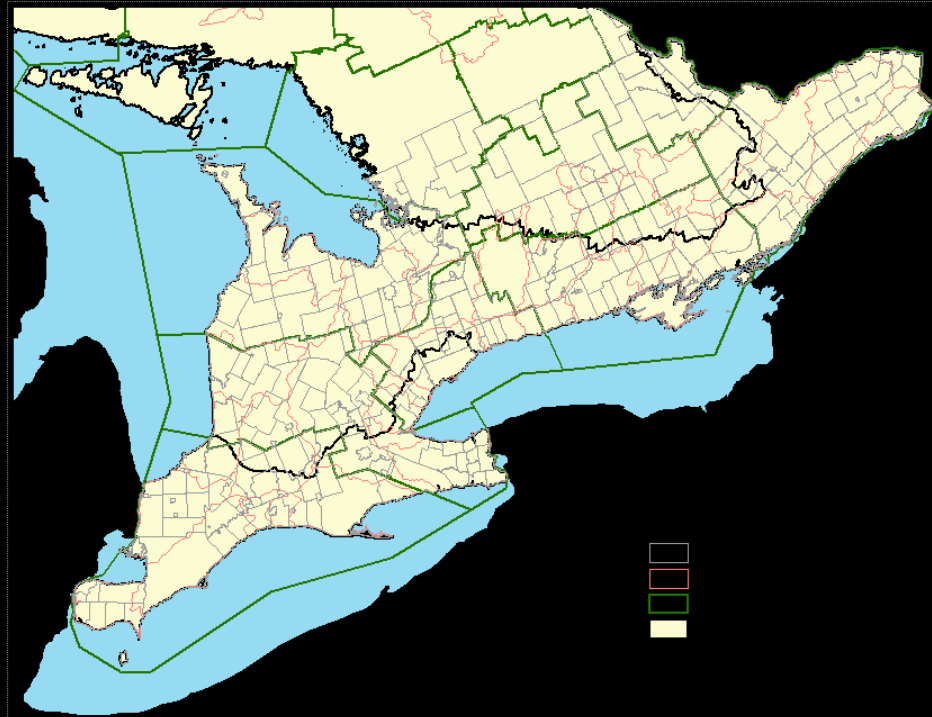
Information

- Information on ecological and socio-economic data
- Takes time and resources
- Spatial (mapped) information
- Mobilize and map expert knowledge



Implementation

- S. Ontario
 - Local decision making (municipal)
 - Overlapping jurisdictions
 - Overlapping programs



Research / science

- Species habitat mapping
- Species viable populations
- Connectivity
- Restoration
- Cost surface
 - Restoration based, carbon and biomass; fragmentation
- Landscape systems and climate change
- Conservation lands & IUCN classes
- Planning process vs. the tool