

# **VSP** **Vegetation Sampling Protocol**

## **Landscape Inventory and Monitoring Applications**

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# Us vs. the World

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- Plot based inventory & monitoring

- Europe

- 260,000 national forest inventory plots from 17 countries ; 4,300,000 vegetation-plot records

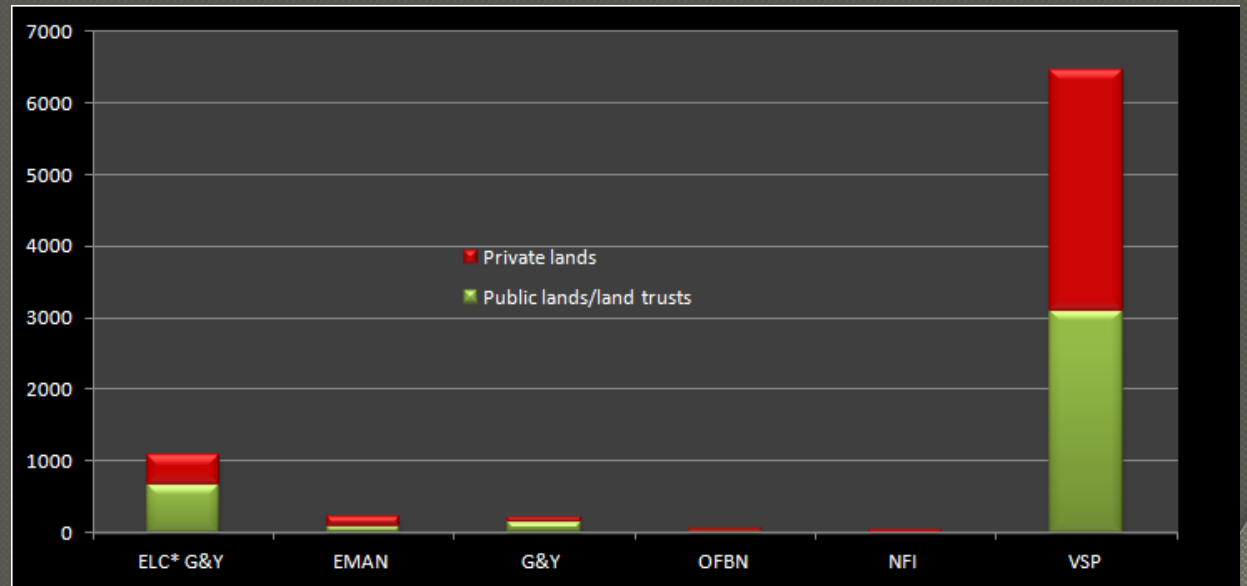
- China

- the 7<sup>th</sup> NFI (2004 -2008), 415,000 fixed plots

- Japan

- 15,675 forest plots measured every 5 years;
- More than 3,000 permanent plots measured annually

<b>Southern Ontario vegetation inventory and monitoring program</b>	<b>Plots located on publicly owned land or property held by land trusts</b>	<b>Plots located on other land designations (likely private)</b>	<b>Total number of plots</b>	<b>Percentage of sampling on public land or land held by land trusts</b>
G&Y & ELC*	672	405	1077	62%
EMAN	93	134	227	41%
G&Y	144	68	212	68%
OFBN	18	37	55	33%
NFI	2	42	44	5%
VSP	3099	3357	6457	48%
All	4028	4043	8072	51%



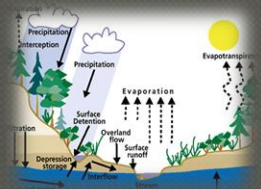
\* Plot size of 100m<sup>2</sup>

**Vegetation information  
needs in multifunctional /  
settled landscapes**

# Vegetation



**Invasive species**



**Water cycle**

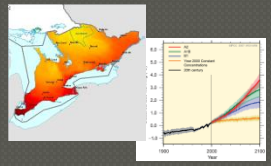


**Land use planning & NHS**

**Biodiversity**



**Carbon offsets**



**Climate change**



**Wildlife and SAR**



**Mapping**



**Forest management**



**Ecological goods & services**



**Human health & recreation**

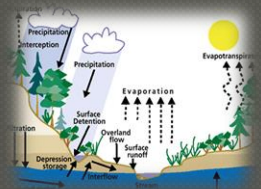


**Inventory Monitoring**

# Vegetation



**Invasive species**

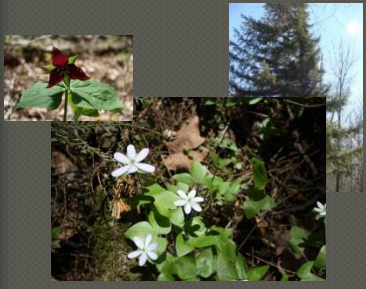


**Water cycle**

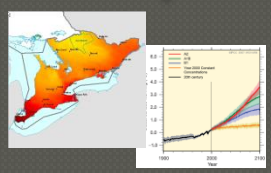


**Land use planning & NHS**

**Biodiversity**



**Carbon offsets**



**Climate change**



**Wildlife and SAR**



**Mapping**



**Forest management**



**Ecological goods & services**



**Human health & recreation**



**Inventory Monitoring**

# **Without vegetation information**

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- We can make only add-hock decisions
- We may make inappropriate decisions which may lead to undesirable outcomes
- We can't really manage or plan

# Inventory and Monitoring



**VSP**

# VSP Inventory and Monitoring

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- ◉ Multipurpose sampling method and approach
- ◉ Supports adaptive management
- ◉ Meets diverse resource management, conservation and planning needs
- ◉ Applicable at present and in the future



# VSP

- Focus on base data collection
- Integrative approach to field data collection
- Records precise spatial location
  - Within known, fixed area
- Takes the advantage of spatial technology and information
- Requires to record sampling method
  - Random, purposive
- Follows sampling rigour
  - but doable and practical



# Applicable to different vegetation types



Grasslands



Wetlands



Forests



Anthropogenic  
communities



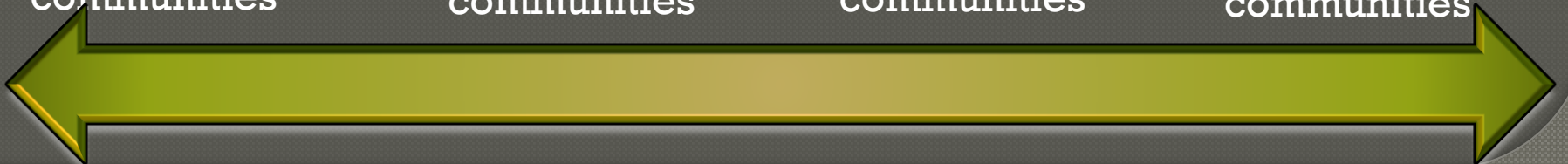
Disturbed  
communities







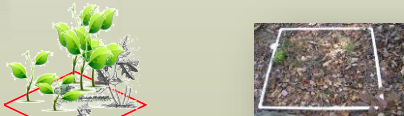
Semi-natural  
communities



Natural  
communities



# Modular approach

VSP Modules	Inventory	Monitoring
Plant abundance (cover)		
Tree measurements		
Dead standing trees (Snags)		
Lying dead-wood	<p>optional</p>	
Soil, micro-topography & plot surface		
Sub-plots	<p>optional</p>	
Tree health	<p>optional</p>	
Geographic location	<p><b>X &amp; Y</b></p>	<p><b>X &amp; Y*</b></p>



# VSP sample

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- Where exactly the sample was taken
  - Precise geographic location
- What is the size and shape of sampled area?
- Is the sample based on a sampling design or not?
  - What type of sampling design?
- Understand
  - measurements scales
  - data limits



# From plot to landscape



**Plot**



**Stand**



**Landscapes**



**Regions**

**Regions**



**Spatial scale**

**Stand/  
property**



**Plot**

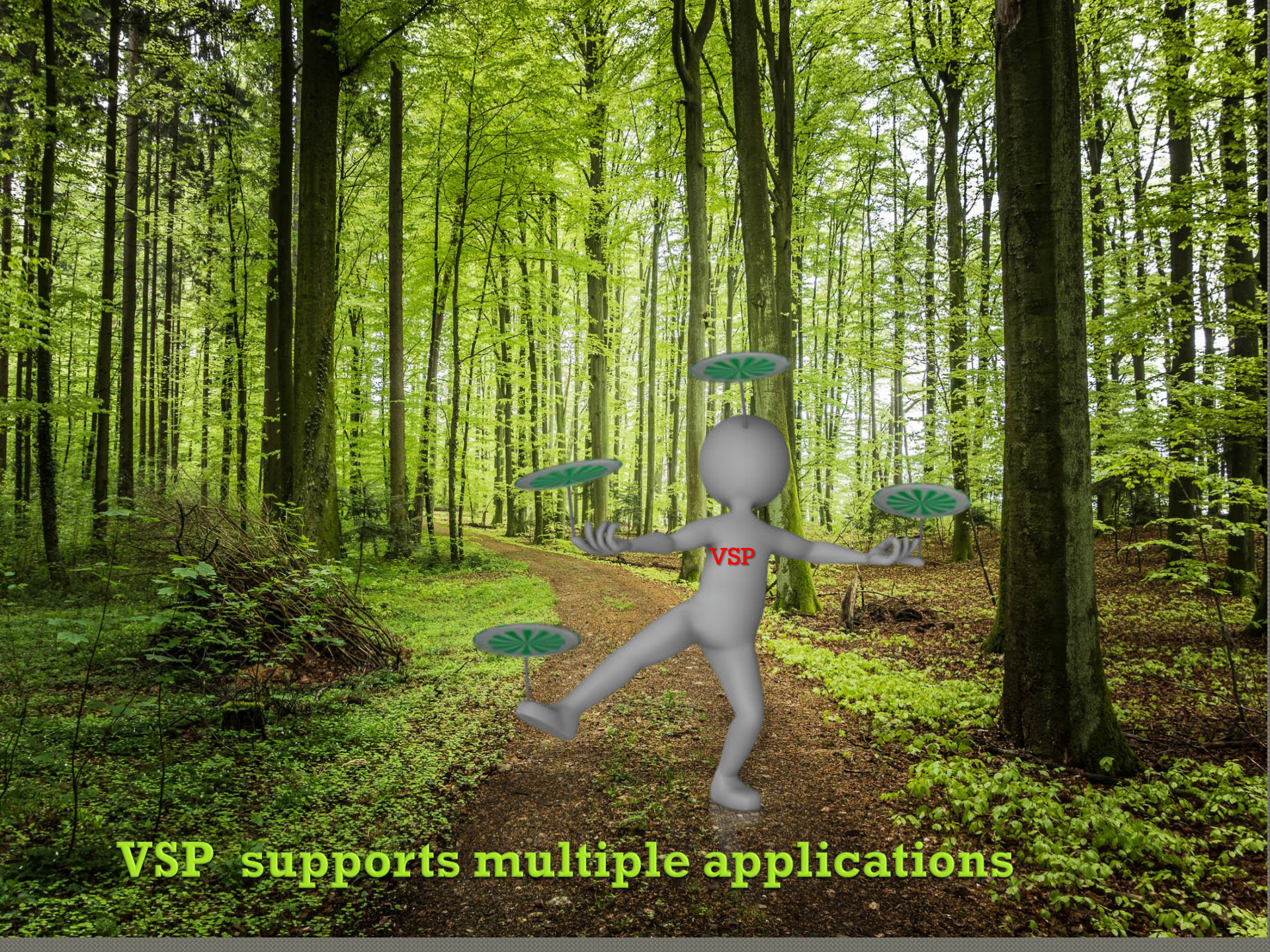


*Time step 1  
(setting a baseline)*

*Time step 2*

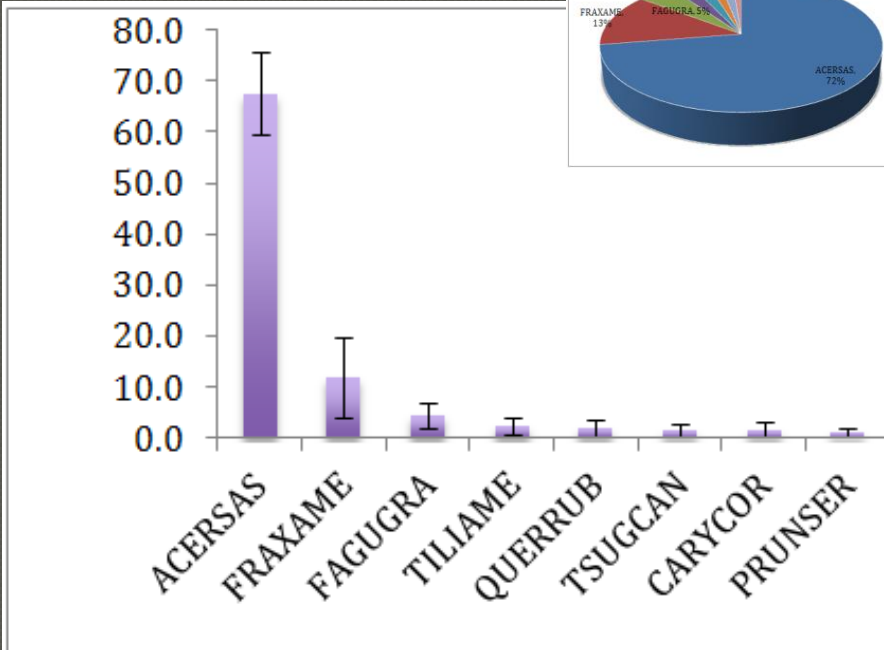
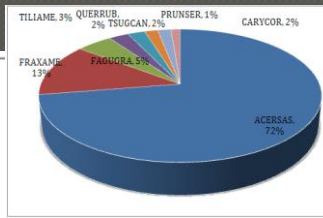
*Time step 3*

**Temporal scale**

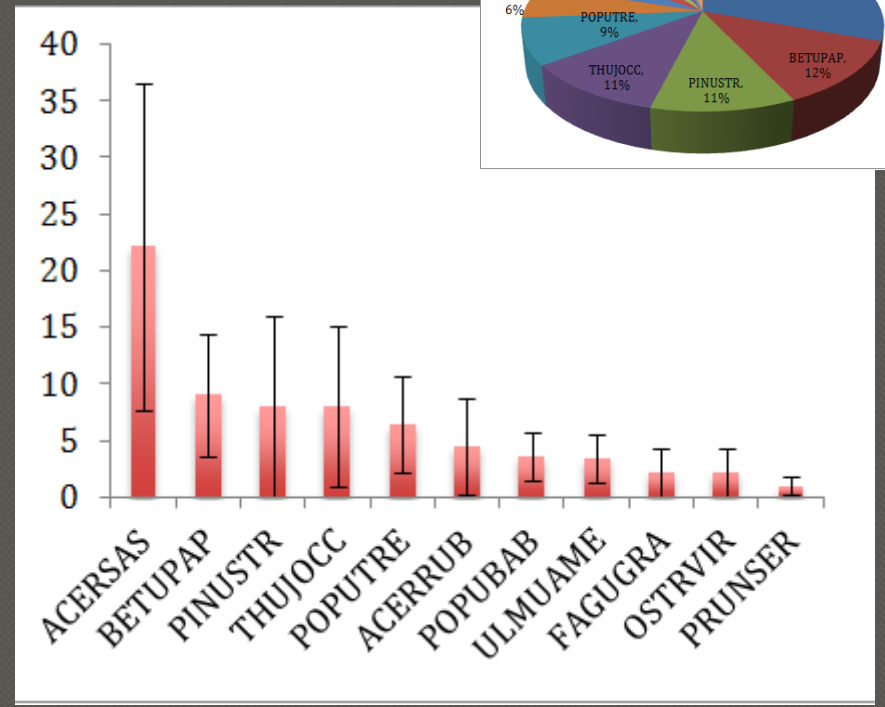
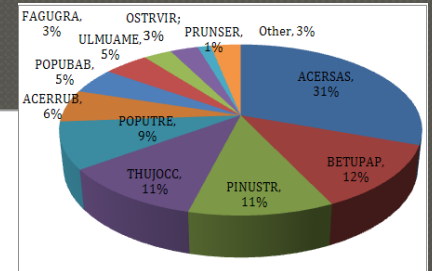


**VSP supports multiple applications**

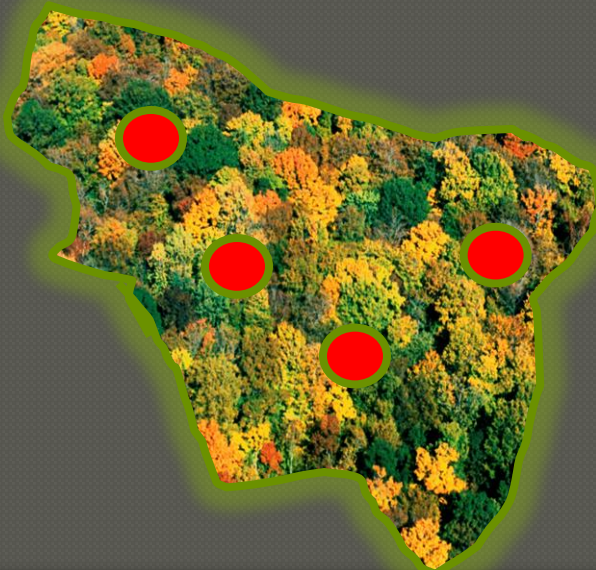




**Stands sampled by VSP plots can be mapped and statistically described.**



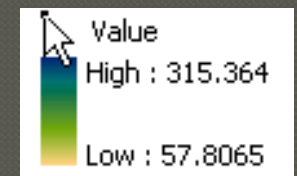
**Mean absolute abundance +/- 1 SE .**



**Mean absolute abundance +/- 1 SE .**

# Carbon and biomass

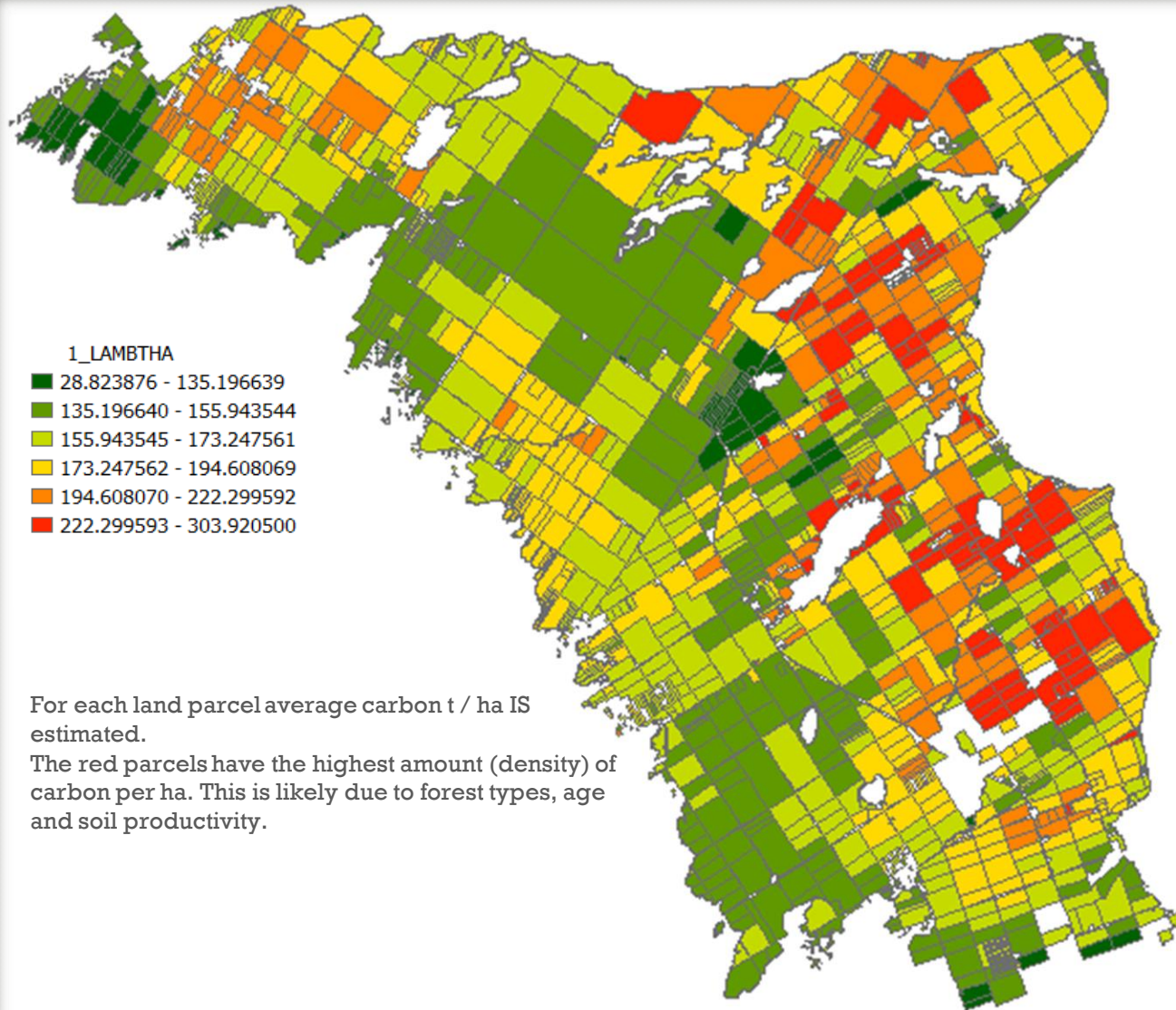
**Bruce - Above Ground Biomass loss since 1966**



Loss66\_09  
1

The legend shows a red square next to the number 1.

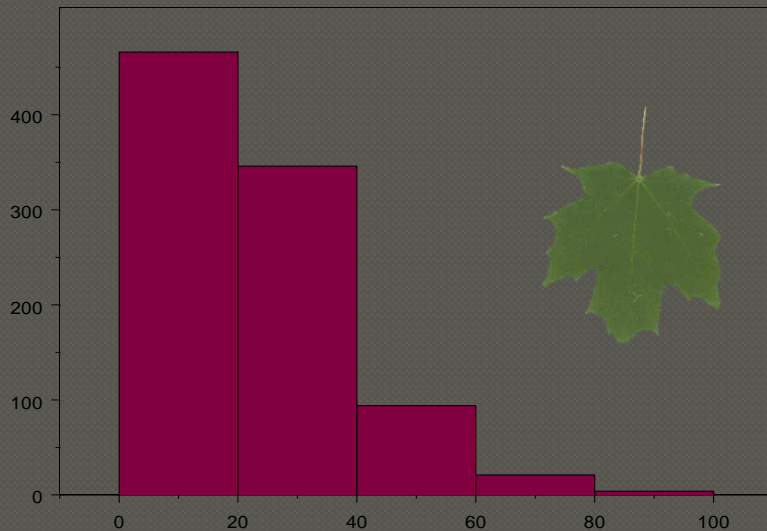
# Carbon and biomass



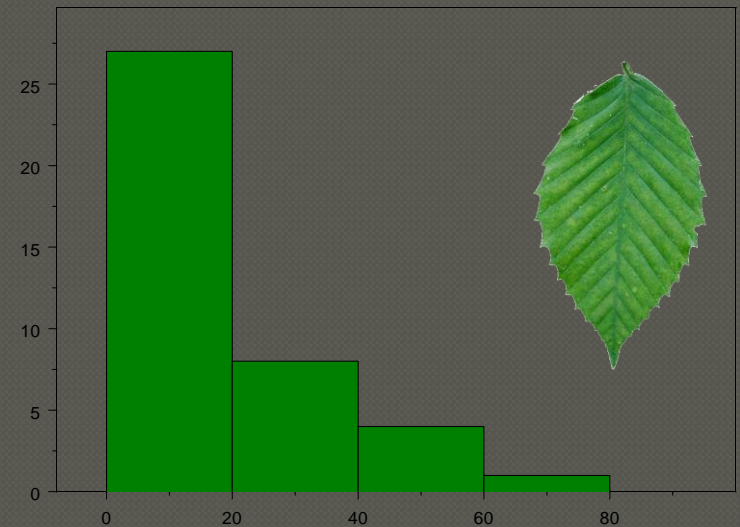
For each land parcel average carbon t / ha IS estimated.

The red parcels have the highest amount (density) of carbon per ha. This is likely due to forest types, age and soil productivity.

# Niagara Escarpment

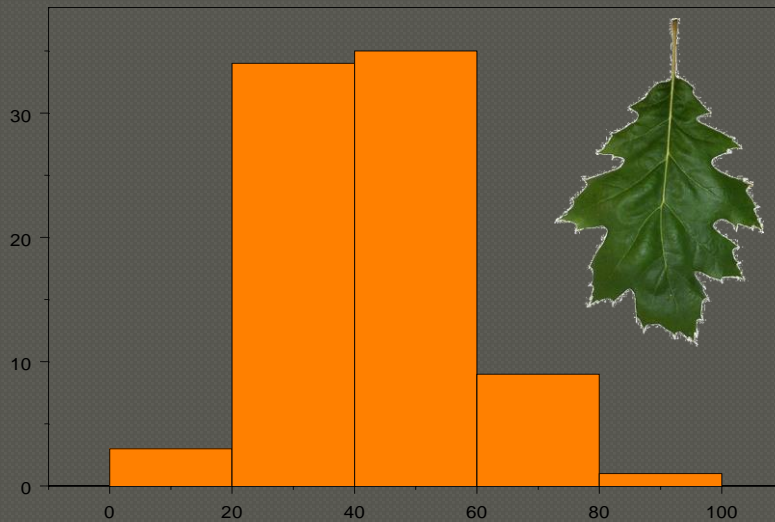


The diameter distribution of Sugar Maple shows the typical "reverse-J" curve which is indicative of an all-aged distribution. Sugar Maple shows presence of all size classes (DBH > 5cm and above) and thus ages, which is necessary to support forest regeneration.



American Beech has low relative frequency among sampled trees. However, its diameter distribution also shows the typical "reverse-J" curve which is indicative of an all-aged distribution.

# Niagara Escarpment



The diameter distribution of Red Oak (*Quercus rubra*) doesn't show the typical "reverse-J". The absence of the 5 to 20 cm (younger) trees and the average diameter of 42 cm indicate suppressed and poor regeneration of this species.



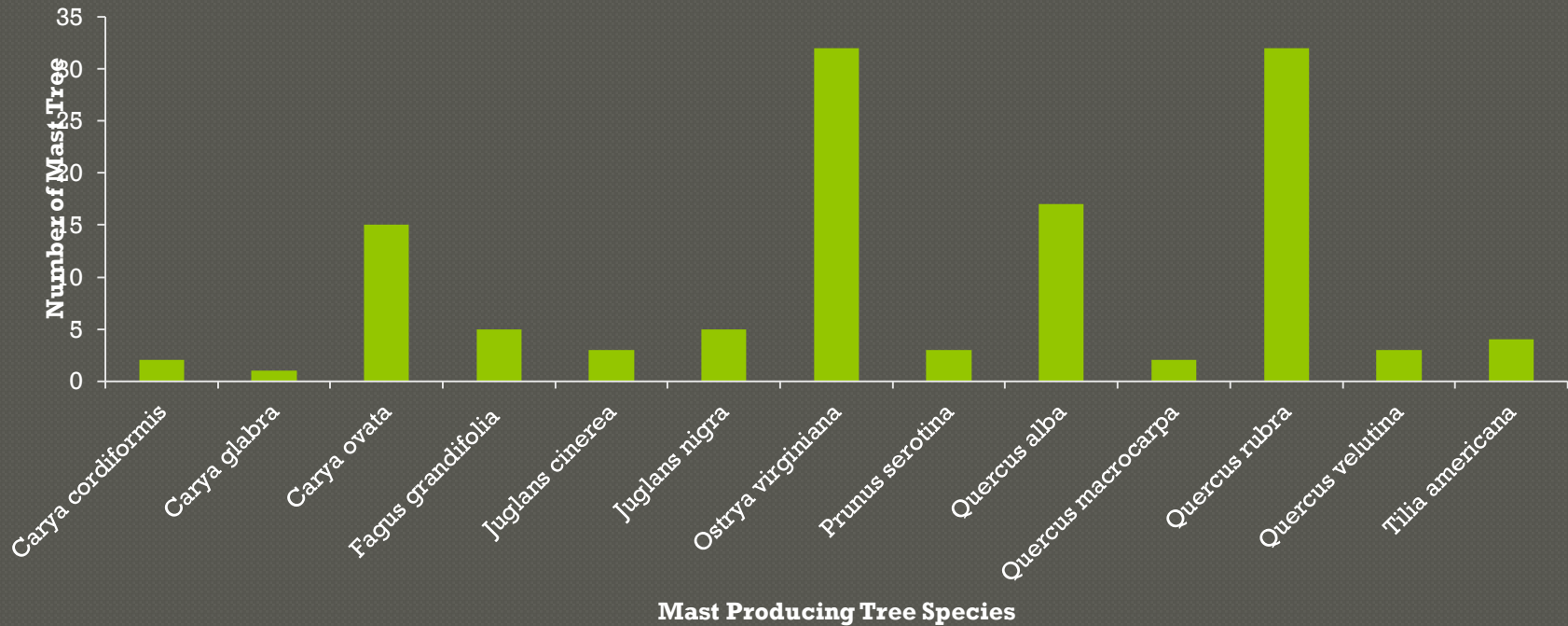
Red Oak seedling and sapling regeneration is almost absent from the samples. When observed at a very few plots it was recorded only as trace.



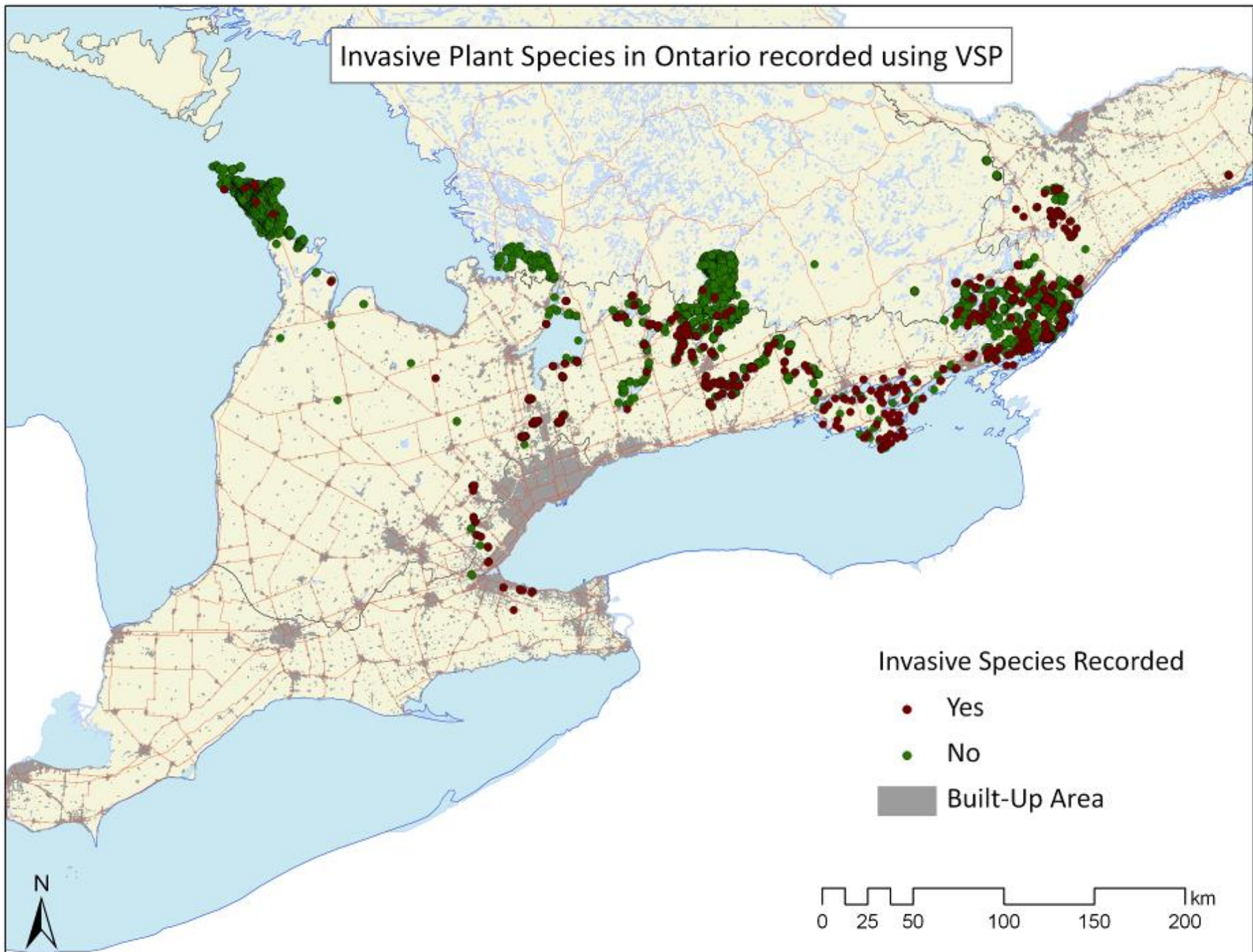
# Mast trees

- Average of 2.2 mast trees per plot

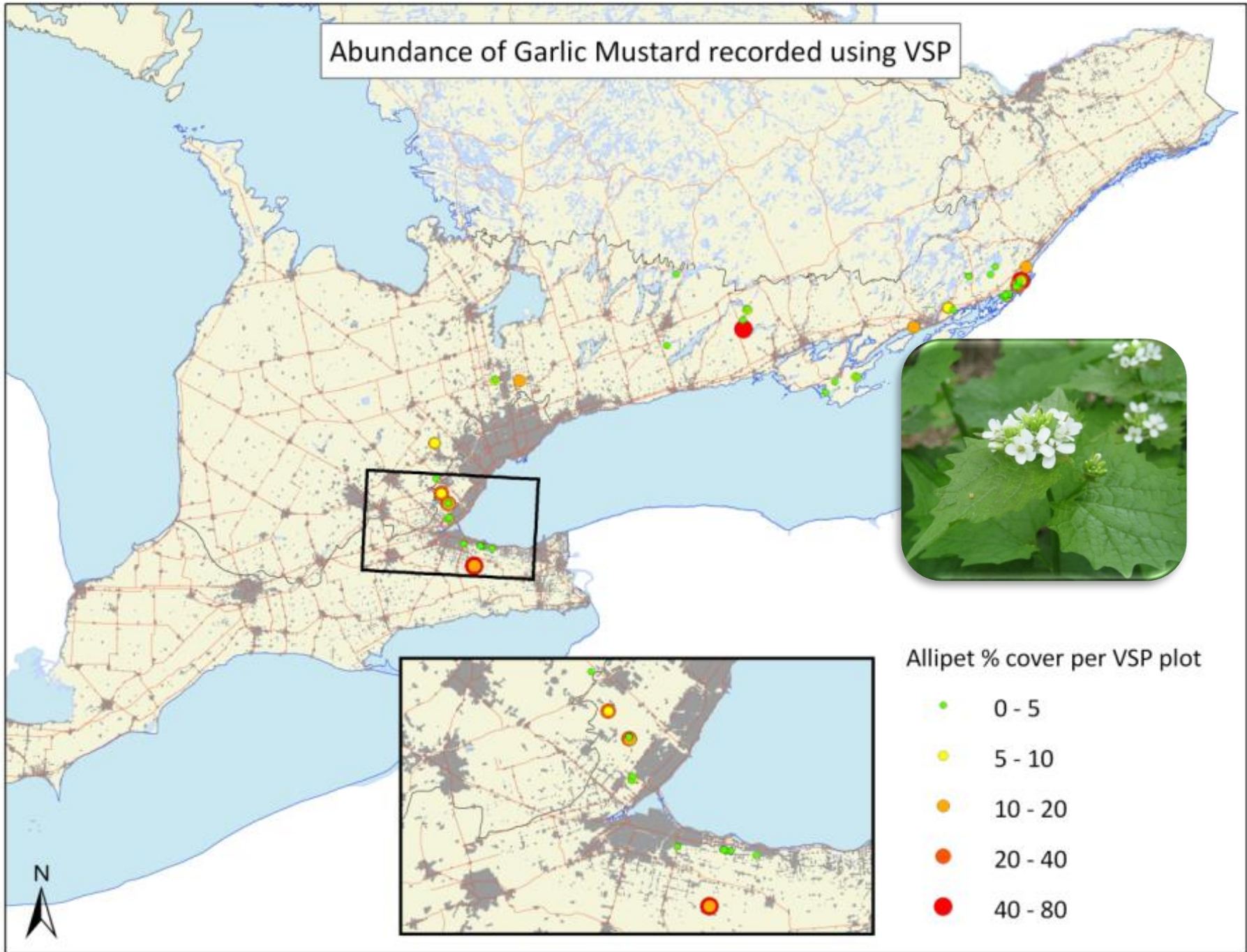
**Number of Mast Producing Trees Observed Across 56 Plots in Niagara Escarpment**



# Invasive Plant Species in Ontario recorded using VSP



# Abundance of Garlic Mustard recorded using VSP



# VSP base data is flexible

- Enables deriving more than 30 indicators of:
  - Ecosystem composition
  - Ecosystem structure and function

		Increasing Spatial Scale ----->		
		Plot	Stand / Vegetation Zone	Landscape
Plant species composition/ community structure	abundance indicator plant species (definition required)	yes	yes	no
	abundance indicator plant species (definition required)	yes	yes	no
	abundance invasive plant species	yes	yes	no
	density forest regeneration species	yes	yes	yes
	floristic quality	yes	yes	no
	native plant species richness	yes	yes	yes
	natural area index	yes	yes	no
	non-native plant species richness	yes	yes	yes
	number shade tolerant/intolerant species	yes	yes	no
	plant species richness	yes	yes	yes
	presence/absence forest regeneration species	yes	yes	yes
	presence/absence indicator plant species (definition required)	yes	yes	yes
	presence/absence invasive plant species	yes	yes	yes
	presence/absence obligate wetland species	yes	yes	yes
	richness obligate wetland species	yes	yes	no
	Shannon-Weiner index	yes	yes	yes
	WEED index	yes	yes	no

		Increasing Spatial Scale ----->		
		Plot	Stand / Vegetation Zone	Landscape
Terrestrial ecosystem structure and function	basal area	yes	yes	yes
	biomass	yes	yes	yes
	carbon sequestration	yes	yes	yes
	carbon stocks	yes	yes	yes
	composition/percent cover of vertical strata	yes	yes	no
	measures of tree seed sources	yes	yes	no
	number mast trees	yes	no	no
	ratio small/big tree stem density	yes	yes	no
	snag densities	yes	yes	no
	tree condition/health	yes	no	no
	tree diameter distributions	yes	yes	no
	tree stem density	yes	yes	no
	vegetation height	yes	yes	no

# VSP Derivatives

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- Biodiversity Indicators
- Invasive Species
- Forest structure
- Habitat characteristics
- And more



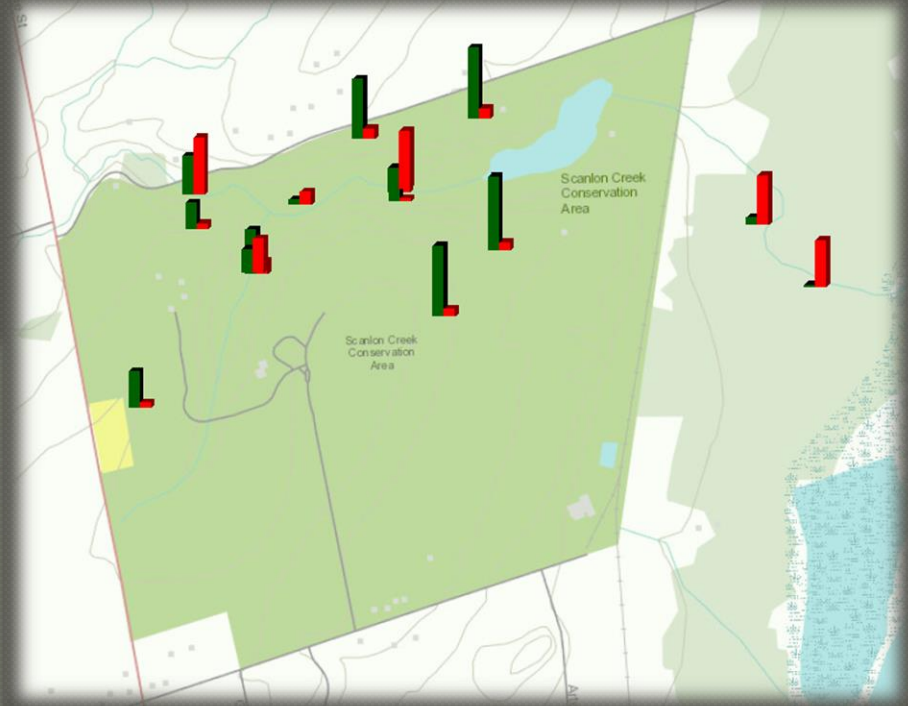
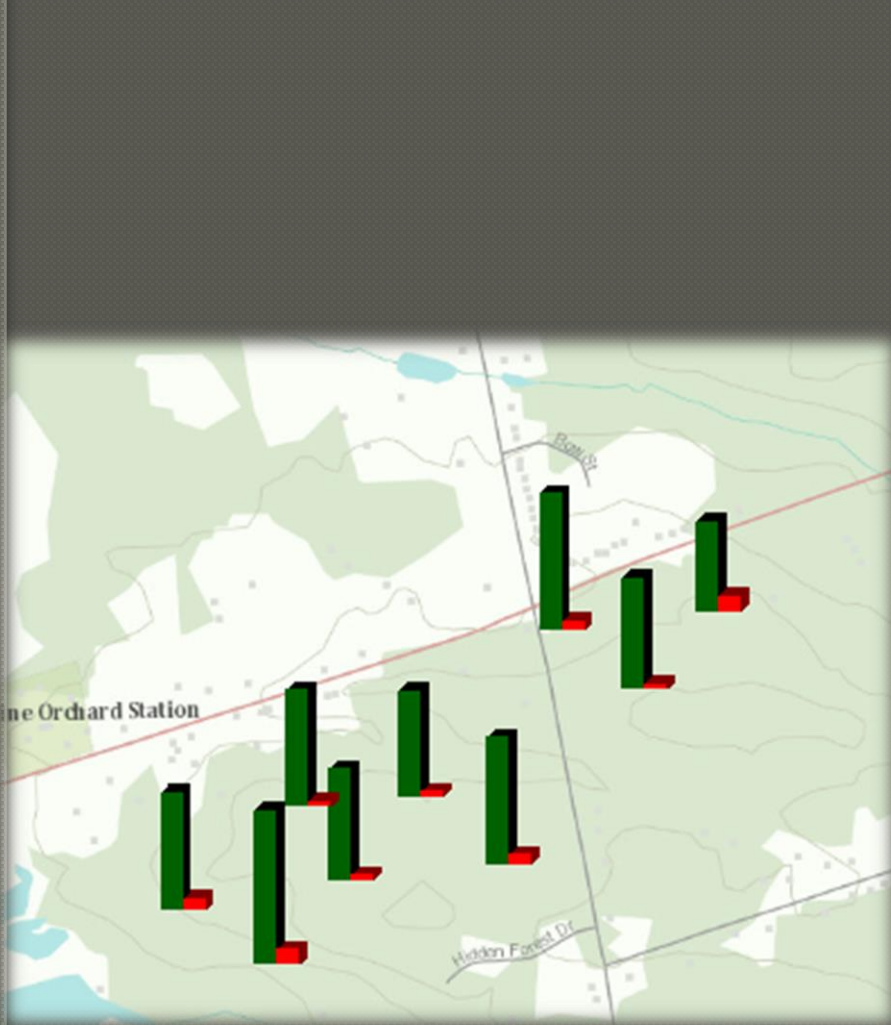
# Biodiversity indicators

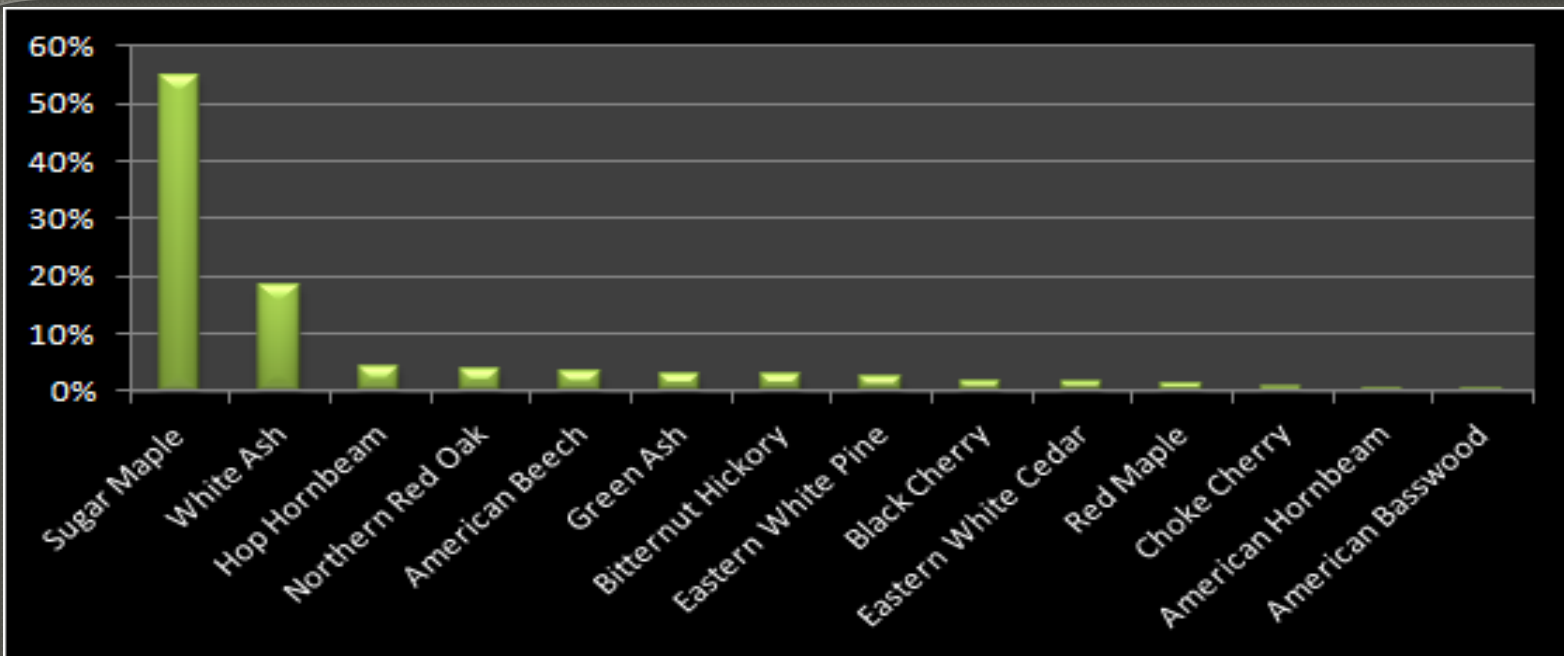
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- Species richness
- Floristic quality
- Natural Area Index
- Species importance value

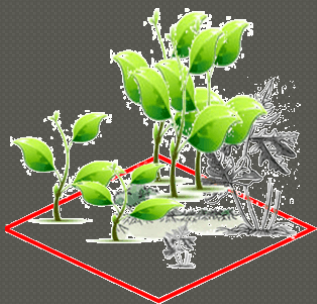


# Native vs. Non-native plants per plot

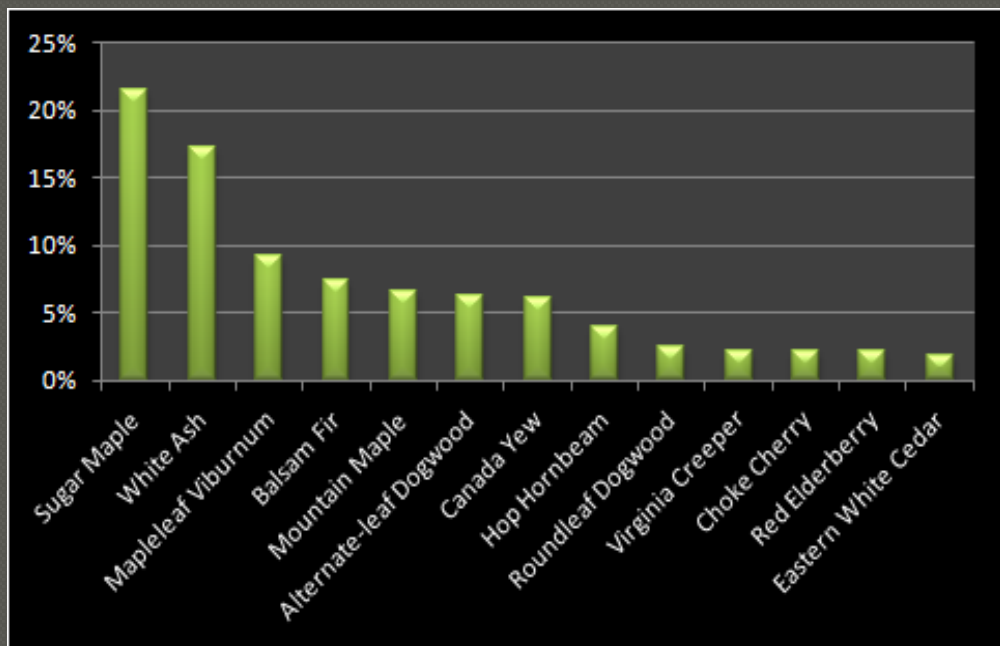




Tree regeneration: VSP pilot project  
Lake Simcoe protection plan

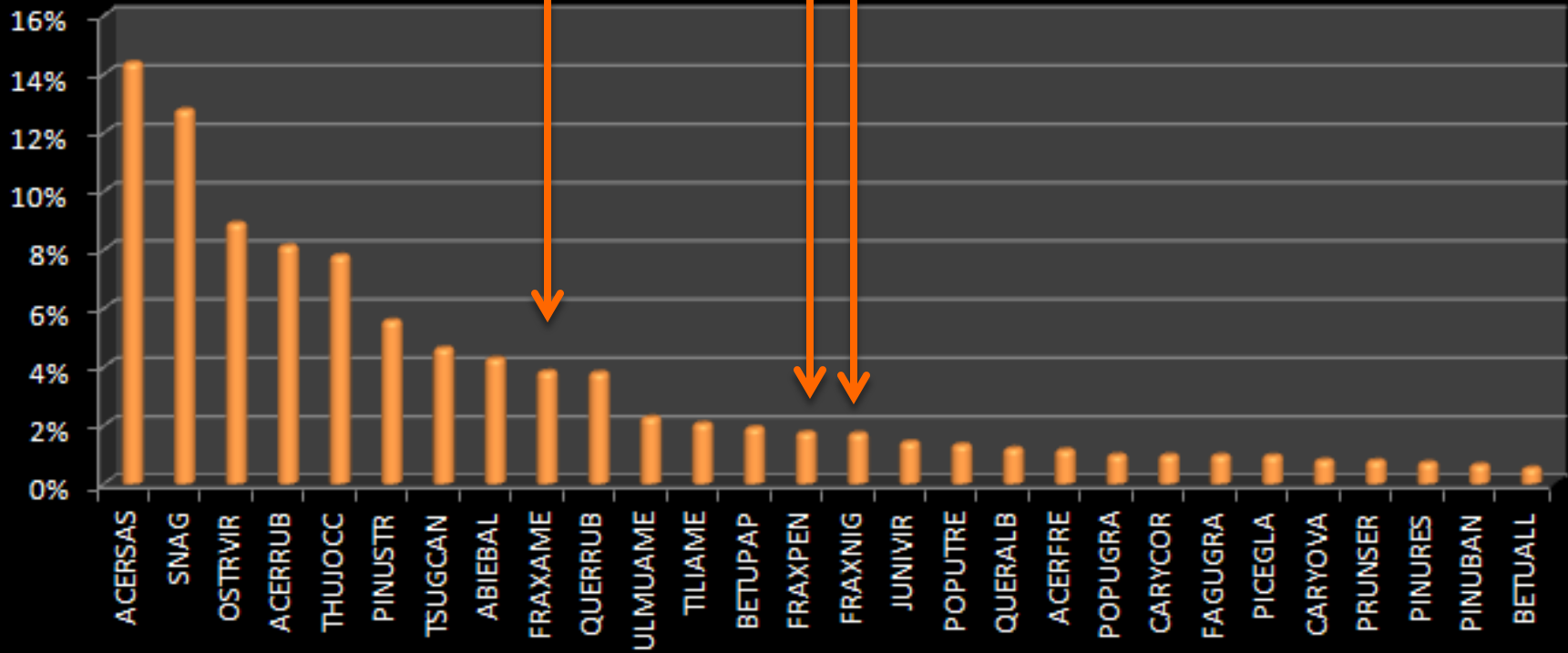


Tree regeneration - Niagara Escarpment





# Potential impact of EAB?



Ash sp. makes 8% of all trees measured

If Ash dies, snags will increase from 13 % to 21% measured trees.

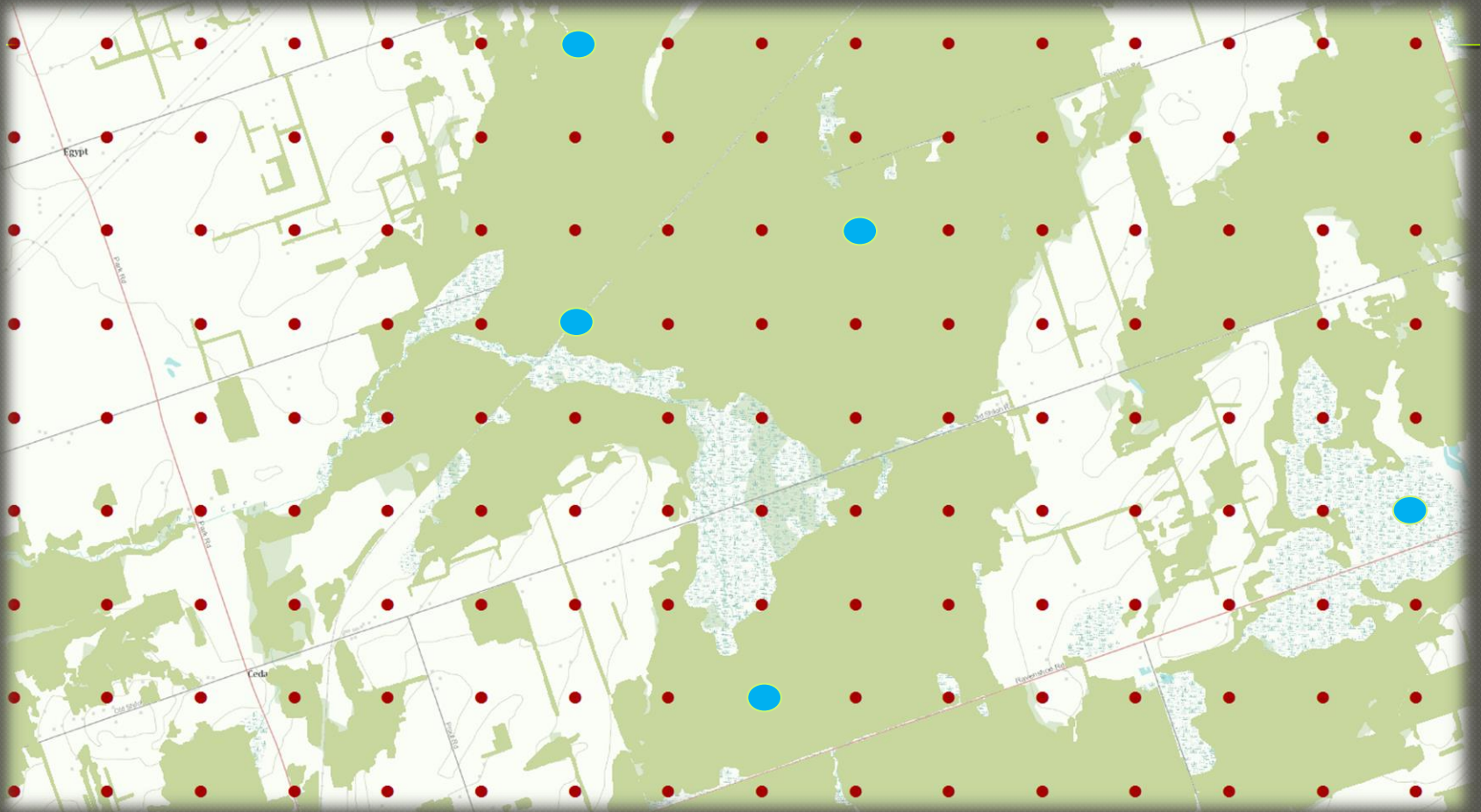
# VSP monitoring

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- Lake Simcoe protection plan
  - Pilot project in 2011-12; 105 plots sampled
  - Development of sampling design
  
- Niagara Escarpment Plan
  - Piloted in 2011-12; ~ 140 plots sampled

# Lake Simcoe watershed

Monitoring network design



- A set of VSP monitoring plots (blue points) will be selected for the Lake Simcoe watershed.



- Faculty of Forestry, University of Toronto
- St. Lawrence National Park
- Bruce Peninsula National Park
- Trent-Severn Waterway National Historic Site (386 km along central Ontario)
- Nature Conservancy of Canada (Eastern Ontario Region)
- Eastern Ontario Models Forest
- Frontenac Arch Biosphere Reserve
- Ontario Parks - Provincial Parks and Nature Reserves
- MNR Kemptville District
- MNR Aurora District
- MNR Midhurst District
- MNR Peterborough District
- Prince Edward County Stewardship Council
- Stormount, Dundas & Glengarry Stewardship Council
- Niagara Escarpment Commission
- Niagara Biosphere Reserve Fund
- Invasive Species Centre
- Ministry of Environment
- RBG

Thank you!

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