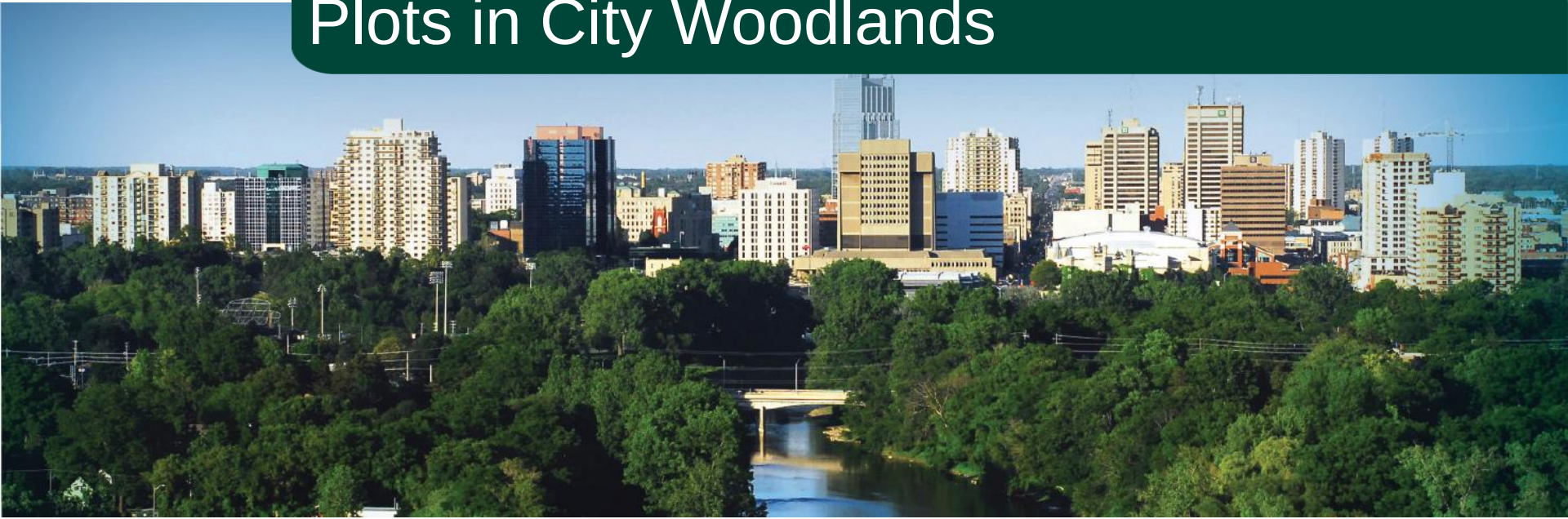
Establishment of Permanent Sample Plots in City Woodlands



Urban Forestry
Marnie Demand, Urban Forestry Planner
November 6, 2024

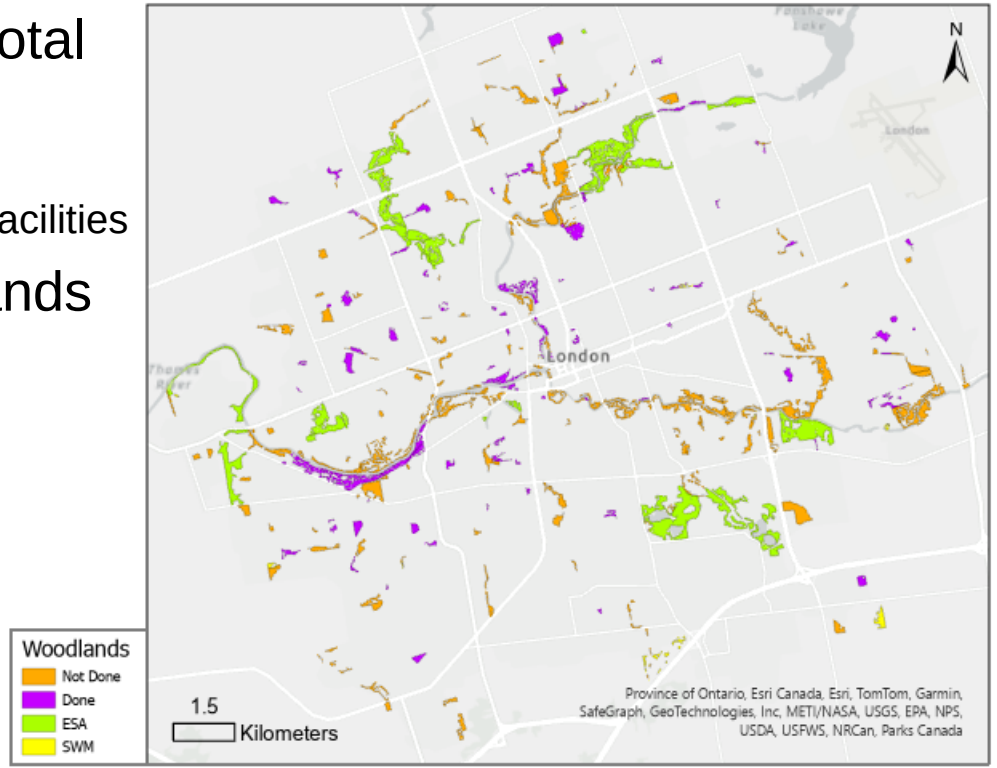
Link to Urban Forest Strategy

- Addresses Urban Forest Strategy, Action 11.5: Establish long term monitoring plots in forest woodlands.

MAINTAIN BETTER			
Strategic Goals	**Actions**	**Priority**	**Timeframe**
11 Monitor existing and potential canopy cover.	**11.1** Conduct an analysis of plantable space across different land use types within London in order to estimate canopy potential.	High	Short-term 1-2 years
	11.2 Monitor canopy cover change over time by land use types to measure strategy performance. An inexpensive, accurate and repeatable method such as the USFS iTree Canopy[j] program is recommended. This should be based on up-to-date summer aerial photography, and repeated at 5 year intervals, prior to or in conjunction with Official Plan reviews.	High	Short-term 1-2 years
	11.3 Monitor urban forest structure, function, and values over time using the USFS iTree Eco program. This should be repeated at 10 year intervals. The 2012 UFORE study can be used as a baseline and results updated with new iTree Eco local inputs. The iTree Eco re-analysis is to be completed and reported no later than 2018. iTree Eco is a new adaptation of the UFORE model.	High	Medium-term 3-5 years
	11.4 Model the projected canopy gain from the current and planned urban forest in order to refine estimates for the number of new plantings required and time to reach canopy cover targets.	Medium	Medium-term 3-5 years
	11.5 Establish long term monitoring plots in forest woodlands.	Medium	Long-term >5 years

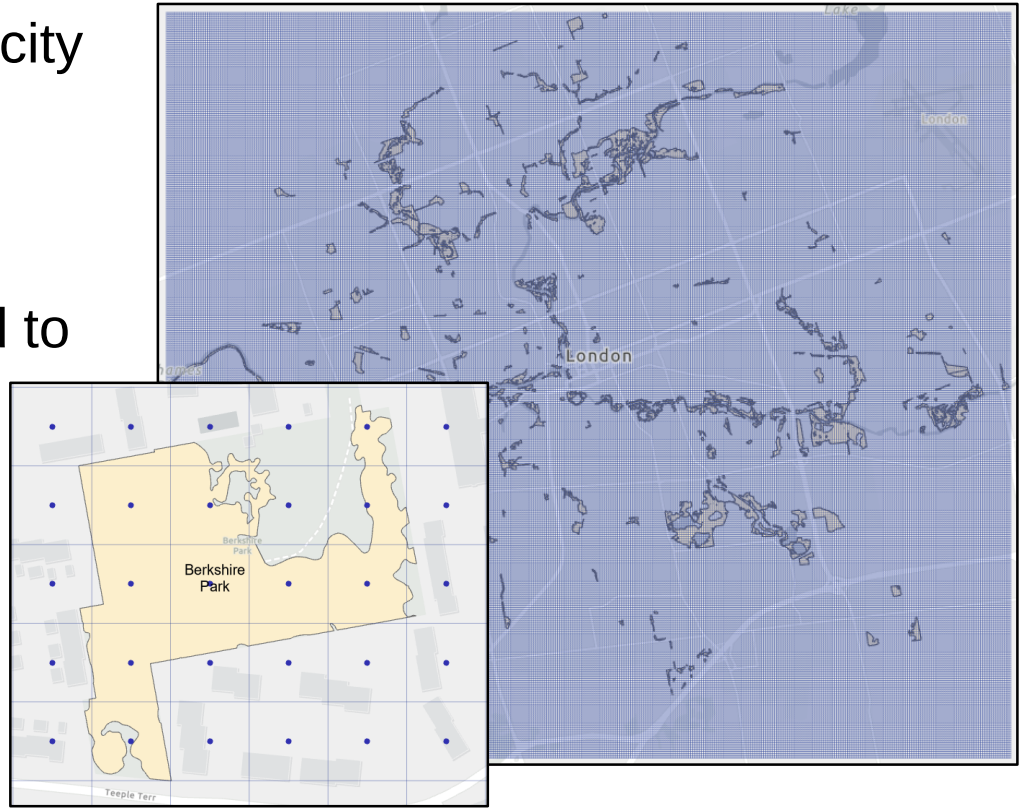
Status on Permanent Sample Plot Data Collection

- City has 290 woodlands in total
  - Includes:
    - 25 ESAs
    - 19 Stormwater Management Facilities
- PSPs installed in 79 woodlands so far
  - Distributed across the City
- Circular, 0.04 ha area
  - 11.3 m radius
    - + 8 Quadrats on perimeter



PSP Placement

- Apply fishnet grid across city
- Points within woodlands retained
- Within each woodland, random number assigned to each plot
  - Ranked from high to low
  - Highest numbered plot selected



Data Collected on Woodland: Species Present

- List of tree species
  - ~100 species total
  - Mean: 12.7 species/woodland
  - Range: 2 to 32
- List of shrub species
  - ~50 species total
  - Mean: 6.2 species/woodland
  - Range: 0 to 14
- Wildlife
  - Visual observations
  - Merlin App (birds)

Tree	# of Woodlands
hackberry	50
Manitoba maple	50
black walnut	49
sugar maple	46
Norway maple	44

Shrub	# of Woodlands
European buckthorn	68
grape vine	47
choke cherry	43
Virginia creeper	38
Rubus sp.	36

Data Collected on Woodlands: Invasive Species Frequencies

- Categories:
  - Invasive trees
  - Invasive shrubs
  - Invasive groundcovers and/or herbaceous plants
- Each category rated as:
  - Abundant
  - Moderate
  - Infrequent
  - None

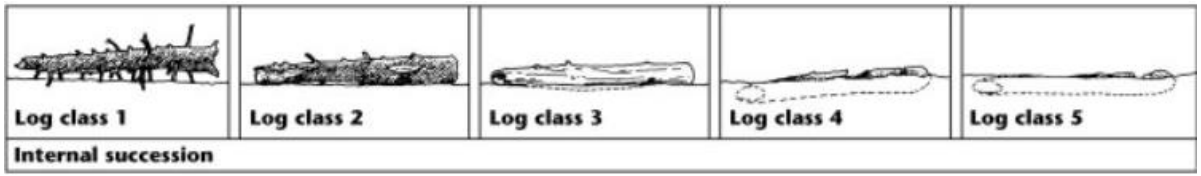
Frequency of Invasive Trees	
Category	**# of Woodlands**
Abundant	16
Moderate	15
Infrequent	37
None	10

Frequency of Invasive Shrubs	
Category	**# of Woodlands**
Abundant	20
Moderate	31
Infrequent	23
None	4

Frequency of Invasive Groundcovers or Herbaceous	
Category	**# of Woodlands**
Abundant	11
Moderate	24
Infrequent	25
None	18

Additional Data Collected on Woodland

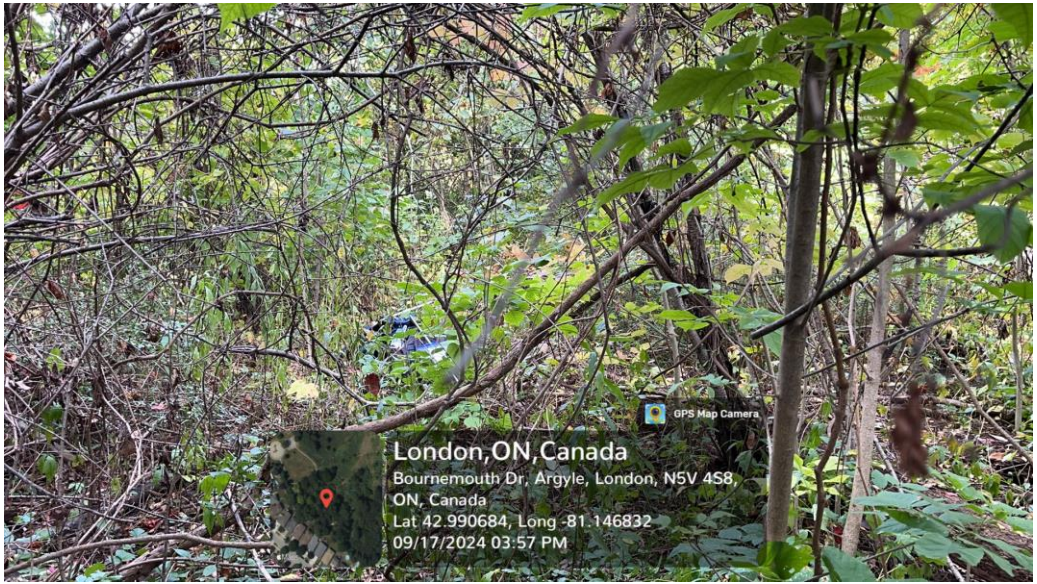
- Visual estimate of % conifer
- Species-at-risk observed
  - Kentucky coffee-tree, butternut, and a chimney swift (Merlin app)
- Damage to woodland
  - Vandalism
  - Excessive garbage
  - Encroachment
  - Unauthorized trails
  - Etc.
- Coarse woody debris
  - Description
    - Abundance
    - Size
    - Decay class



Coarse Woody Debris Decay Classes
(Province of British Columbia, Silviculture and stand management training, Module 3 - Stand level components of forest biodiversity, 2024)

Data Collected on PSP

- Understory Layer
  - Approximate height of layer
    - Mean: 2.5 m
  - Dominant invasive species
    - Percent Invasive
      - Mean: 47.5%
  - Dominant native species
    - Percent native species
      - Mean: 51.0%
- Vine species
  - % of trees and shrubs covered by vines
    - Mean: 8.4% across all plots
    - Affecting 44 of 79 plots



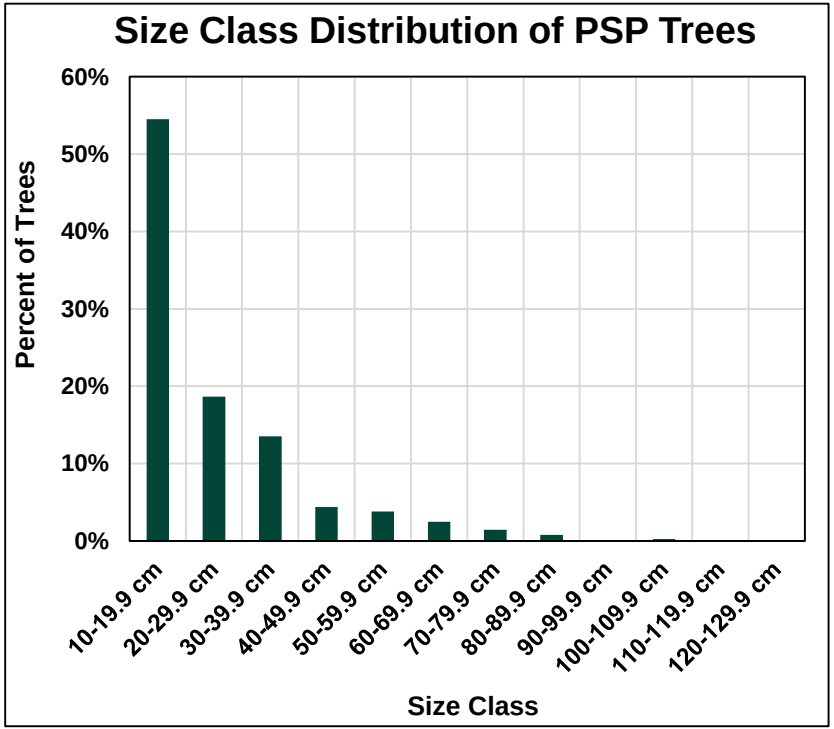
Grampian Woods

Trees within PSPs

- All trees with Diameter at Breast Height (DBH) of 10 cm or greater:
  - Tagged (excluding oaks), to mark plot, enable repeat measurements
  - DBH
  - Species
  - Condition rating (Excellent, good, fair, poor, dead)
  - Wildlife Tree (snag) class (1-8)
  - Damaging agent(s) if known
  - Multi-stem trees:
    - All stems 10 cm or greater in DBH separately tagged and recorded
    - Noted as multi-stemmed

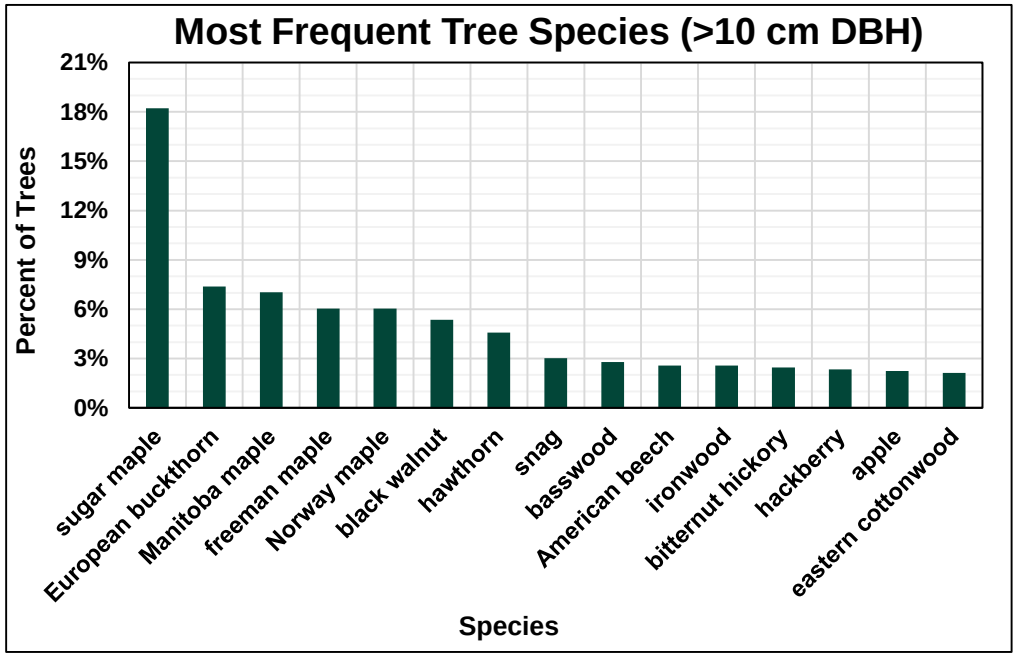
Size Range of Trees within PSPs

- DBH of trees 10+ cm in diameter:
  - 895 trees (or stems) within the 79 PSPs
- DBH range:
  - Max: 121.8 cm
    - Red oak in Camden Crescent Park
  - Mean: 24.7 cm
  - Median: 18.5 cm



Species and Condition of Trees within PSPs

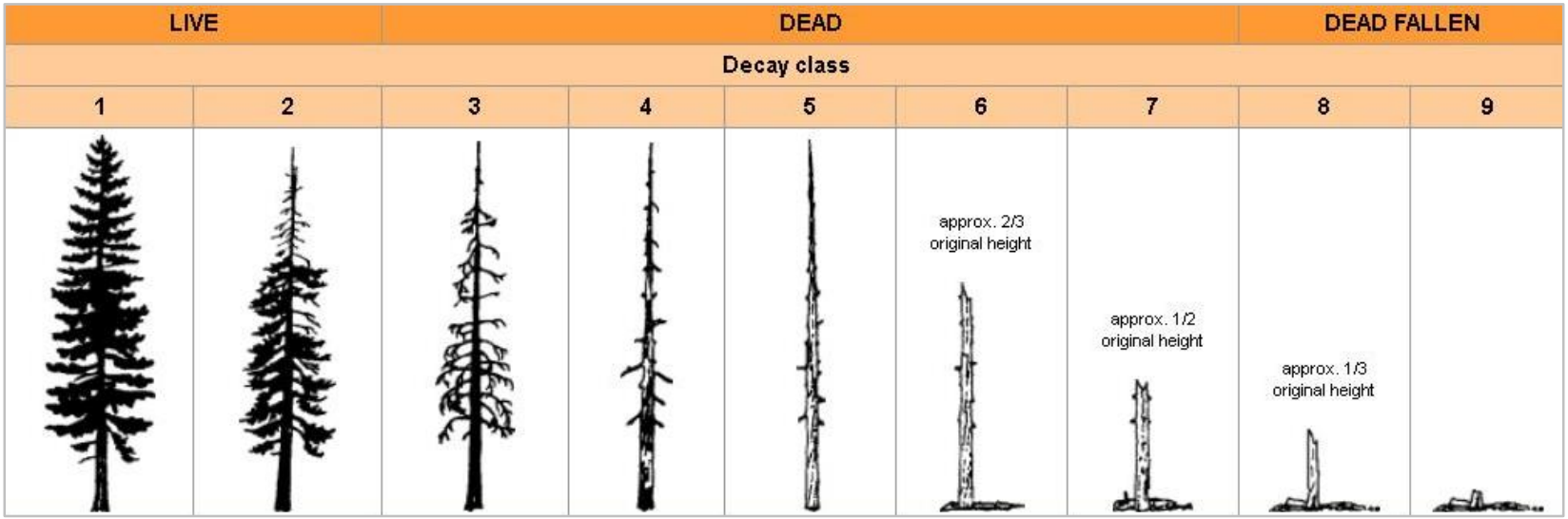
- ~58 tree species recorded in PSPs



Tree Condition	% of Trees
Excellent	34.9%
Good	34.2%
Fair	12.3%
Poor	11.7%
Dead	6.9%

Wildlife Tree Ratings

- Wildlife tree classes
  - Utilizing rating system from the Province of British Columbia



Wildlife Tree Classes
(Province of British Columbia, Silviculture and stand management training, Module 3 - Stand level components of forest biodiversity, 2024)

Forest Conditions at PSP

- ELC Category at plot
- Maximum tree height within plot
- Stand basal area (variable radius plot), from plot centre
- Type of location:
  - Woodland edge
  - Trail
  - Middle of wooded area,
  - Unmaintained field
  - Maintained field/park

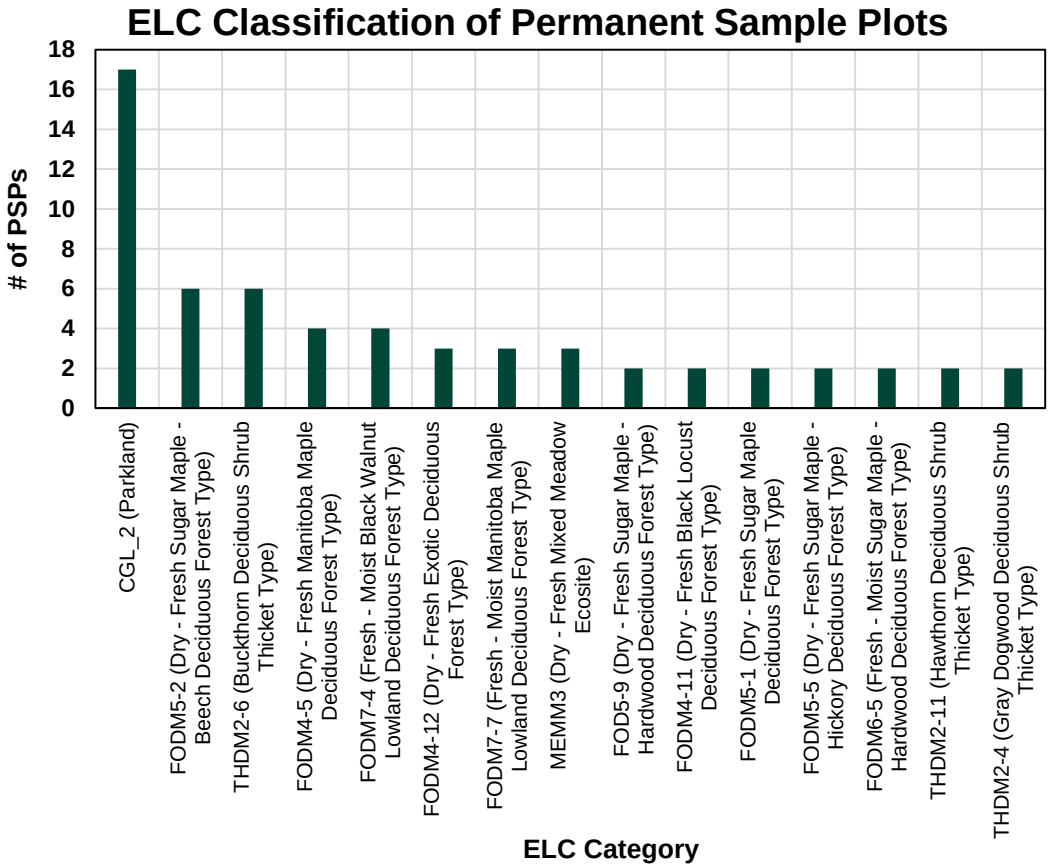
Location Type	# of Woodlands
Woodland Edge	28*
Trail	4
Middle of Wooded Area	26
Maintained Field (e.g., manicured park)	16*
Unmaintained field (e.g., meadow)	6

* Note: One plot is included in two categories

ELC Category at PSP

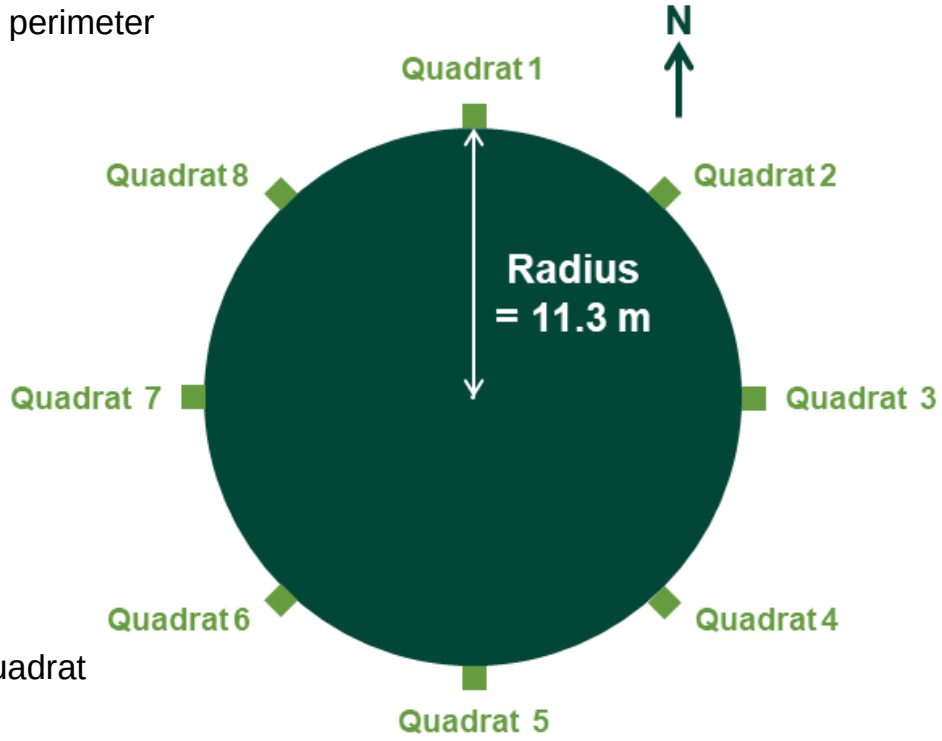
- Total of 35 different ELC categories
  - Top 15 categories graphed

Type of ELC Category	% of Plots
Deciduous Forest	58.8%
Parkland	21.3%
Thicket	13.8%
Meadow	6.3%



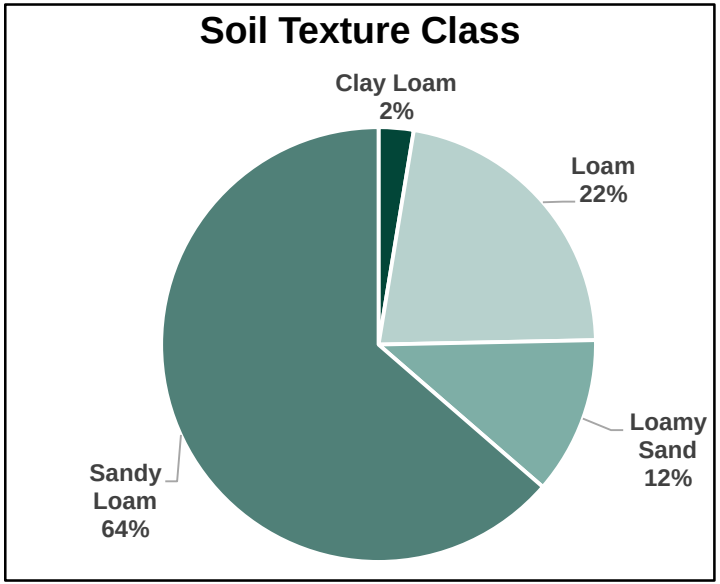
Quadrats

- Eight 1 m x 1 m plots, located outside PSP on its perimeter
  - N, NE, E, SE, S, SW, W, NW of plot centre
- Soil samples collected
  - Thickness of LFH horizon measured
  - Thickness of A horizon measured
- Percent cover:
  - Conifer tree
  - Deciduous tree
  - Shrub
  - Herbaceous/groundcover vegetation
  - Moss
  - Ferns
  - Grass/sedges
  - Lichen
  - Leaf litter
  - Rocks or bare soil
  - Woody debris
- Percent of all vegetation that is invasive within quadrat



Soil Testing Results: General Parameters

- pH: 5.2 to 8.1
  - Median: 7.3
- Organic Matter: 1.9% to 9.4%
  - Median: 4.6%
- Electrical conductivity: 0.16 to 0.49 ms/cm
  - Median: 0.26 ms/cm “very low”)
- K/Mg ratio: 0.04 to 0.41
  - Median: 0.16
  - Optimal: 0.25-0.35



Soil Testing Results: Selected Elements

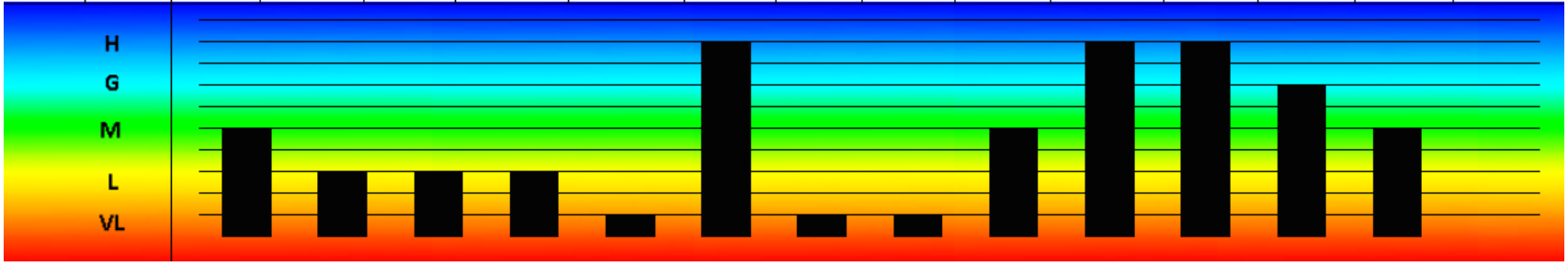
- Phytotoxic levels not observed

- Manganese: 10-197 ppm
  - Median: 56 ppm (“very high”)
- Iron: 50-115 ppm
  - Median: 75 ppm (“very high”)
- Boron: 0.2 to 2 ppm
  - Median: 0.8 ppm (“medium”)
- Sulphur: 5-78 ppm
  - Median: 9 ppm (“very low”)

Soil Testing Results Examples

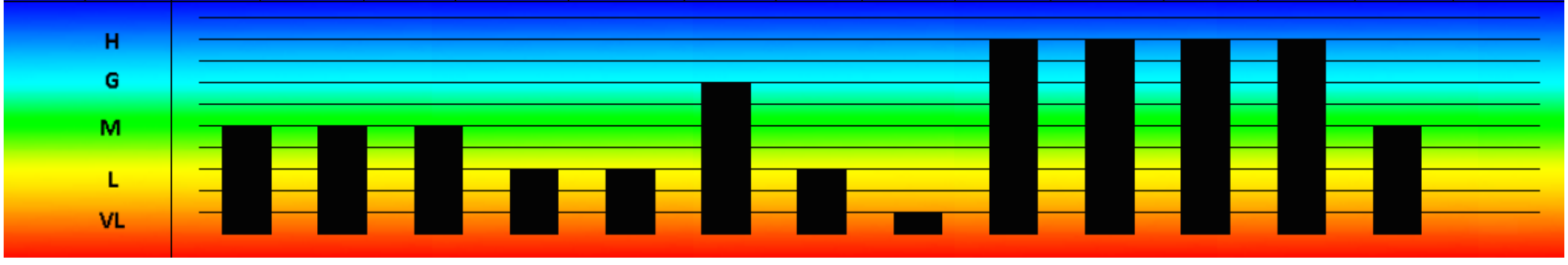
Typical site (near-median values): Constitution Park

Sample ID	Lab Number	Organic Matter %	Phosphorous-P ppm		Potasssium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Aluminum Al ppm
			Bicarb	Bray-P1											
040	15840	4.2	13	19	80	114	3610	15	11	4.6	56	84	2.1	0.8	447



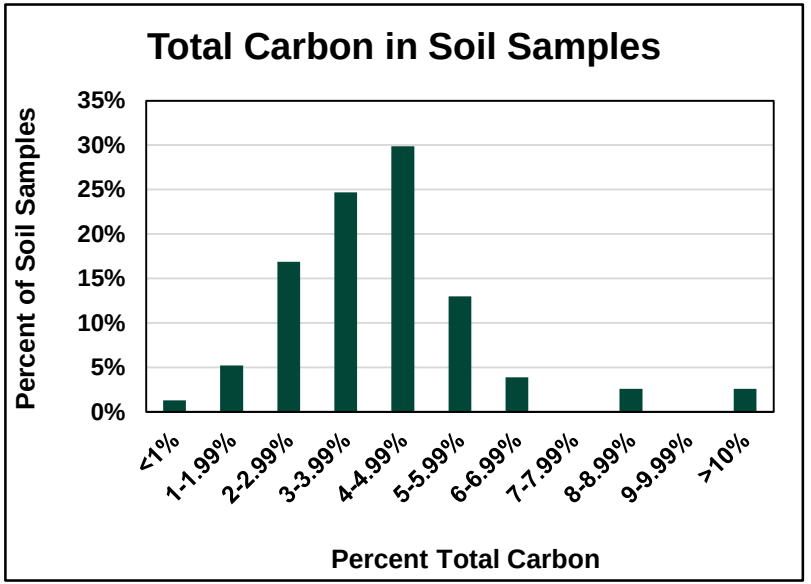
High metals: Queen's Park

Sample ID	Lab Number	Organic Matter %	Phosphorous-P ppm		Potasssium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Aluminum Al ppm
			Bicarb	Bray-P1											
061	32612	3.6	39	76	67	131	2480	16	7	15.9	79	75	6.6	0.8	639



Soil Carbon and Nitrogen

- Total Carbon: 0.74% to 24.21%
  - Median: 4.05%
- C:N Ratio: 1.9 to 96
  - Median: 15.1
- Nitrate: 1-19 ppm
  - Median: 5 ppm (“low”)
- Mineralizable Nitrogen: 27-59 ppm
  - Median: 47 ppm



Questions?

- Additional analysis still underway