Temporal changes in terrestrial biota observed through Toronto and Region Conservation Authority’s Natural Channel Design Monitoring Program 2-15 years post-restoration

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Environmental Monitoring and Data Management

Natural Channels Conference
September 26, 2017
TRCA’s Natural Channel Design Project

- NCD goals
  - Geomorphic
  - Ecosystem restoration

- Monitoring and evaluating effectiveness
  - Needed to inform decision-making

- **Riparian vegetation** (ELC communities, regional species of concern inventories, invasives)

- Amphibian and breeding bird surveys
Objectives

• Describe terrestrial monitoring methods implemented and provide recommendations for improvement

• Identify temporal changes in:
  – Vegetation communities (wetland, meadow, aquatic)
  – % native flora species
  – Degree of exotic invasion
  – Avian habitat use
  – Frog species richness

• Explore Species-area Relationships
Monitoring Methods

- Terrestrial Field Data Collection Protocol (TRCA 2011)
  - Flora, vegetation communities, breeding birds, amphibians
  - Incidentals

- Scoring and Ranking System
  - Not just species richness
  - Local occurrence (rarity), area-sensitivity, sensitivity to development, population trends, habitat dependence
# Scoring and Ranking System

<table>
<thead>
<tr>
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<th>Flora</th>
<th>ELC community</th>
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<tbody>
<tr>
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<td>Rare, stringent habitat needs</td>
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<tr>
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<td></td>
<td></td>
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<tr>
<td>L3</td>
<td>Least sensitive, common</td>
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<td>Common</td>
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<tr>
<td>L4</td>
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<tr>
<td>L5</td>
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Regional Conservation Concern – Restricted occurrence

Urban Conservation Concern – Secure in rural only

Generally secure

Member of Conservation Ontario
Vegetation Communities and Flora

- Flora species and vegetation communities were surveyed concurrently from May until October – twice over ~15 years

- Ecological Land Classification (ELC) protocol for Southern Ontario
  - Novel application

- Six main categories of natural cover: forest, successional, dynamic, meadow, wetland, and aquatic (used for statistical analysis)

- Flora of concern mapped (L1-L4)

- Invasive species monitoring (points or level of disturbance within a polygon)
Breeding Bird Surveys

- Breeding bird surveys were conducted during a 6-8 week period between late May and mid-July

- Sites were visited twice during the breeding season

  - Spot-mapping

- Surveyed at approximately 5-year intervals
Amphibians

- Loosely based on Marsh Monitoring Program although no formal time limit or radius used
- Three surveys (based on date and overnight temperatures)
- Each of these surveys was separated by at least 15 days
- *Incidental species were also recorded (reptiles, mammals)
- Surveyed at approximately 5 year intervals
Results

- Site-specific

- Complex
  - To view the full report please contact: dyoung@trca.on.ca

- Pooled for analysis and discussion
One of the goals of the NCD project related to terrestrial flora and fauna was to create a riparian corridor with native and diverse vegetation that supports terrestrial habitat equivalent to that of undisturbed streams.

Concurrently monitor the NCD sites along with several natural riparian corridors and un-restored stream channels in urban areas.

This would have allowed a direct comparison among unrestored, restored and natural riparian corridors in an urban landscape.

Using a standardized survey protocol (time and space) as this would eliminate site size effects.
Results: Natural Cover Type

• Each ELC community can be grouped into categories of natural cover types (e.g. Native Forb Meadow and Exotic Cool-season Grass Graminoid Meadow = Meadow)

• Compared between surveys
Results – Natural Cover Type

- Altered channel design
- Beaver
Results – Flora Species

# non-planted

- Colonization, more wetland opportunity, further established so identification possible

% native
Plantings

• Plantings were a major component of the flora at NCD sites
  – An array of native upland and wetland species

• Generalist trees and shrubs are doing well such as staghorn sumac (*Rhus typhina*), basswood (*Tilia americana*), cedar (*Thuja occidentalis*) and dogwoods (*Cornus* spp.)

• Long-term survival of coniferous species questionable
  – Slow-growing and may not be able to compete with invasive species or fast-growing deciduous species
  – Plant conifers more densely and increase maintenance efforts early on to give these species a chance for survival
Plantings

• Wetland and prairie planting survival
  – Competition with invasives (esp. wetland plantings)
  – Improper environmental conditions (prairie plantings needing sandy soils)

• Check for proper labelling of nursery stock
  – E.g. Oriental bittersweet (Celastrus orbiculatus) likely mislabelled as the native American bittersweet (C. scandens)
Exotic Flora Species

- On average, 57% of non-planted flora species were exotic

- No change temporally in the % exotic species
Exotic Disturbance

- In each ELC polygon
- Subjective, yet informed, measurement
- 3 assessment criteria
  - Dominance
  - More/less virulent
  - Prospect for succession
Exotic Disturbance

- No temporal change

- Most communities are either moderately or severely affected by exotics
Breeding Birds – Species Richness

- **NS**

- Baseline data (pre-restoration) likely would have shown large increases.
Breeding Birds – Wetland Guild

- Increases
Breeding Birds – Meadow Guild

- Declines
- No change in birds using sparse shrub or forest edge but may occur in the future
Frogs – Species Richness

- Frog species richness was relatively stable at most NCD sites
- Range 0 - 4
Incidentals

• Commonly encountered species include
  – Beaver, eastern chipmunk, eastern cottontail, mink, muskrat and white-tailed deer, red fox, domestic cats, raccoon
  – Moderate tolerance and adaptation to natural areas within more urbanized landscapes

• Meadow vole
• Three midland painted turtles
• Coyote
• Common snapping turtle (L2)
• Northern short-tailed shrew (L3)
• Meadow jumping-mouse (L3)
• Red squirrel
• Eastern gartersnake
Notable Observations

- Burndenet Creek (NCD 8)
  - L3 community (Red Maple Mineral Deciduous Swamp) replaced by Common Reed Mineral Shallow Marsh (also fringing north pond)
  - Common snapping turtle (SAR and L2-ranked)

- Morningside Creek (NCD 18)
  - A large site with several pairs of swamp sparrows
  - Wood frog (L2) (and highest frog species richness of all sites)

- Highland Creek (NCD 5)
  - Two L2-ranked communities: Mineral Fen Meadow Marsh, Open Clay Barren
Species-area Relationships - Flora

- Site size is an important predictor of species richness and richness of vegetation communities
Species-area Relationships - Fauna
Summary

• NCD sites provide natural space for vegetation communities, flora and fauna communities (and some rare/sensitive species)

• Planted flora are doing exceptionally well when planted in suitable conditions

• Sites are shifting to more wetland and aquatic natural cover types (beaver/restoration) and bird communities are responding to these changes
  – Scrub communities maturing and may change composition further
  – Wetland restoration a good feature to include

• Larger sites contained a greater number of vegetation communities and this corresponded to greater flora and fauna species richness
Further Improvements to Restoration and Terrestrial Monitoring

- Use geo-referenced locations of invasives to target removal

- Flora intended for planting should be better checked for proper labelling, native status and proper environmental conditions for plantings (e.g. soil, slope)

- Future NCD projects should be surveyed using a standardized methodology (e.g. point counts, transects) pre- and post- restoration and reference sites should be concurrently surveyed
Acknowledgements

• Terrestrial monitoring staff
  – S. Hayes, G. Miller, P. Prior, N. Gonsalves, D. Tune

• Funders

• dyoung@trca.on.ca