Quantifying assimilative capacity of all tributaries to Lake Simcoe based on cumulative impacts to biological integrity

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Outline

- Background on the issue – scale is important
- Objectives of Research
- Approach & Progress to date
- Outcomes

Background

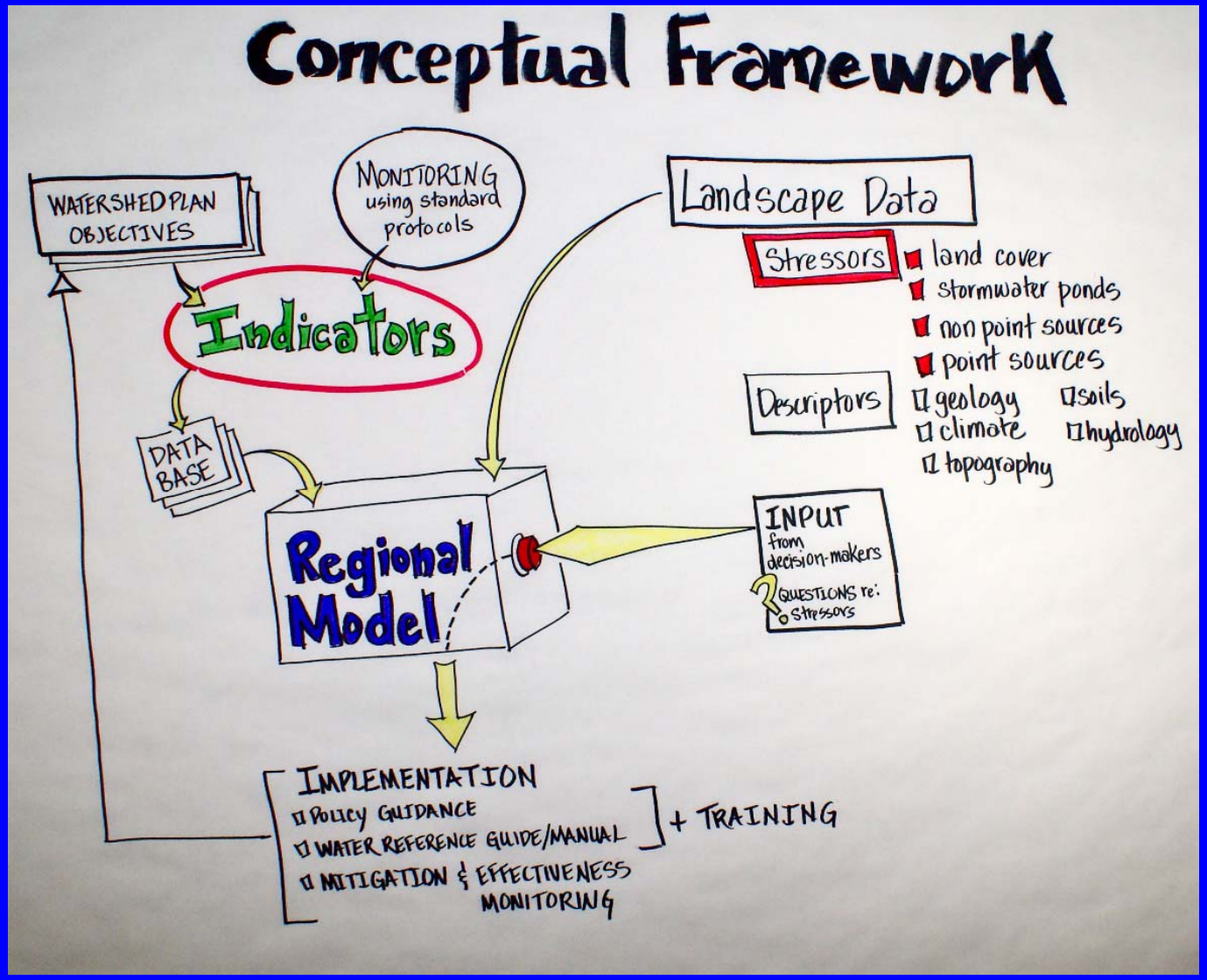
- Lake Simcoe is eutrophic
- Tribs are major contributors
- Growth will continue
- Lots of Restoration work
- Need to address priority issues

"Vision"

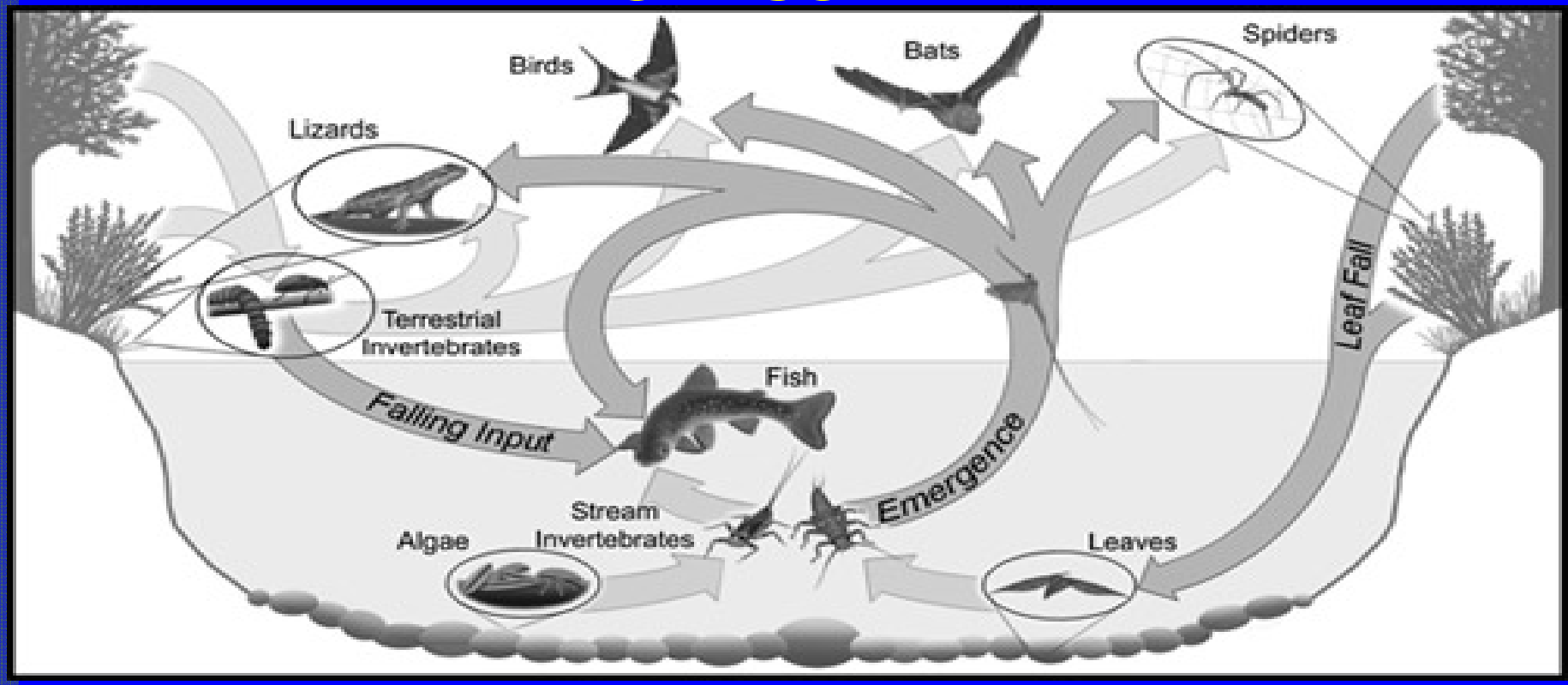
A "Tool(s)"for predicting with enough confidence the affects of a stressor on (stream) conditions to facilitate informed planning decisions.

Acknowledge that models are imprecise but improve over time

"The Easy Button"



Premise #1



- More Complex food chains can assimilate more nutrients….

from Fausch and Murakami 2002

Premise #2

Priority areas to work should be in:

1. Streams that contribute high loads of phosphorus
2. Locations with Disrupted or at risk food chains

Study Objective

- Develop models of the cumulative effects of stressors in a catchment to indicators of stream health (as in food chains)
- Match stream condition with modeled loads and downstream buffering capacity (riparian wetlands)
- Initiate a decision support system for implementation

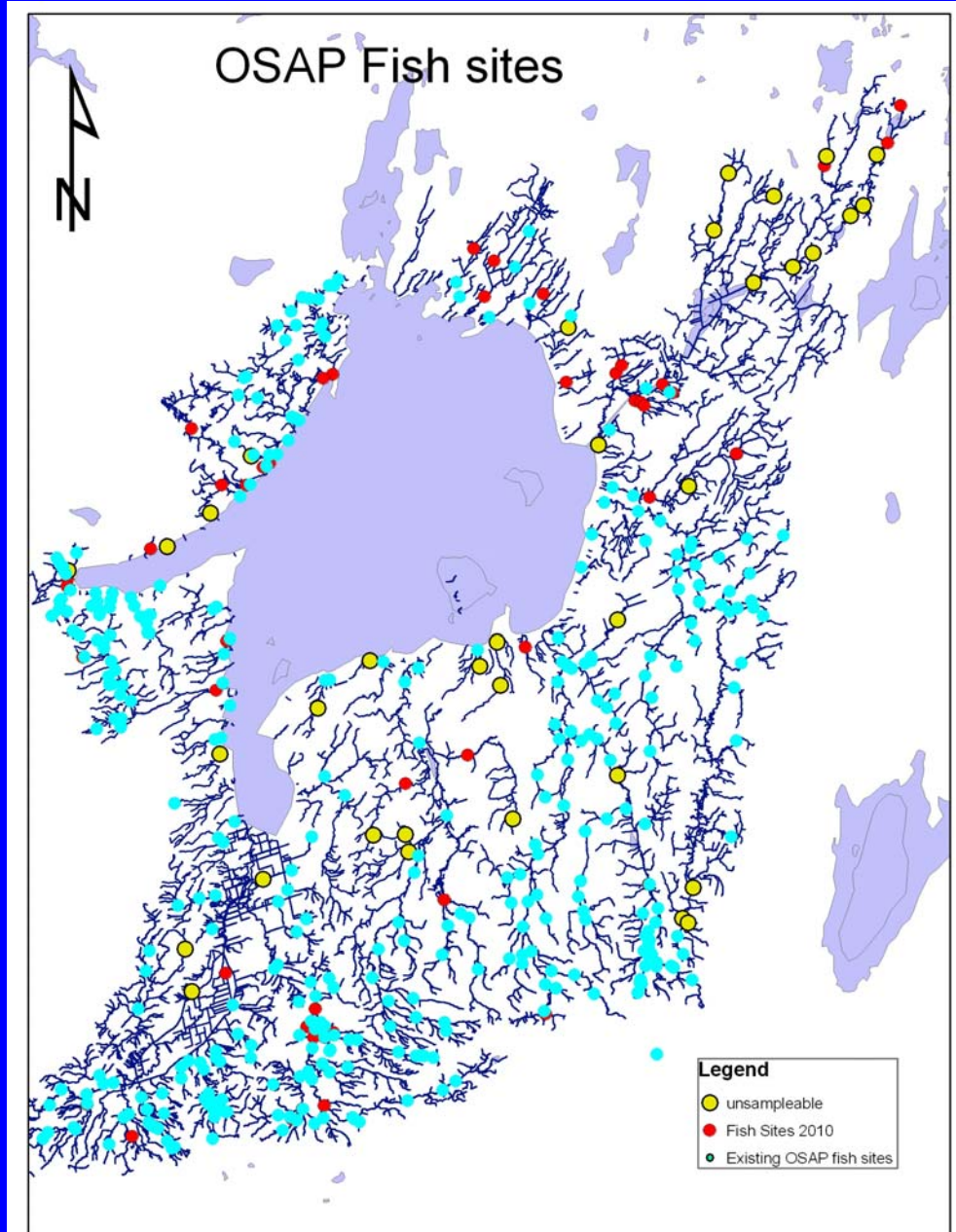
Fish assemblages and benthic invertebrates

Landscape Modeling 101

- Model expected conditions at a site based on primary drivers and a “gradient of Stressors”
- Look for “Tipping Points”

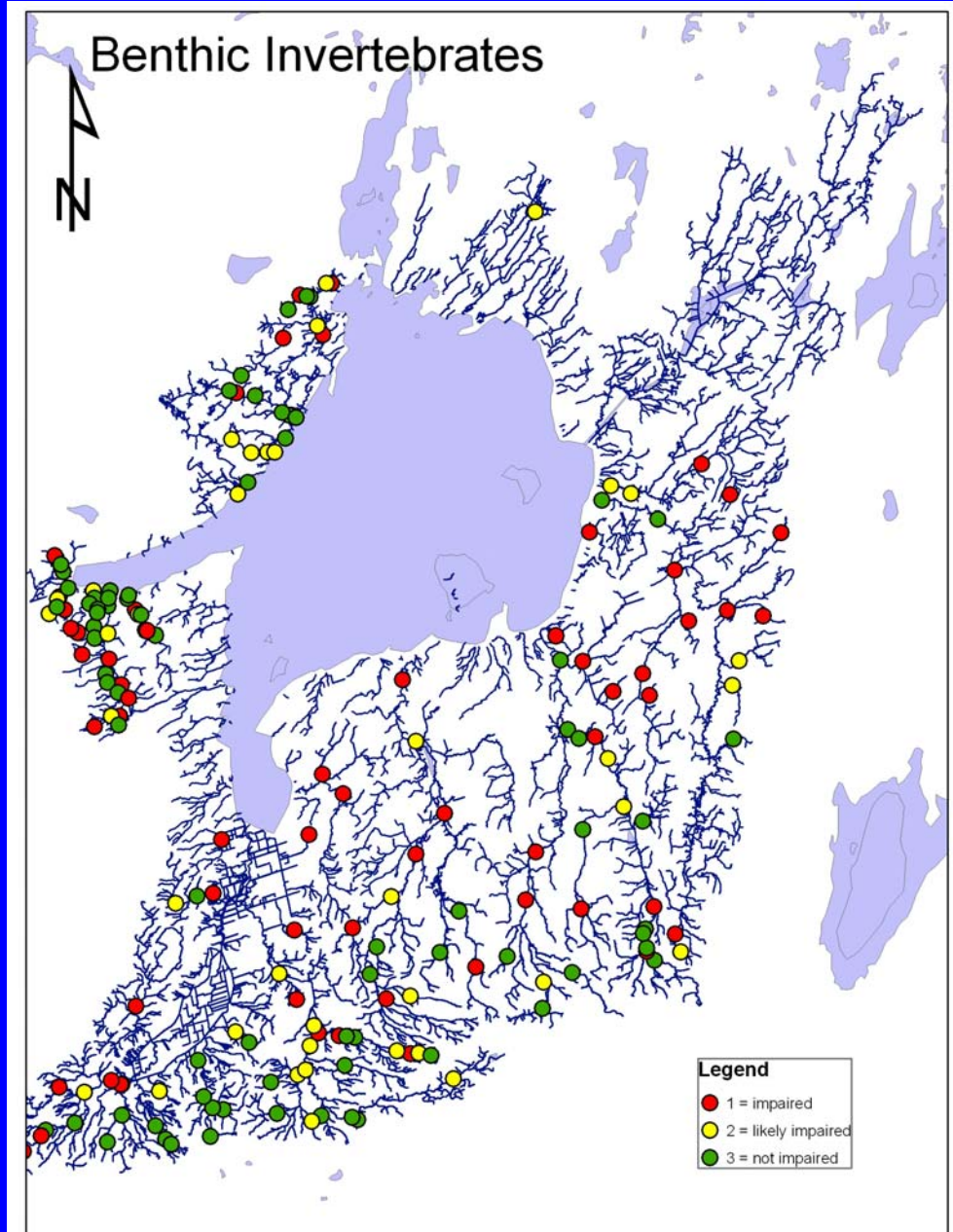
Fish Data

- 498 sites (39 species)
- Filled Gaps in 2010
- Found lots of unsampleable reaches..
- Developing layer to exclude from analysis
- Great Dataset! thanks to LSRCA



Benthic Data

- Almost as good as fish.. Some gaps
- Family level id available
- Lots of variation
- Good Dataset! thanks to LSRCA/MOE-Dorset



Analysis Approach:

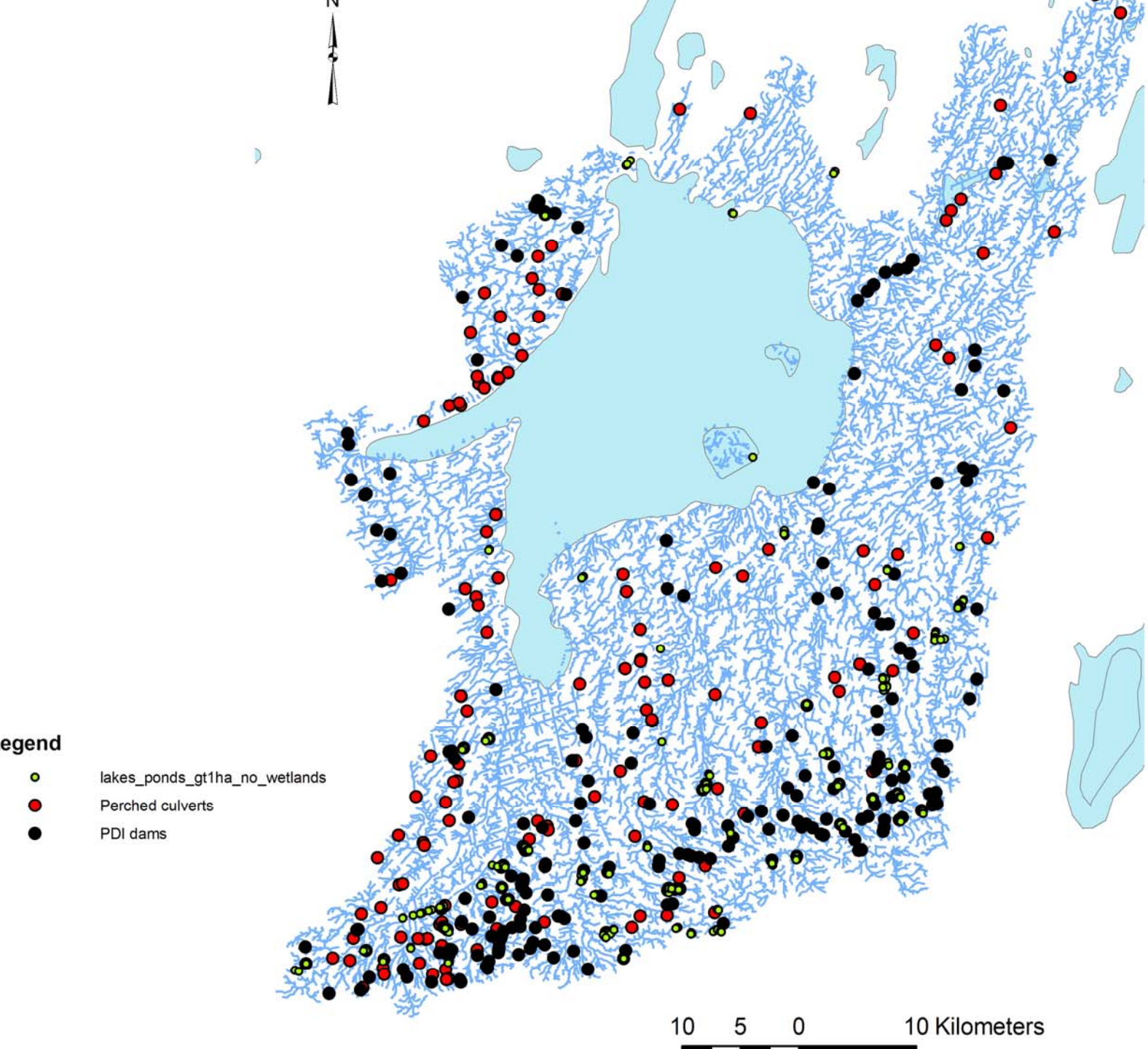
- Defined and attributed non-modifiable (primary) conditions for each sample sites watershed
  - Surficial Quaternary Geology
  - Slope (within 200 m)
  - Climate (GDD – annual precipitation)
  - Catchment Area
- Defined watersheds for each stream segment (7600) and attributed primary variables as above

Attributing Modifiers

- Evaluate pathways and processes
- develop metric(s) from data useful for planning and land/water management purposes
  - Soil Erosion/phosphorus metric
  - Hydrologic Metric
  - Fragmentation:
  - Connected Wetlands

Modifier Dataset Status

- Land Cover
  - LSRCA Updated ELC,
- Improved water layer (for predictions)
  - Intermittent stream layer
  - wadeable/Unwadeable
- Fragmentation:
  - PDI
  - Perched Culverts
  - On-line ponds

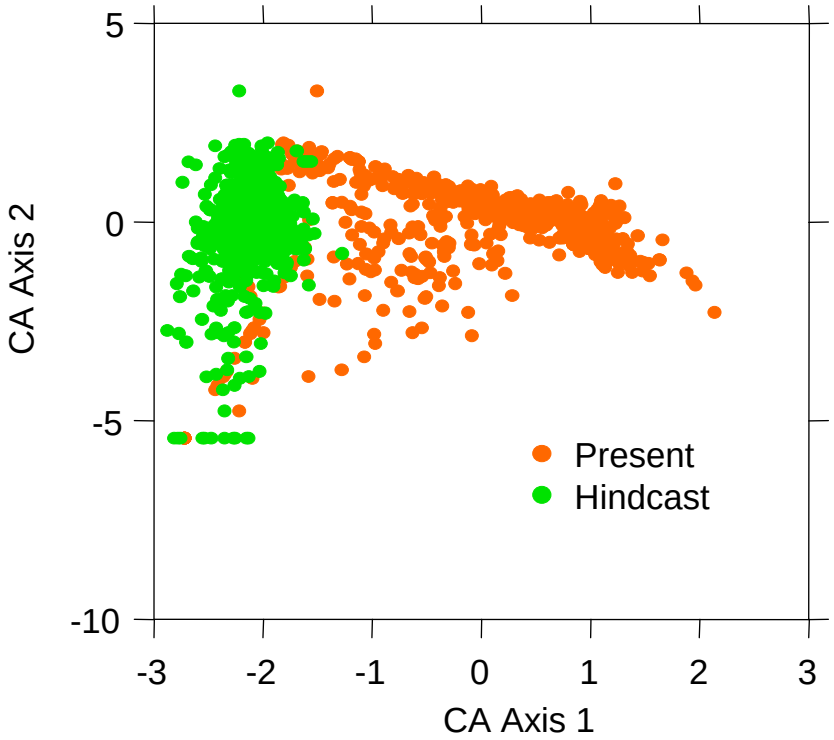

N
egend
lakes_ponds_gt1ha_no_wetlands
Perched culverts
PDI dams
10 5 0 10 Kilometers

Analysis
General Linear modeling will quantify:

Fish/benthos assemblage metric = primary variables + sediment transport index + flow alteration index + fragmentation +buffer potential

Each metric will also have squared term to account for curvilinearity of relationship

Setting Forest Cover to 100% enables us to hindcast a reference condition for each site and produce State of the resource summary



Example from: Kilgour and Stanfield 2006 special publication AFS Symposium 48

Conduct Landscape Analysis

- Apply model predictions to each segment to predict existing communities and state of impairment
- Classify sub-watersheds & compare with P loads

Identify priority restoration areas

Expectations for Lake Simcoe

- Greater predictive power (tighter CI's) due to much better stressor data
- Stronger linkages to causal pathways .... Better direction for management:
  - Water pollution
  - Fragmentation
  - Wetland buffering capabilities
  - Land use planning
  - Etc...

Outcomes from the Models..

- Use models to predict outcomes from alterations to land and water use
  - Polygon by polygon (field by field) assessment of contributions
  - Improve models over time
  - Incorporate ranges in coefficients reflect alternate land/water use strategies.
- Incorporate into the “Easy Button” decision support system

Bonus Outcomes from Project

- Report Card?
  - better than expected (A+) to significantly impacted (E)
- Intermittent stream layer useful for water budgets; nutrient load analysis:
- Perched culverts & fish
  - priority road crossing restoration opportunities
- Unsampleable waters
  - Save sampling effort, improve study designs, nutrient load assessment

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