Geostatistical modelling of landscape drivers of in-stream chloride concentrations across a gradient of urbanization

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Project Background
Chloride, the primary constituent of road salt, has a number of environmental impacts which include the alteration of water quality and adverse effects on aquatic and terrestrial organisms. Acute and chronic chloride concentrations in the Lake Simcoe and Toronto regions have been routinely exceeding ecological toxic safety thresholds set by the Canadian Council for Ministers of the Environment (Perera et al., 2013; Winter et al., 2011).

The use of high spatial resolution sampling will allow for spatially explicit modelling that incorporates chloride inputs, landscape features, in-stream chloride concentrations and flow connectivity to provide a finer grained look at the spatial structure of each watershed. (McGuire, et al., 2014).

Research Objective
To characterize and compare spatial patterns in in-stream chloride concentrations among three sub-watersheds in different states of urbanization in the Lake Simcoe and Greater Toronto Regions.

Methods
Electrical conductivity (EC) is measured using a YSI EXO2 Water Quality Sonde (Figure 1). Synoptic longitudinal sampling has occurred in sub-catchments of each watershed for the 2016 Summer and Fall seasons, and future sampling is planned for Winter and Spring 2017.

Electrical conductivity (EC) is used as a surrogate for chloride ion Concentrations. A CI – EC relationship is currently being developed for each watershed.

References

Field Sites

Preliminary Results

Future Research
- The relationship between electrical conductivity and Cl concentrations will be characterized for each watershed.
- Geospatial modelling will be conducted to study the spatial relationships between Cl inputs, landscape features, and in-stream chloride concentrations.
- Spatial structure will be compared between the three study watersheds, shown in Figure 2, to determine if there is a continuity of landscape drivers for in-stream chloride concentrations across differing states of urbanization.

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Figure 3. Electrical conductivity vs. distance from the stream outlet in the (a) East Holland and (b) Willow Creek Watersheds. Note the lack of strong relationship as you move upstream in East Holland, and the small negative downward trend in conductivity as you move upstream in Willow Creek.