# Guiding Stormwater Management Using Biological Potential

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### Urban Stream Syndrome







### Goals?

### Urban Stream Syndrome: Biological Potential





### Goal

- Introduce biological potential model
- Utility in restoration target setting
- Utility in informing what might help



Data



Urban (>10%ISC) N=334 38 met ALU

N=1731

37 declined

goal

All impaired or worse

### Data Compilation

- Biotic Index (based on Full Scale methods) and Bioclassification scores for sites across NC
- NCDENR (largest source), cities, counties
- Seasonally corrected and recent TV values
- NLCD 2006 LU/LC data
- 1731 sites
- Also compiled watershed predictor information

### Methods: Biological Potential

- Quantile regression
- Standardized EPT and Biotic Index by bioregion
- Put all samples on 0 to 100 scale
- Potential = 90th Quantile Regression
- Distance to potential = percent of predicted



### Methods: Distance to Potential

• CART models

- Random Forests
- Discriminant Analysis



## Methods: Distance to Potential

#### Silicic residual

Lithology Surface material is the residual of the disintegration of igneous and metamorphic rock (silicic residual) Geologic belt Inner Piedmont, Chauga Belt, Smith River Allochthon, and Sauratown Mountain Triassic Basins

#### "Sauratown" belt and Triassic Basins

#### • Watershed size

- Stream flow statistics
- Age of development (change)
- Type of urbanization
- Geometry of urbanization
- Percent impervious cover
- Other land cover/change
- Flow path land cover
- Stormwater infrastructure
- Riparian condition/percent
- Development ordinances
- BMP installations
- Permitted discharges
- Stream slope
- Geology/Lithology
- Dams
- Road Density/Crossings

### Results: Biological Potential Model



### Results

Farther from potential : Fine textured soils, more untreated Ag, less clustered urbanization Closer: Coarser soils, more treated Ag, clustered urban land cover

**EPT: All Sites** 





Finer soils

More clustered urban land cover

### Results Summary

- CART, RF and DFA give some similar predictors:
  - Geometry of land use (clustering scoring higher)
  - Untreated agricultural land use (negative effect)
  - Roads (generally negative)
  - Sauratown region (more positive)
  - Forest in buffer (more positive)
  - Steeper streams (more positive)

### • Untreated agriculture and urbanization



USEPA

### • Percent like adjacencies (clustering)



Landscapes2

### • Road density and crossings





### • Riparian condition



Austin, TX

- Unmanageable Predictors:
  - soil type (fine alluvium), slope, area, land cover shape, and physiographic region/lithology, percent like adjacencies (clustering), road density and crossings, untreated agriculture and urbanization

None of these are quick or easy...are they manageable?

- Manageable Predictors:
  - riparian condition

### What Next?

- Here is the reality.
- What are we to do?
- Use potential to:
  - Prioritize
  - Measure progress
  - Explore tiered uses





### What next?

#### • Tiered uses





Maine...Ohio....Florida....Minnesota...

## Concerns

- Is this writing off streams?
- Build and they will come is an uphill battle
- Chemical environment equally difficult

INVITED FEATURE

Ecological Applications, 21(6), 2011, pp. 1926–1931 © 2011 by the Ecological Society of America

#### River restoration: the fuzzy logic of repairing reaches to reverse catchment scale degradation

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Mixed-chemical exposure and predicted effects potential in wadeable southeastern USA streams



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### Increased salinization of fresh water in the northeastern United States

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Contributed by Gene E. Likens, August 4, 2005

Chloride concentrations are increasing at a rate that threatens the availability of fresh water in the northeastern United States. Increases in roadways and deicer use are now salinizing fresh waters, degrading habitat for aquatic organisms, and impacting large supplies of drinking water for humans throughout the reagion. We observed chloride concentrations of up to 25% of the exists (8). Regulation of road salt was recently considered by the Canadian government after much controversy (6).

Relatively little is known regarding the relationship between widespread increases in suburban and urban development and long-term changes in baseline salinity across regions of the United States. Impervious surfaces now cover >112.610 km<sup>2</sup> in

### Ongoing work – Jonathan Miller, NCSU



## Ongoing work – California SCCWRP



#### likely unconstrained

possibly unconstrained

possibly constrained

likely constrained



Streams constrained below CSCI 0.79

- Introduce biological potential model
- Utility in restoration target setting
- Utility in informing what might help

