



The Optimal Spatial Scale in Watersheds for Predicting Nutrient Concentrations

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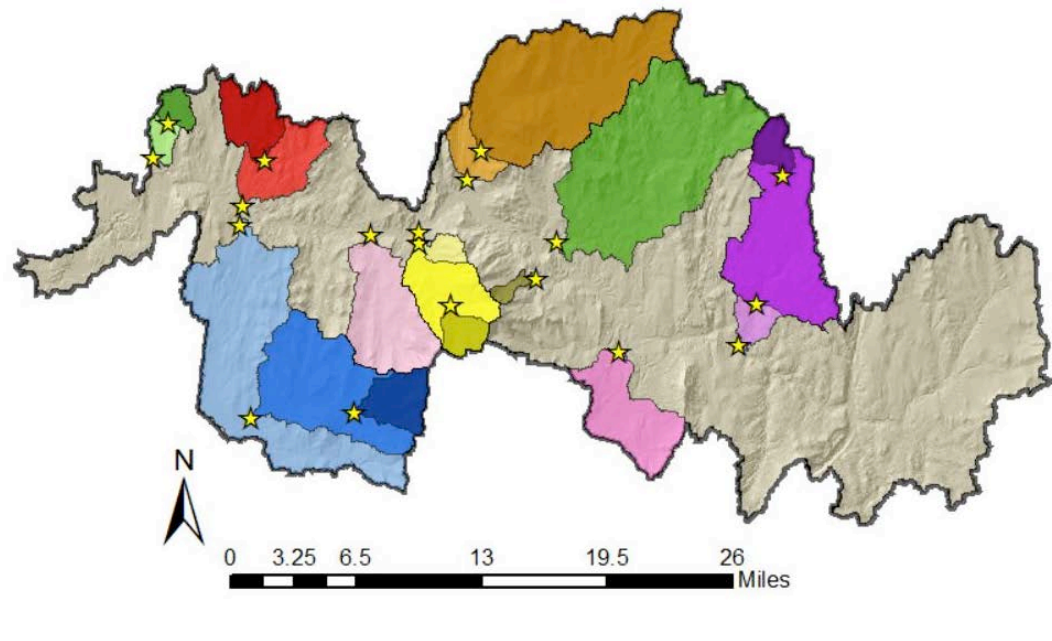
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Outline

- Introduction
- Hypothesis
- Methods
- Results
- Discussion
- Future Work
- References
- Acknowledgements

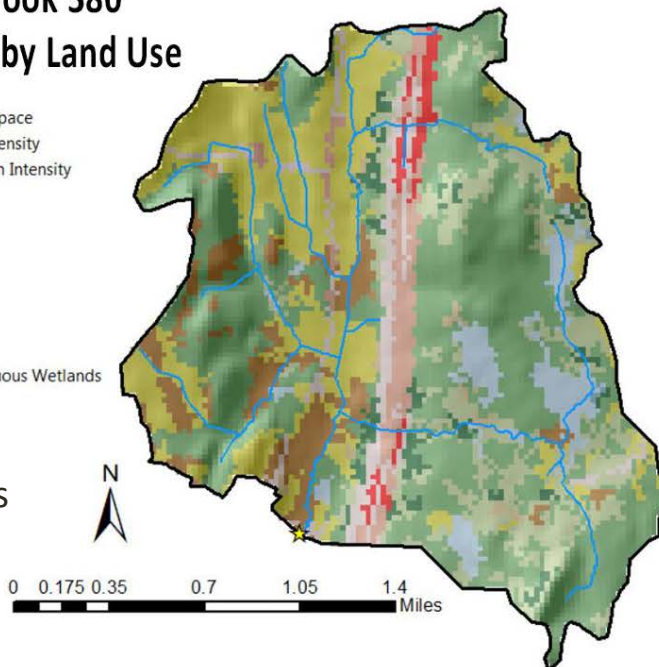


19 sampling sites in the Lamoille River watershed

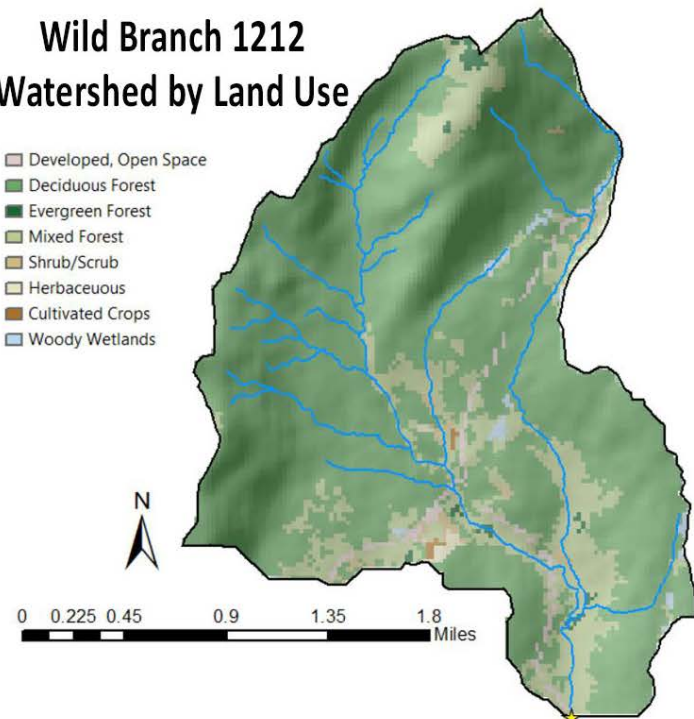
Introduction

- Land use within watersheds directly affects the water quality of the rivers
- Land use composition is used to predict concentrations of nitrogen and phosphorus in the rivers

Deer Brook 380
Watershed by Land Use



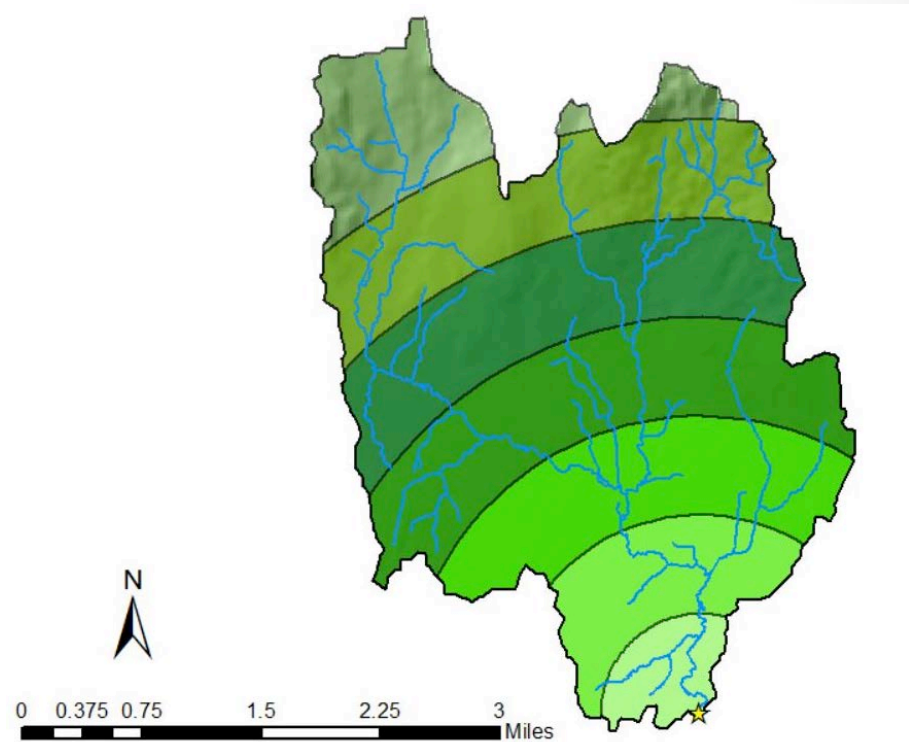
Wild Branch 1212
Watershed by Land Use



Two catchments with different land use compositions

Hypothesis

- Different spatial scales are used to predict nutrient concentrations
- **A unique radial distance upstream exists that leads to an optimal correlation between land use data and nutrient concentration data.**



The interval-based method used in this research

Nutrient Concentration Methods

- Water samples analyzed with EPA Standard Methods
 - Total Nitrogen
 - Total Phosphorus
- Only high-discharge sample dates were considered
 - Within 24 hours of a discharge peak greater than 1000 cfs on the Johnson, VT USGS hydrograph
- 80 water samples considered
 - 10 stream sites
 - From 2012 to 2014

GIS Methods

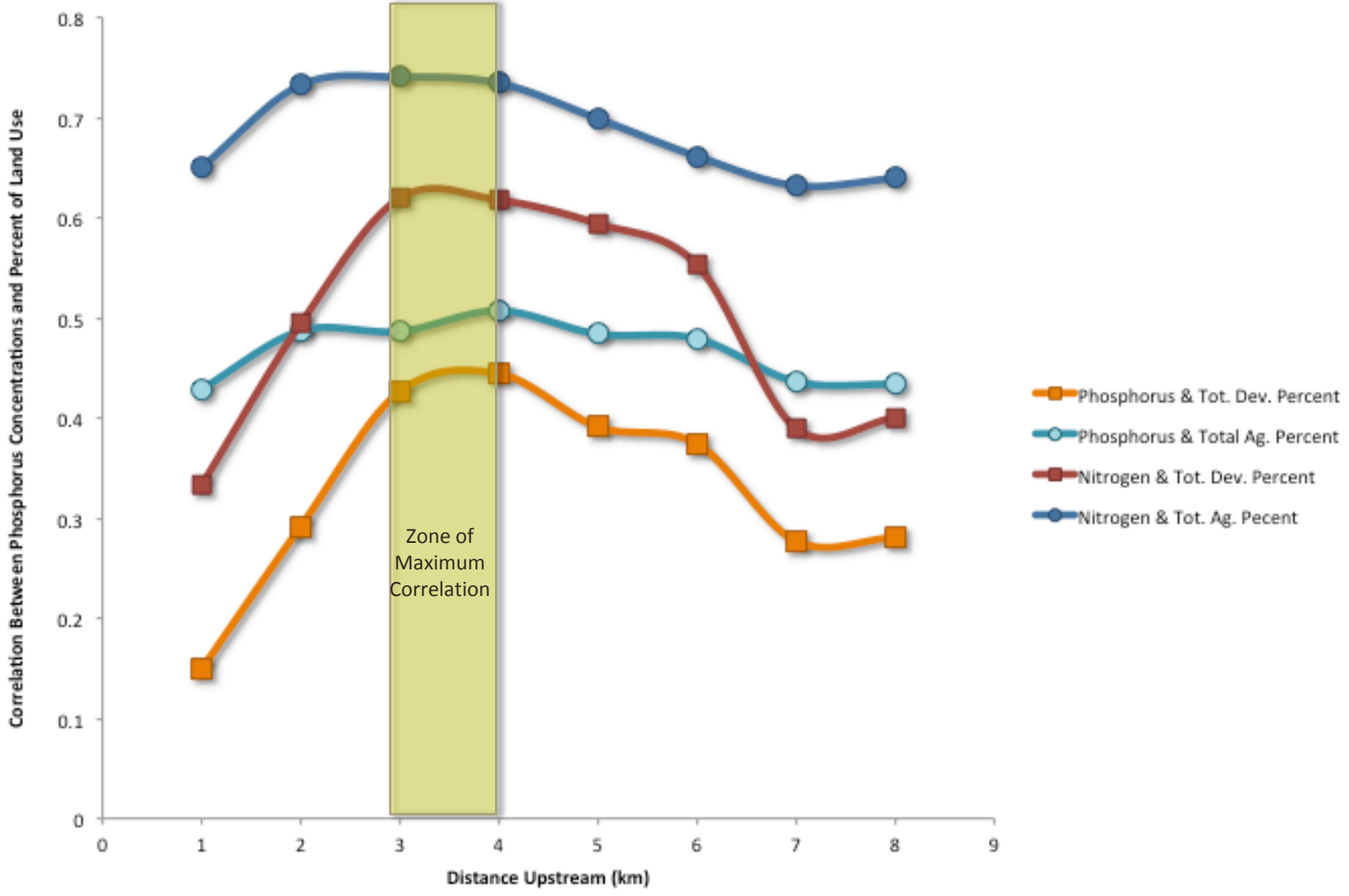
- ESRI ArcGIS v.10.2
- Vermont Center for Geographic Information datasets
 - 2010 Land Use Raster
 - Composite Variables Generated:
 - Percent Total Agriculture
 - Percent Total Developed
 - Percent Total Natural Vegetation
- Land use data extracted at 1km radial intervals upstream from the sample sites
 - 10 Watersheds

Statistical Methods

- Pearson Product-Moment Correlation Coefficient
 - Nutrient Variables
 - Total Nitrogen
 - Total Phosphorus
 - Land Use Variables
 - Percent Total Agriculture
 - Percent Total Developed
 - Percent Total Natural Vegetation
 - Correlation computed at each 1km radial interval upstream
- Correlation Value (r)
 - Greater than 0.50 is a large effect size (Cohen, 1988)
 - Enough variation is explained between datasets to scientifically infer causality

Results

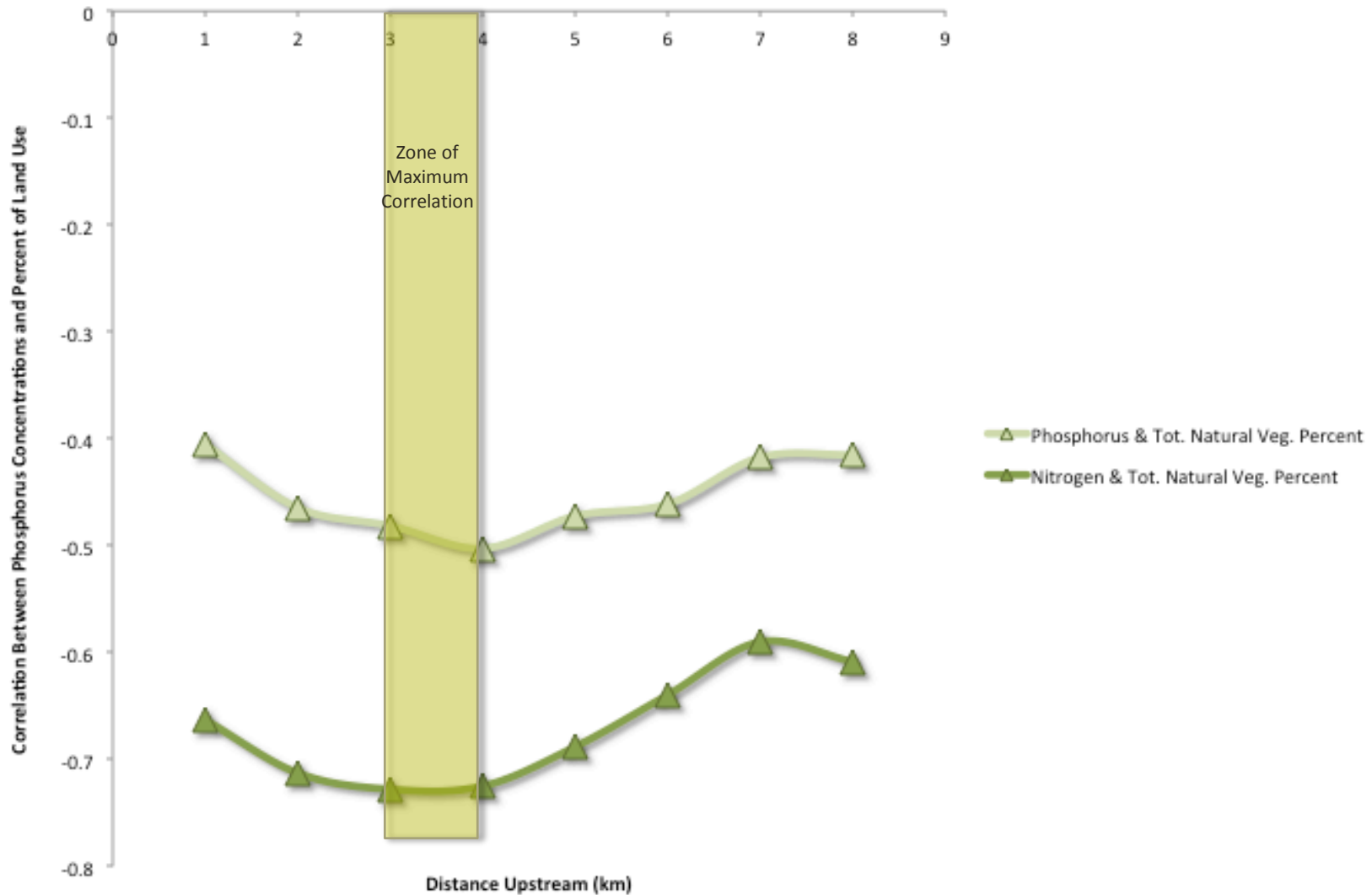
Phosphorus and Nitrogen Correlations with Different Land Use Proportions Over Increasing Radial Distances Upstream



Correlation Between Nitrogen and Phosphorus and Anthropogenic Land Use Percents

Results

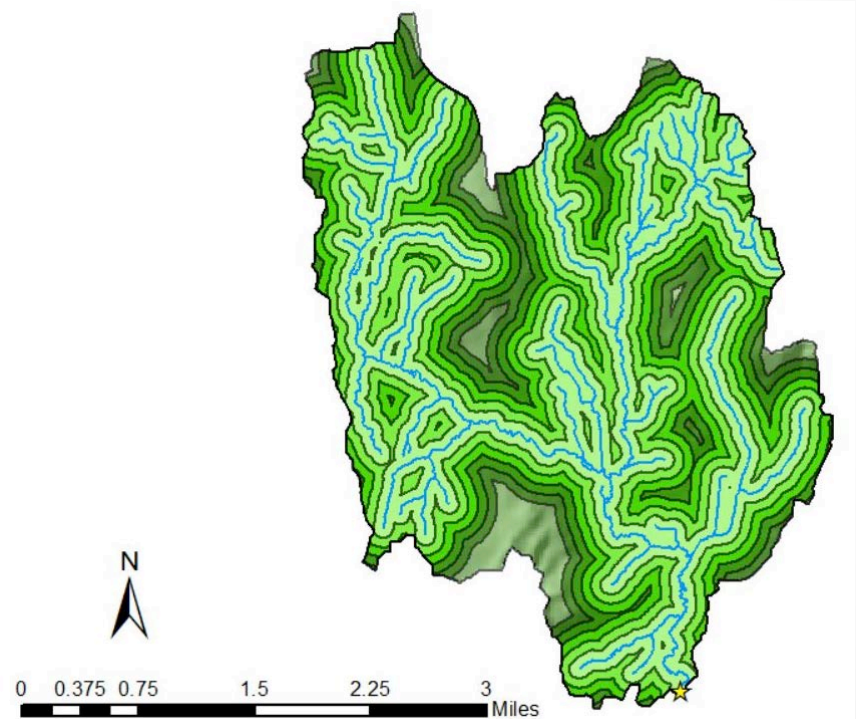
Phosphorus and Nitrogen Correlations with Natural Vegetation Land Use Proportions Over Increasing Radial Distances Upstream



Correlation Between Phosphorus and Land Use Percent Over Upstream Distances

Discussion & Future Work

- The land use up to the 3-4km radial distance upstream will provide an optimal nutrient concentration modeling
- Similar analysis with:
 - 100m Interval Belt Transect
 - Functional Distance
 - As the stream flows



The 100m interval belt transect method

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The 2014 JSC RACC Team

