

Baseflow turbidity of tributaries to the upper Little Tennessee River, North Carolina and Georgia

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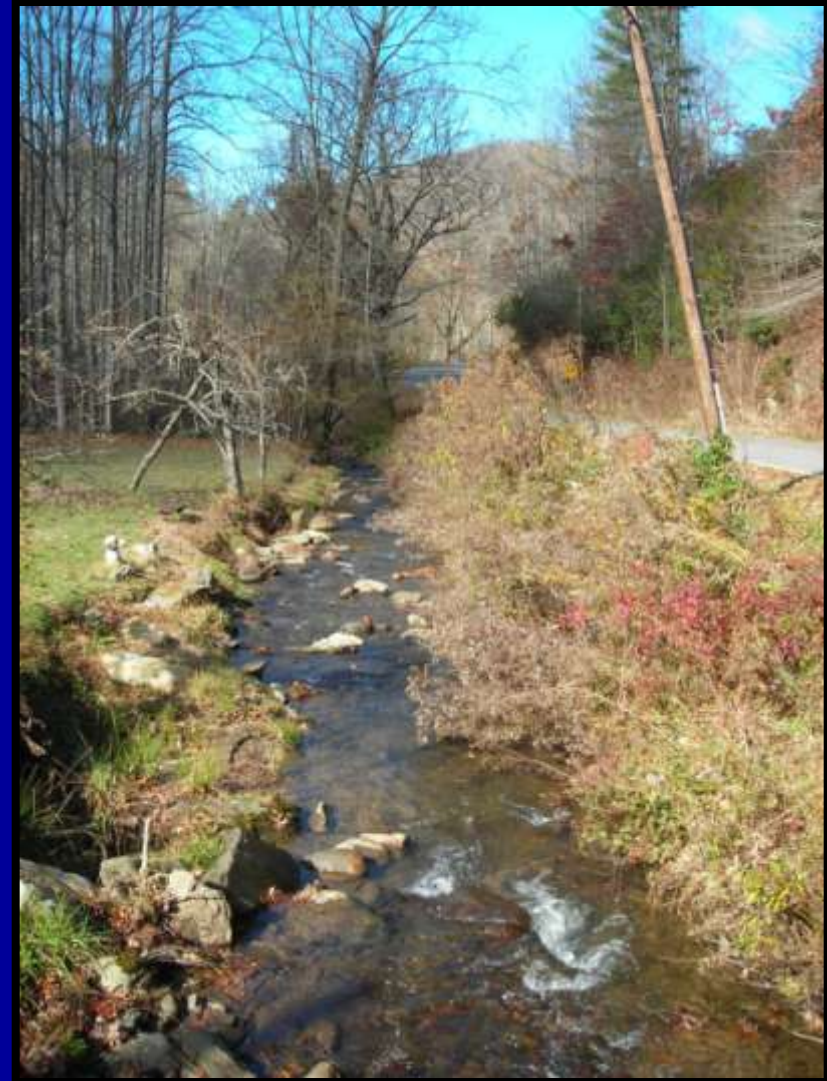
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Objective

- Link baseflow turbidity to basin-scale land use
- Develop assessment tool for mitigation sites and banks using a watershed approach

Turbidity

- Effects of high turbidity
- Baseflow vs stormflow



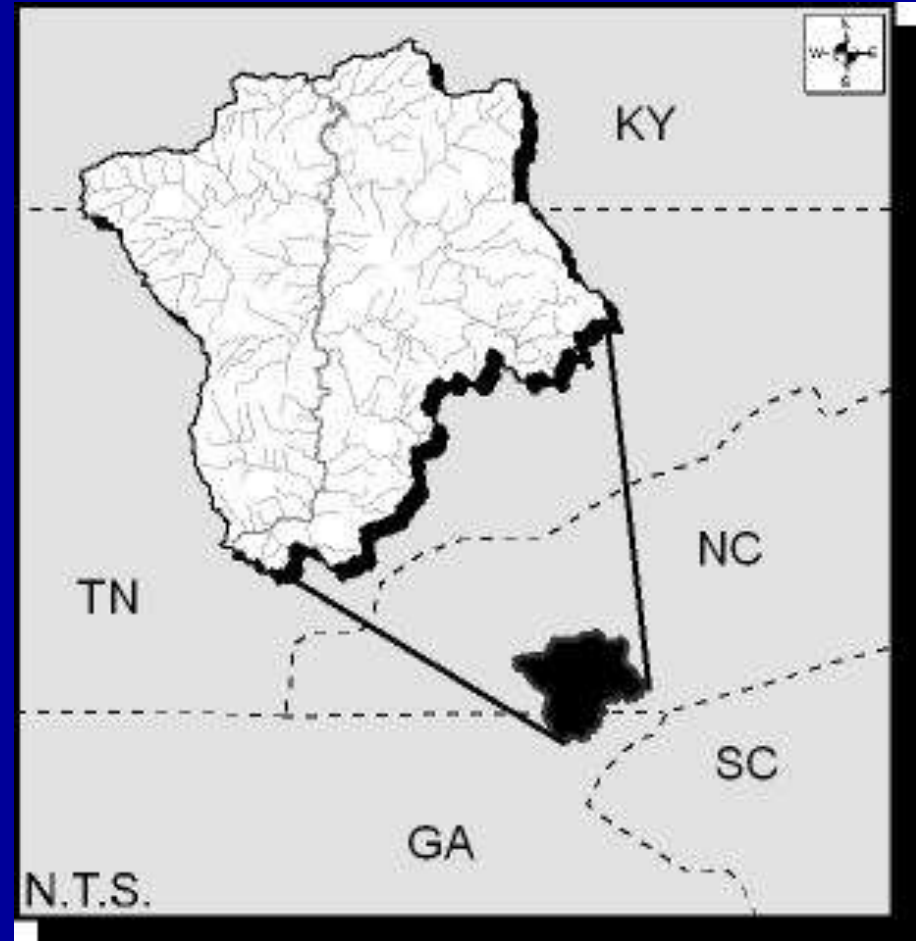
Study Area

Southern Blue Ridge
physiographic province

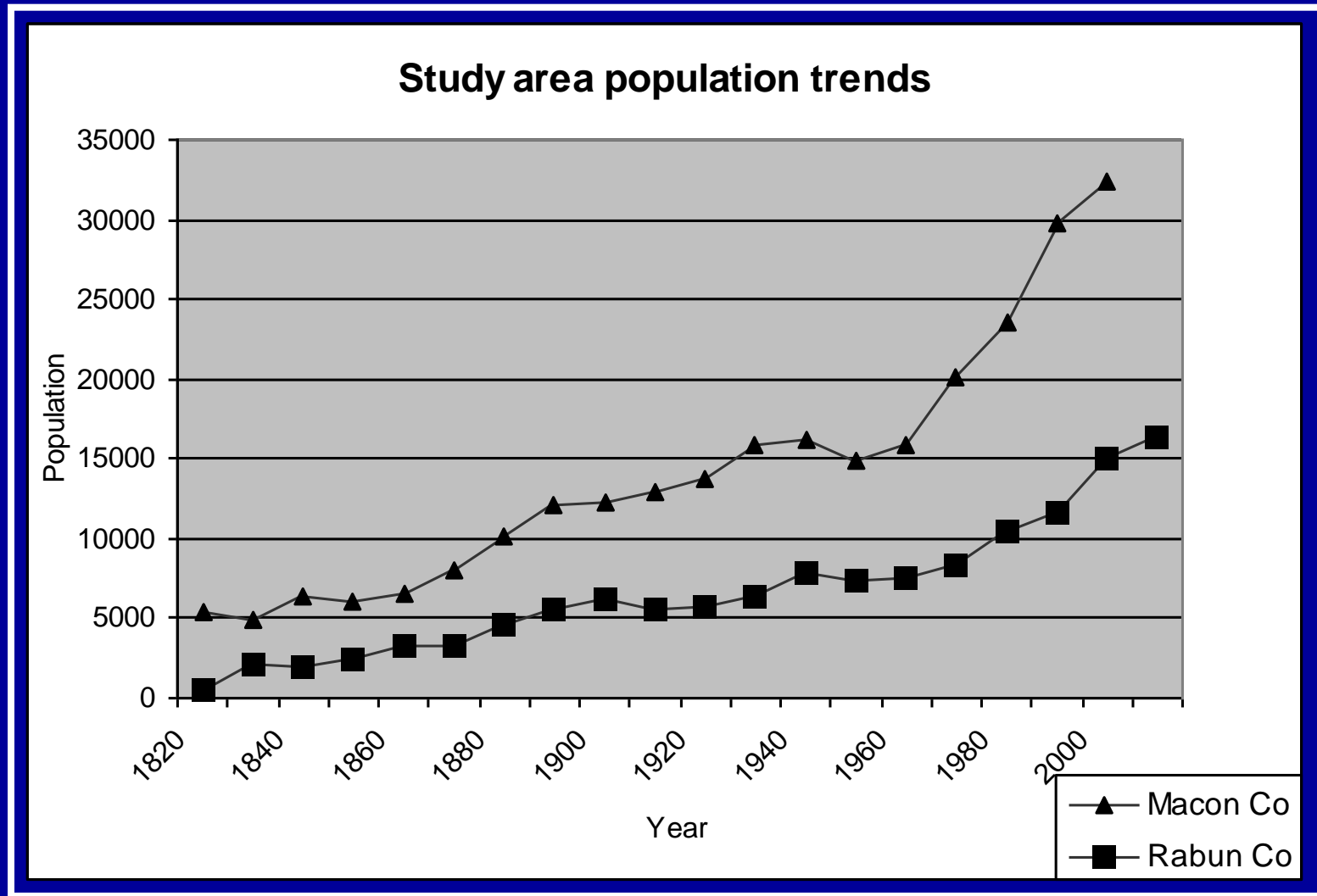
Drainage area: 863 km²

Located in Rabun County,
GA and Macon County,
NC

Rationale for selecting the
upper Little Tennessee
River basin as study area



Population trends in Macon County, North Carolina and Rabun County, Georgia, 1820-2000



Population levels for 2006 are estimated (U.S. Census Bureau)

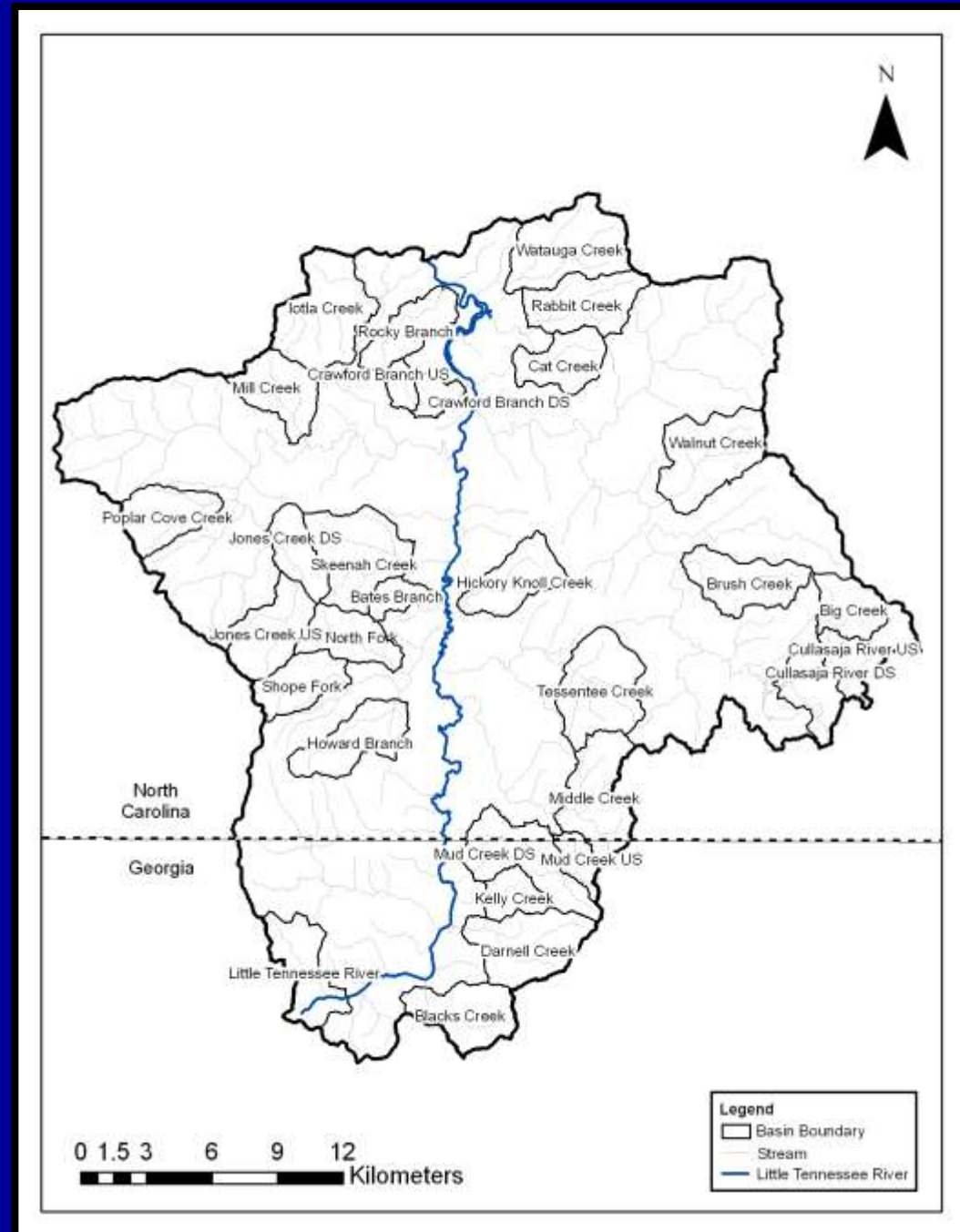
Site Selection

30 sub-basins

- Draining different levels of land cover found in study area

Small regional scale

Low order tributaries



Representative Photographs

Study area landscape



source: Ralph Preston

Stream reach



Walnut Creek

Parameters

- 27 independent variables
 - 16 land cover variables
 - 11 landscape/geomorphic variables, including
 - topography, drainage basin size, stream length and stream density

Data Collection

- Turbidity sampled on 11 occasions (Nov 2006-May 2007)
- Streams sampled during baseflow conditions

Statistical Analysis

- Correlation between each independent variable and baseflow turbidity

Independent variables exhibiting a statistically significant correlation with the geometric mean of NTU

Parameter	Correlation coefficient (r)
Pasture (%)	0.75
Average Basin Elevation	-0.63
Deciduous Forest (%)	-0.56
Total Developed (%)	0.55
Total Forested (%)	-0.55
Developed- Open (%)	0.54
Grass (%)	0.51
Crop (%)	0.39
Average Basin Slope	-0.36

0.05 level of significance yields a critical value of 0.361 (n = 30)

0.01 level of significance yields a critical value of 0.463 (n = 30)

Statistical Analysis

- Forward stepwise multiple regression to identify the combination of independent variables that have the greatest effect on baseflow turbidity

Variable	Partial R ²	Partial Adjusted R ²
Pasture (+)	0.56	0.54
Total Developed (+)	0.077	0.065
Avg. Elevation (-)	0.102	0.099
SUM	0.7344	0.7037

Variable	Partial R ²	Partial Adjusted R ²
Pasture (+)	0.56	0.54
Developed- Open (+)	0.074	0.062
Avg. Elevation (-)	0.106	0.102
SUM	0.735	0.7045

Variable	Partial R ²	Partial Adjusted R ²
Pasture (+)	0.56	0.54
Avg. Elevation (-)	0.055	0.037
Total Forested (-)	0.049	0.038
SUM	0.664	0.615

Variable	Partial R ²	Partial Adjusted R ²
Pasture (+)	0.56	0.54
Avg. Elevation (-)	0.05	0.037
Deciduous Forest (-)	0.072	0.064
SUM	0.68	0.64

Summary

- Pasture land cover identified as the primary correlate of differences in baseflow turbidity
- Description of pasture land cover class:
 - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle
- Baseflow turbidity negatively related to the pasture of forest land cover and drainage basin slope
- Baseflow turbidity positively related to the percentage of pasture, crop, grass, and developed land cover

Mitigation Context

- Establishes correlation between land use and baseflow turbidity
- Serves as surrogate for water quality sampling
- Justifies mitigation site selection using watershed approach
 - Studies document impacts of baseflow turbidity
 - Meyer et al. (1999), Walters et al. (2001)
- Establishes functional lift for proposed restoration activities

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