Mapping Headwater Streams in North Carolina

North Carolina Division of Water Quality
North Carolina State University
North Carolina Department of Transportation

Background

Problem: Existing Maps Inaccurate and Inconsistent

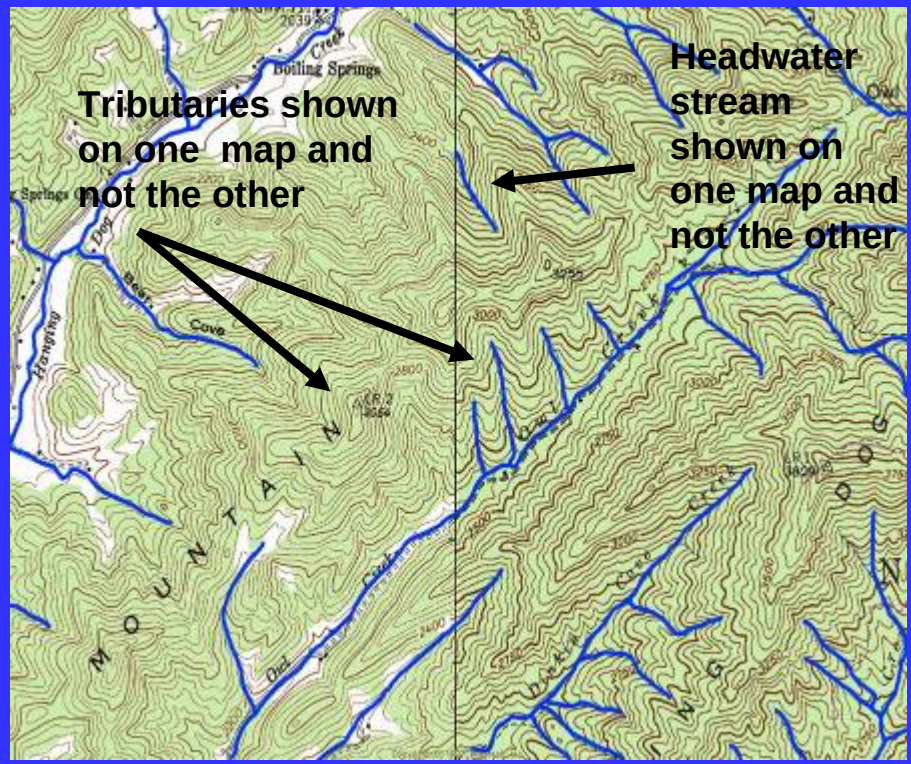
Critical to NC Division of Water Quality 401 program and other public agencies and private sector

Solution: Make better maps

Take advantage of state-wide LiDAR (**LI**ght **D**etection **A**nd **R**anging) coverage

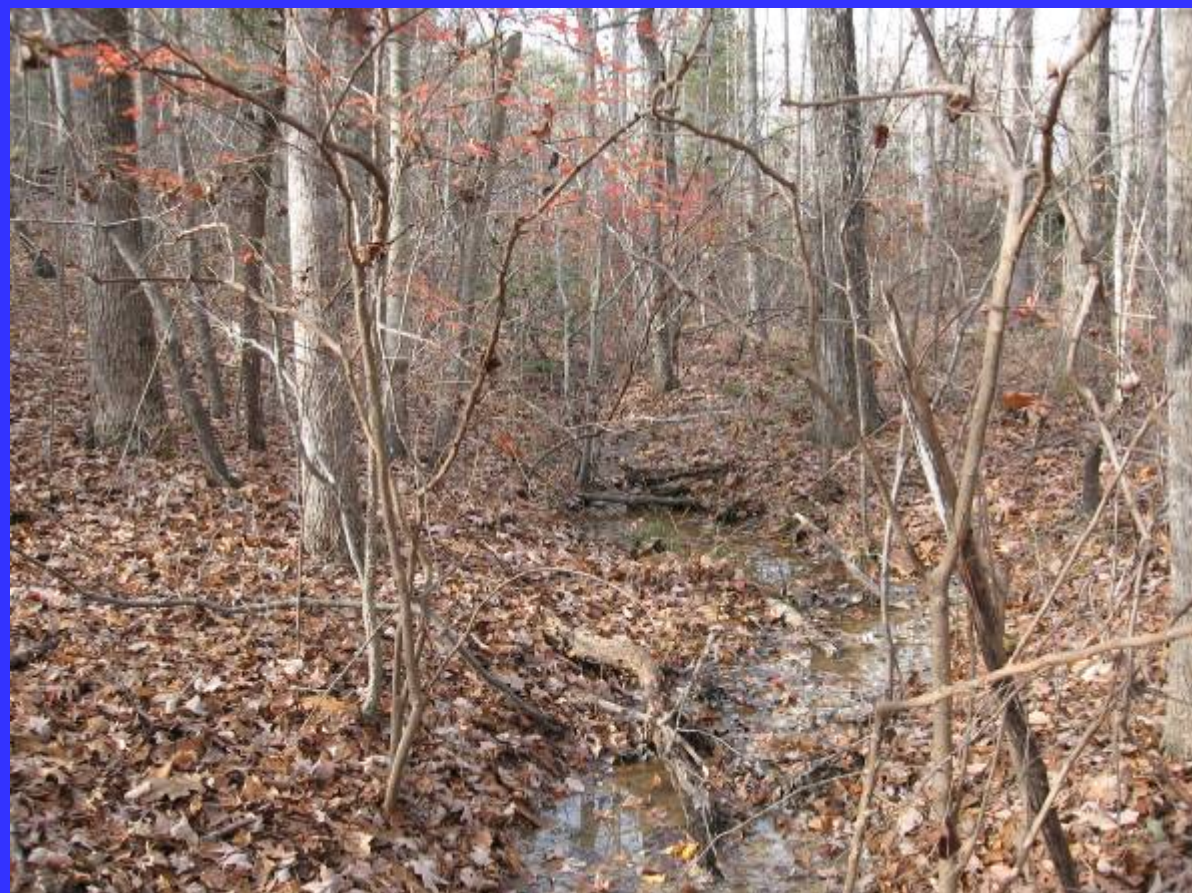
Stream Mapping Project began early 2004

(NCDWQ, NCSU, NCDOT)



Approach

- Use LiDAR data acquired from the NC Floodplain Mapping Program to create new topographic maps
- Conduct field identification and mapping of intermittent and perennial streams and their origins in headwater areas
- Conduct spatial analysis using GIS data and field data
- Use field data and other GIS data to create predictive models of streams and origins



What are we trying to predict with spatial models?

- Presence/Absence of stream in a valley
- Stream length
- Flow Duration –ephemeral, intermittent or perennial

What are the influencing factors?
What processes do these factors represent?
How do factors and processes vary spatially?

Methods: Field Data

- Walk streams
- Locate Origins
- Determine flow regime (DWQ Stream ID, 2005)
- GPS origins (sub-meter accuracy)

http://h2o.enr.state.nc.us/ncwetlands/regcert.html

Methods: GIS Data

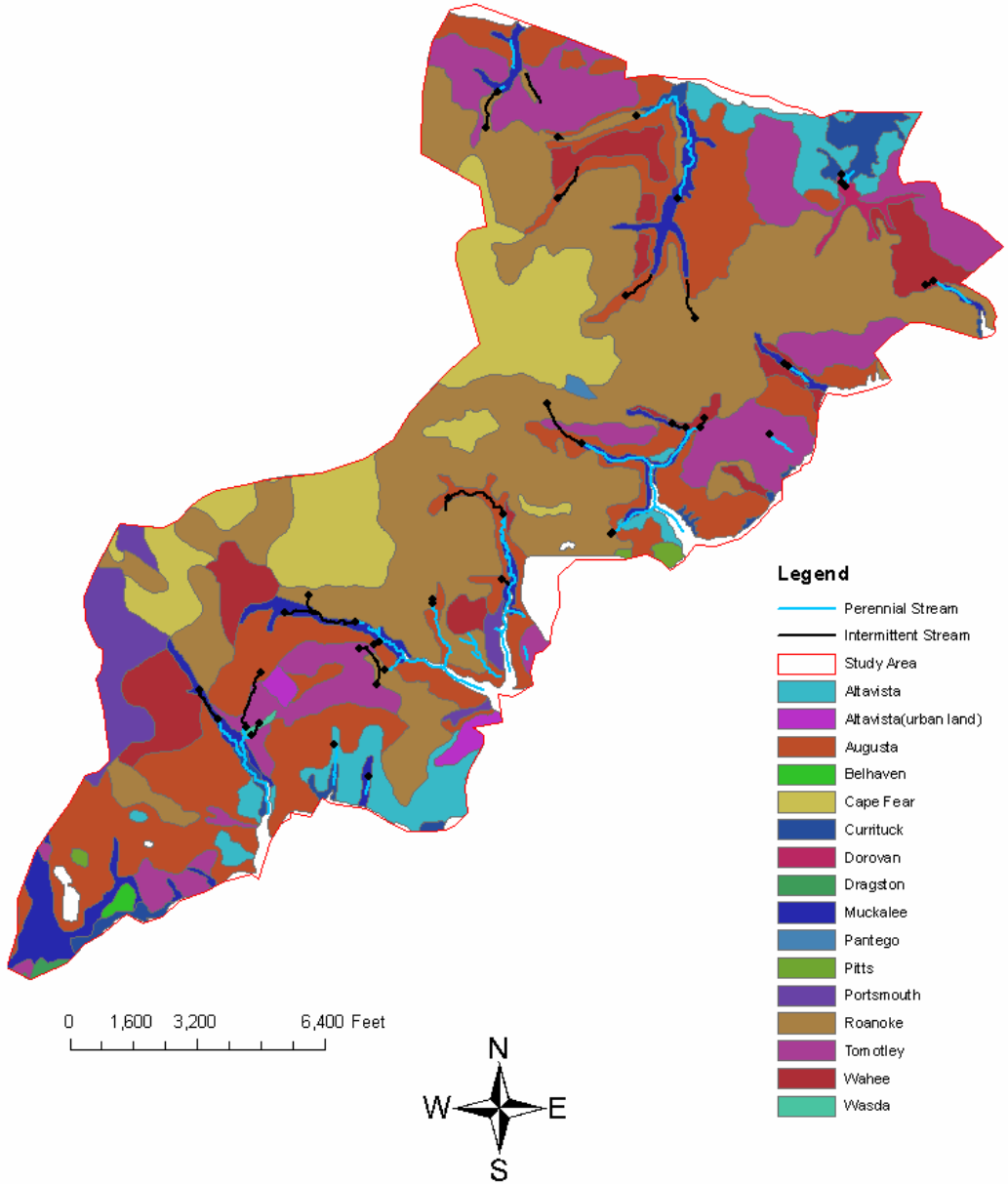
Create Digital Elevation Models (DEMS)

•Generate Terrain Derivatives

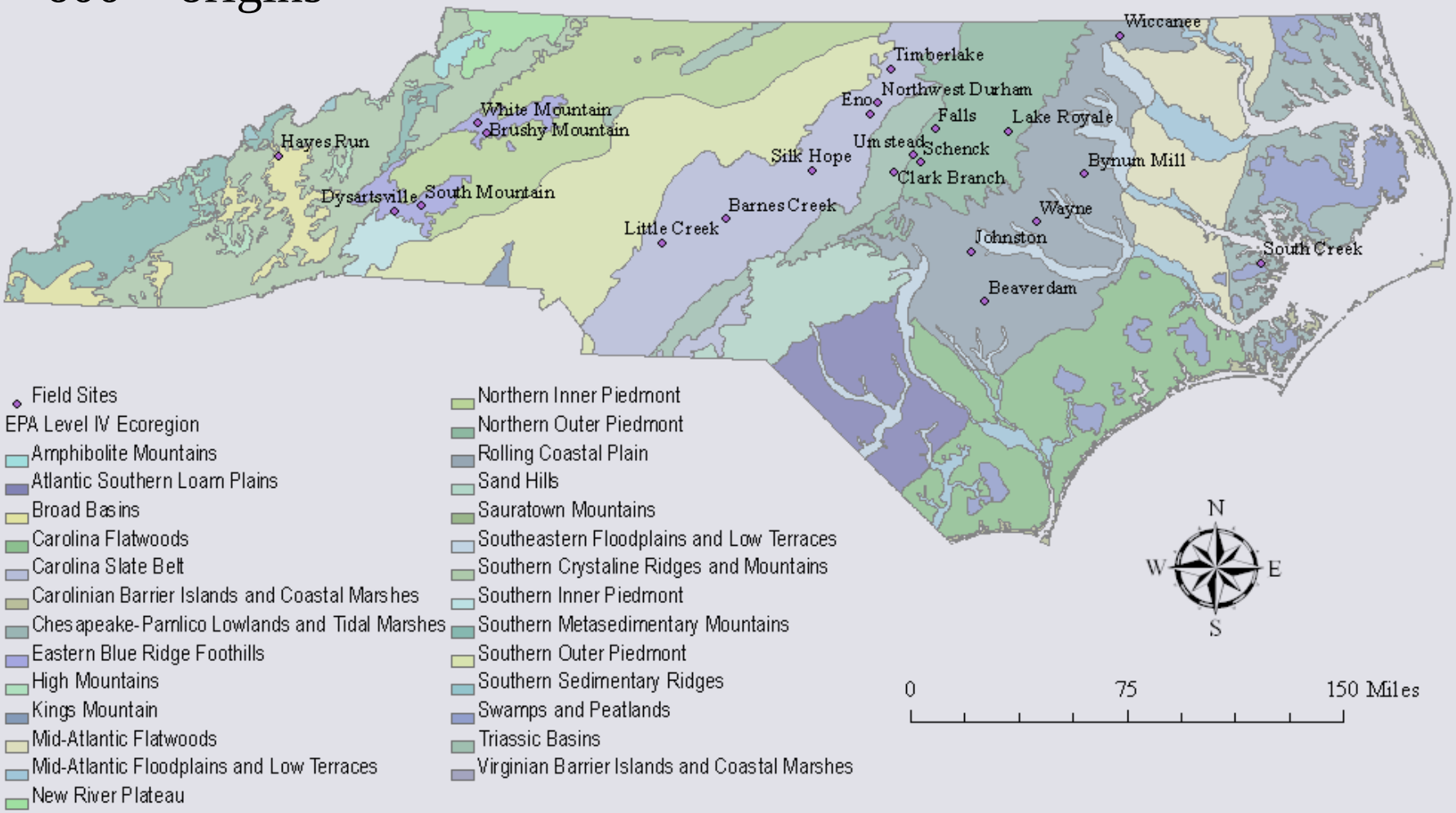
•Acquire existing GIS Data, ex. Soils, geology…

Spatial patterns and analysis

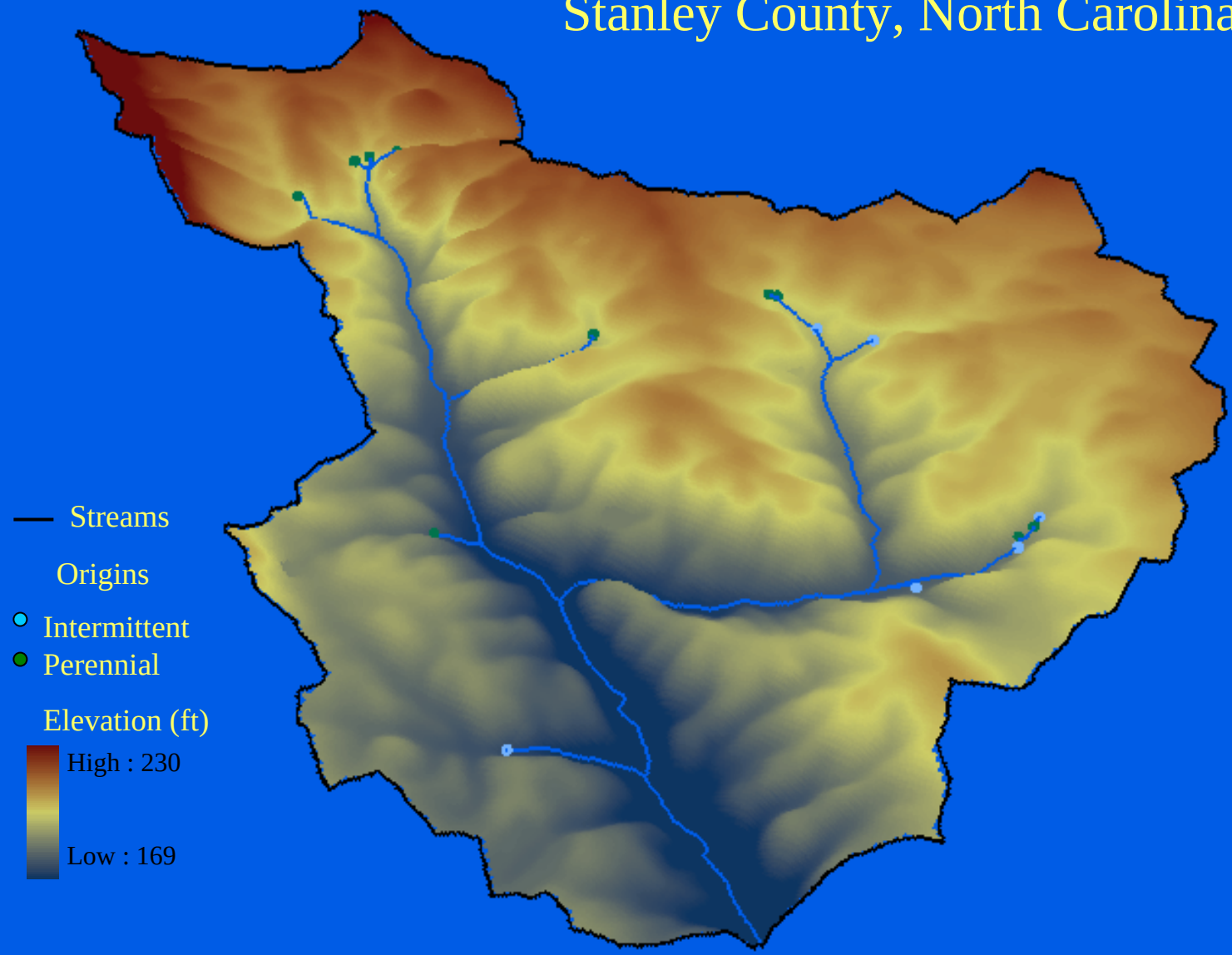
Figure 3: Area Soils
PCS Phosphate Company Study Area
Beaufort County, NC



- 23 watersheds
- 600 + origins



Little Creek, Yadkin Basin
Stanley County, North Carolina



Variables used (or to be used) in Analysis

- Level IV Ecoregion
- Local Slope
- Average Slope
- Contributing Drainage Area
- Local Curvature, profile and plan
- Average Upslope Curvature, profile and plan
- Soils
- Geology
- Land use
- Indices (roughness, stream power…)

General Description

Ephemeral to intermittent	46 %
Intermittent to perennial	36 %
Ephemeral to perennial (all mtns)	14 %
Other, wetlands and modified	8 %

does not include outer coast

First order intermittent stream length

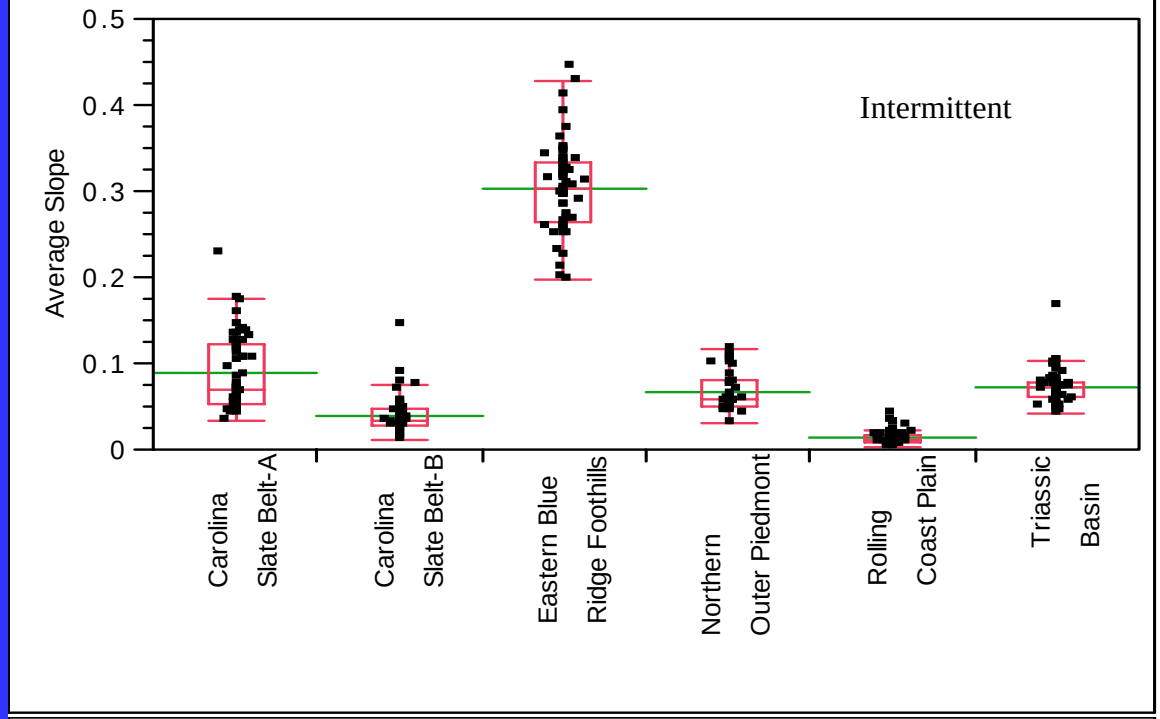
mountains	33 %
piedmont	22 %
inner coast plain	32 %
outer coast plain	56 %

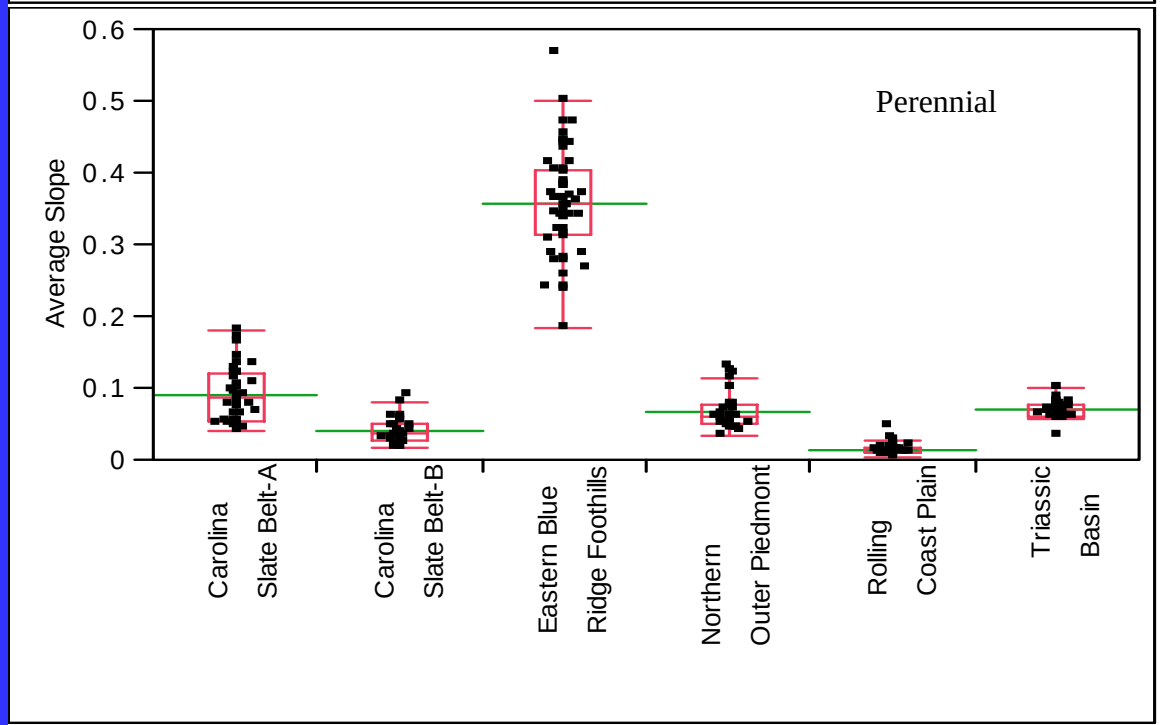
44 origins/1 site

*Data for 21 sites, 542 origins

Average Slope
Int/Per
Within Ecoregion
*Eastern Blue Ridge

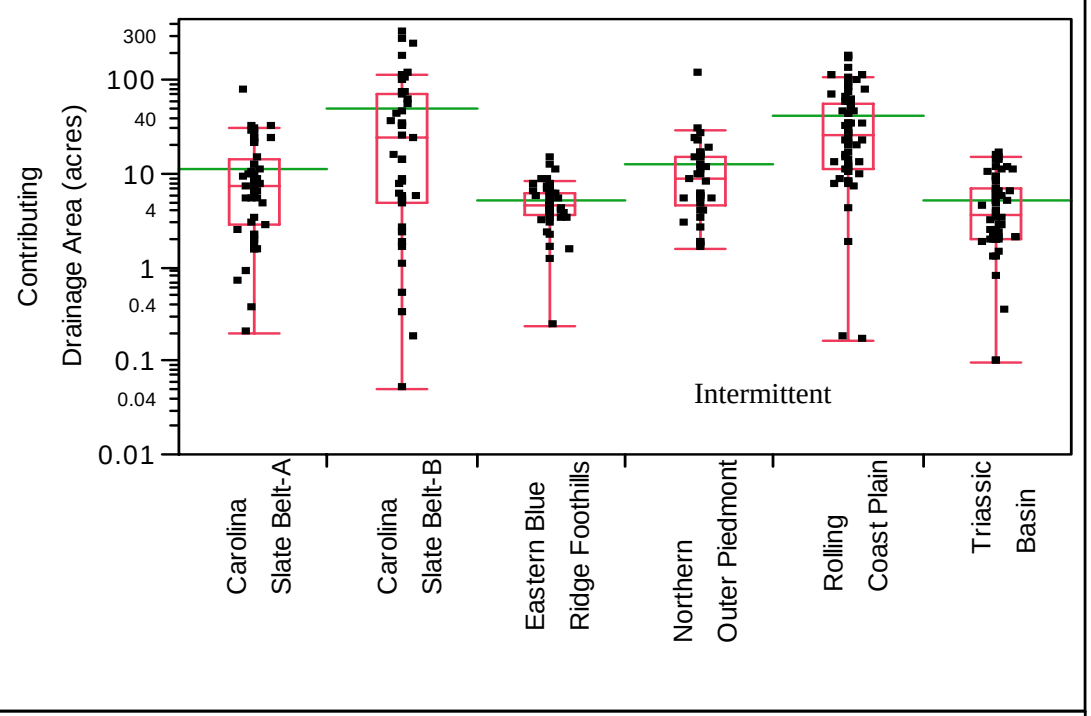
Between Ecoregions
*Eastern Blue Ridge
*Rolling Coastal Plain
*Triassic Basin

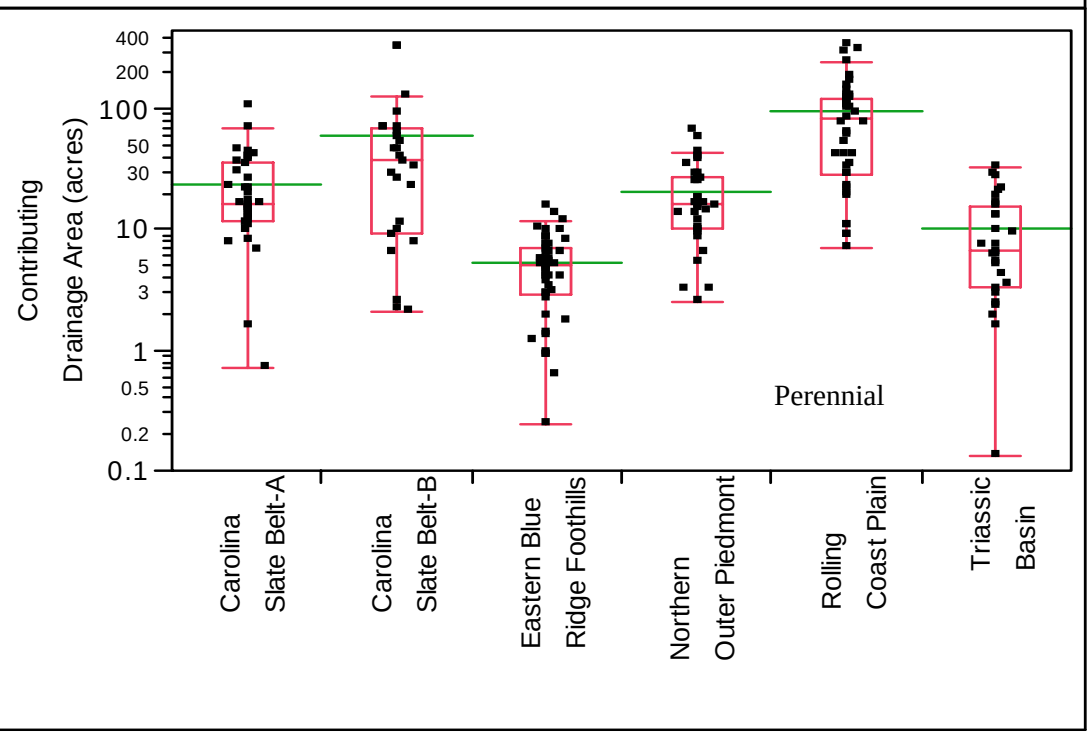




Contributing Drainage Area
Int/Per
Within Ecoregion
All except
Eastern Blue Ridge &
Group B-Slate Belt

Between Ecoregions
*Rolling Coastal Plain
*Triassic & Eastern BR
*Slate Belt & N. Outer Piedmont





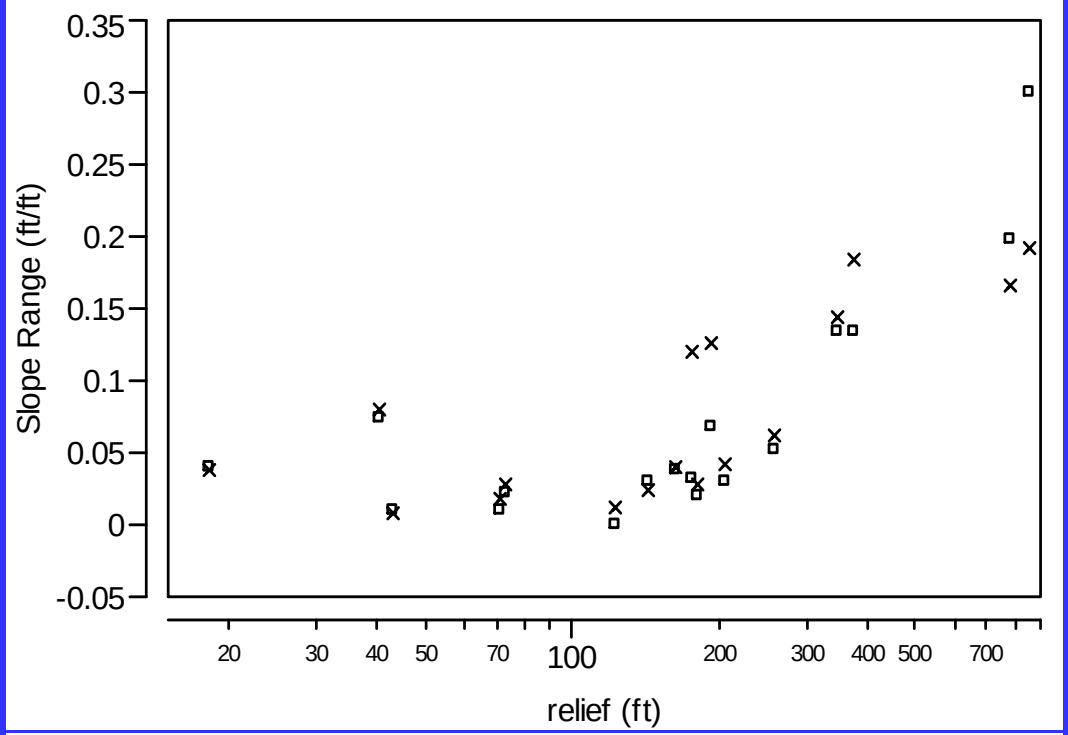
Landscape Process…..

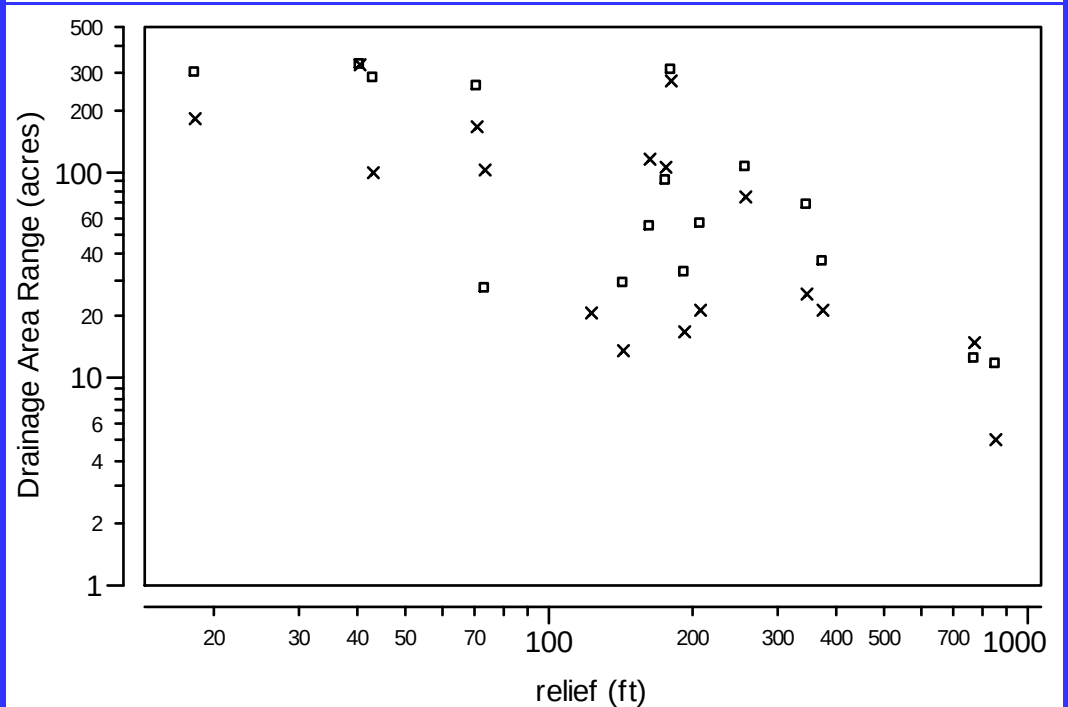
Trend Plots
Average Slope and Contributing Drainage Area against Topographic Relief by Site

Range (max-min)

Avg Slope ↑ Relief ↑

Drainage Area ↓ Relief ↑





Distribution of Intermittent and Perennial Origin Contributing Drainage Area (acres)

	Carolina Slate Belt-A		Carolina Slate Belt-B		Eastern Blue Ridge Foothills		Northern Outer Piedmont		Rolling Coastal Plain		Triassic Basin	
	int	per	int	per	int	per	int	per	int	per	int	per
Min	0.20	0.72	0.05	2.04	0.23	0.24	1.55	2.54	0.16	7.16	0.10	0.13
10%	1.47	7.53	0.77	2.39	2.17	1.02	1.80	4.07	7.52	10.76	1.24	1.89
25%	2.85	11.58	4.89	9.52	3.72	2.91	4.48	10.05	11.15	28.82	1.95	3.27
50%	7.36	15.99	23.80	37.50	4.60	4.98	8.82	16.18	25.67	84.00	3.70	6.85
Mean	**11.20**	23.74	50.86	60.85	**5.16**	**5.27**	**12.72**	20.52	40.66	95.59	**5.11**	10.40
75%	14.47	35.40	69.96	68.16	6.34	7.04	15.06	27.11	55.15	122.00	7.16	15.79
90%	27.39	43.33	**142.41**	187.26	**8.16**	**9.81**	22.99	41.31	**101.33**	217.34	**11.87**	27.80
Max	74.63	107.00	322.27	328.28	14.60	15.85	115.95	64.81	173.65	343.66	16.51	32.49

Much to be Done!