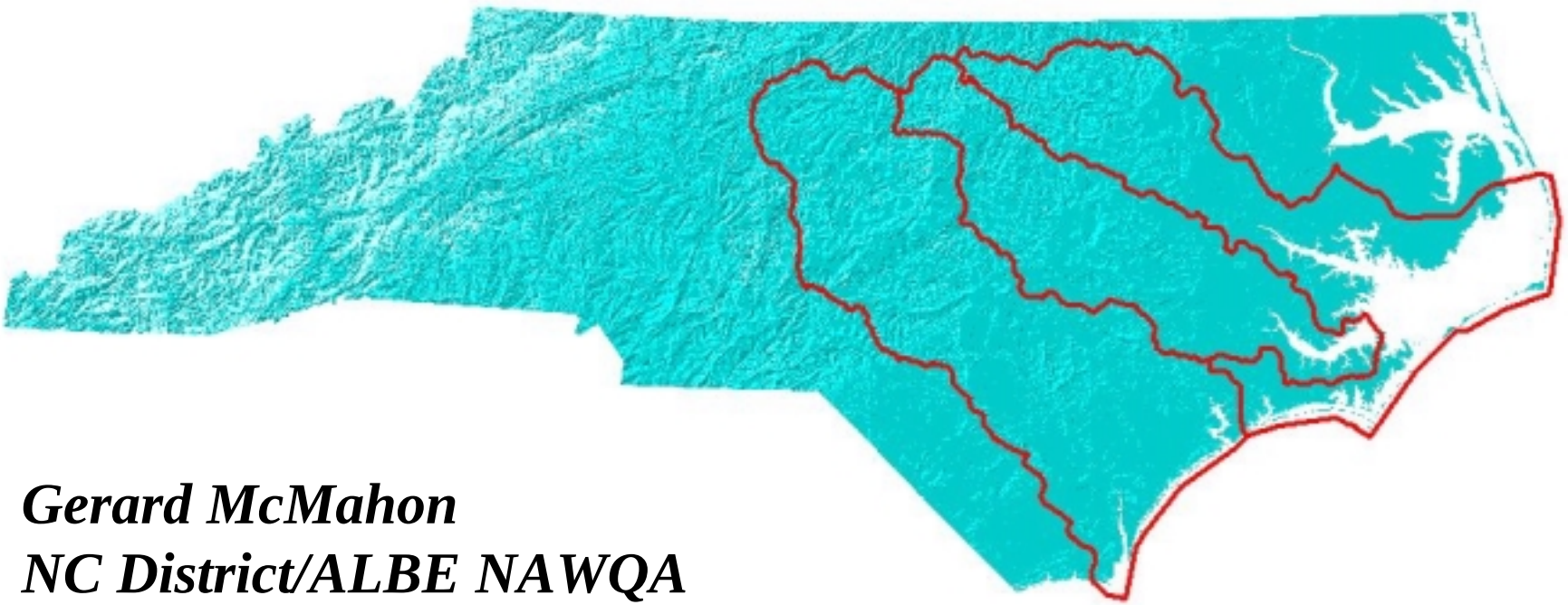
On-going SPARROW research/management applications:
Coastal North Carolina



Gerard McMahon
NC District/ALBE NAWQA
SPARROW Workshop
Reston, Virginia
October 29, 2002

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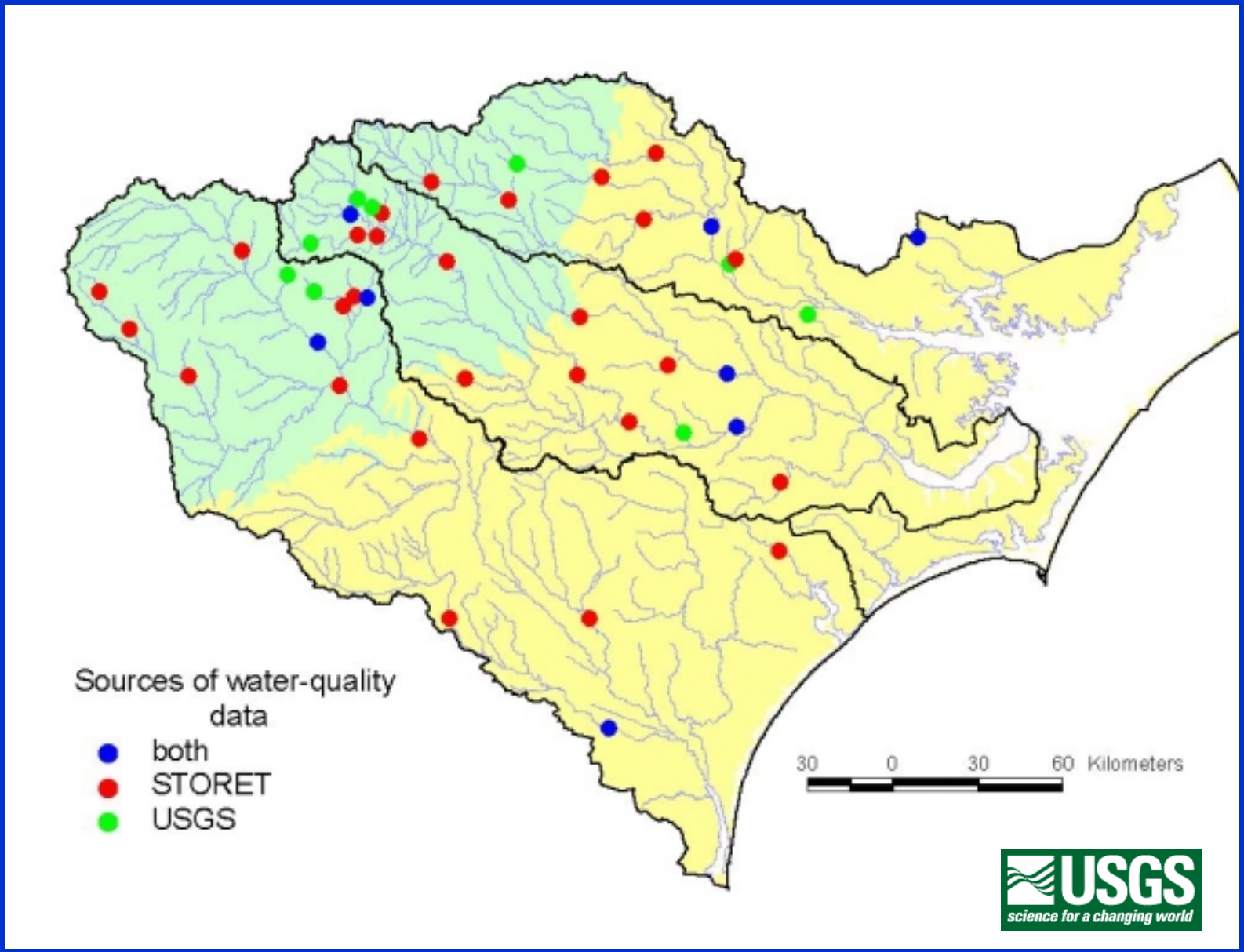
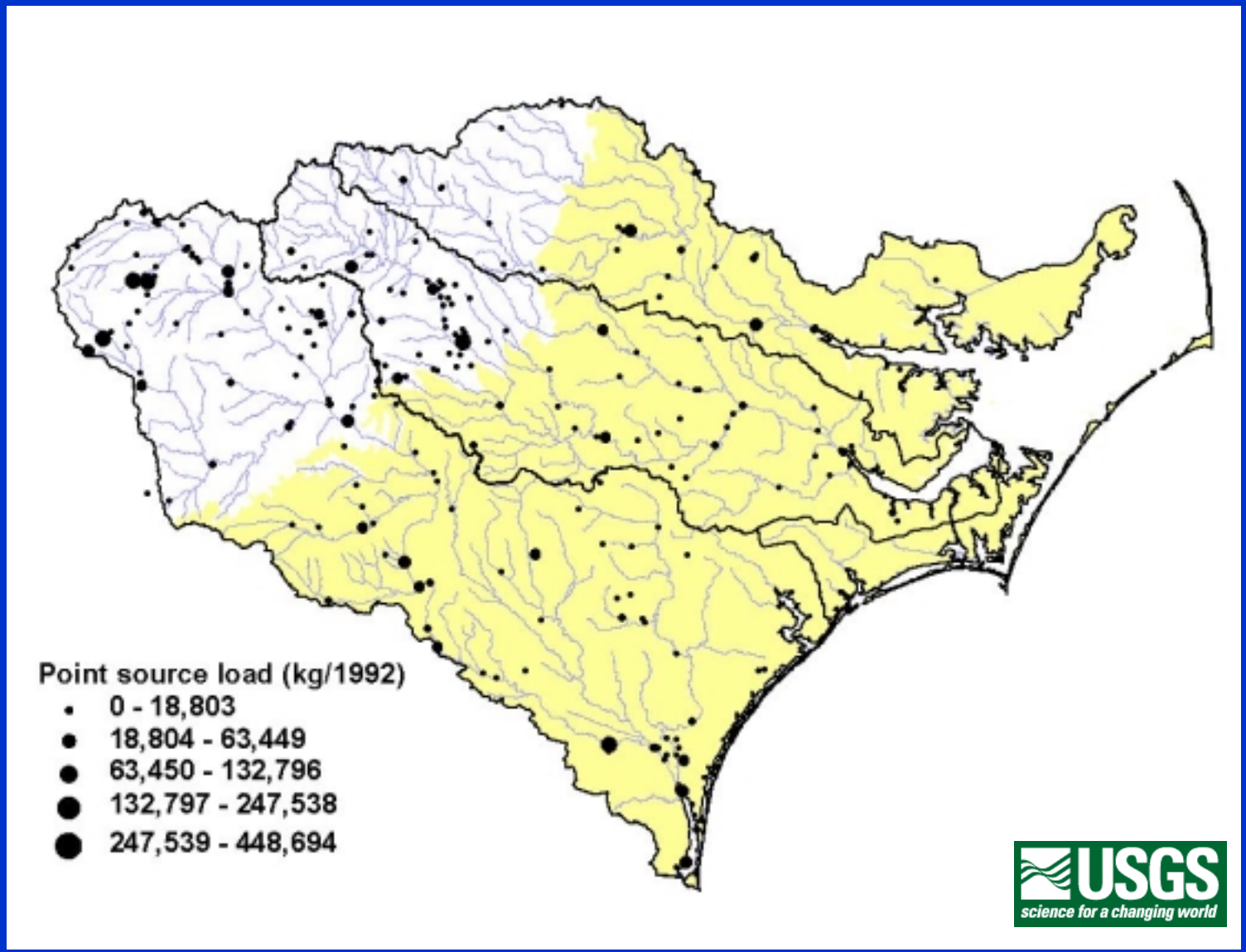
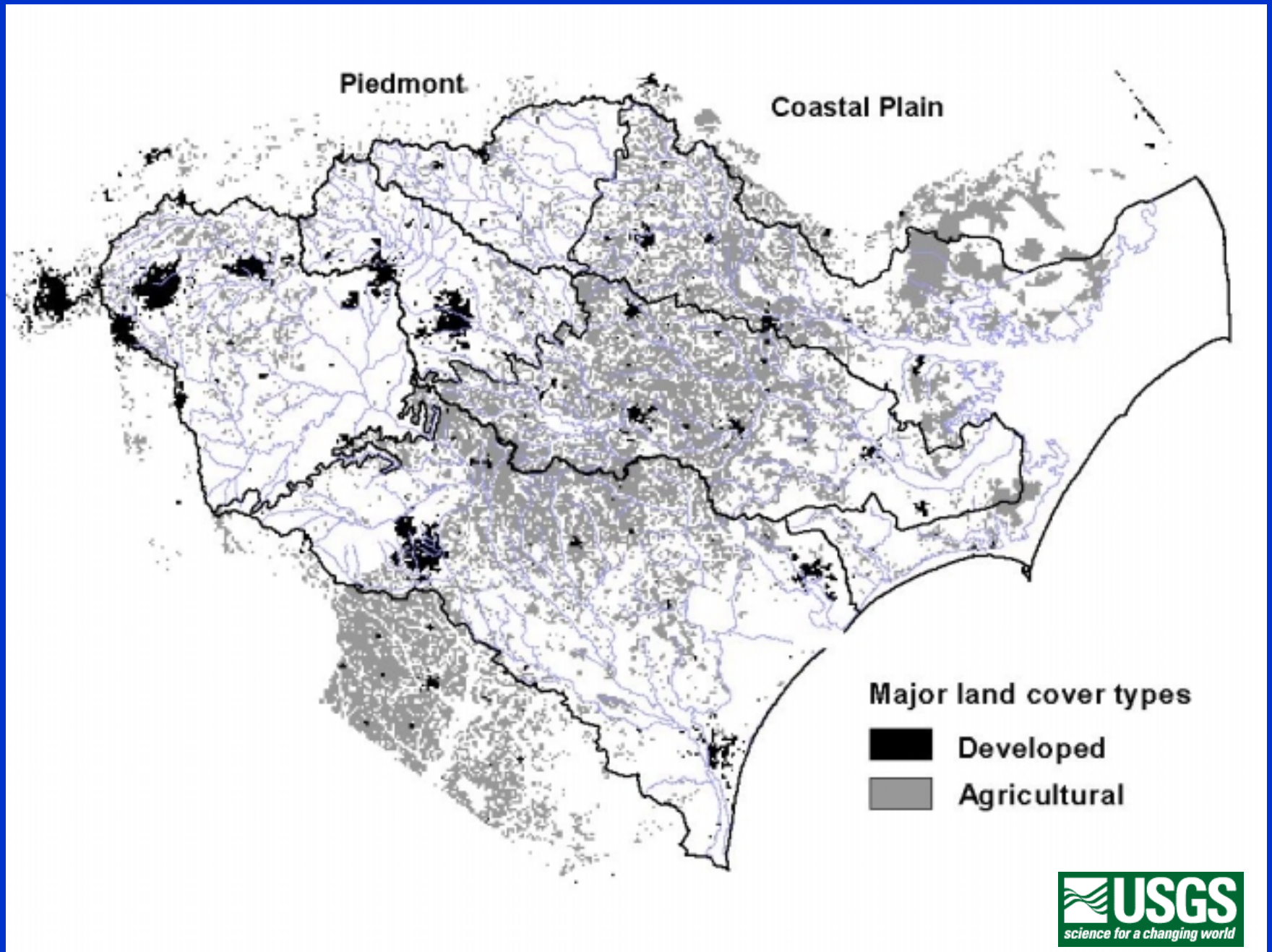
Location of 44 monitoring sites used for load calculation



Point source fluxes, kg/1992




Piedmont
Coastal Plain
Major land cover types
Developed
Agricultural
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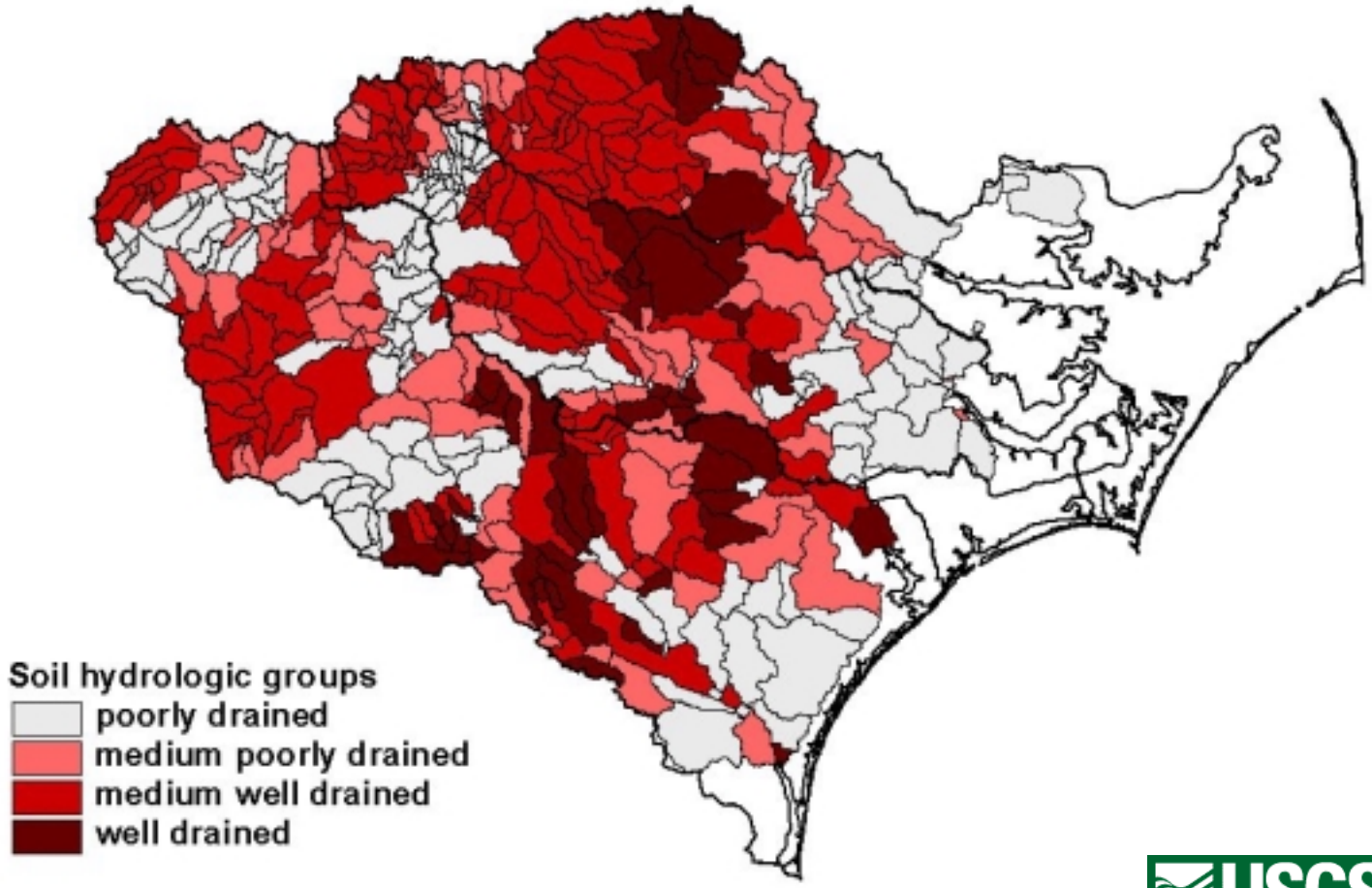
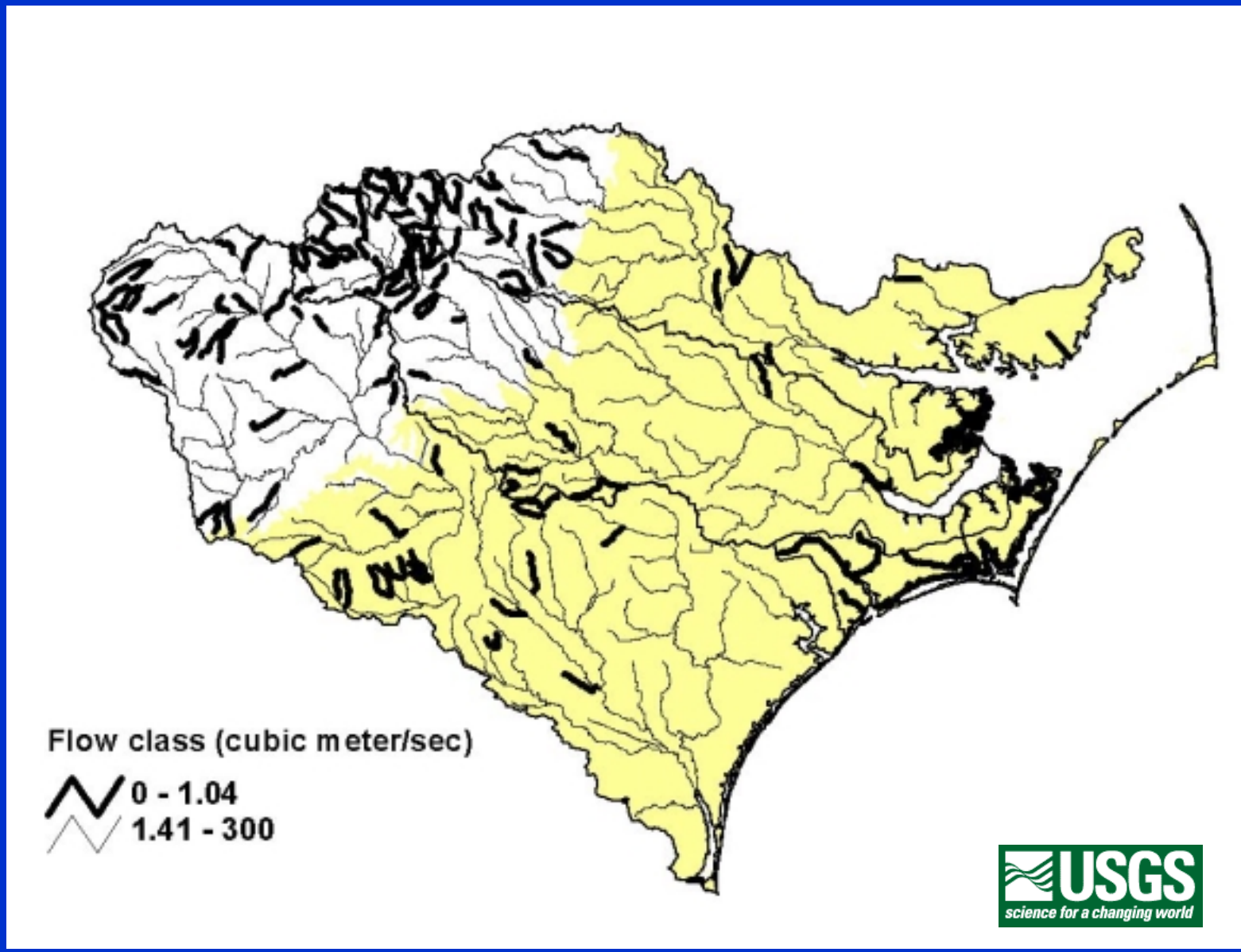
Soil Hydrologic Group, average values

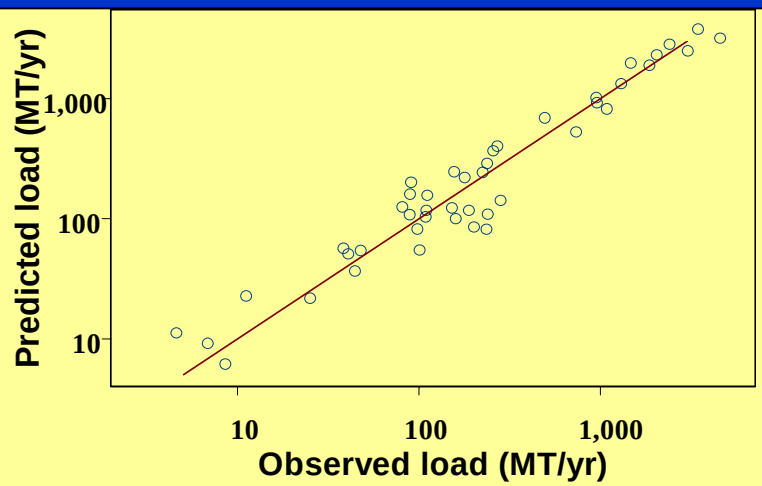


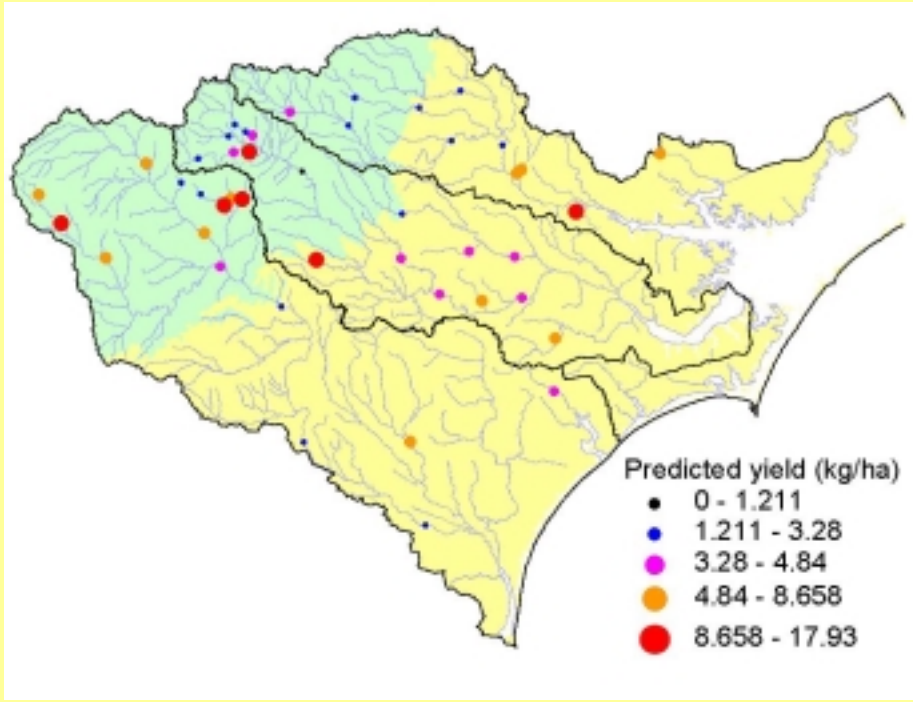
Stream flow classes (m3/sec)



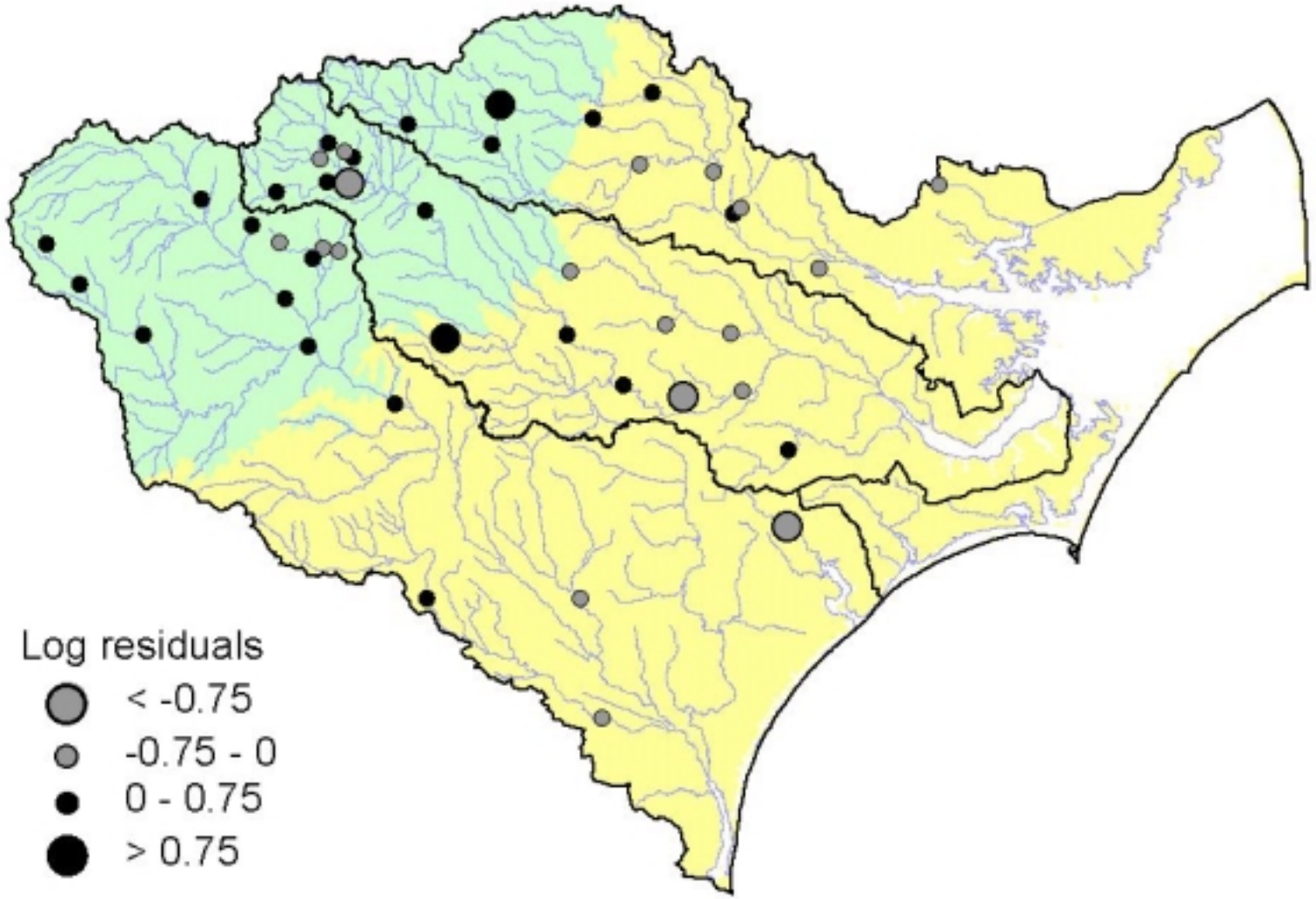
NC SPARROW land cover-based regression model

R2	**0.93**	
MSE	**0.22**	
TN sources	**Parameter**	**p-value**
Point sources (MT/1992)	**0.85**	**0.006**
Agr. Land area (km^2)	**5.9**	**0.09**
Non-agr land area (km^2)	**1.79**	**0.08**
Land delivery variable		
Soil hydrologic group	**4.13**	**0.001**
Aquatic loss		
Small stream (km^{-1})	**0.08**	**0.02**
Large stream (km^{-1})	**0.002**	**0.35**
Reservoir (m/yr)	**16.4**	**0.008**





Spatial distribution of model residuals



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Export coefficients (kg/ha) : SPARROW and literature

SPARROW	Model with decay terms	Model without decay terms
Agricultural land	59	7.4
Non-agricultural	18	2.5

Lit. Review	Forest	Row Crop	Pasture	Mix. Agr	Urban	Feedlot
Median	2.5	9	5	14	6	2900
IQR	1 – 4	4 – 23	3 – 11	9 – 26	4 – 11	1800 – 3500
Max	7	80	31	42	39	7800

In-stream loss coefficients

		Land area model			Mass input model		
		per km	per day		per km	per day	
small stream		**0.08**	**0.99**		**0.045**	**0.55**	
(vel = 7.7 mi/day)							
large stream		**0.002**	**0.06**		**0.002**	**0.07**	
(vel = 19 mi/day)							

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Application 1: SPARROW total nitrogen budget

- **Incremental yield – How much total nitrogen enters each local stream reach?**
- **Delivered yield – How much total nitrogen exits each river basin at the estuary?**
- **Sources -- What are the sources of total nitrogen that is delivered to the stream systems?**

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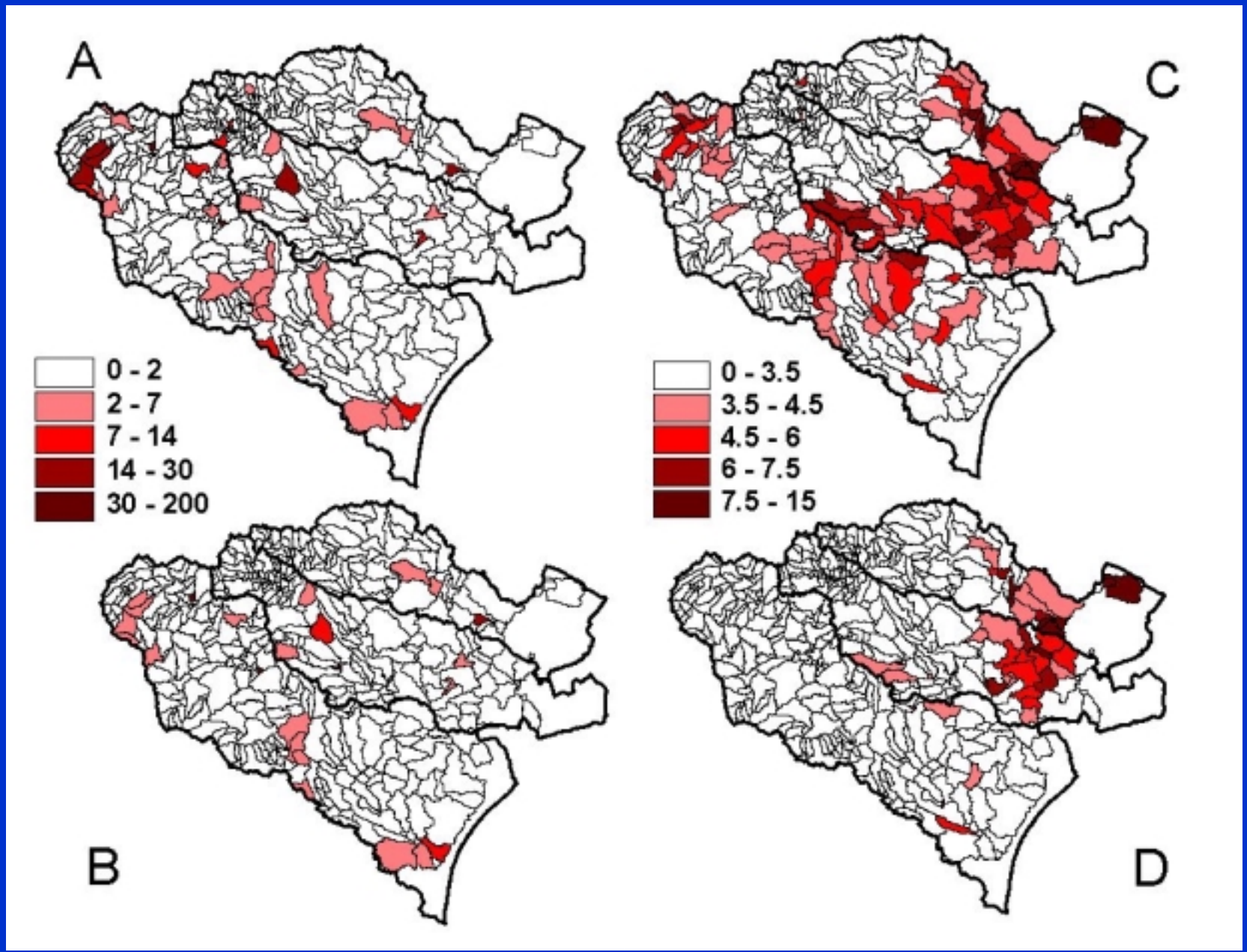
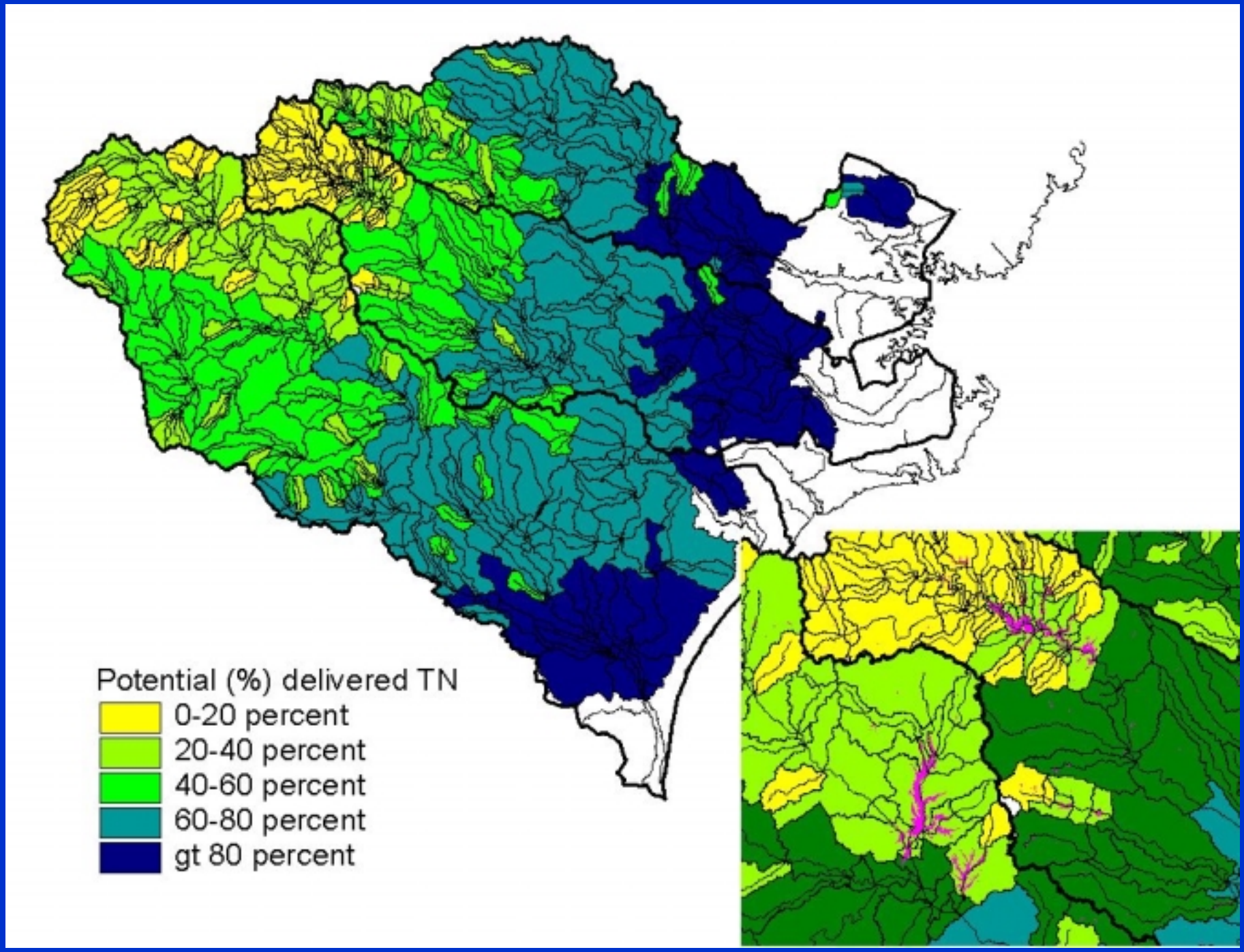
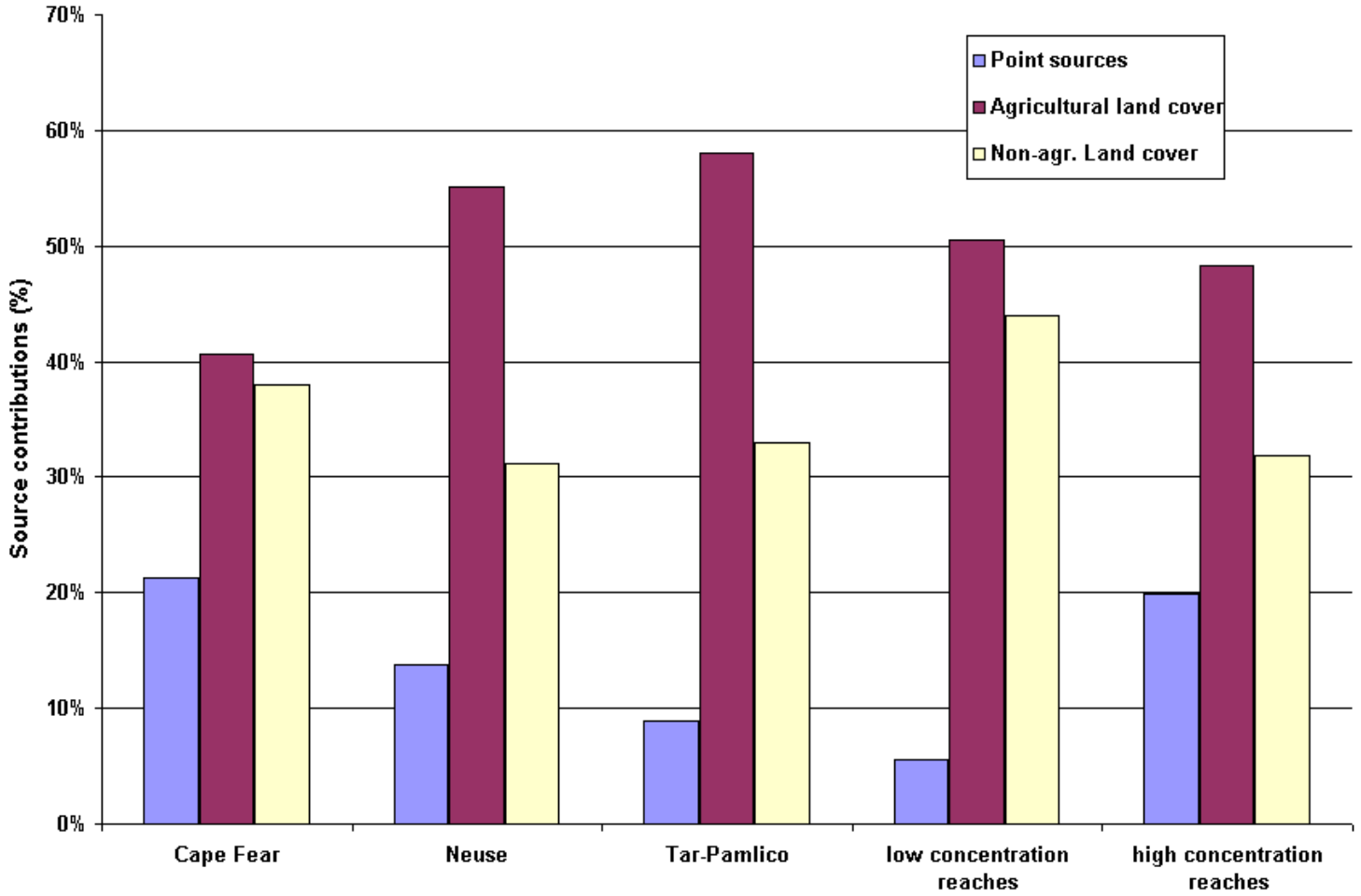
Point source yield (kg/ha)

Agricultural yield (kg/ha)




Potential (%) delivered TN
0-20 percent
20-40 percent
40-60 percent
60-80 percent
gt 80 percent

TN budget for sources delivered to streams, by: (a) 3 NC basins; (b) 2 stream classes



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Application 2: Using SPARROW for TMDL Assessment

- **Understand where reaches with potentially problematic TN concentrations exist.**
  - **Using bootstrap coefficients, develop distribution, at each reach, of probability of exceeding TN concentration of interest.**
- **Understand where additional monitoring should occur?**
  - **Using information about prediction uncertainty and exceedence probability.**

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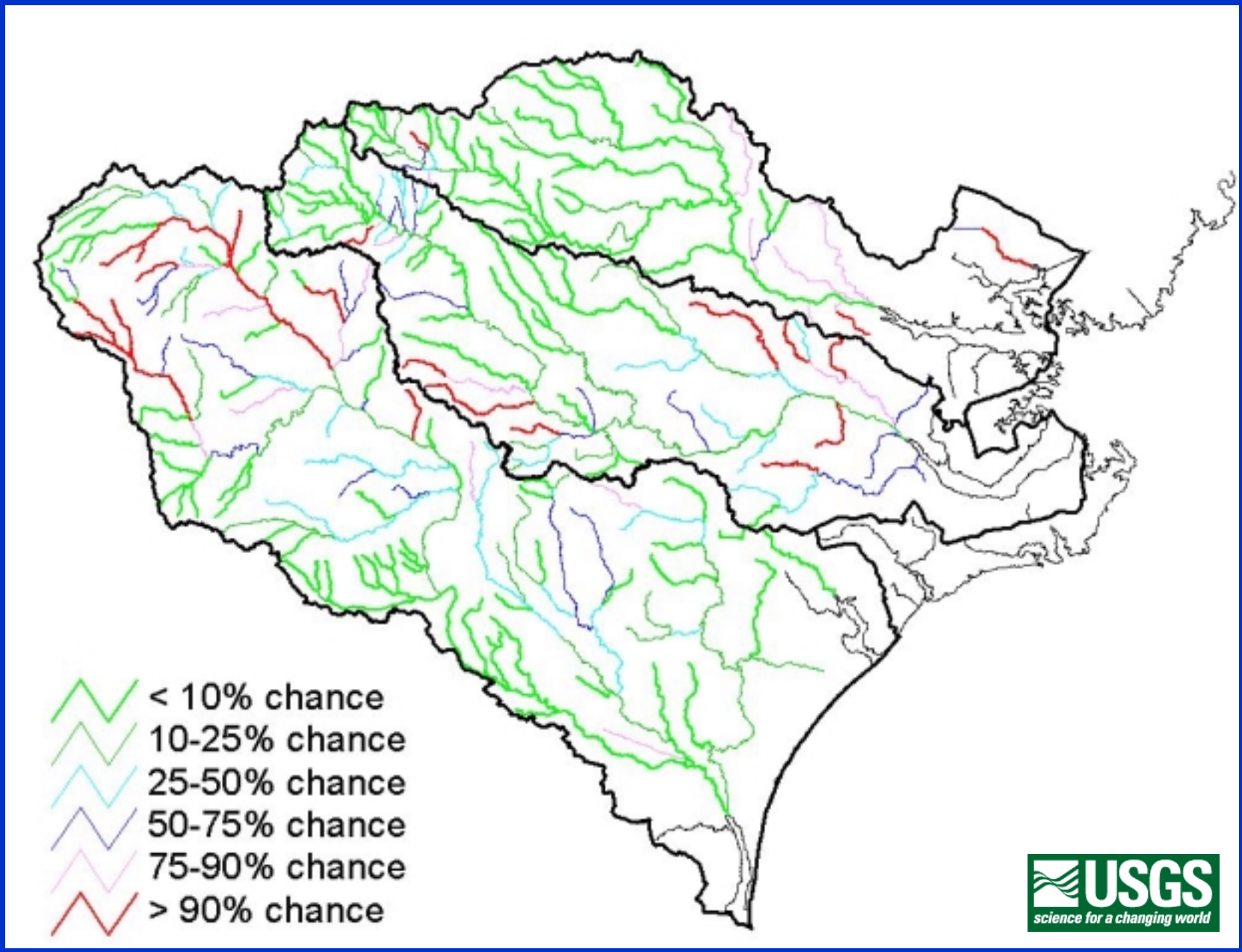
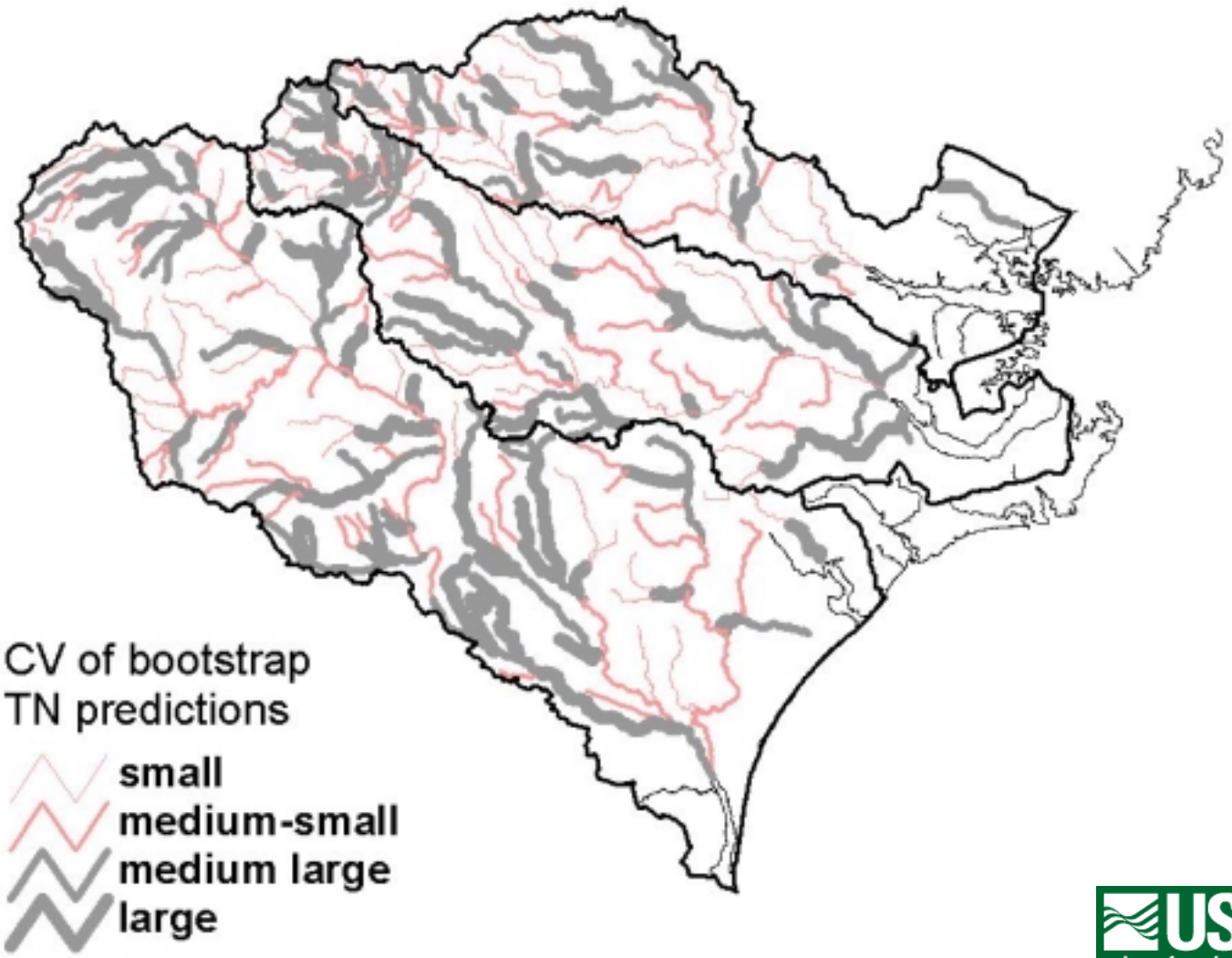
Probability of exceeding TN concentration of 1.5 mg/L



Relative variability of TN predictions



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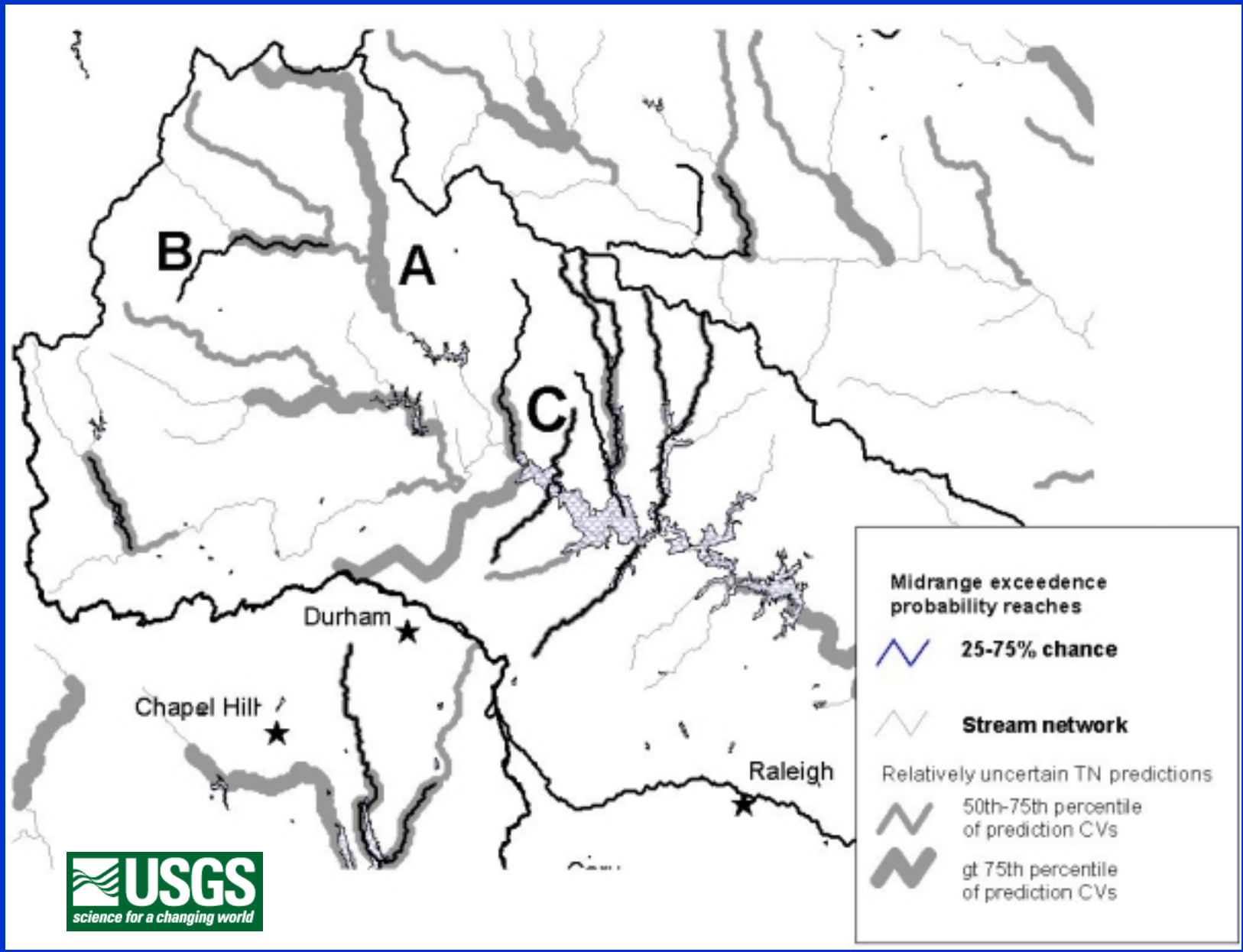
Identifying locations for further monitoring?



What's next?

- **Model and application development**
  - **Examine alternative model specifications (e.g., residuals problem)**
  - **Explore reconciliation of results from multiple models**
  - **Explore application using circa 2000 data**
  - **Explore use with Bayesian estuary chlorophyll model**
  - **Explore Southeastern US SPARROW model**

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