Assessment of Water Quality in Virginia's Non-Tidal Streams using a Probabilistic Sampling Design (ProbMon)

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Presentation Overview

- Virginia's ProbMon Study Design
- Data Management/Analysis Issues
- Study Update - Year 1 to Year 3
- Selected Study Results
- Uses of Probabilistic Data in VA
- Future Goals

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Virginia's Aquatic Resources

- 9 major river basins
  - 49,350 stream miles
- 248 public lakes
  - 162,230 acres
- 1,044,900 acres wetlands (23% tidal)
- 498 watersheds
- ~1,500 ambient stations
- ~200 biomonitoring stations
- ~40,000 water samples
- 74% of VA waters not assessed

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Virginia's ProbMon Study Design

- Target Populations: All Non-Tidal Freshwater Perennial Rivers and Streams

- Sample Frame: River Reach File 3 (1:100,000 scale); All R (regular), S (start), T (terminal), N (non-networked), W (one bank wide river)

- Stratification: Unequal probability selection by Strahler order: 1st, 2nd. 3rd, 4th, 5th

- State-wide over 5 years (not rotating basin)

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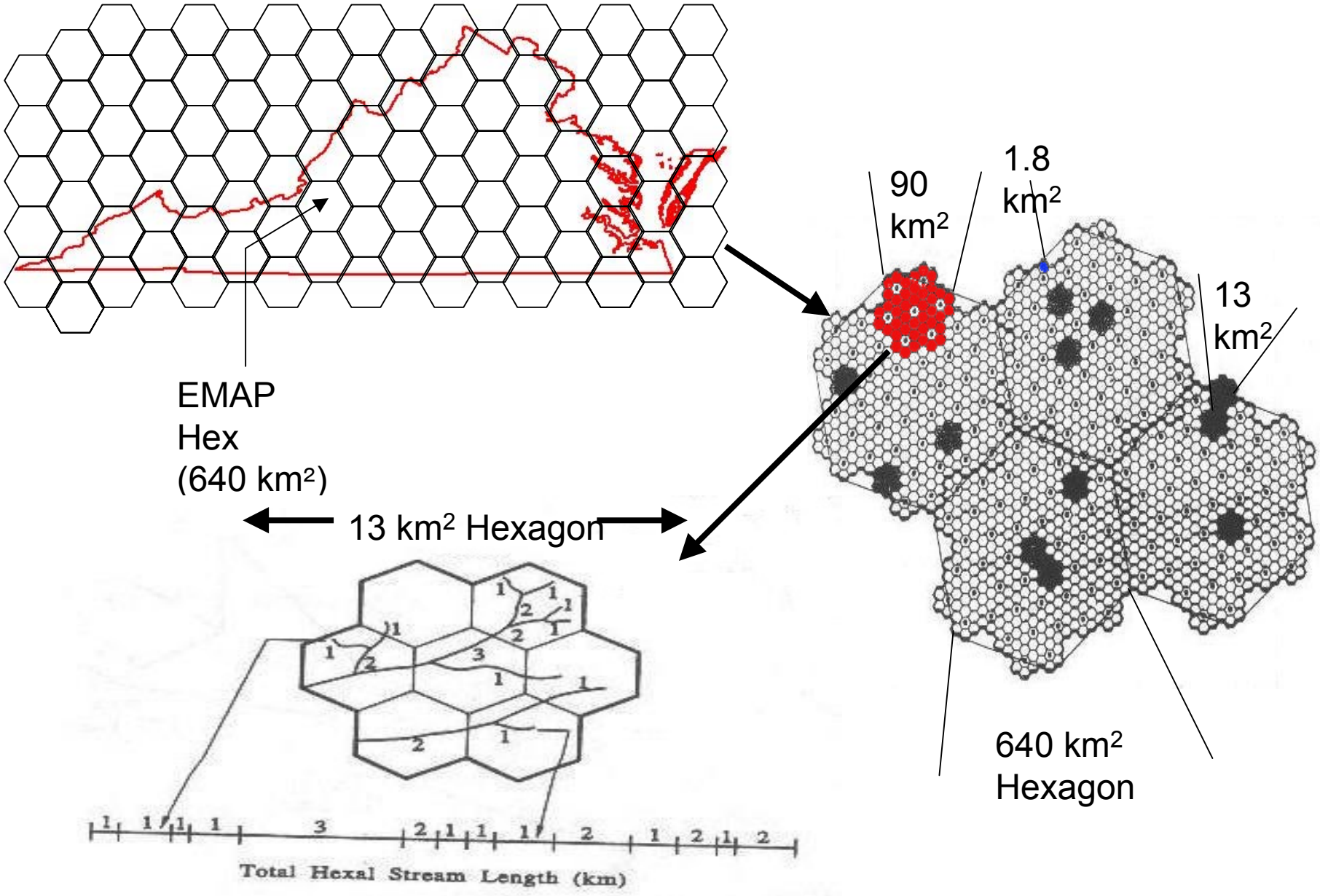
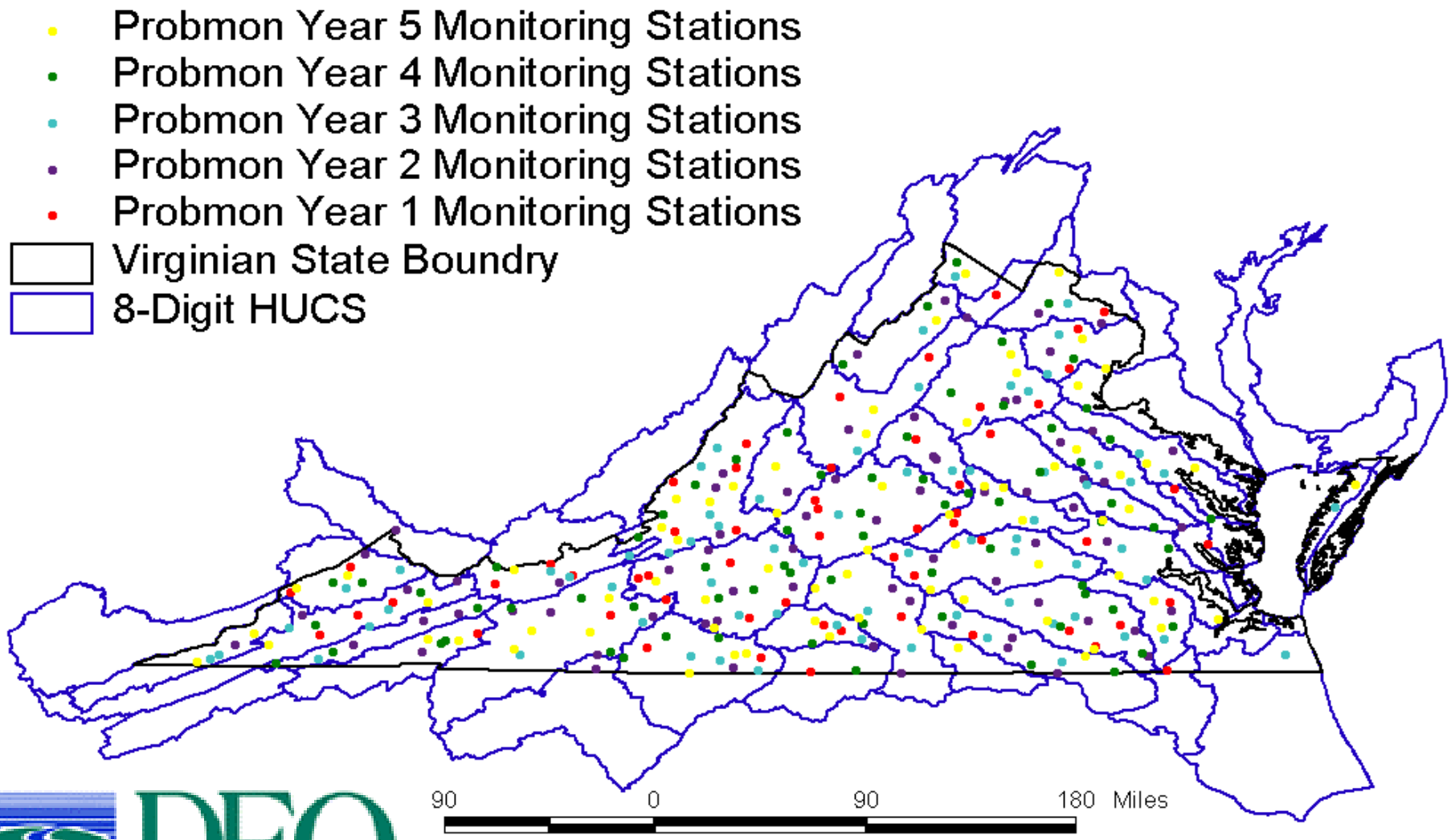
How Are Sites Randomly Selected?



Five Years Study by Watershed



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Data Collected

- Field data
  - DO, Temp, pH, Sp Cond
- Benthic community metrics
  Rapid Bioassessment Protocol (RBPII) & 'draft' Stream Condition Index (SCI)
- Habitat Survey
  - RBP & RBS
- Bacteria Indicators
  - (Fecal Coliform & E. Coli)
- Chlorophyll (water column)
- Total Organic Carbon
- Land Cover Data (GIS)

- Nutrients
- Solids
- Hardness
- Alkalinity
- Turbidity
- Chlorides
- Sulfates
- Heavy Metals & Pesticides (in sediment)
- Dissolved Metals (in water column)

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Data Storage/Data Analysis

- Raw data: CEDS and EDAS
- Combined data stored In Access
- Access databases imported into GIS
- Different software to create CDF curves
    - S-plus, SAS, ‘R’

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Study Update - Year 3

- 211 Stations Evaluated (2001 to 2003)
- Chemical Target Sample n = 173
  - Non-Target (n = 20), Other Target (n = 10), Permission Denied (n = 8)
- Biological Target Sample n = 159
  - Non-Target (n = 34), Other Target (n = 10), Permission Denied (n = 8)
- Land Owner Permission Denied (< 4%)

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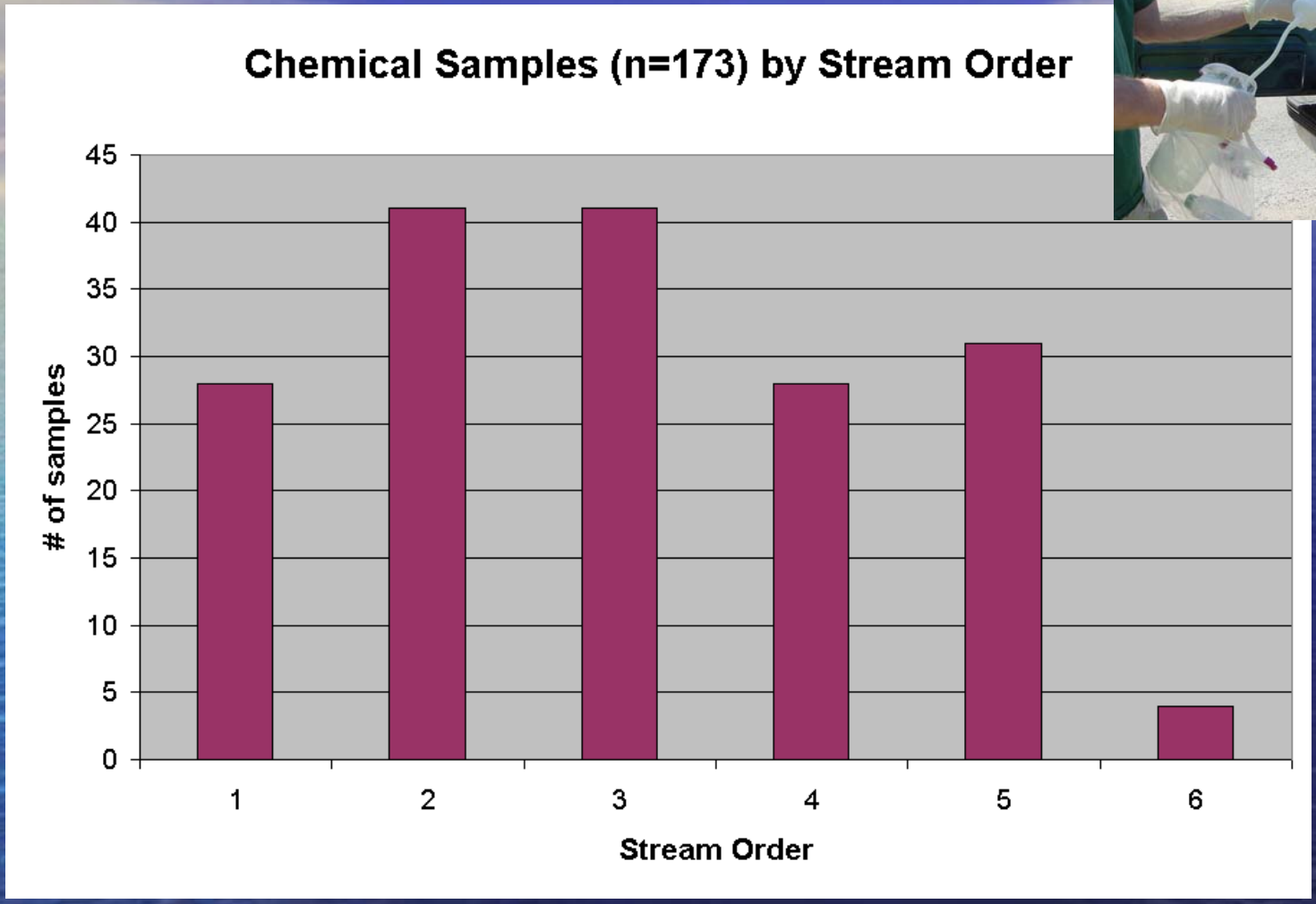
Study Update - Year 3



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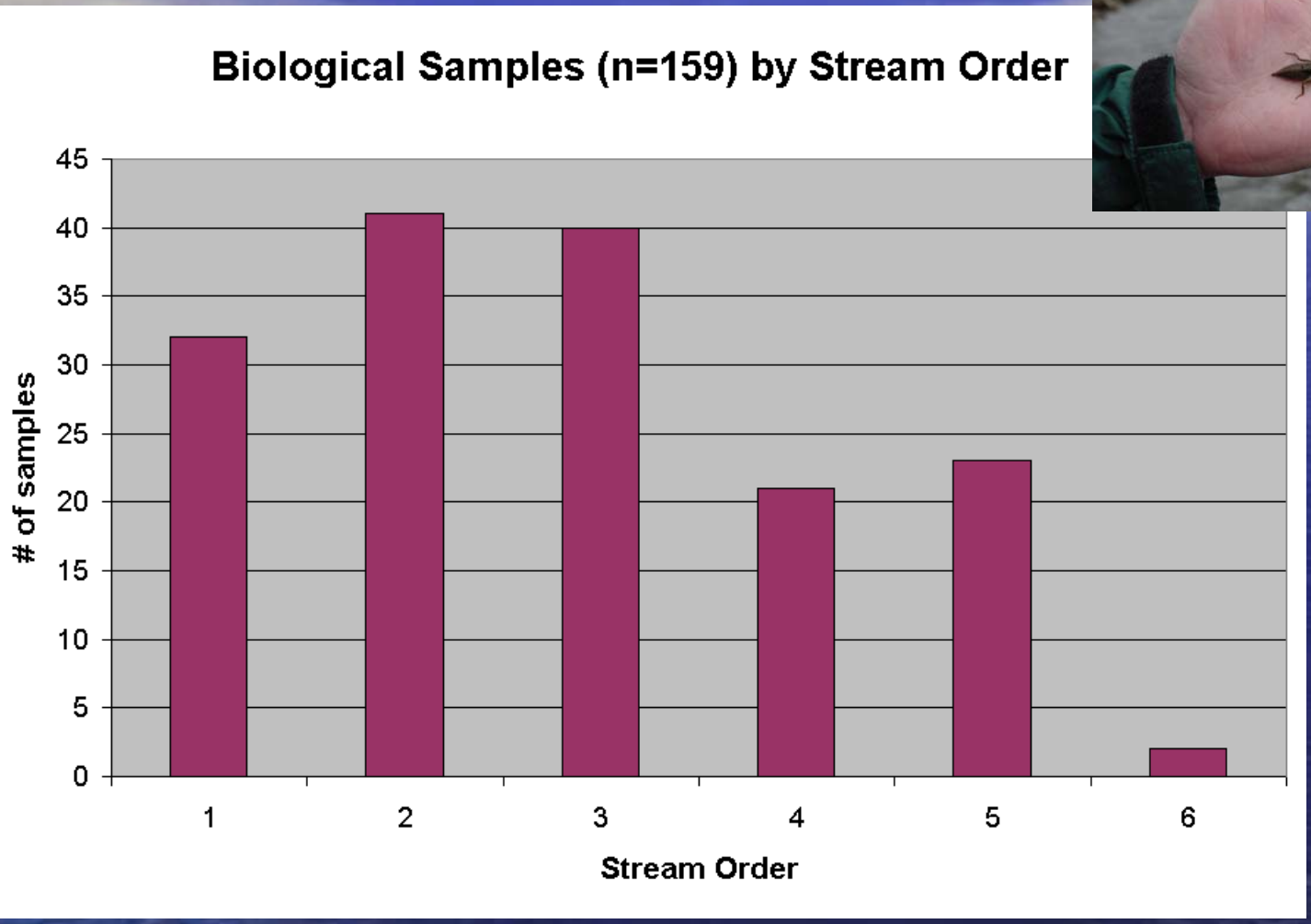
Study Update - Year 3



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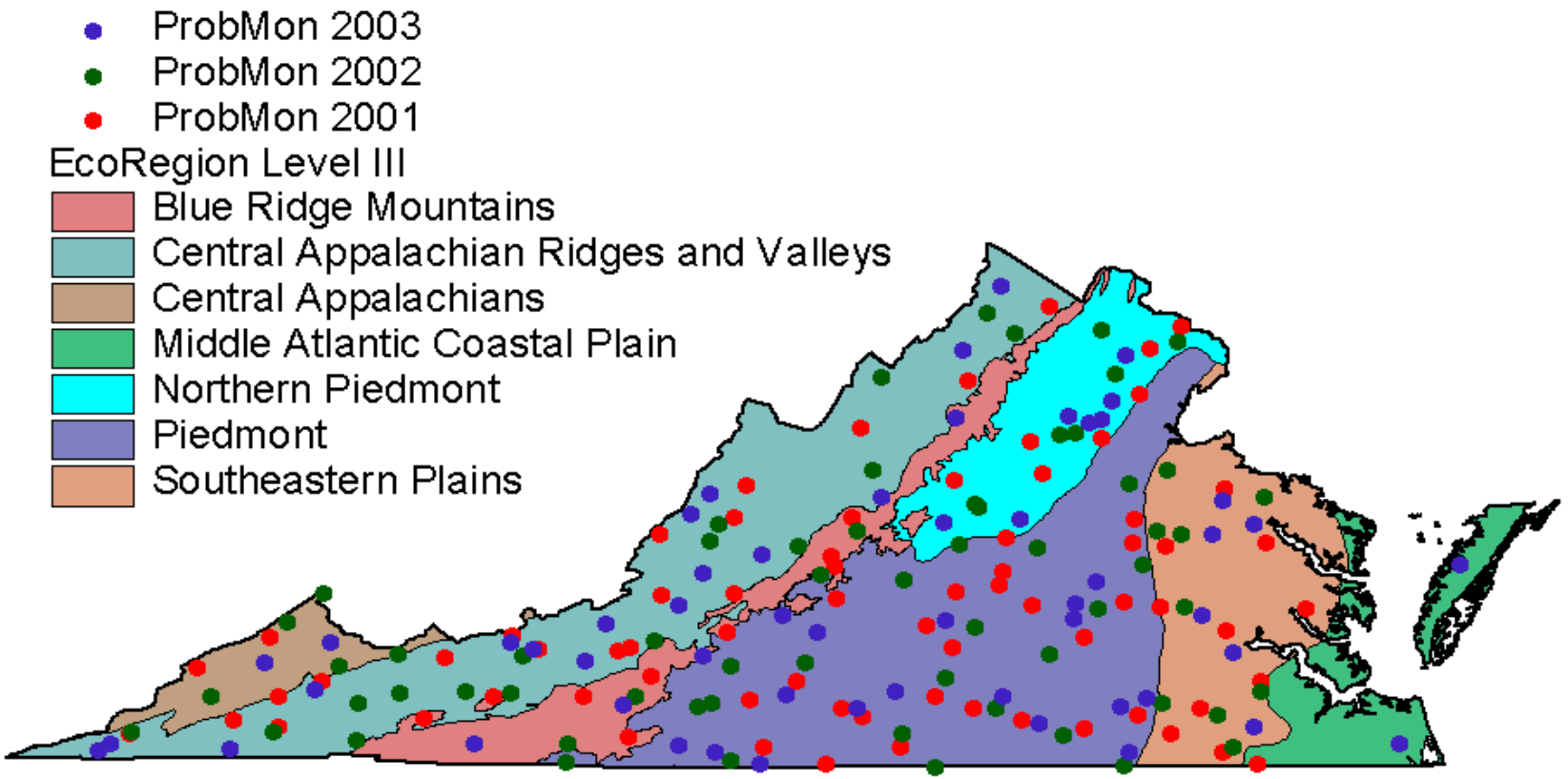
Station Locations



200 0 200 Miles

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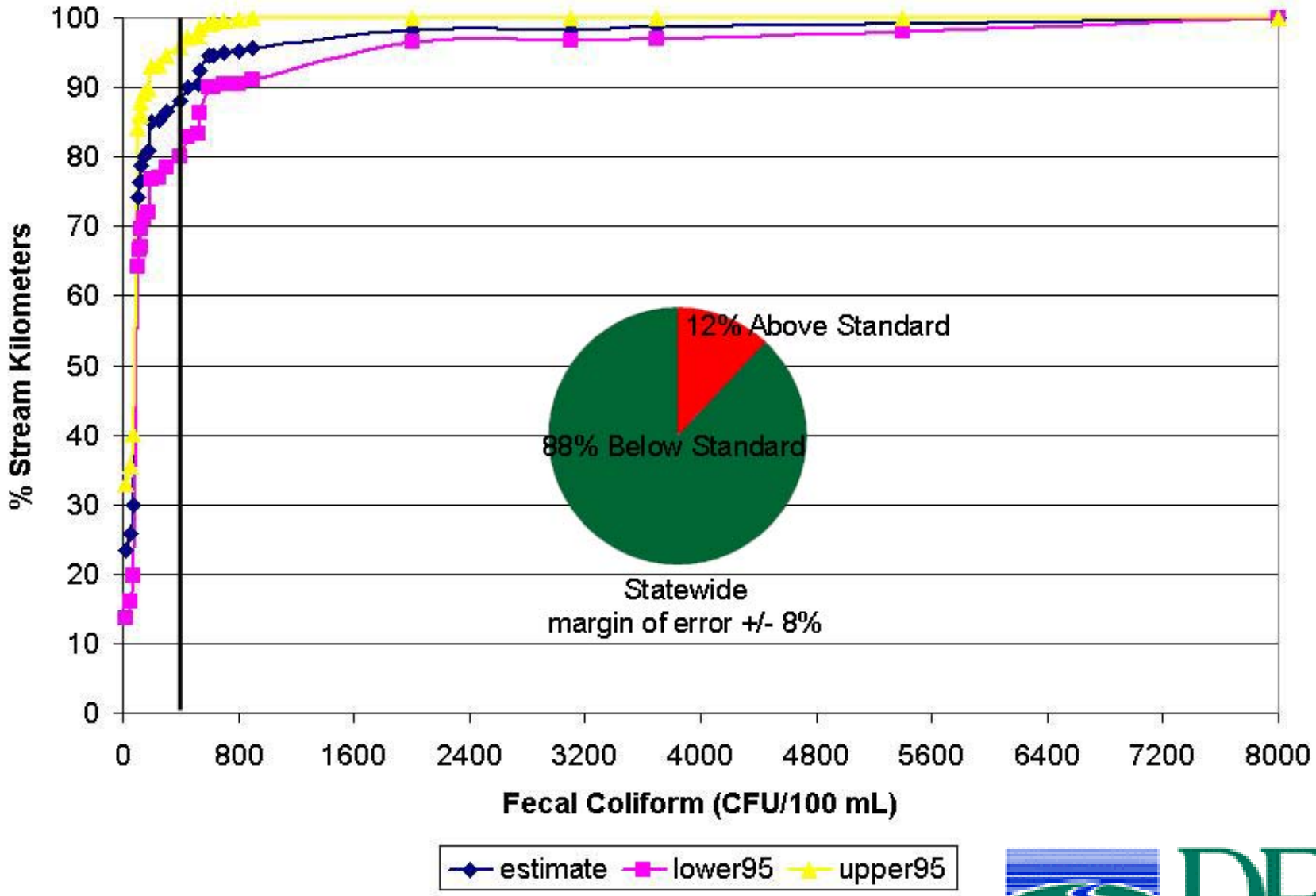
Study Results - Fecal Coliform (n=172)



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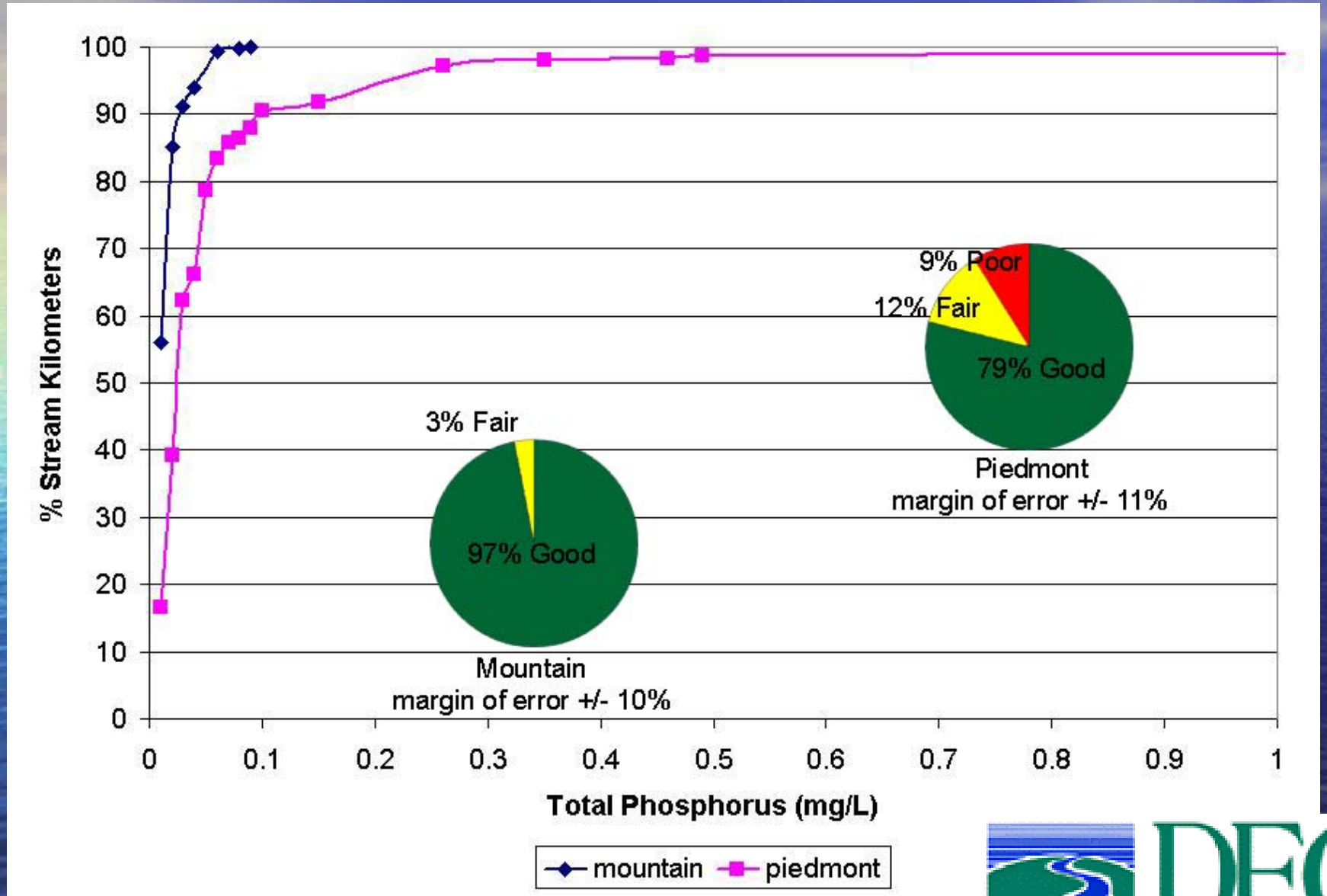
Study Results - Total Phosphorus (n=173)



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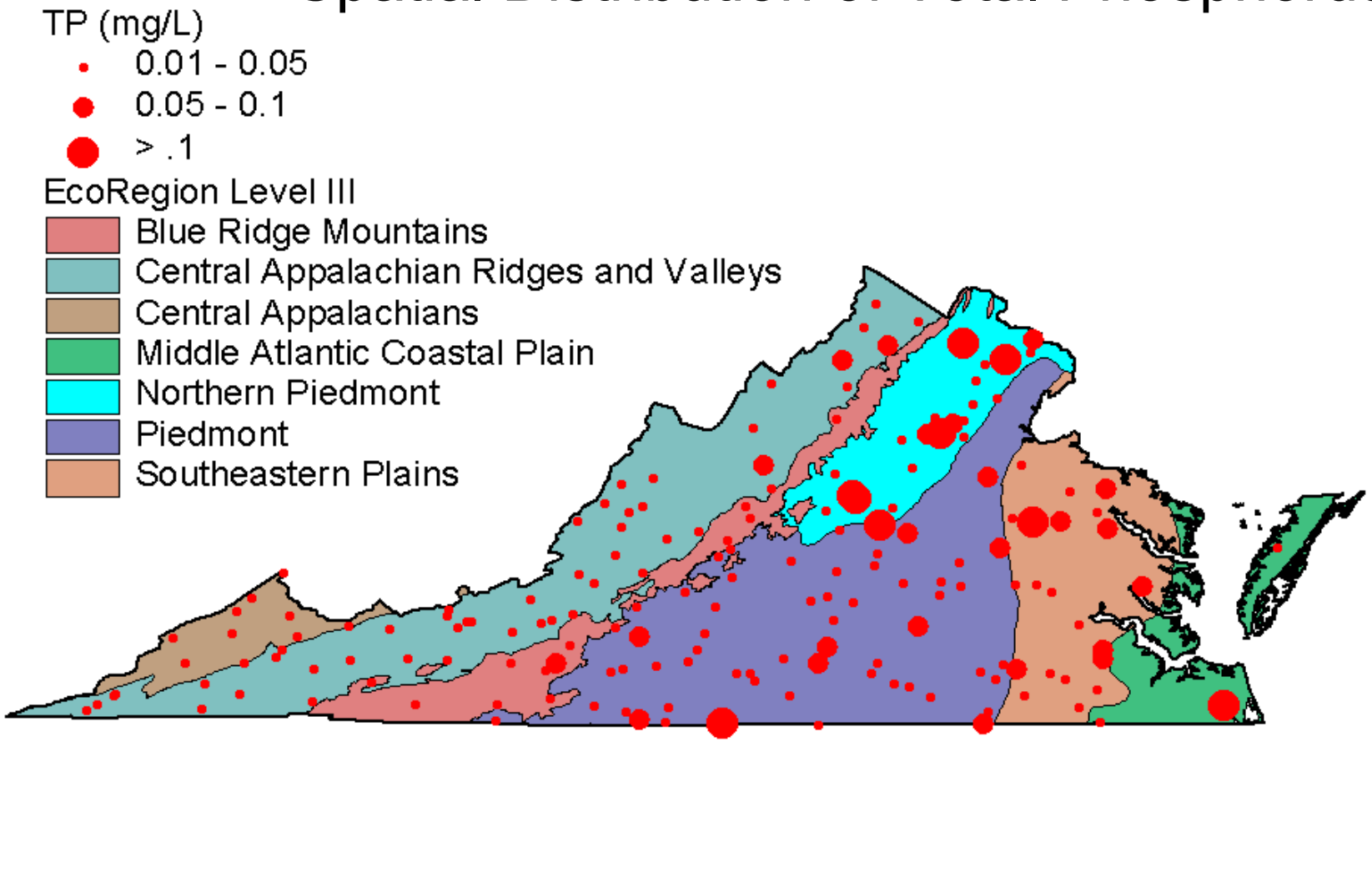
Spatial Distribution of Total Phosphorus



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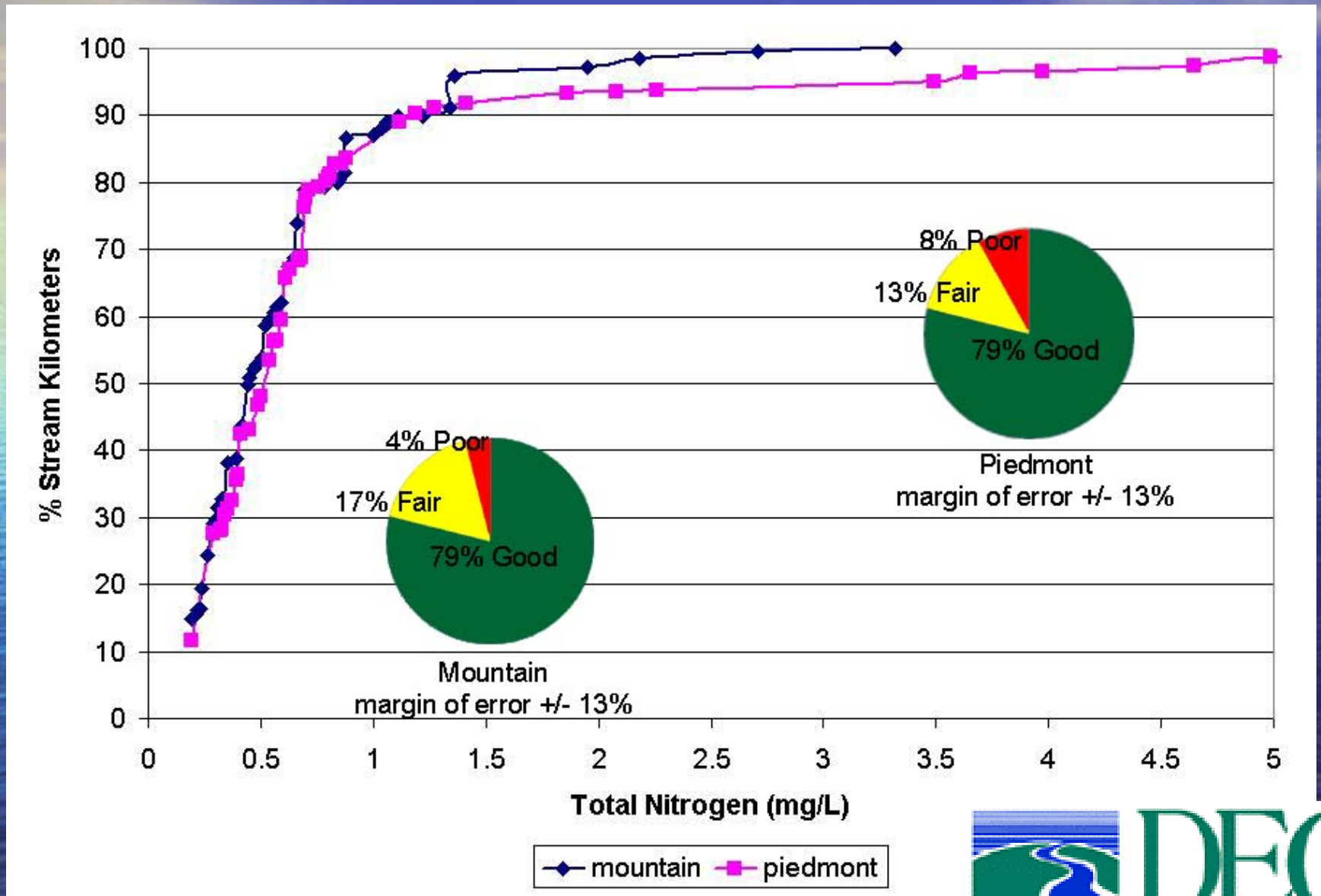
Study Results -Total Nitrogen (n=173)



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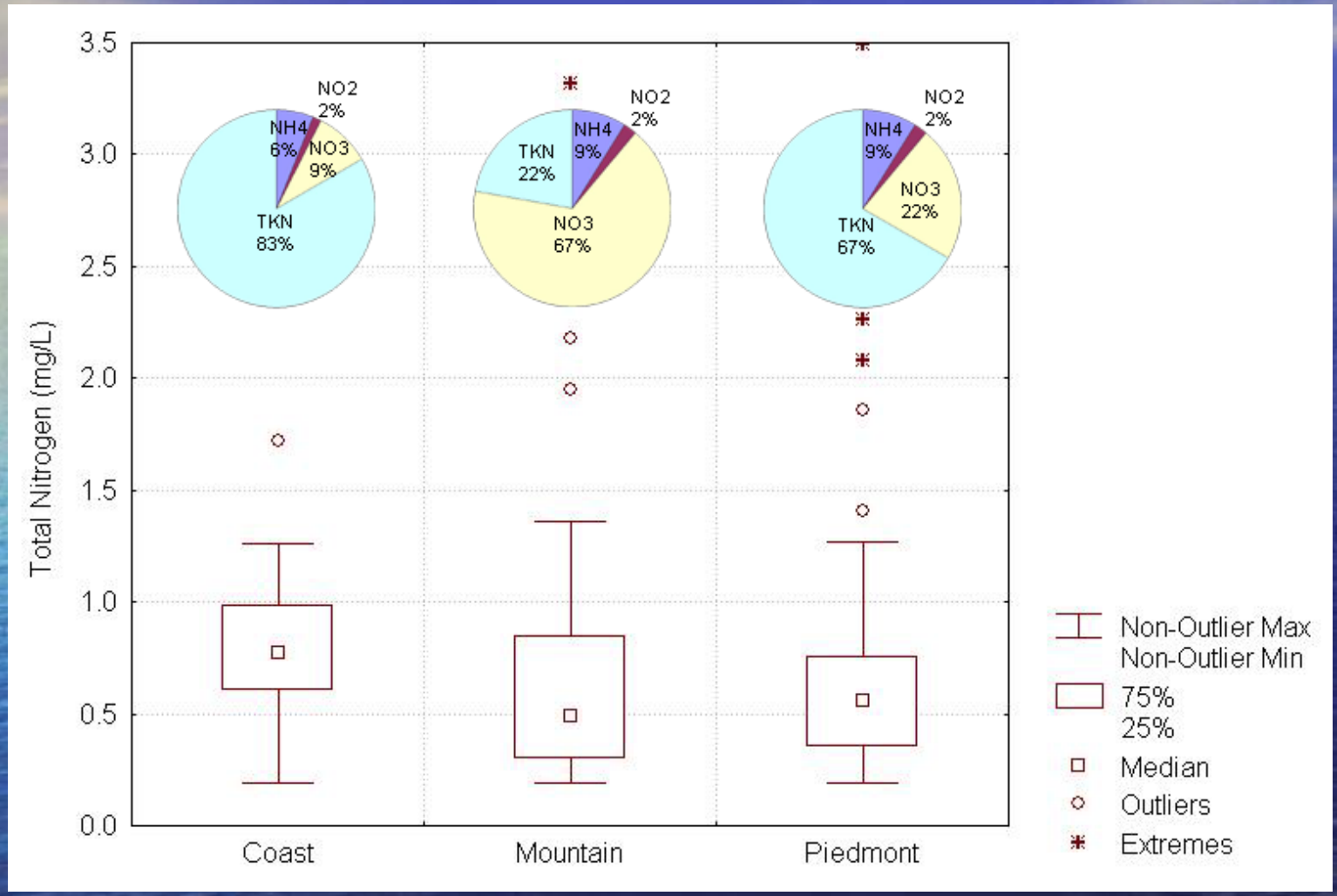
Study Results -Total Nitrogen by EcoRegion



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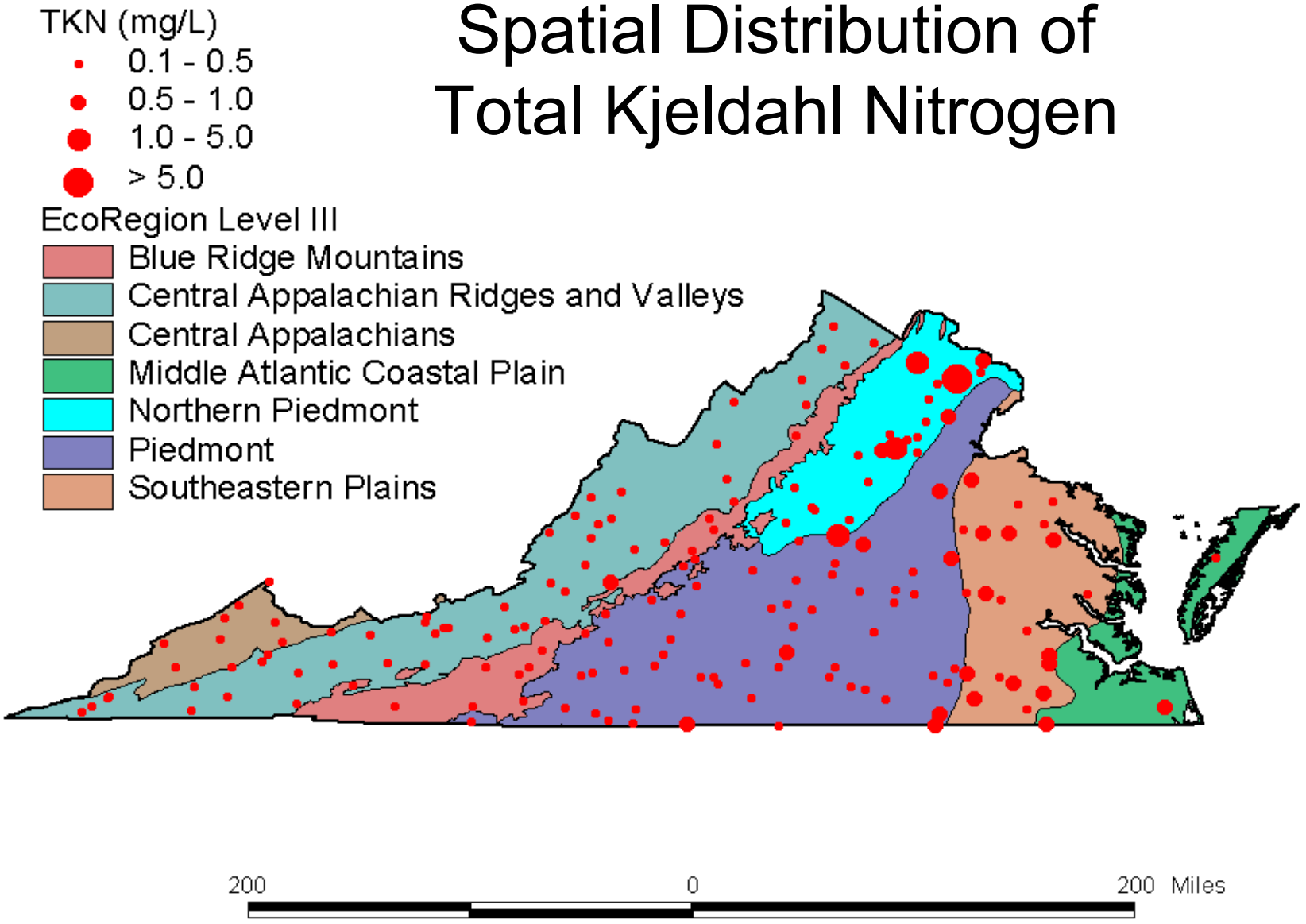
Spatial Distribution of Total Kjeldahl Nitrogen



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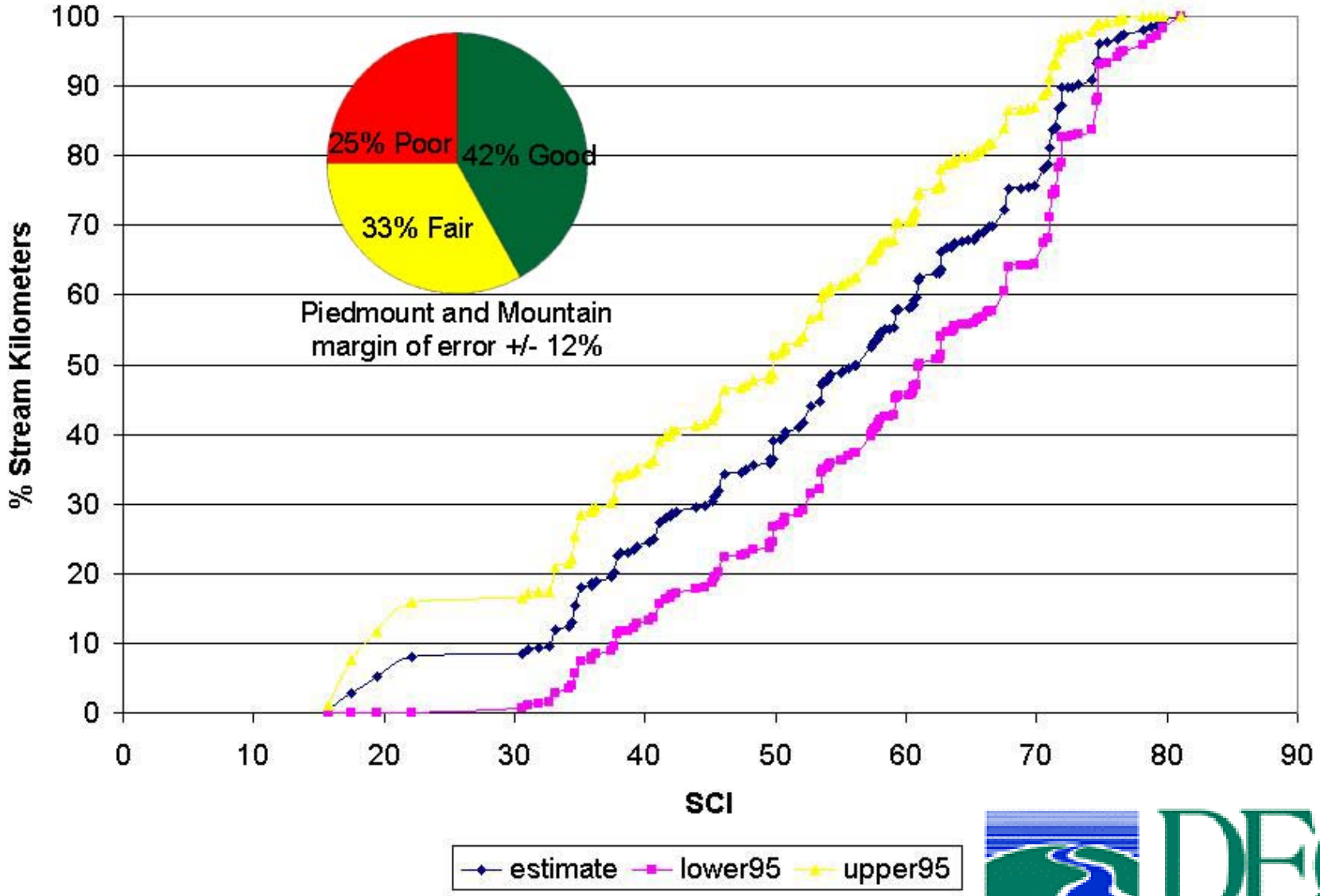
Study Results - 'draft' SCI (n=136)



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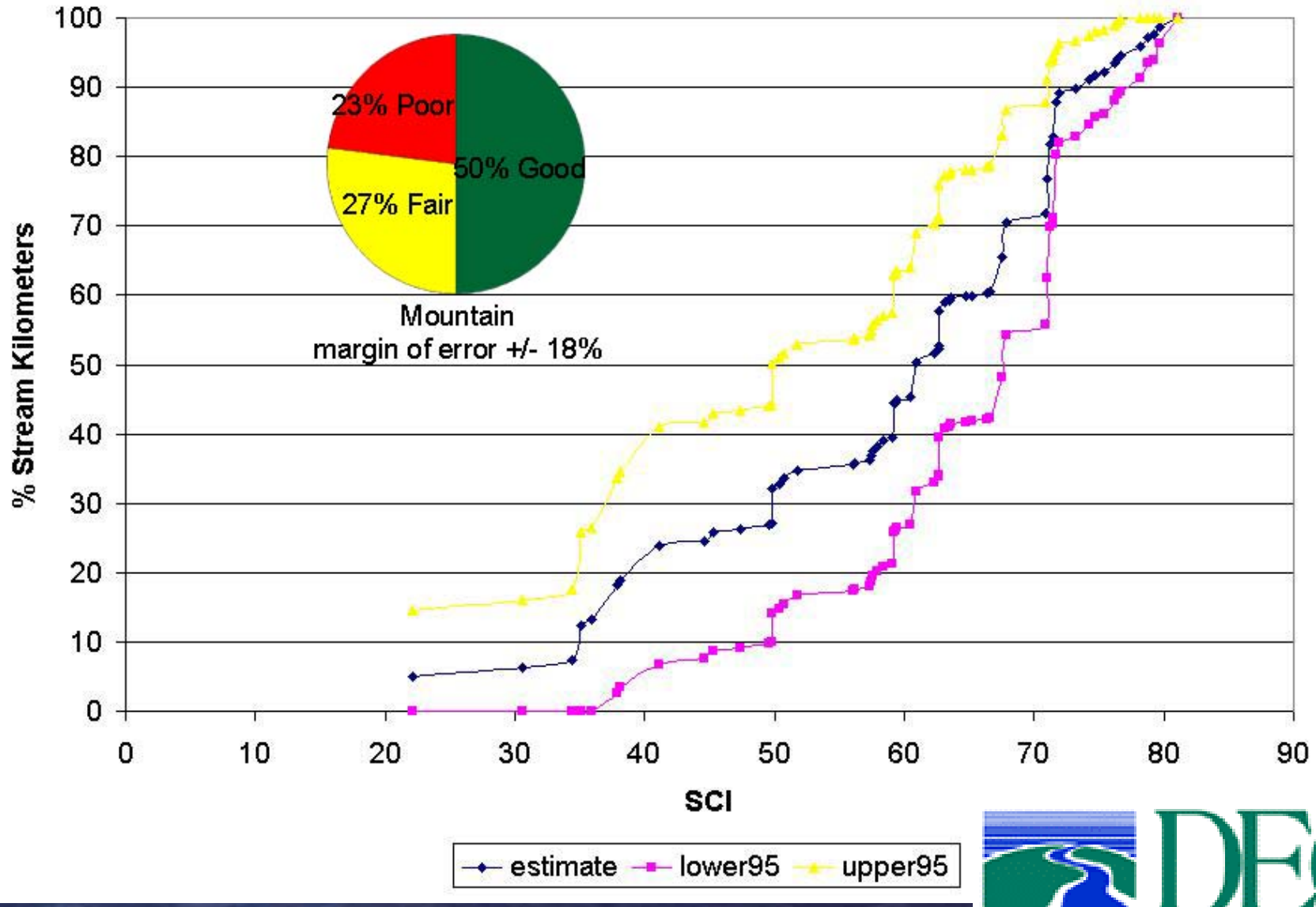
Study Results - ‘draft’ SCI Mountains (n=62)



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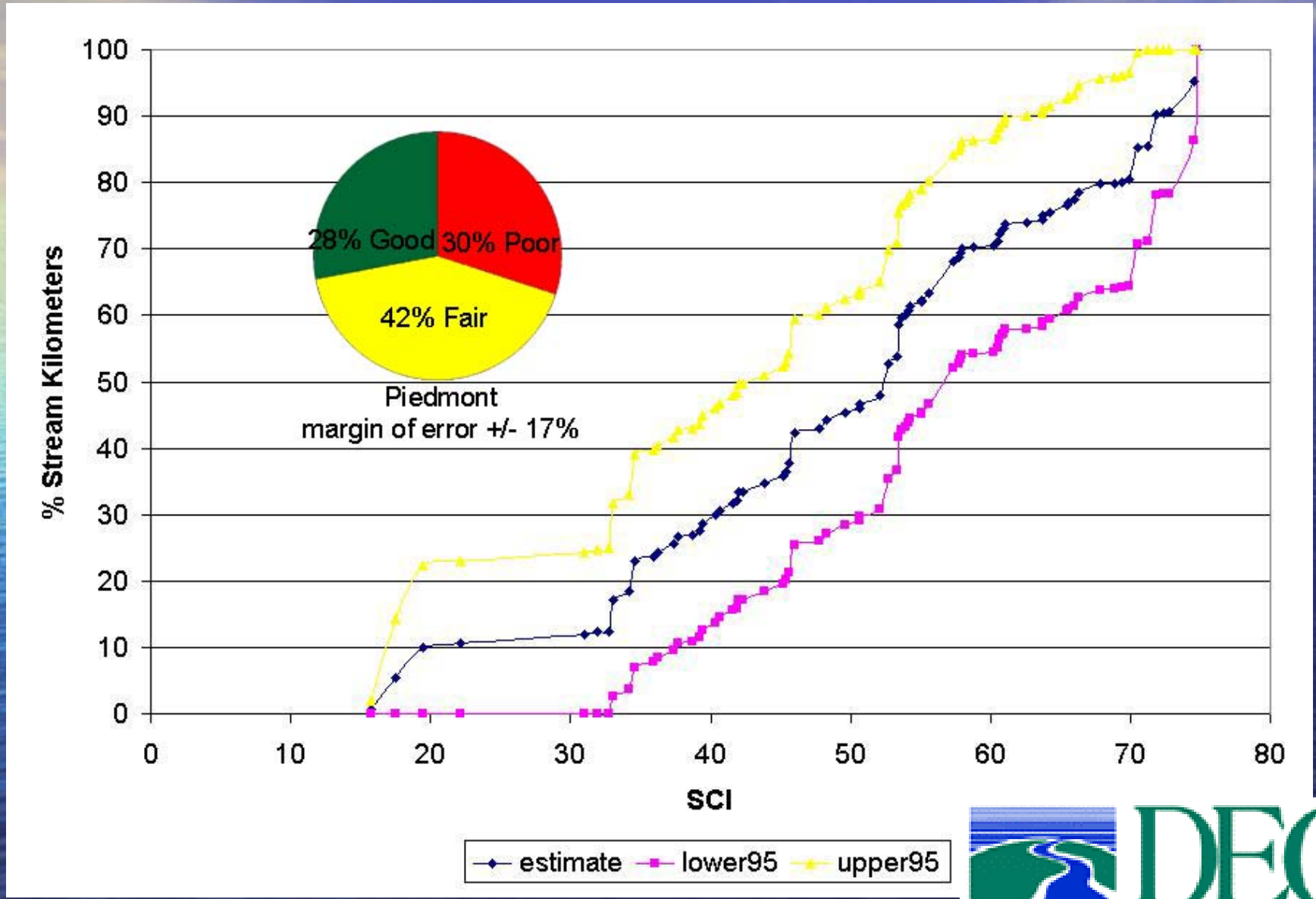
Study Results - ‘draft’ SCI Piedmont (n=74)



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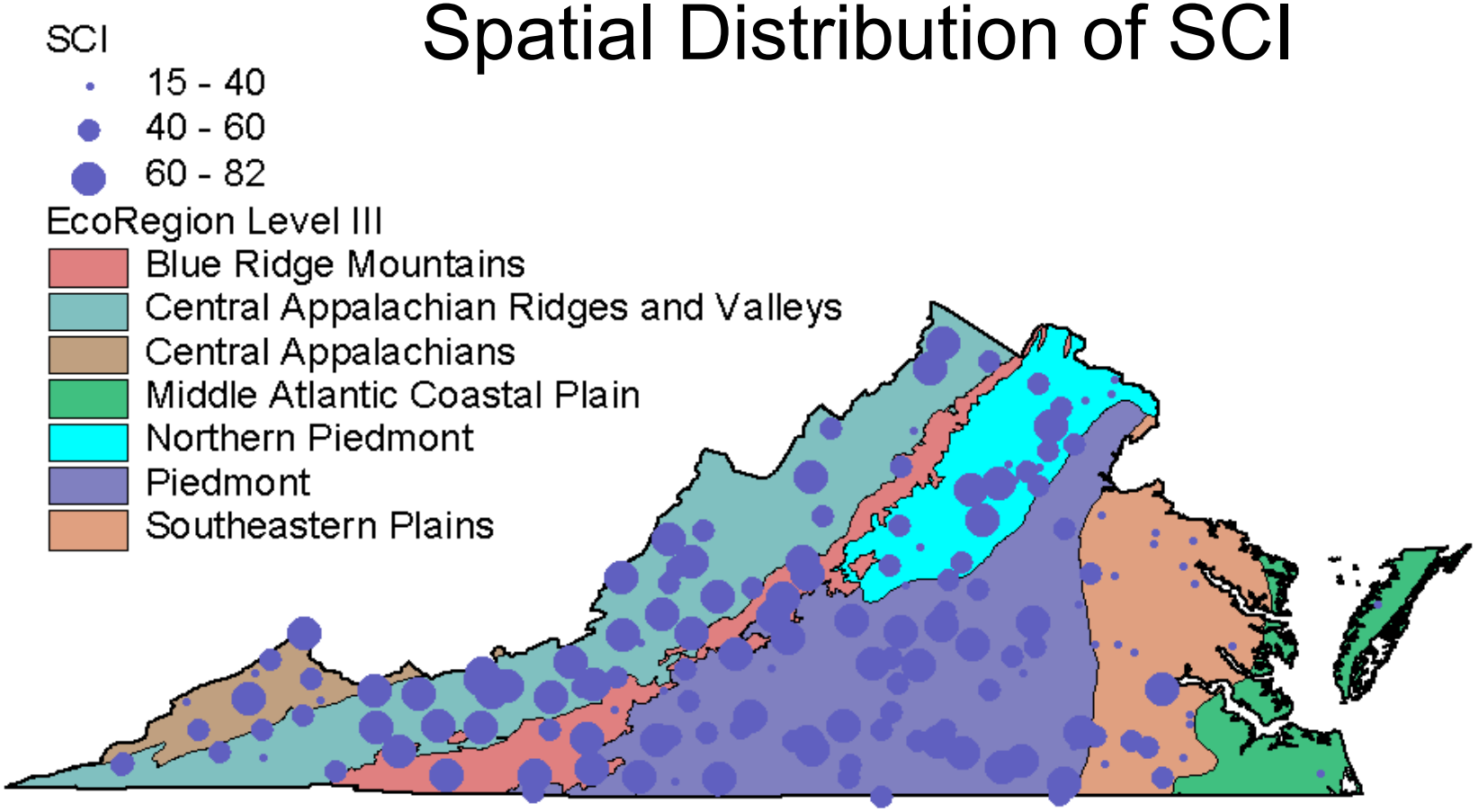
Spatial Distribution of SCI



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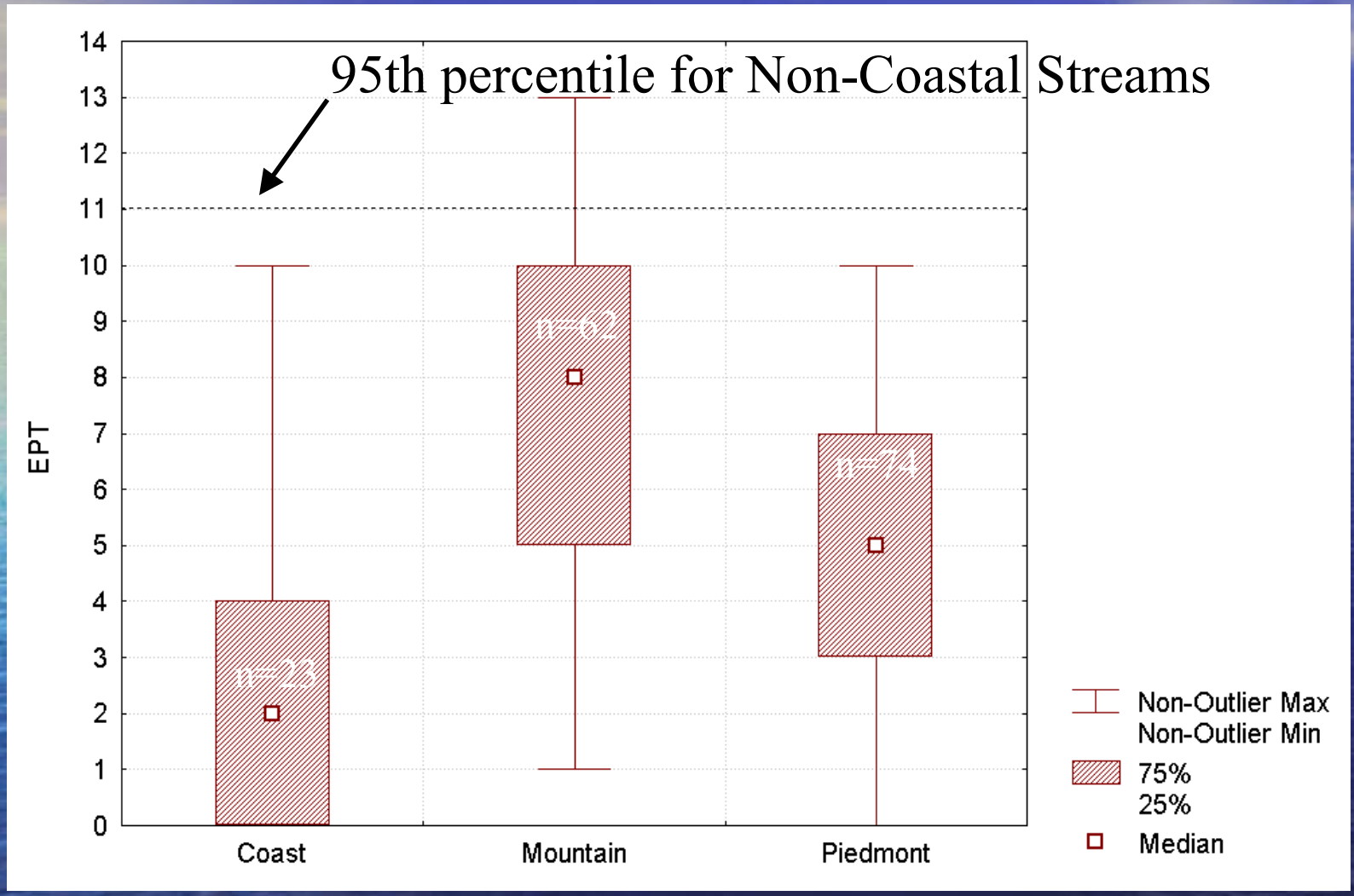
Study Results - Biological



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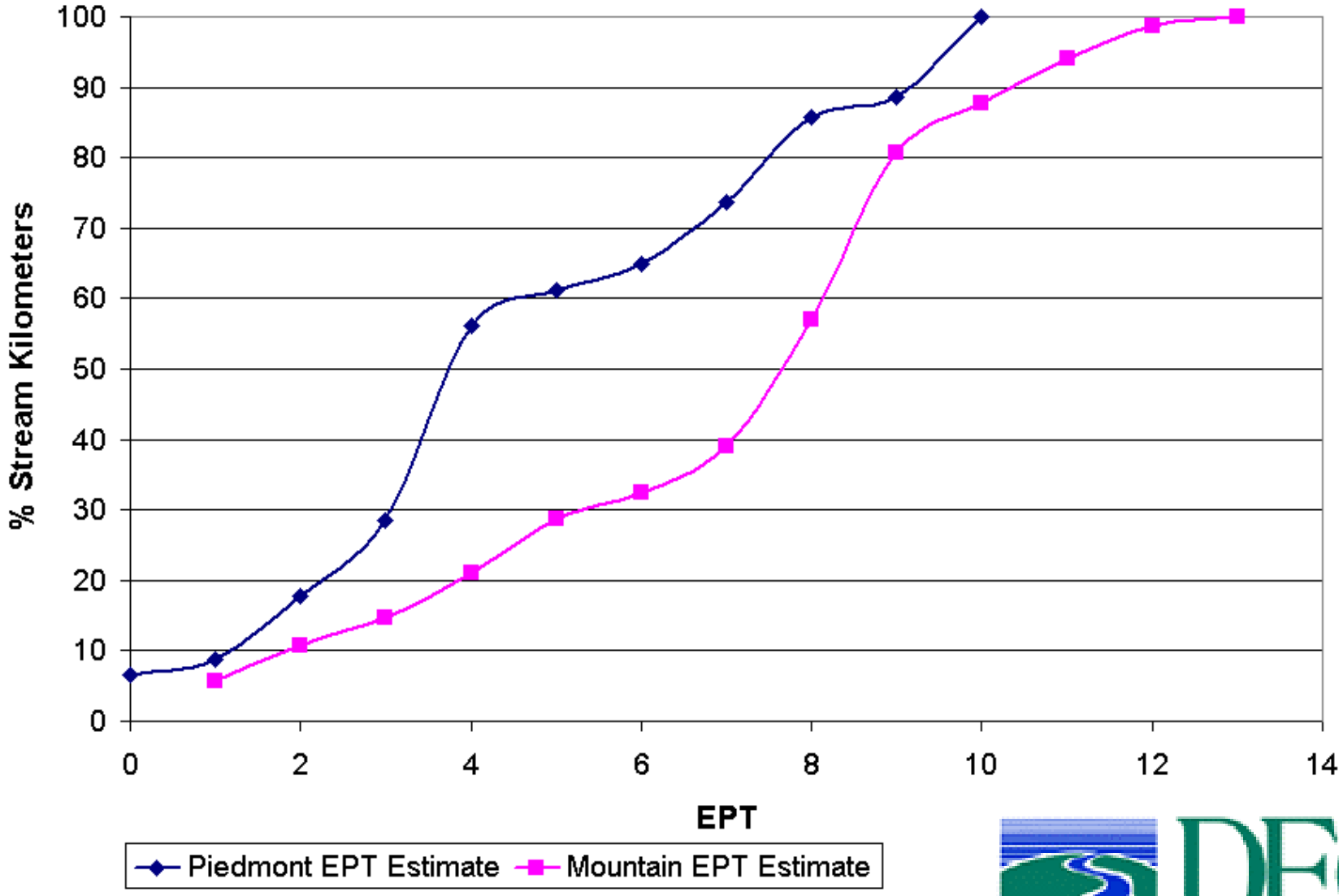
Study Results - EPT (Mountain n=62; Piedmont n=74)



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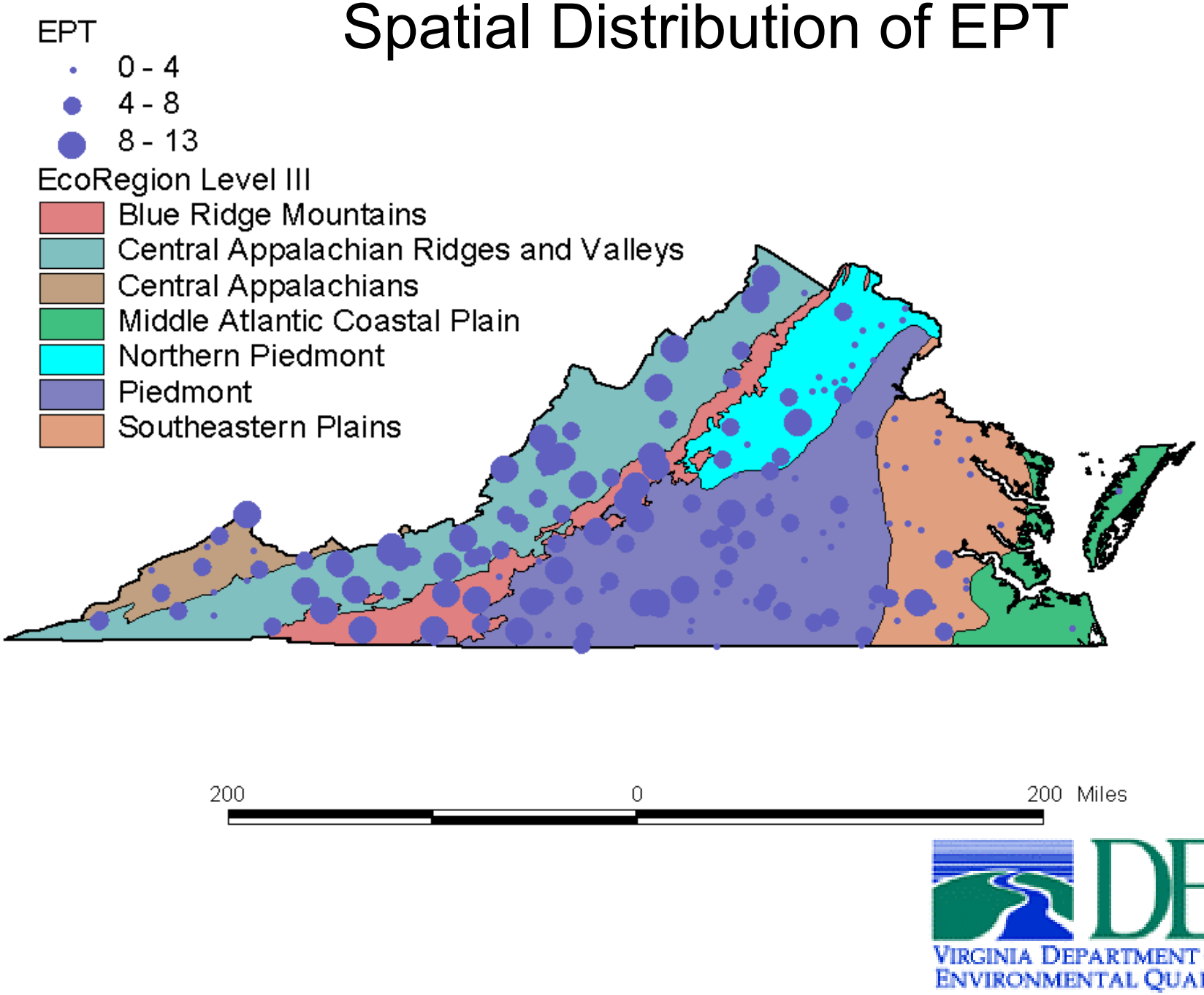
Spatial Distribution of EPT



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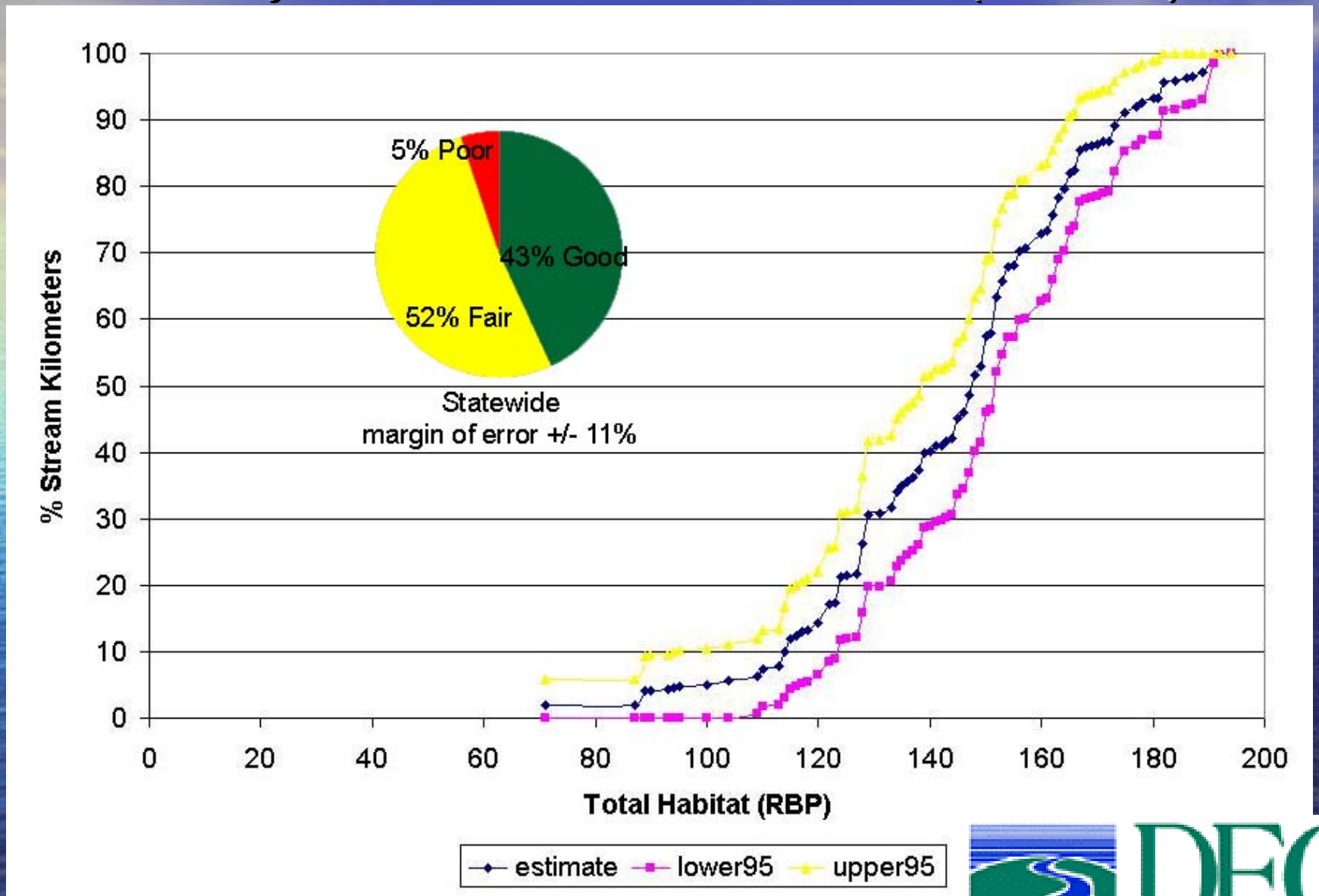
Variability in Headwater Stream Landuse/Settings

Study Results - Habitat RBP (n=157)



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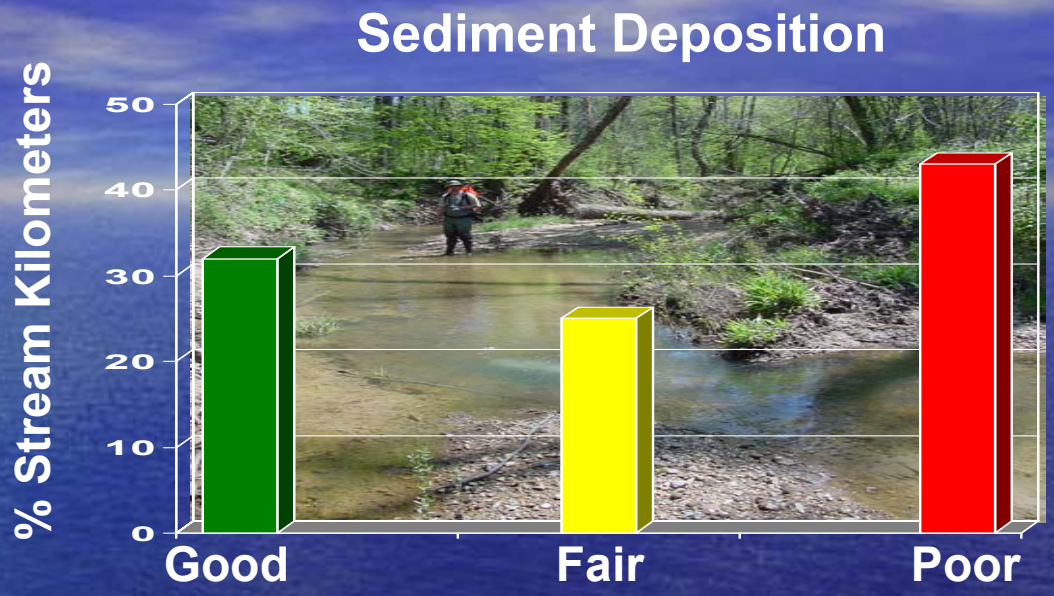
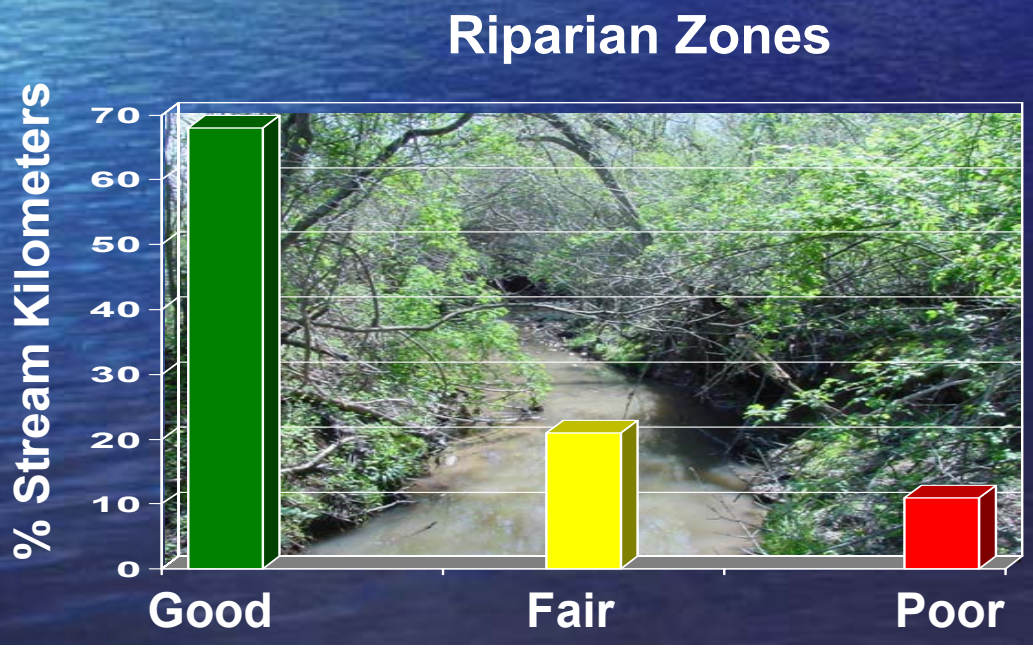
Study Results - Habitat RBP (n=157)





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Uses of ProbMon Data

- Status of all rivers and streams in Virginia
    - A tool to evaluate effectiveness of TMDL and other NPS pollution programs
- Enhance stressor analysis for biological TMDL studies
- Evaluate impact of new standards
- Provide data for new standards
- Provide data to refine SCI

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ProbMon Partnerships

- USGS & SPMDs (Virtual Guppies)
- Virginia Tech to survey fish communities at ProbMon stations
- EPA - National Wadeable Streams Assessment
- Philadelphia Academy Sciences - Periphyton Index
- Public Outreach Tool

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Future Goals

- Make probabilistic monitoring a permanent monitoring tool in Virginia
- Report on the status of all Virginia's rivers and streams to policy-makers and the general public
- Add a second biological indicator
- Appropriately Integrate into 305(b)/303(d) Report

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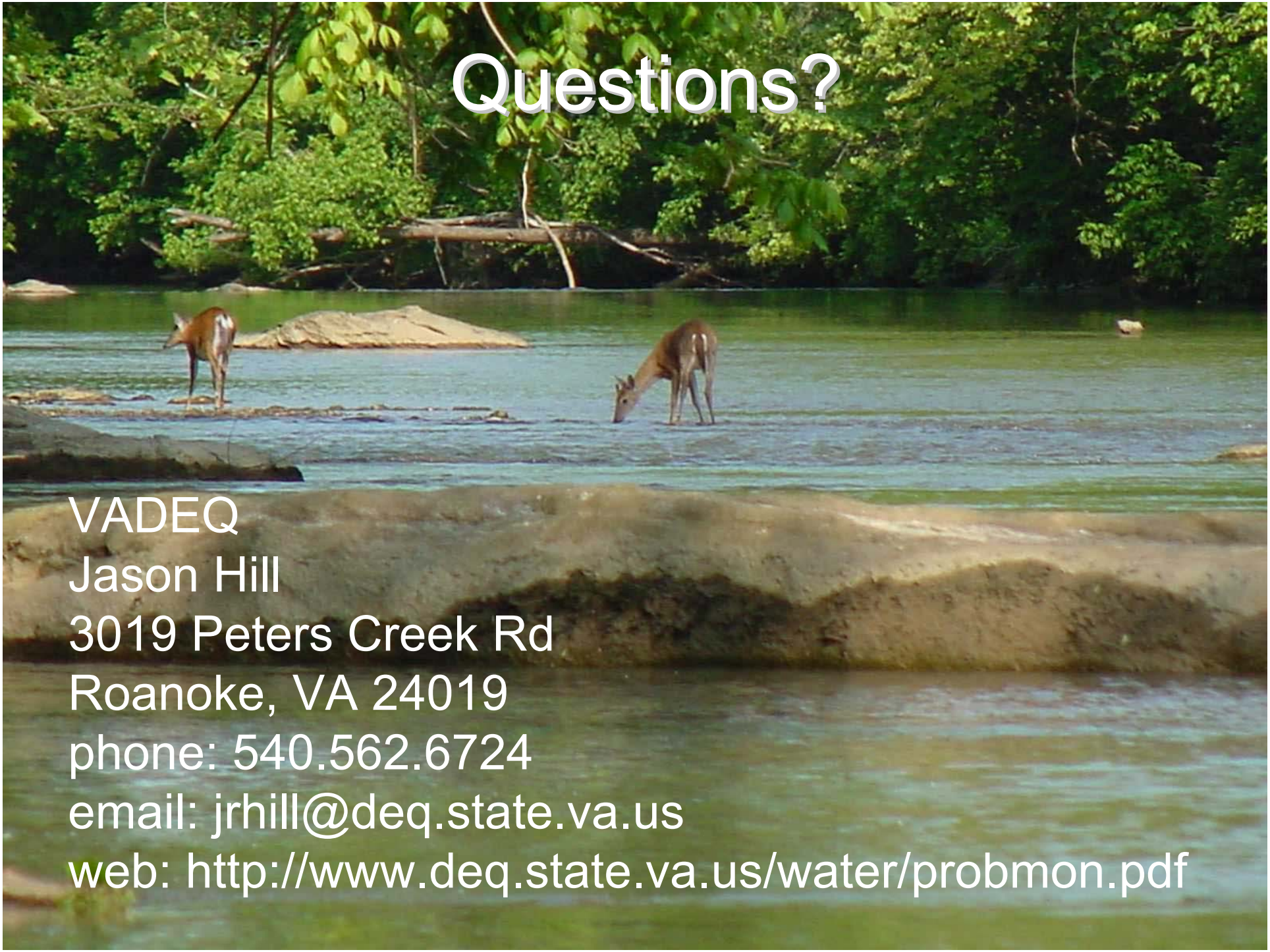

Questions?

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