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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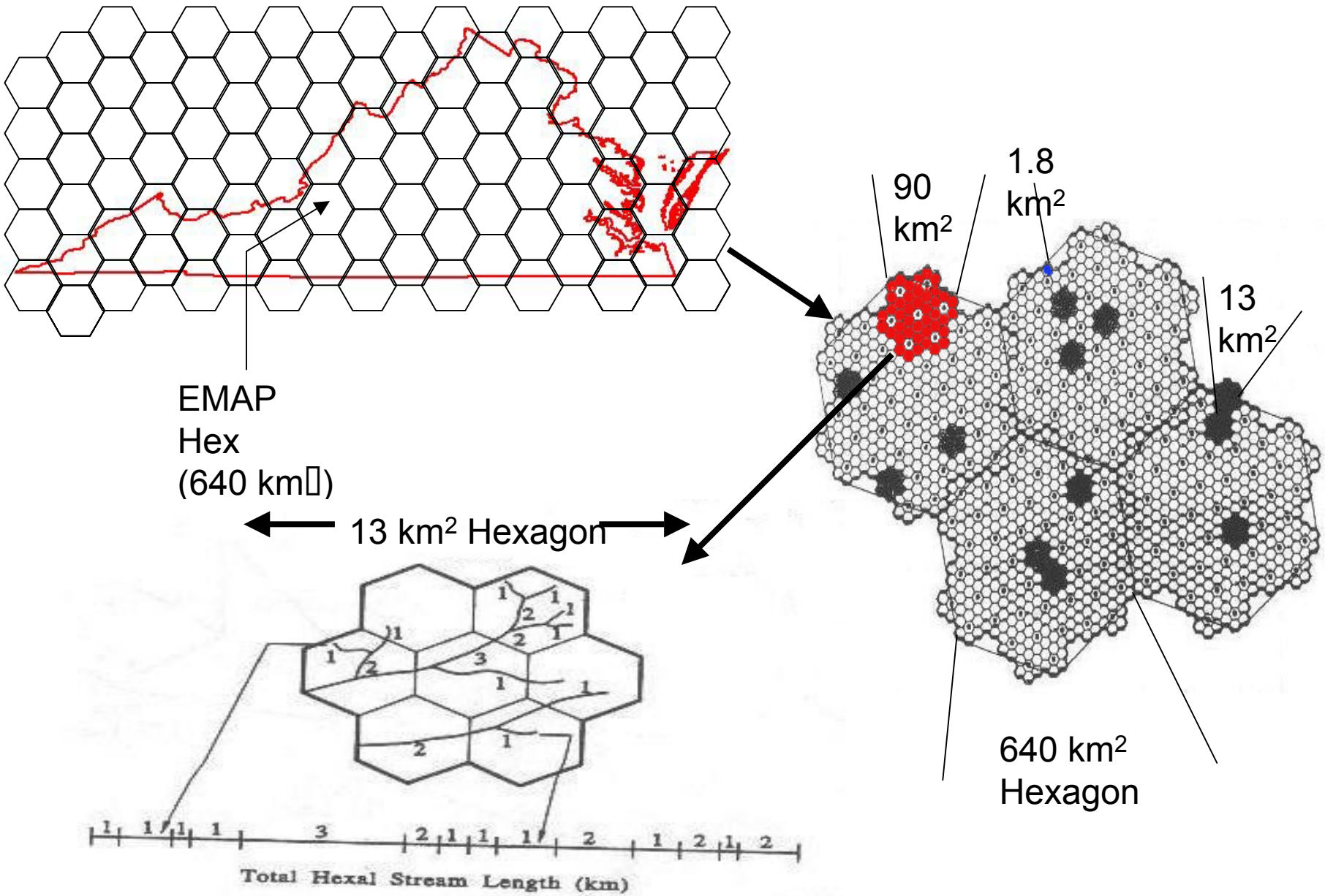
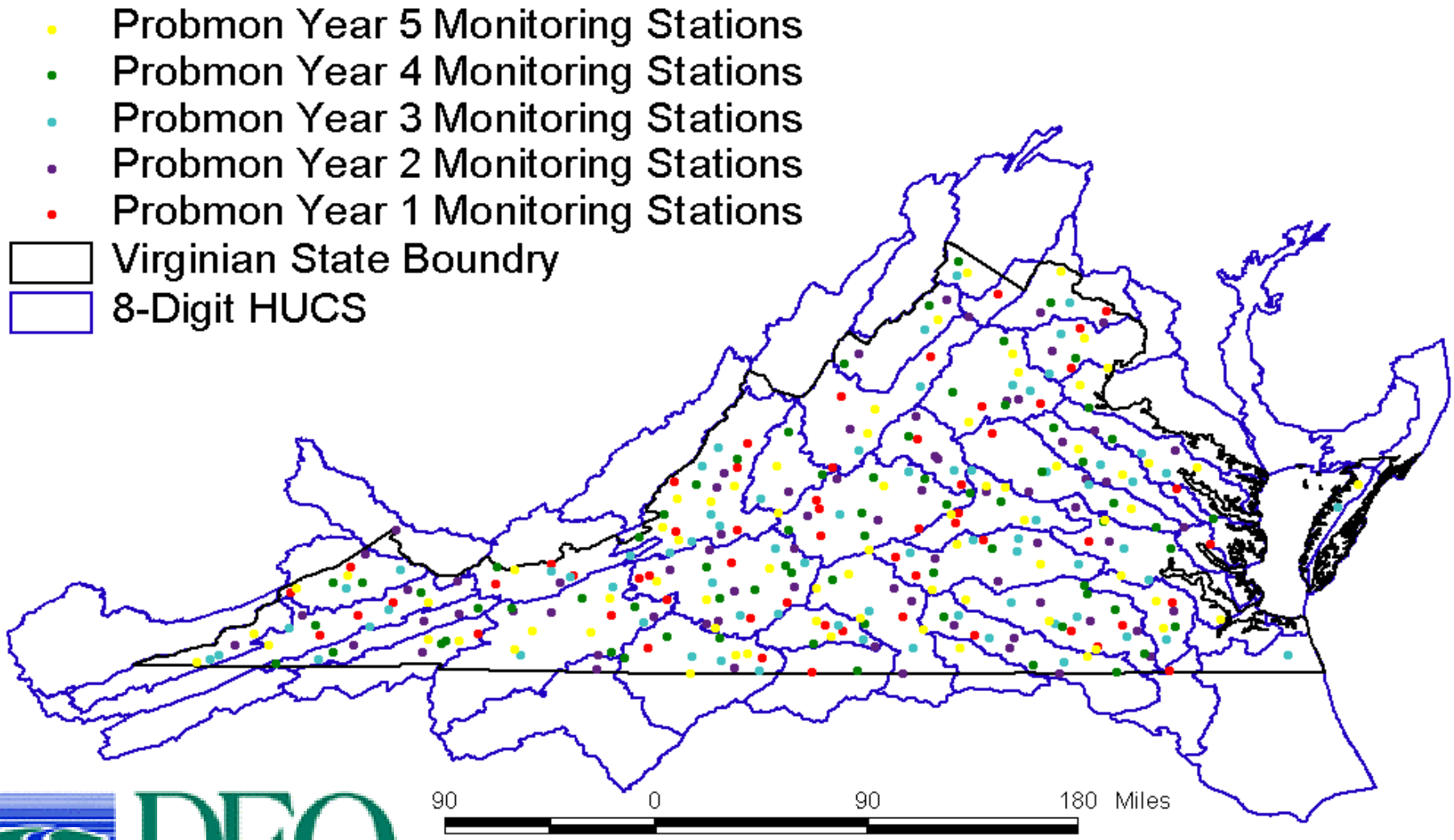
How Are Sites Randomly Selected?



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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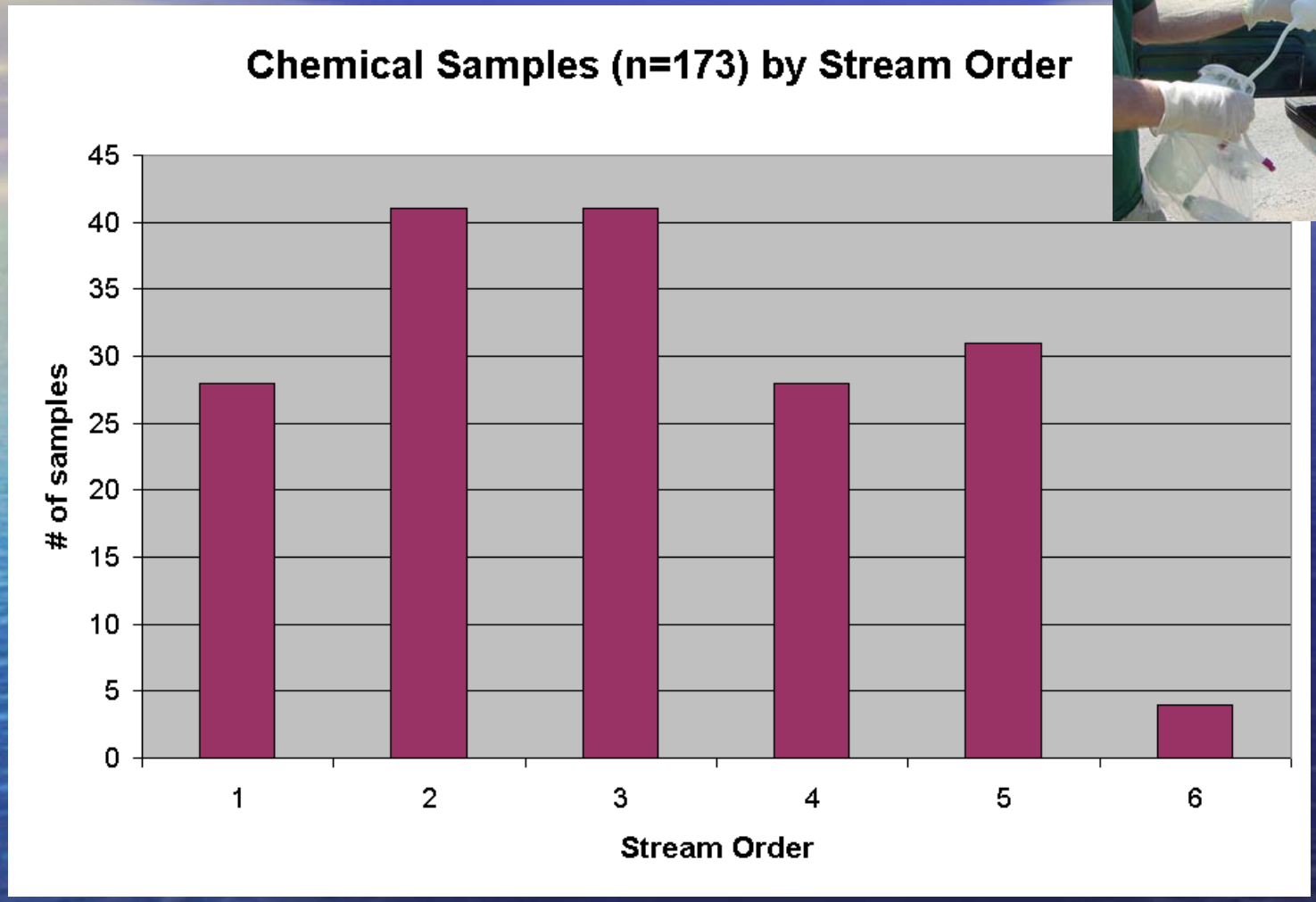
Study Update - Year 3



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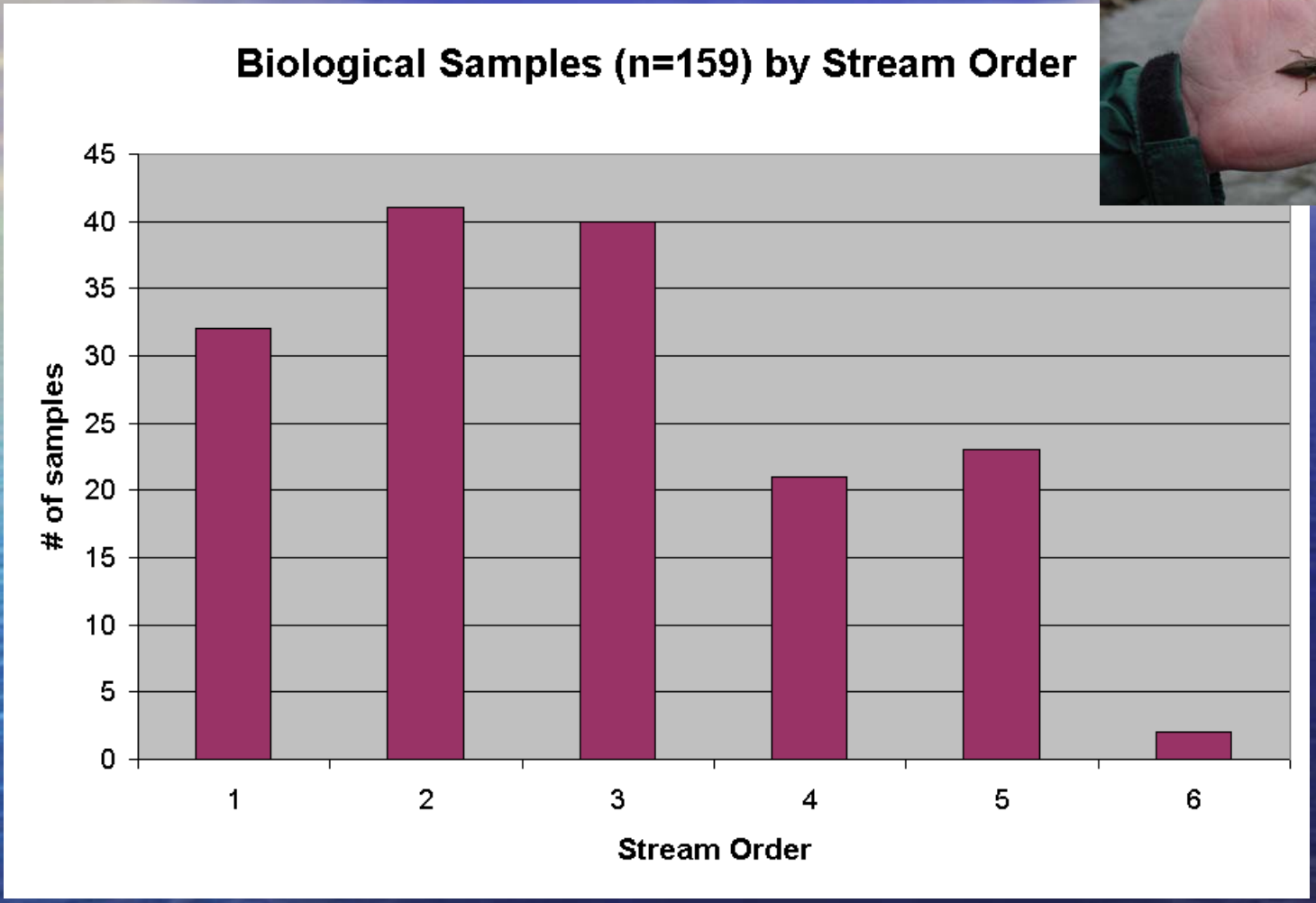
Study Update - Year 3



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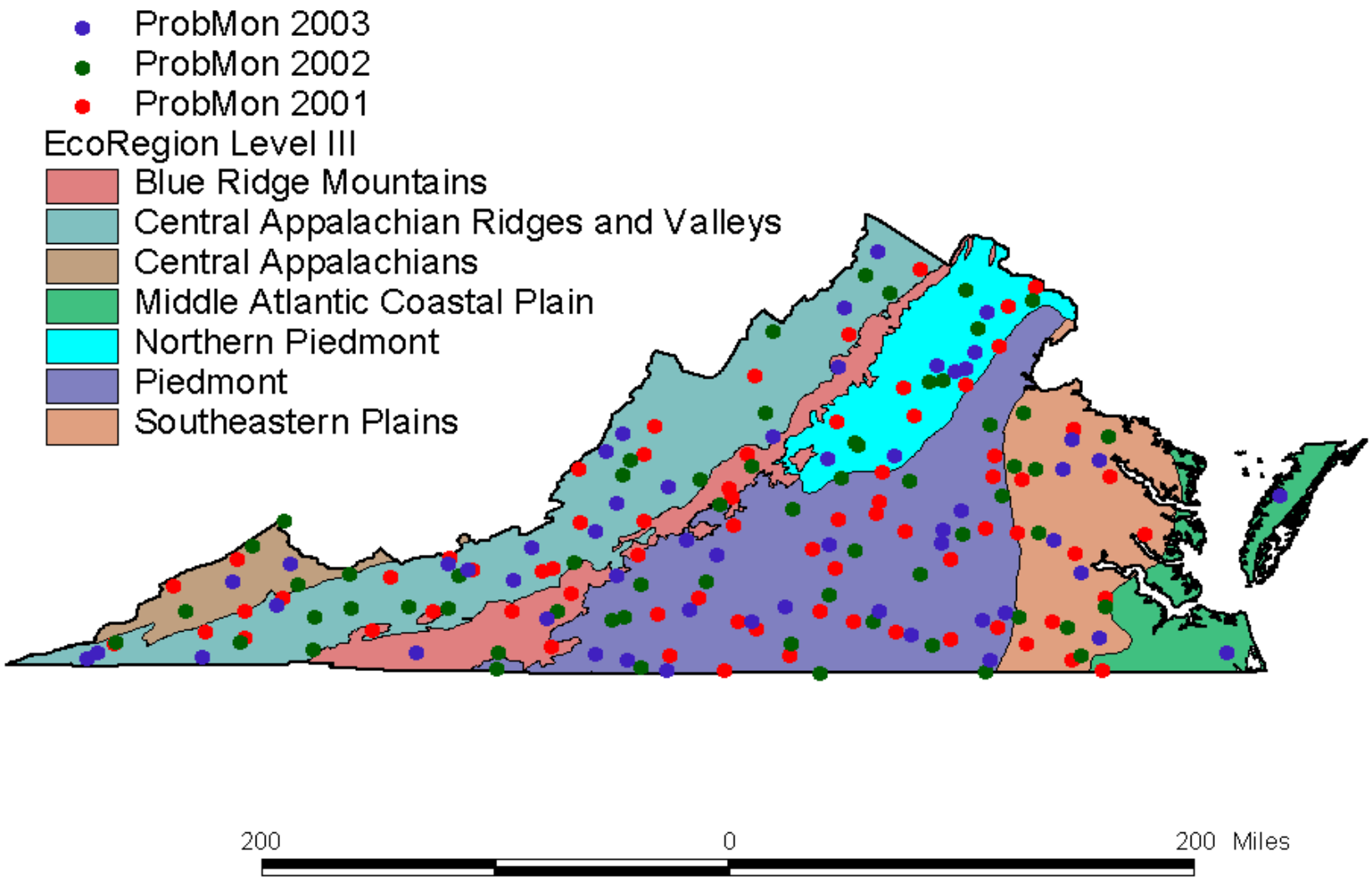
Station Locations



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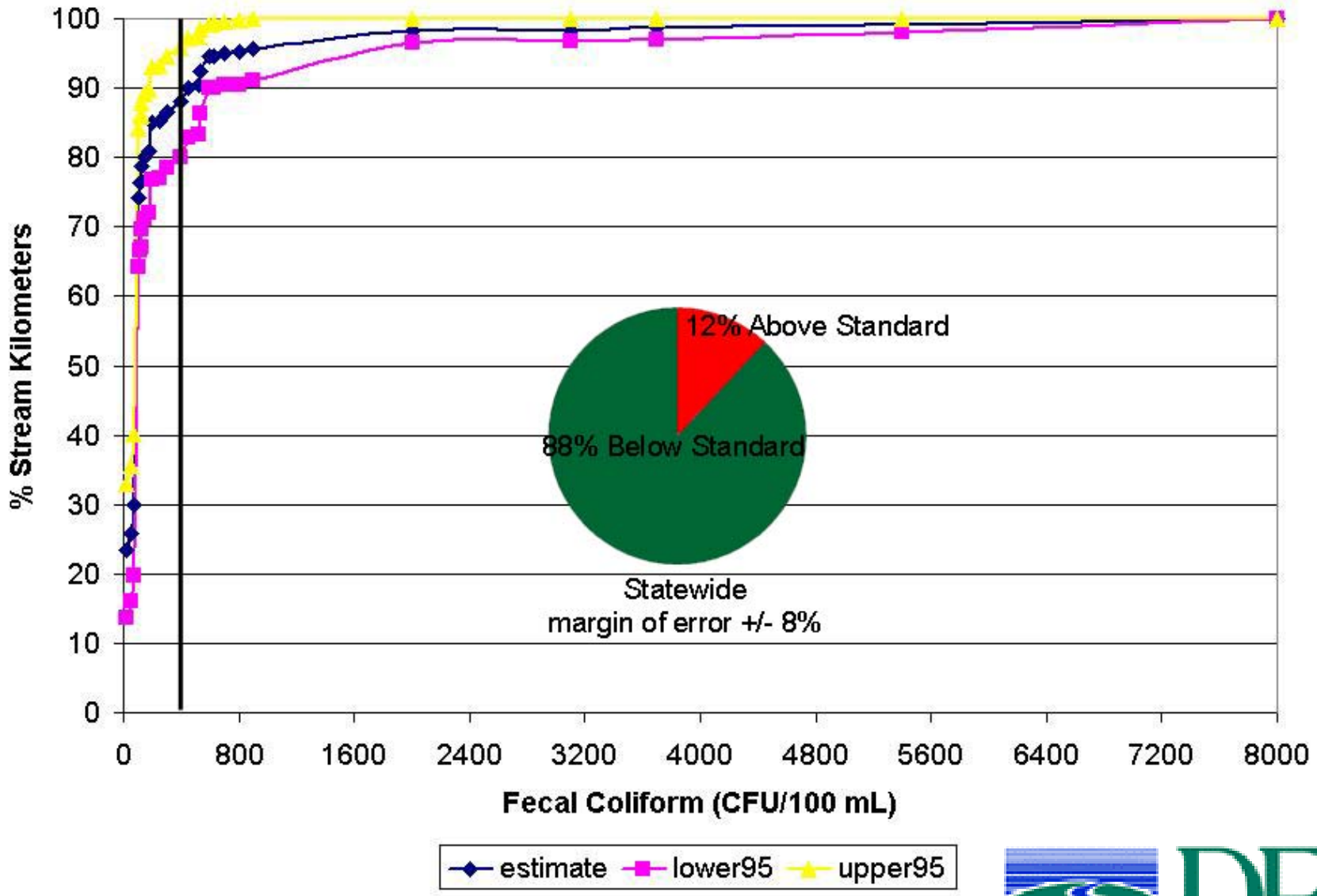
Study Results - Fecal Coliform (n=172)



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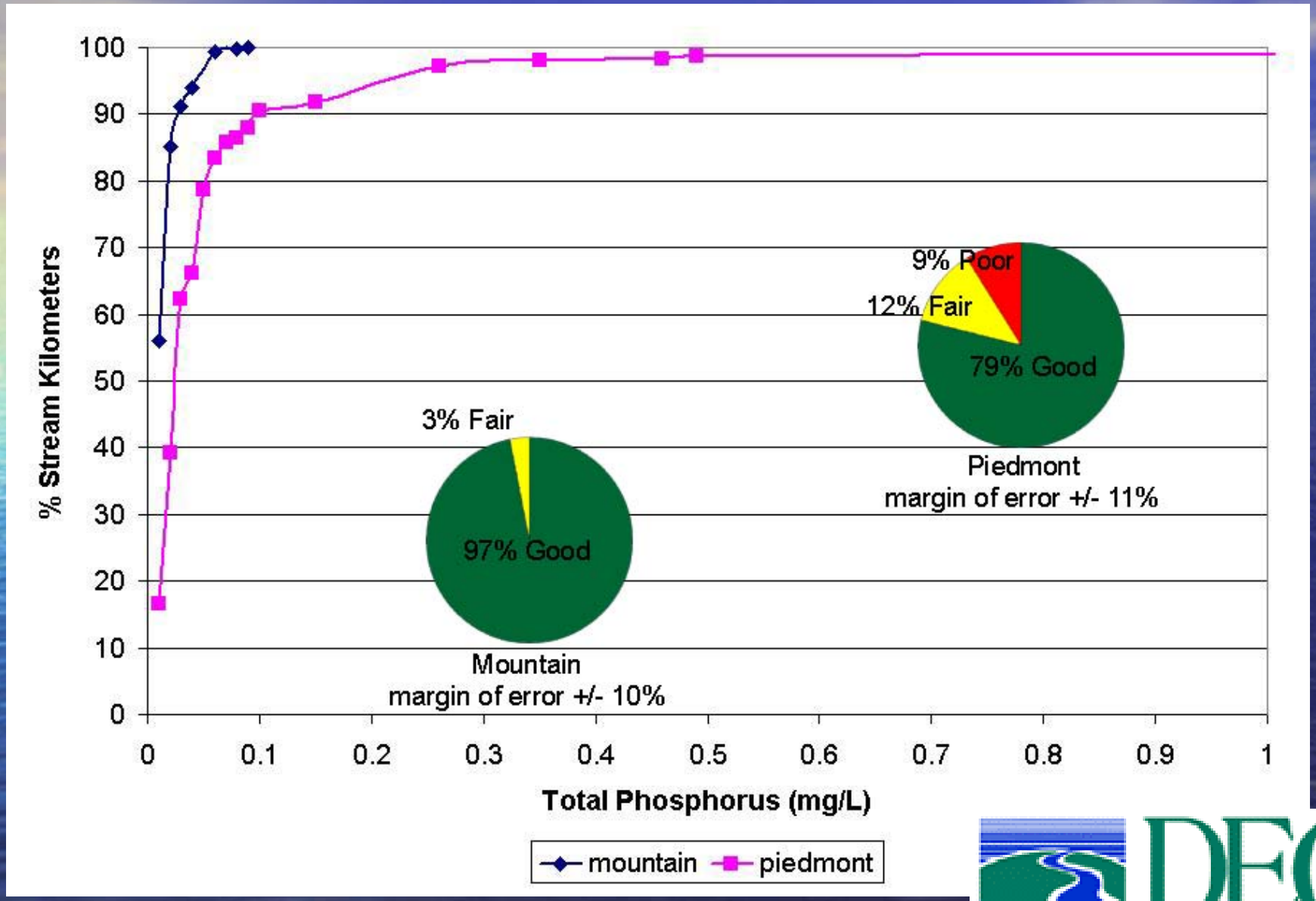
Study Results - Total Phosphorus (n=173)



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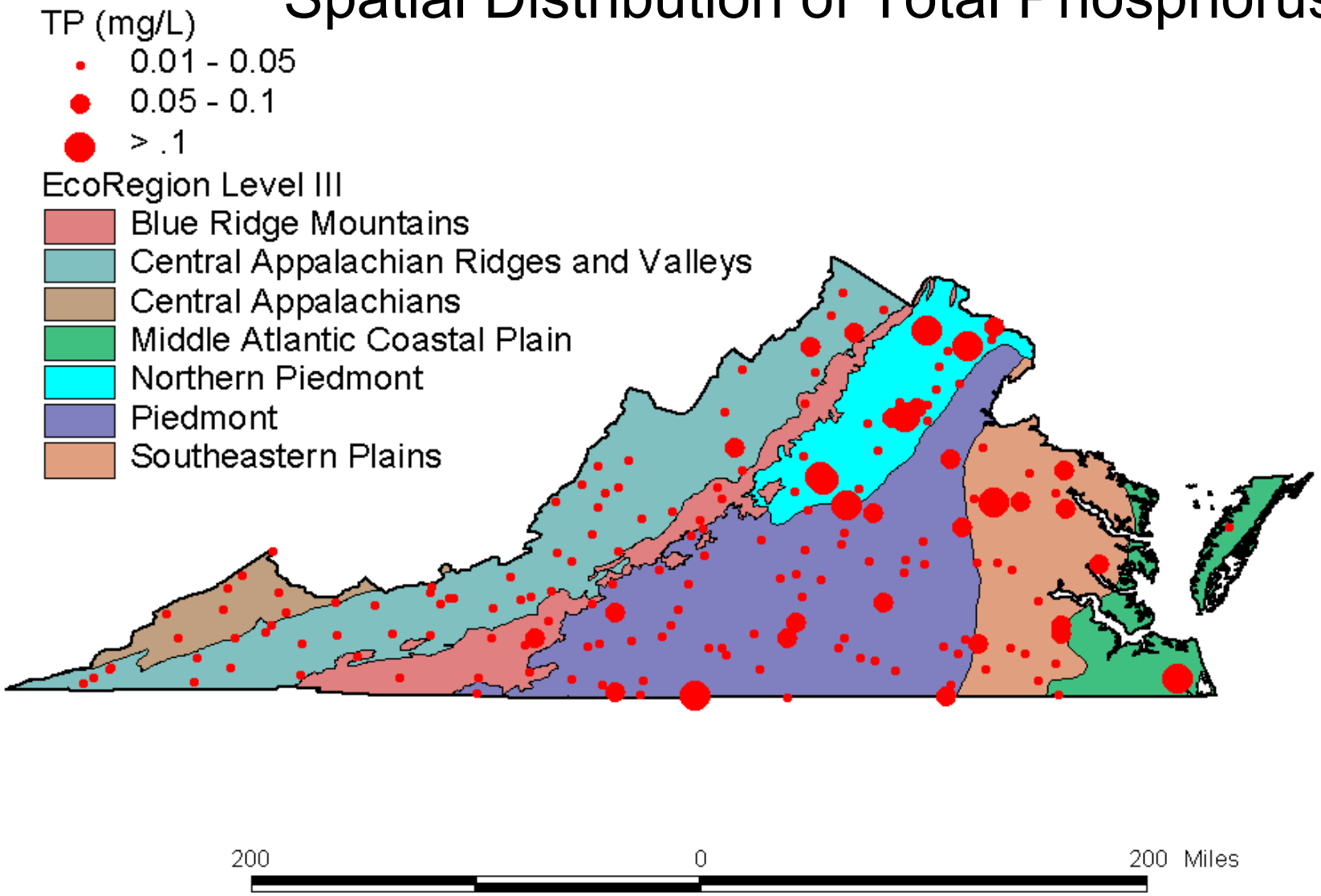
Spatial Distribution of Total Phosphorus



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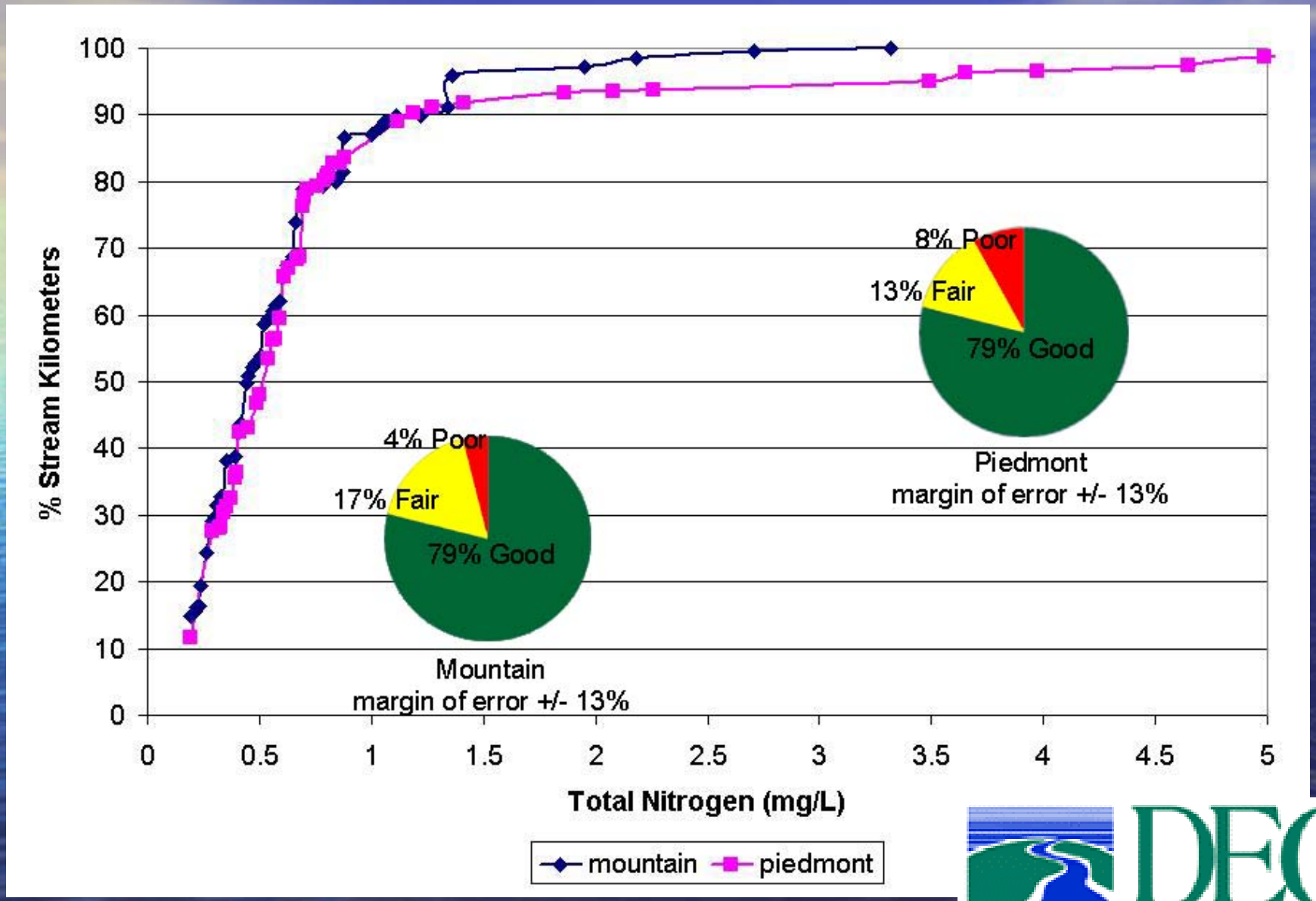
Study Results -Total Nitrogen (n=173)



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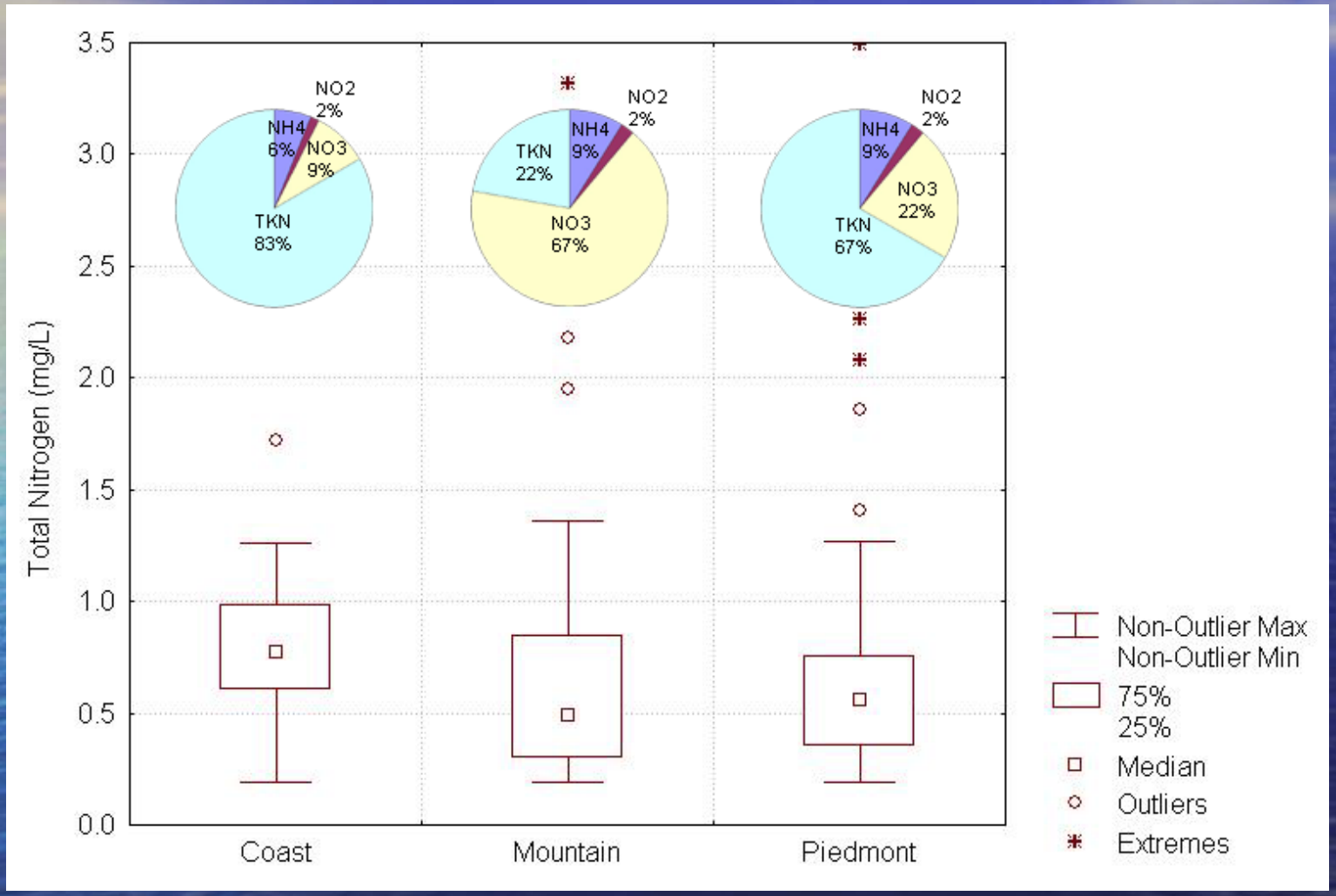
Study Results -Total Nitrogen by EcoRegion



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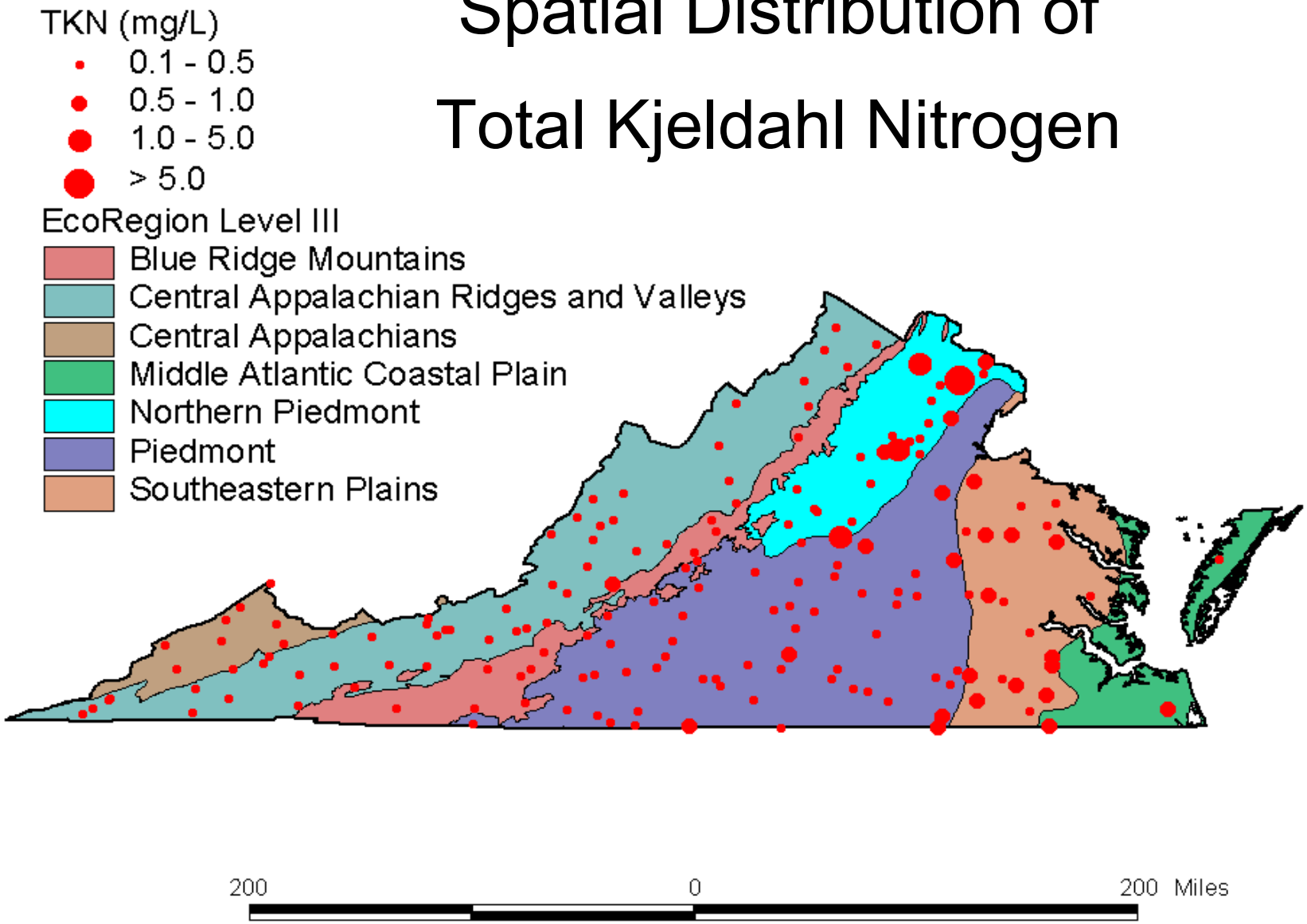
Spatial Distribution of Total Kjeldahl Nitrogen



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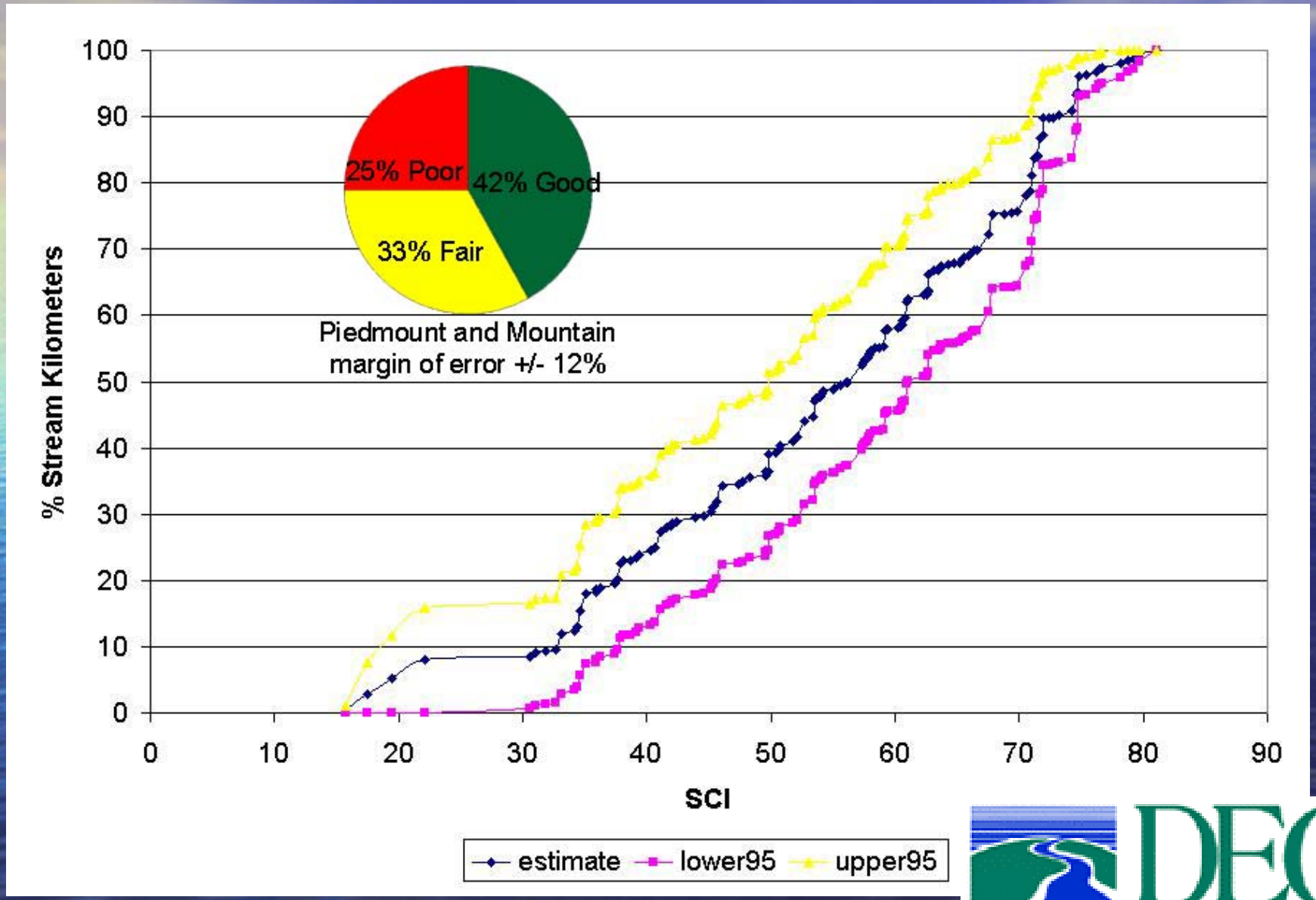
Study Results - 'draft' SCI (n=136)



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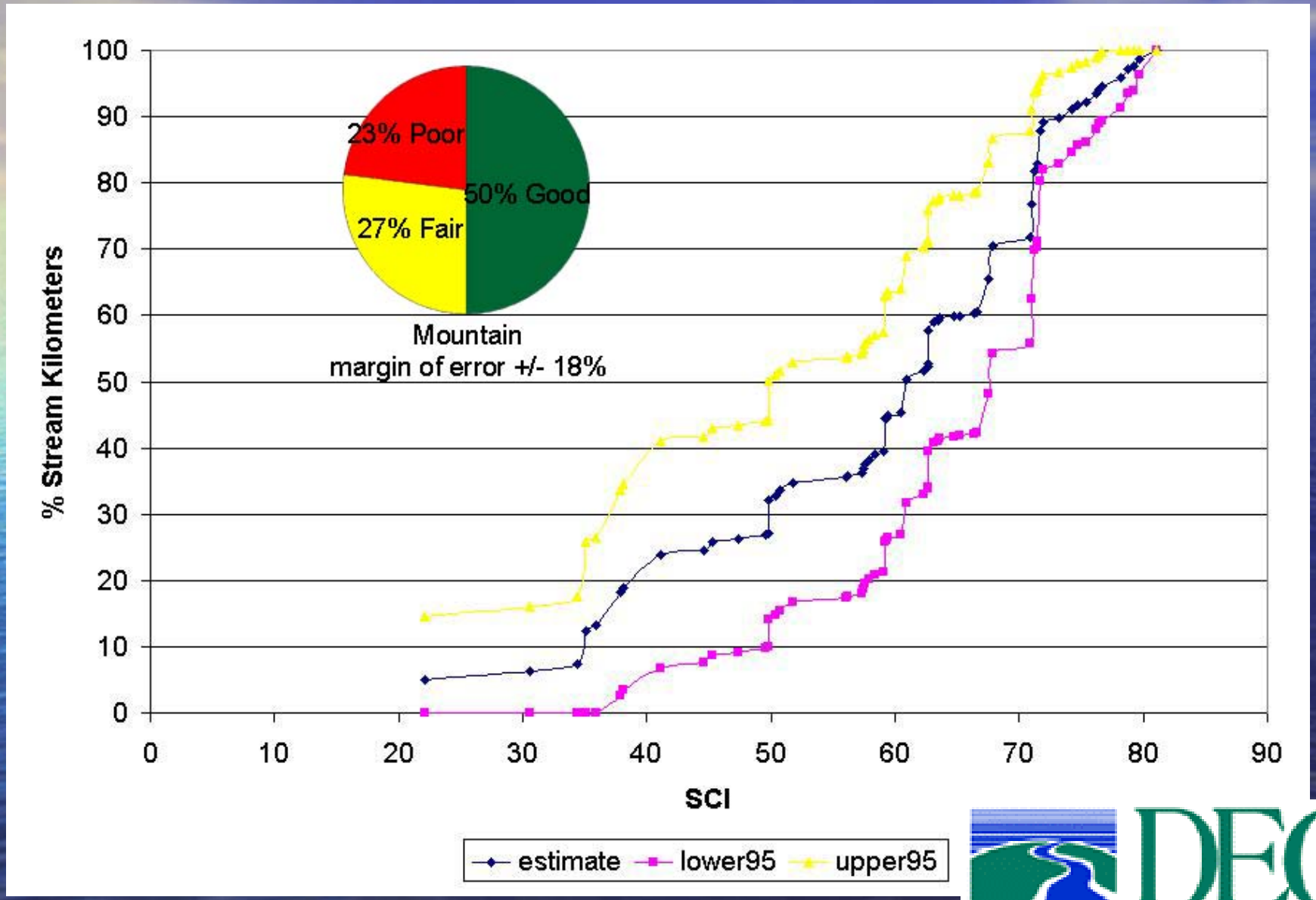
Study Results - 'draft' SCI Mountains (n=62)



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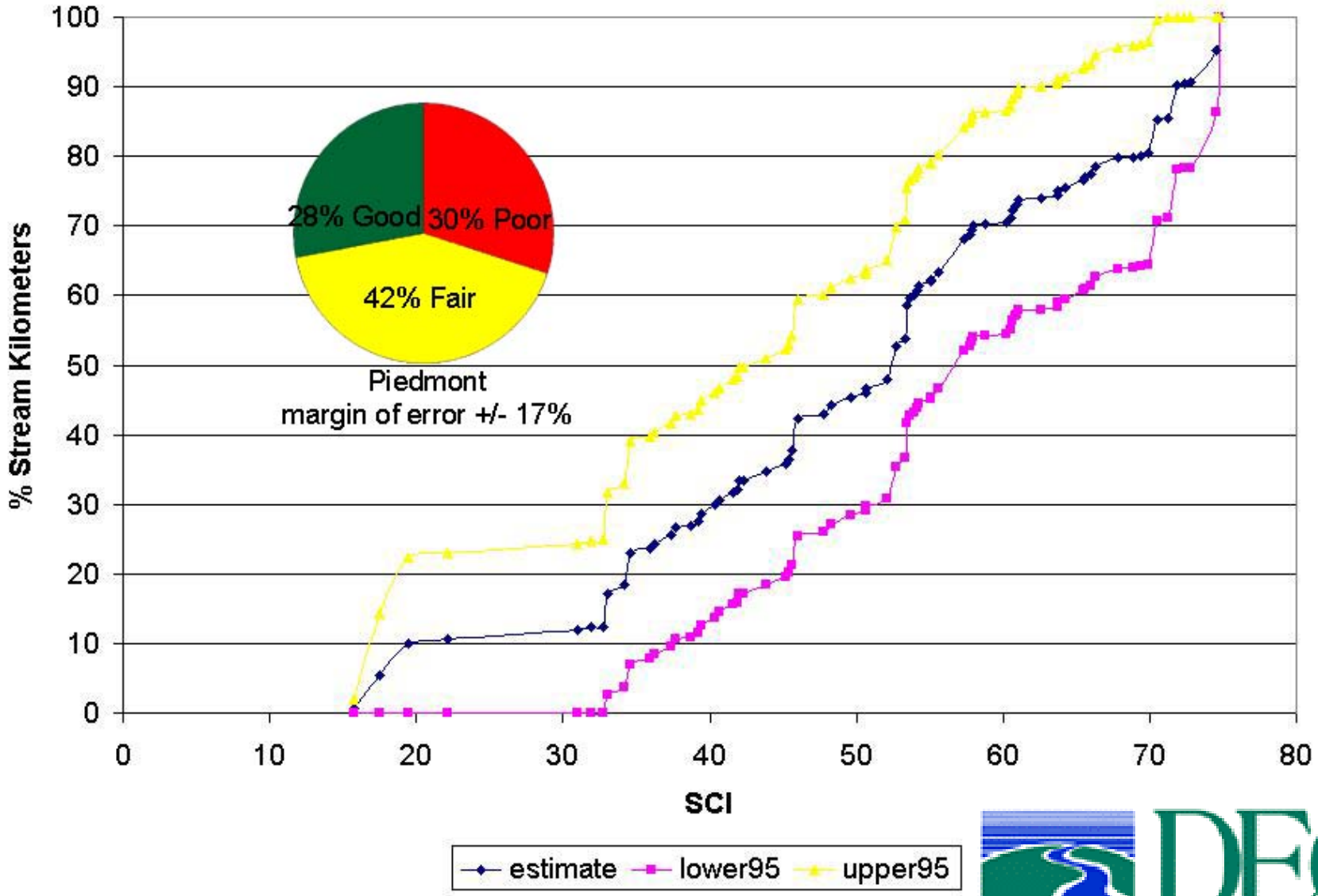
Study Results - 'draft' SCI Piedmont (n=74)



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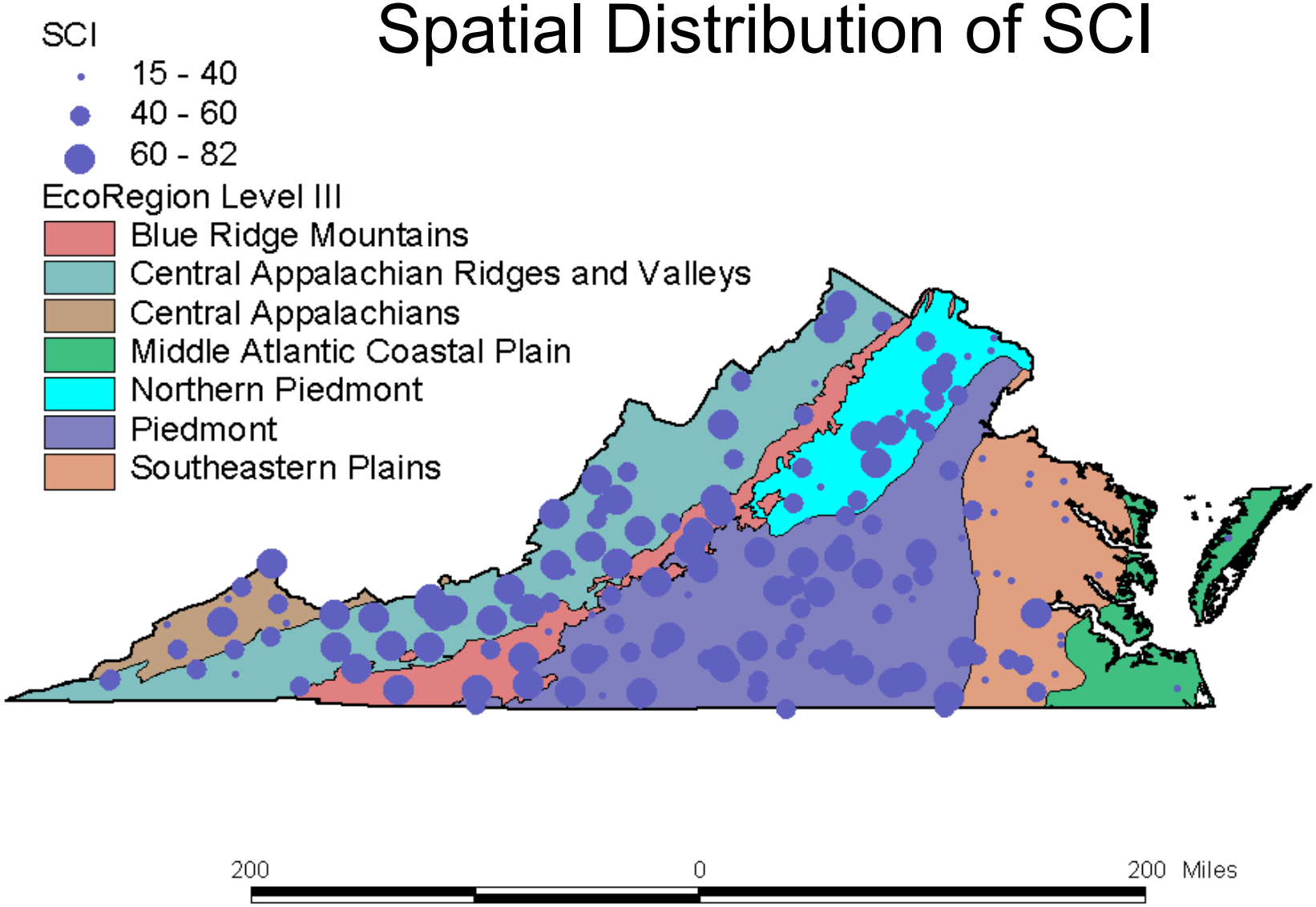
Spatial Distribution of SCI



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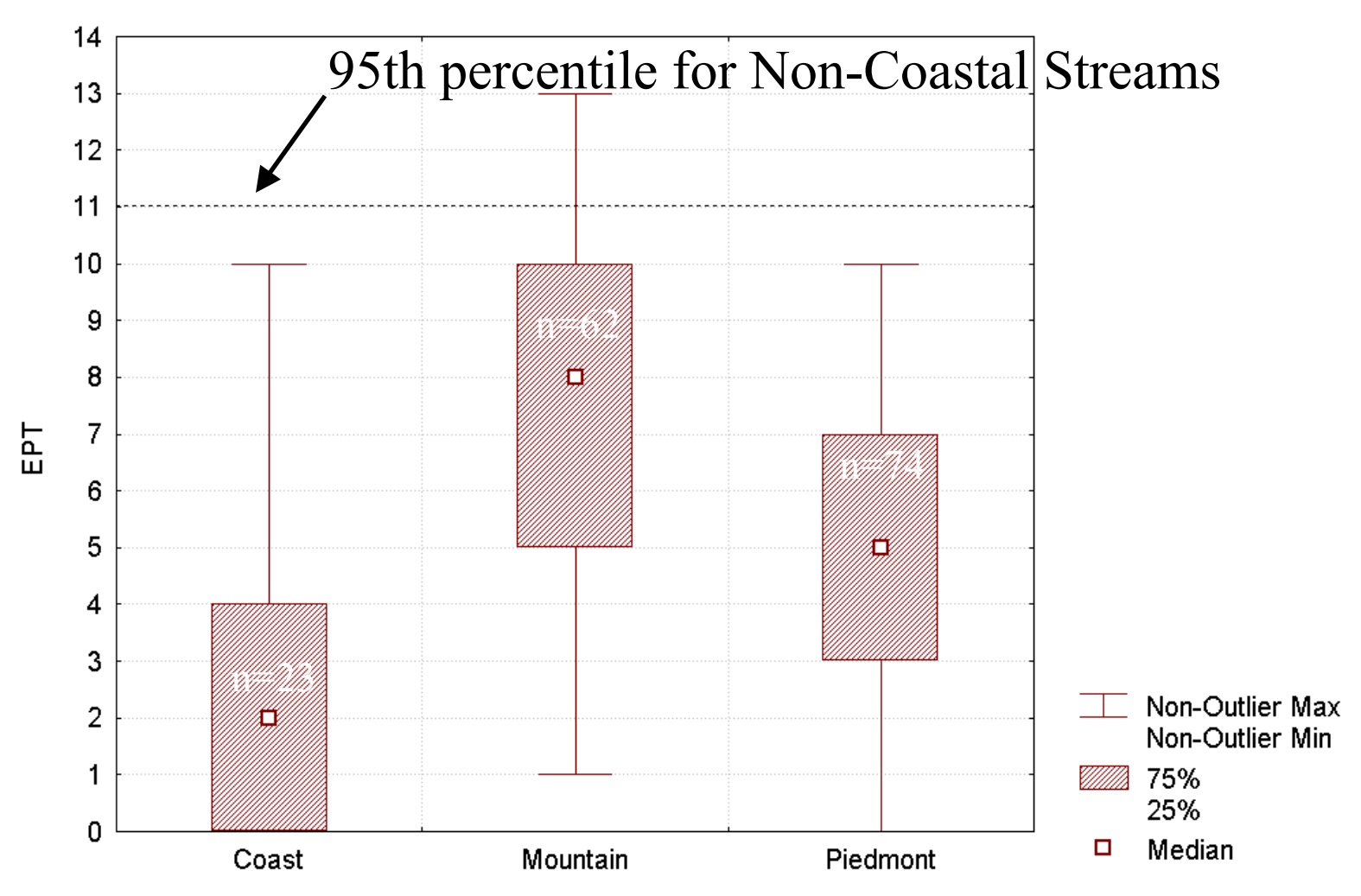
Study Results - Biological



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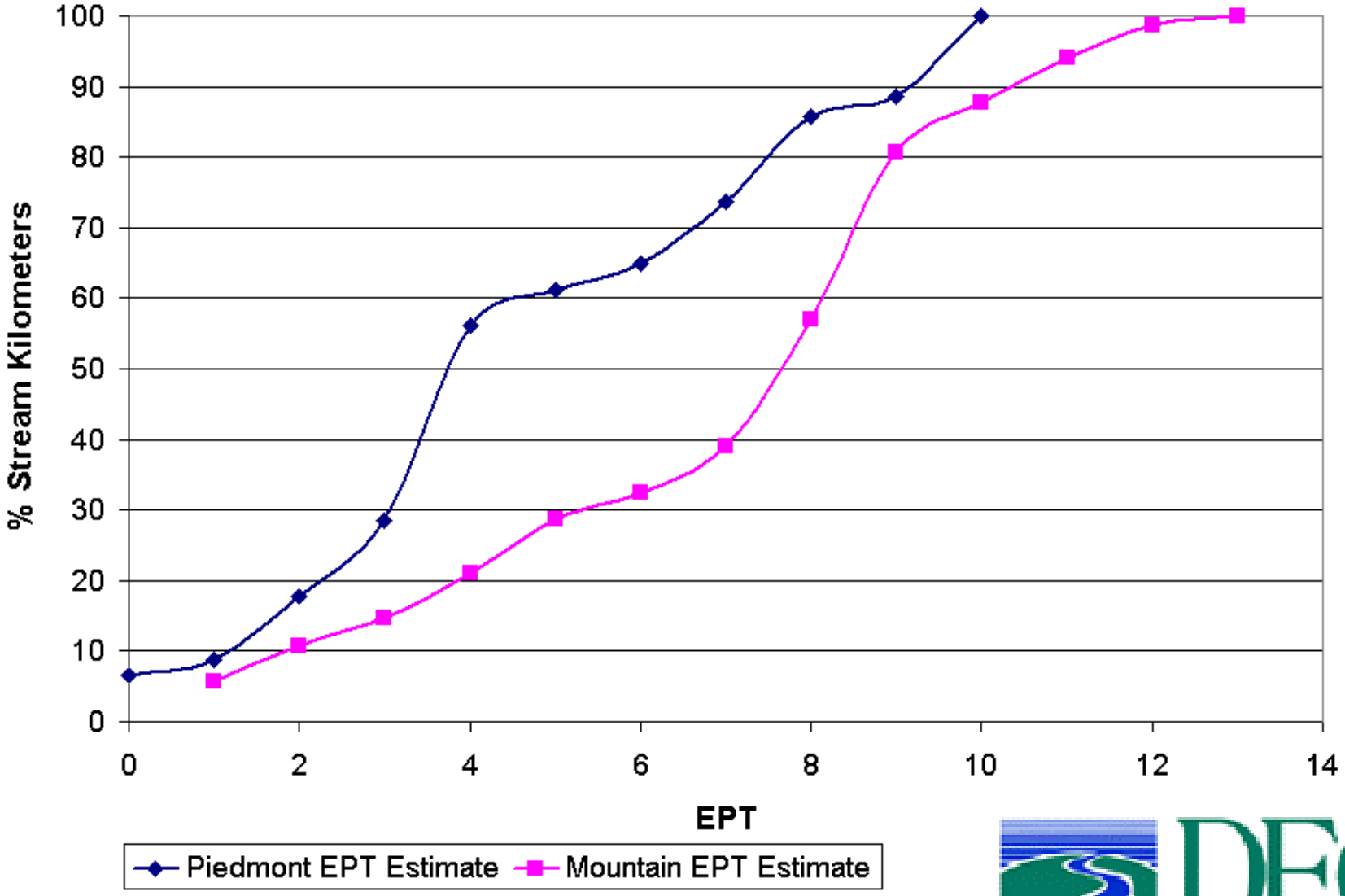
Study Results - EPT (Mountain n=62; Piedmont n=74)



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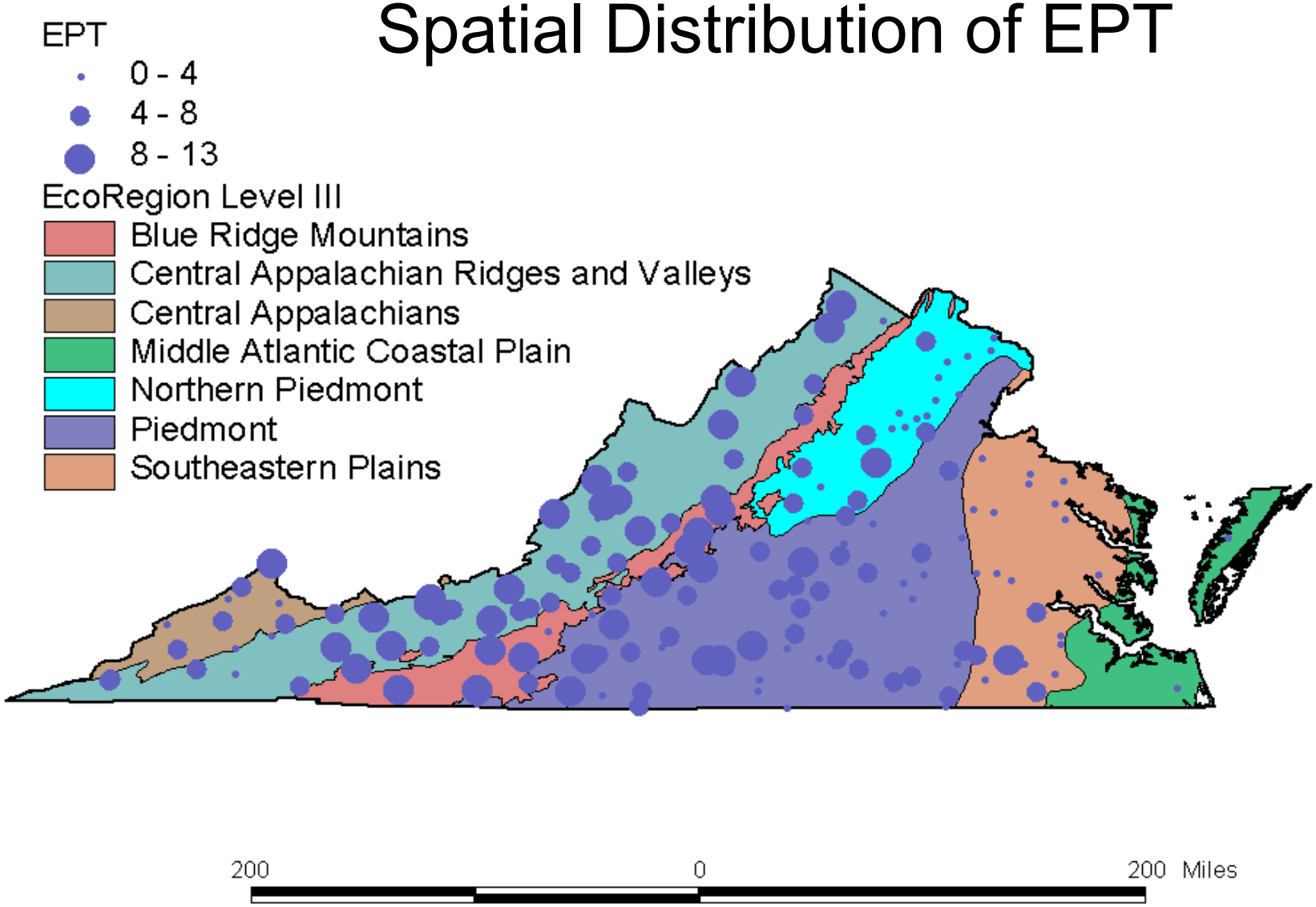
Spatial Distribution of EPT



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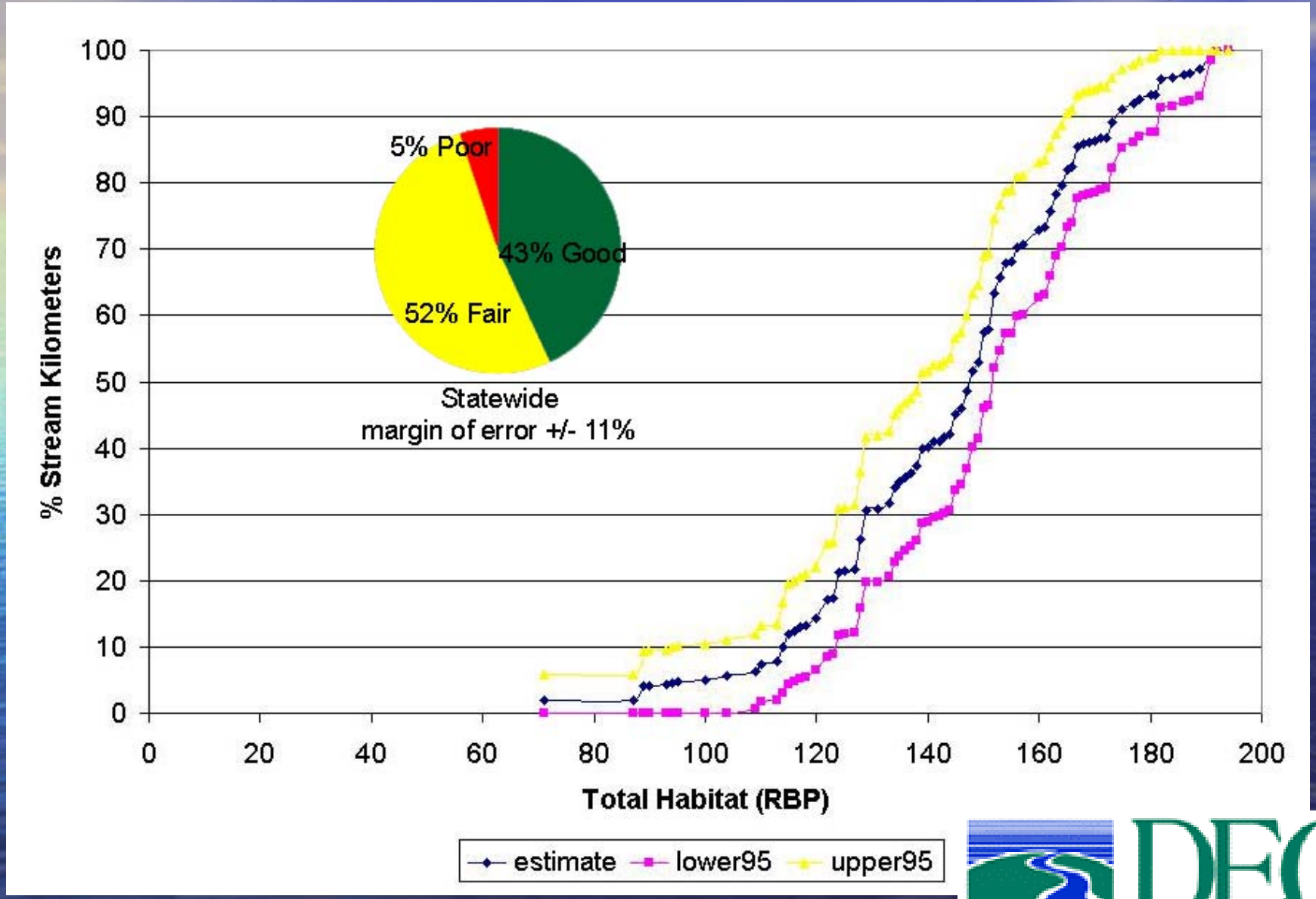
Variability in Headwater Stream Landuse/Settings

Study Results - Habitat RBP (n=157)



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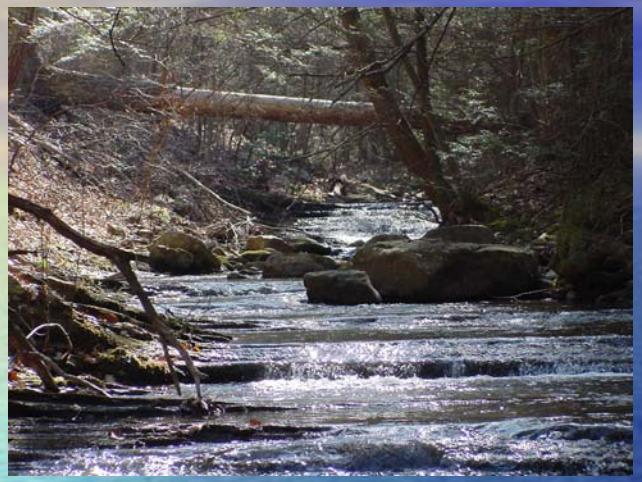
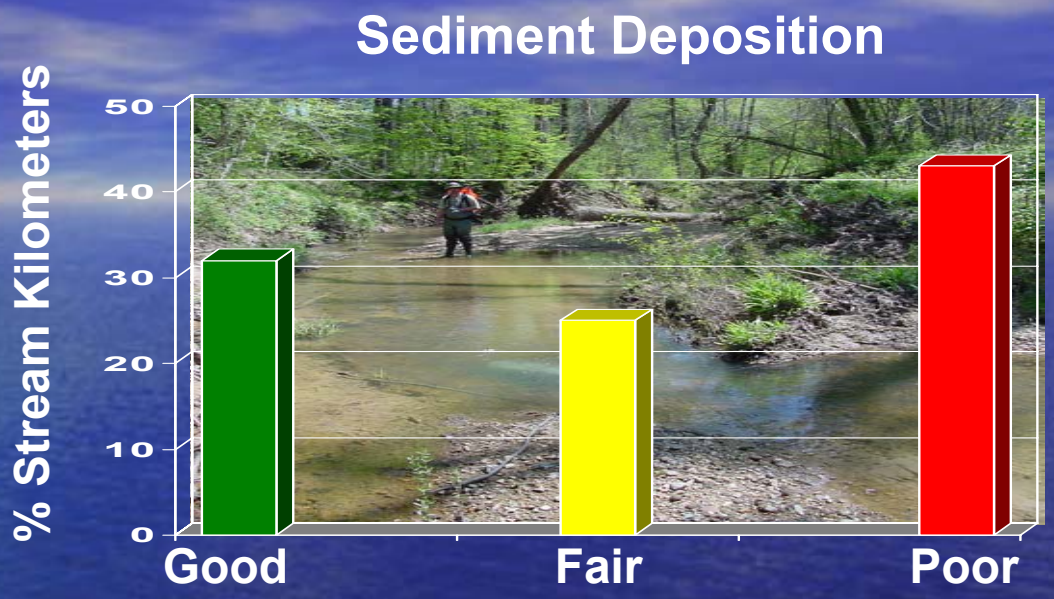
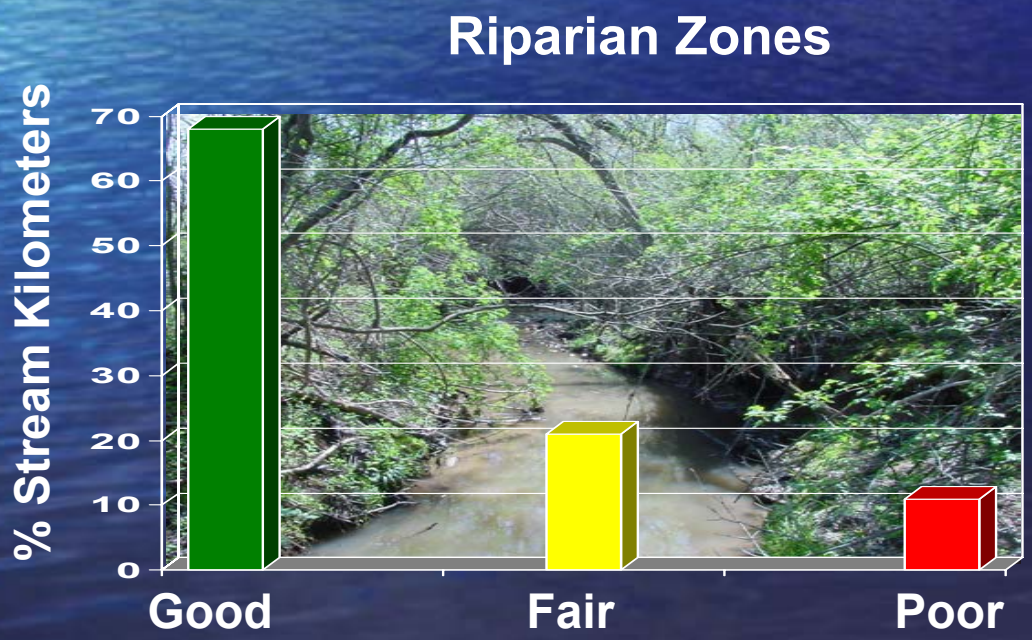
Study Results - Habitat RBP (n=157)







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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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Acknowledgements

EPA: Tony Olsen, Corvallis Office, for assistance and support with random site selection, weighting, and CDF Curve generation

Private Landowners across the state of Virginia for allowing DEQ field staff to access ProbMon sites

DEQ: W.Brown, R.Daub, D.Schmidt, W.Shanabruch, M.Alling, J.Brooks, A.Cario, C.Chamberlain, C.Cook, C.French, B.Harrison, G.Holland, L.Seivard, S.Torbeck, D.Smith, R.Stewart, M.Shaver, C.Staten, K.Wills, R.Johnson, N.Heagy, E.Cumbow, L.Sparks, A.Silvia, W.Harlan, C.Davey, D.Wolfram, J.Howell, A.Wazlak, W.Van Wart, M.Titman, R.Turner, M.Richardson, R.Anderson, A.Barron, D.Lazarus, M.Hutchison, S.Woody, G.Anderson, J.Winningham, D.McLeod, T.Liptak, J.Harris, R.Bodkin, T.Frazier, J.Palmore, B.Thomas, A.McKee, S.Cioccia

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Questions?

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