Nutrients in Iowa's Waters

Mary P. Skopec, Ph.D.
Supervisor
Water Monitoring Section
Iowa Department of Natural Resources

Development of Nutrient Strategy

Iowa Senate File 2293 (2002)

- Develop Nutrient Budget by Watersheds
- Study Impacts of Phosphorus on State's Waters
- Assess Effectiveness of Nutrient Control Technologies
- Adopt Numeric Criteria for Nutrients (significant progress by end of 2004)

Nutrient Status of Iowa Streams

Nutrient Impacts on Water:

1. In-stream or lake effects (concentration)

2. Nutrient Received by Downstream Waters (load)

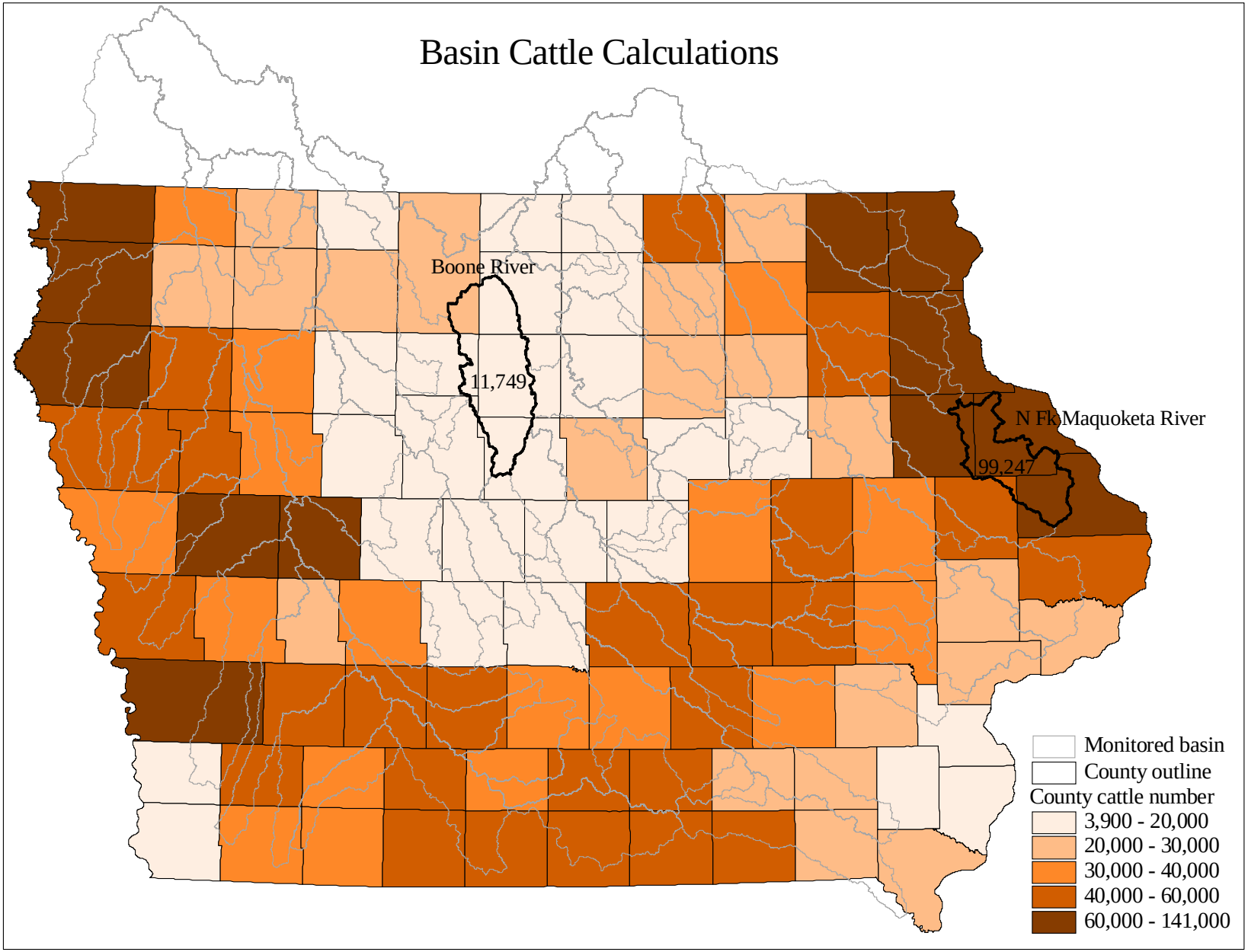
Nutrient Status of Iowa Streams

- Relate to Nutrient Budget ("typical" year 2000)
- Compare Inputs/Outputs to WQ
- Hydrology – Estimates range between 800,000 and 1,000,000 miles of tile drainage in the state
- % of Time Samples Exceed Benchmark Values

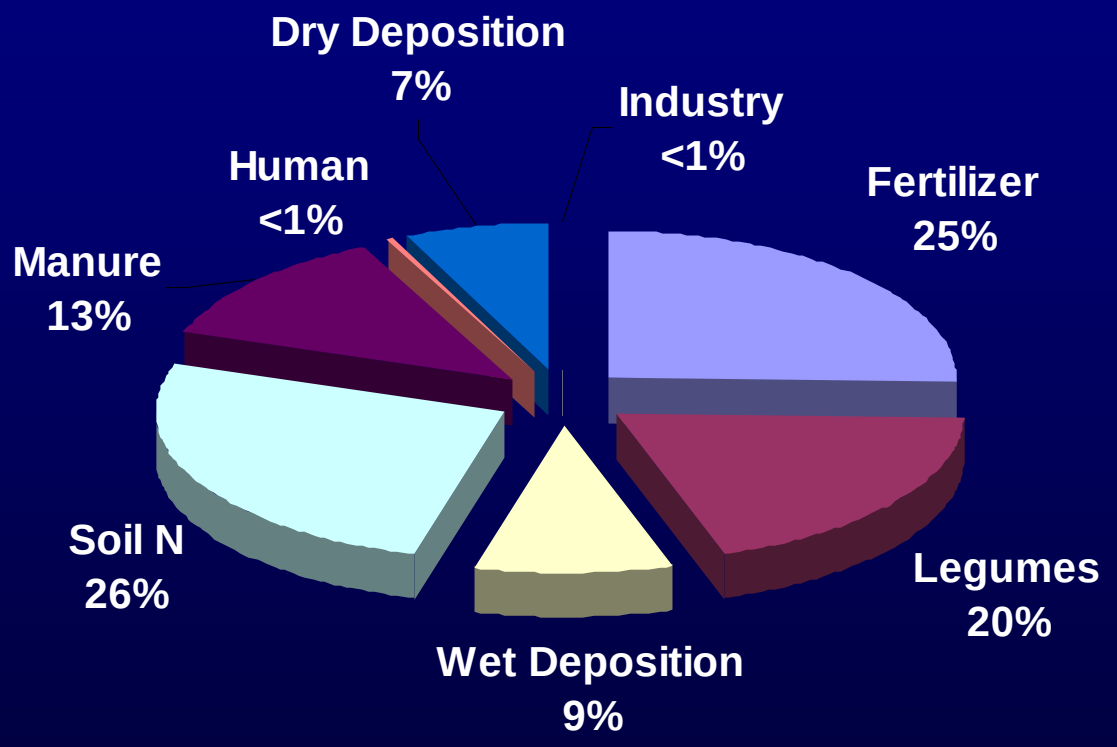
Nutrient Budget - Ground Rules

- Budget is not a predictive model, it is an accounting of inputs and outputs
- Consensus of Experts on Method
  - ISU, NSTL, IDALS, IDNR, NASS
  - Gulf of Mexico Hypoxia Report as Template
- GIS used to apportion into watersheds
  - Data from 1997 and 2001

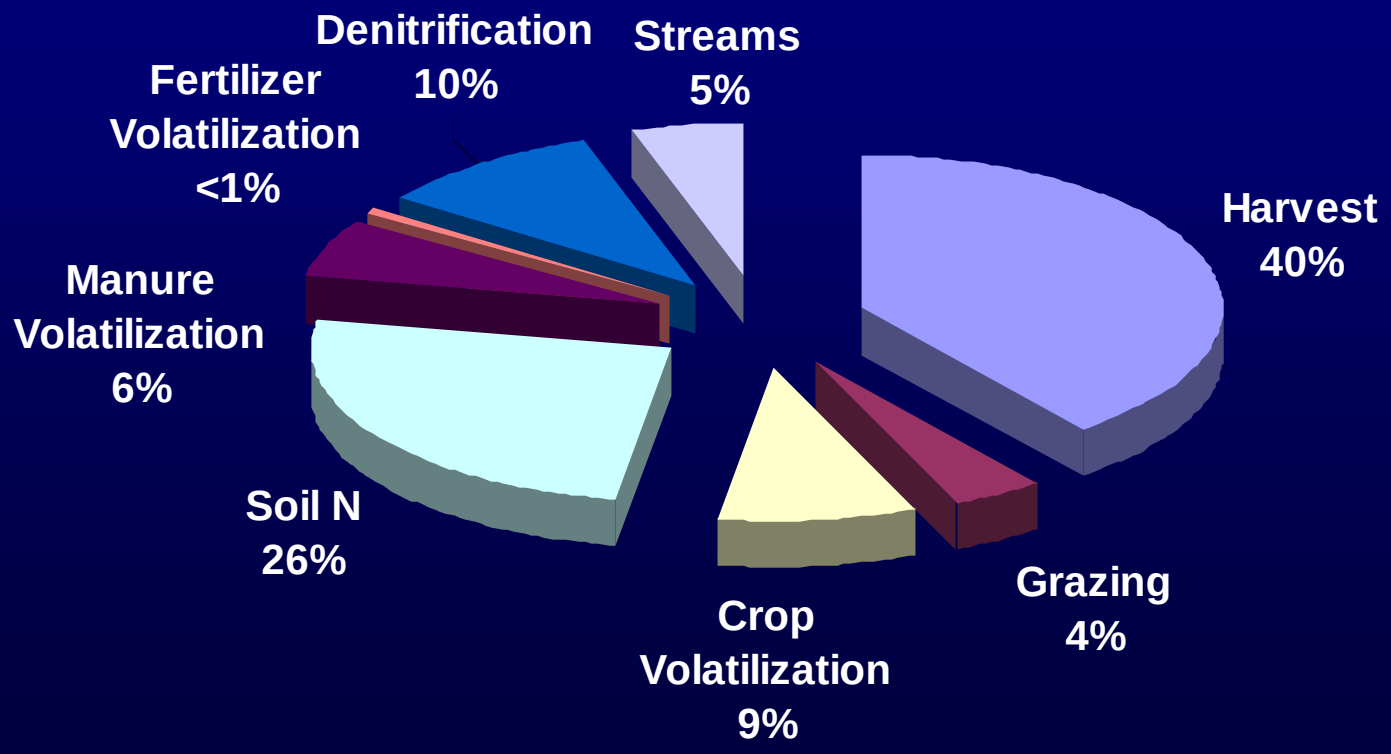
Basin Cattle Calculations

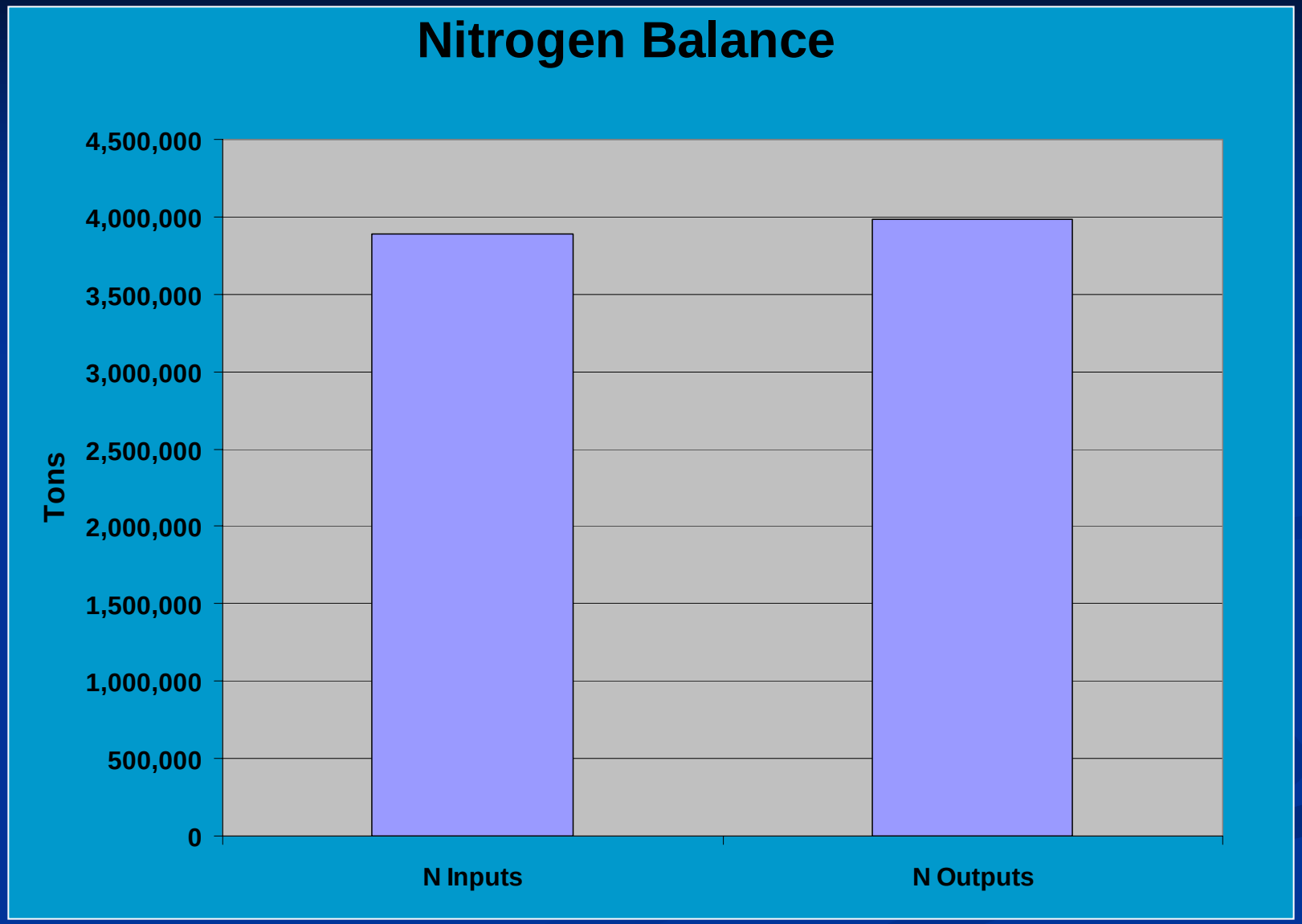


Nitrogen Inputs

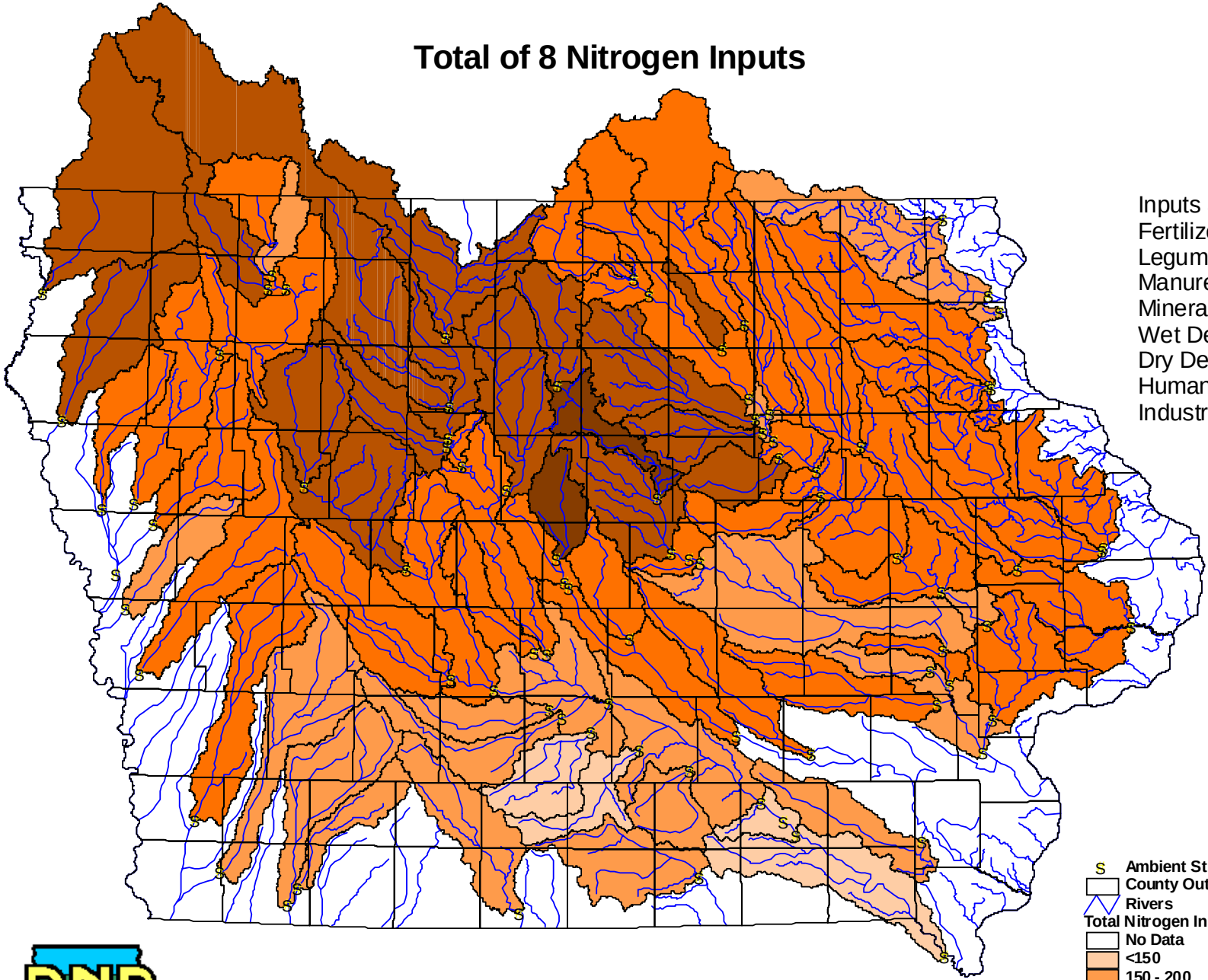


Nitrogen Outputs




Nitrogen Balance
Tons
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
N Inputs
N Outputs

Total of 8 Nitrogen Inputs

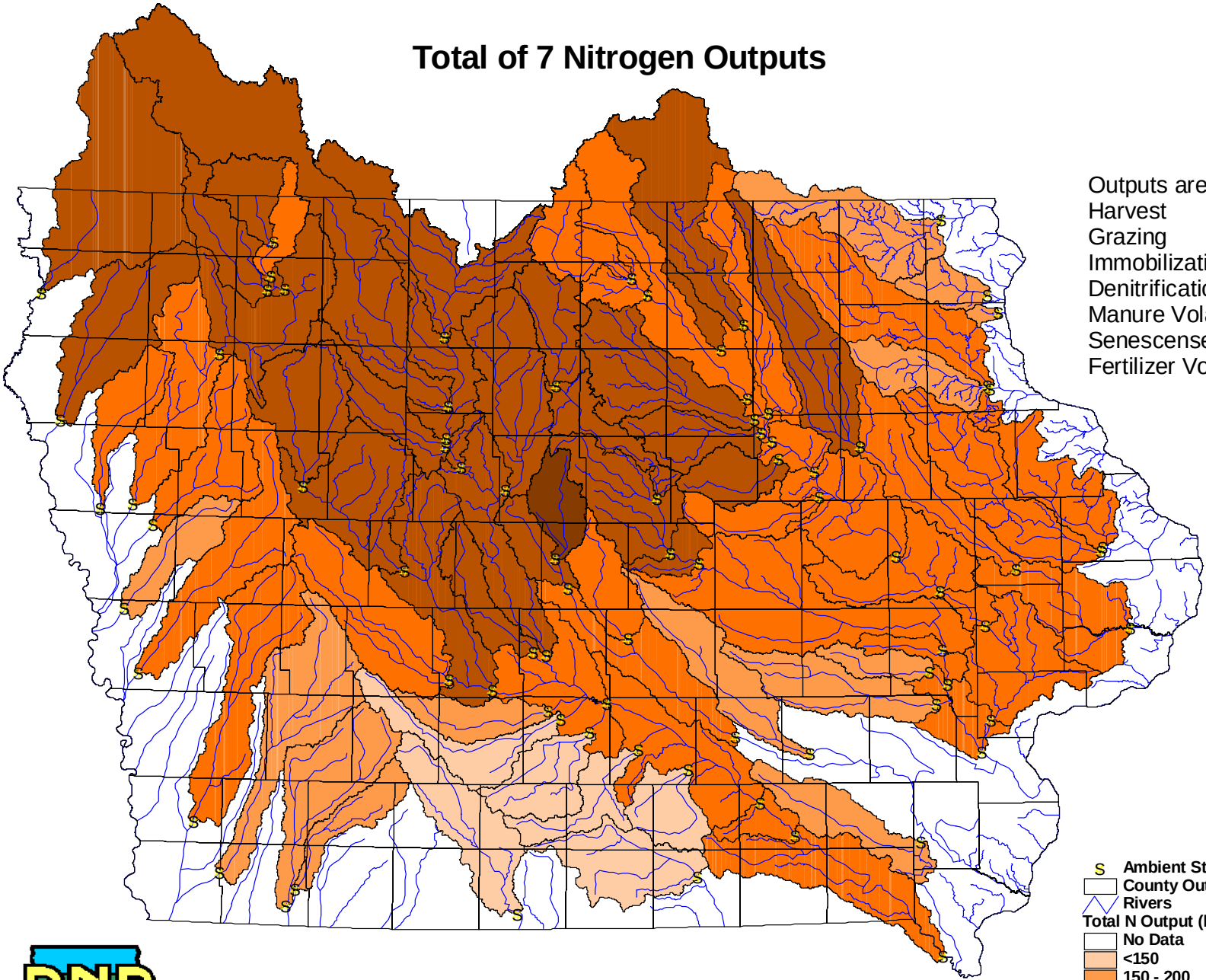


Inputs are:
Fertilizer
Legumes
Manure
Mineralization
Wet Deposition
Dry Deposition
Human
Industrial

S Ambient Stream Sites
County Outlines
Rivers
Total Nitrogen Inputs (lbs/ac)
No Data
<150
150 - 200
200 - 250
250 - 300
>300

October 6, 2003

Total of 7 Nitrogen Outputs



Outputs are:
Harvest
Grazing
Immobilization
Denitrification
Manure Volatilization
Senescense
Fertilizer Volatilization

S Ambient Stream Sites
County Outlines
Rivers
Total N Output (lbs/acre)
No Data
<150
150 - 200
200 - 250
250 - 300
>300

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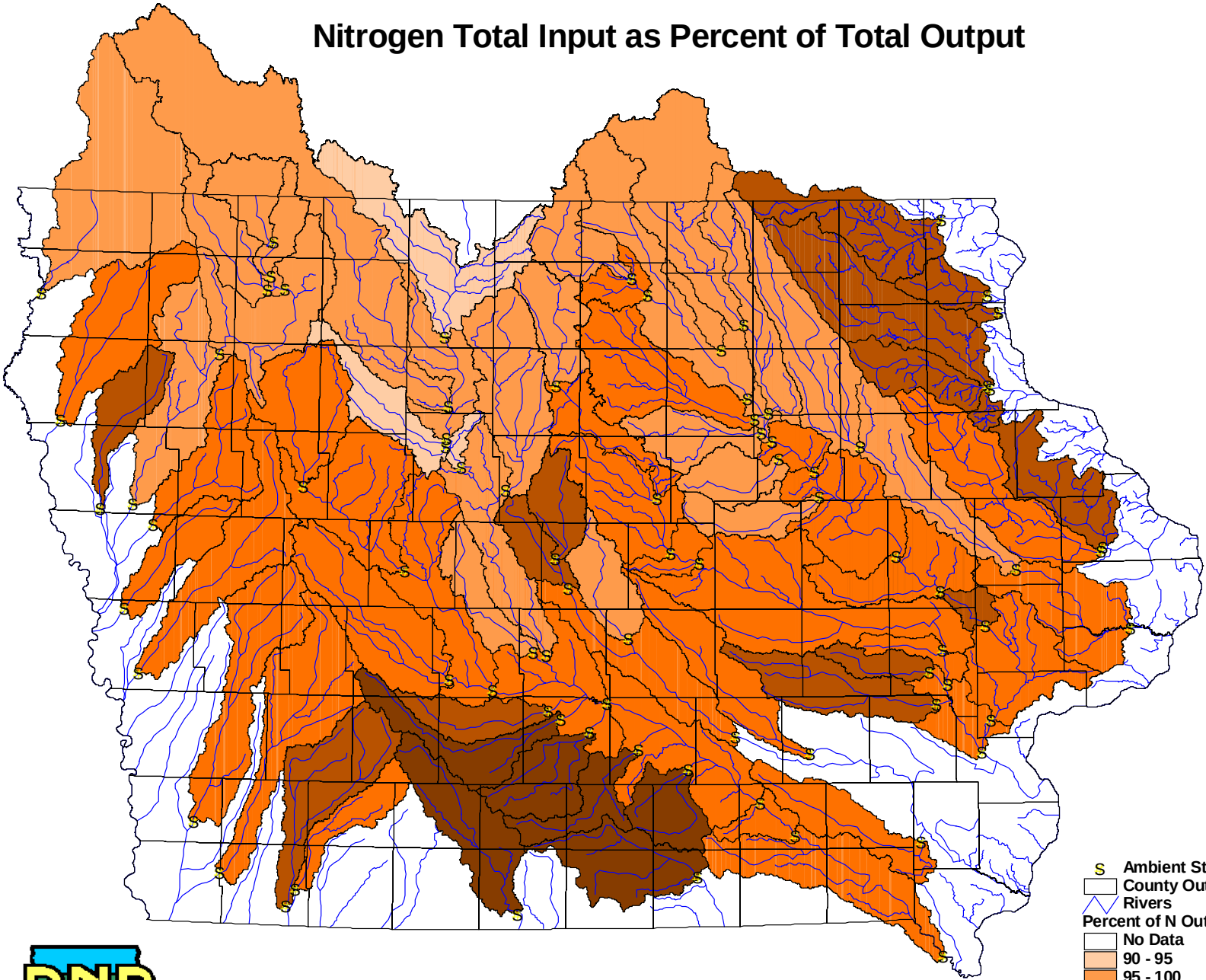
Nitrogen Total Input as Percent of Total Output



S Ambient Stream Sites
County Outlines
Rivers
Percent of N Output
No Data
90 - 95
95 - 100
100 - 105
105 - 110
110 - 130

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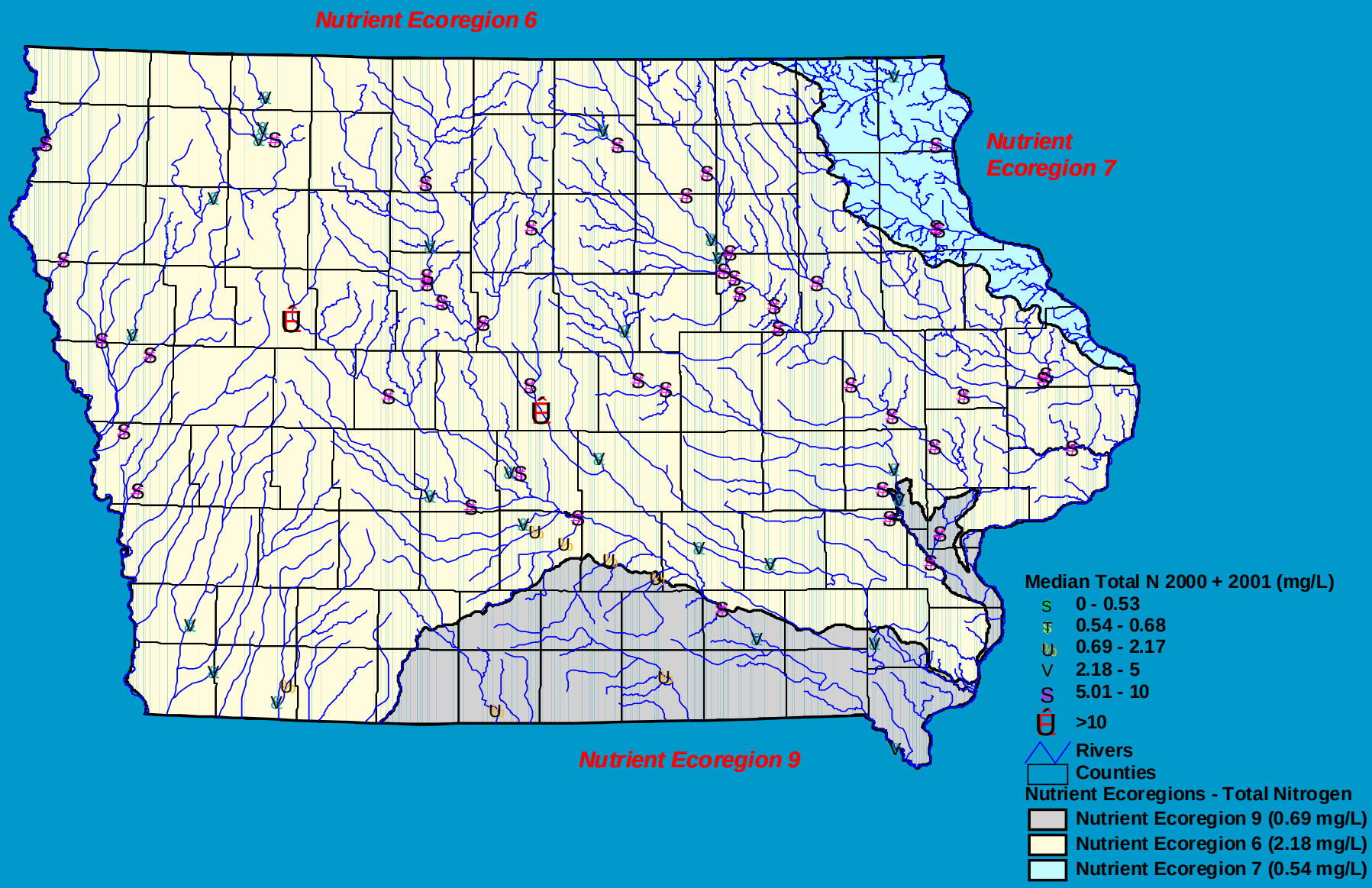
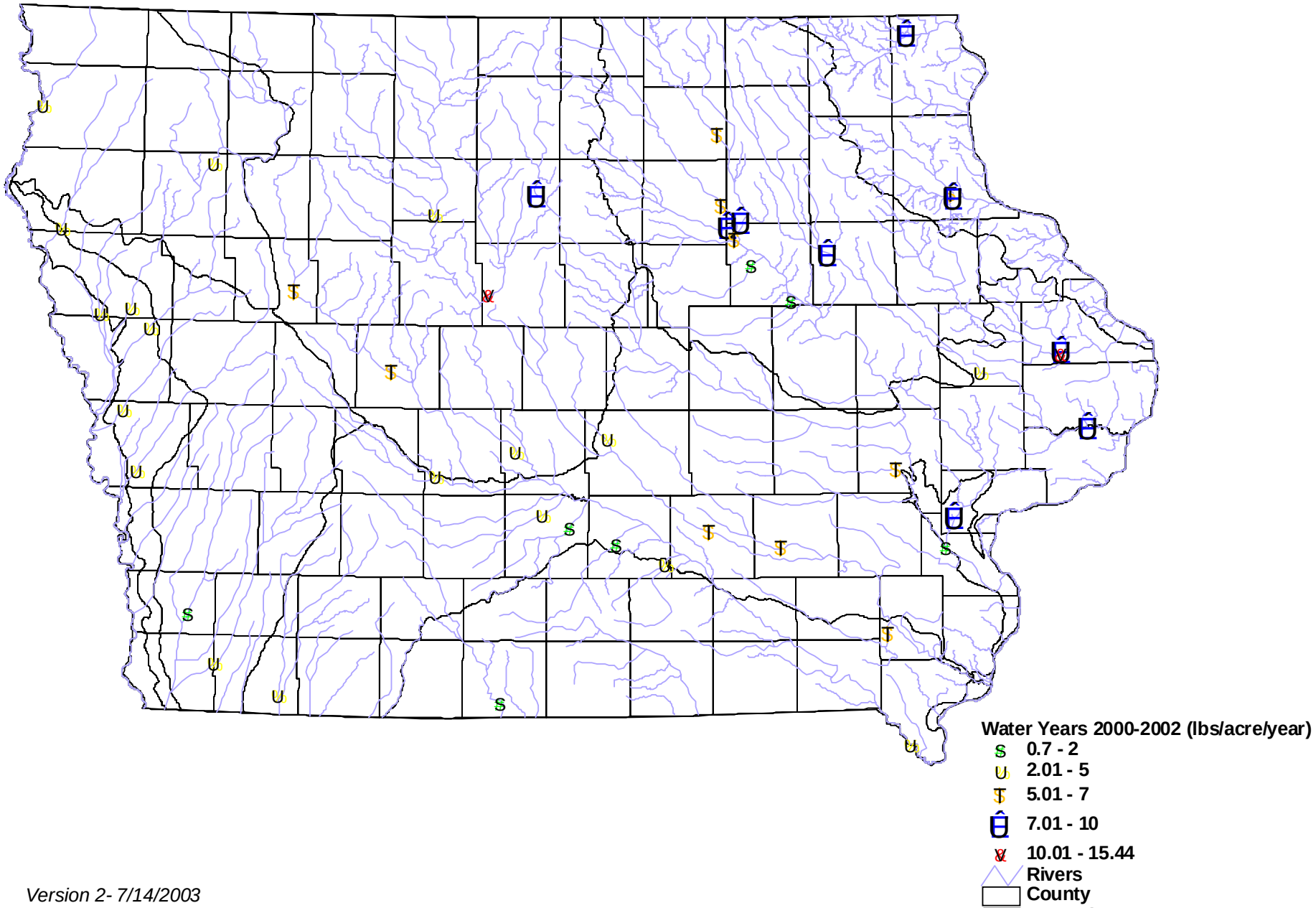
Ambient Stream Data for 2000 and 2001
(event and non-event data)



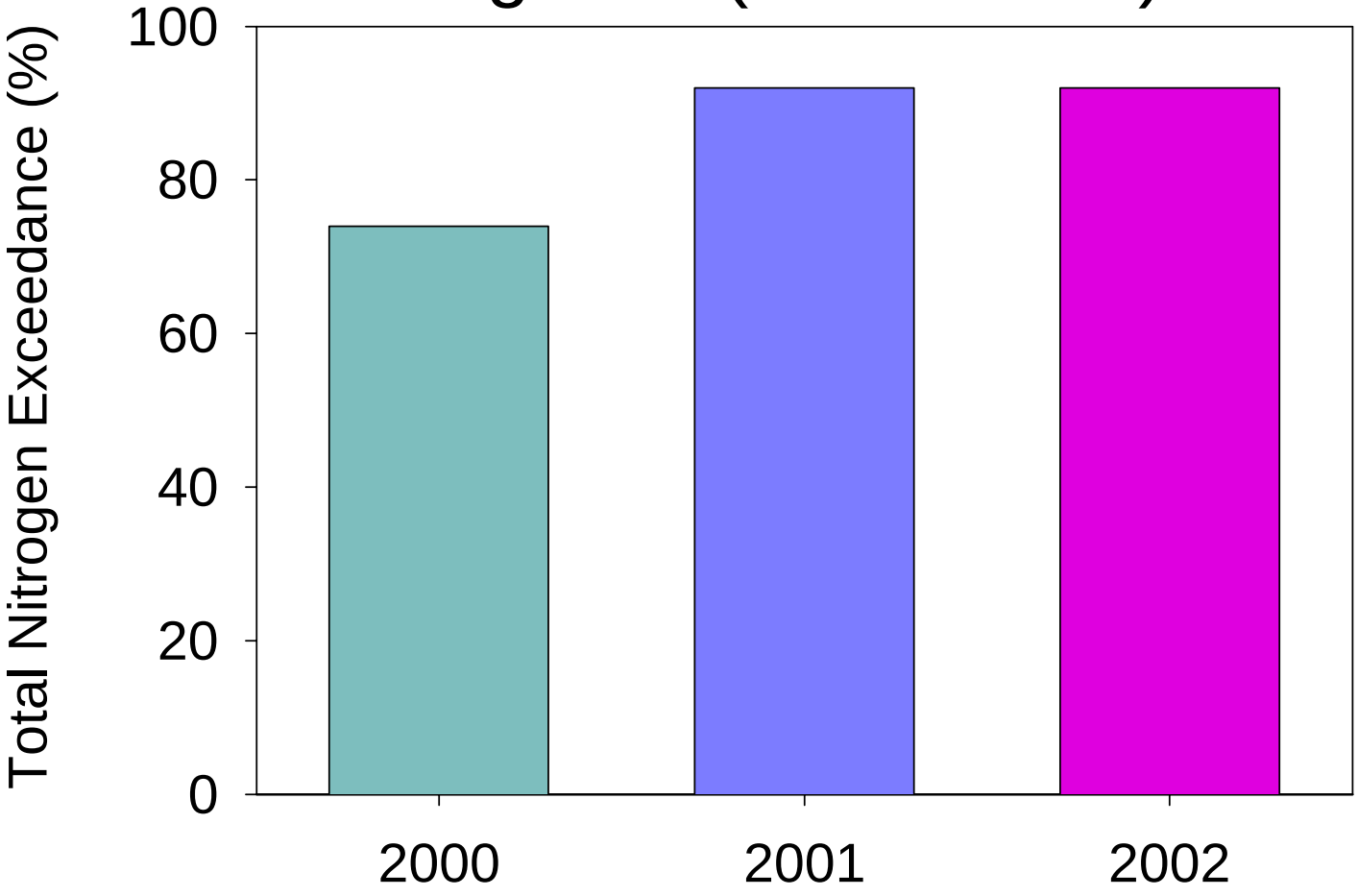
Nitrogen Yield from Watersheds



Version 2- 7/14/2003

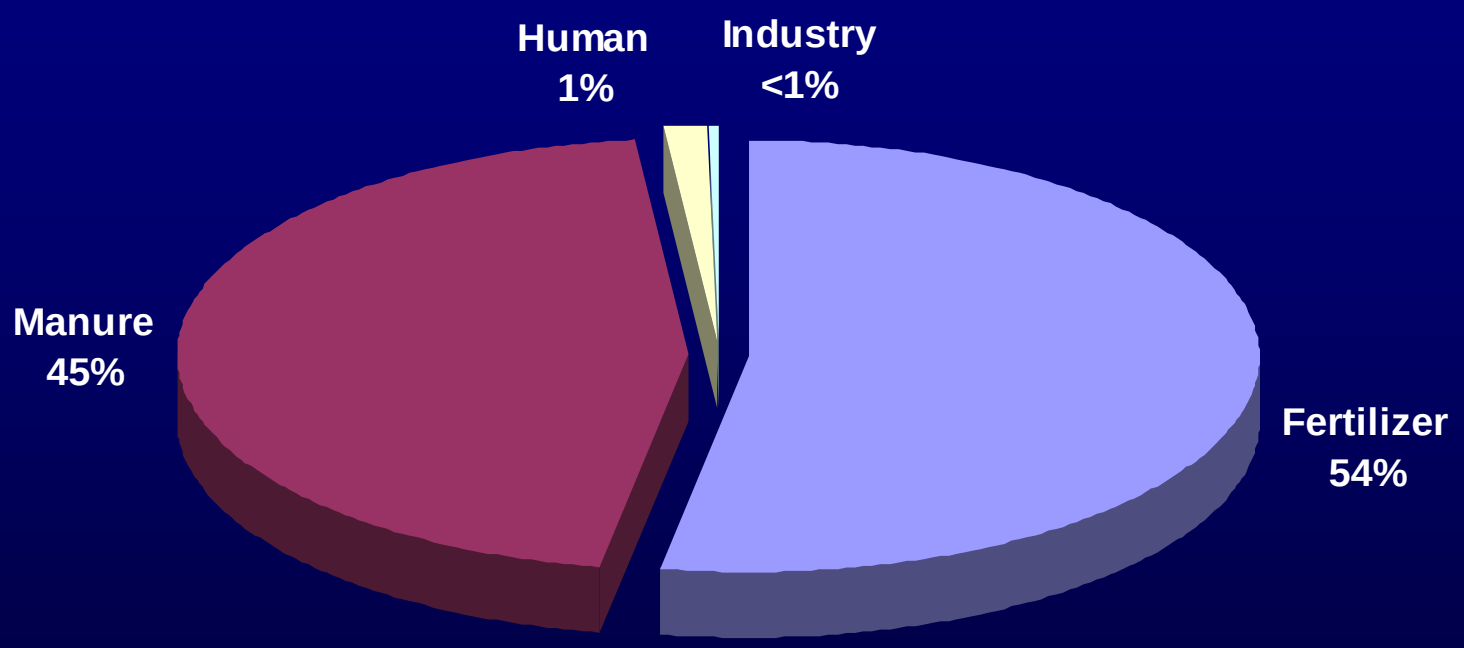
Ambient Monitoring - Stream Data (2000 - 2002)

Region 6 (69 streams)

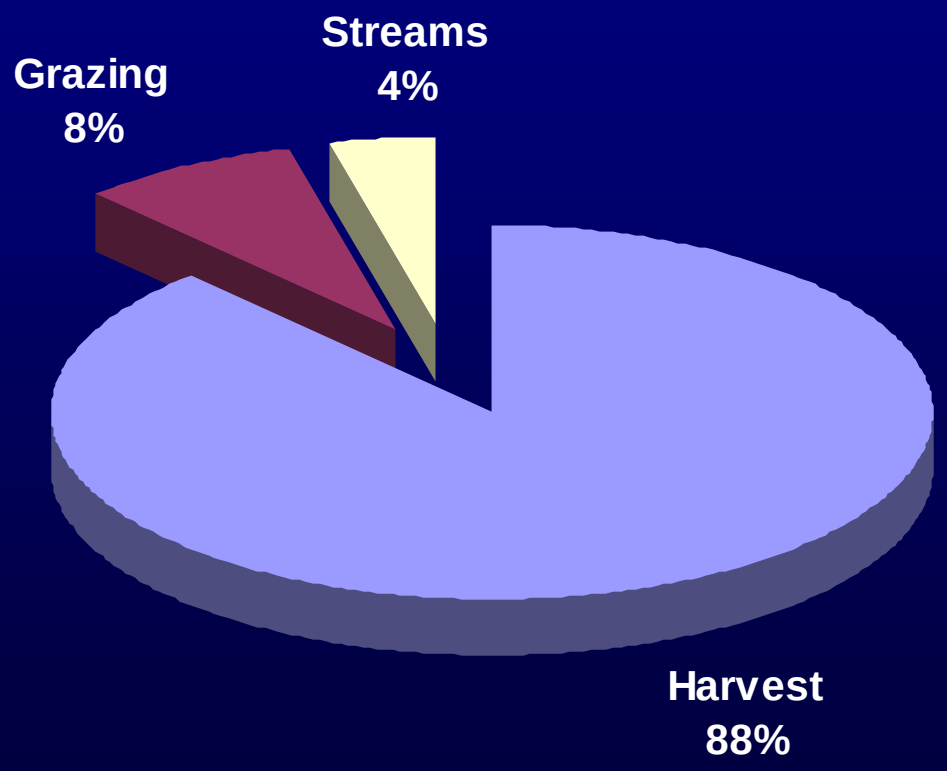


Total N - 2.18 mg/L

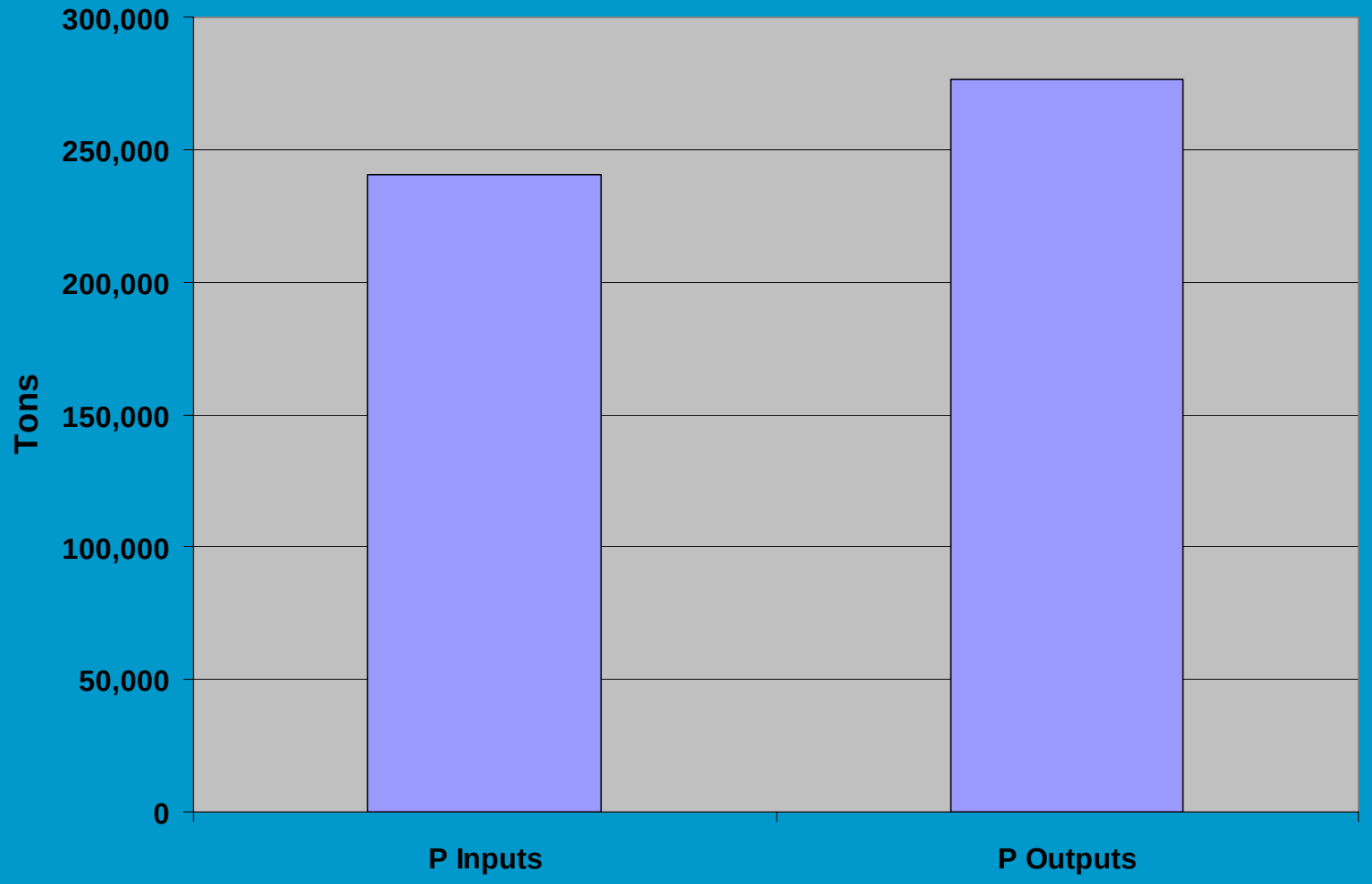
Phosphorus Inputs



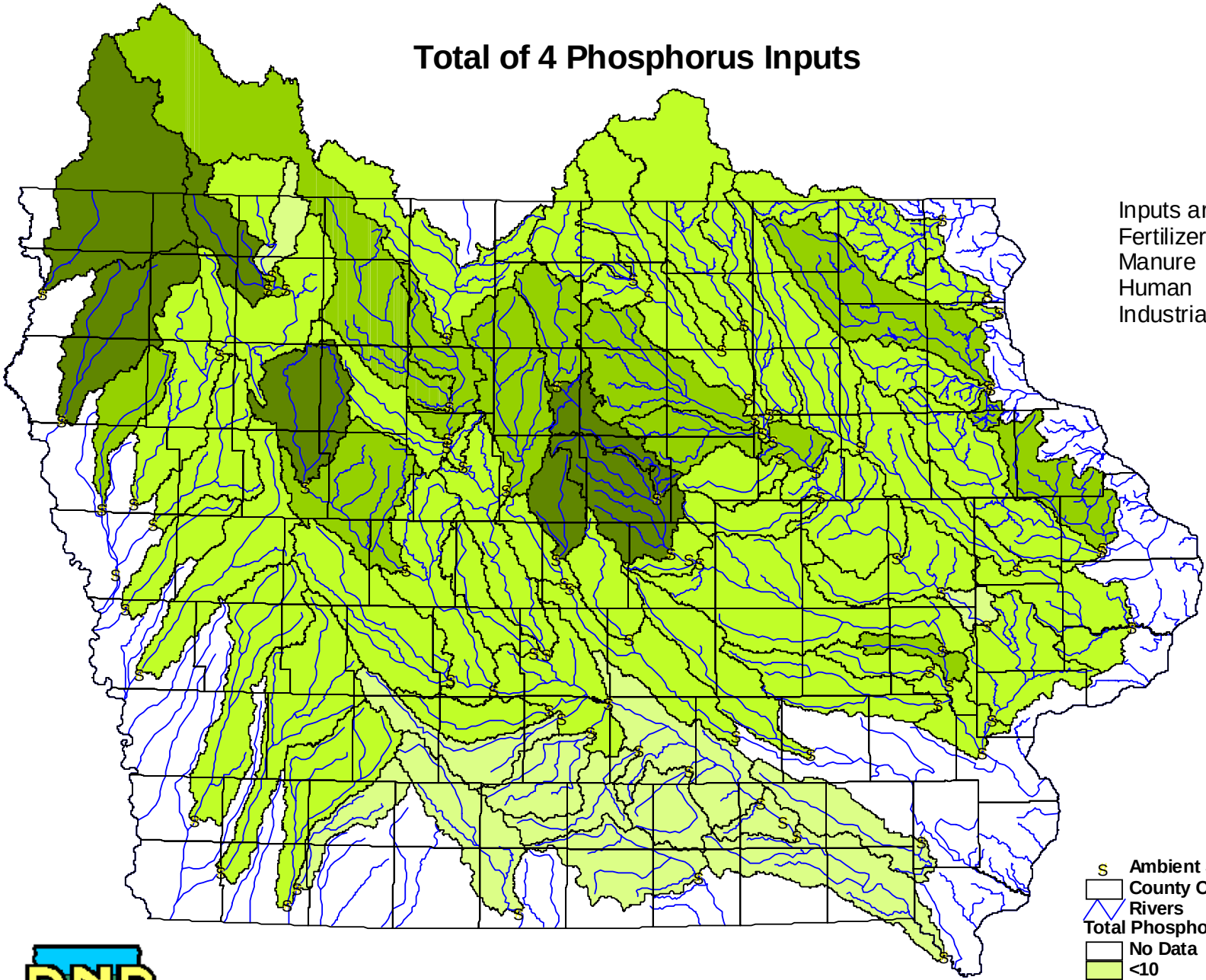
Phosphorus Outputs



Phosphorus Balance



Total of 4 Phosphorus Inputs



Inputs are:
Fertilizer
Manure
Human
Industrial

S Ambient Stream Sites
County Outlines
Rivers

Total Phosphorus Inputs (lbs/ac)

- No Data
- <10
- 10 - 15
- 15 - 20
- >20

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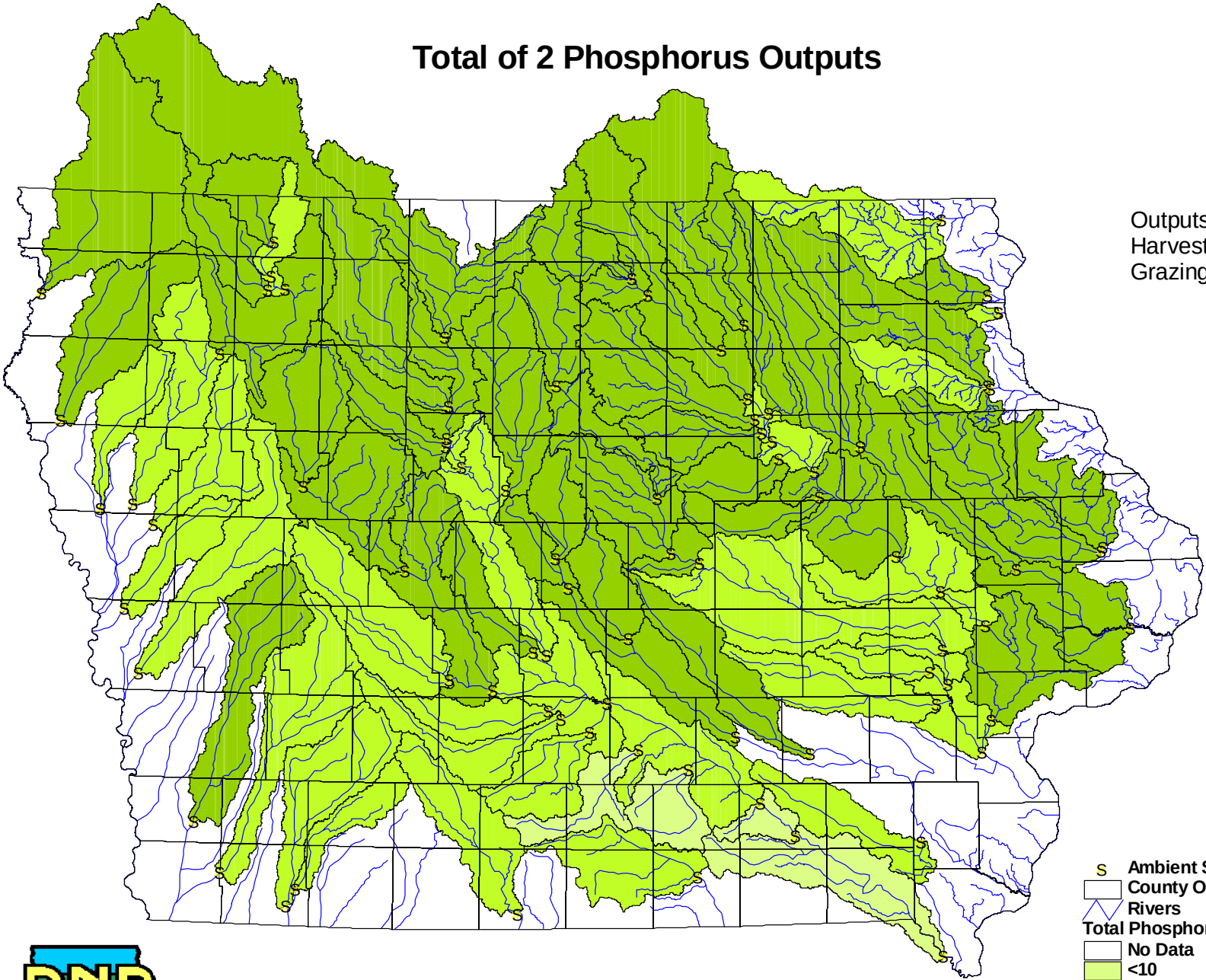
Total of 2 Phosphorus Outputs



Outputs are:
Harvest
Grazing

S Ambient Stream Sites
County Outlines
Rivers
Total Phosphorus Outputs (lbs/ac)
No Data
<10
10 - 15
15 - 20
>20

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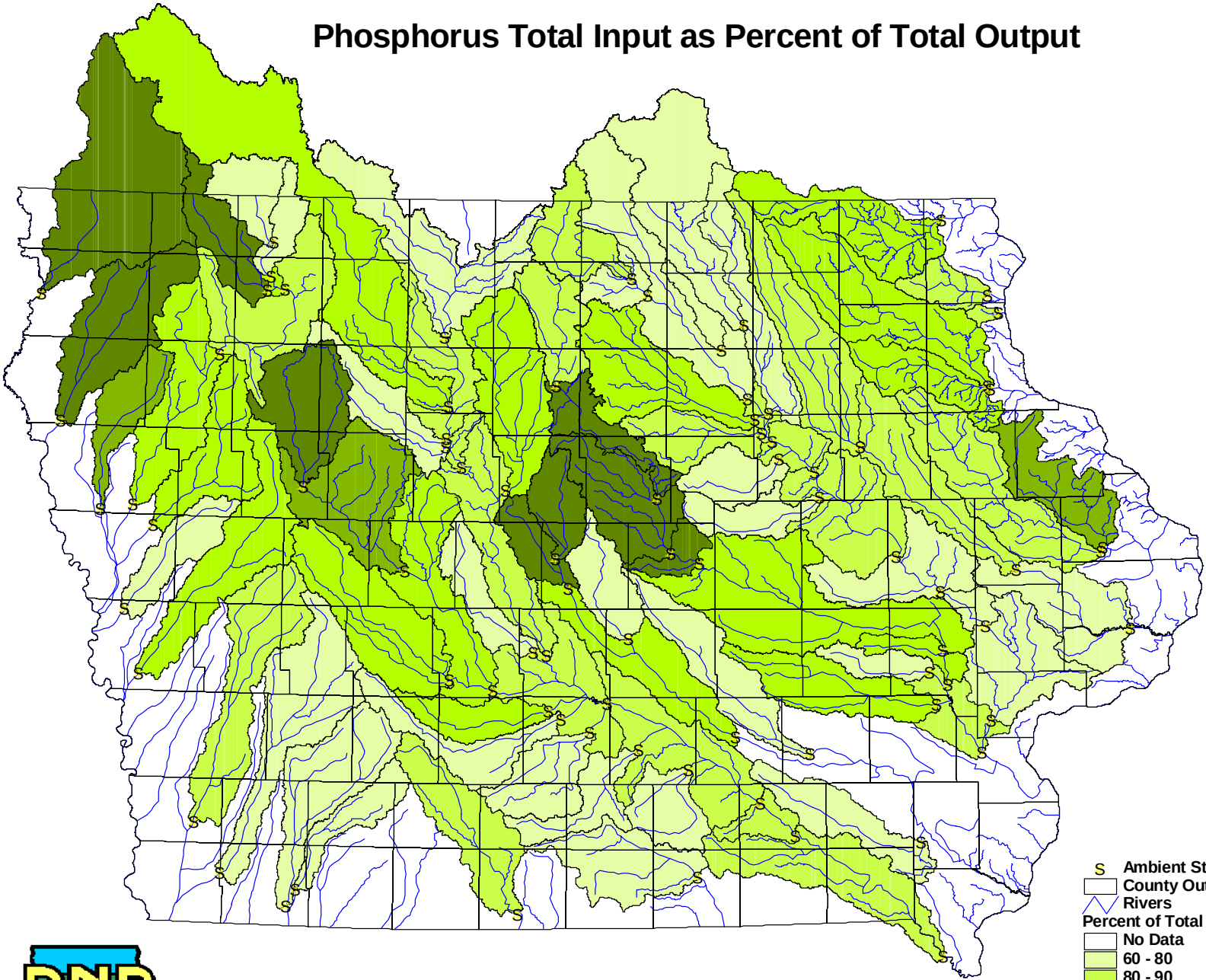
Phosphorus Total Input as Percent of Total Output



S Ambient Stream Sites
County Outlines
Rivers

Percent of Total P Output

- No Data
- 60 - 80
- 80 - 90
- 90 - 100
- 100 - 110
- 110 - 206

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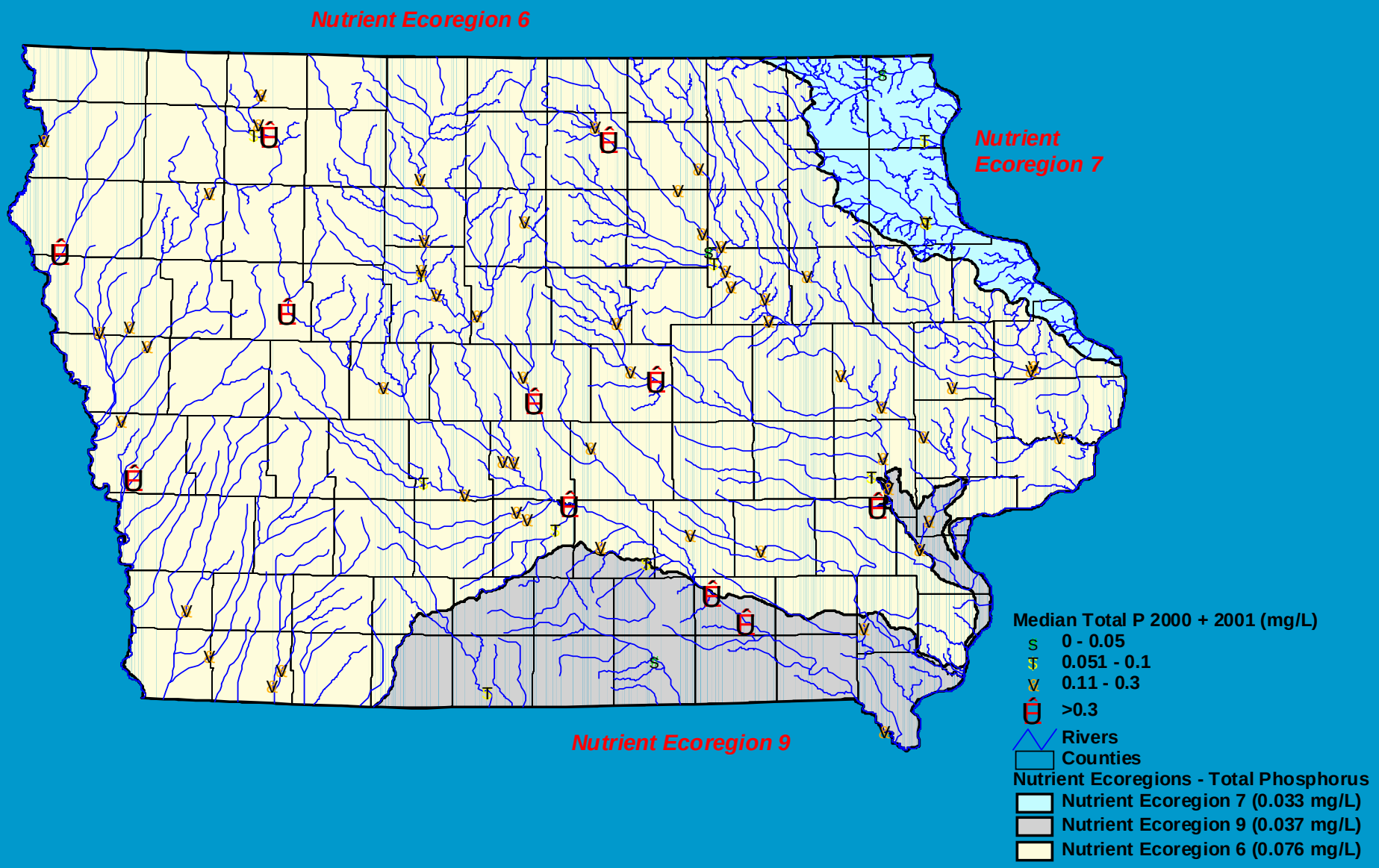
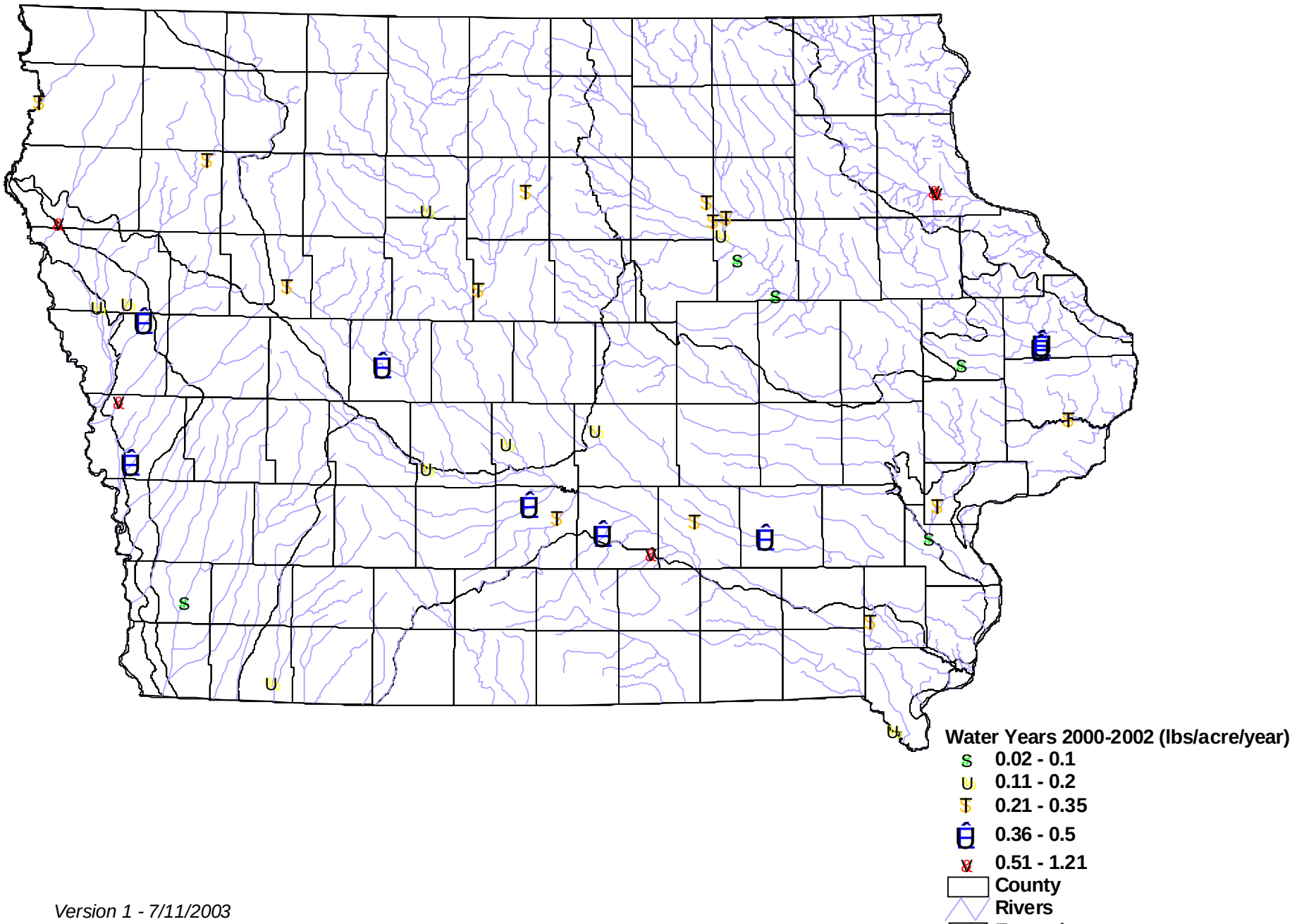
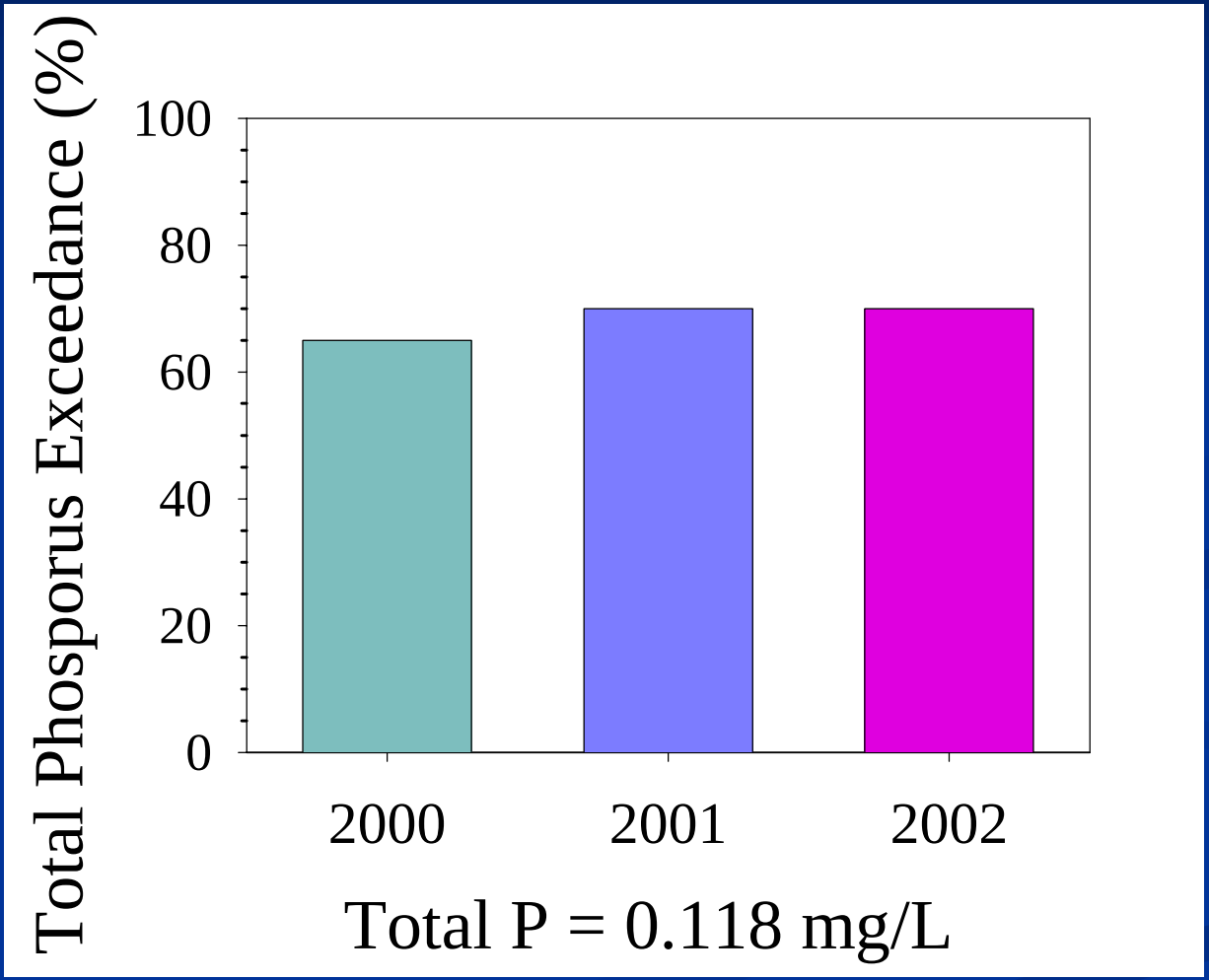
Ambient Stream Data for 2000 and 2001
(event and non-event data)



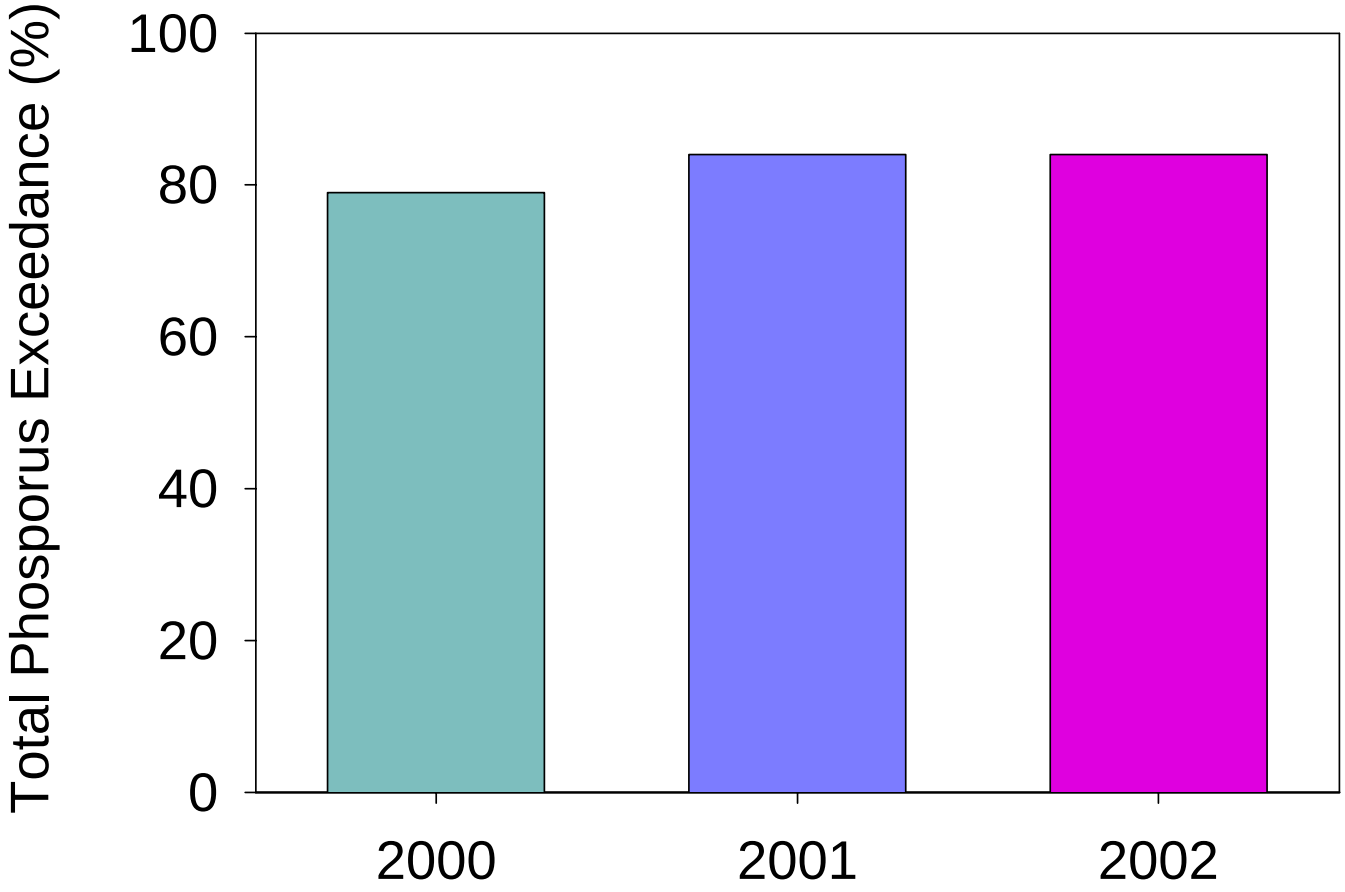
Phosphorus Yield from Watersheds



Version 1 - 7/11/2003


Total Phosporus Exceedance (%)
100
80
60
40
20
0
2000
2001
2002
Total P = 0.118 mg/L

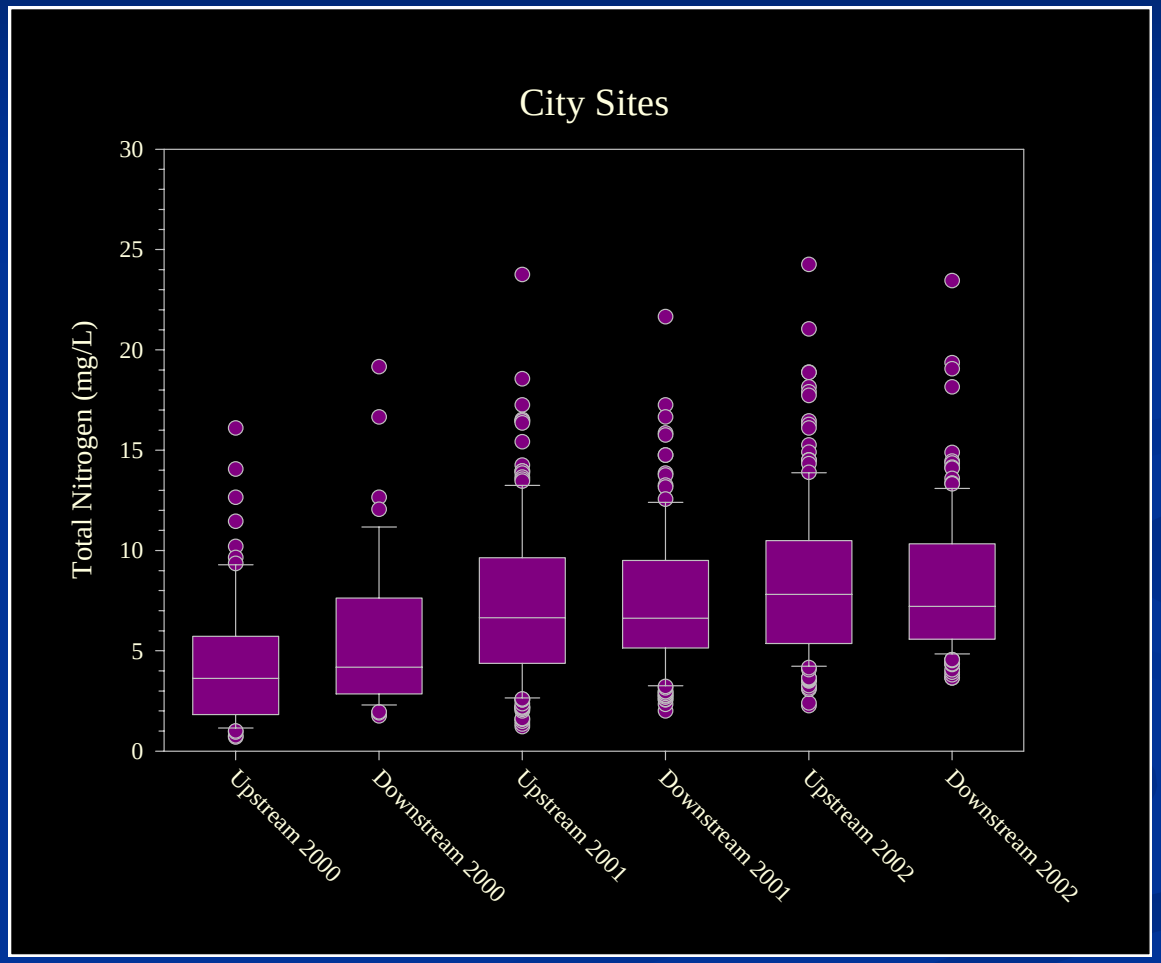
Ambient Monitoring - Stream Data (2000 - 2002)



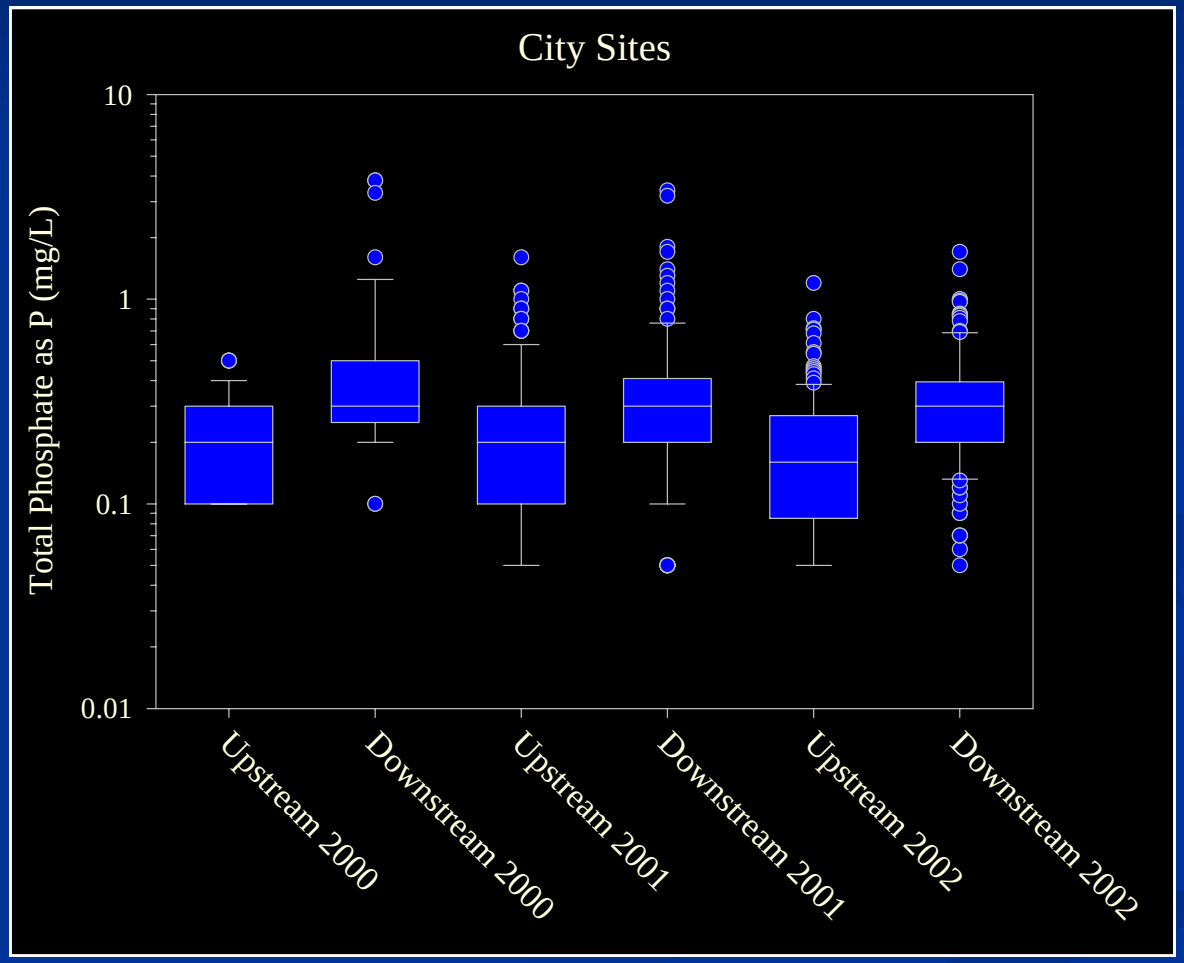
Total P - 0.076 mg/L

Impact of Urban Areas

Upstream vs. Downstream TN

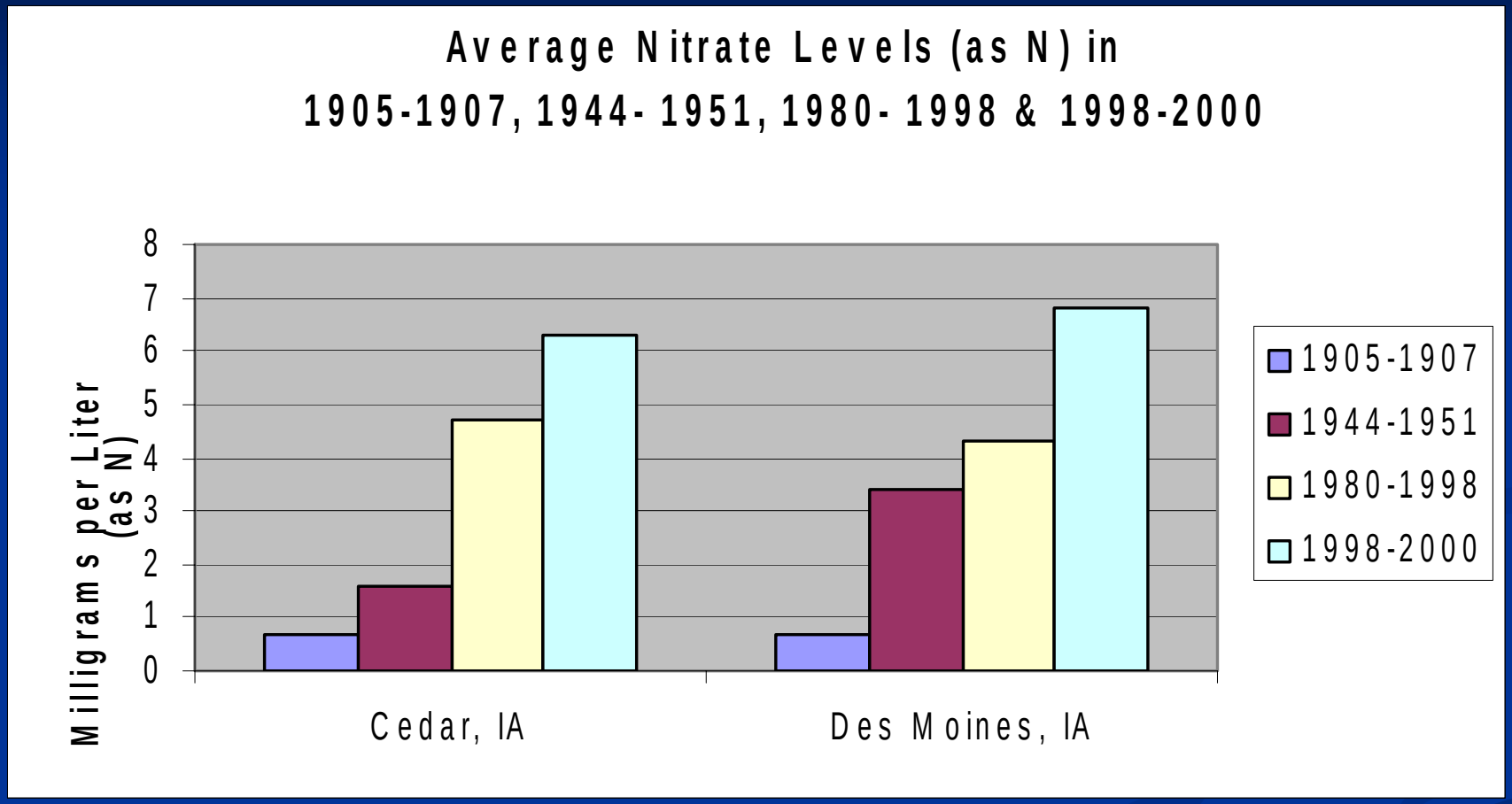


Upstream vs. Downstream TP

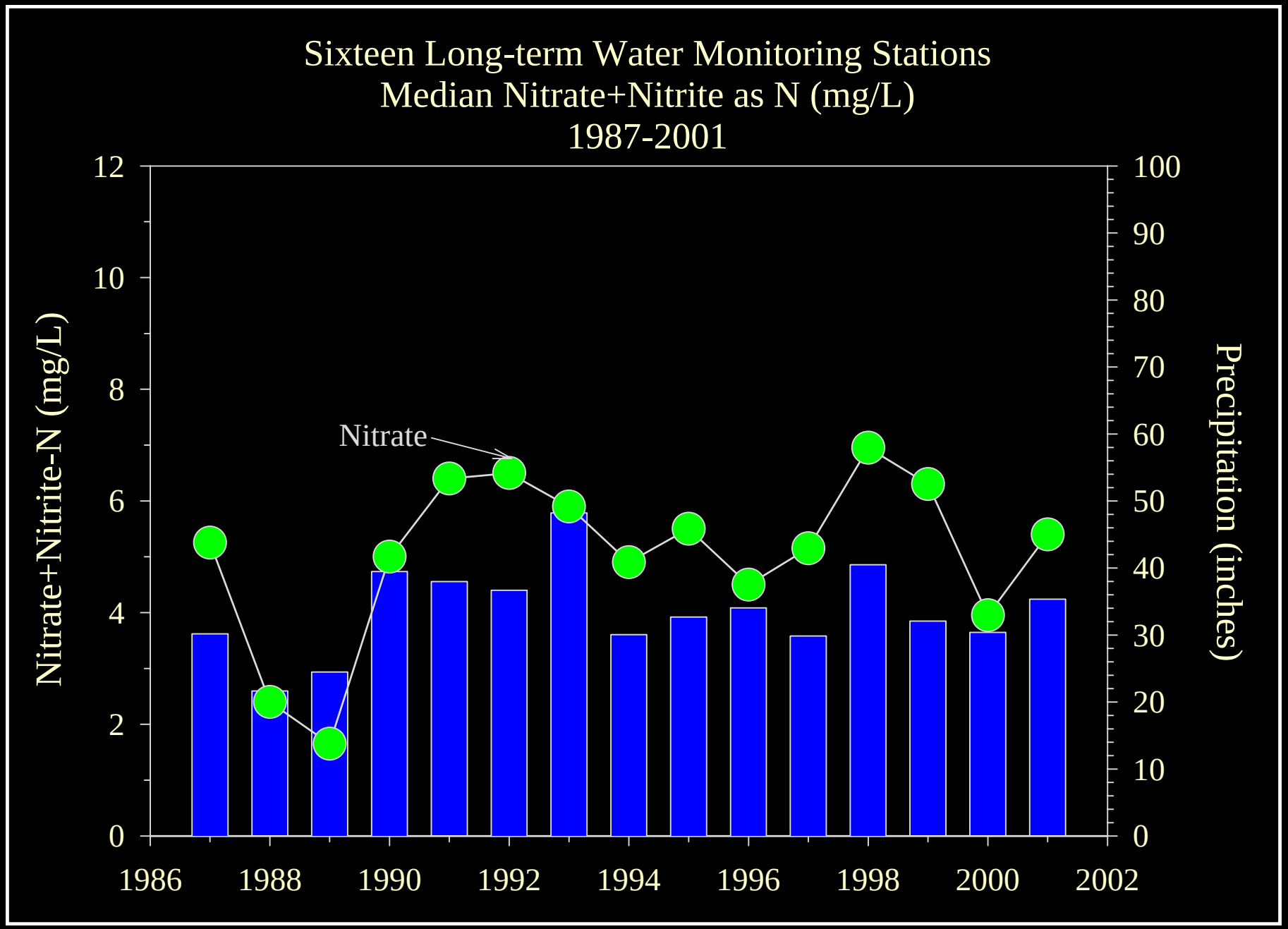


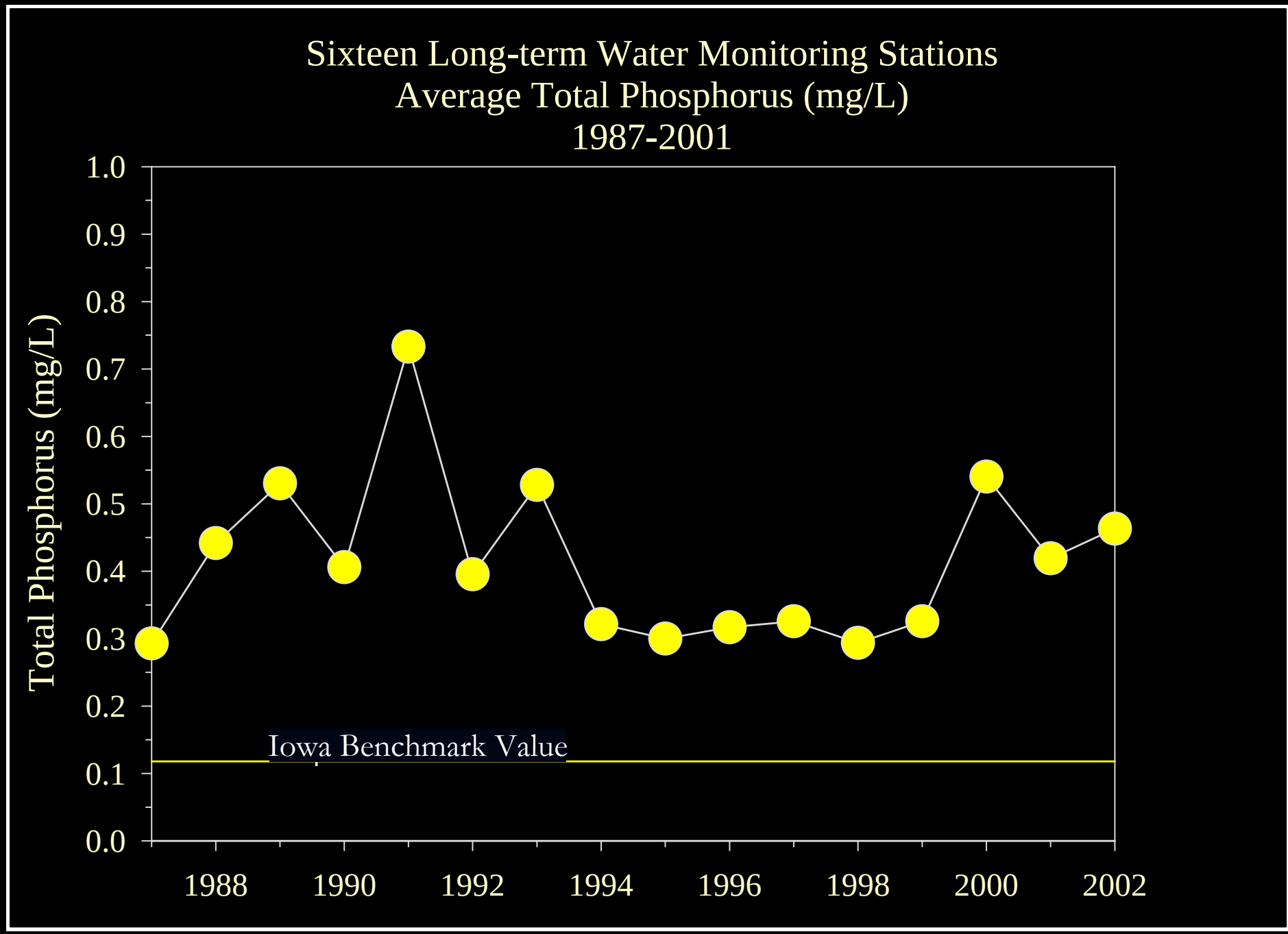
Nutrient Trends

- Limited Data Statewide
- 16 “Long-term” Stations – since 1986
- USGS Data Collection
- Municipal Data Collection Efforts



* Data: Cedar Rapids Water Department , Des Moines Water Works, and United States Geological Survey


Sixteen Long-term Water Monitoring Stations
Median Nitrate+Nitrite as N (mg/L)
1987-2001
Nitrate+Nitrite-N (mg/L)
Precipitation (inches)
Nitrate
0
2
4
6
8
10
12
0
10
20
30
40
50
60
70
80
90
100
1986
1988
1990
1992
1994
1996
1998
2000
2002


Sixteen Long-term Water Monitoring Stations
Average Total Phosphorus (mg/L)
1987-2001
Total Phosphorus (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Iowa Benchmark Value
1988
1990
1992
1994
1996
1998
2000
2002

Summary

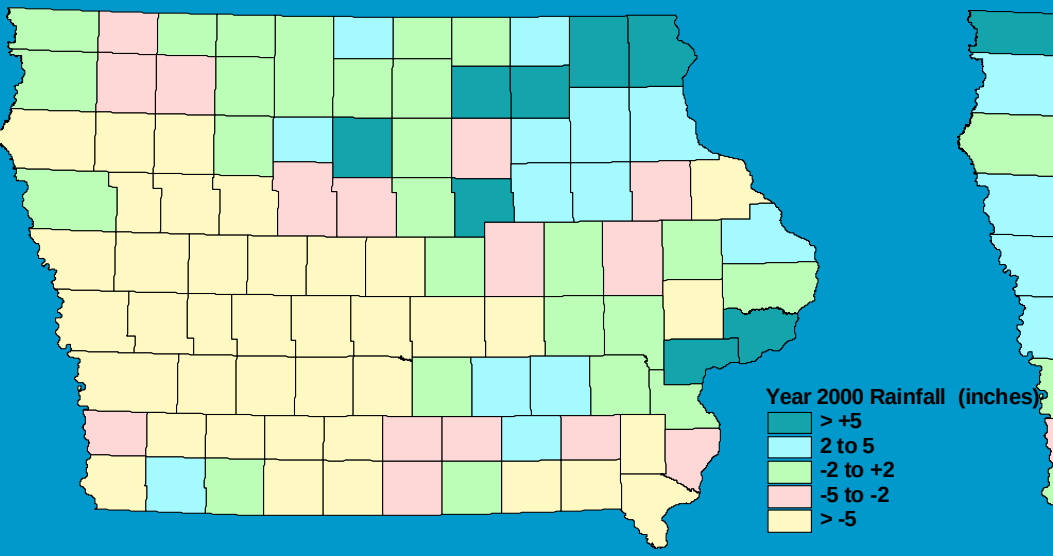
- Highest Inputs Do Not Equal Highest Conc.
- Location of Highest Conc. Vs. Greatest Yield
- Streams Exceed Benchmark Values
  - 90% of Time for TN
  - 70-80 % of Time for TP
- Cities Have Significant Impact on P conc.

Questions?

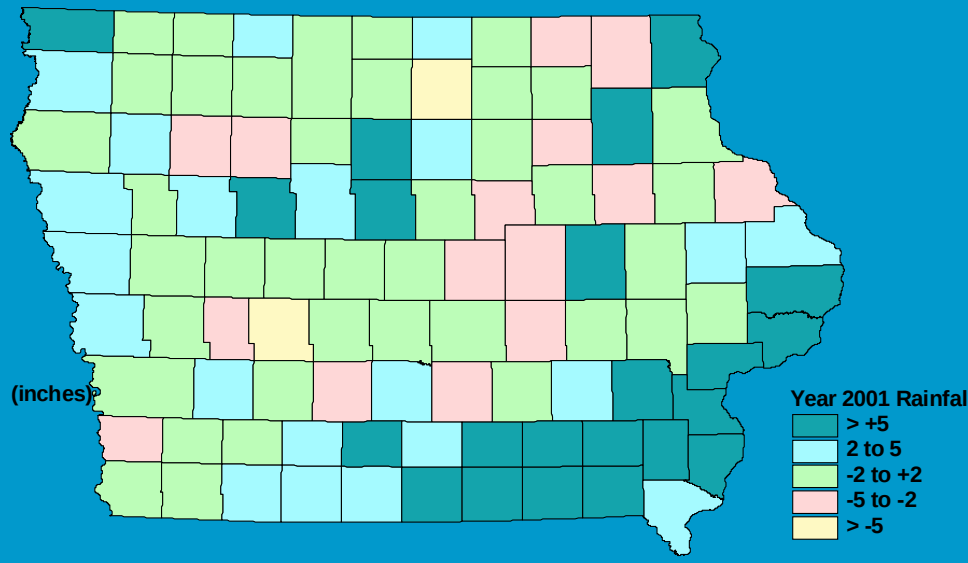
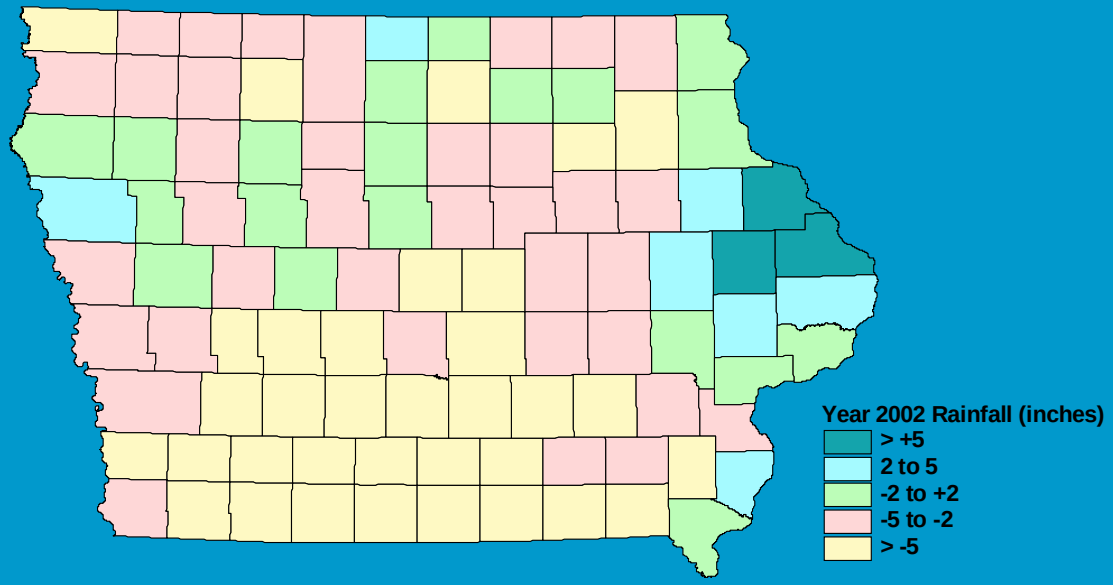
Email: mskopec@igsb.uiowa.edu

Caution! 2000 – 2002 was very dry

Departure from Normal Annual Rainfall



Departure from Normal Annual Rainfall



Departure from Normal Annual Rainfall