Improving the Raccoon River

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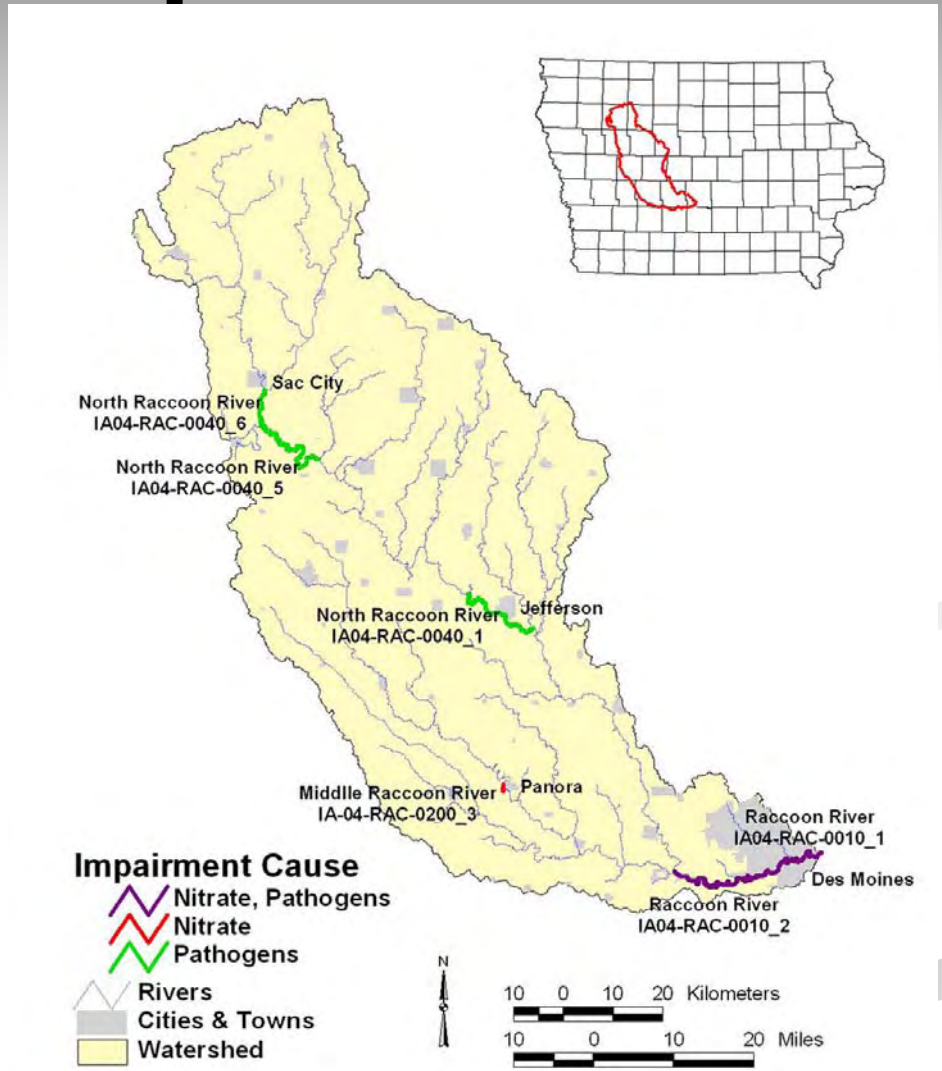
What we'll discuss today:

- Water Quality problems in the Raccoon
- Possible ways to improve water quality
- Your thoughts on how to improve water quality in the Raccoon River

What are the problems?

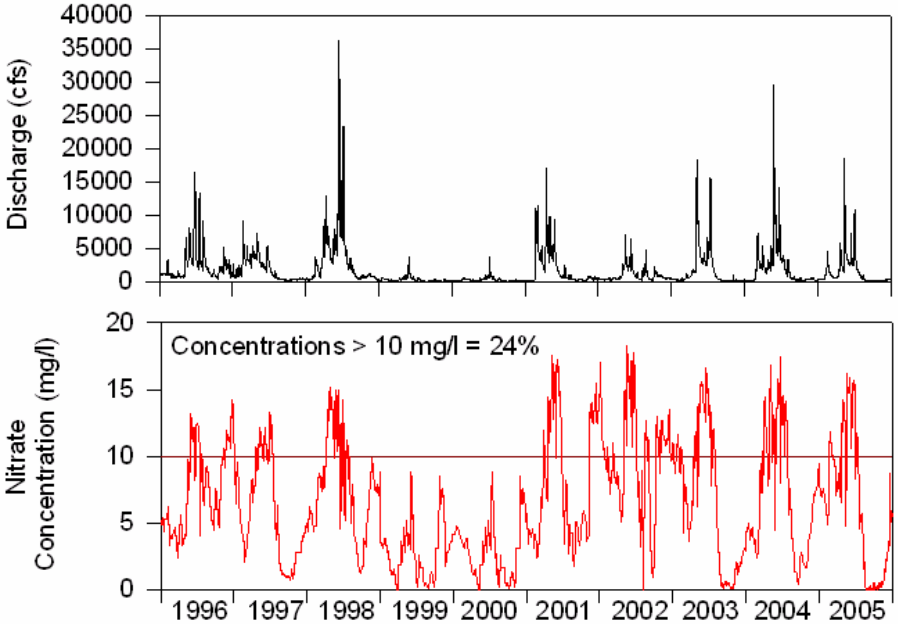
Nitrate concentrations in the Raccoon River are above drinking water standards at Des Moines Water Works and City of Panora

Bacteria (*E.coli*) concentrations in the Raccoon River are above applicable water quality standards for primary contact recreation

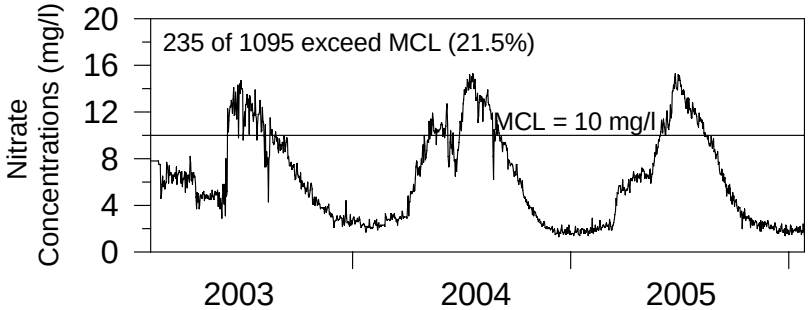


Levels of Nitrate in the Raccoon River

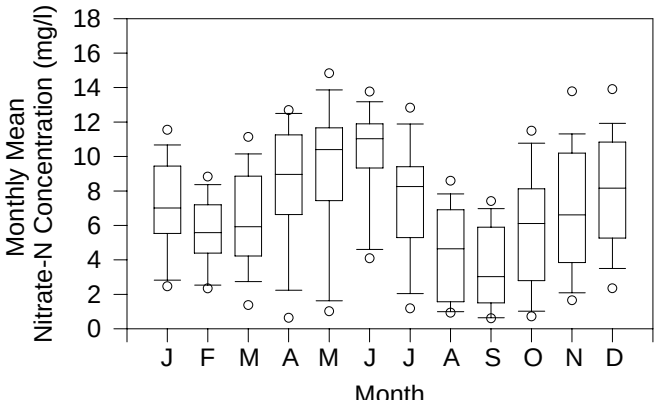
DMWW

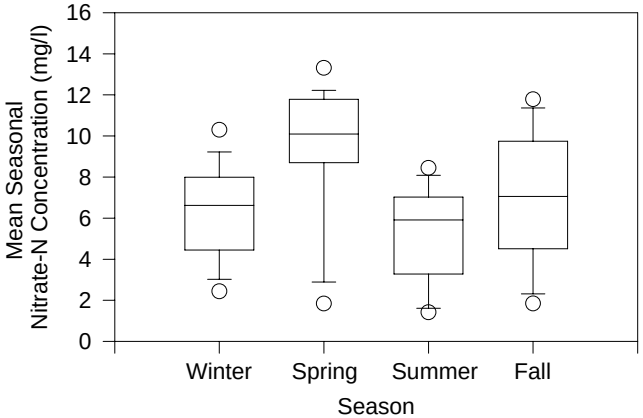


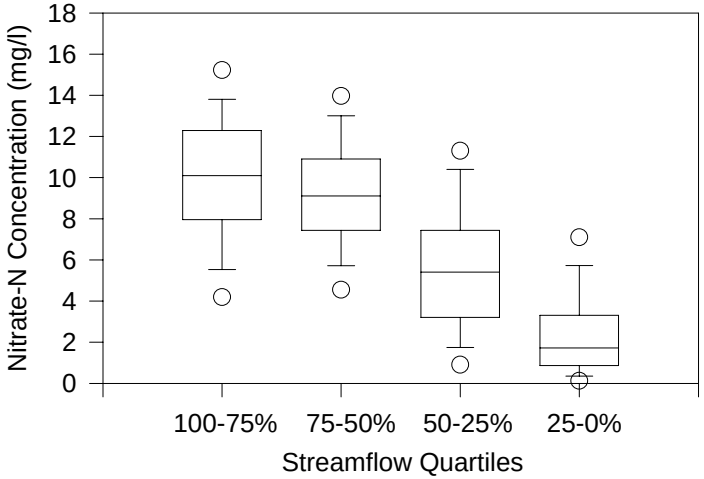
Panora



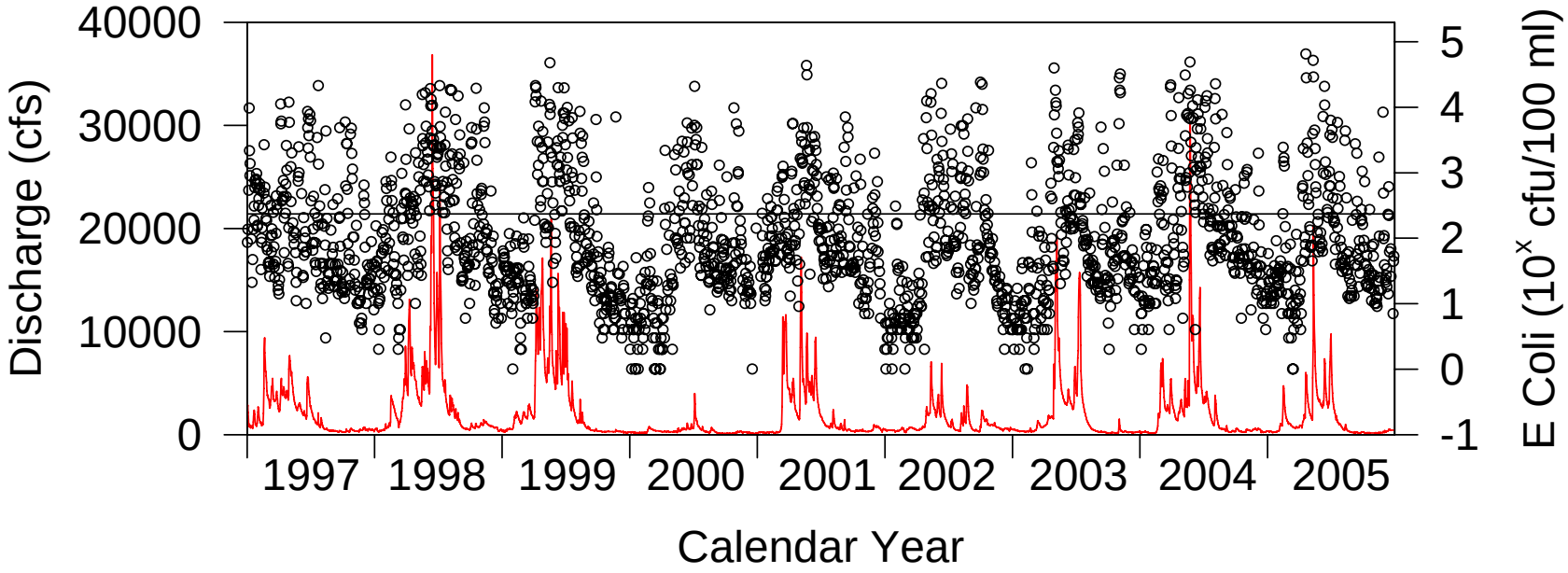
How do nitrate concentrations vary in the Raccoon River?





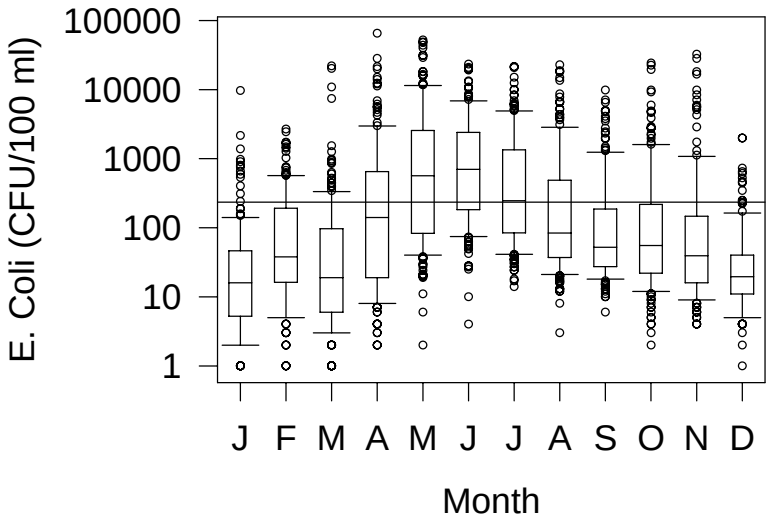


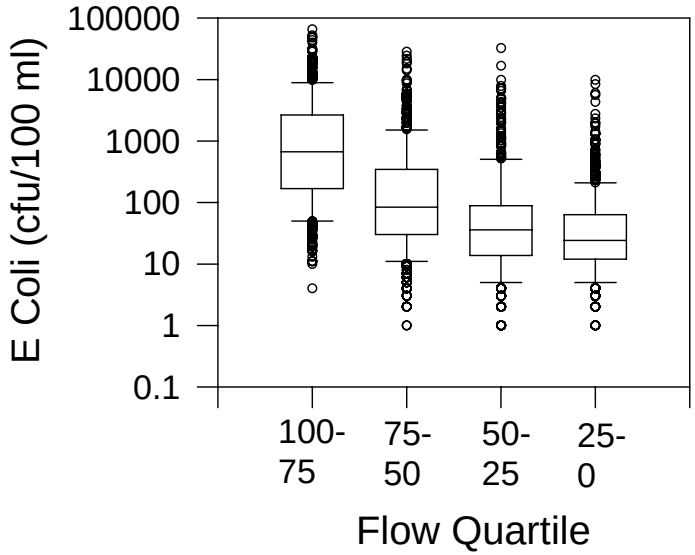
Bacteria Concentrations



- Average concentration = 1,156 CFU/100 ml (median = 68)
- Exceeded 235 CFU/100 ml 31% of the time from 1997-2005

Do Bacteria Concentrations Vary in the Raccoon River?

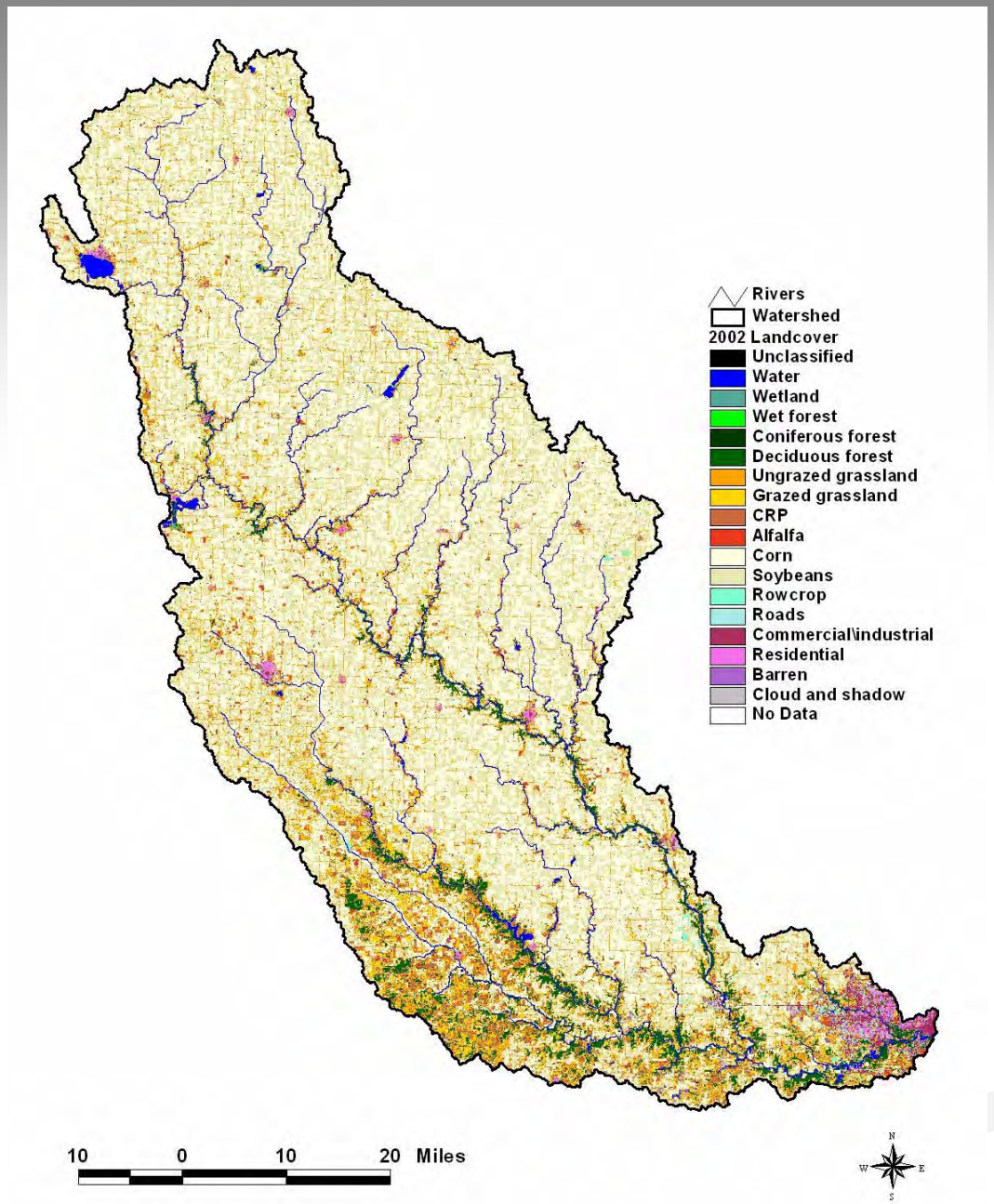


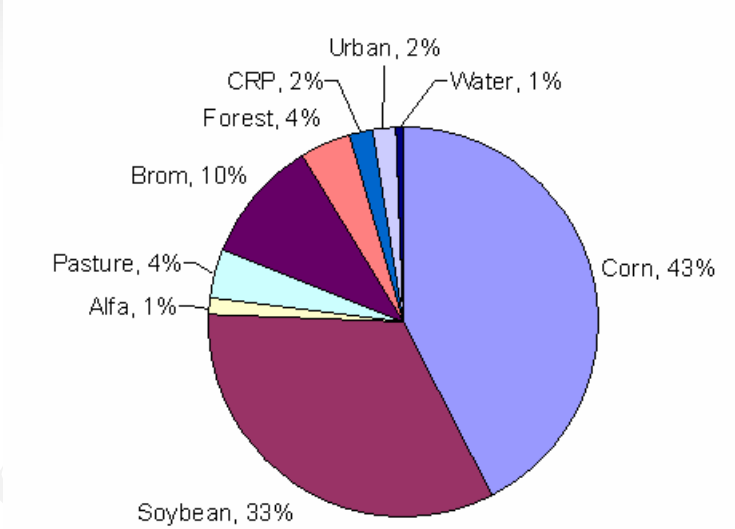


Where do pollutants come from?

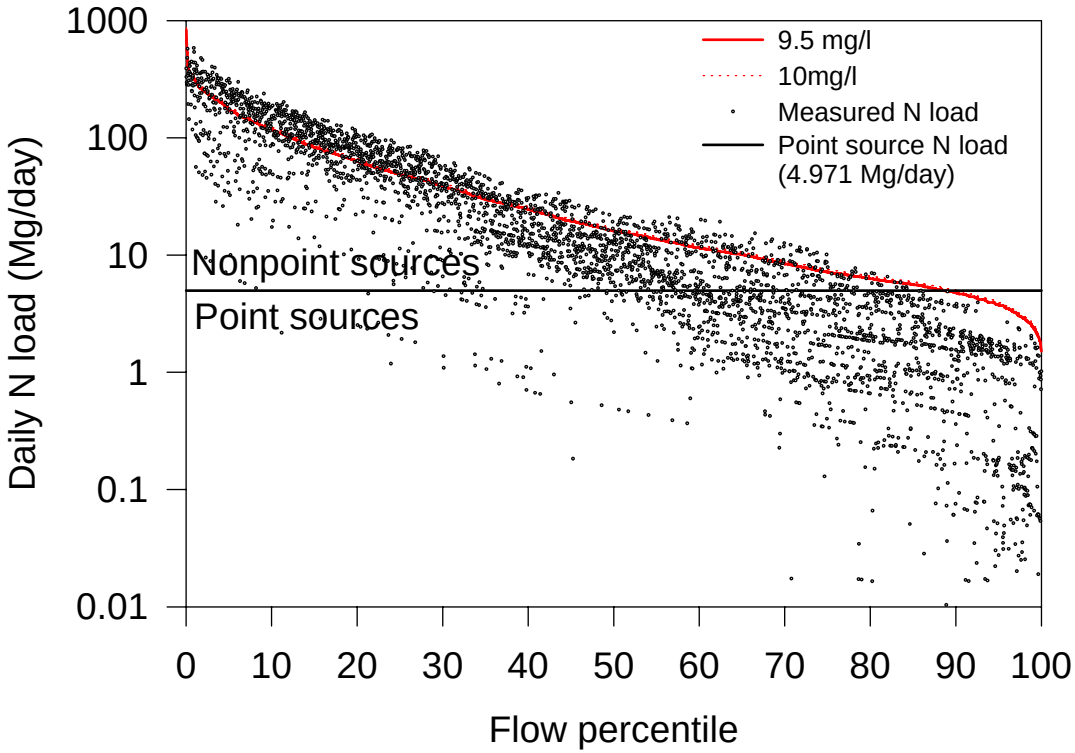
- Two main categories of sources
  - Point sources
  - Nonpoint sources
- Most of our current water quality problems come from nonpoint sources which are not regulated

Land Cover in Raccoon River Watershed





Nitrate Load and Flow



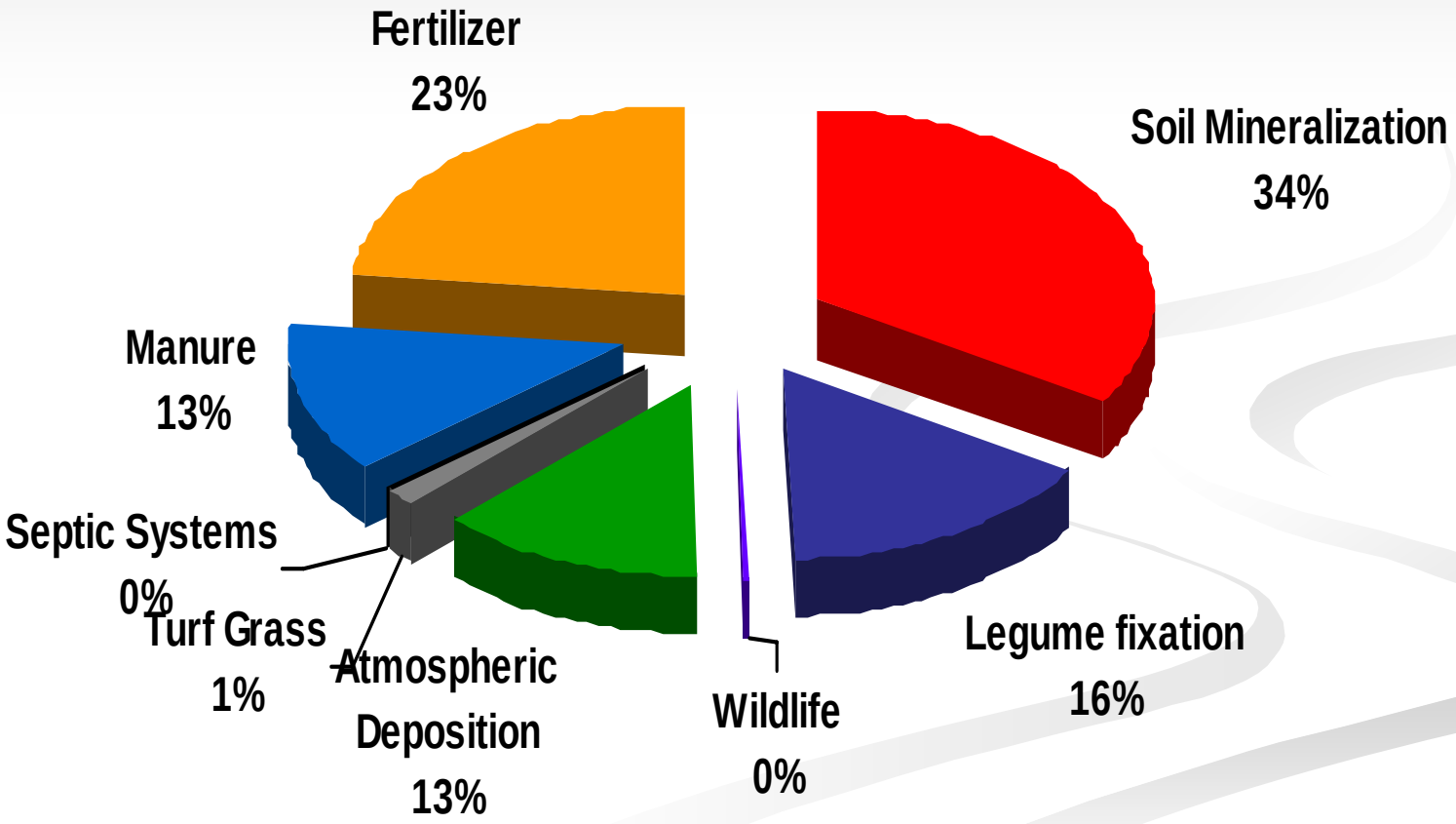
Contribution during Exceedances

Nonpoint Source	Point Source
89.7%	10.3%

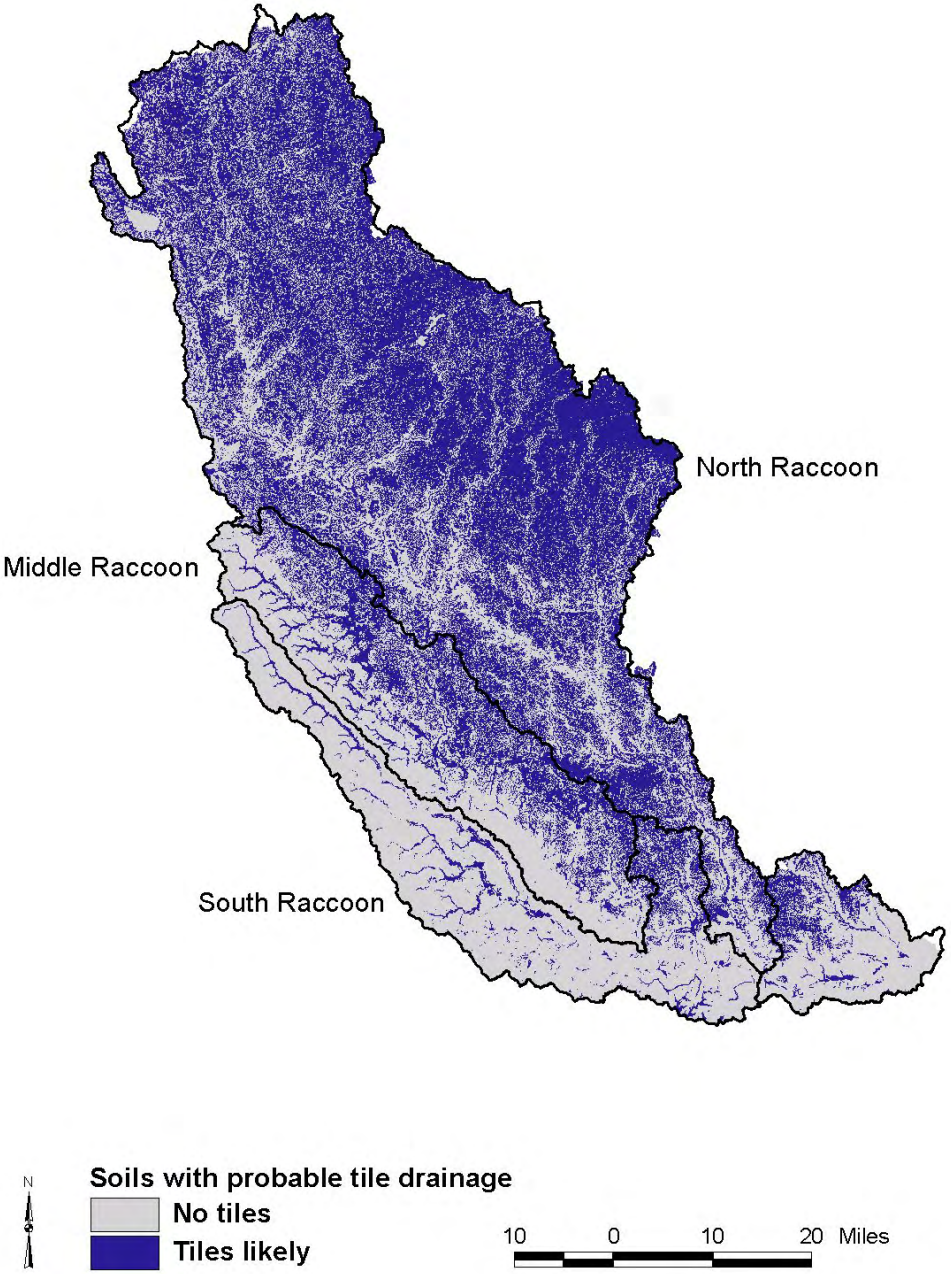
Nonpoint Nitrate sources

- Agriculture
  - Fertilizer on row crop fields (tiling)
  - Legume fixation
  - Manure
- Residential
  - Septic tanks
  - Residential turf and garden fertilizers
- Background
  - Atmospheric
  - Wildlife
  - Decomposing organic matter

Potential Nonpoint Source Contributions of Nitrate to the Raccoon River



Soils with Probable Tile Drainage



North Raccoon = 77.5 %

South Raccoon = 42.1%

Point Sources of Nitrate

- Wastewater Treatment facilities
  - Regulated by the DNR and EPA
    - 77 entities with NPDES permits in the Raccoon River basin

Where does *E.coli* bacteria come from?

Nonpoint Sources

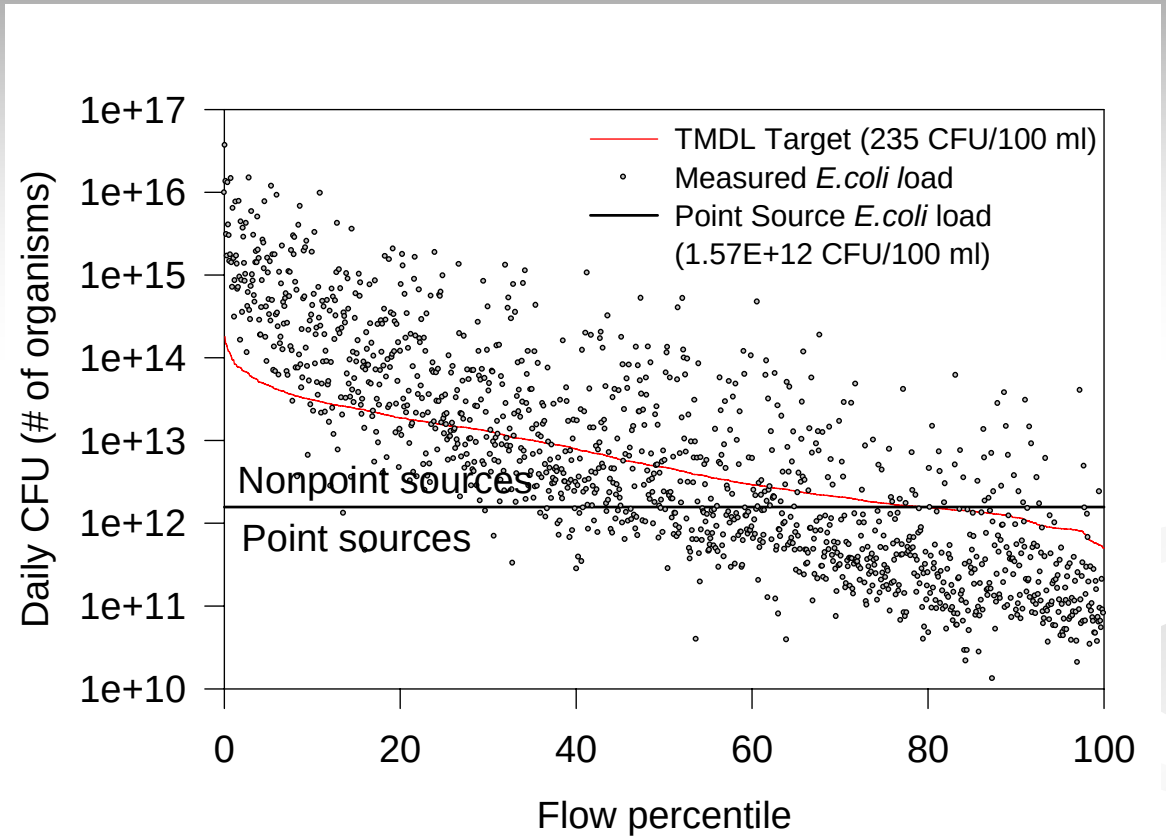
- Agriculture
  - Manure application on row crop fields
  - Open feed lots
  - Pastured livestock
- Residential
  - Septic systems
- Background
  - Wildlife

Point Sources

- Wastewater Treatment facilities regulated by the DNR and EPA

  77 entities with NPDES permits in the Raccoon River basin

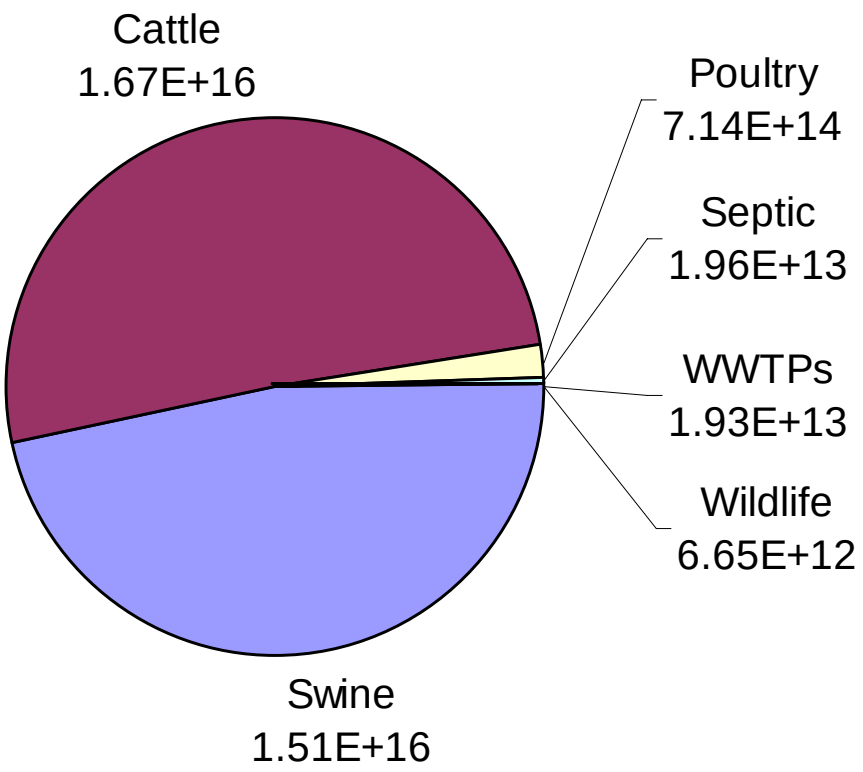
Bacteria and River Flow



Contribution during Exceedances

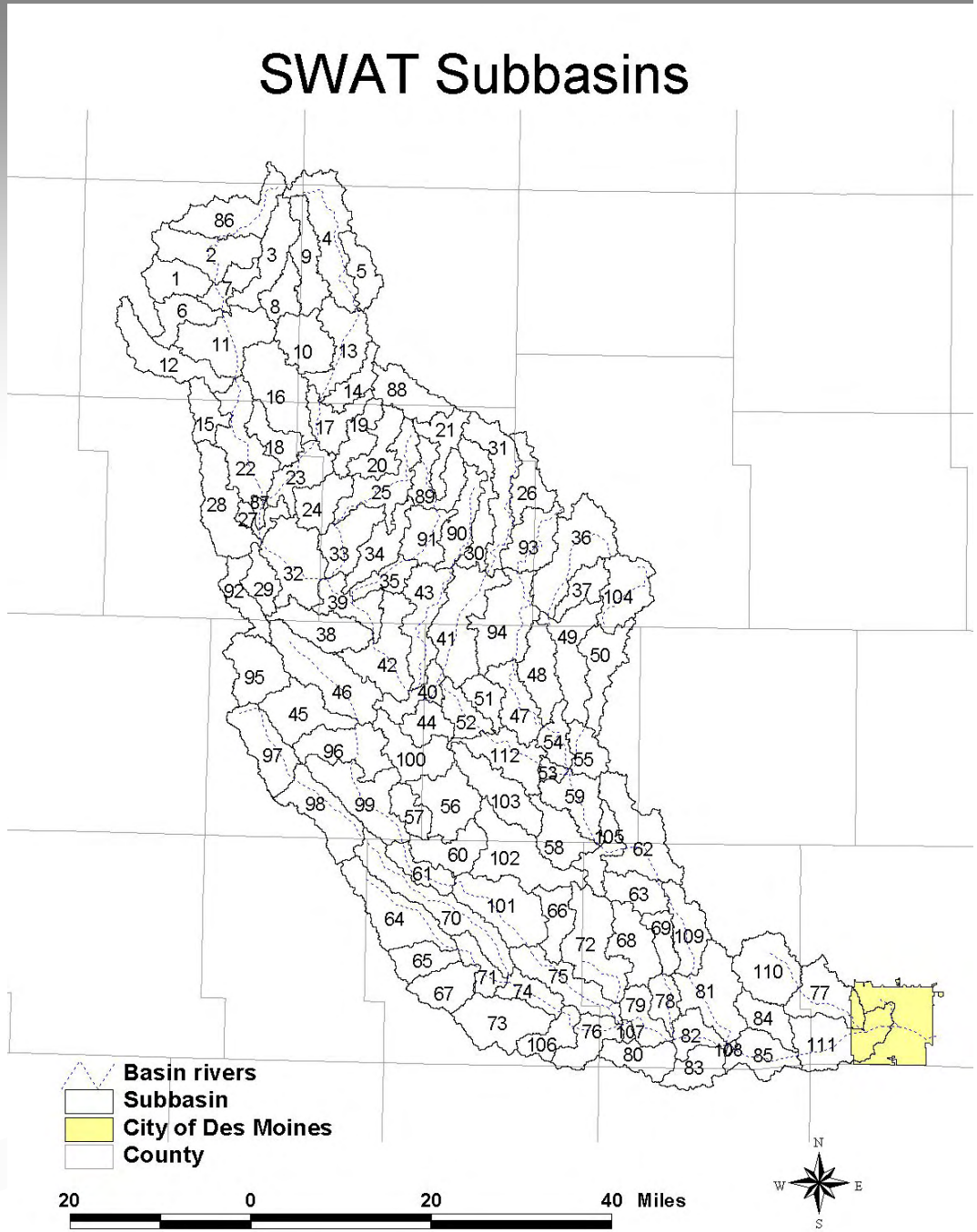
Nonpoint Source	Point Source
90%	10%

How much *E.coli* bacteria is produced in the watershed?

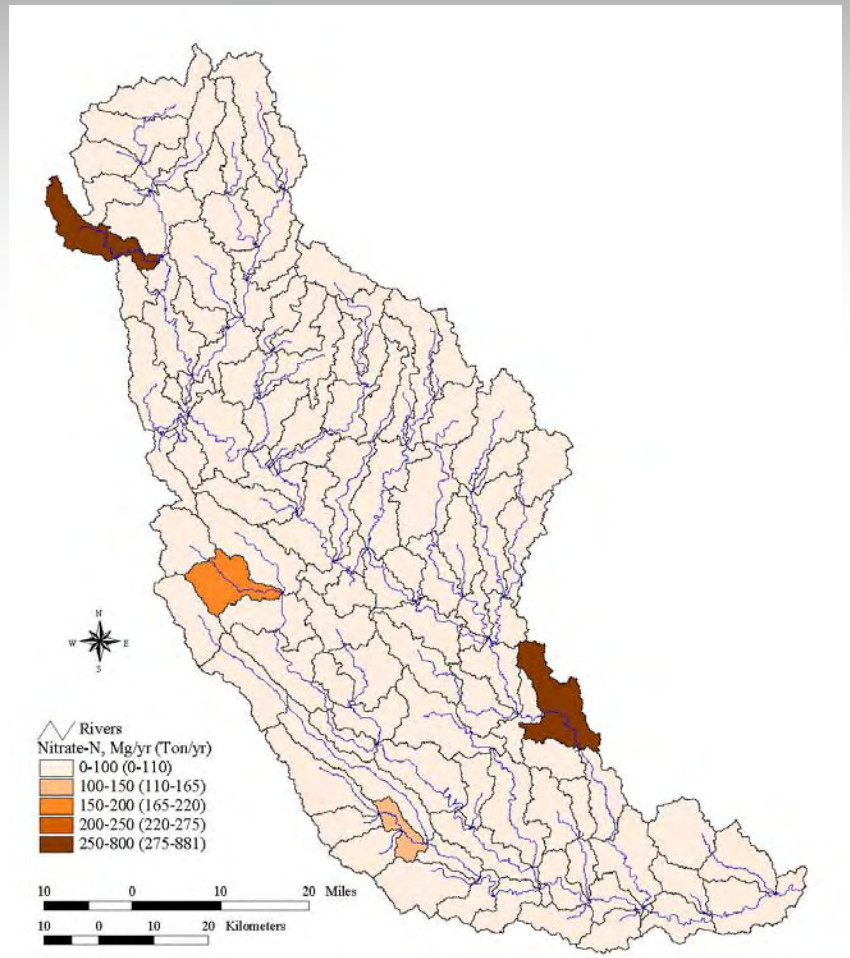


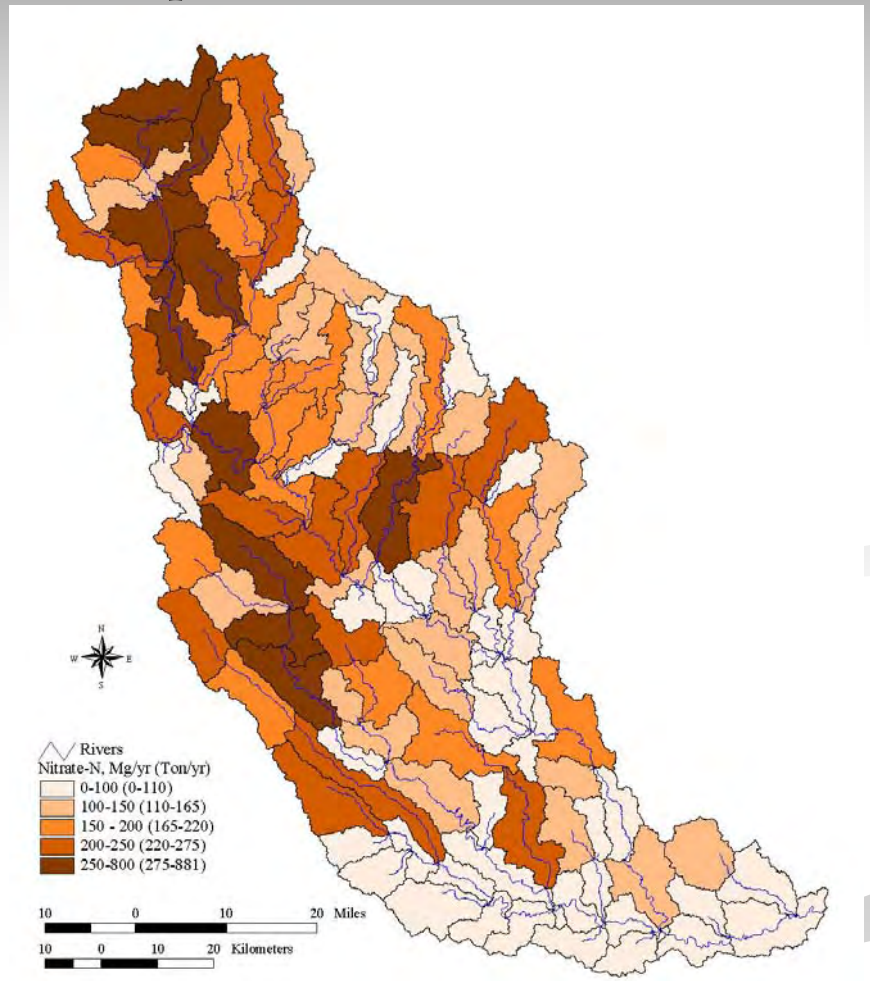
SWAT Model

- Continuous watershed scale hydrology and water quality model
- Developed to predict impacts of land management practices on watershed hydrology and water quality



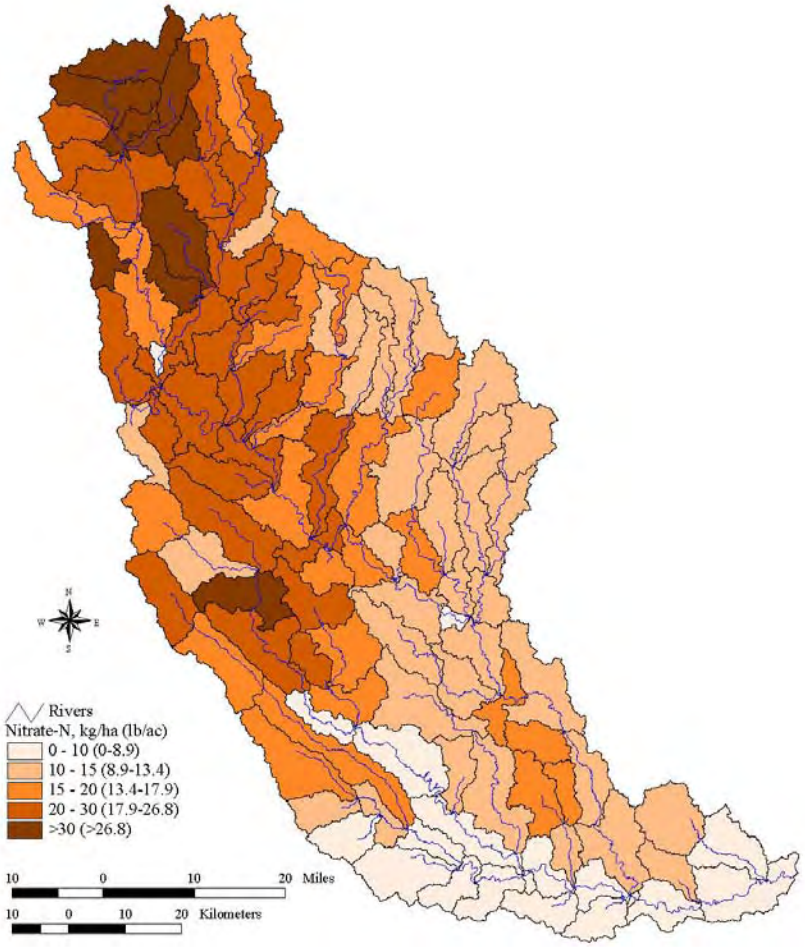
Nitrate Load from
Point Sources and Nonpoint Sources

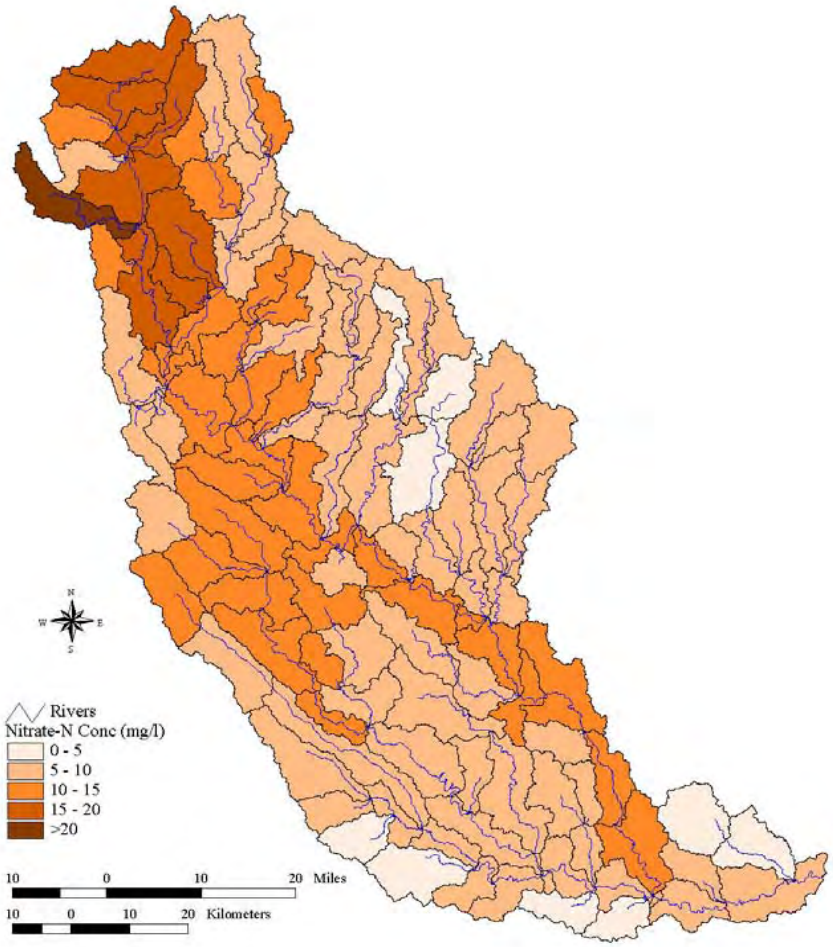




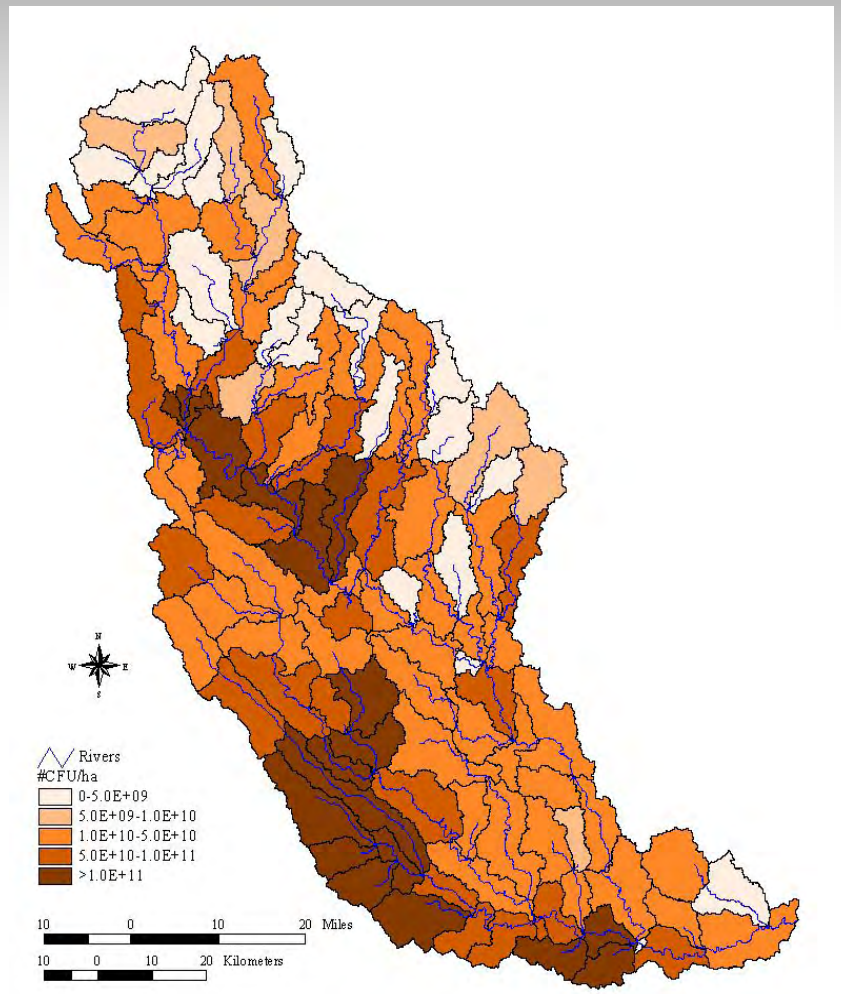
Nitrate

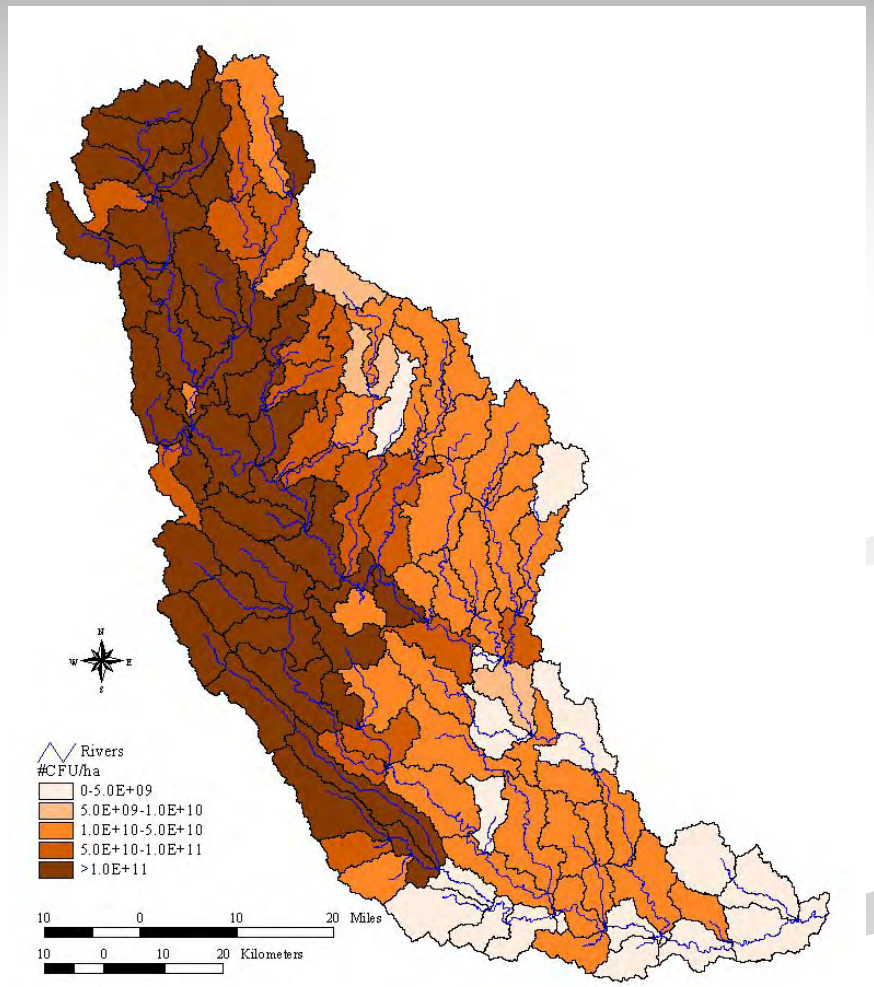
Loads and Concentrations



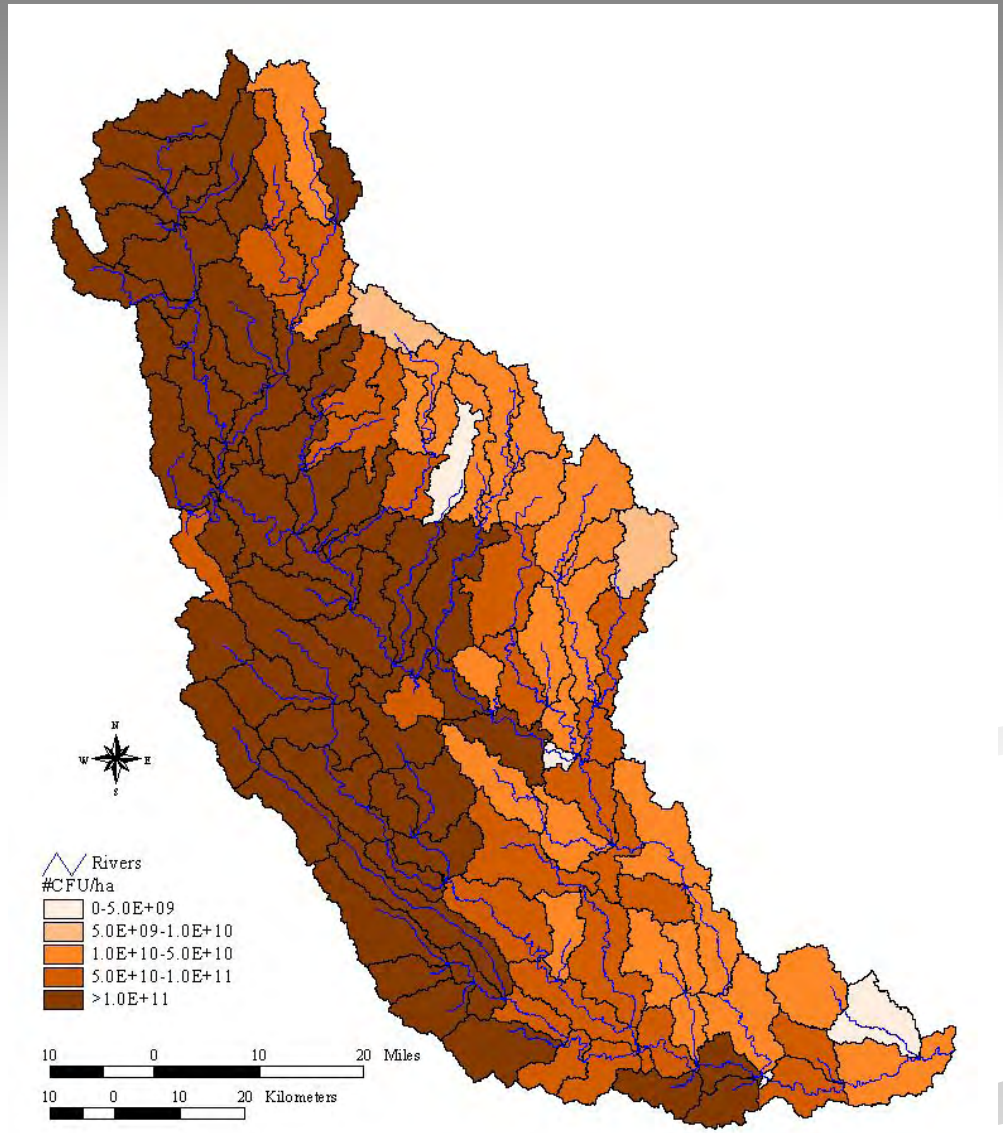


Bacteria from
Point Sources and Nonpoint Sources





Combined Bacteria Loads



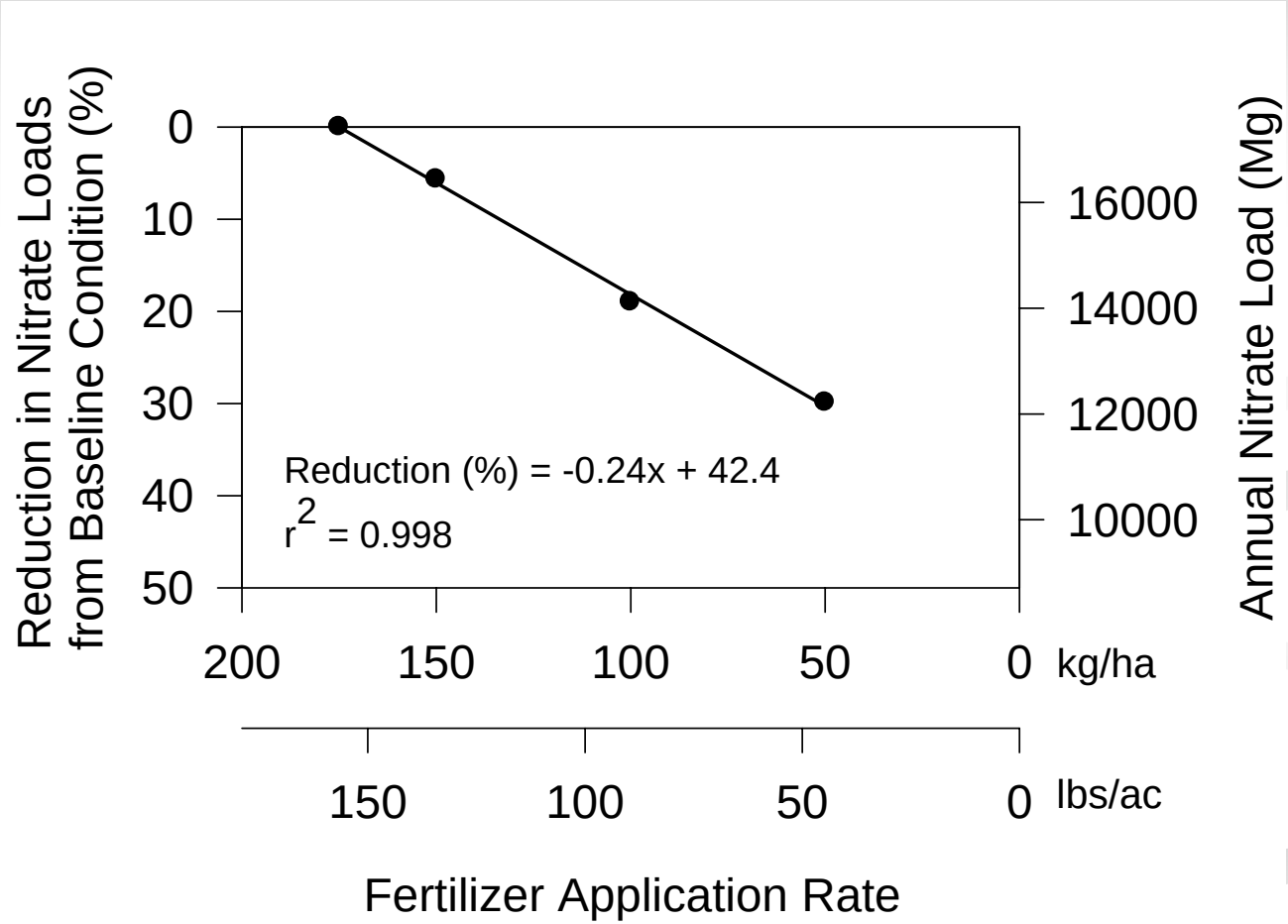
Modeled Load Reduction Scenarios

1. Reduce the rate of ammonia fertilizer application in the watershed to 134 lbs/ac, 89 lbs ac and 45 lbs/ac.
2. Remove all cattle from the streams.
3. Remove all human waste from the watershed.
4. Convert all row crop lands located on slopes greater than B slopes to CRP grassland.
5. Convert all row crop lands located on floodplain alluvial soils to CRP.

Nitrate Load Reductions

Scenario	Annual Nitrate Load (tons)	Percent Change from Baseline
Baseline condition	19,173	0%
Reduce fertilizer from 152 to 134 lbs/ac	18,080	-5.7%
Reduce fertilizer from 152 to 89 lbs/ac	15,530	-19.0%
Reduce fertilizer from 152 to 45 lbs/ac	13,440	-29.9%
No cattle in streams	19,058	-0.6%
No human waste	17,294	-9.8%
Convert crop ground on C slopes or greater to CRP	17,466	-8.9%
Convert crop ground on alluvial soils to CRP	18,521	-3.4%

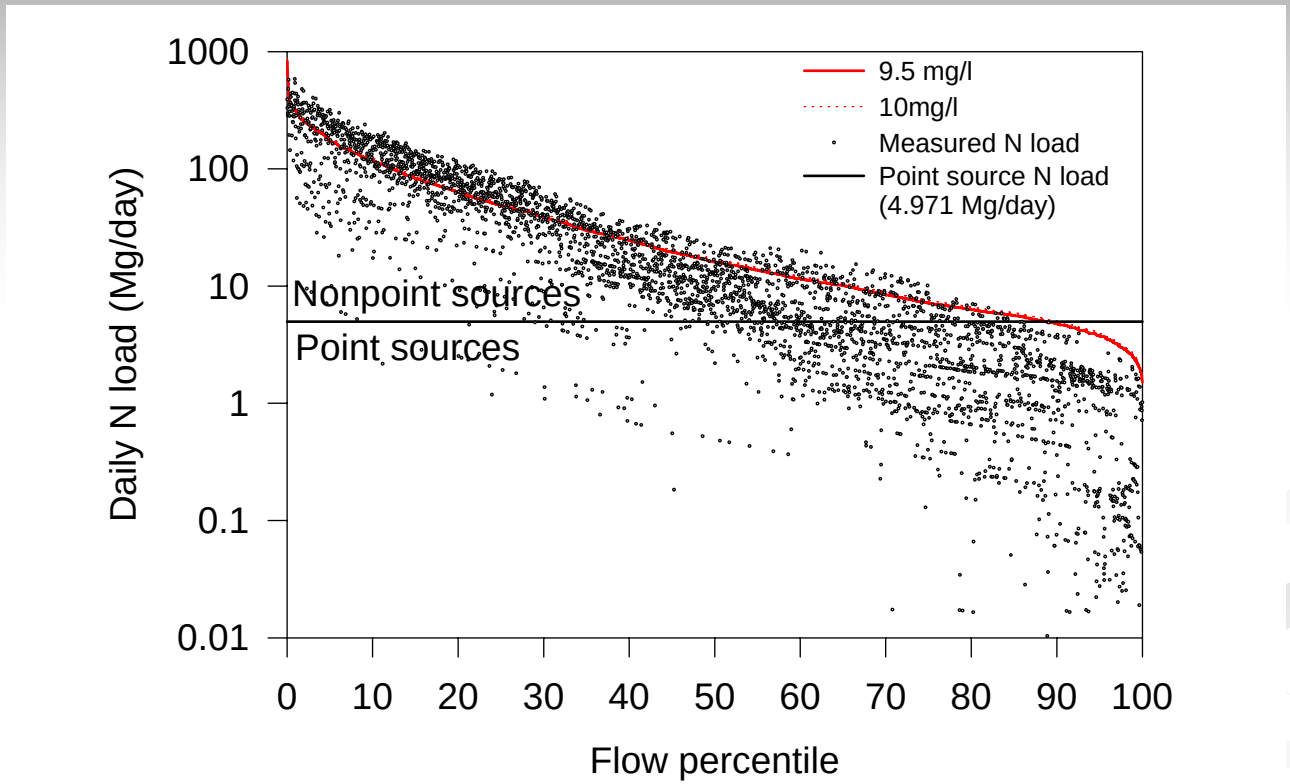
Nitrate load reductions achieved with reduced fertilizer applications



Bacteria Load Reductions

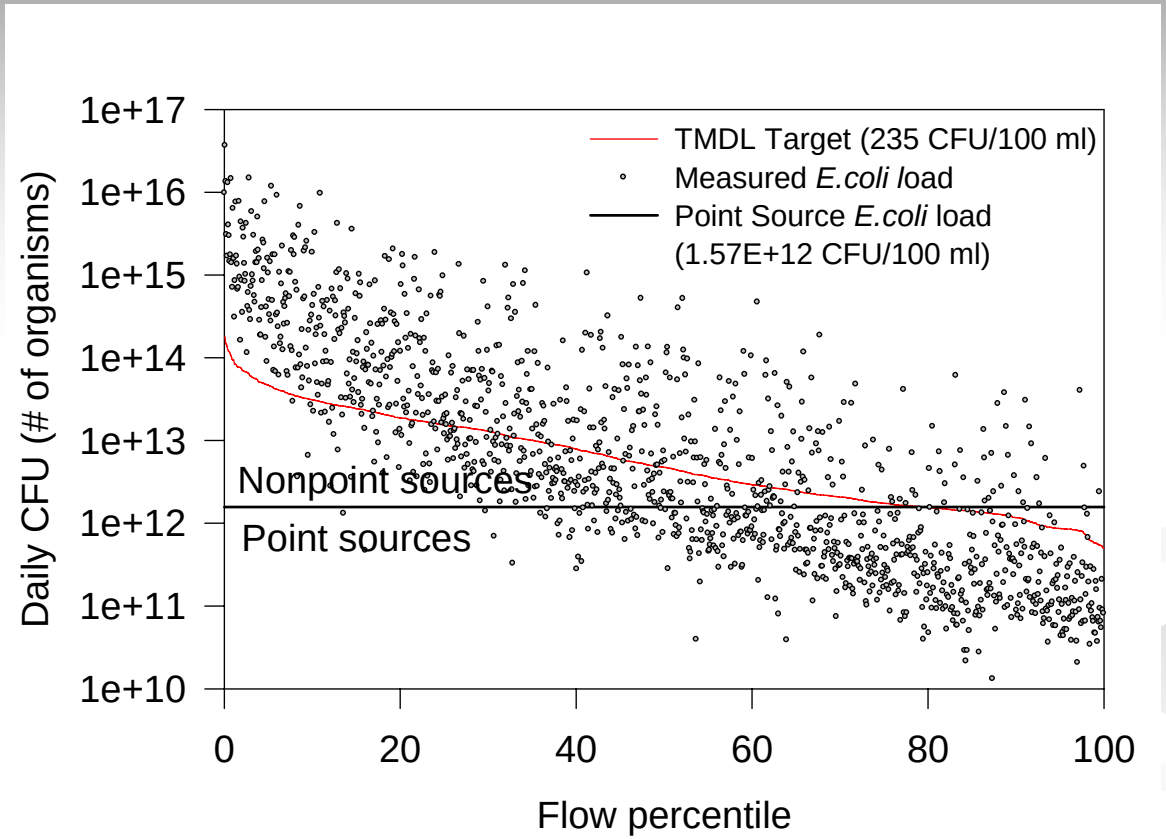
Scenario	Reduction in *E.coli* Load from Baseline Condition (%) (63 Subbasins)			
	Average	**Median**	**Min.**	**Max.**
No cattle in streams	0.68	0.69	0.00	2.09
No human waste	0.88	0.89	0.00	2.20
Convert crop ground on C slopes or greater to CRP	6.90	0.35	0.00	68.19
Convert crop ground on alluvial soils to CRP	3.85	0.38	0.00	33.19

Needed Nitrate Reductions



Nitrate Reduction Needed	% of Days Needing Reduction	Contribution during Exceedances	
		Nonpoint Source	Point Source
48.1%	27.0%	89.7%	10.3%

Needed Bacteria Reductions



Bacteria Reduction Needed	% of Days Needing Reduction	Contribution during Exceedances	
		Nonpoint Source	Point Source
99.7%	44.5%	90%	10%

Achieving Reductions

- Adoption / Installation of targeted best management practices needed to achieve reductions

- Management practices will have different effectiveness on Nitrate or Bacteria

Achieving Nitrate Reductions

- From Nonpoint sources:
- Improved nitrate-nitrogen management
  - Rate, timing, and method
    - Use spring or split nitrogen application
    - Base application rates on the Late-Spring Soil Nitrate Test (LSNT) and fall stalk nitrate tests.
    - Take appropriate nitrogen credit for legume crops such as soybeans or alfalfa, and for application of manure.

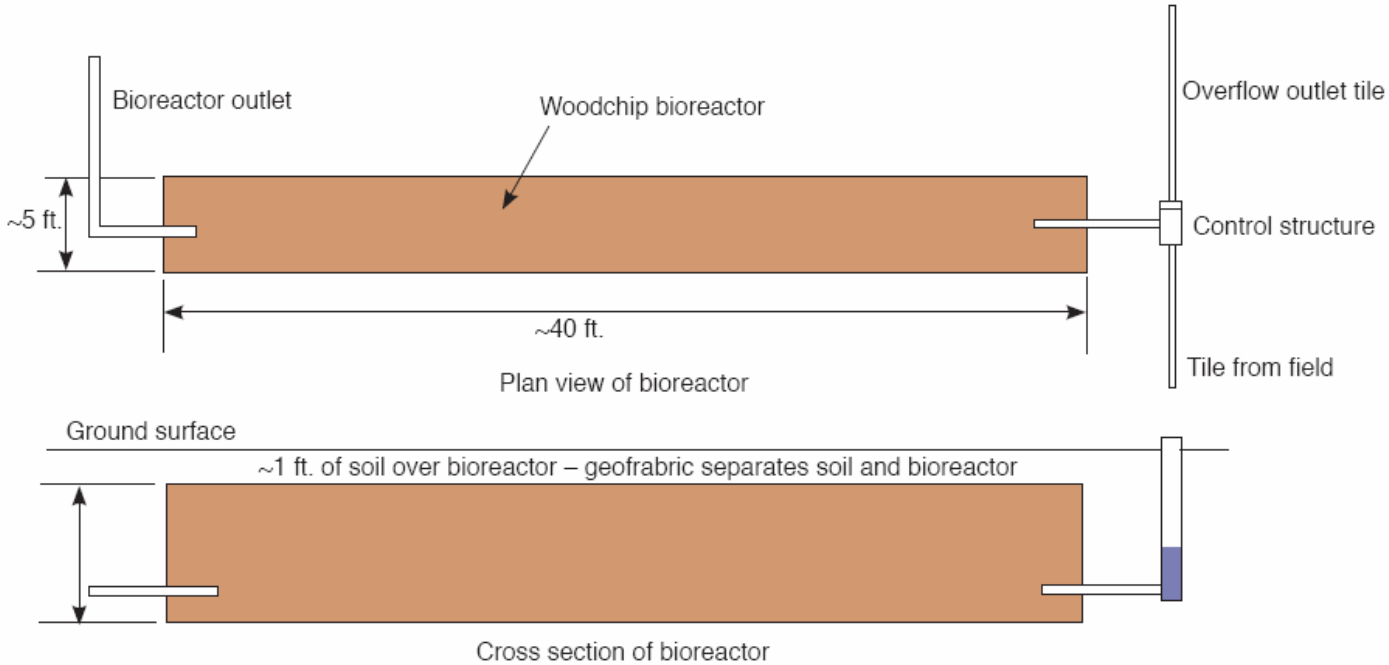
Achieving Reductions

- Establish fall cover crops
- Addition of perennial species to crop rotation
- Enrollment of land into CRP

Achieving Reductions

- Construction of nitrate removal wetlands at the outfall of large tile drainage systems (CREP)

- Alternative Drainage Designs & Wetlands
  - Controlled Drainage Systems



Achieving Bacteria Reductions

- From Nonpoint Sources:
  - Control runoff from feedlots and manured fields
  - Take credit for manure and incorporate it into soils
  - Exclude livestock from streams

Achieving Reductions

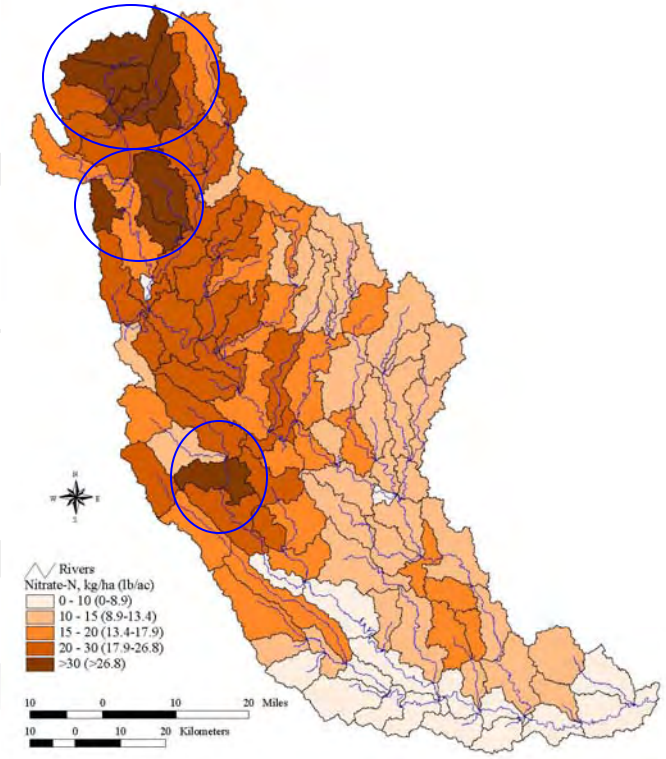
- Septic systems
  - Update illegal or failing systems
  - County led

Achieving Reductions

- Point Sources
  - Nitrate
    - Permits will have Total Nitrogen Limits
    - DNR will require monitoring of nitrogen levels in effluent
  - Bacteria
    - Permits will have monitoring requirements and limits
    - Require disinfection or discharge outside of recreation season
    - Dependent on Use Attainability Analysis

Achieving Reductions

- Targeting priority watersheds
- Completing a detailed watershed assessment
- Developing a targeted plan



Watershed Tools

- Tablet Computers for Watershed Assessments
- Handheld GIS units for Stream Assessments

Adam Kiel

515-242-6149

Available Resources

- Financial Resources
  - Grant programs administered by DNR and DSC
  - State and Federal programs administered by IDALS and USDA
  - WIRB
- Technical Resources
  - DNR
    - Field Office
    - Water Monitoring
    - Watershed Improvement
  - Local SWCD and NRCS
  - Other Organizations, such as ISA, ACWA, Extension

What's next?

- Public Comment Period
  - Ends November 26
- Finalize report and submit to EPA
- Local stakeholders use report as a basis for targeting priority areas to begin addressing the problems.

- With enough improvement and time, Raccoon River is removed from the impaired waters list

Comments or Questions?

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