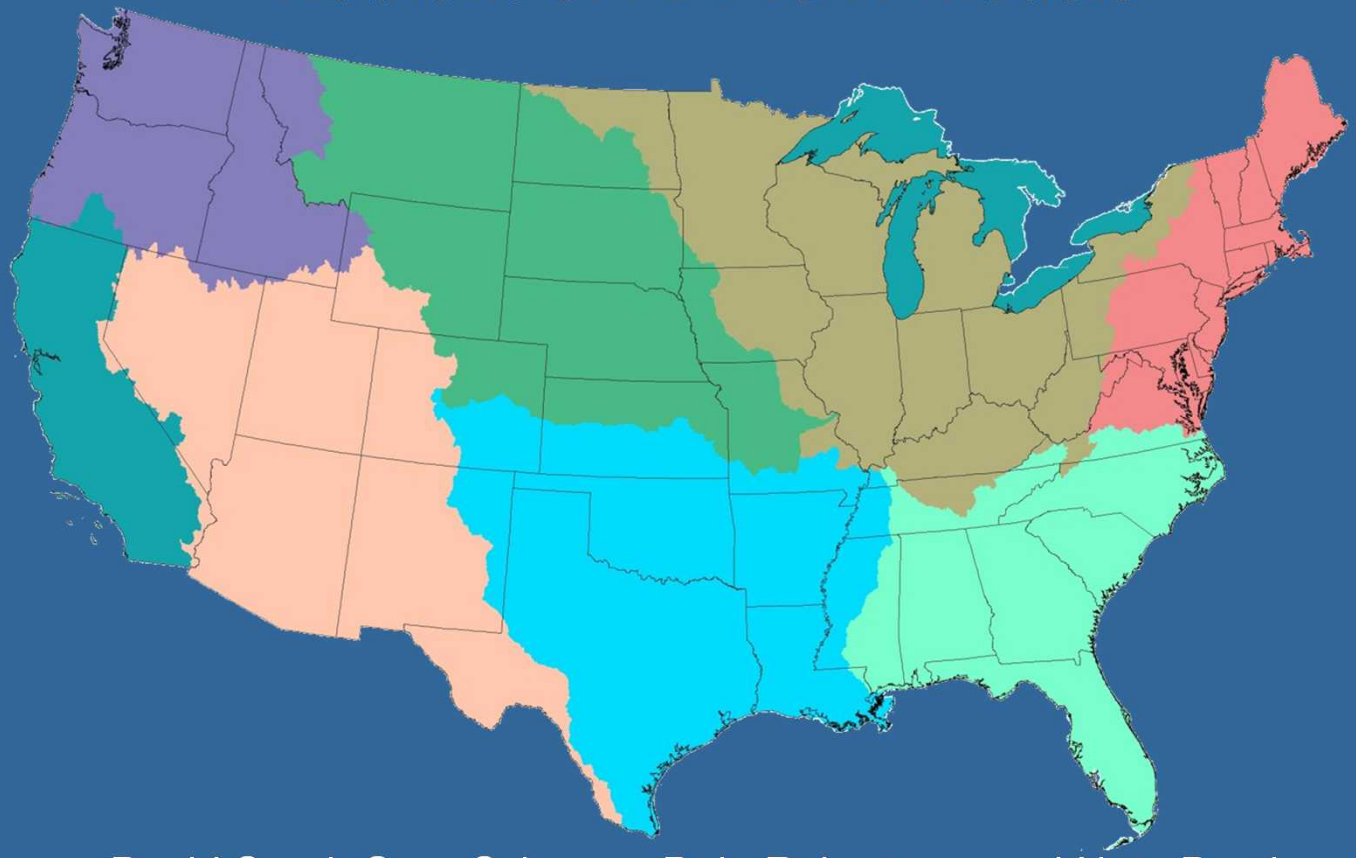
Lessons Learned from Creating Multi-Agency Nutrient Datasets to Estimate Loads and Calibrate Regional Nutrient SPARROW Models



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SPARROW Water-Quality Model

SPAtially Referenced Regression on Watershed Attributes

Monitoring Data
Annual Loads

(Y variable)

Geographic Data Layers

Climate

Sources or Land Use

Soils

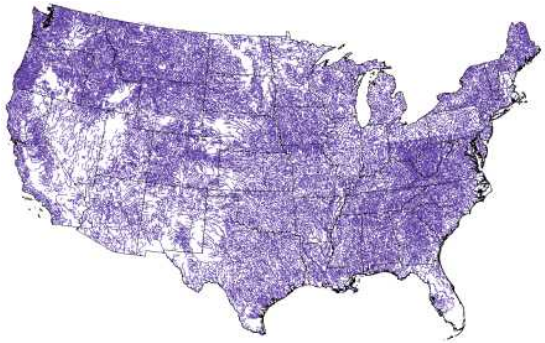
Stream & Reservoir Water Velocity

(X variables)

Index

to network

Routed Stream Network

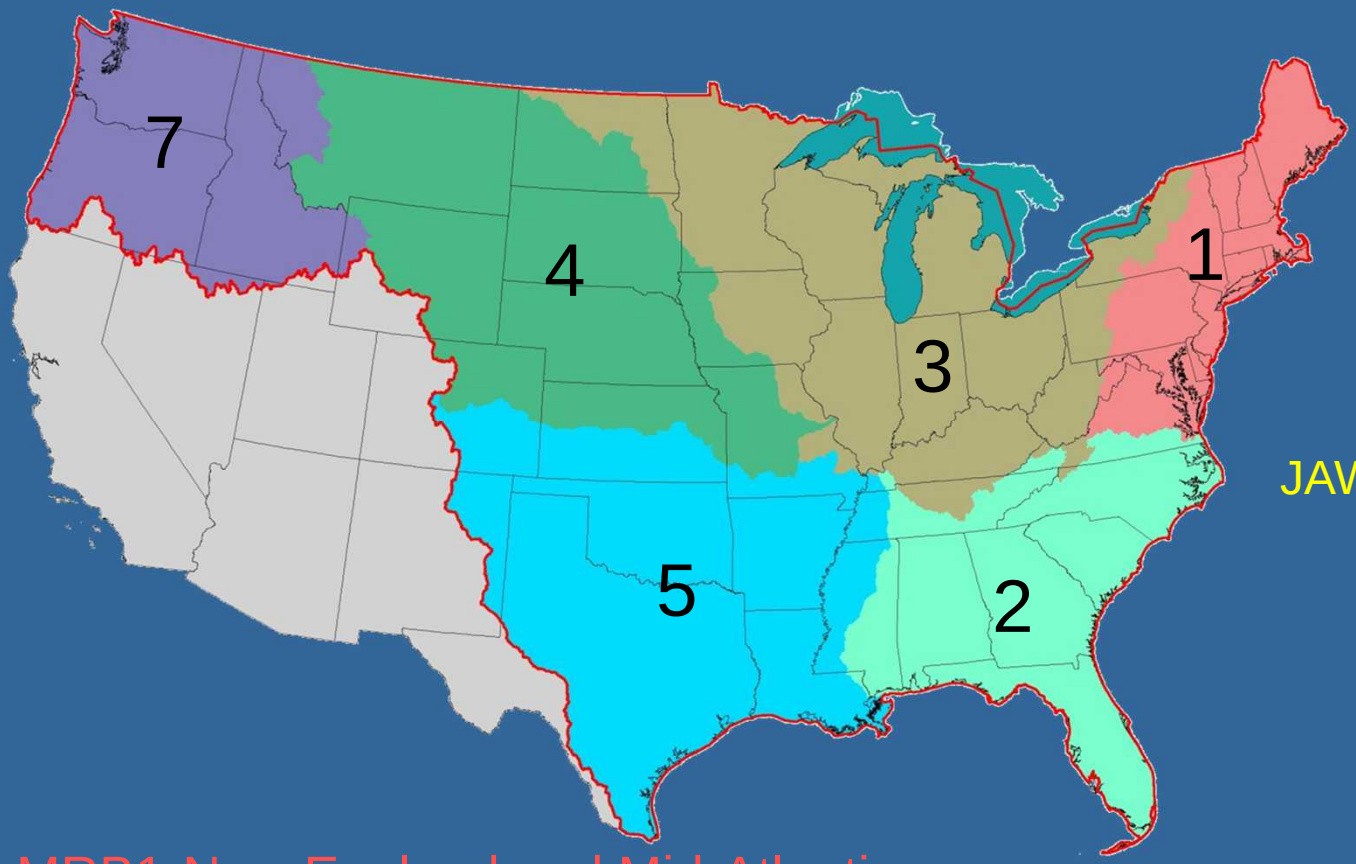


Calibrate *model*

Model Predictions at all Stream Reaches

http://water.usgs.gov/nawqa/sparrow

Regional Nutrient SPARROW Models



JAWRA, Oct 2011

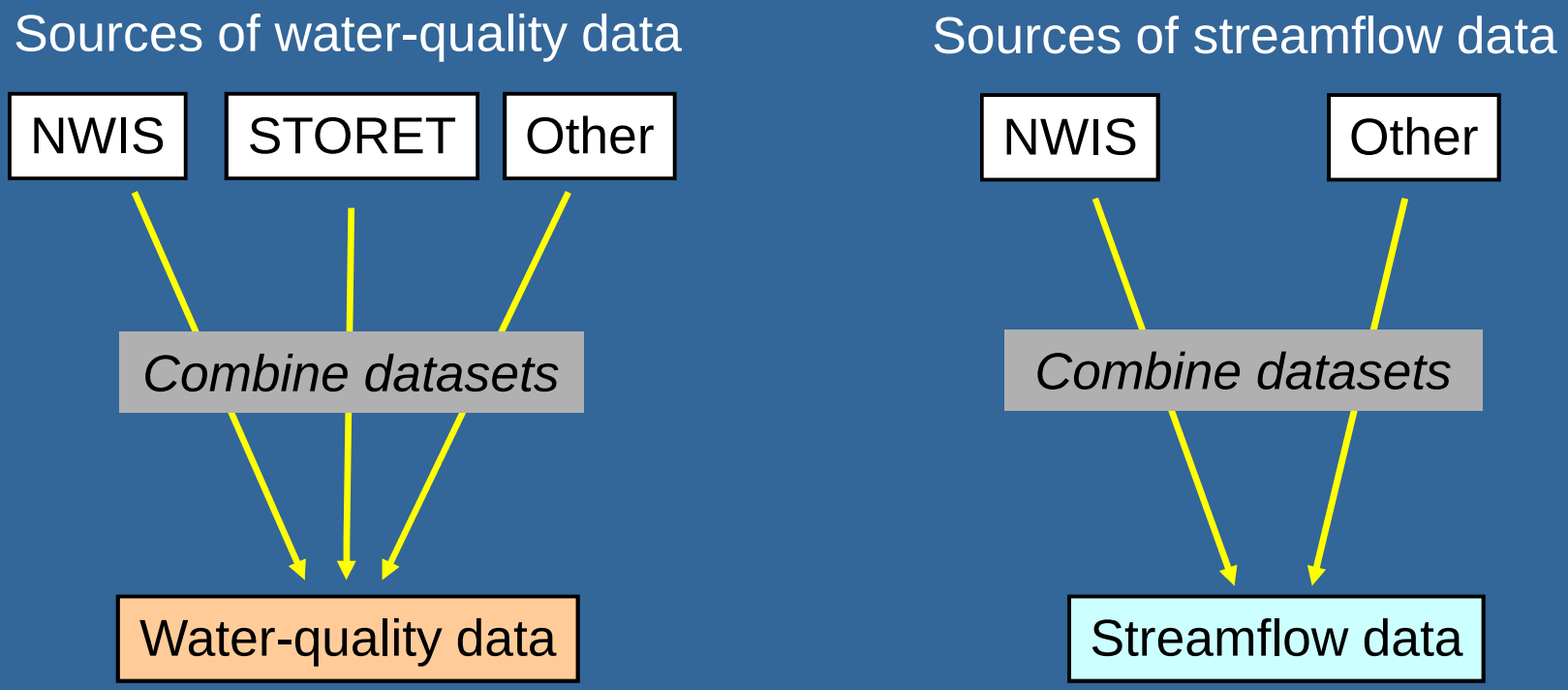
MRB1-New England and Mid-Atlantic
MRB2-South Atlantic-Gulf and Tennessee
MRB3-Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
MRB4-Missouri
MRB5-Lower Mississippi, Arkansas-White-Red, and Texas Gulf
MRB7-Pacific Northwest

Calibration targets for Regional Nutrient SPARROW models:

-Mean annual TN and TP loads detrended to 2002 (monitoring data)

Monitoring Data Compilation and Screening

Nutrient Load = Concentration x Flow



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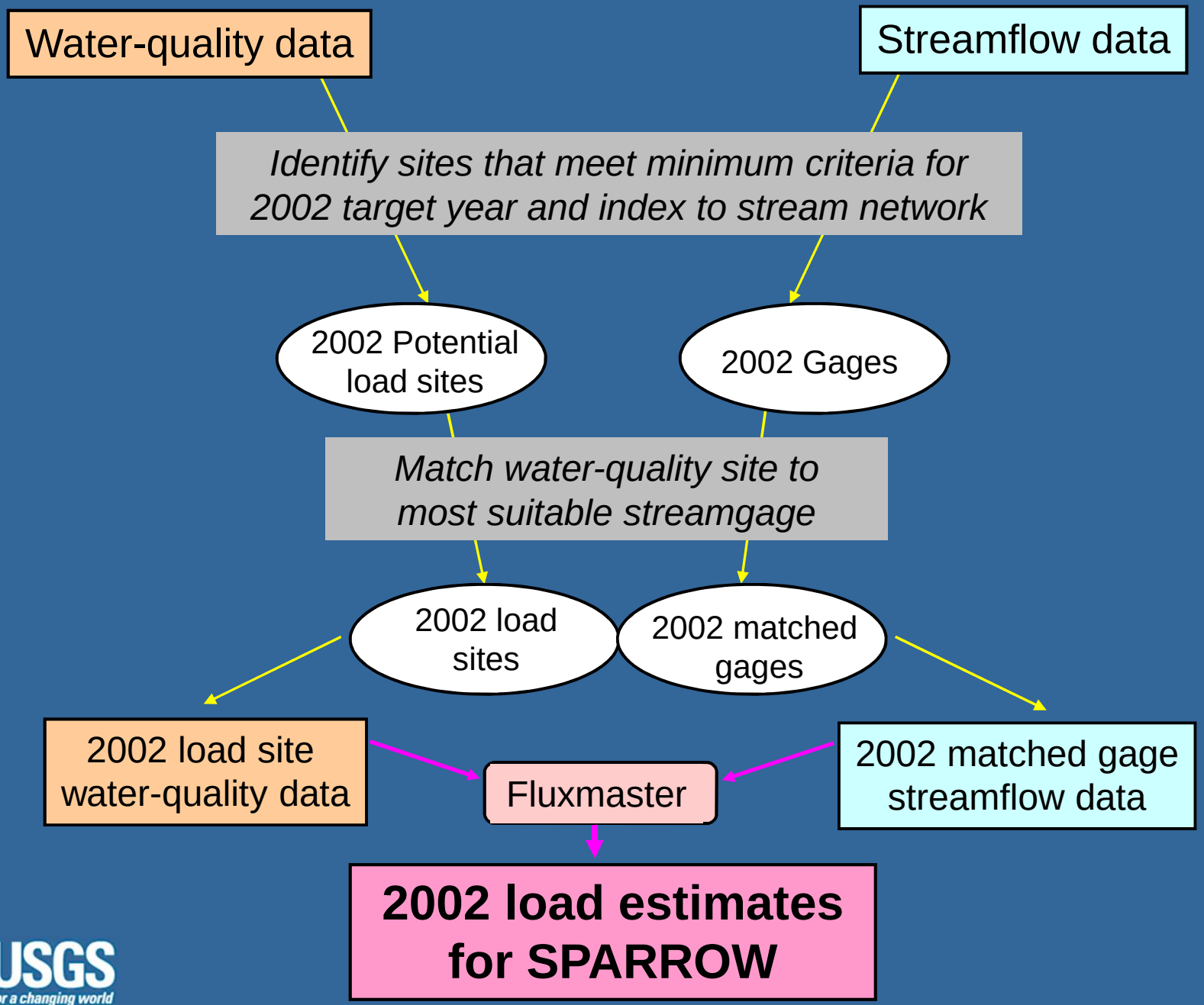

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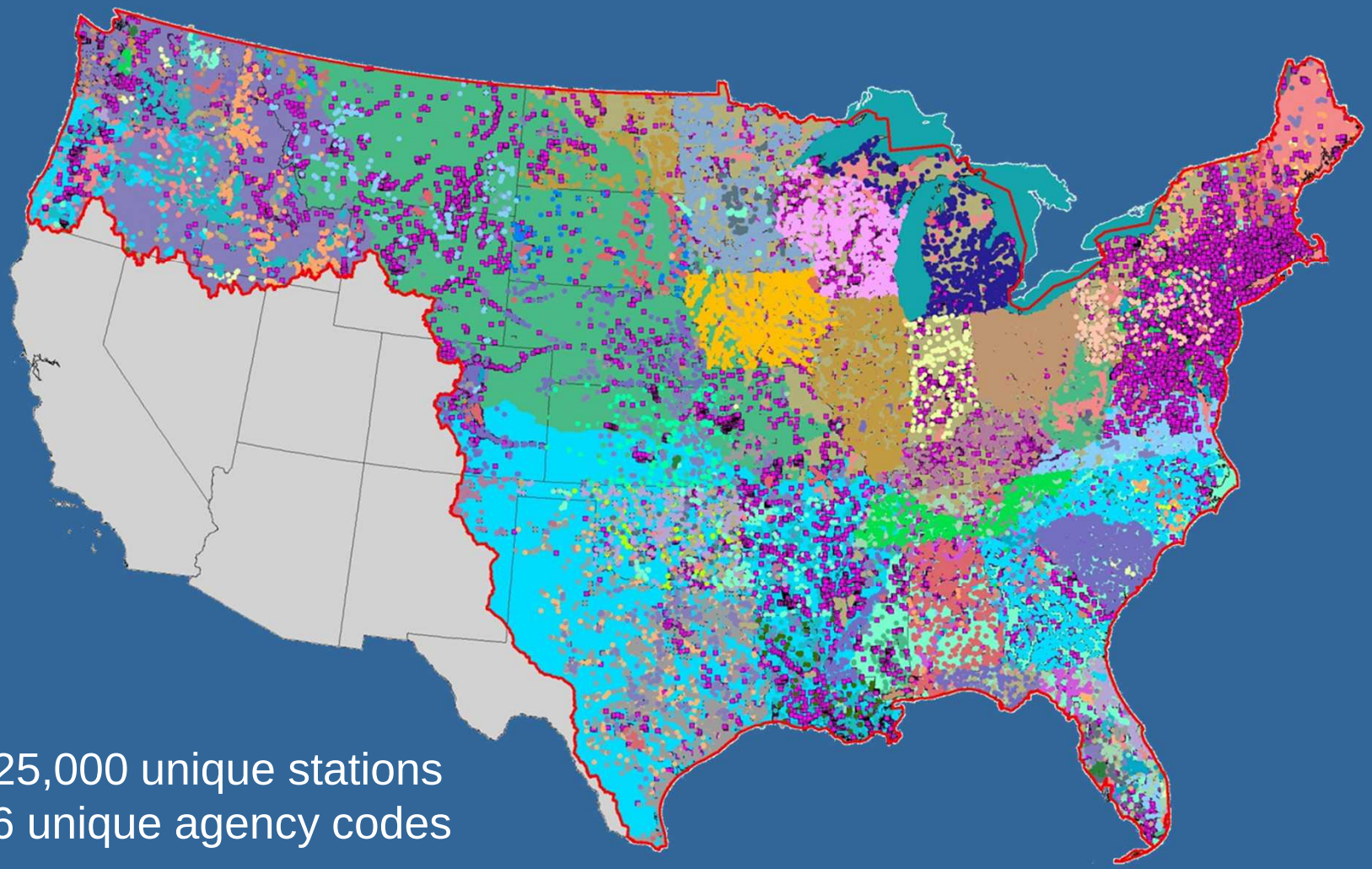
Stream Sites with Nutrient Data



~125,000 unique stations
186 unique agency codes

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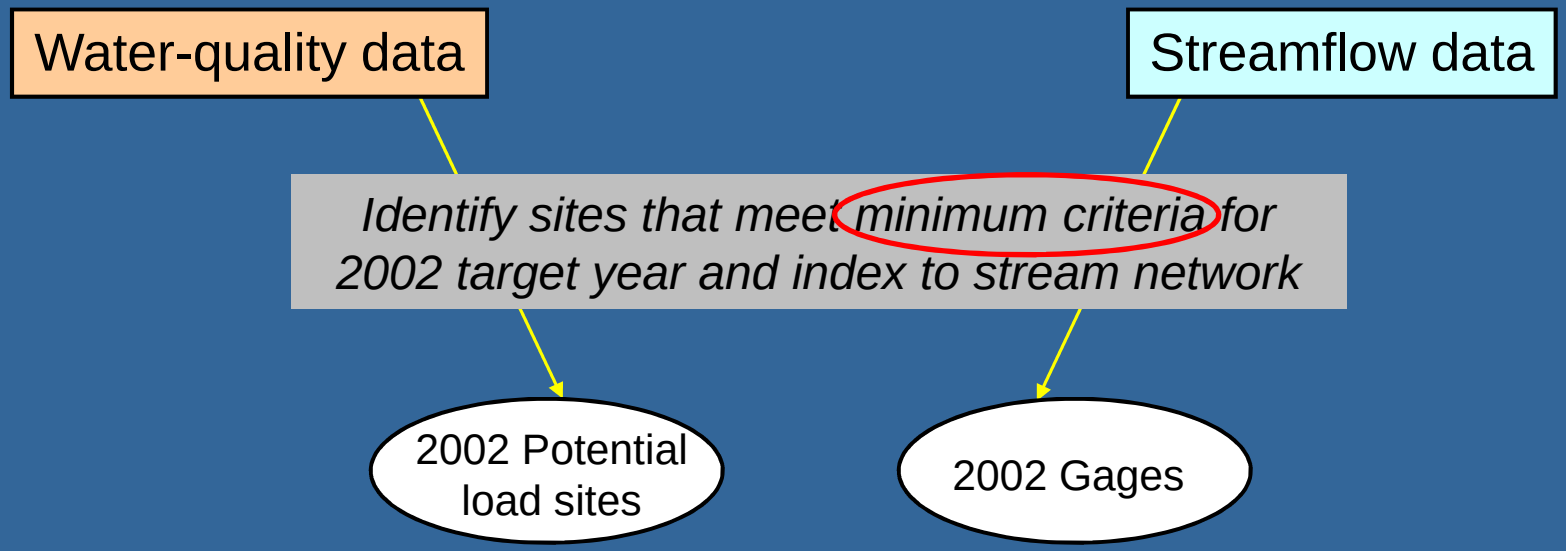

Minimum WQ Criteria
- 2 years of record
- 20 samples
- Includes data within 2 to 7 yrs of 2002 (based on length of record)

Minimum Flow Criteria
- 2 years of daily value record
- Including 2002

~10,500 Potential load sites

~6,000 streamgages

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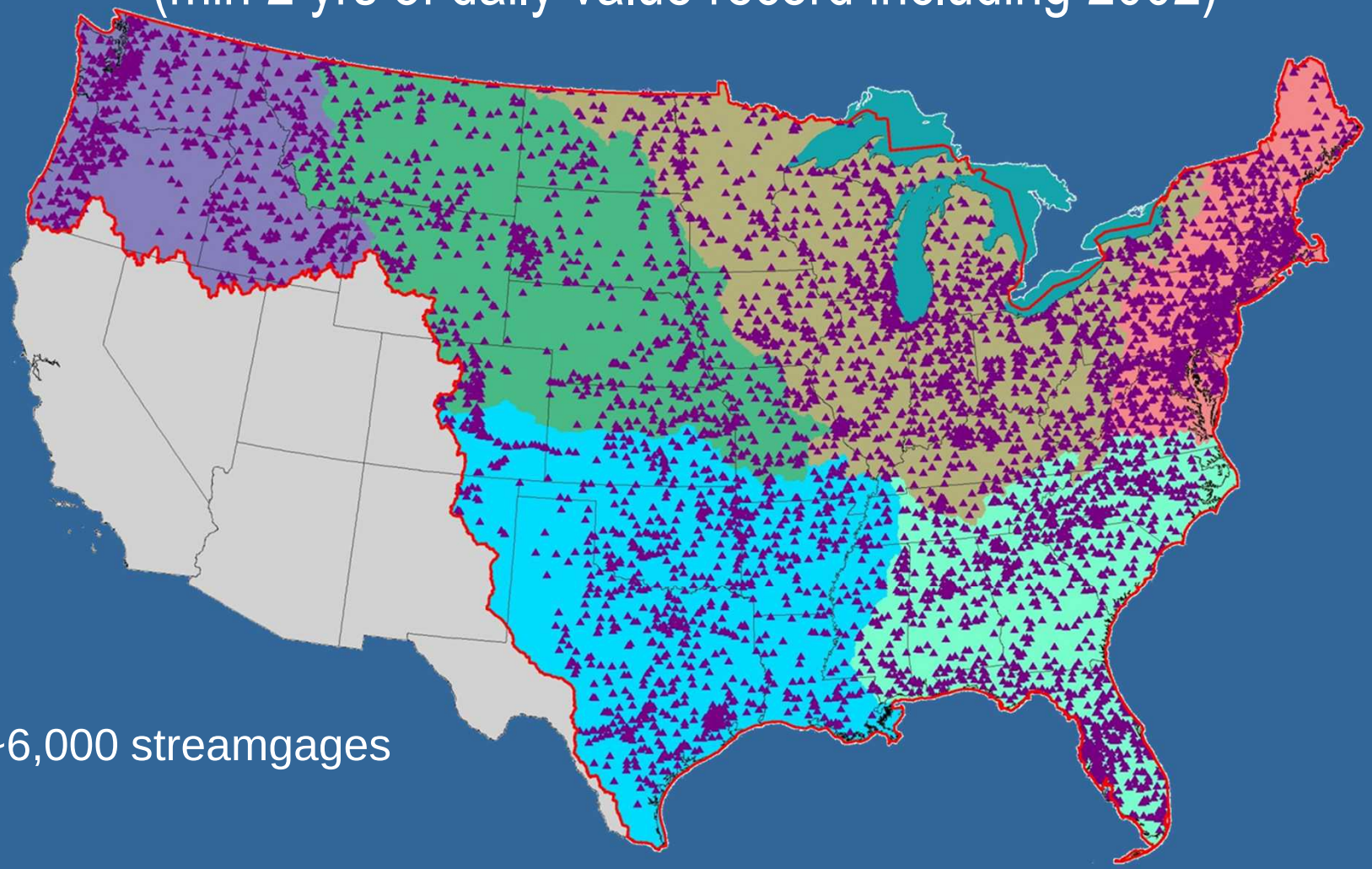
2002 USGS Streamgages

(min 2 yrs of daily value record including 2002)



~6,000 streamgages

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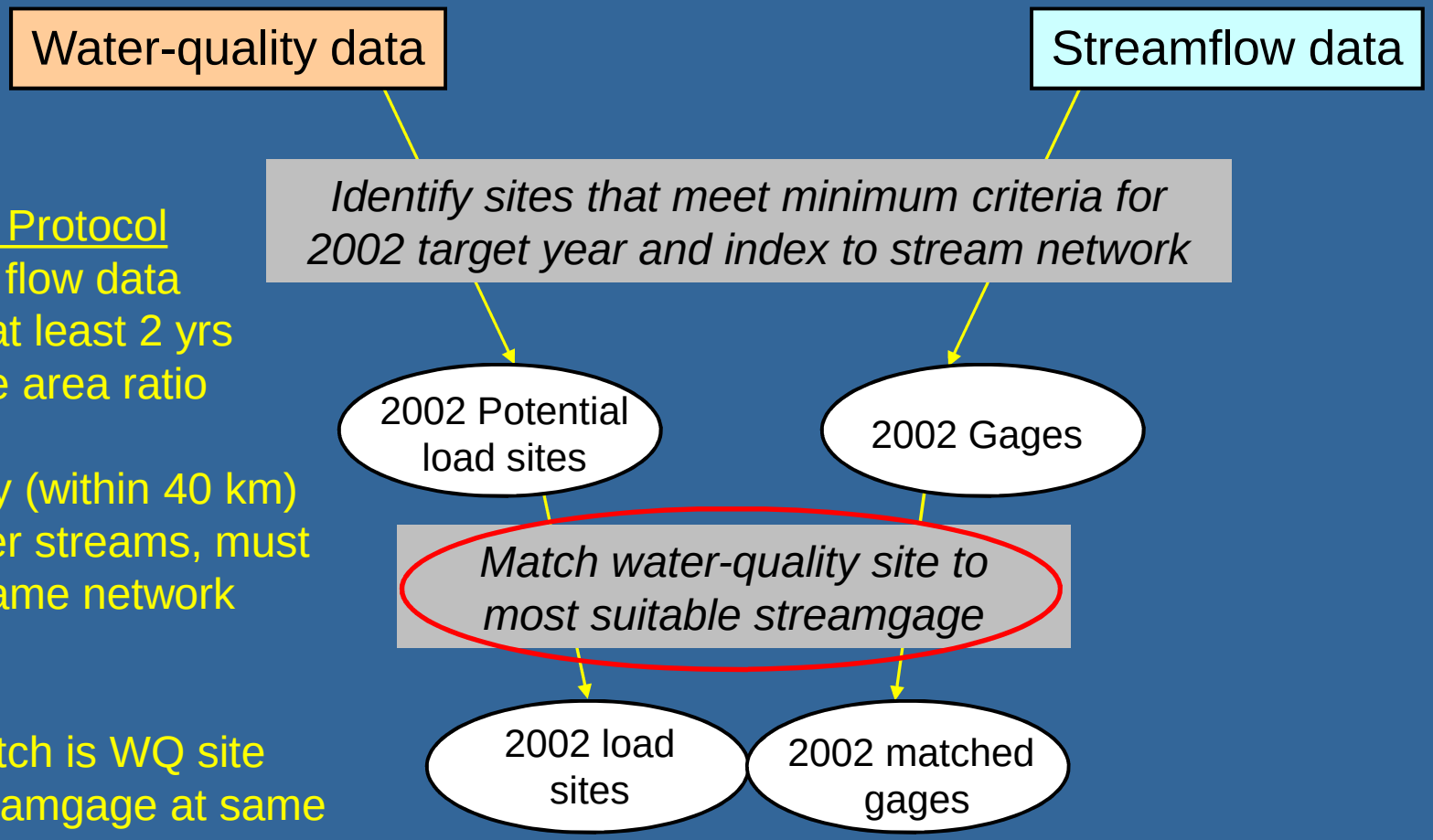

Matching Protocol

- WQ and flow data overlap at least 2 yrs
- Drainage area ratio 0.5 to 2
- Proximity (within 40 km)
- For larger streams, must be on same network

*Best match is WQ site and streamgage at same location with overlapping WQ and flow data

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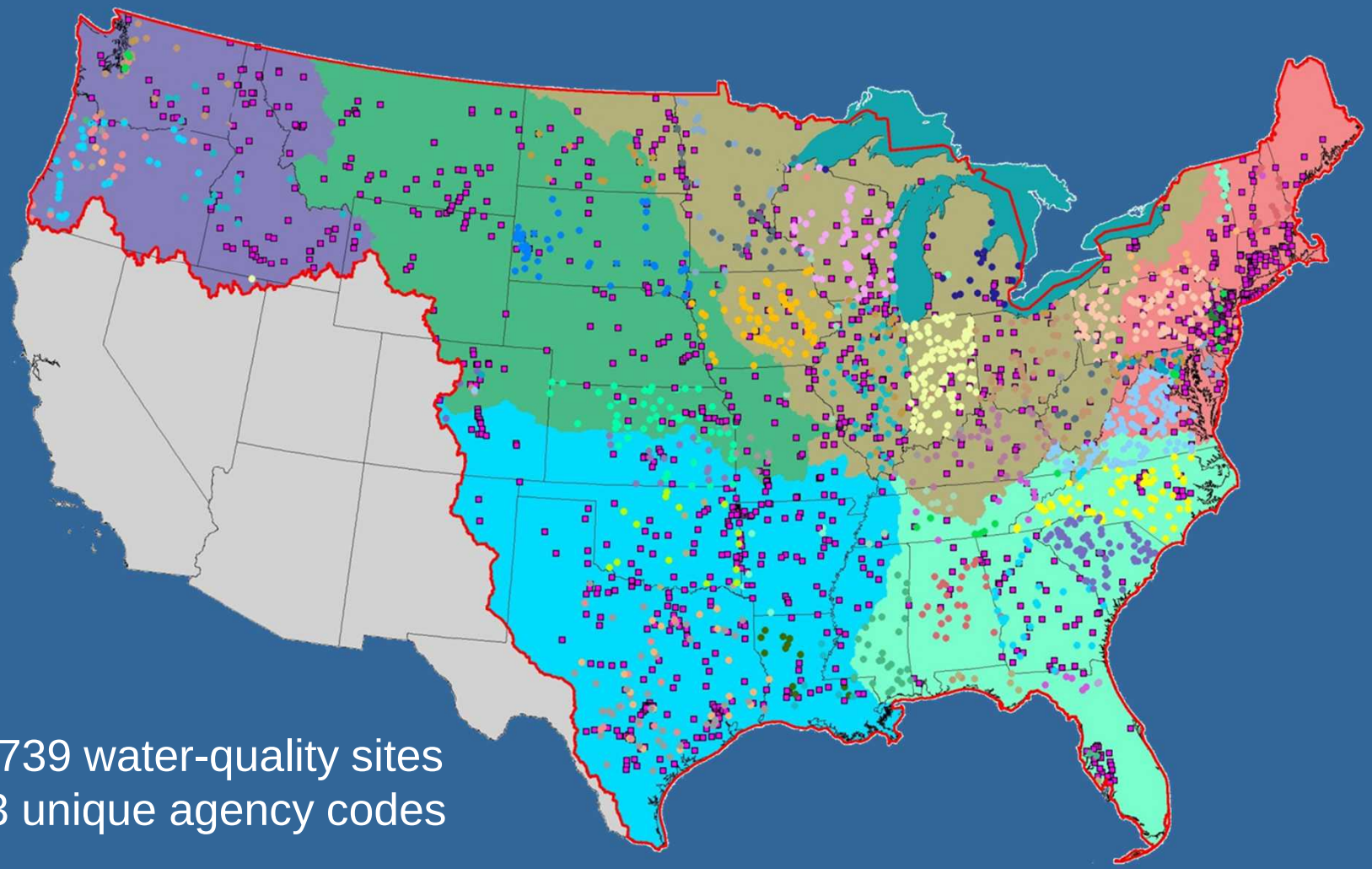
2002 SPARROW Nutrient Load Sites



2,739 water-quality sites
73 unique agency codes

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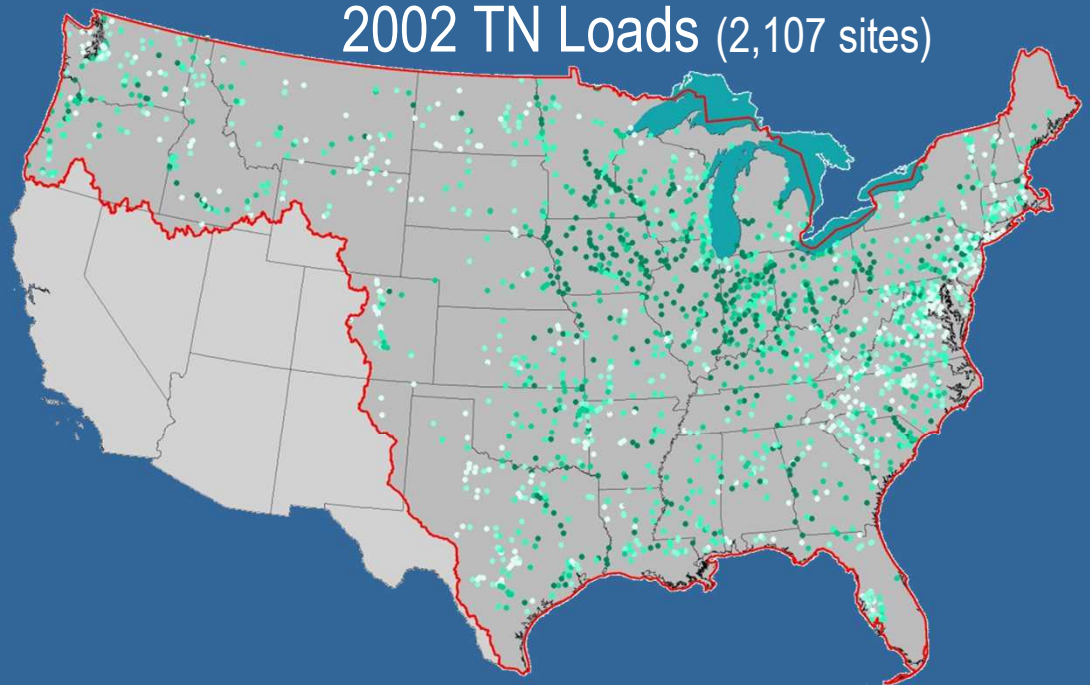
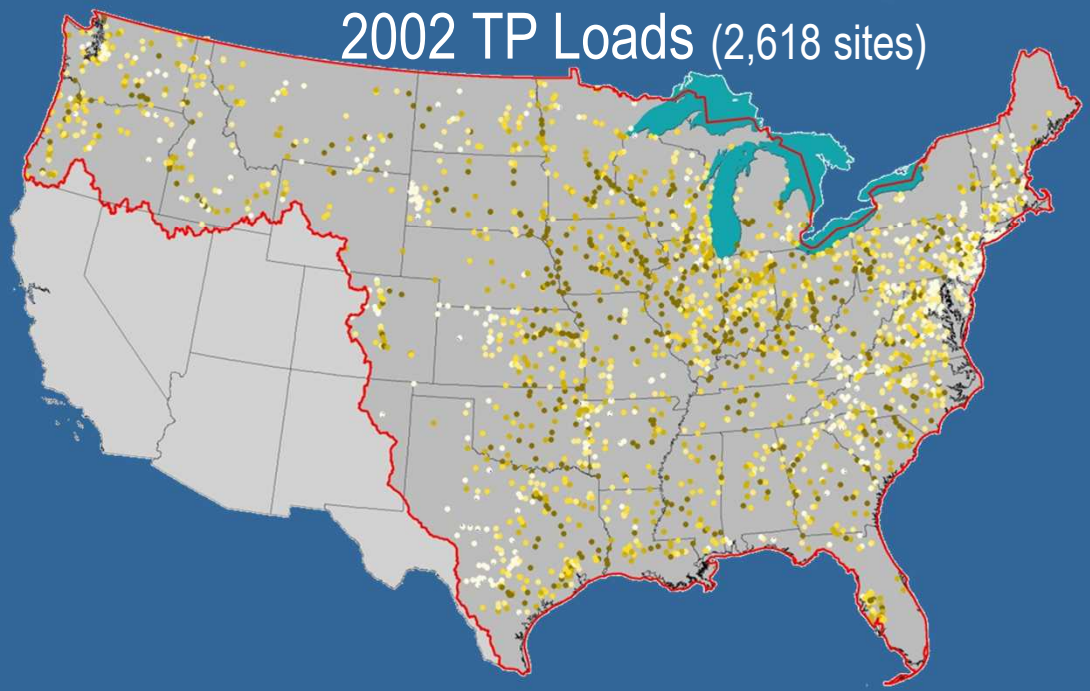
Primary reasons for exclusion

- Not enough data to calculate mean annual load
- Insufficient location information
- No suitable streamflow gage nearby





2002 load estimates for SPARROW models

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Factors Affecting Load Accuracy (COV)

- Accuracy improves with increases in:

  -Number of WQ observations

  -Percent of uncensored data (fewer “<“)

  -Standard Deviation in flow for WQ observation days (sample over a wide range of flows)

  -Period length of WQ observation (TP only)

Factors Affecting Load Accuracy (COV)

- Accuracy gets worse with increases in:

  -RMSE of WQ Model

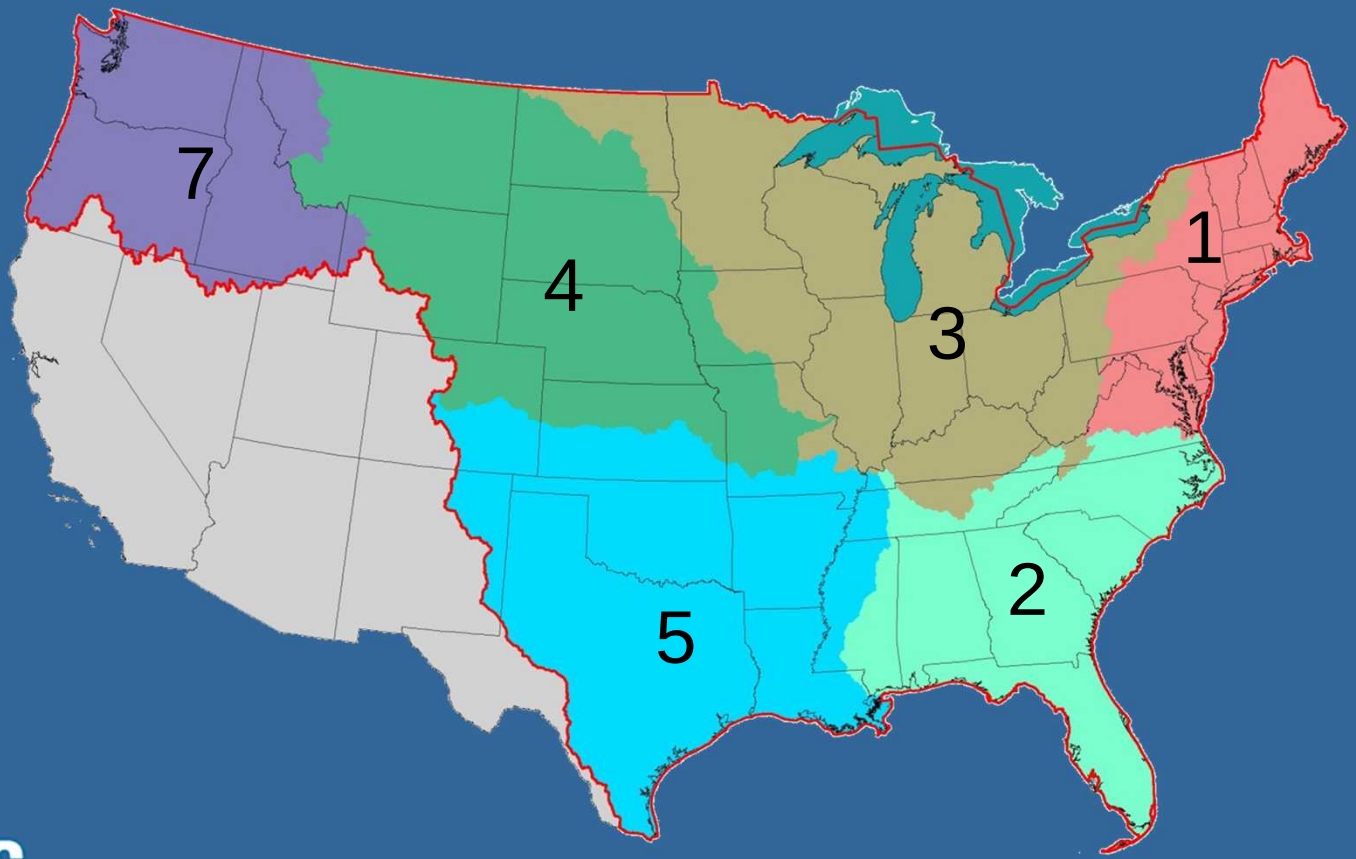
  -Flow bias ratio (flow predicted/flow observed)

  -Maximum number of days between samples

  -Standard Deviation in daily flow for prediction period (flashiness)

Trends in Historical Data Availability

- Streamflow
- Water-quality



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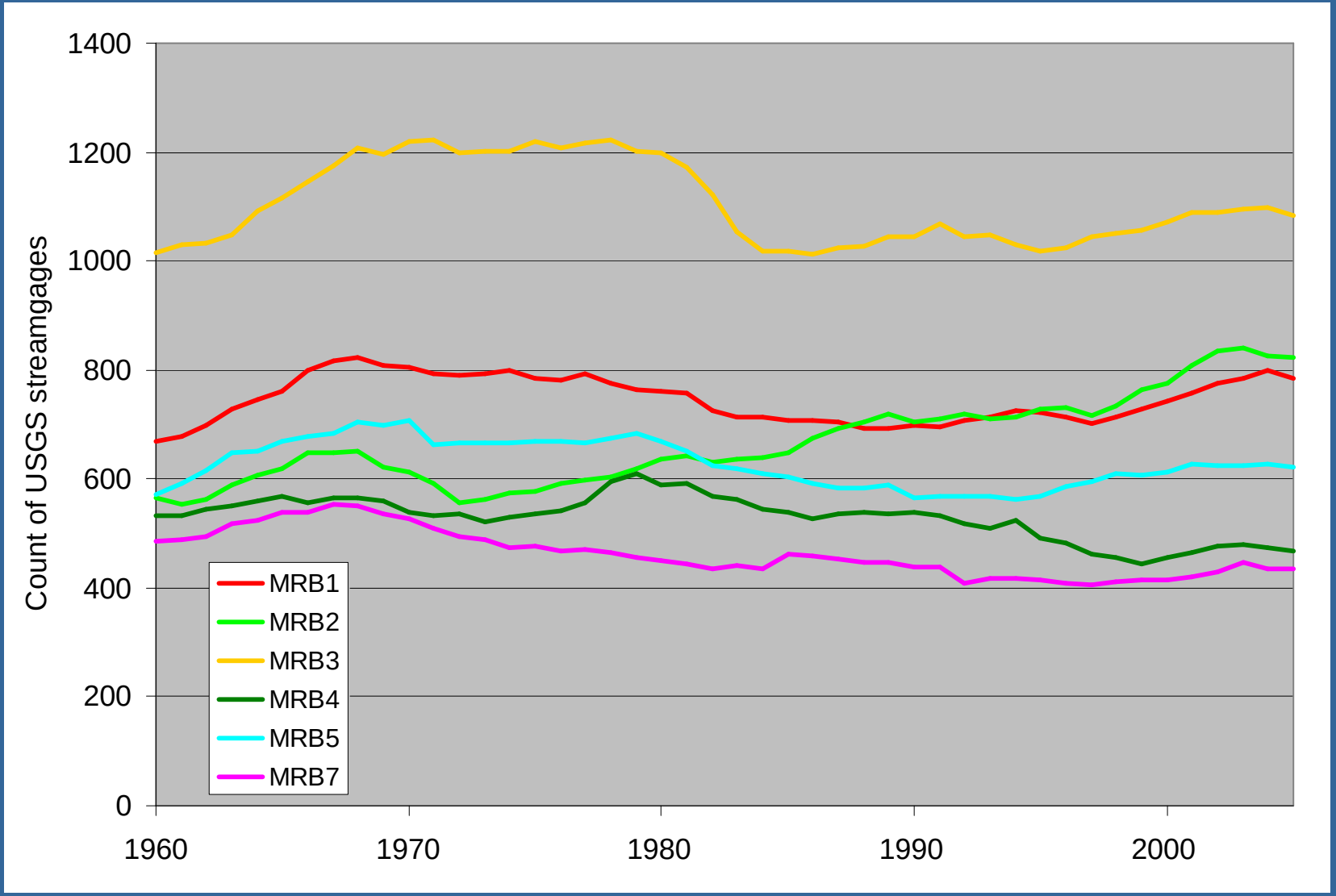
Trends in Available Streamflow Sites



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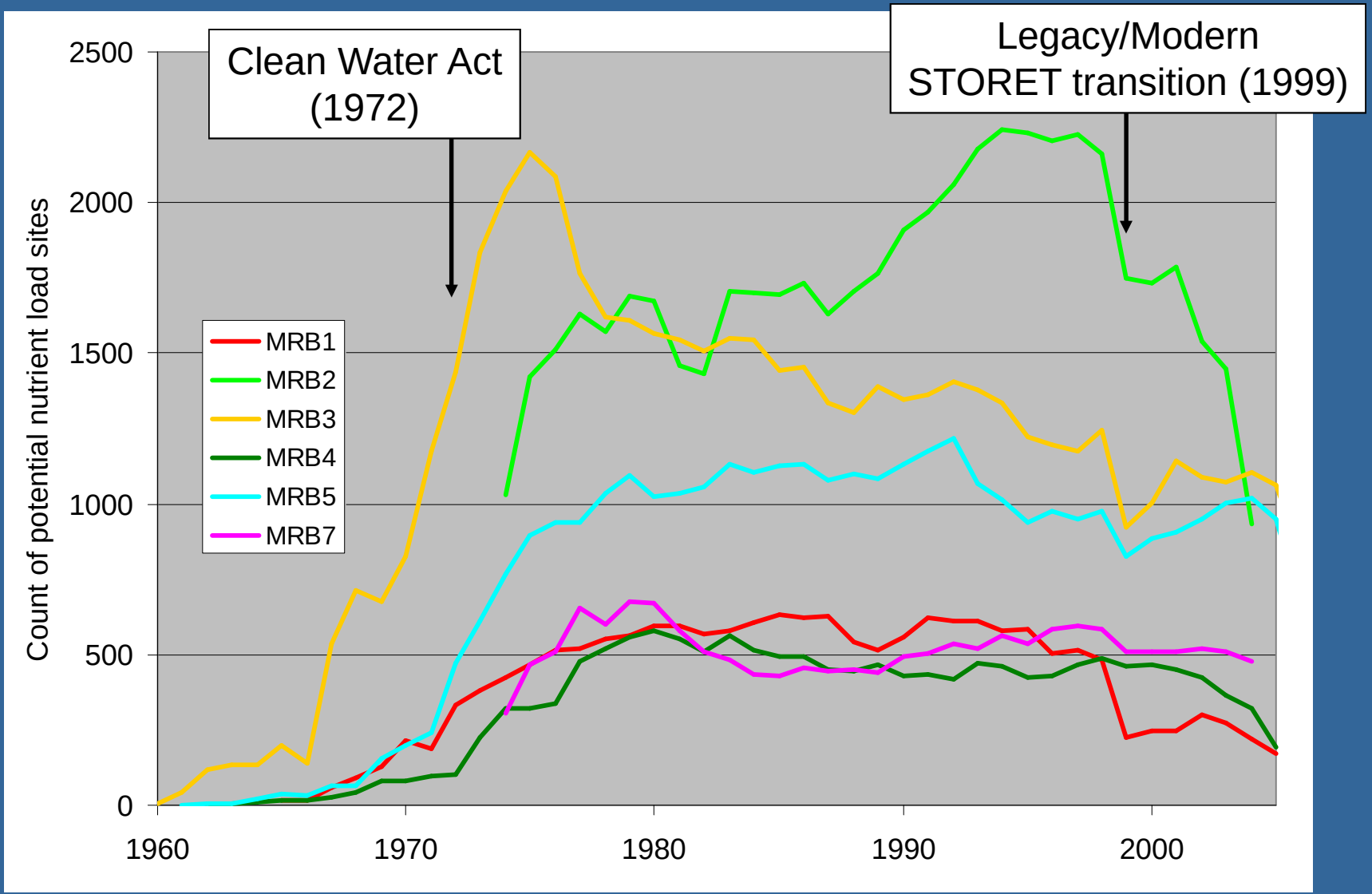
Trends in Potential Load Sites



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Improving Data Access

- States, Tribes and Territories can now contribute water-quality data to STORET via the Water Quality Exchange (WQX) (http://www.exchangenetwork.net/index.htm)

- Data can be retrieved easily from NWIS and STORET using web-based data portals (http://www.waterqualitydata.us/) ←New WQP

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Future Considerations

- Water-quality models will continue to be used by decision makers

- Sampling agencies that have an interest in estimating loads and would like their data to be considered for use in regional water-quality modeling can consider the following points to meet the needs for continued monitoring and modeling:

  -Implement sampling strategies suitable for accurate load calculations

  -Provide detailed and accurate location information

  -Incorporate data into national databases

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