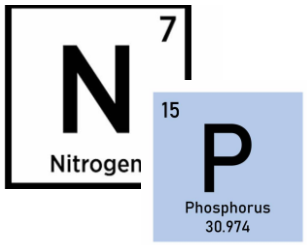
White River Benthic Algae Study

White River- State of the River

June 15, 2021

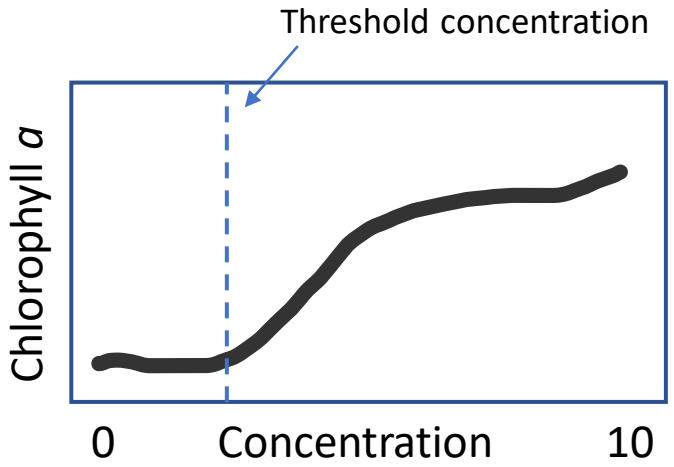
Presented by Natalie Day

U.S. Geological Survey



Nutrient concentrations can regulate algal growth in streams

- Nutrient concentrations can be compared to threshold values known to promote algal growth
  - No algae specific threshold for the state of Colorado
    - CDPHE regulation 31 is meant to protect domestic water supply, agriculture, and recreation, may be too high to limit benthic algal blooms.
  - We compare nutrient concentrations to thresholds established by Montana Department of Water Quality*
  - Nutrient limitation also considered (16 N: 1 P)

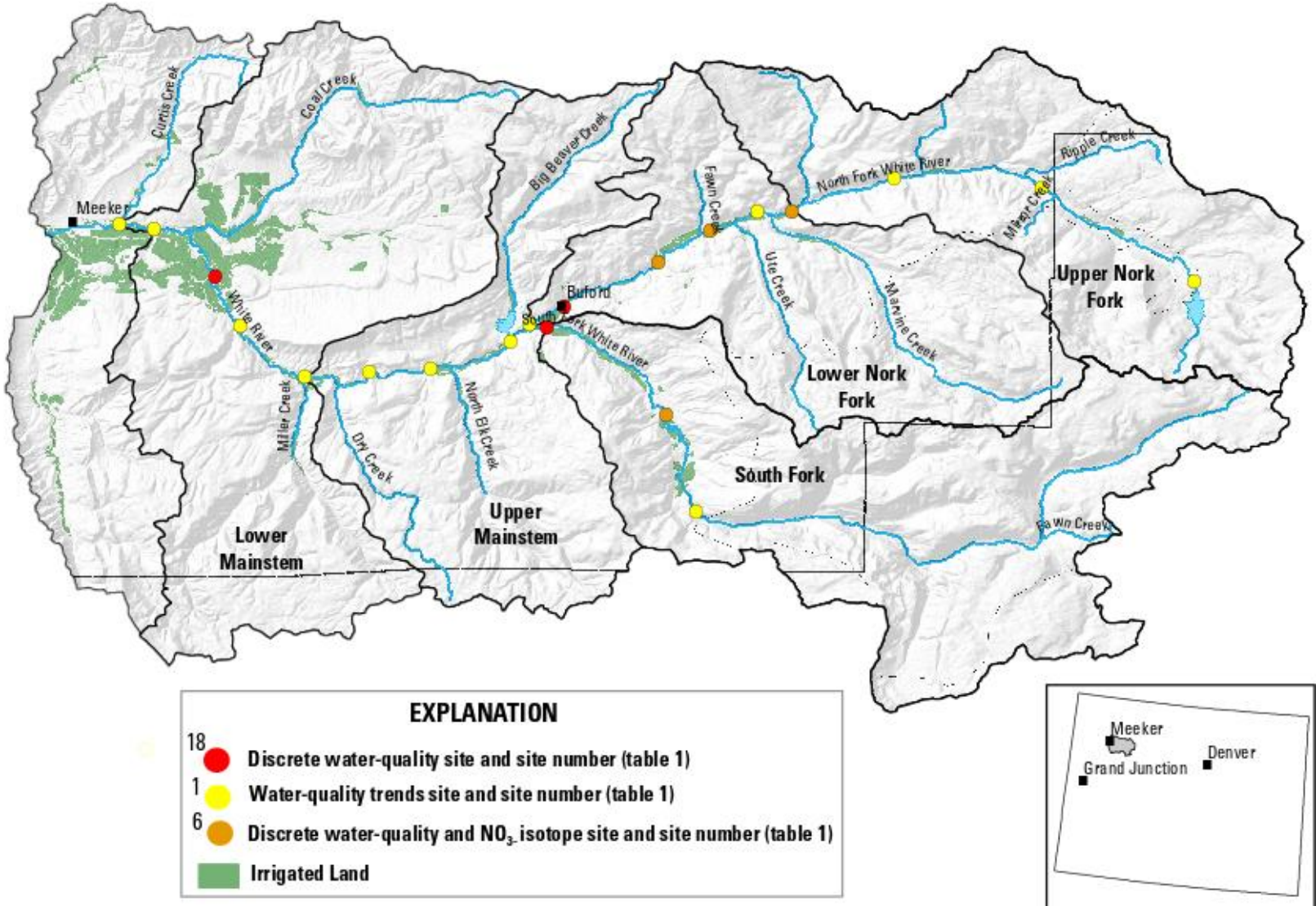


*http://deq.mt.gov/Portals/112/Water/WQPB/Standards/PDF/WhitePaper_FNL3_Nov12-08.pdf

Nutrient side of the study design

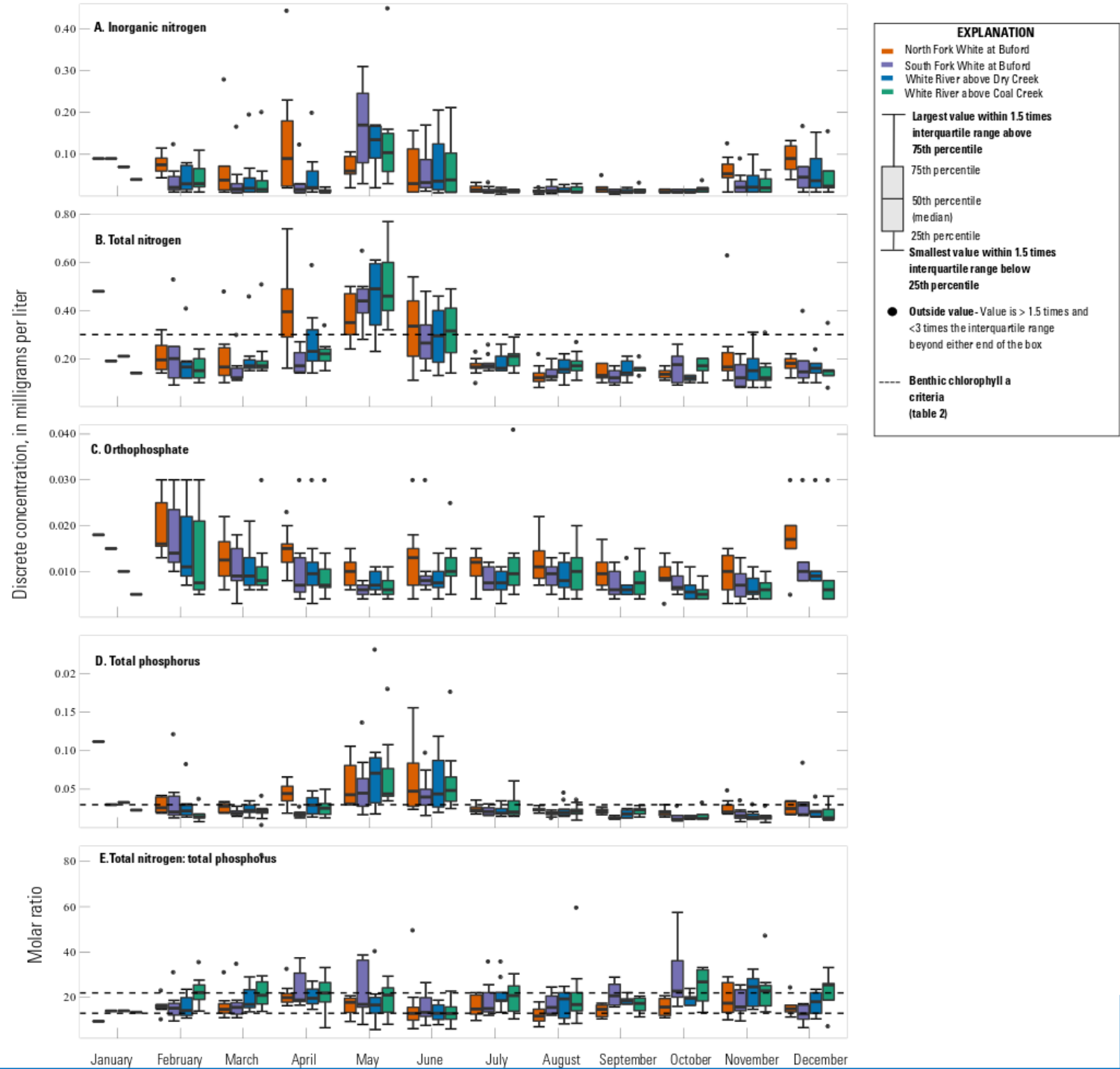
- **4 long-term monitoring sites**, 20 years of regularly collected data
  - Seasonality– when are concentrations the highest? What does this tell us about major sources?
  - Trends- have concentrations changed over time? Are changes occurring everywhere?

- **20 short-term monitoring sites**, with 2 years of data collected in spring and summer
  - Spatial- Better explore spatial variation in concentrations
  - Sources-
    - synoptic and N isotope



Nutrient concentrations at 4 long-term sites

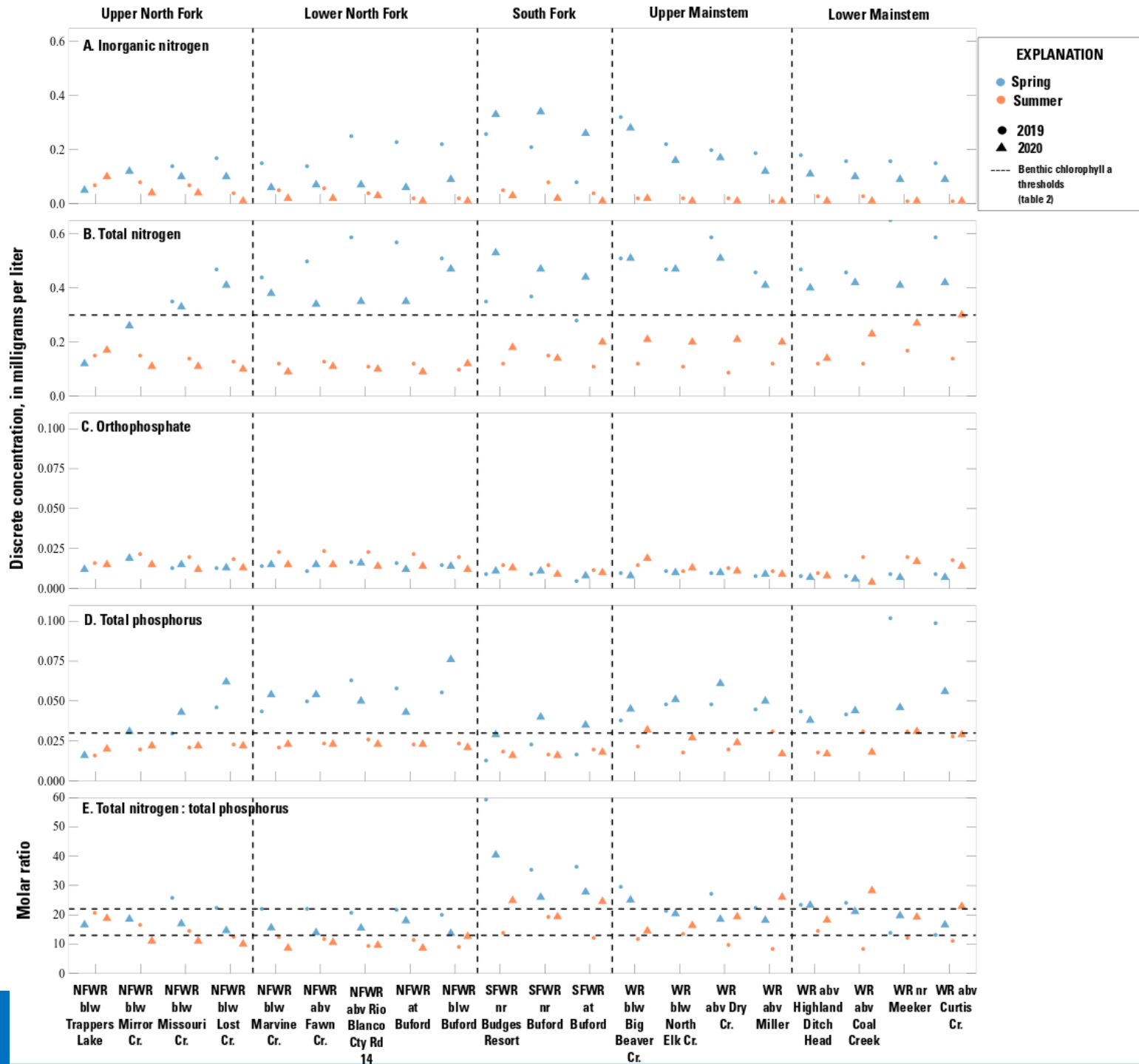
- Concentrations are highest during spring runoff for most forms of nitrogen and phosphorus
- Orthophosphate has more consistent concentrations throughout the year



Nutrient concentrations across a broader spatial scale

- Concentrations during summer represent conditions during peak algal growth

- Algal thresholds
  - Below N threshold until furthest downstream site
  - Exceed P threshold on mainstem
  - N:P ratios indicate N limitation on North Fork, variable limitation on South Fork and mainstem.



USGS science for a changing world

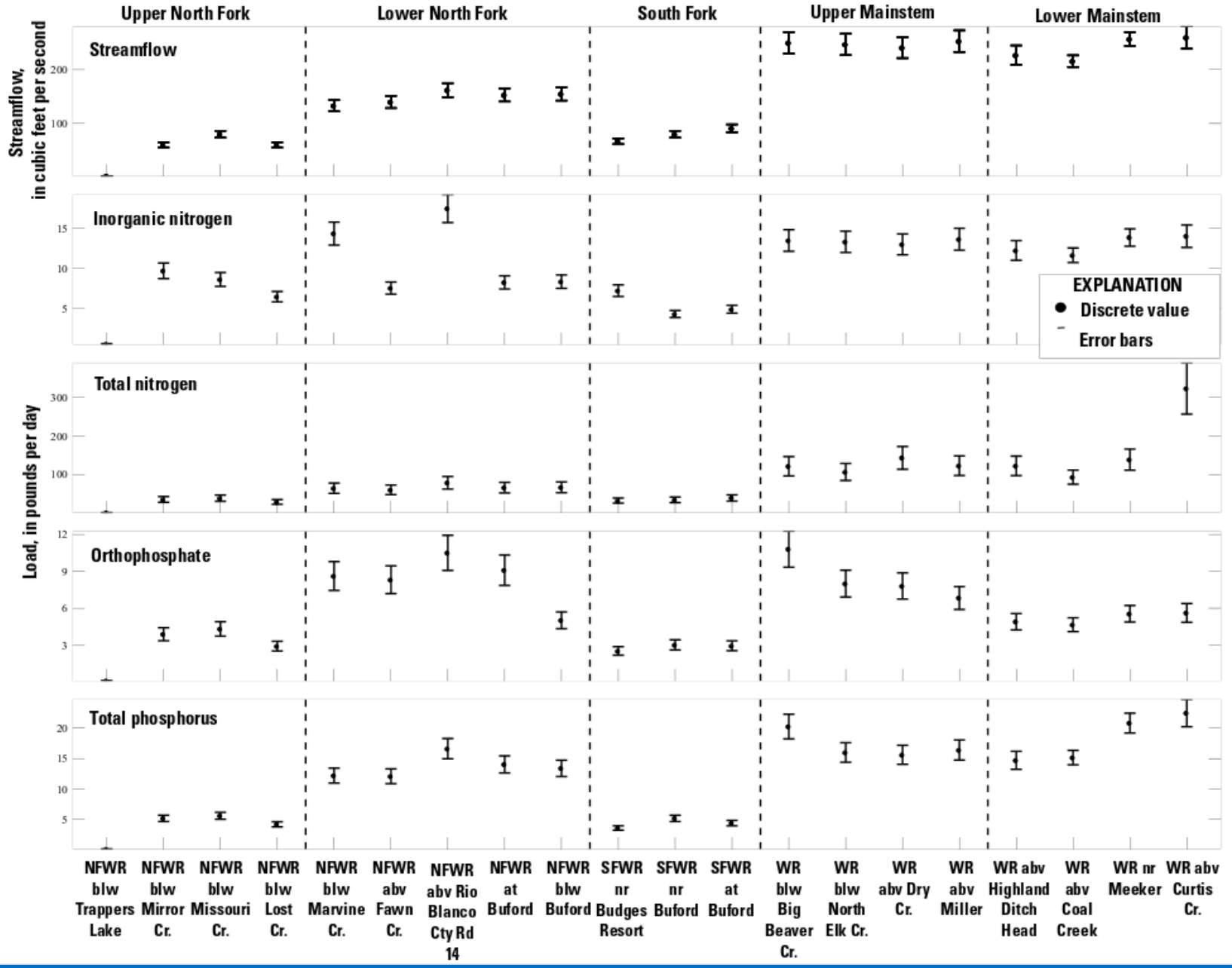
Loads and yields are useful for identifying source areas of nutrients

- Synoptic sampling conducted during baseflow conditions (October) to estimate loads and yields

  Load = Concentration * Streamflow

- Streamflow and loads increased from upstream to downstream and below tributaries

- Large increases in total N at furthest downstream site

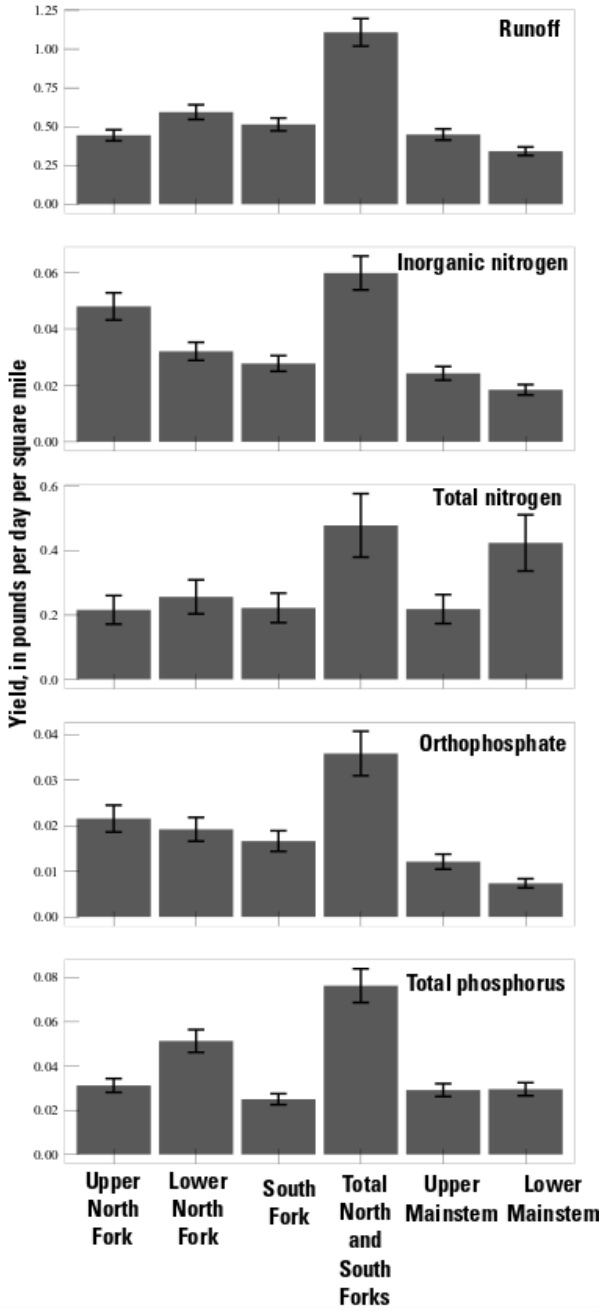


Loads and yields are useful for identifying source areas of nutrients

- Yields normalize the effects of drainage area and streamflow differences among sites

  Yield = Load/ Basin area

- Identifying areas with higher yields can help target load-reduction strategies
- Highest yields of inorganic nitrogen and orthophosphate were in Upper North Fork
- Yields of total nitrogen consistent until lower mainstem
- Total phosphorus yields highest in lower north fork basin



Upcoming publications

- Scientific investigations report
  - #1- Streamflow and nutrients
  - #2- Linking factors to algae

- Fact Sheet
- Data releases

- May 2022