RULE 2 STAKEHOLDER WORKGROUP

2023 TRIENNIAL REVIEW
MAY 19, 2022

ARKANSAS
ENERGY & ENVIRONMENT

HOUSEKEEPING

- Please speak into a microphone
- Only one conversation at a time
- Participation is limited to seated panel
- Bathrooms are behind the elevators
- Silence cell phones
- Coffee and water are in the back
- Emergency exit is on the west side of the room, opposite the door

PURPOSE OF WORKGROUP

To assist DEQ by providing feedback on proposed revisions

- **Offer unique perspectives of water interests that each Stakeholder represents**
- **Facilitate discussion**
- **Work as a team to provide reasonable and achievable recommendations for proposed Rule 2 revisions**

PARTICIPANT EXPECTATIONS

- Attend all Stakeholder meetings
- Respect all participants and their right to express their views
- Participate in discussions for each topic in a timely manner
- Stay on topic

2.508 TOXICS

AQUATIC LIFE UPDATES

ARKANSAS
ENERGY & ENVIRONMENT

CADMIUM - NPDES

EPA Criteria	Freshwater CMC (Acute)(ug/L)	Freshwater CCC (Chronic)(ug/L)
Existing 1986*	3.7	1.03
Proposed 2016*	1.8	0.72
***These numbers are hardness-dependent based on a hardness of 100mg/L as $CaCO_3$**		

- **16 NPDES permitted facilities with 17 outfalls**
  - Using proposed criteria
    - 12 outfalls are capable of meeting more stringent criteria at this time
- **2 NPDES permitted facilities have shown limit failures within the past 5 years under the existing criteria**
  - Both would have had a few additional failures under the new criteria

CADMIUM – INSTREAM DATA

- 12,718 total data points from 509 monitoring stations within the past 5 years
- 55 total cadmium exceedances of the proposed criteria (both acute and chronic)
- 15 chronic only exceedances of the proposed criteria

TOXIC RELEASE INVENTORY (TRI) DATA

2018	2019	2020
21.3 lb/yr	58.84 lb/yr	9.08 lb/yr

AMMONIA

	1999 Criteria** Existing	2013 Criteria** Proposed
Acute (1hr avg) (mg/L)	24	17
Chronic (30 day rolling avg)(mg/L)	4.5*	1.9*
*Not to exceed 2.5 times criterion continuous concentrations as a 4-day avg within a 30 day period		
**Based upon a temperature of 20°C and a pH of 7.		

- **The new EPA 2013 criteria accounts for the sensitivity of freshwater mussels**
  - Arkansas has 10 Federally Endangered Mussel Species, 3 Federally Threatened Species, 9 State Critically Imperiled Species, 12 State Imperiled Species, and 17 State Vulnerable Species
    - Total of 40 freshwater mussel species

AMMONIA

Effluent Characteristics	Discharge Limitations			Monitoring Requirements	
	Mass (lbs/day, else specified)	Concentration (mg/l, else specified)		Frequency	Sample Type
	Monthly Avg.	Monthly Avg.	7-Day Avg.		
Flow	N/A	Report, MGD	Report, MGD (Daily Max.)	once/day	totalizing meter
Overflows	monthly total SSOs (occurrences/month)			see comments[1]	
Overflow Volume	monthly total volume of SSOs (gallons/month)			see comments[1]	
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	216.8	10	15	once/week	composite
Total Suspended Solids (TSS)	325.3	15.0	22.5	once/week	composite
Ammonia Nitrogen (NH_3-N)					
(April)	60.7	2.8	6.9	once/week	composite
(May – October)	56.4	2.6	6.4	once/week	composite
(November – March)	158.3	7.3	18.4	once/week	composite

520 NPDES permits

- Under the proposed criteria
  - 50 NPDES permits are capable of meeting more stringent criteria at this time
  - 444 NPDES permits show a minimum of 1 limit value changing
- **356 NPDES permitted facilities have shown limit failures within the past 10 years under the existing criteria**
  - An additional 24 (380 facilities total) facilities would have had a limit failure if under the new criteria

AMMONIA

Toxic Release Inventory (TRI) Data

2018	2019	2020
91,579.61 lb/yr	103,028.8 lb/yr	78,898.09 lb/yr

TOXIC UPDATE PROPOSALS DISCUSSION

ARKANSAS
ENERGY & ENVIRONMENT

2.508 TOXICS
HUMAN HEALTH ADDITIONS

ARKANSAS
ENERGY & ENVIRONMENT

HUMAN HEALTH EXPOSURE INPUT CHANGES

EPA Human Health Exposure Inputs		
	1994	**2015**
Body Weight	70 kg	80 kg
Fish Consumption	17.5 g	22 g
Drinking Water Intake	2.0 L	2.4 L

*These changes were made by the EPA, not DEQ

BENZENE

EPA 2015 Criteria*
Water + Organism (ug/L)
0.58
***Values based on cancer risk factor of 10^{-6} and a cancer slope factor of either 0.015 or 0.055.**

- **Carcinogen**
  - Exposure can cause anemia, decrease in blood platelets, and increased risk of cancer
- **4 NPDES permitted facilities**
  - All are capable of meeting the more stringent criteria at this time

TRI DATA

2018	2019	2020
33.40 lb/yr	65.34 lb/yr	6.14 lb/yr

TOLUENE

EPA 2015 Criteria
Water + Organism (ug/L)
57

- **More dangerous to children and pregnant women**
- **Exposure can cause nervous system, kidney, or liver problems**
- **3 NPDES permitted facilities**
  - All are capable of meeting the more stringent criteria at this time

TRI DATA

2018	2019	2020
49.02 lb/yr	116.17 lb/yr	24.69 lb/yr

ETHYLBENZENE

EPA 2015 Criteria
Water + Organism (ug/L)
68

- **Exposure can cause eye and throat irritation, vertigo and dizziness. May cause blood, liver, and kidney damage.**
- **4 NPDES permitted facilities**
  - All are capable of meeting the more stringent criteria at this time

TRI DATA

2018	2019	2020
3.68 lb/yr	11.64 lb/yr	9.20 lb/yr

XYLENE

EPA 1992 Criteria
MCL
10 mg/L

- **Exposure can cause irritation of the skin, eyes, nose, and throat; difficulty breathing; impaired lung function; impaired memory; stomach discomfort; headaches; lack of muscle coordination; changes in sense of balance; and possible changes in the liver and kidneys**
- **1 NPDES permitted facility**
  - Does not currently have limits, only monitoring

TRI DATA

2018	2019	2020
19.31 lb/yr	63.50 lb/yr	39.01 lb/yr

PHENOL

EPA 2015 Criteria
Water + Organism (mg/L)
4

- **Readily absorbed throughout the body**
  - Highly irritating to the skin, eyes, and mucous membranes. Can cause anorexia, progressive weight loss, diarrhea, vertigo, salivation, dark coloration of urine, and blood and liver effects.
- **5 NPDES permitted facilities with 9 outfalls**
  - All are capable of meeting the more stringent criteria at this time

TRI DATA

2018	2019	2020
3 lb/yr	8 lb/yr	7 lb/yr

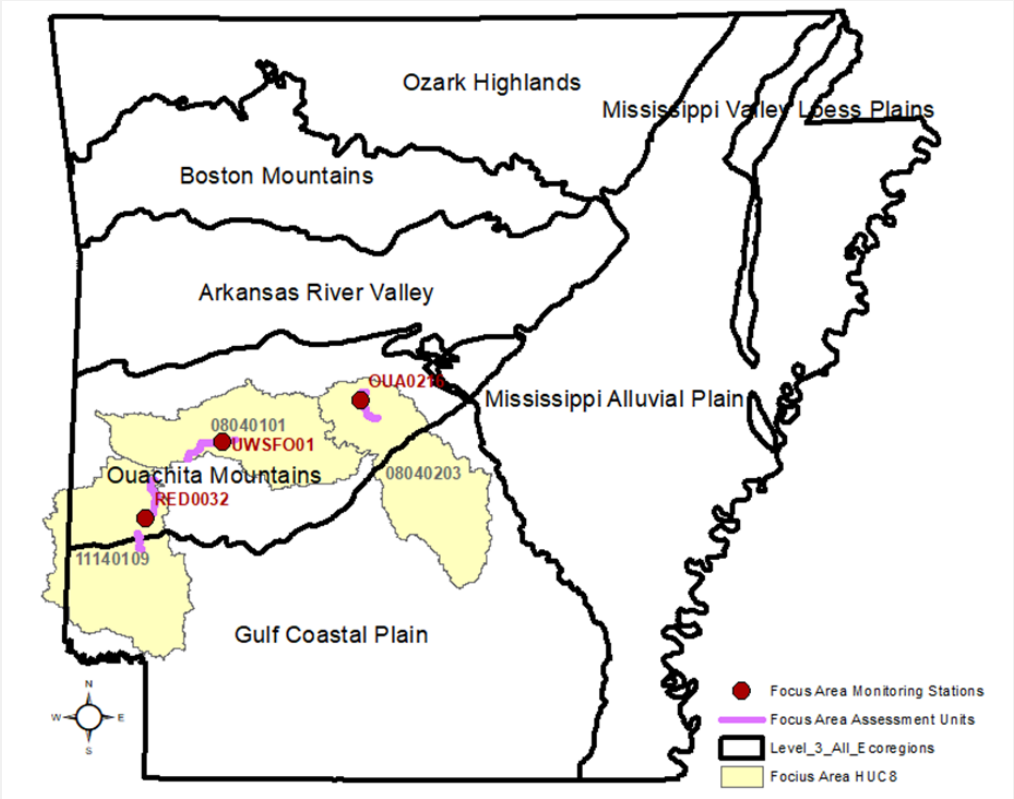
TOXIC HUMAN HEALTH ADDITION DISCUSSION

ARKANSAS
ENERGY & ENVIRONMENT

2.505 SITE SPECIFIC DO CRITERIA

ARKANSAS
ENERGY & ENVIRONMENT

ASSESSMENT UNIT LOCATIONS



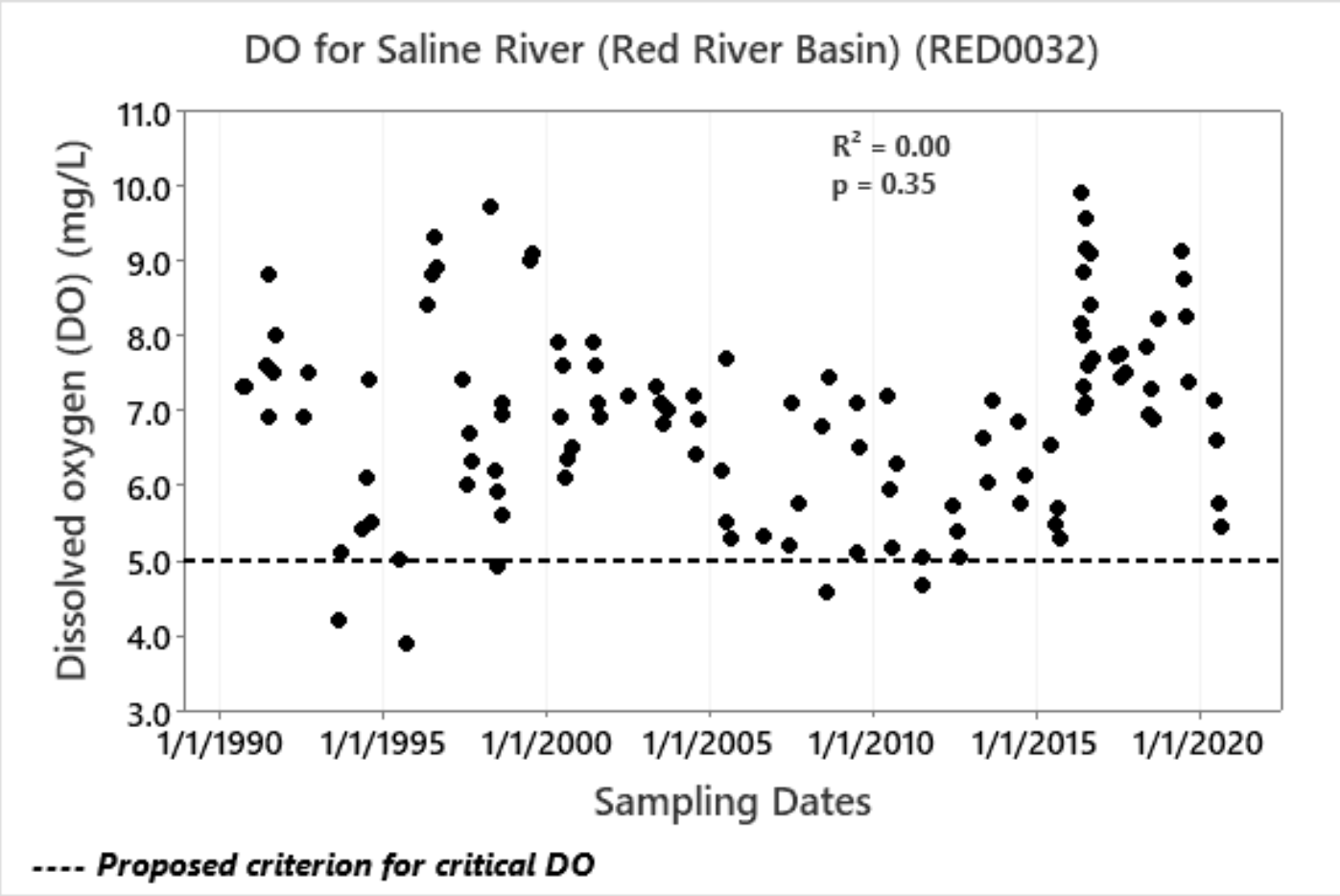
DO CRITERIA

- Dissolved oxygen standards applicable in Ouachita Mountains Streams with > 10mi^2 watershed area:
- Current primary season: 6 mg/L
- Current critical season: 6 mg/L
- Proposed critical season: 5 mg/L

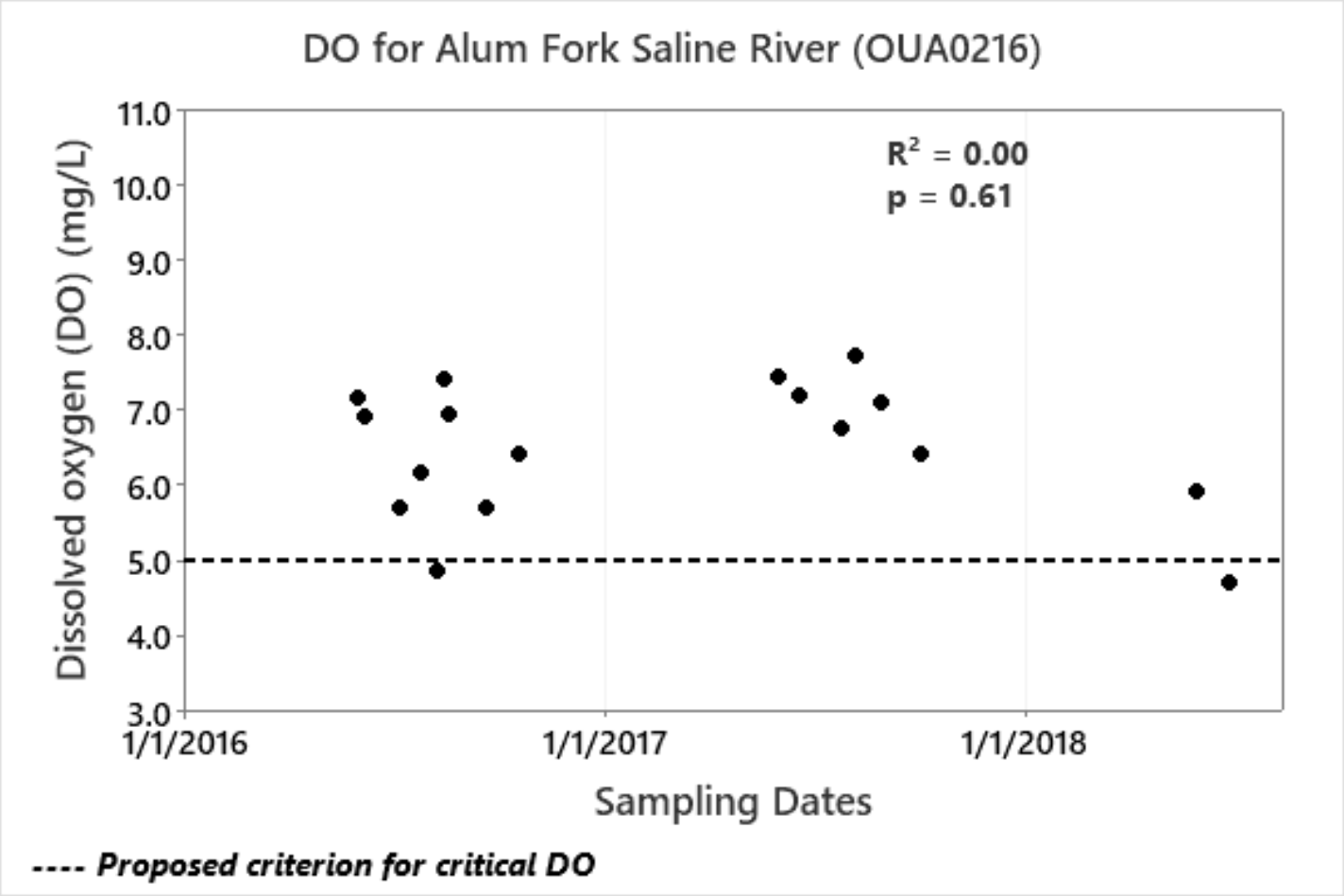
DO SITE SPECIFIC RATIONALE

- Existing water quality data over time
- Land use/cover reflects minimal anthropogenic impact
- Lack of NPDES point sources
- Aquatic life use support demonstrated by biological data

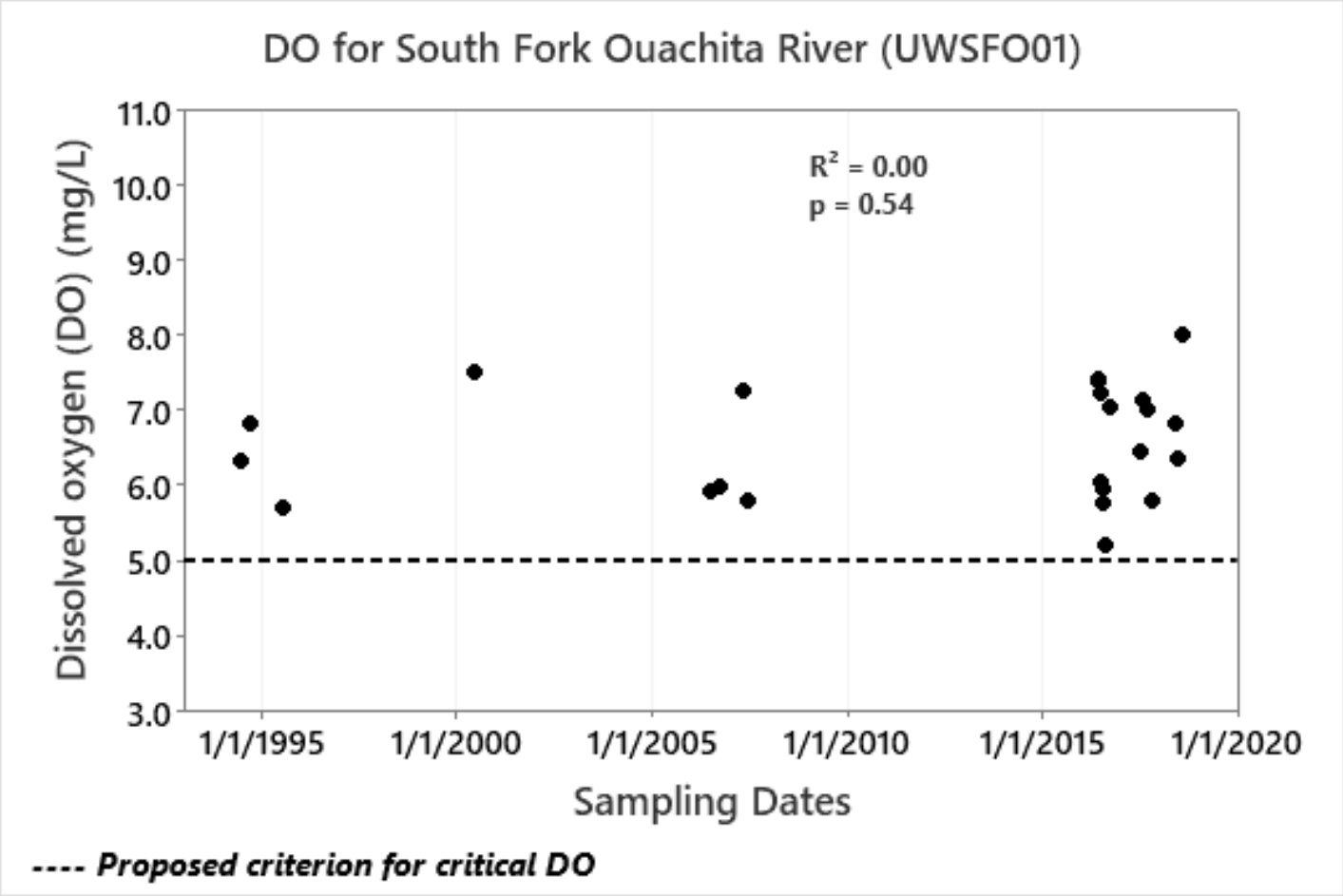
Critical Season DO (>22°C)



Critical Season DO (>22°C)



Critical Season DO (>22°C)



LAND USE DATA – HUC12

Stream Name	Forest	Grass/Shrubs	Wetland	Pasture	Cultivated land	Urban	Barren/Open land	Water
Alum Fork Saline River	86.58	5.07	0.07	0.51	0	4.43	0.01	3.3
South Fork Ouachita River	81.24	2.06	0	10.38	0	5.87	0.35	0.1
Saline River (Red River Basin)	50.97	29.71	0.01	13.64	0	5.51	0.07	0.07

ASSESSMENT UNITS BIO-ASSESSMENT

HILSENHOFF BIOTIC INDEX SCALE

0.00 - 3.75 Excellent
3.76 - 4.25 Very Good
4.26 - 5.00 Good
5.01 - 5.75 Fair
5.76 - 6.50 Fairly poor
6.51 - 7.25 Poor
7.26 - 8.0 Very poor

FISH BIOCRITERIA SCORE

25 - 32 Mostly Similar
17 - 24 Generally Similar
9 - 16 Somewhat Similar
< 9 Not Similar

Waterbody	Hilsenhoff Biotic Index	Fish Biocriteria Score
Alum Fork Saline River	3.97	20
South Fork Ouachita River	4.71	22
Saline River (Red River Basin)	3.4	22

DO SITE SPECIFIC PROPOSALS DISCUSSION

ARKANSAS
ENERGY & ENVIRONMENT

STATUS OF ECOREGION STUDIES

ARKANSAS
ENERGY & ENVIRONMENT

PURPOSE OF ECOREGION STUDIES

- **Creation of New Indices of Biotic Integrity (IBIs)**
  - Fish
  - Macroinvertebrates
- **Development of tiered aquatic life uses**
- **Development of nutrient criteria**
- **Revision of minerals criteria**

DATA COLLECTION

- Monthly water quality
- Fish collection in summer
- Macroinvertebrate collection in fall
- Two 48-hour diurnal dissolved oxygen, pH, and temperature
- Habitat and flow
- Chl-a/periphyton

ECOREGION STUDY SUMMARY

Ecoregion	Start	End	Number of Sites Sampled	Type of Sites Sampled	Next Steps
Ozark Highlands	2013	2023	19	ERW	2023 data gap study, 30 sites across a disturbance gradient
Boston Mountains	2014	2022	27	ERW	2022 data gap study, 30 sites across a disturbance gradient
Ouachita Mountains	2016	2018	51	Across a disturbance gradient	Data analysis
Gulf Coastal Plain	2019	2022	75	Across a disturbance gradient	Data analysis
Arkansas River Valley	2023	2024	45	Across a disturbance gradient	Sampling
Delta	2025	2030	90	Across a disturbance gradient	Site selection

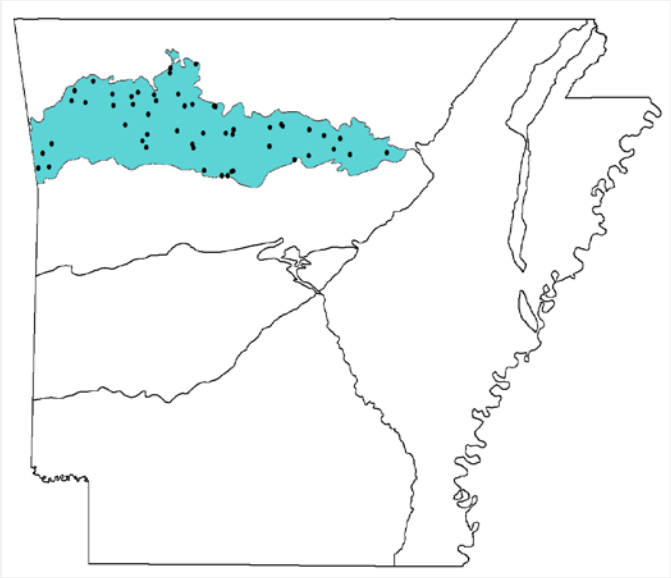
BOSTON MOUNTAINS

ERW 27

2012-2015

GAP 30

- 2022
- Disturbance Bin Counts
  VH=13, H=19, M=13, L=12



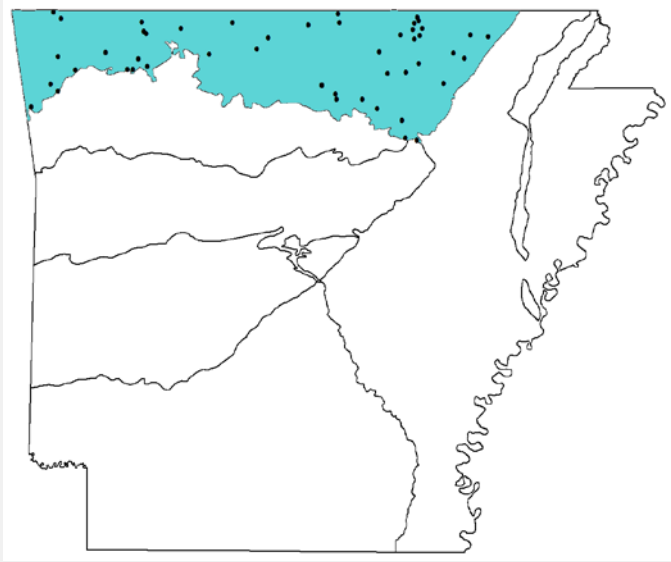
OZARK HIGHLANDS

ERW 18

2016-2018

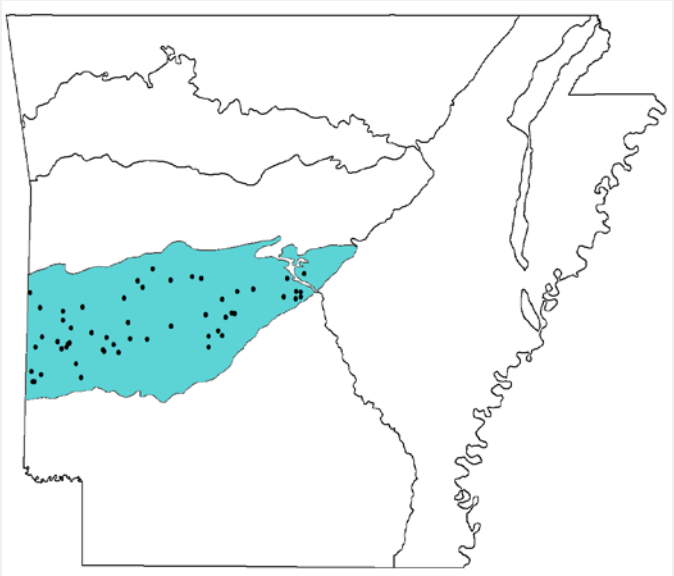
GAP 30

- 2023
- Disturbance Bin Counts
  VH=14, H=10, M=10, L=14



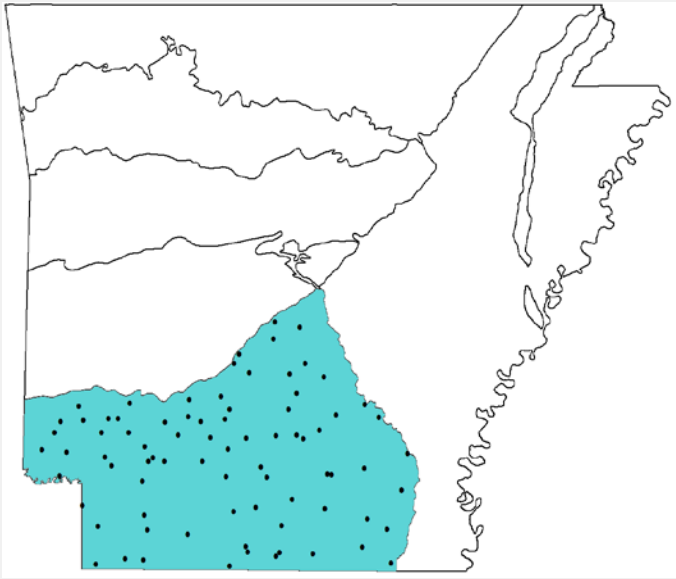
OUACHITA MOUNTAINS

- 2016-2018
- 54 sites
- ERW
- Sampled along a continuous disturbance gradient



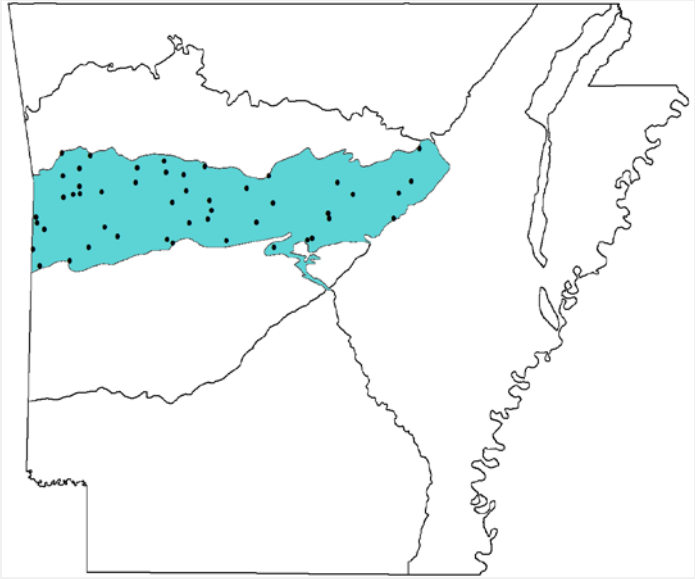
GULF COASTAL PLAIN

- **West & Central**
  2019-2022
- **East**
  2021-2022
- **Disturbance Bin Counts**
  VH=23, H=19, M=14, L=20
- **76 sites**

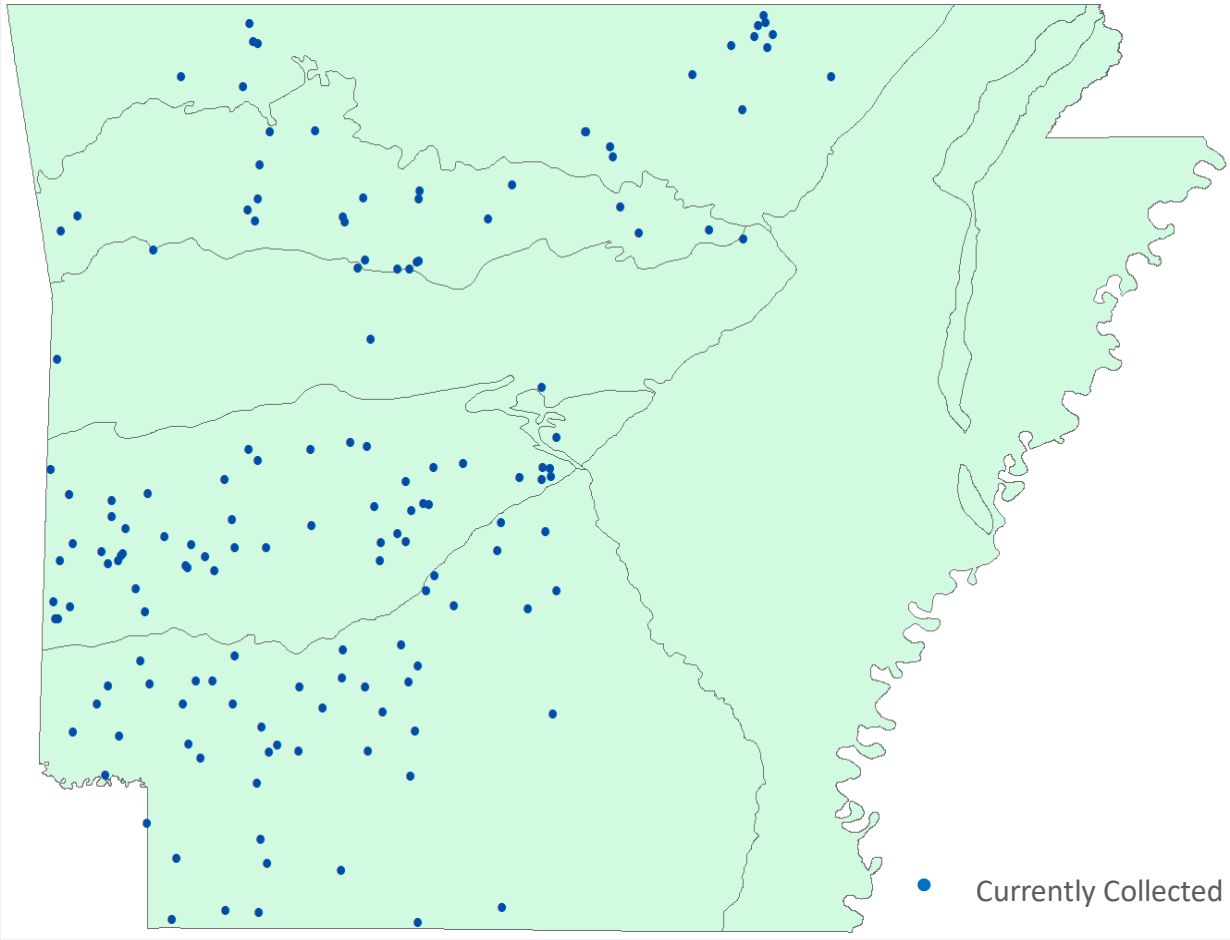


ARKANSAS RIVER VALLEY

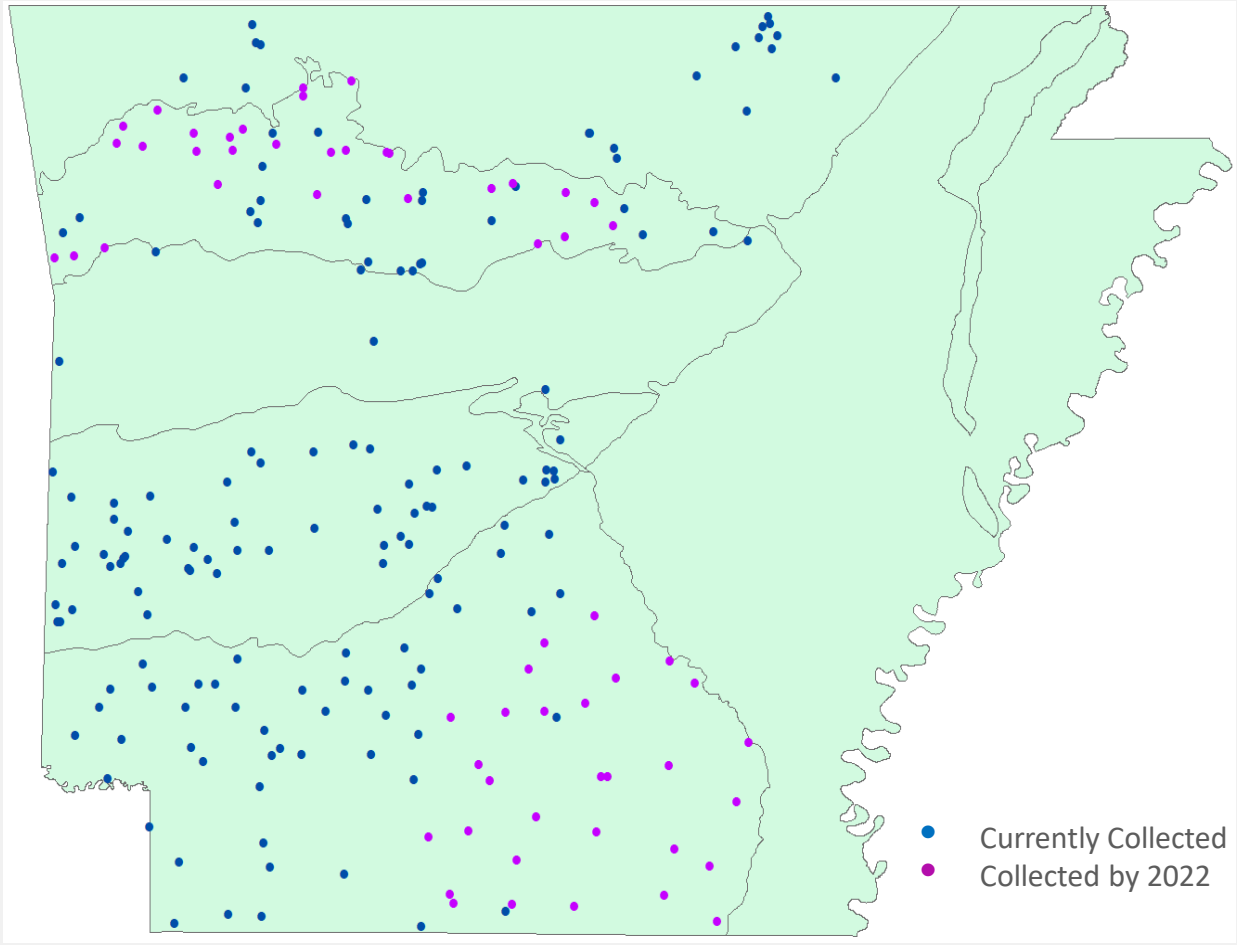
- **45 sites planned**
- **2023-2024**
- **Disturbance Bin Counts**
  VH=14, H=9, M=8, L=14



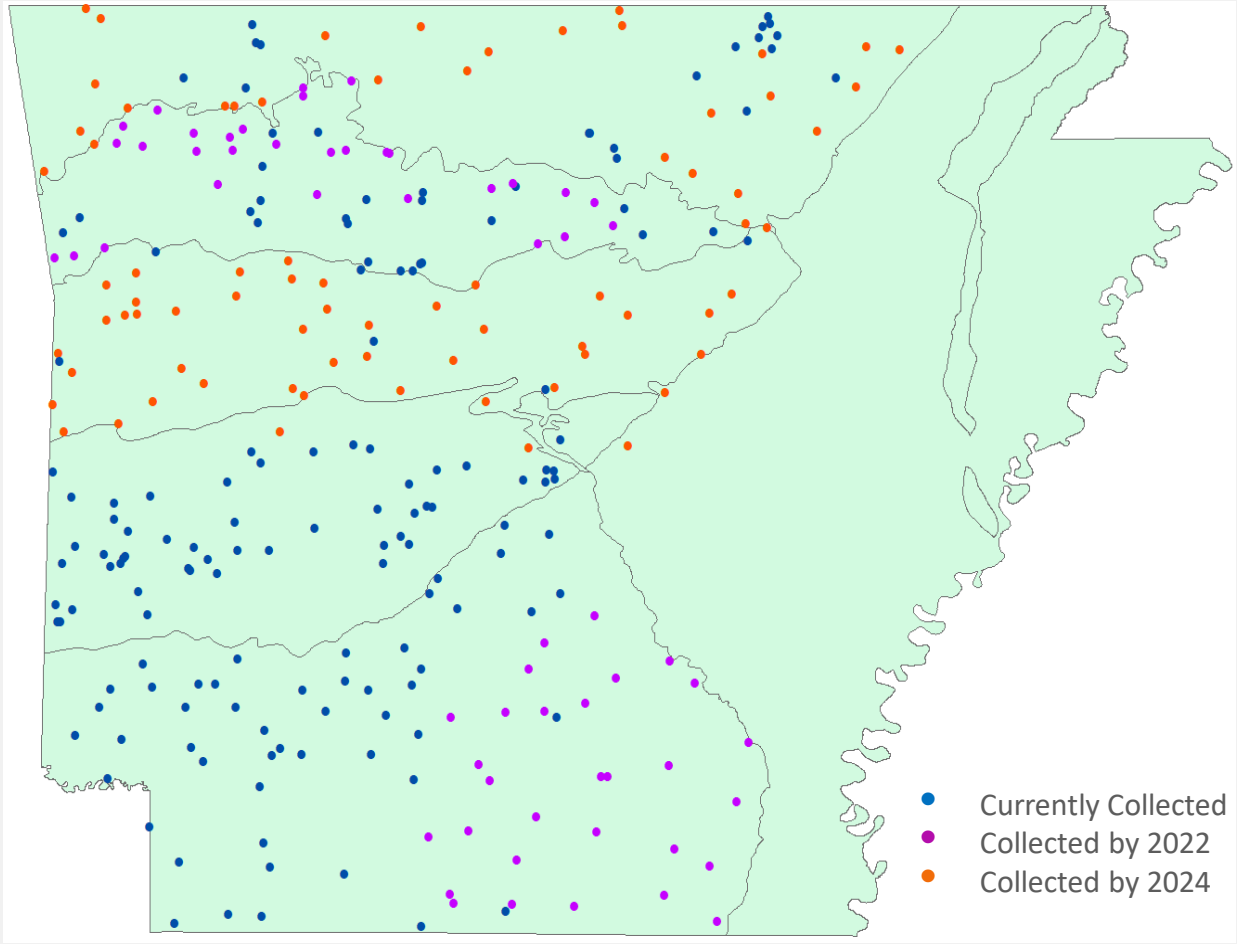
BIOLOGICAL DATA SITES COLLECTED



BIOLOGICAL DATA SITES COLLECTED BY 2022



BIOLOGICAL DATA SITES COLLECTED BY 2024



ECOREGION STUDIES DISCUSSION

ARKANSAS
ENERGY & ENVIRONMENT

STATUS OF MINERAL CRITERIA

ARKANSAS
ENERGY & ENVIRONMENT

RULE 2.511 MINERALS

- Rule 2.511(B) Ecoregion Reference Stream Values (ER) were included in 1991
- Rule 2.511(B) values are realistic for some waters, but not relevant for others

MINERALS CRITERIA HISTORY

1967

- “Waste discharge shall not affect existing mineral quality so as to interfere with other beneficial uses.”

1973

- “For tributary streams not listed, the corresponding limits for chlorides, sulfates, and total dissolved solids shall be 250, 250, and 500 mg/l, respectively.”
- Specific numeric standards were established for 51 streams/stream segments.

MINERALS CRITERIA HISTORY

1983 – 1987

- Ecoregion work was conducted, establishing the ecoregion numbers that would eventually be integrated into Rule 2.

2007

- To date, site specific criteria were established for 127 streams/stream segments.

2016

- EPA Technical Support Document “Ion Report” evaluated several approaches to developing mineral criteria in Arkansas.

2016 ION REPORT

Explored relationship between TDS and conductivity and three analyses to develop aquatic life criteria for chloride, sulfate, and TDS.

Ecoregion Approach

- Compiled 20+yrs of data, 200,000 individual data points, 839 locations
- 75th or 95th percentiles of reference condition could serve as candidate criteria
- Values comparable to 1991 ER values

2016 ION REPORT (CONT.)

- **Laboratory-Toxicity Based Approach**
  - Lack of sensitive taxa data
  - Additional information needed for low hardness waters
  - Expensive

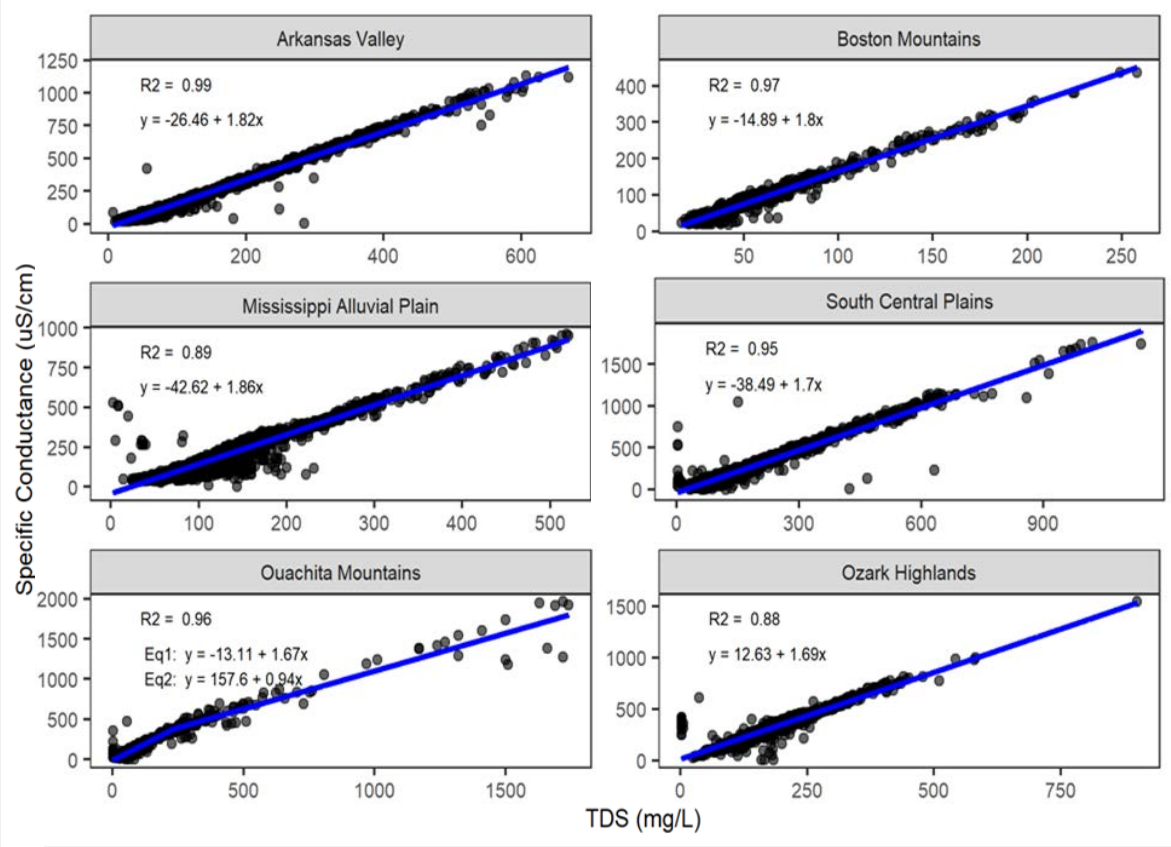
- **Field-Based/Stressor-Response Approach**
  - Species Sensitivity Distribution
  - Presence-Absence of taxa along mineral gradient
  - Limited data (taxonomic resolution and pairing of water chemistry to biology)

SPECIFIC CONDUCTIVITY

- DEQ is investigating using specific conductivity (SC) for future minerals criteria development
- SC was selected as the measure of the ionic mixture for field-based methods because it is:
  - Fast, inexpensive, accurate, and precise
  - Measures all and only dissolved ions
  - Able to continuously record in situ
  - Sensitive measure in dilute waters
  - Monitored with biota by most states
  - Less affected by non-ionic constituents

Measurement method: detection limit	All ions?	Speed	Approximate sample range and sample volume	Sample filtration required	Field use	Continuous measure possible	Mixture composition
Specific Conductivity	Yes	Seconds	Wide range, µL–mL, volume or in-situ	No	Yes	Yes	No
Total dissolved solids (TDS) (gravimetric)	Yes + nonionic dissolved solids	Days	Requires large volumes for freshwater	At times	No	No	No

RELATIONSHIP BETWEEN TDS AND SC FOR WQP DATA SET BY ECOREGION



EXTIRPATION LEVELS BASED ON FIELD-BASED METHOD

- EPA's method for deriving benchmarks for specific conductivity based on the extirpation of benthic invertebrates using large regional data sets with paired biology and chemistry data.
- Requires minimums of 90-120 genera with > 25% occurrence at 500-800 sites to produce reliable results.
- Current DEQ data sets do not contain sufficient sample sizes to produce reliable results using this method.

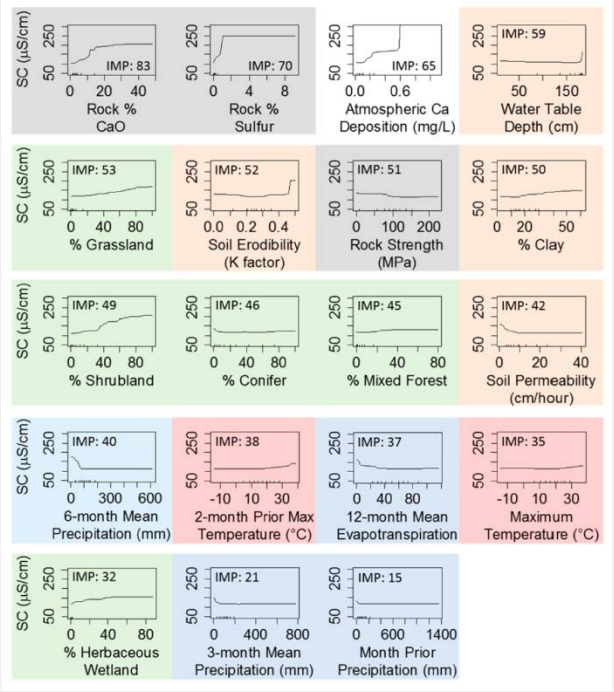
Background to Criterion Model

1. Derivation of background values

2. Background to Criterion Model

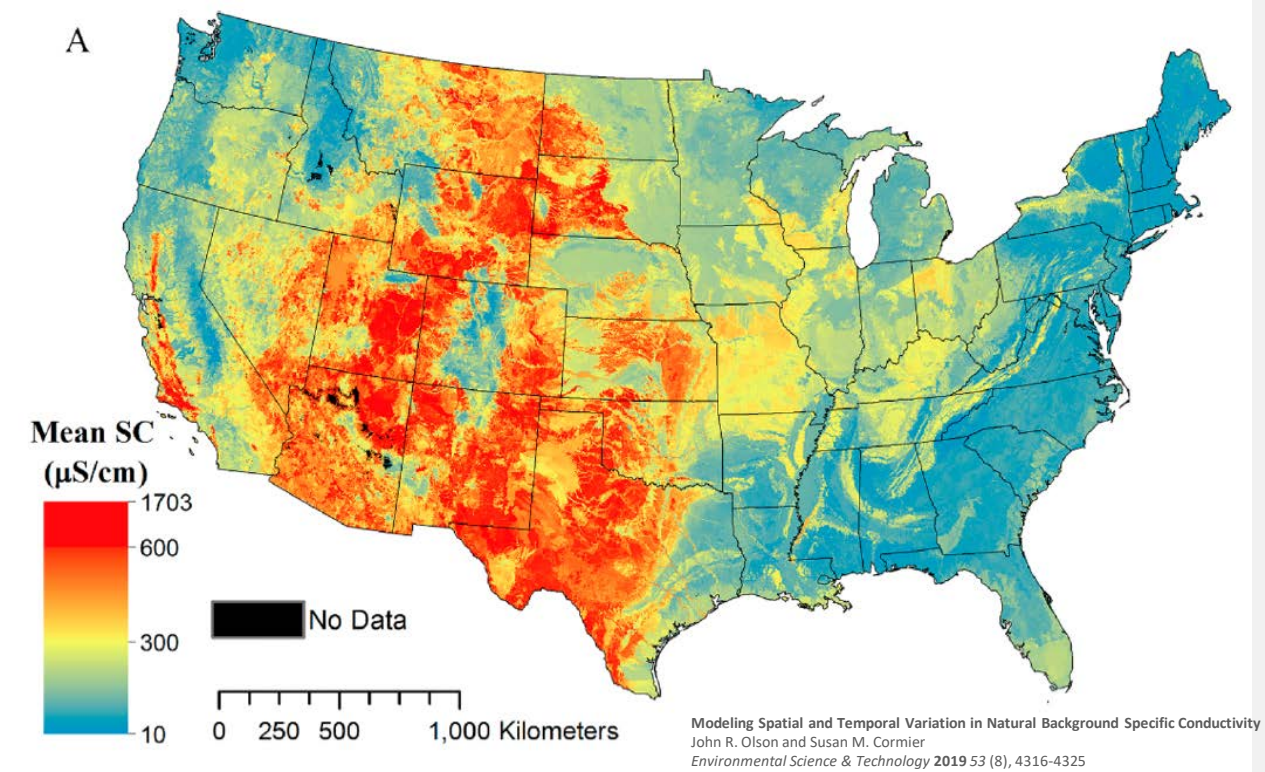
NATIONAL BACKGROUND MODEL

- A statistical model of the natural spatial and temporal variation in SC for the contiguous United States
- Relates observed SC to environmental predictors using random forest machine learning
- Used 2.4 million SC observations from across the continental United States from STORET, state natural resource agencies, and the USGS National Water Information System



Modeling Spatial and Temporal Variation in Natural Background Specific Conductivity
John R. Olson and Susan M. Cormier
Environmental Science & Technology **2019** *53* (8), 4316-4325

NATIONAL BACKGROUND MODEL

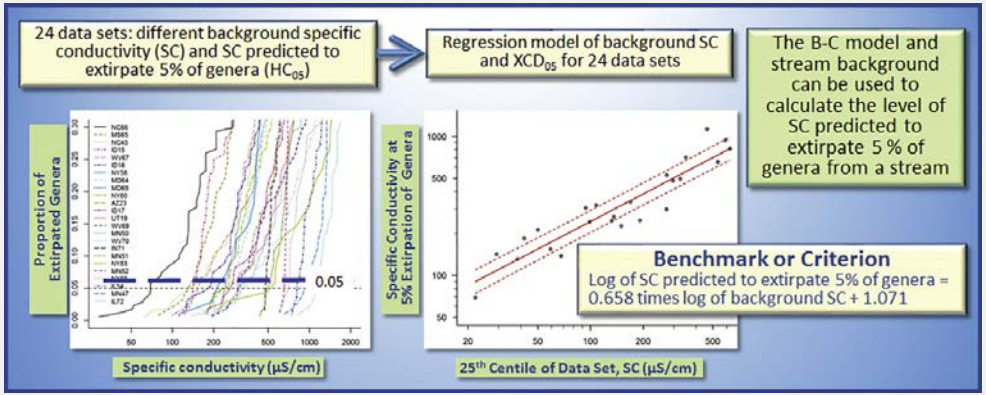


Modeling Spatial and Temporal Variation in Natural Background Specific Conductivity
John R. Olson and Susan M. Cormier
Environmental Science & Technology **2019** *53* (8), 4316-4325

EXTIRPATION BASED ON NATIONAL BACKGROUND TO CRITERION MODEL

The relationship between background conductivity and species occurrences can be mathematically modeled to predict percent extirpations based on three assumptions

- A genus rarely occurs where the background exceeds its upper physiological limit
- The lowest possible tolerance limit of a genus in a region is defined by the natural background
- There will be a regular association between natural background SC and the SC at which salt-intolerant genera are present



Cormier, S.M., et al., A field-based model of the relationship between extirpation of salt-intolerant benthic invertebrates and background conductivity, Sci Total Environ (2018)

FUTURE STEPS

- Continue collecting paired chemical and biological data to better inform models and future method selection.
- Explore species occurrences, extirpation rates, and model fits to determine best methods for criteria development.

MINERAL CRITERIA DISCUSSION

ARKANSAS
ENERGY & ENVIRONMENT

KEEP IN TOUCH

OFFICE OF WATER QUALITY

Arkansas Energy & Environment
Division of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118

PHONE

501.682.0744

EMAIL

Rule_2_Comments@adeq.state.ar.us

WEBSITE

https://www.adeq.state.ar.us/water/planning/reg2/triennial/2023/

@AREnergyEnvironment

@ArkansasEE

ARKANSAS
ENERGY & ENVIRONMENT