

Re-evaluating least-disturbed reference streams in Arkansas' ecoregions

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Arkansas Chapter American Fisheries Society
26 February 2014 – Rogers, Arkansas

Background

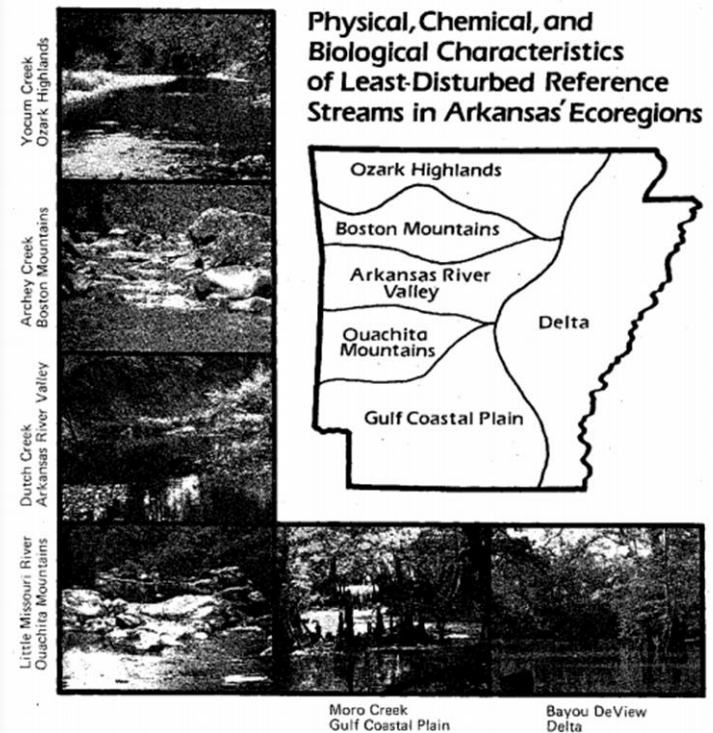
- Clean Water Act of 1972
 - “fishable/swimmable”
- Provide basis for development, review and adoption of water quality standards
- Define chemical, physical, and biological parameters of least-impaired streams



Background

Objectives

- Ecoregions
- Site selection
- Range of watershed sizes
- Critical survey periods



**Volume I: Data Compilation
1987**

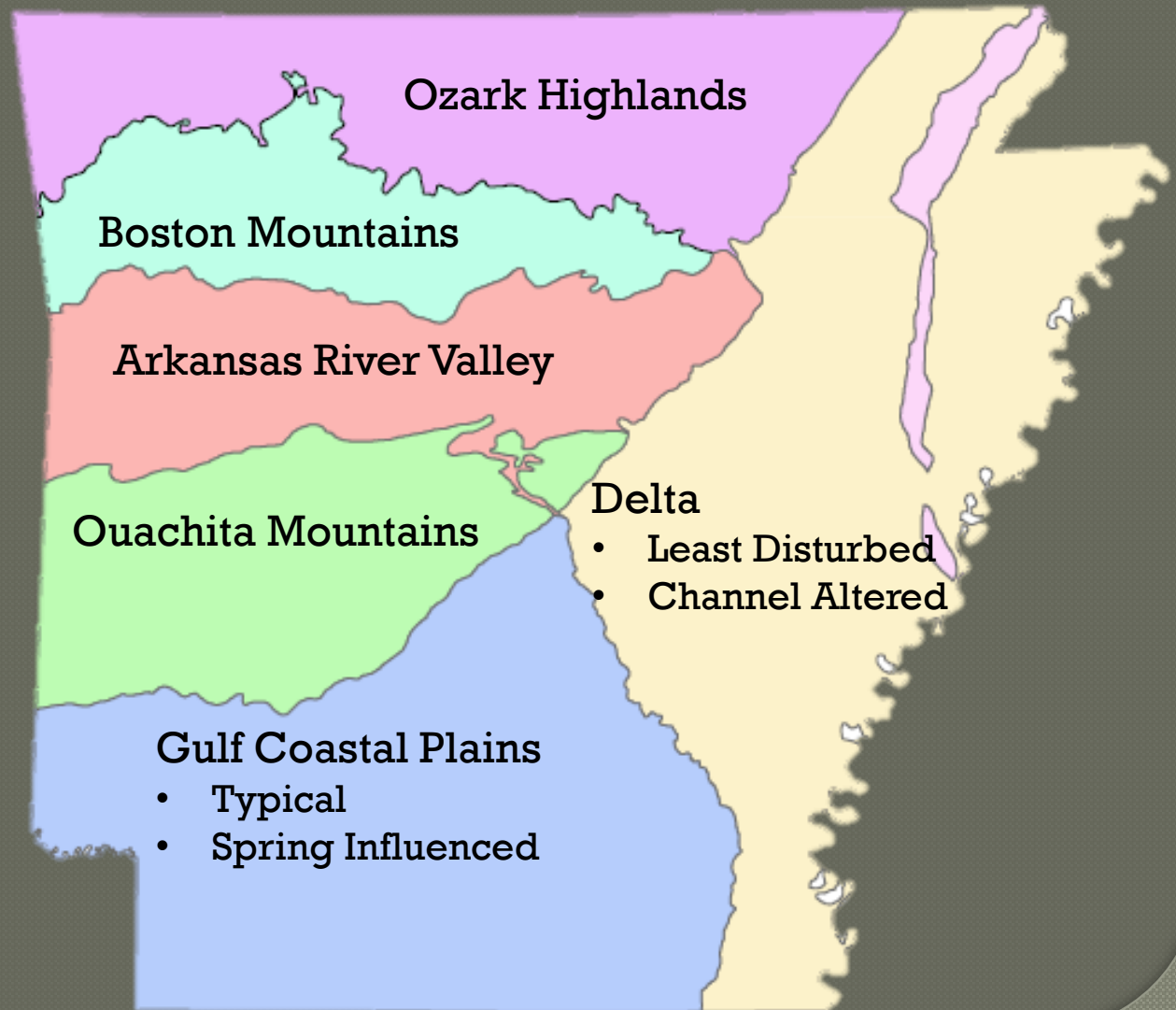
**State of Arkansas
Department of Pollution Control and Ecology**



Least Disturbed Ecoregion Reference Streams

Objectives

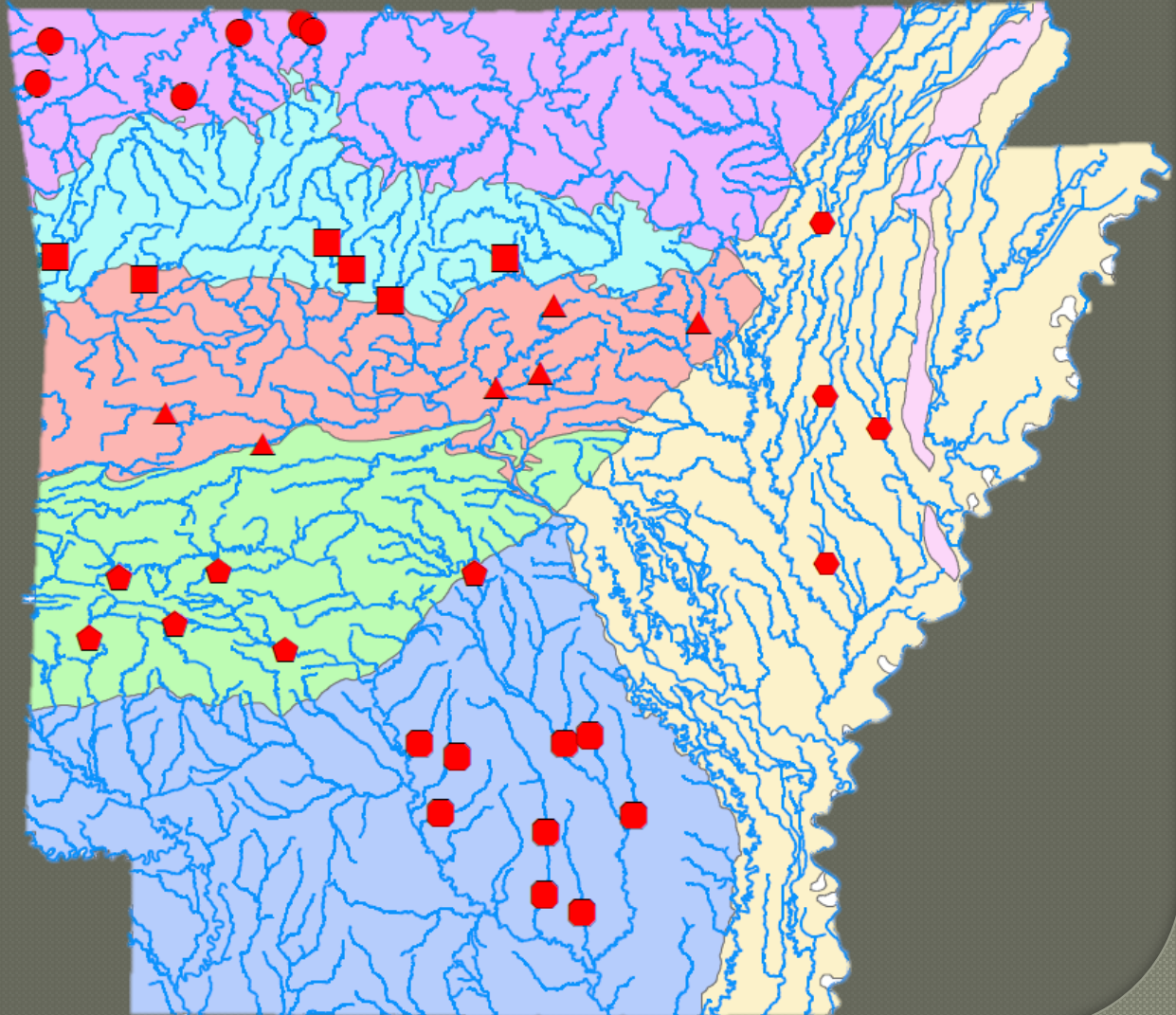
- Ecoregions



Least Disturbed Ecoregion Reference Streams

Objectives

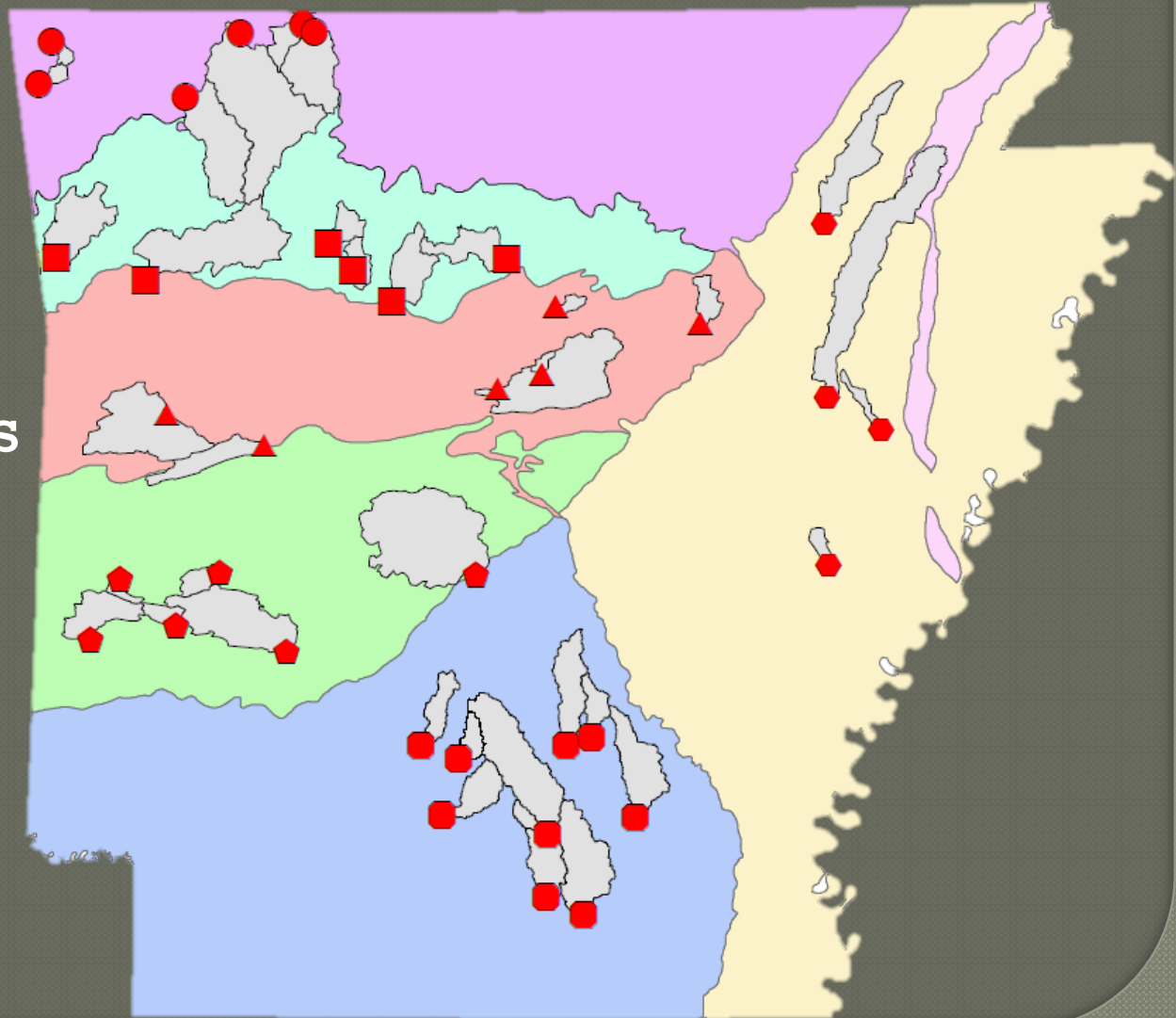
- Site selection
 - 36 Sites
 - Most representative of ecoregion
 - Least disturbed



Least Disturbed Ecoregion Reference Streams

Objectives

- Range of watershed sizes
 - 20-50 mi²
 - 100-200 mi²
 - 300-500 mi²



Background

Objectives

- Critical survey periods
 - Late Summer
 - ↑ Temp
 - ↓ Dissolved Oxygen



Freshwater Illustrated



Data Collected 1983-1986

● Chemical

- Q, cfs
- Temperature, °C
- pH
- Turbidity, ntu
- TSS, mg/L
- TDS, mg/L
- BOD-5, mg/L
- BOD-20, mg/L
- Nitrates
- Total Phosphorus, mg/L
- PO₄-P, mg/L
- NO₂+NO₃-N, mg/L
- NH₃-N, mg/L
- Cl -, mg/L
- SO₄ =, mg/L
- Fe, mg/L
- Conductivity, µmho
- Alkalinity, mg/L
- Chlorophyll a, µg/L
- Fecal Coliform
- Dissolved Oxygen

● Physical

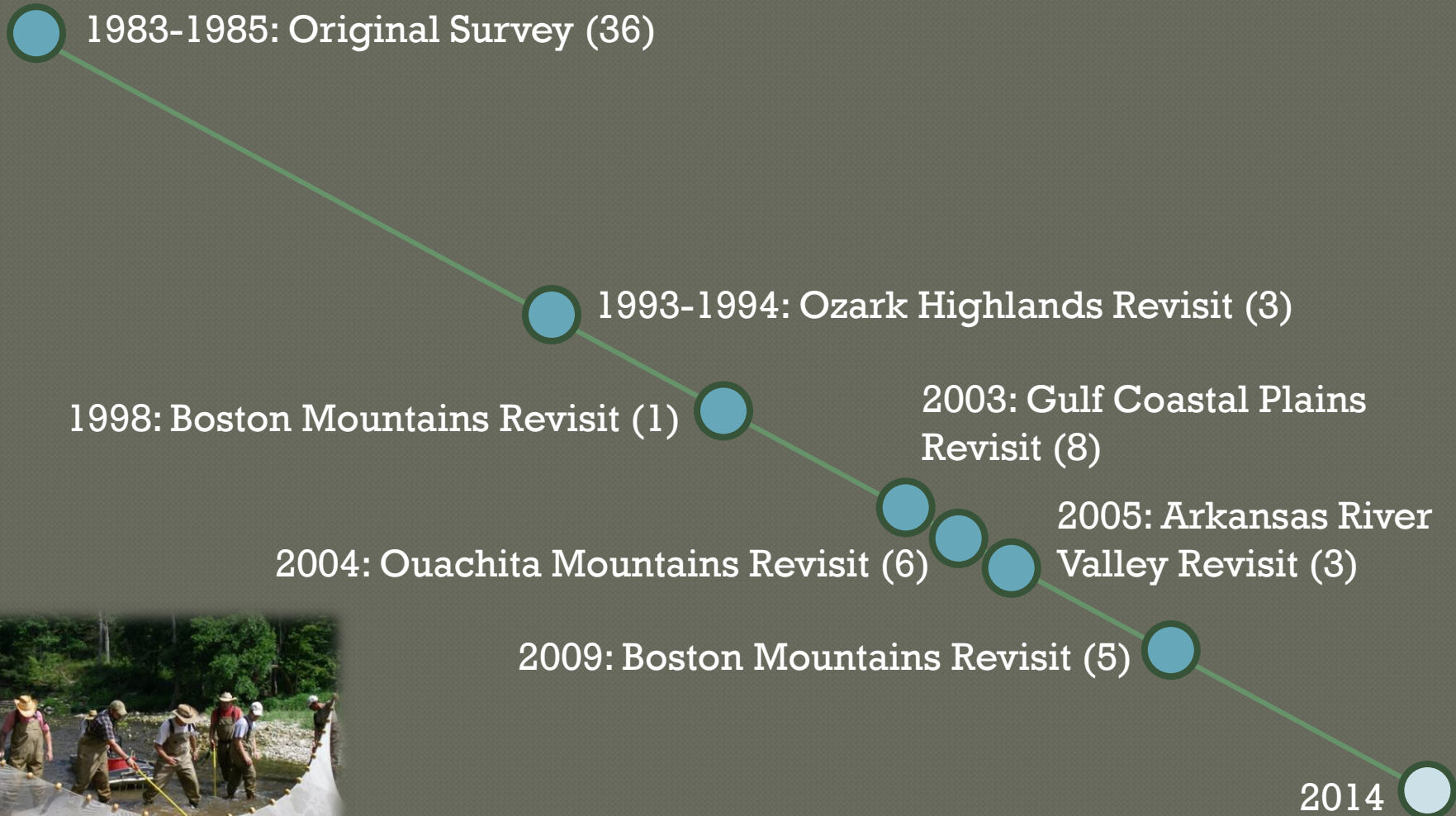
- Drainage area
- Watershed land use
- Stream Gradient
- Mean Channel Width
- Mean Stream Width
- Mean Stream velocity
- Observed Flow
- Average Substrate Type
- Mean Instream Cover
- Riffle/Pool ratio of Transects
- Mean Bank Overstory Cover
- Mean Bank Ground Cover
- Mean Bank Stability
- Mean Stream Canopy

● Biological

- Fish
- Macroinvertebrates

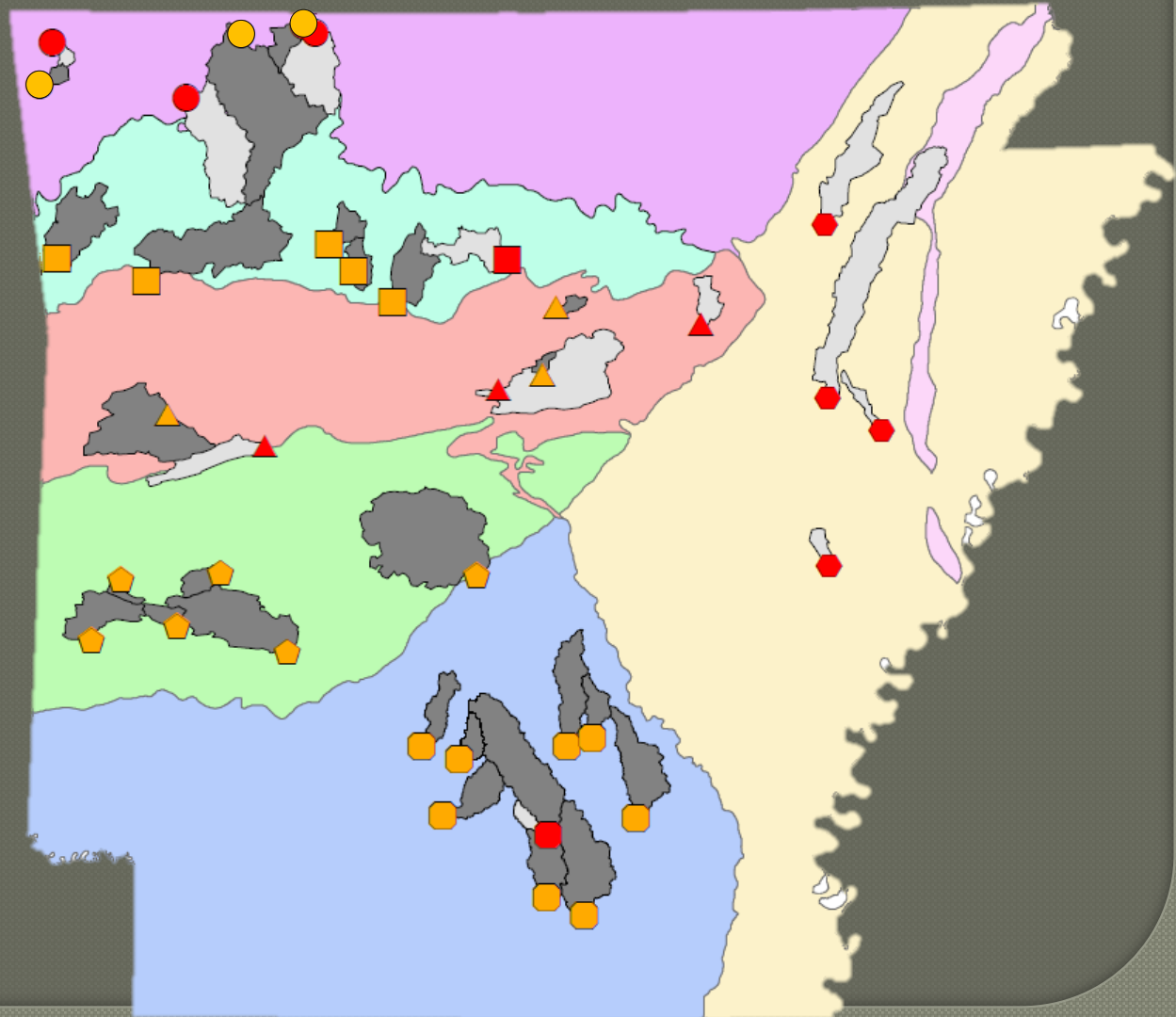


Least Disturbed Ecoregion Reference Streams – Fish Revisited



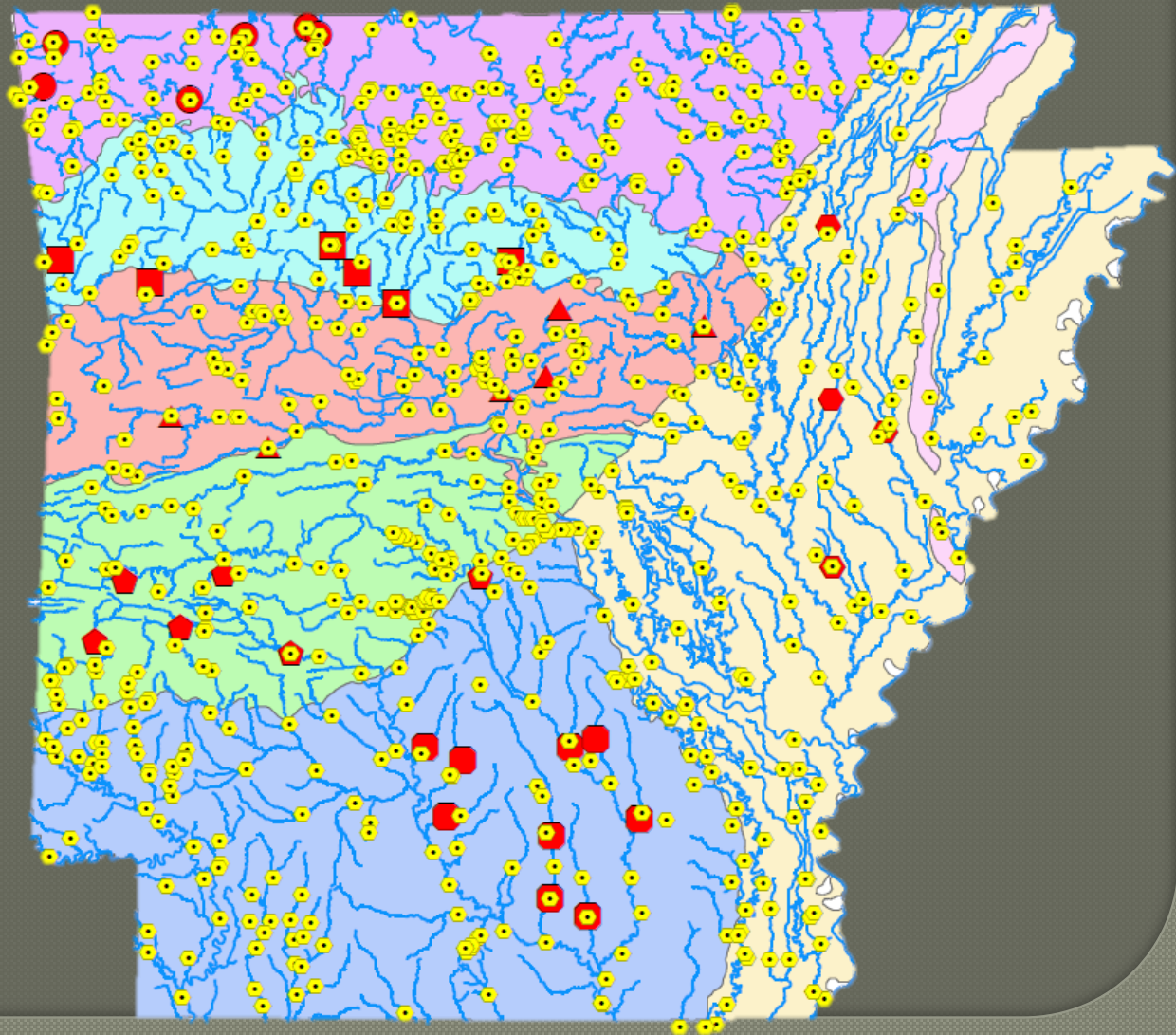
Least Disturbed Ecoregion Reference Streams – Fish Revisited

25 of 36



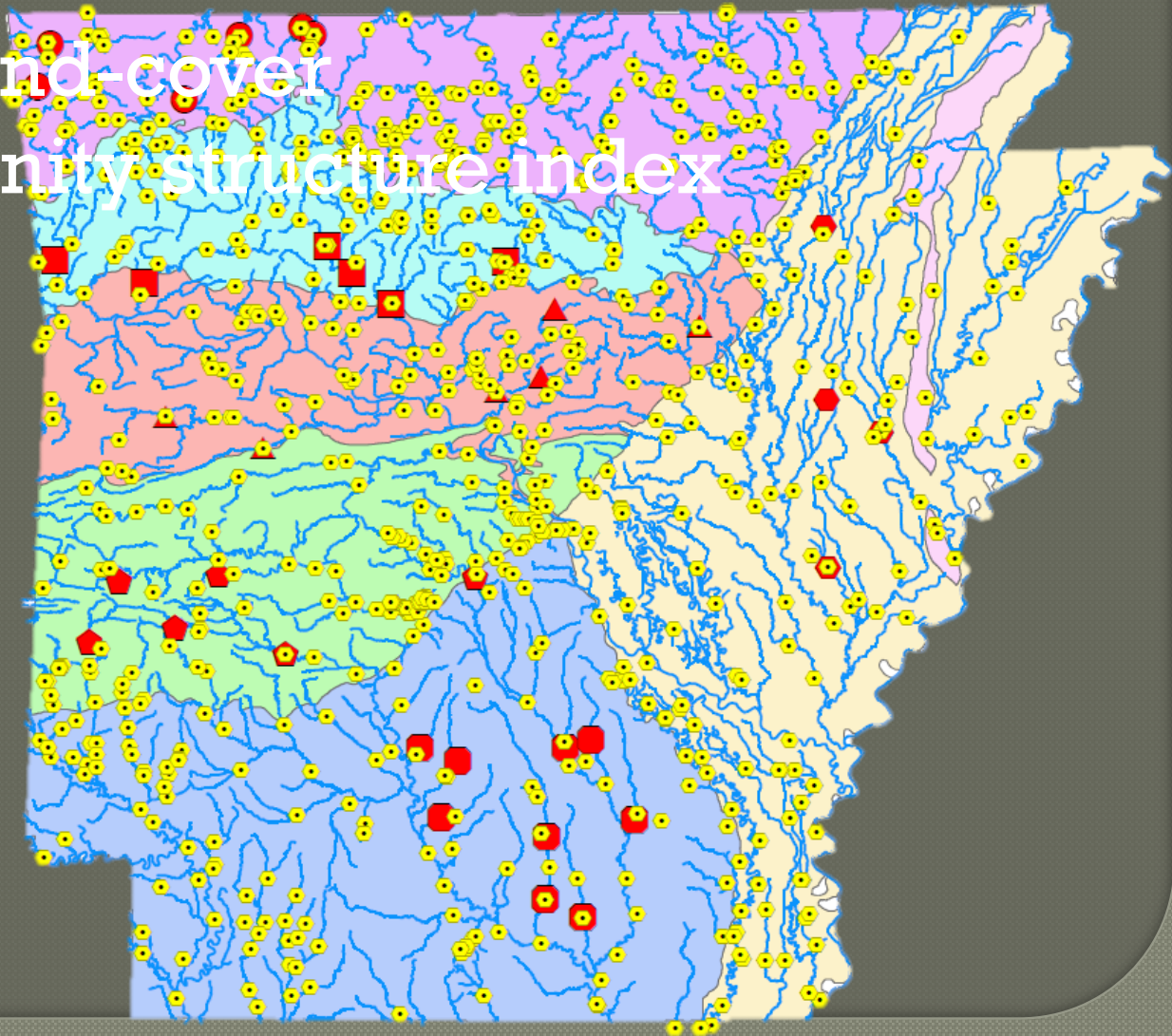
Least Disturbed Ecoregion Reference Streams – Fish Revisited

- Ambient and roving water quality monitoring stations



Least Disturbed Ecoregion Reference Streams – Fish Revisited

- Land-use Land-cover
- Fish community structure index
 - Ecoregion
 - Site specific



Land-use Land-cover

- 1986
- 1992
- 1999
- 2006
- Categories
 - Forest
 - Agriculture and pasture
 - Urban



Fish Community Structure Index

Ecoregion	Total Score	Category	Attribute
Ozark Highlands Boston Mountains	25-32	Mostly Similar	Comparable to the best situation to be expected. Balanced trophic structure and optimum community structure present.
Ouachita Mountains AR River Valley	24-17	Generally Similar	Community structure less than expected. Taxa richness lower than expected. Some intolerant taxa loss. Percent contribution of tolerant forms may increase.
Typical Gulf Coastal	16-9	Somewhat Similar	Obvious decline in taxa richness due to the loss of tolerant forms. Loss of Key and Indicator taxa.
Spring-Influenced Gulf Coastal	0-8	Not Similar	Few taxa present and normally dominated by one (1) or two (2) taxa.



Fish Community Structure Index

- ◉ % Sensitive
- ◉ % Cyprinidae
- ◉ % Ictaluridae
- ◉ % Centrarchidae
- ◉ % Percidae
- ◉ % Primary Feeders
- ◉ % Key Individuals
- ◉ Diversity

Outline

- ◉ Ouachita Mountains
- ◉ Gulf Coastal Plains
- ◉ Boston Mountains
- ◉ Arkansas River Valley
- ◉ Ozark Highlands



Outline

● **Ouachita Mountains**

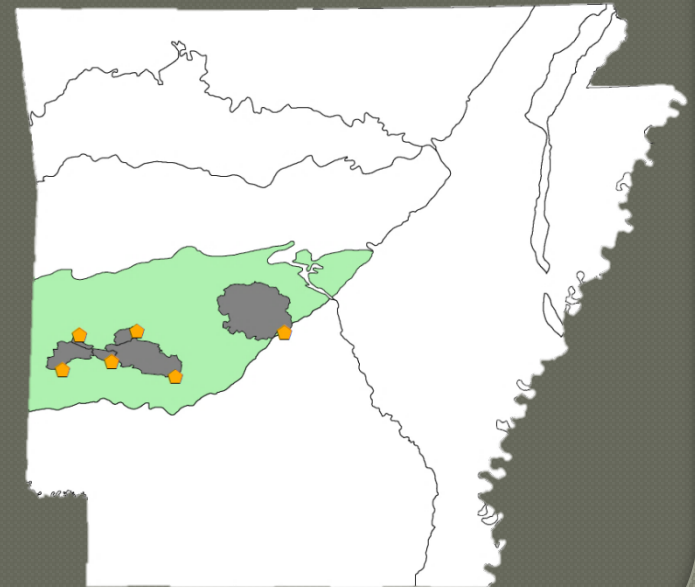
- Board Camp Creek
- Caddo River
- Cossatot River
- Little Missouri River
- Saline River
- South Fork Ouachita River

● Gulf Coastal Plains

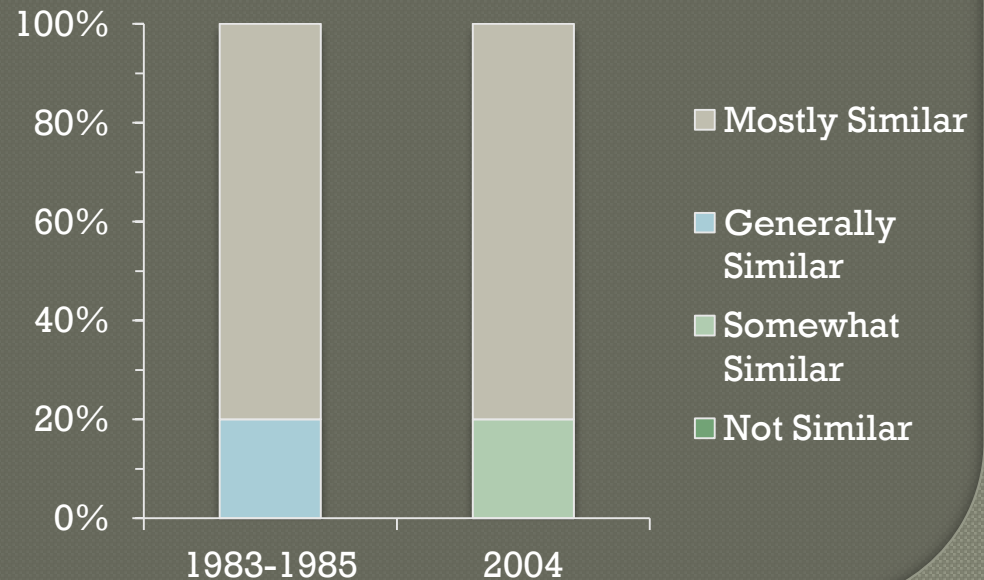
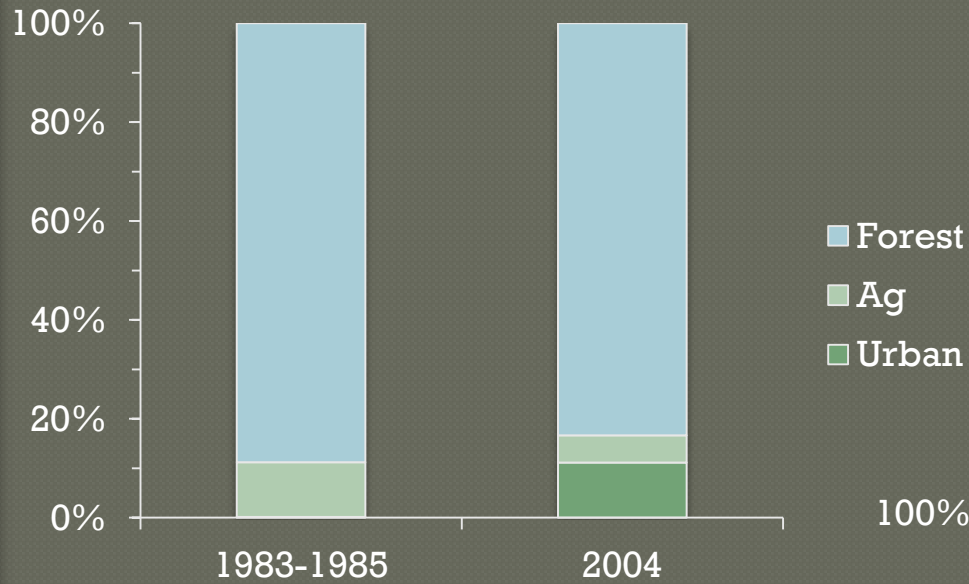
● Boston Mountains

● Arkansas River Valley

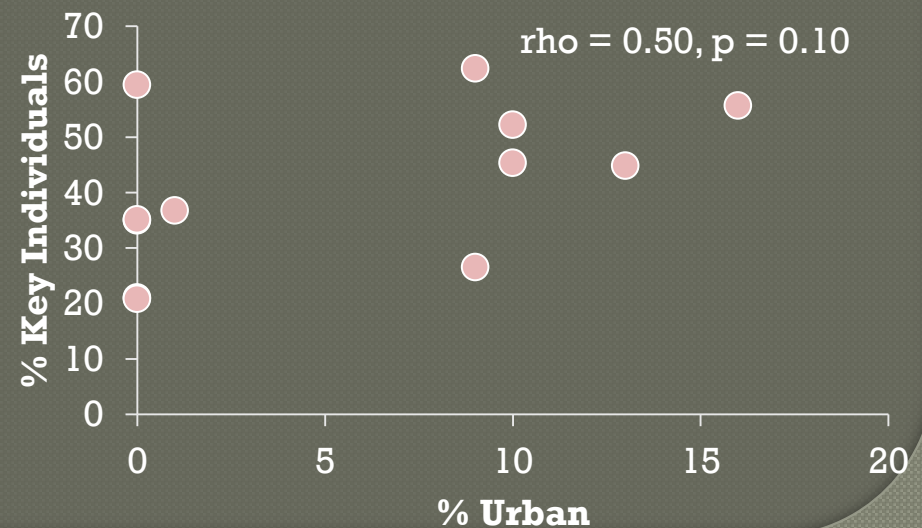
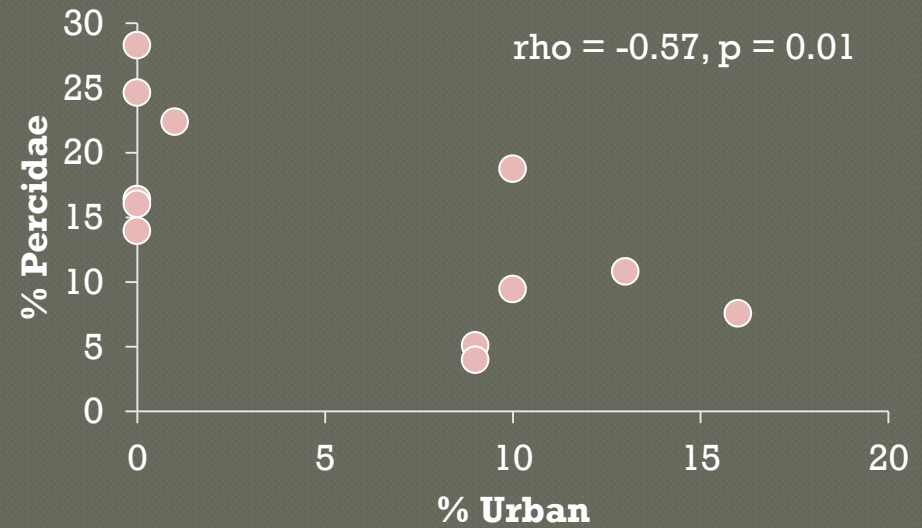
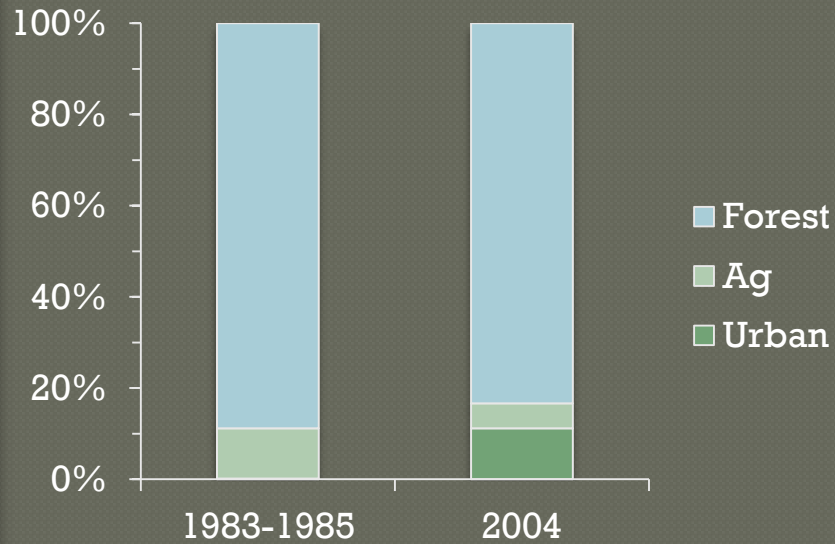
● Ozark Highlands



Ouachita Mountains



Ouachita Mountains



Ouachita Mountains

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● Impaired - Not Supporting Fisheries Designated Use

- Caddo River

- Cause: Silt - Source: Resource extraction

- Saline River

- Cause: Turbidity, TDS - Source: Surface erosion, Unknown

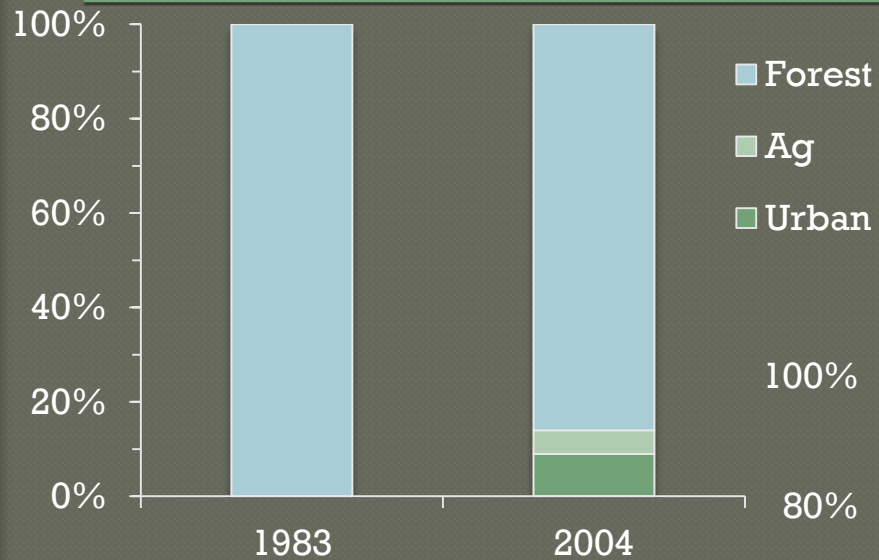
● Impaired – Supporting Fisheries Designated Use

- Little Missouri River

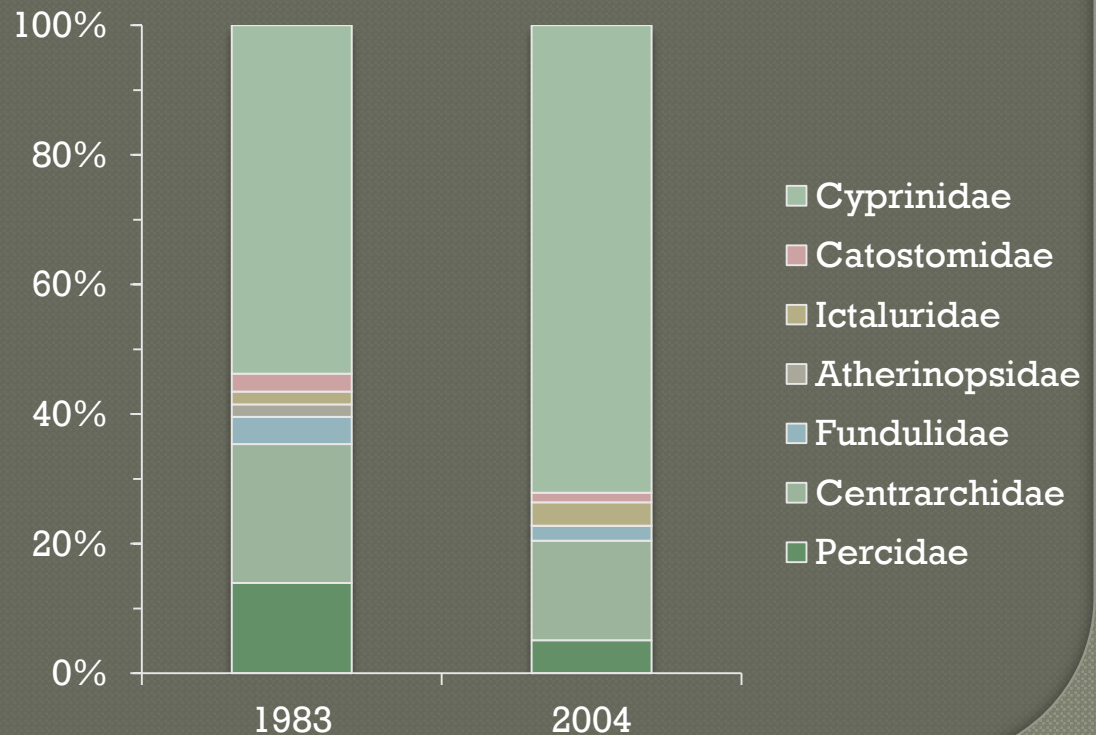
- Cause: Copper - Source: Unknown

Little Missouri River

Ouachita Mountains

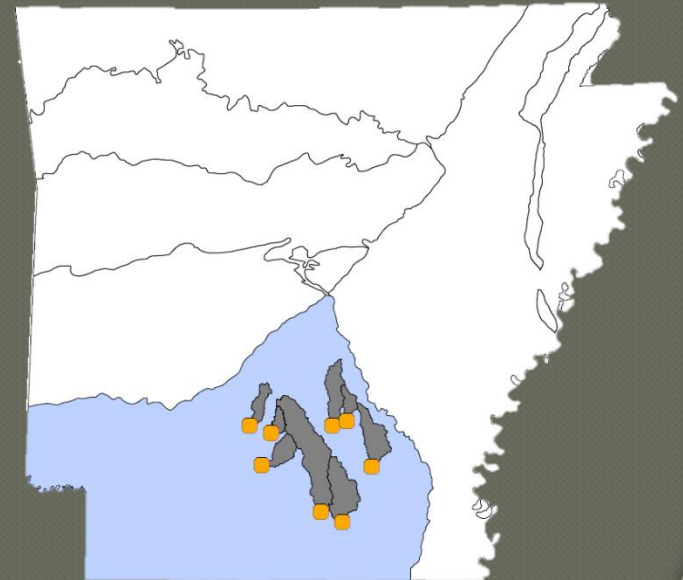


Mostly Similar
↓
Somewhat Similar

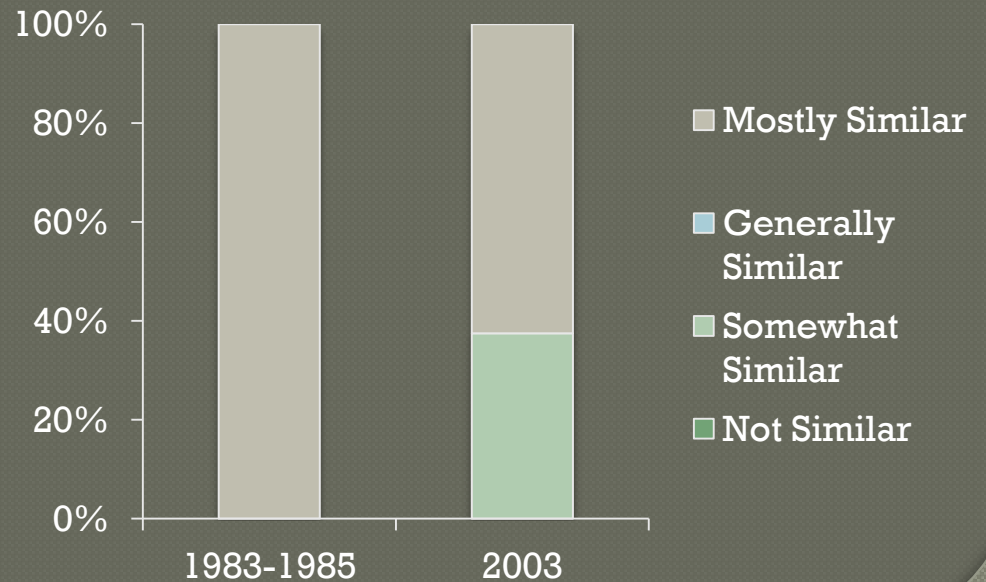
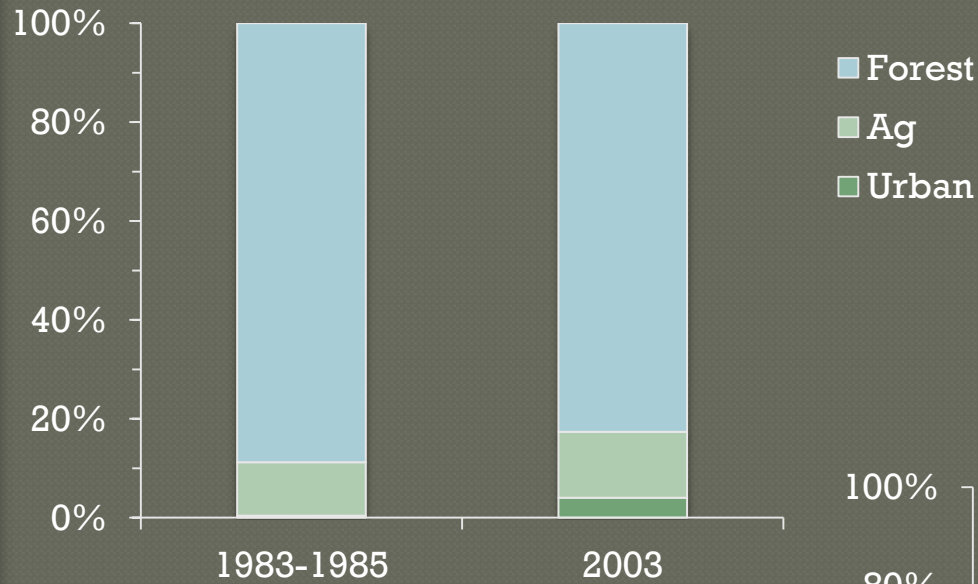


Outline

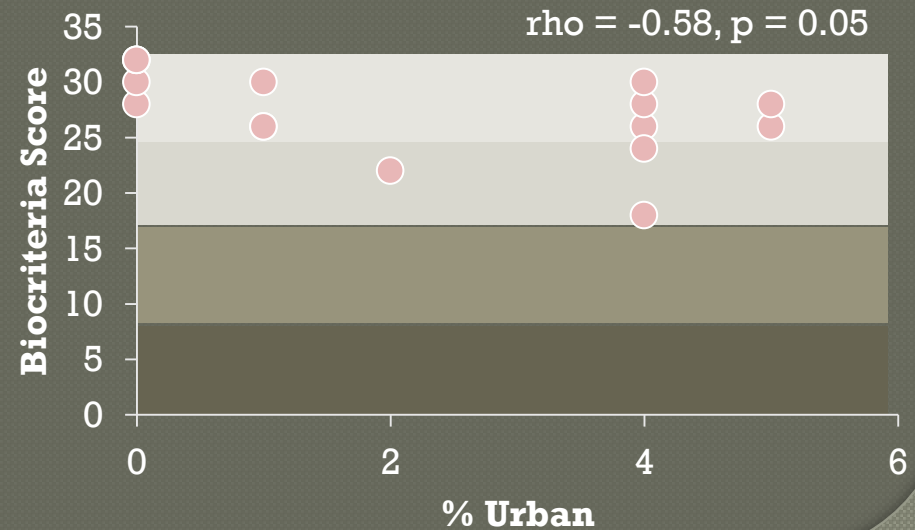
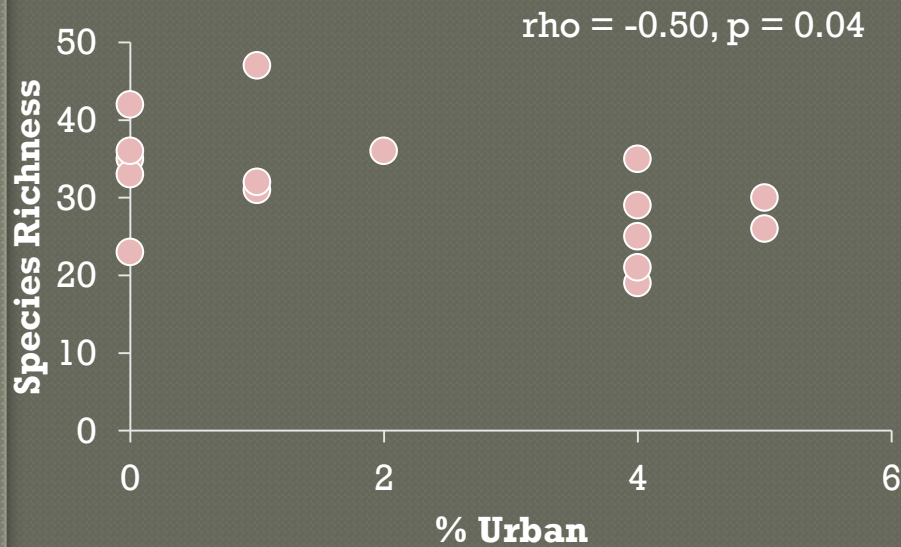
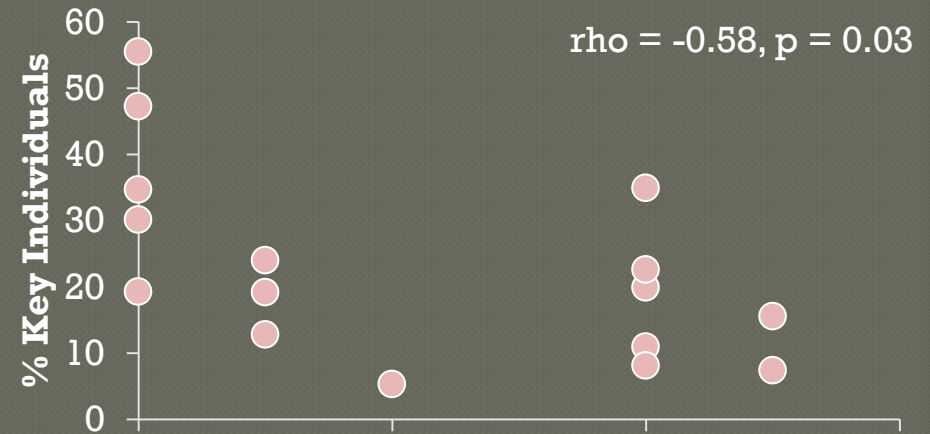
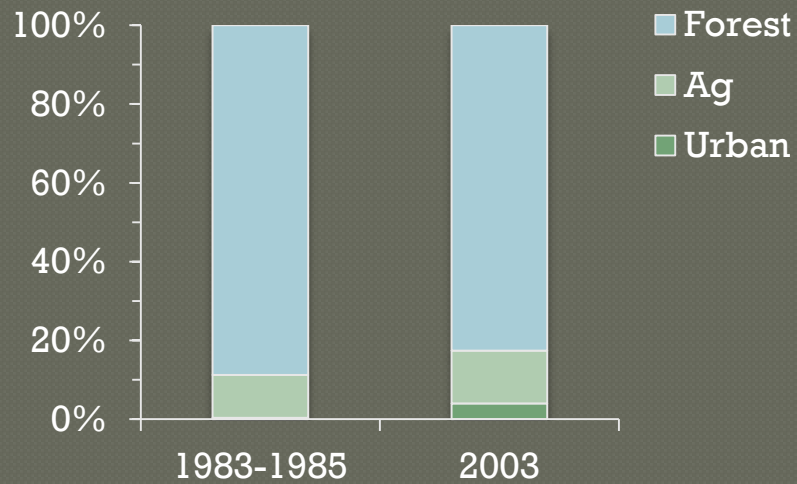
- Ouachita Mountains
- **Gulf Coastal Plains**
 - Big Creek
 - Cypress Creek
 - Derriuseaux Creek
 - East Fork Tulip Creek
 - Freeo Creek
 - Hudgens Creek
 - L'Aigle Creek
 - Moro Creek
- Boston Mountains
- Arkansas River Valley
- Ozark Highlands



Gulf Coastal Plains



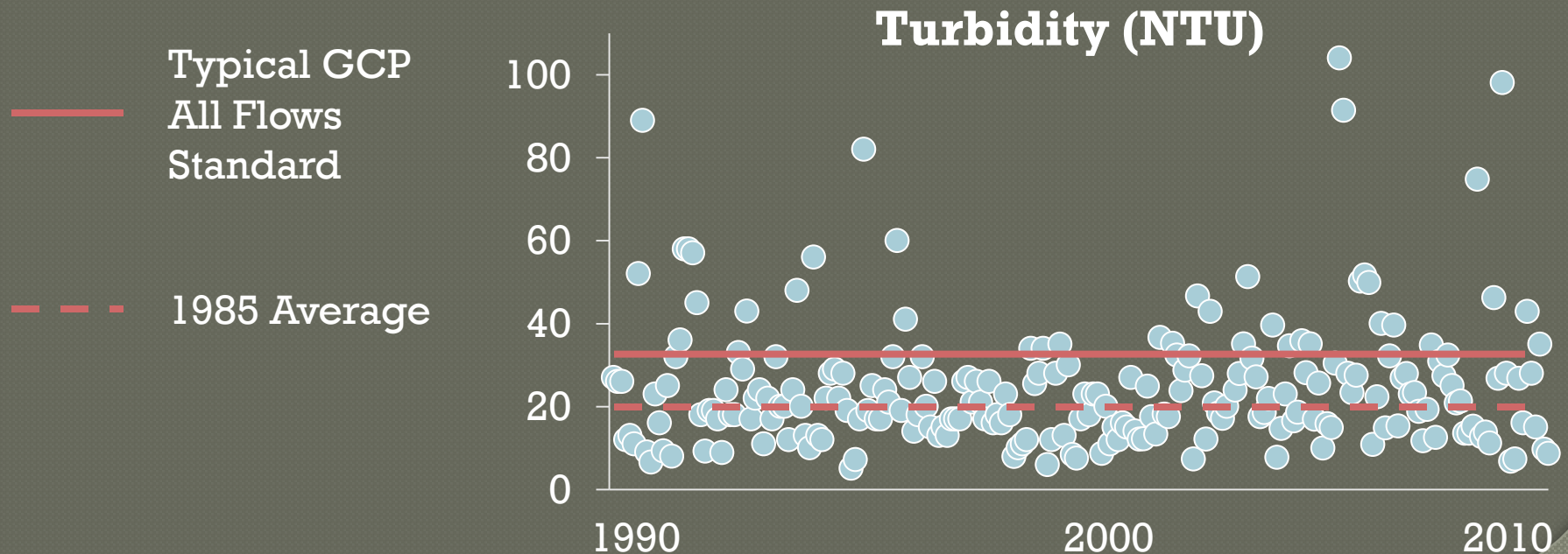
Gulf Coastal Plains



Gulf Coastal Plains

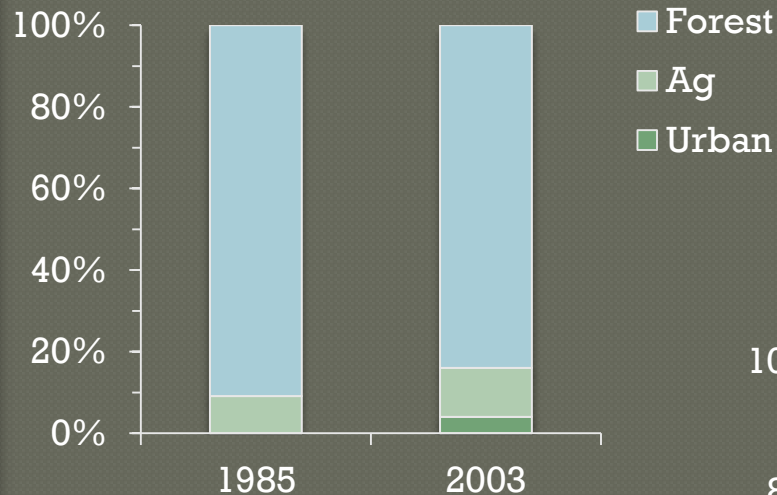
● Impaired - Not Supporting Fisheries Designated Use

- Big Creek
 - Cause: Turbidity - Source: Surface Erosion

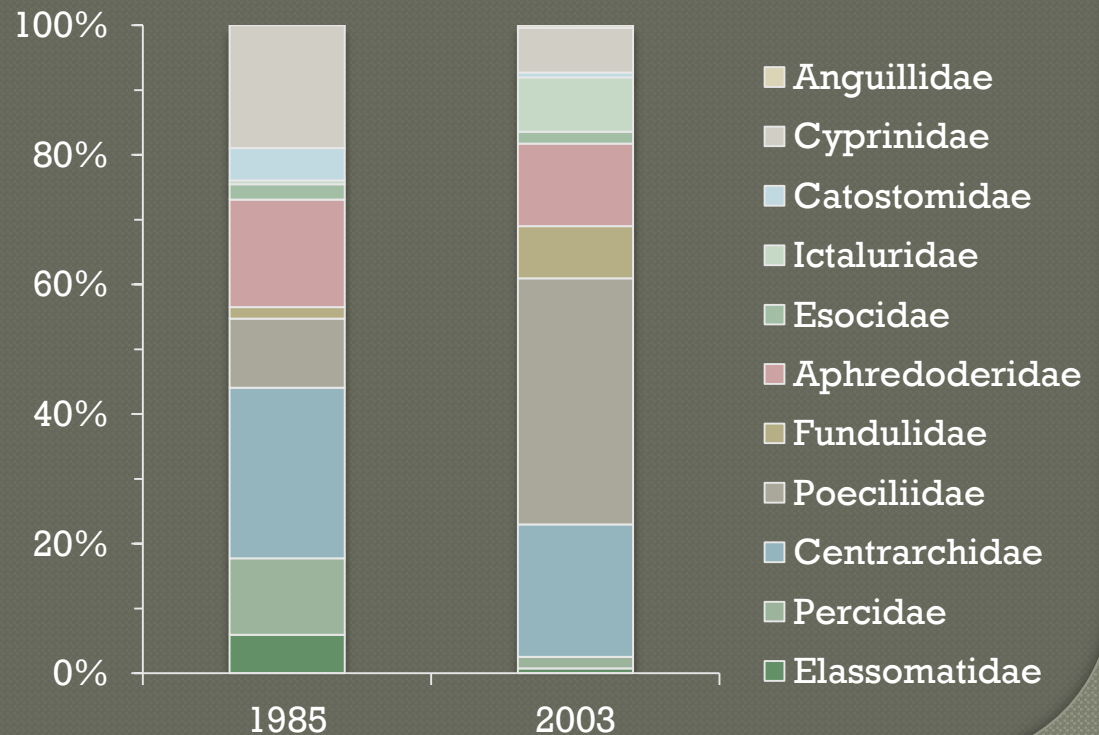


Big Creek

Typical Gulf Coastal Plains

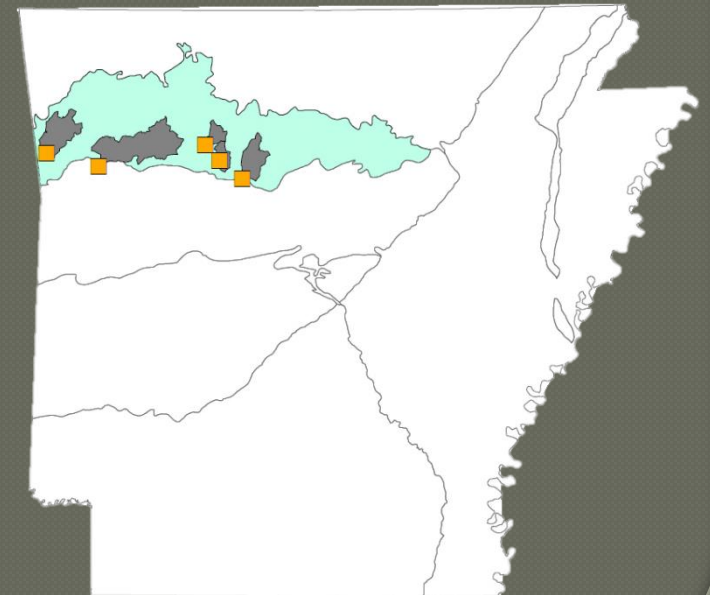


Mostly Similar
↓
Generally Similar

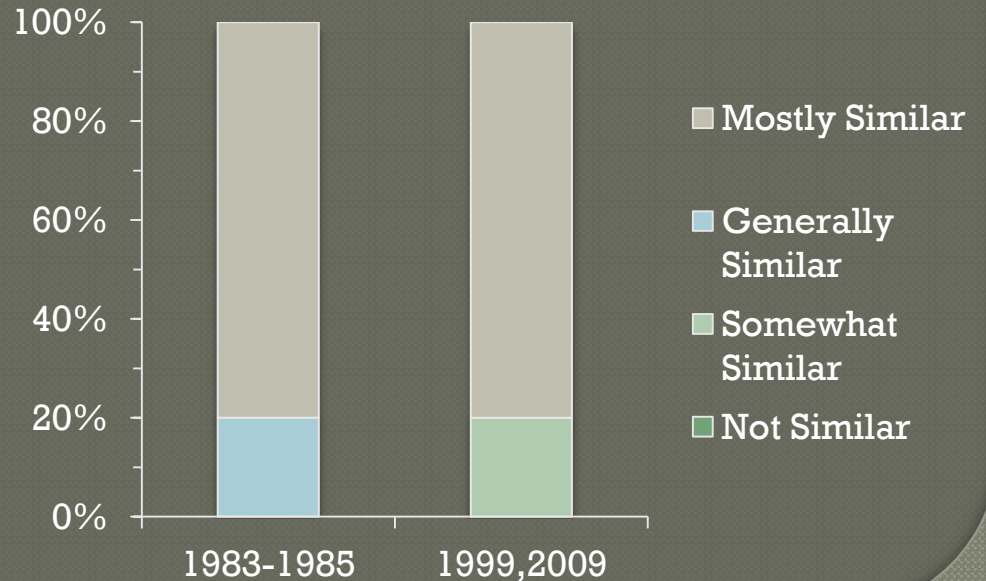
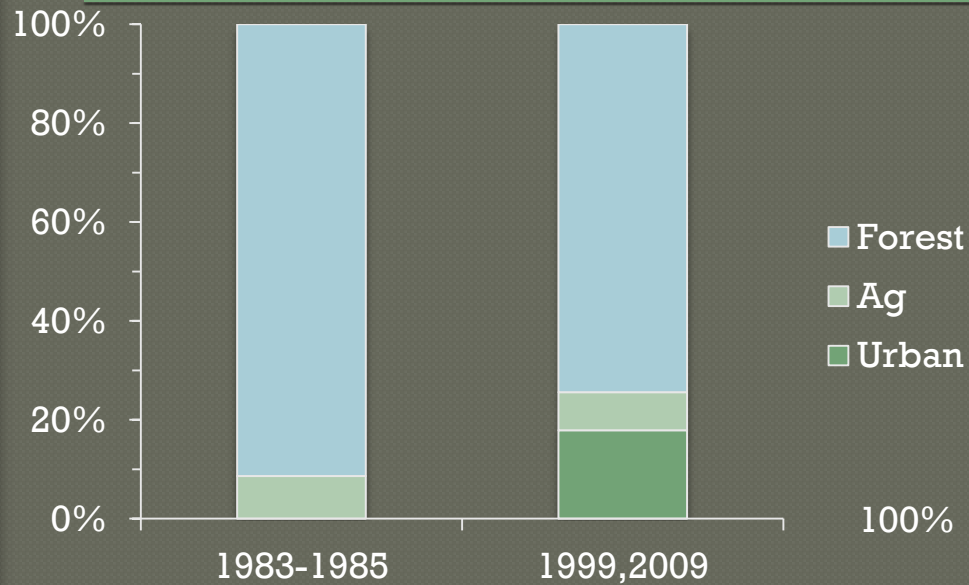


Outline

- Ouachita Mountains
- Gulf Coastal Plains
- **Boston Mountains**
 - Hurricane Creek
 - Illinois Bayou
 - Indian Creek
 - Lee Creek
 - Mulberry River
- Arkansas River Valley
- Ozark Highlands

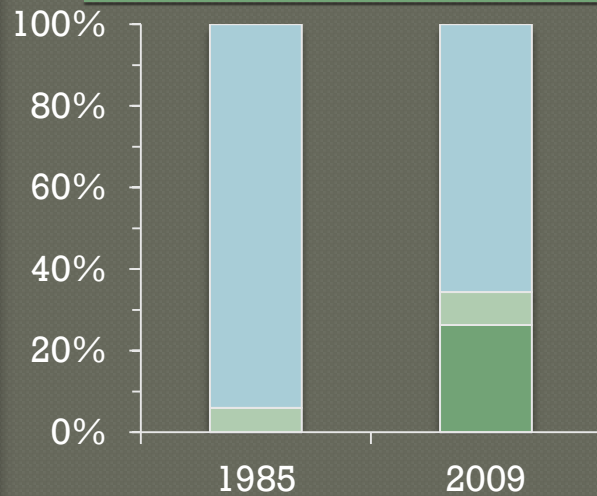


Boston Mountains

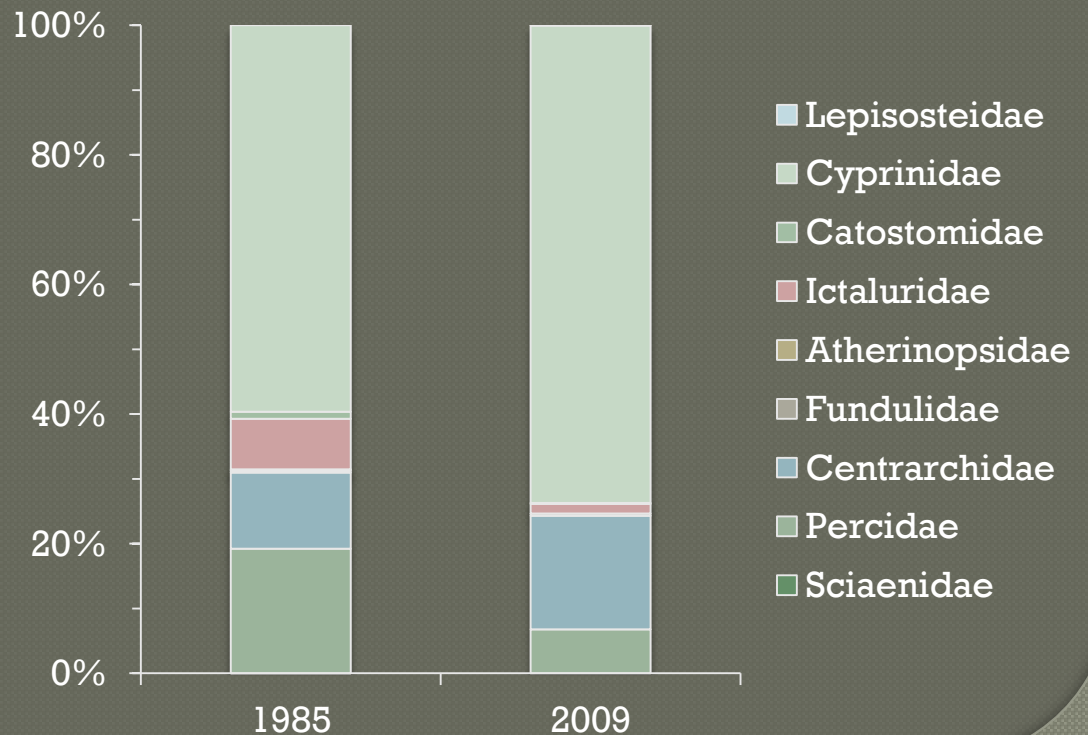


Mulberry River

Boston Mountains

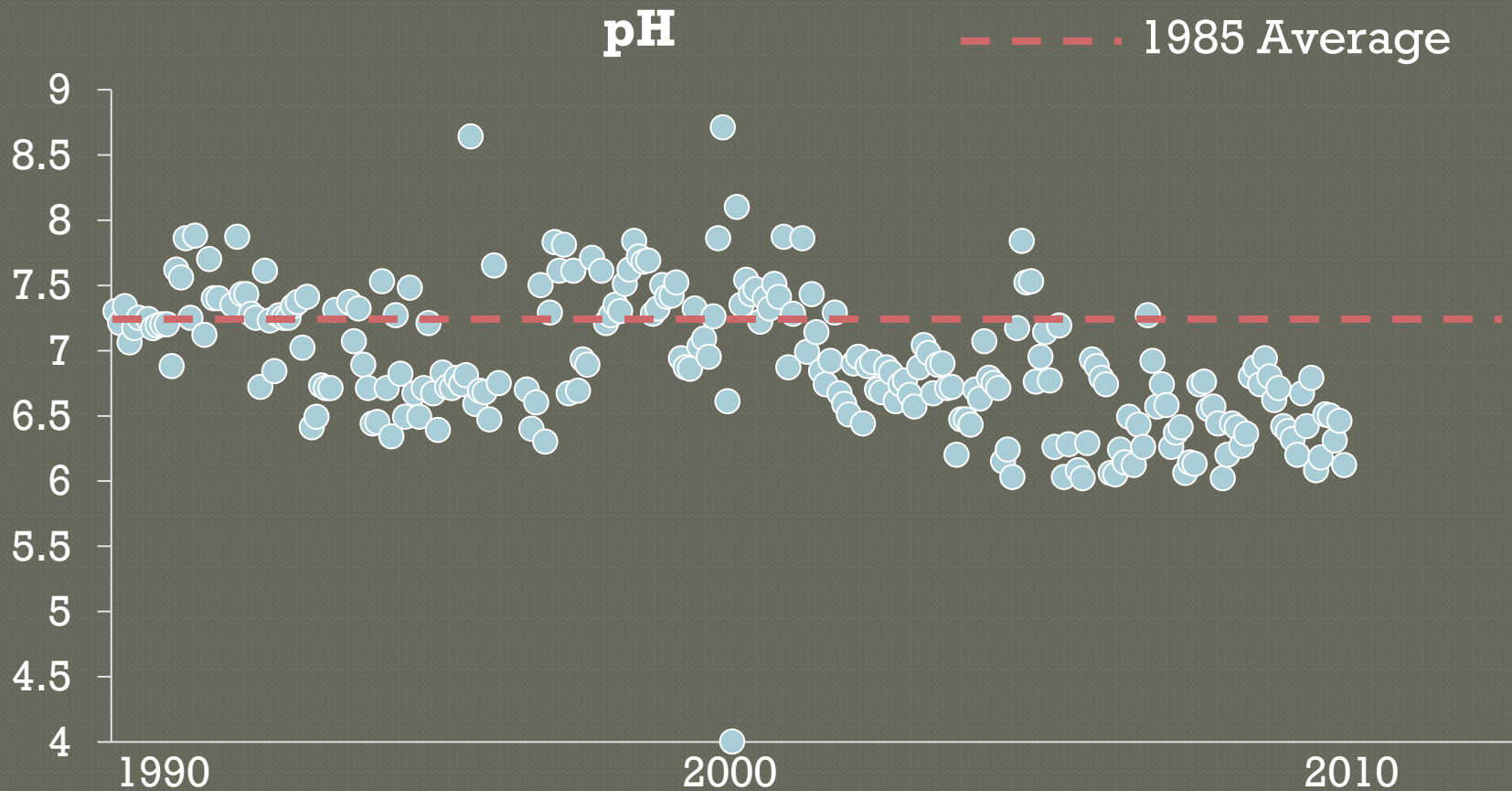


Mostly Similar
↓
Somewhat Similar



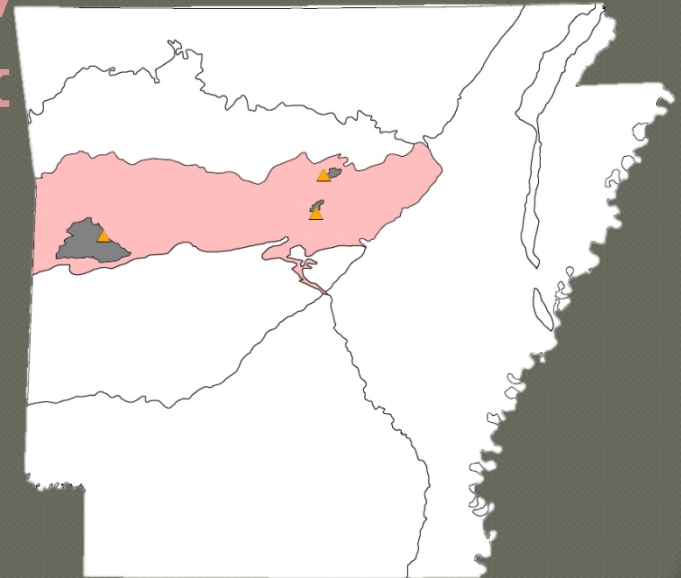
Mulberry River

Boston Mountains

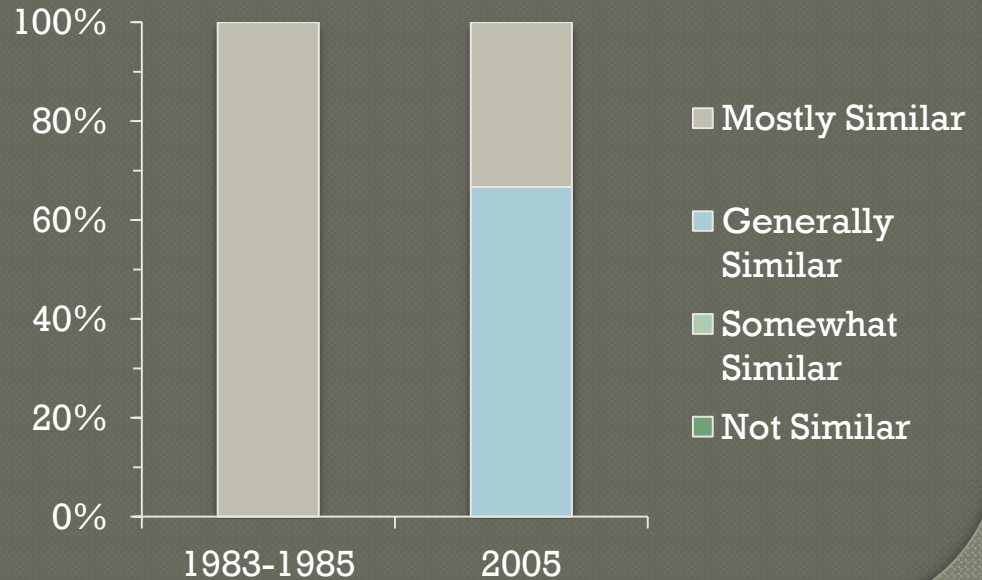
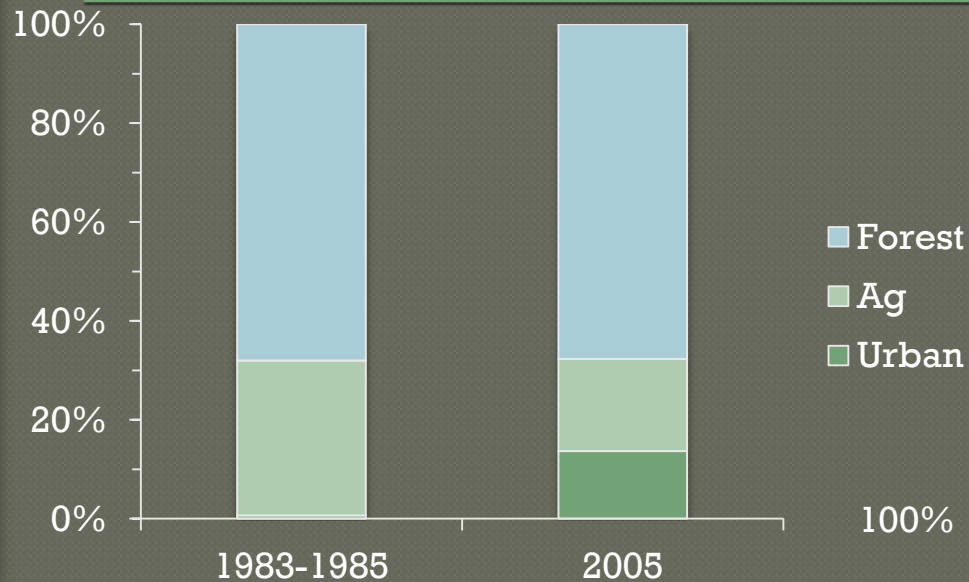


Outline

- Ouachita Mountains
- Gulf Coastal Plains
- Boston Mountains
- **Arkansas River Valley**
 - North Fork Cadron Creek
 - Mill Creek
 - Petit Jean River
- Ozark Highlands



Arkansas River Valley



Arkansas River Valley

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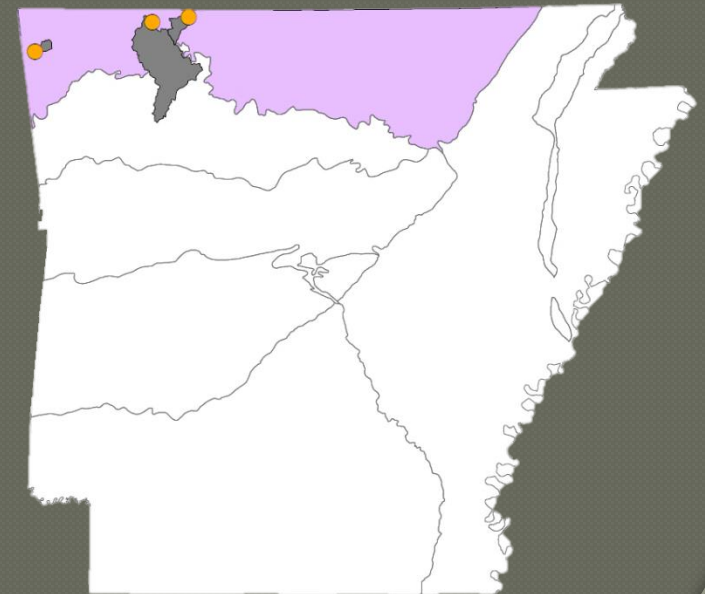
● Impaired - Not Supporting Fisheries Designated Use

- **Petit Jean River**
 - Cause: Turbidity - Source: Sediment Erosion

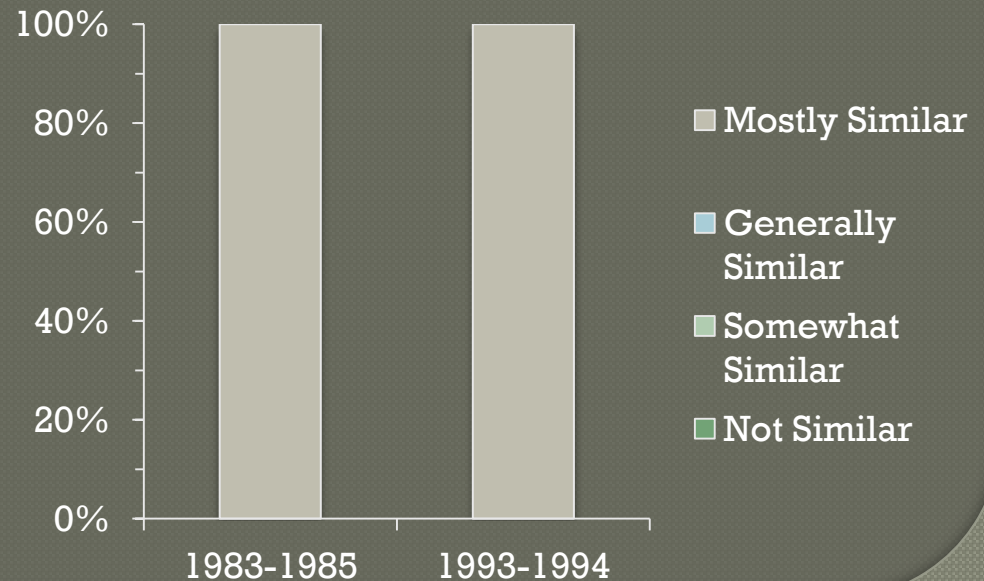
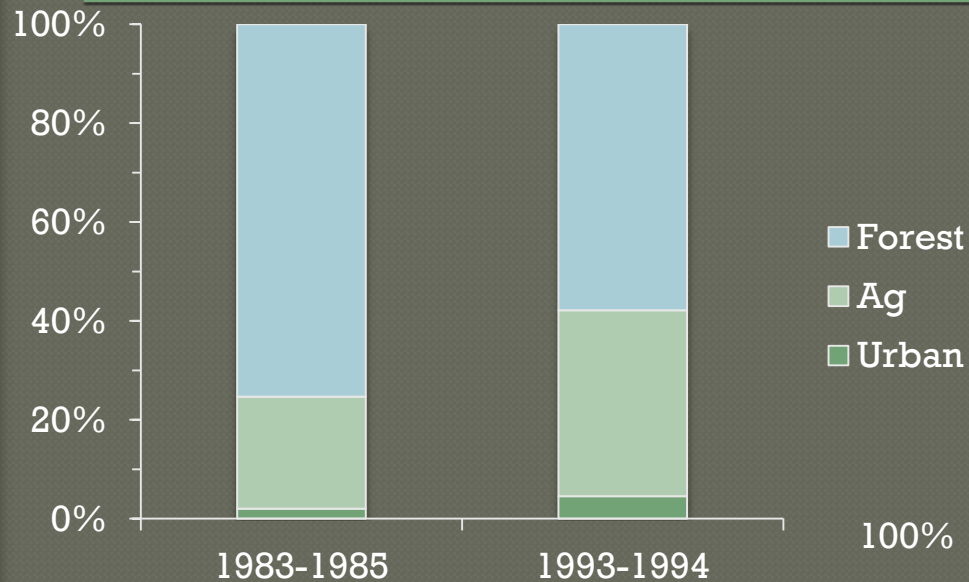


Outline

- ◉ Ouachita Mountains
- ◉ Gulf Coastal Plains
- ◉ Boston Mountains
- ◉ Arkansas River Valley
- ◉ **Ozark Highlands**
 - Flint Creek
 - Kings River
 - Yocum Creek



Ozark Highlands



Ozark Highlands

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● Impaired – Supporting Fisheries Designated Use

- **Kings River**
 - Cause: TDS - Source: Unknown



Future Work

1983-1985: Original Survey (36)



2013: Ozark
Highland

2014: Boston Mountains

2016: Ouachita Mountains
Arkansas River Valley



Conclusions

- Need more data
- Standardize methods
 - 1983-1985: rotenone, mini-fyke nets, electrofishing
 - Present: electrofishing



Questions

