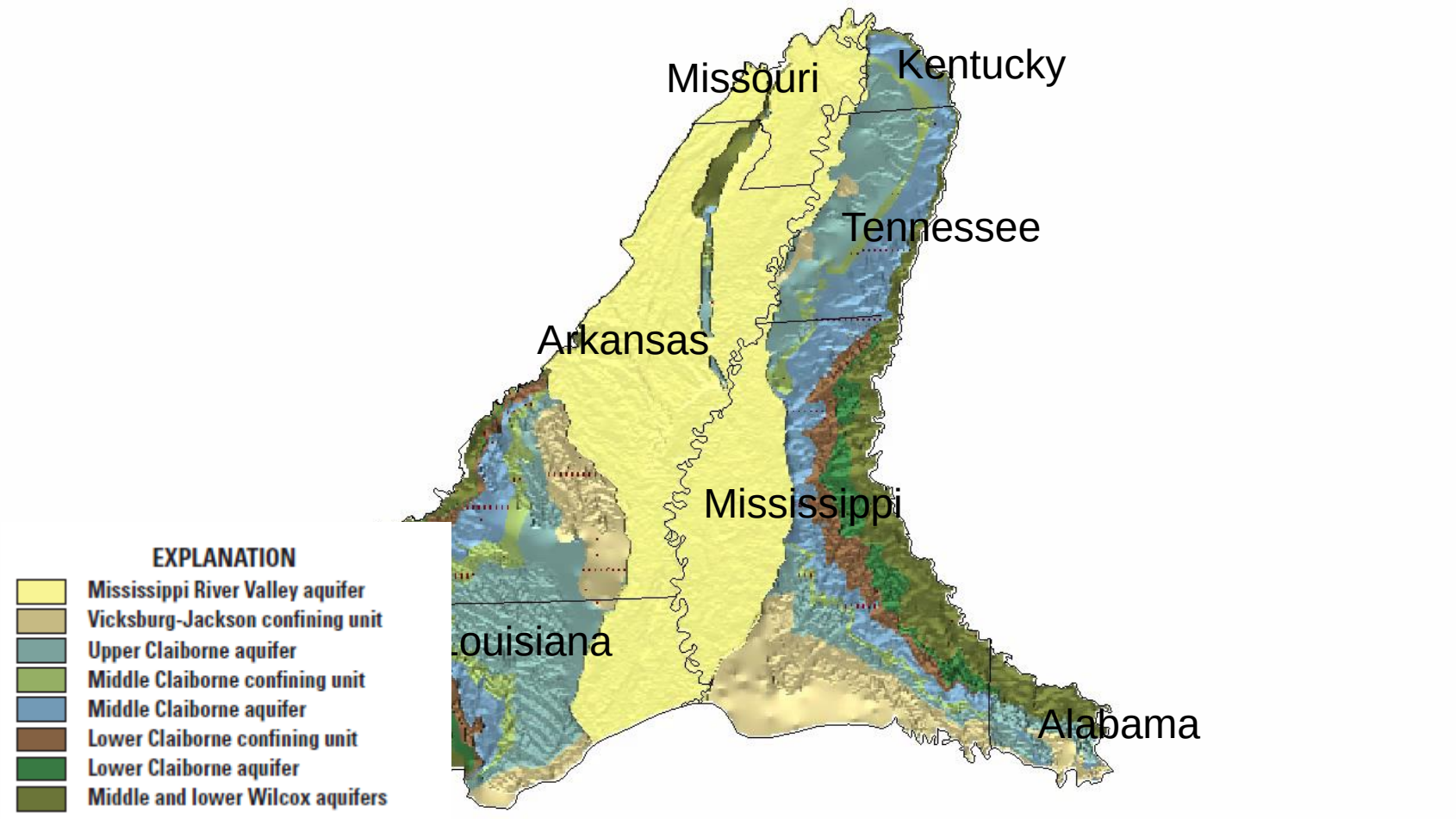
USGS Water Availability and Use Studies in Louisiana

Presented by
John K. Lovelace
US Geological Survey
Dec. 8, 2016

Photo by Shane Stocks,
U.S. Geological Survey

Mississippi Alluvial Plain (MAP)



Background

- The heavy use of the available groundwater resources, primarily for agriculture, has resulted in significant groundwater-level declines and reductions in base flow in streams within the Mississippi alluvial plain, particularly in Arkansas and Mississippi.
- Water managers, planners, and stakeholders lack a basic resource description and analytical tools necessary for effective decision making at a regional scale.

Goals

The overall goals of this study are to assess groundwater availability in the MRVA and develop a decision support framework for management decisions.

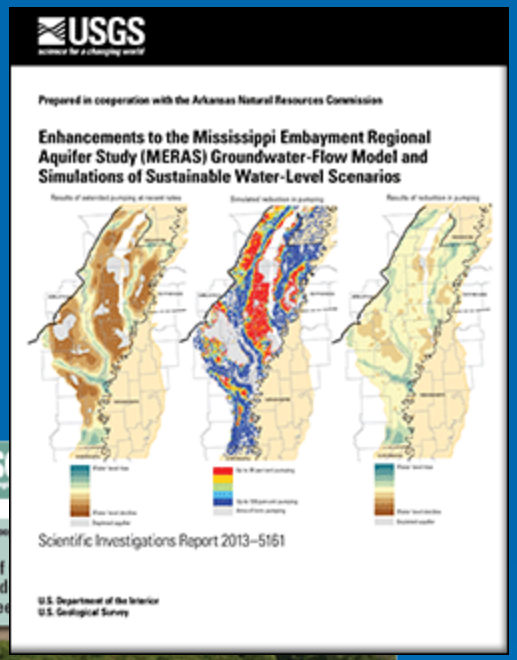
Specific Objectives

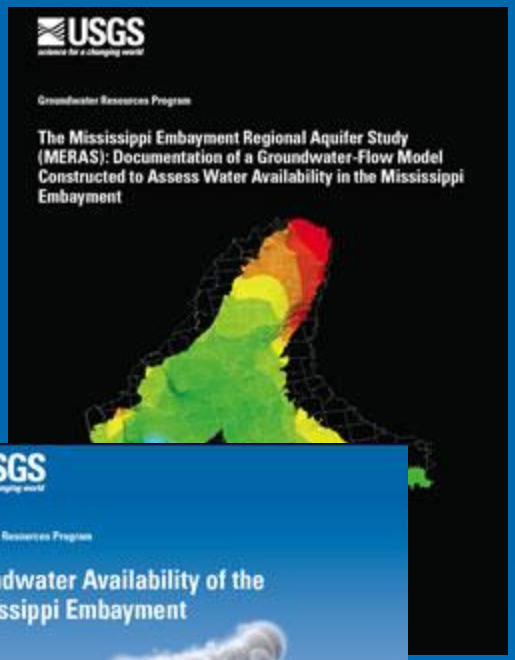
1. Gain system knowledge
   - Establish and enact enhanced groundwater and surface-water monitoring and data plan
   - Update water use estimates and evaluate methods to predict water use
   - Increase the resolution of the simulated surface water system
   - Utilize multiple methods to better estimate recharge
   - Improve understanding of the geohydrologic framework

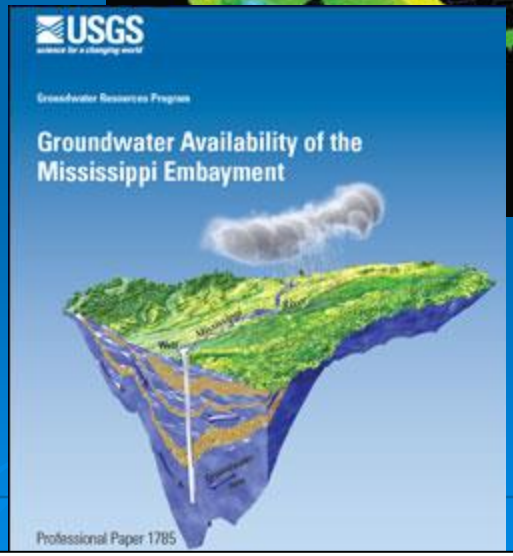
Specific Objectives

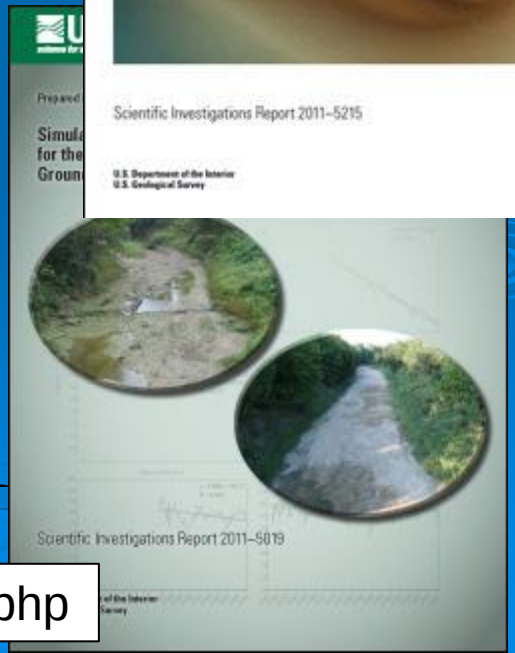
2. System evaluation
   - Determine data uncertainty/data worth
   - Identify potential future scenarios
3. Decision support framework for enhanced management and engineering solutions
   - User defined scenarios
   - Provide anticipated system changes (head and flows)

Mississippi Embayment Regional Aquifer Study (MERAS)



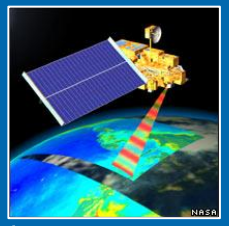


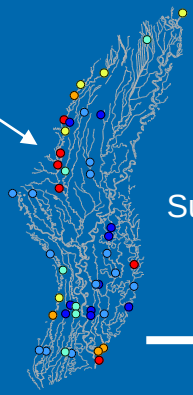




http://ar.water.usgs.gov/meras/page6.php

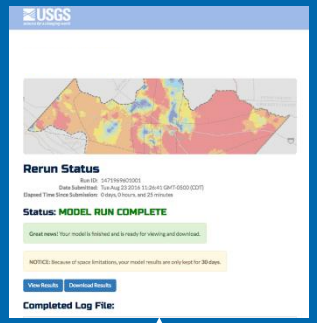
SW Monitoring



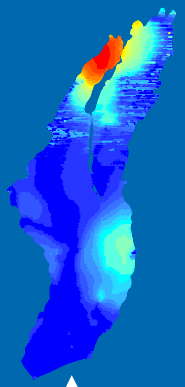


Surface water Model

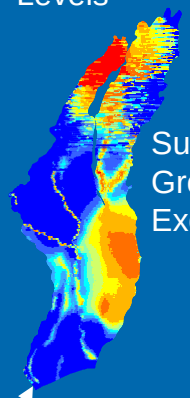
Web-based Decision Support System



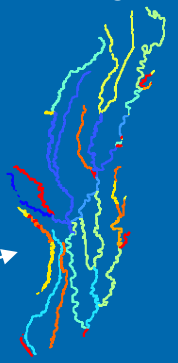
Water Availability Model



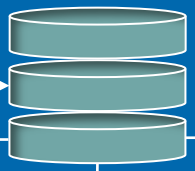
Groundwater Levels

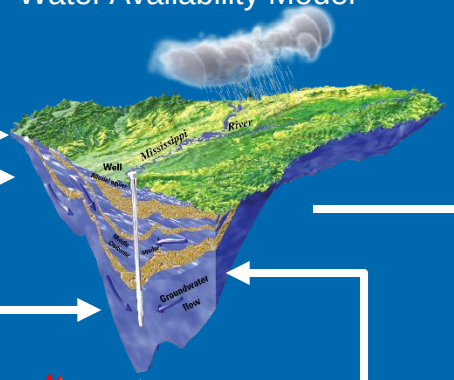


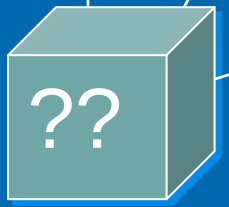
Surface-Groundwater Exchange



Water Balance Model

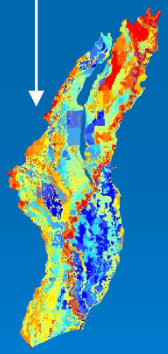


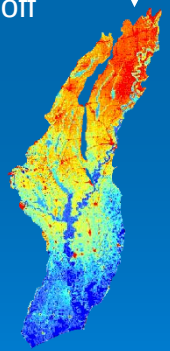




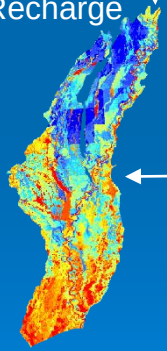
Uncertainty Data Worth

Runoff

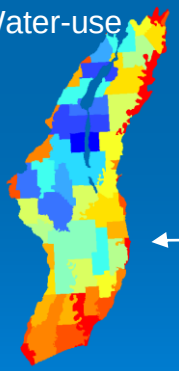


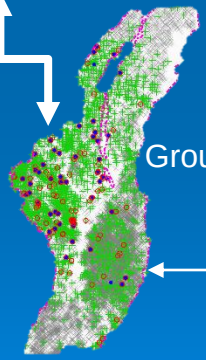


Recharge

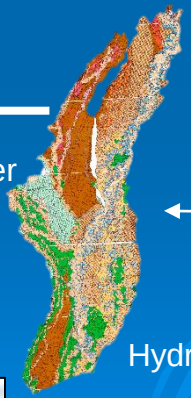


Water-use





Groundwater



Hydrogeology

Geophysics

Evapo-transpiration

USGS

USGS MAP Science Team

Water Budget

- Meredith Reitz, VA
- Rodney Knight, TN
- David Ladd, TN
- Virginia McGuire, NE
- Ronald Seanor, LA

Statistical Analysis

- William Asquith, TX
- Jeremy White, TX
- Burke Minsley, CO

Modeling

- Brian Clark, AR
- Steve Peterson, NE
- Paul Barlow, MA
- Amanda Flynn, NE
- Andrew Leaf, WI
- Jeannie Barlow, MS

USGS MAP Science Team

Hydrogeologic Framework

- Drew Westerman, AR
- John Lane, CT
- Courtney Killian, MS
- Samantha Wacaster, AR
- Ben Miller, TN
- Shane Stocks, MS
- Sam Wallace, TX

Geophysics

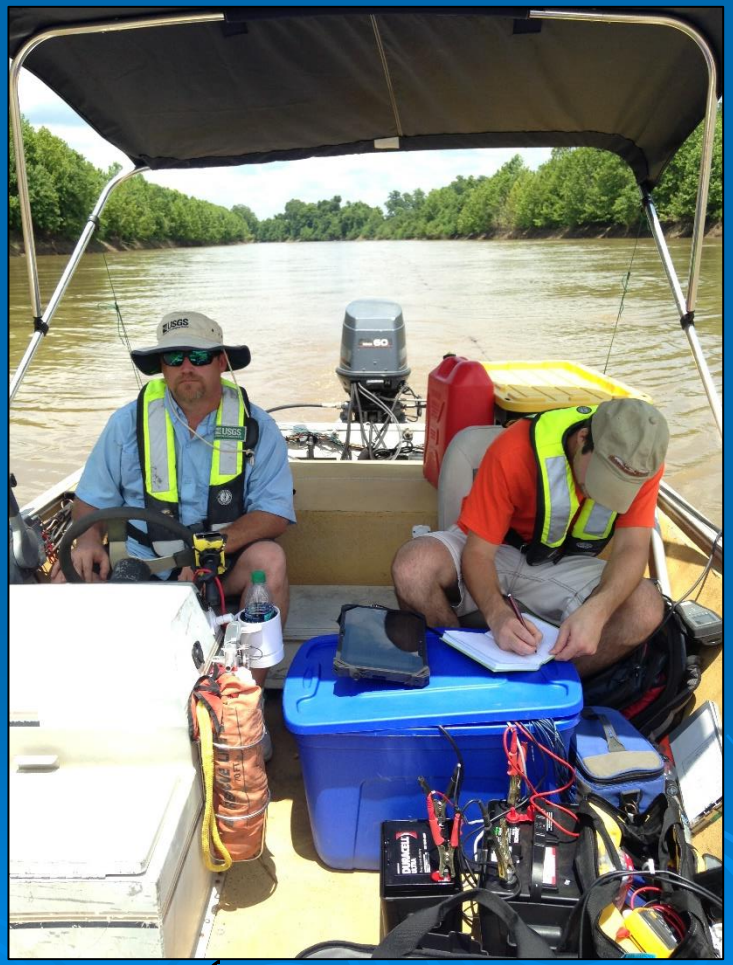
- Bruce Smith, CO
- Scott Ikard, TX
- Carole Johnson, CT
- Eric White, CT

Geophysical Mapping

- River surveys
- Alluvial aquifer system
  - Extent and thickness
  - Resolve vertical and spatial variability
  - One or many layers?
  - Aquifer properties
- Airborne survey

Geophysical Surveys

- Shallow (~30 ft)
  - Land – 47 mi
    - Tallahatchie
    - East – west profile
    - Oxbow
  - **River – 111 mi**
    - Tallahatchie – 37 mi
    - Quiver – 31 mi
    - Sunflower – 43 mi



Miller, Stocks, and Wallace

Geophysical Surveys

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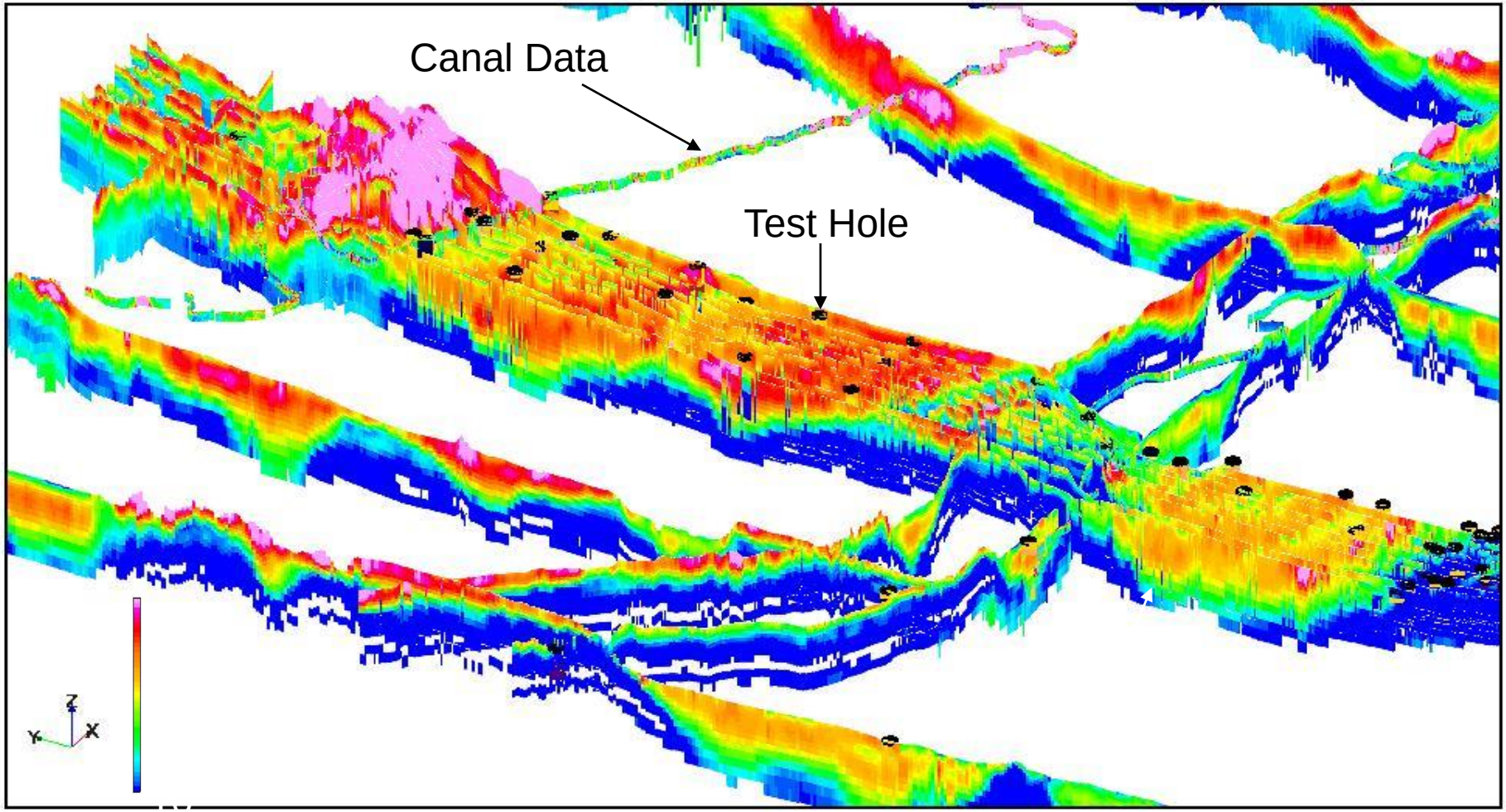
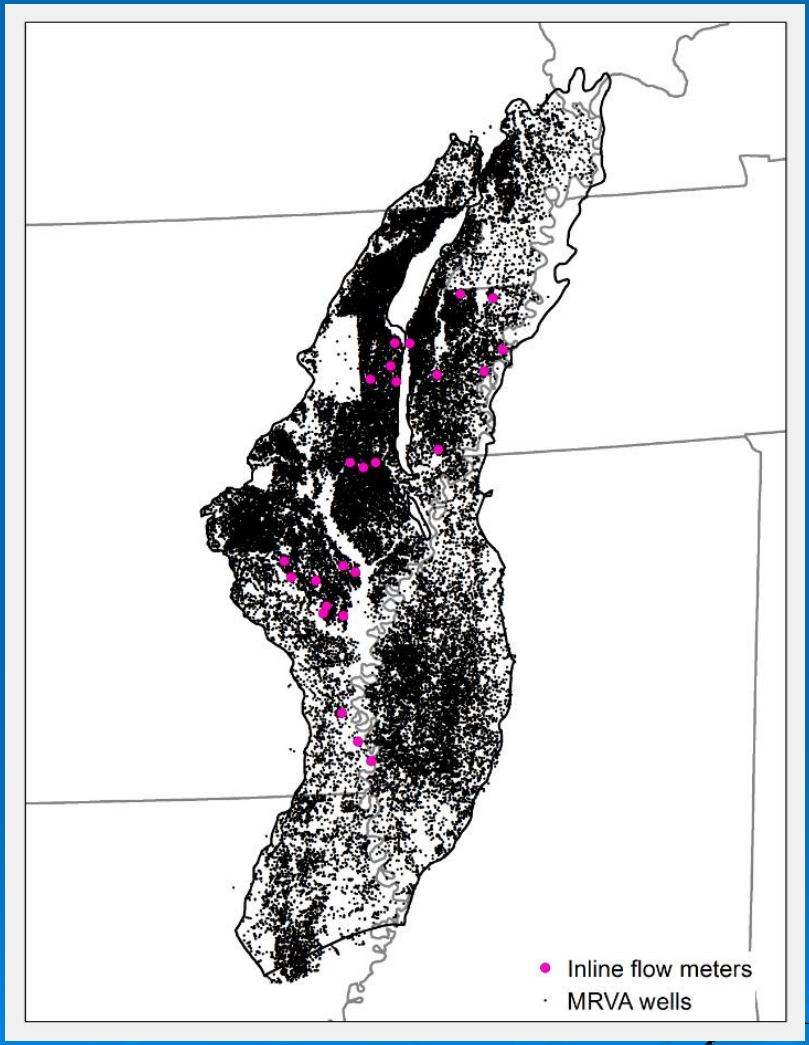
Miller and Payne

Geophysical Results



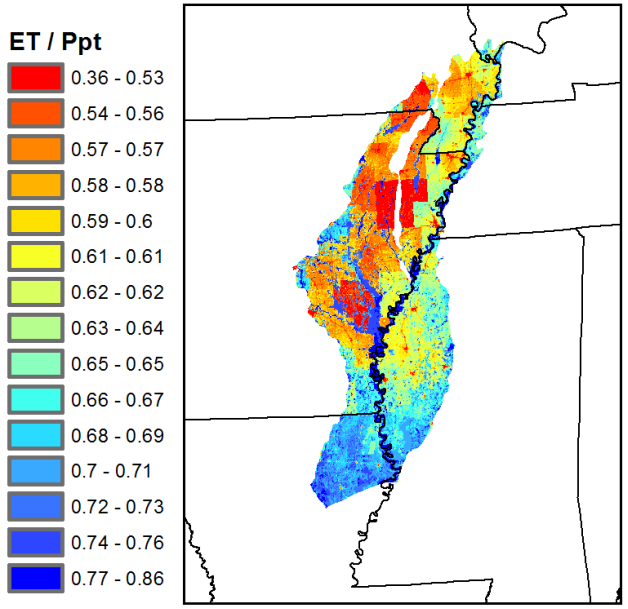
Water Use



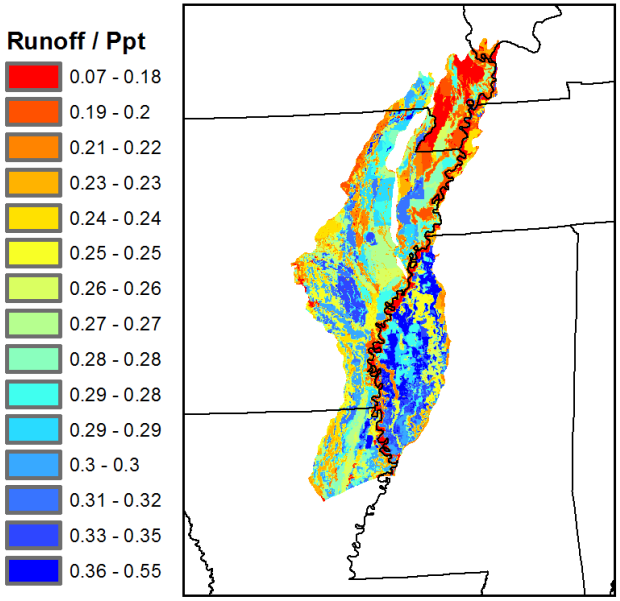
Westerman and other

2000-2013 annual average MAP water budget estimates (preliminary)

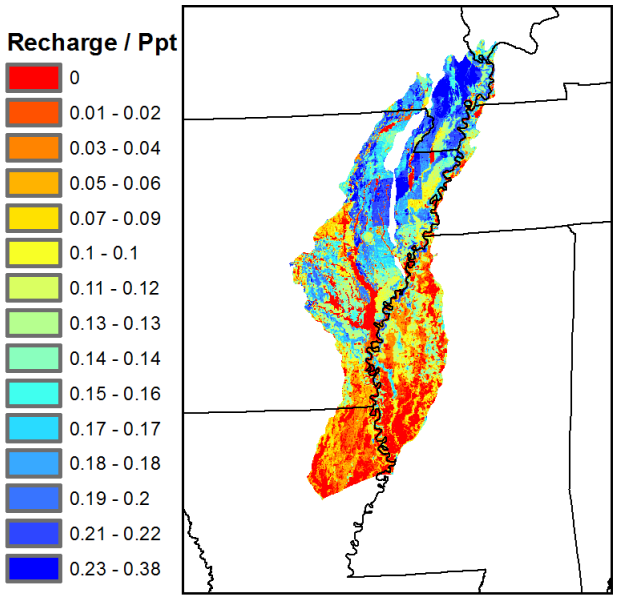
ET: 64%



Runoff: 26%



Recharge: 10%

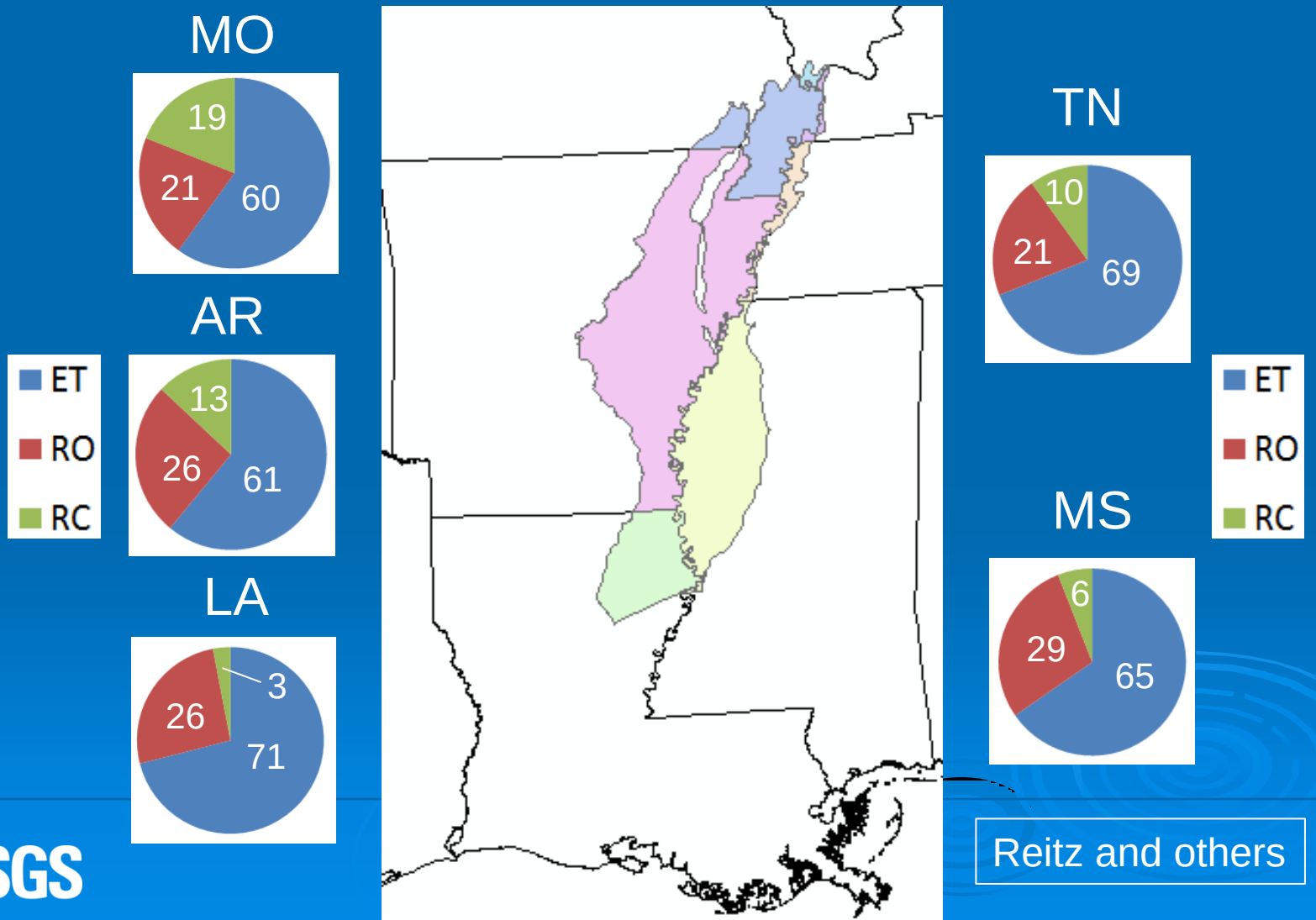


ET: evapotranspiration, RO: surface runoff, RC: recharge

ET + RO + RC = Ppt + Irr

Reitz and others

Annual water budgets by state (preliminary)

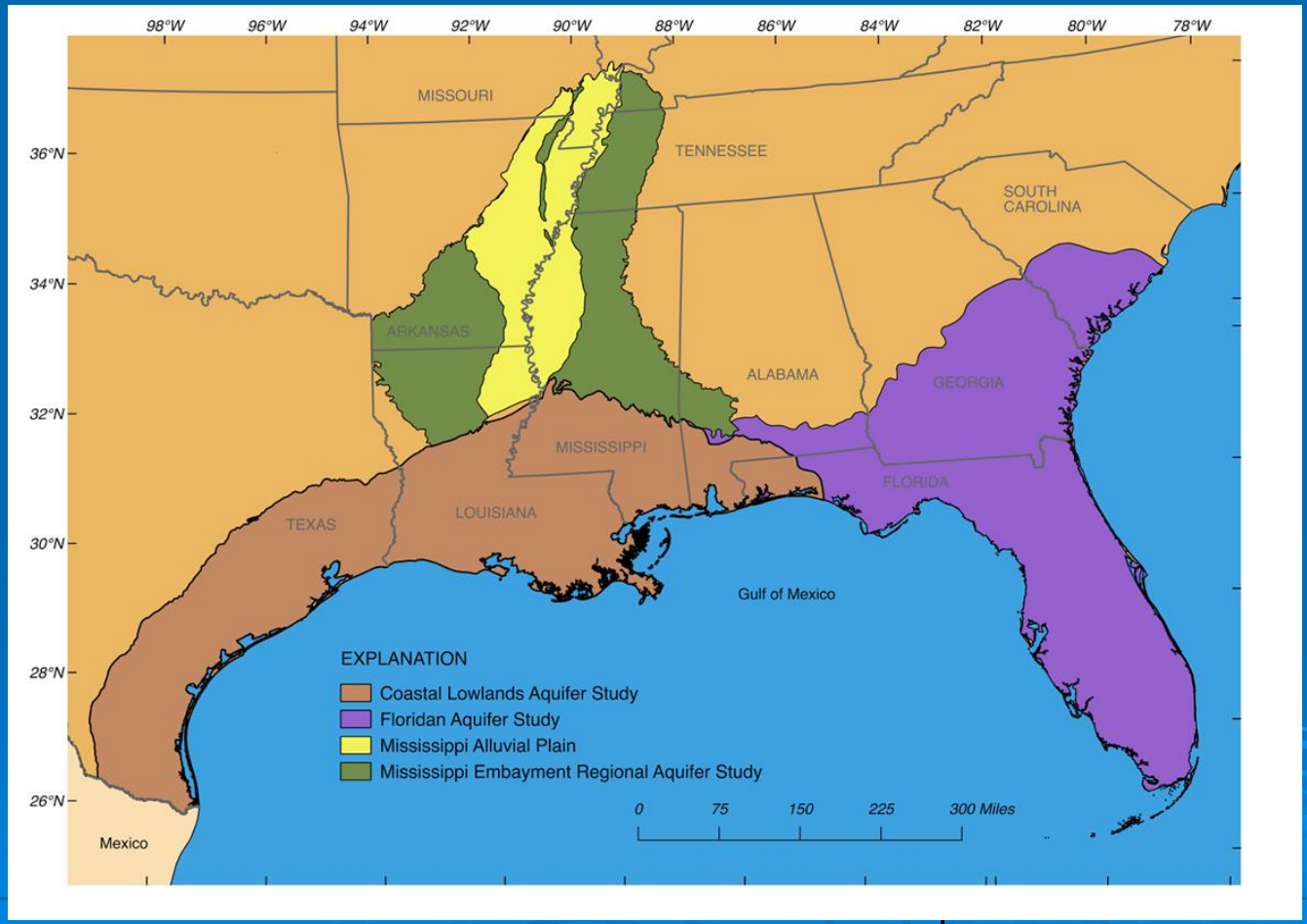


Reitz and others

For more information,
visit the MAP website at
http://wise.er.usgs.gov/map/
or contact
Wade H. Kress
awkress@usgs.gov

Photo by Shane Stocks,
U.S. Geological Survey

Coastal Lowlands Aquifer System (CLAS) Study

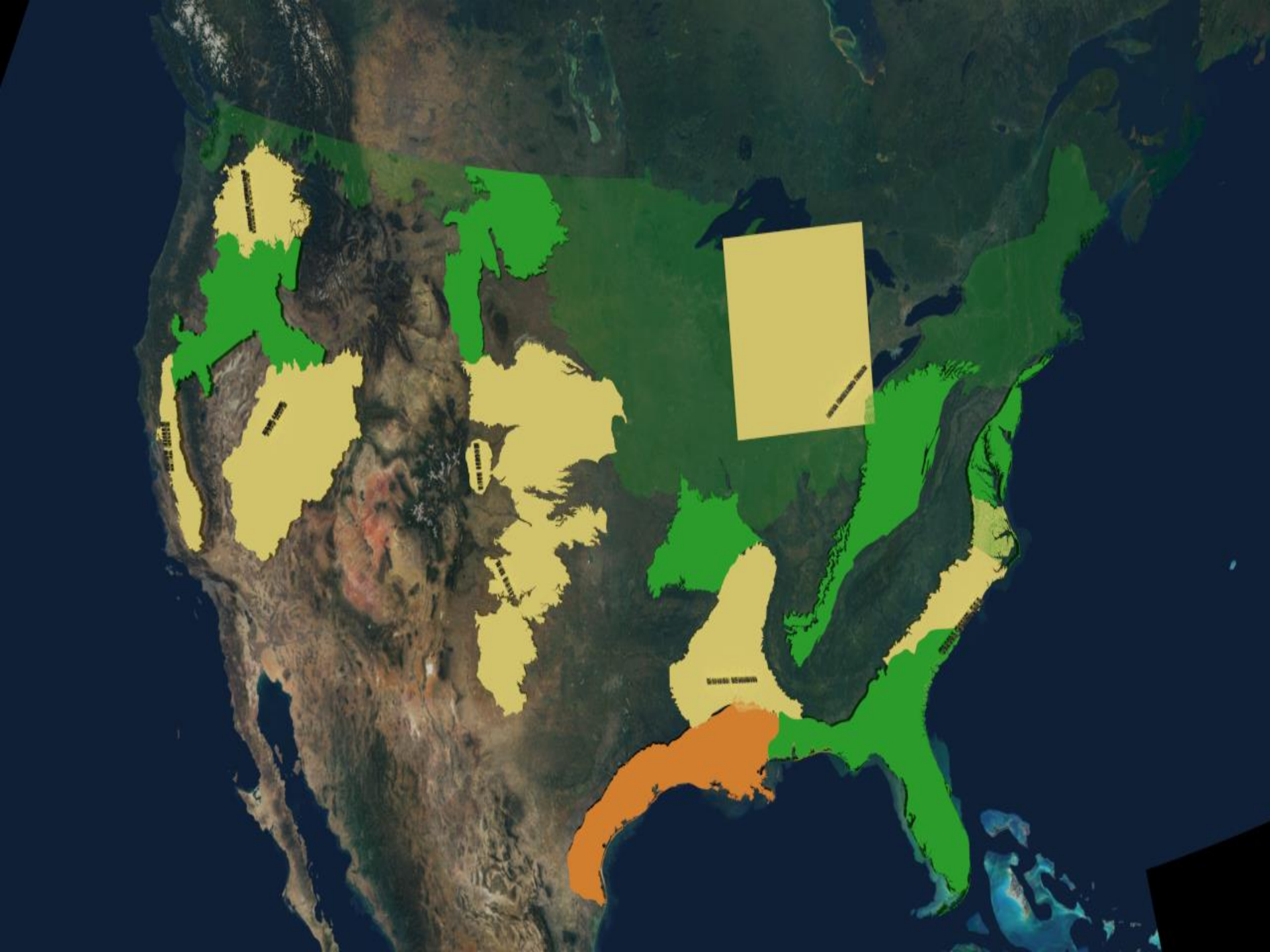


Statement of Need

The depletion of groundwater at a variety of scales and the compounding effects of recent droughts have emphasized the need for an updated status on the availability of the Nation's groundwater resources. In addition, assessment of how those resources have changed over time and development of tools to forecast regional response to human and environmental stressors will assist us in answering basic questions about the Nation's ability to meet current and future demands for groundwater.

Objectives

- Document the effects of human activities on water levels, groundwater storage, and discharge to streams and other surface-water bodies;
- Explore climate variability impacts on the regional water budget; and
- Evaluate the adequacy of data networks to assess impacts at a regional scale.



Approach

- Rigorous analysis of the water budget (current and past groundwater use, storage, recharge, and discharge)
- Construct groundwater model
- Estimate primary aquifer properties
- Simulate predictions
- Evaluate existing regional groundwater monitoring network

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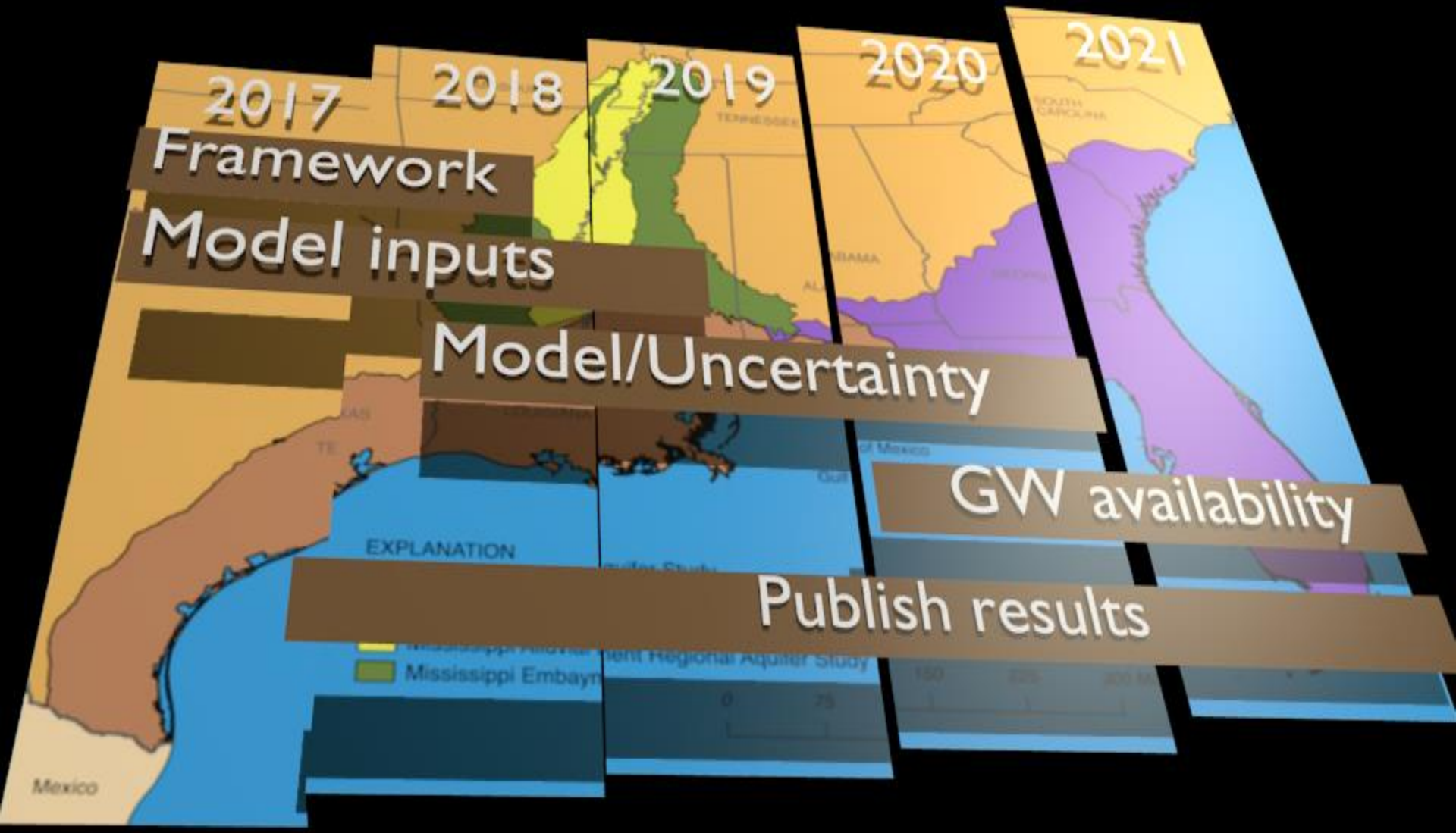
2017
2018
2019
2020
2021
Framework
Model inputs
Model/Uncertainty
GW availability
Publish results
EXPLANATION
Mexico

Timeline

For more information, contact:

Linzy Foster (lfoster @usgs.gov)
Brian Clark (bclark@usgs.gov)

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Red River Focus Area Study

U.S. Department of the Interior
U.S. Geological Survey

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Project Background

The SECURE Water Act (2007) established the WaterSMART program to Sustain and Manage America's Resources for Tomorrow. From this the USGS created the National Water Census with a goal of developing new water accounting tools and assessing water availability at the regional and national scales

WaterSMART

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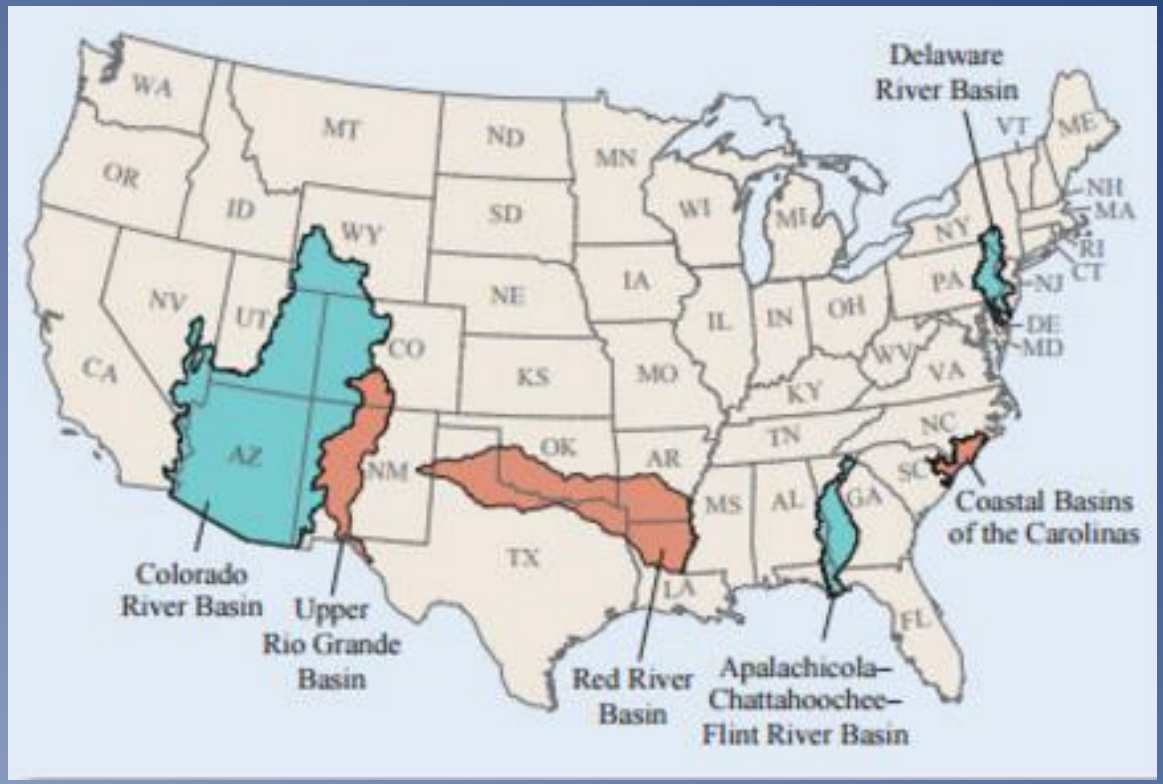
Focus-area studies to date



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Typical Study Area Issues

- Increasing Water Demands
- Interstate Water Conflicts
- Disruption of Aquatic Ecosystems
- Drought
- Flooding
- Groundwater declines
- Streamflow alteration

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Study Goals

- Focus on Water Availability
- Answer the Questions:
  - Is there adequate quantity of water, with sufficient quality and timing-characteristics, to meet both human and ecological needs?
  - Will this water meet both existing and future needs?

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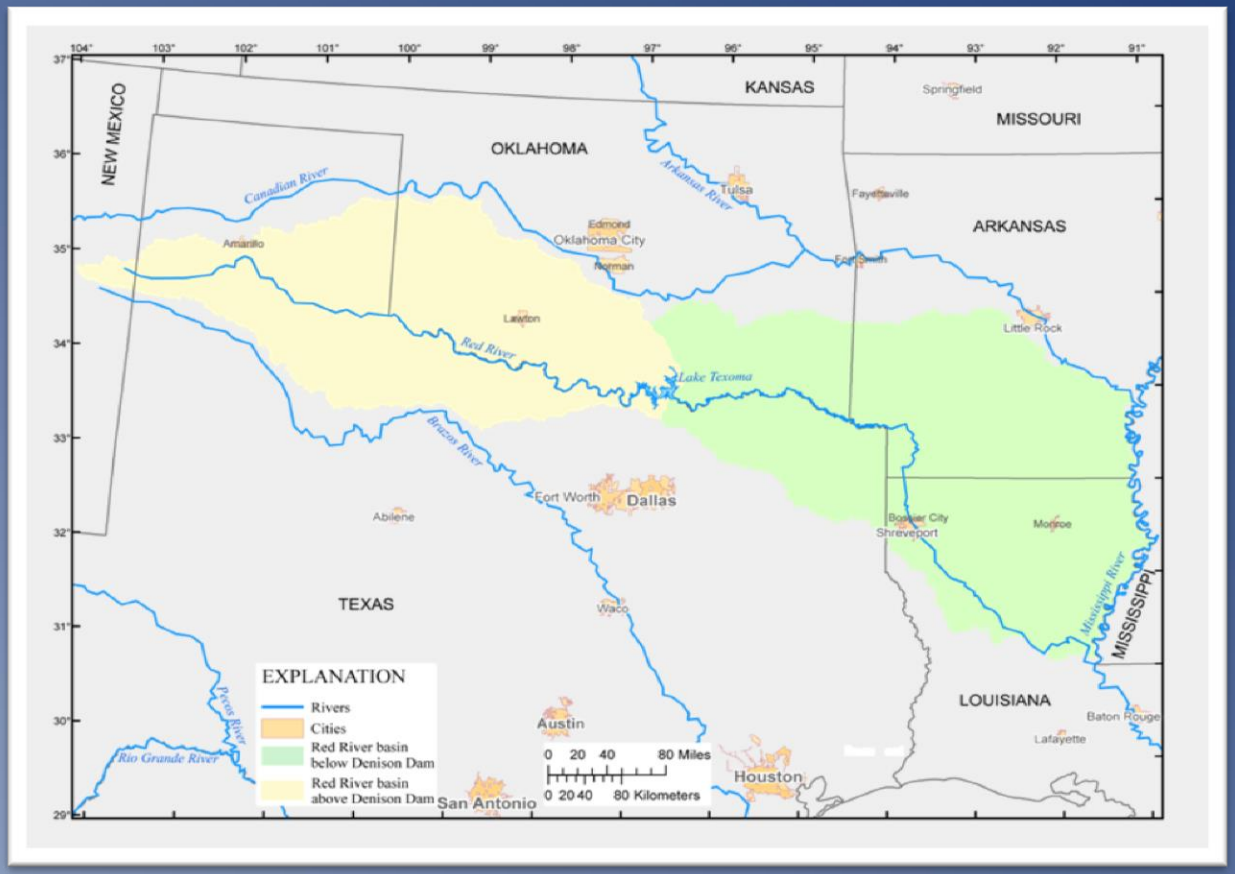
Red River Watershed



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Project Elements

1. Water Use
2. Groundwater Modeling
3. Surface Water Modeling
4. Environmental Flows

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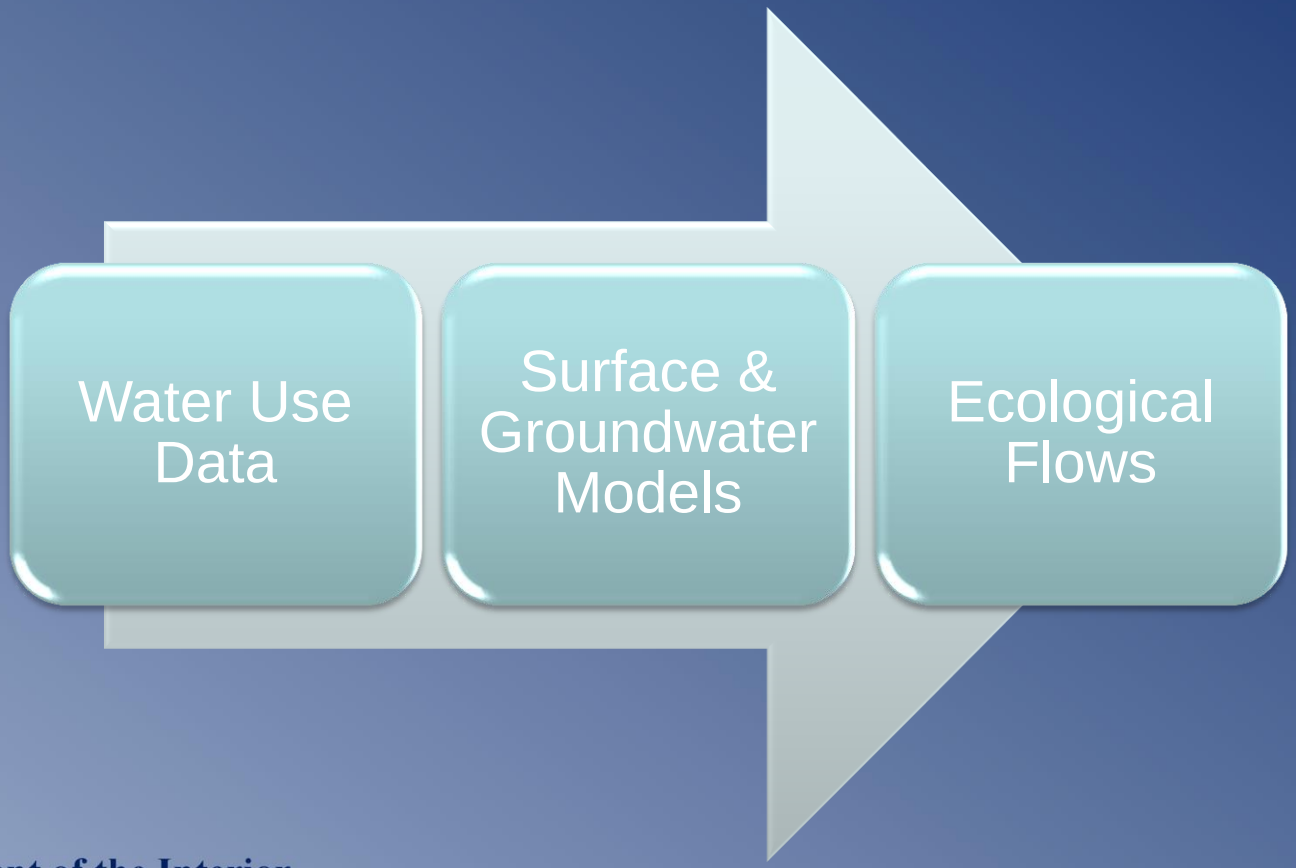
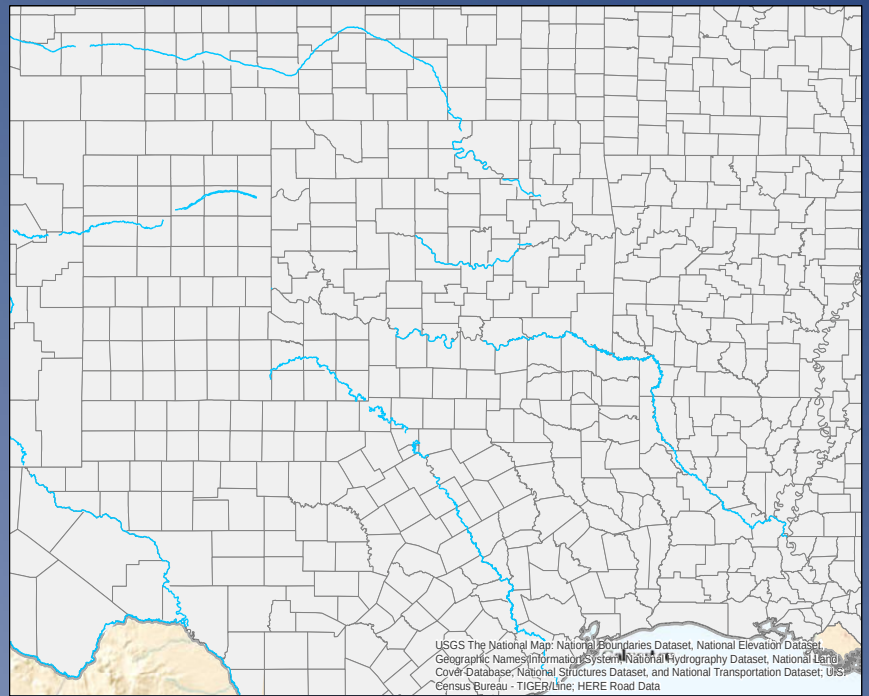
Interconnectivity



Element 1 – Water Use

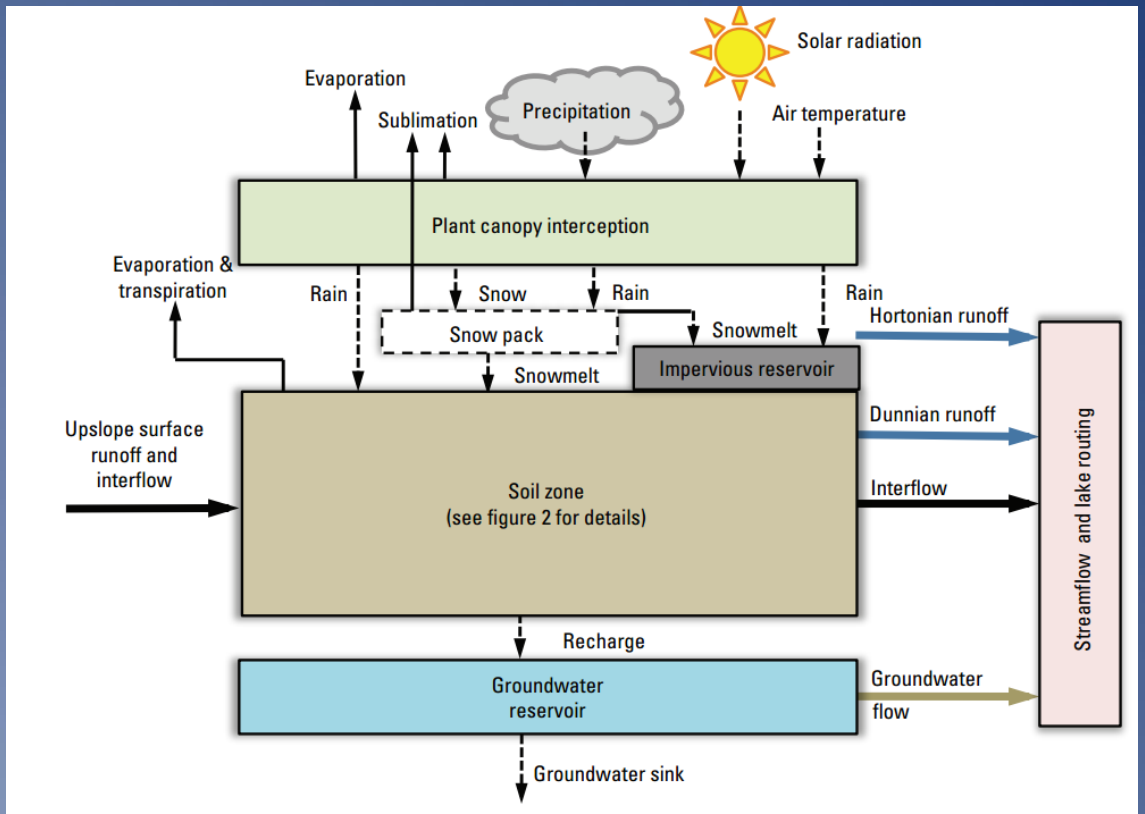
- Refine water use to HUC-8 watersheds
- Enhanced irrigation estimates
- Interbasin transfers
- Consumptive use
- Return flows



Element 1 – Water Use

Support Modeling Effort

- Groundwater
  - 1995 – 2015
  - Seymour
  - RR alluvial
- Surface Water
  - 1980-2015



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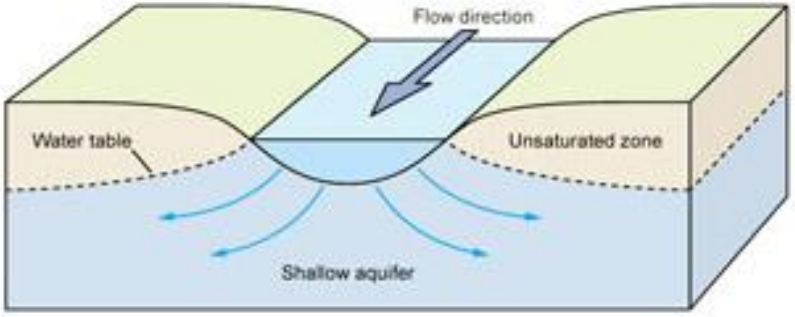
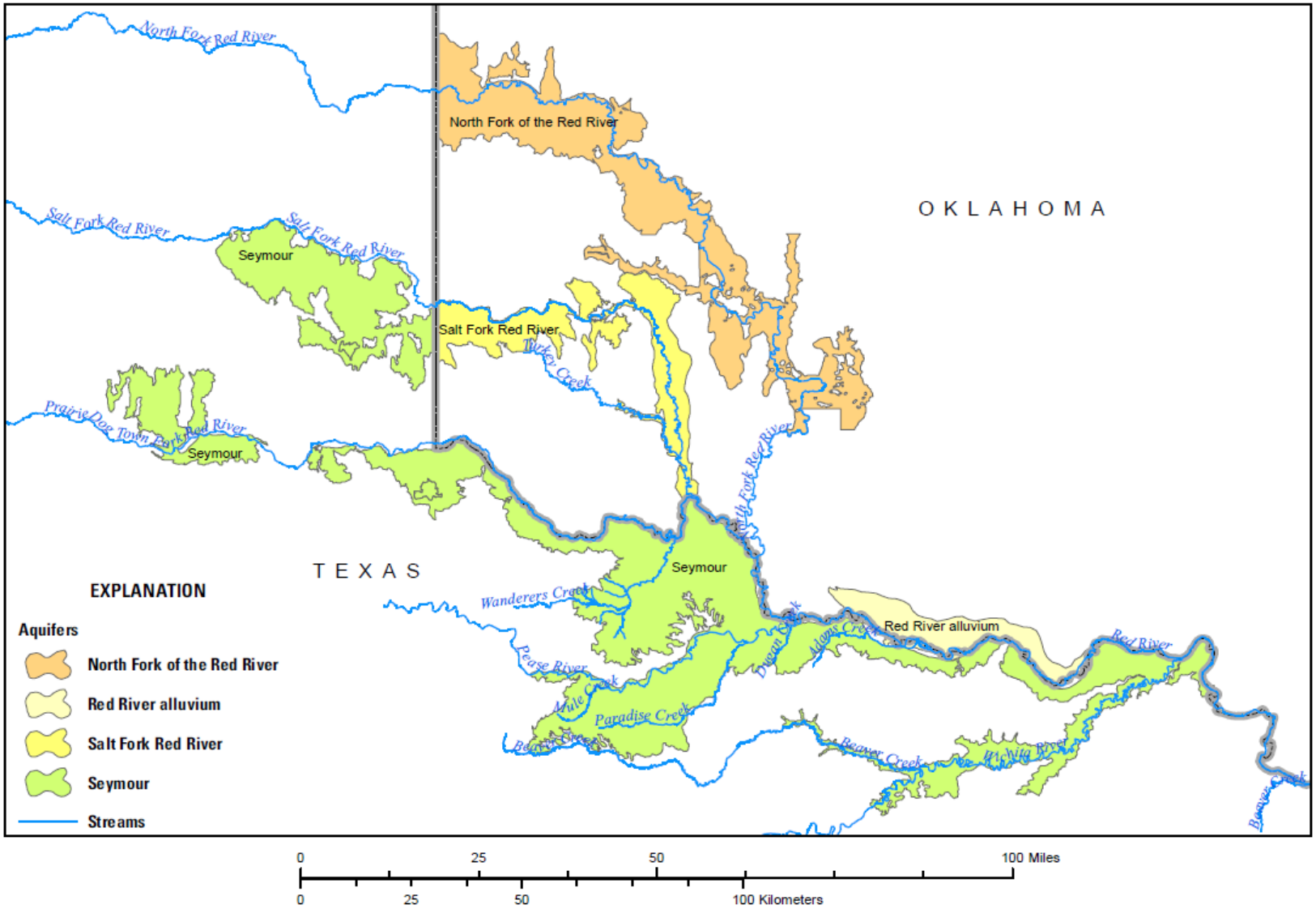
Element 2 – GW Modeling

Develop a model (MODFLOW)

- Upstream of Denison Dam
- Leverage off completed/ongoing studies
- SW/GW interaction
- Simulate possible future scenarios





Notes: Seymour aquifer model has been published and is being included. North Fork Model will be published this FFY and will be included. Parts of Red River alluvium will be included to better model Red River streamflow. Salt Fork is currently being studied and progress of this project will determine whether it gets included.

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Element 3 – Surface Water Modeling

Estimate Daily Streamflows

- Precipitation Runoff Modeling System (PRMS)
- Leverage off completed/ongoing studies
- Predict flows in ungaged area
- Simulate possible future scenarios
- Couple with GW model

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Element 4 – Eco Flows

Changes in Fish Assemblages

- Summarize existing data
- Focus on fish traits
- Abundance calculated on PRMS grid

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For more information, contact

Kristine Blickenstaff
kblickenstaff@usgs.gov
Jennifer Wilson
jenwilso@usgs.gov

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QUESTIONS?

John Lovelace
jlovelac@usgs.gov