



USGS Upper Rio Grande Basin Focus Area Study and Climate Scenarios for the Basin Study

Rio Grande New Mexico Basin Study Launch Meeting
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USGS Upper Rio Grande Basin Focus Area Study

Mike Johnson (NM, Lead, msjohnson@usgs.gov). 22+ USGS Scientists in 4 Water Science Centers (NM, TX, CO, UT)

SECURE Water Act (2010) launched WaterSMART (Water Census). Included 6 *Focus Area Studies*.

GOAL:

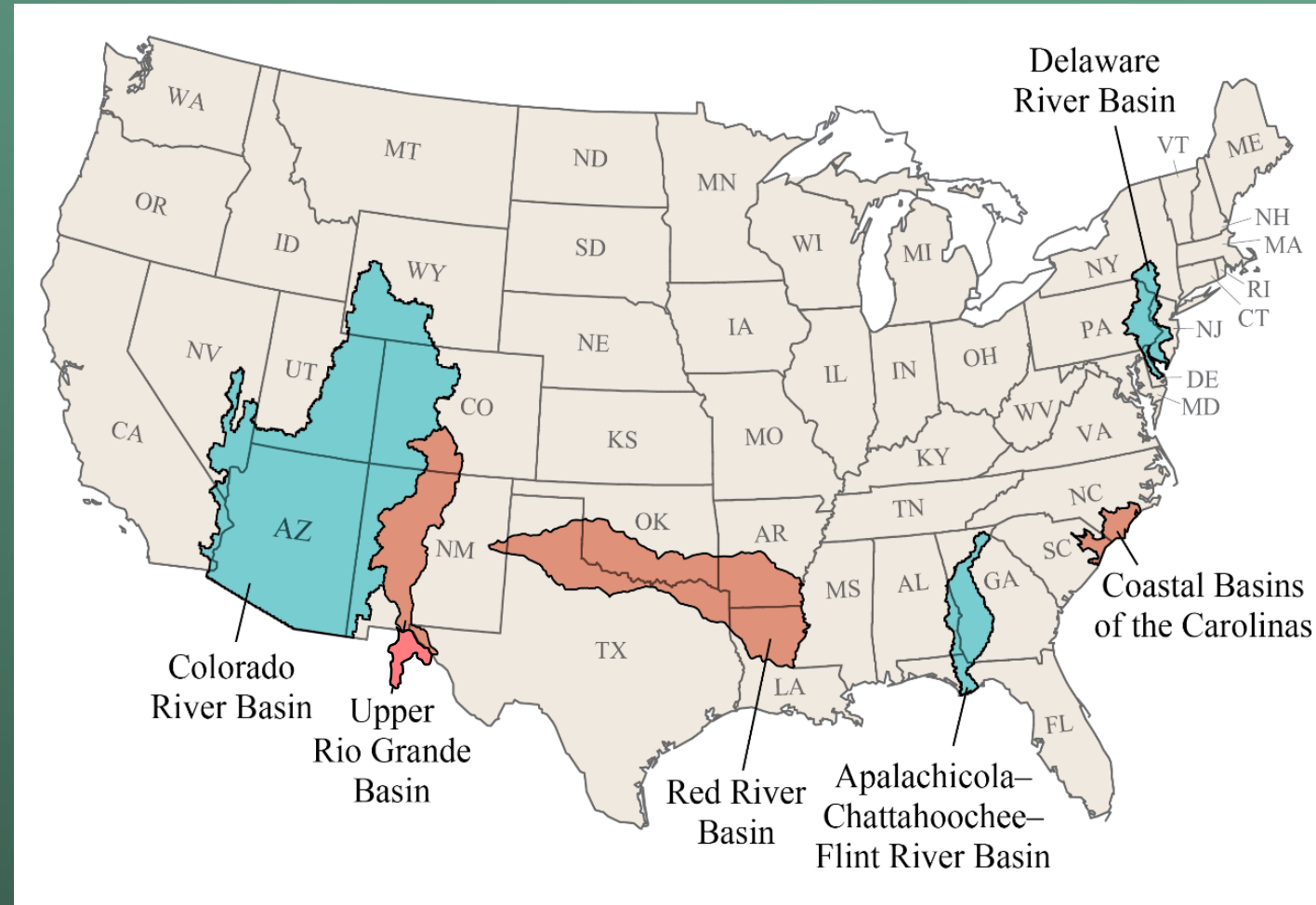
Work with Stakeholders to identify gaps

Develop hydrologic tools and assessments to fill critical gaps

Assess spatial distribution and temporal trends of selected water-budget components

Actively engage stakeholders

Project Duration: 4 years (FY2016-2019)



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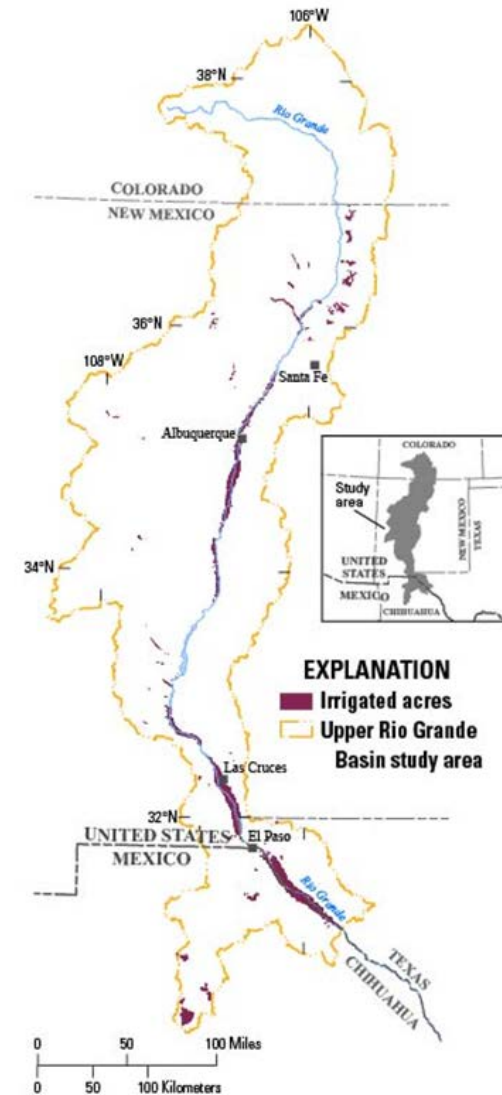
Water Use Compilation

OBJECTIVES:

- Assess water-use data by category for 1985-2015
- Reaggregate to Hydrologic Unit Code 8-digit area (HUC-8)
- Assess irrigated acreage for 2015 using GIS analysis

PRODUCTS:

- **USGS Report** summarizing water use, water use trends and consumptive use for the Basin
- **USGS Data Release** of 2015 irrigated acres in the Basin



Provisional data

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Evapotranspiration (ET) with Simplified Surface Energy Balance Operational Model (SSEBop)

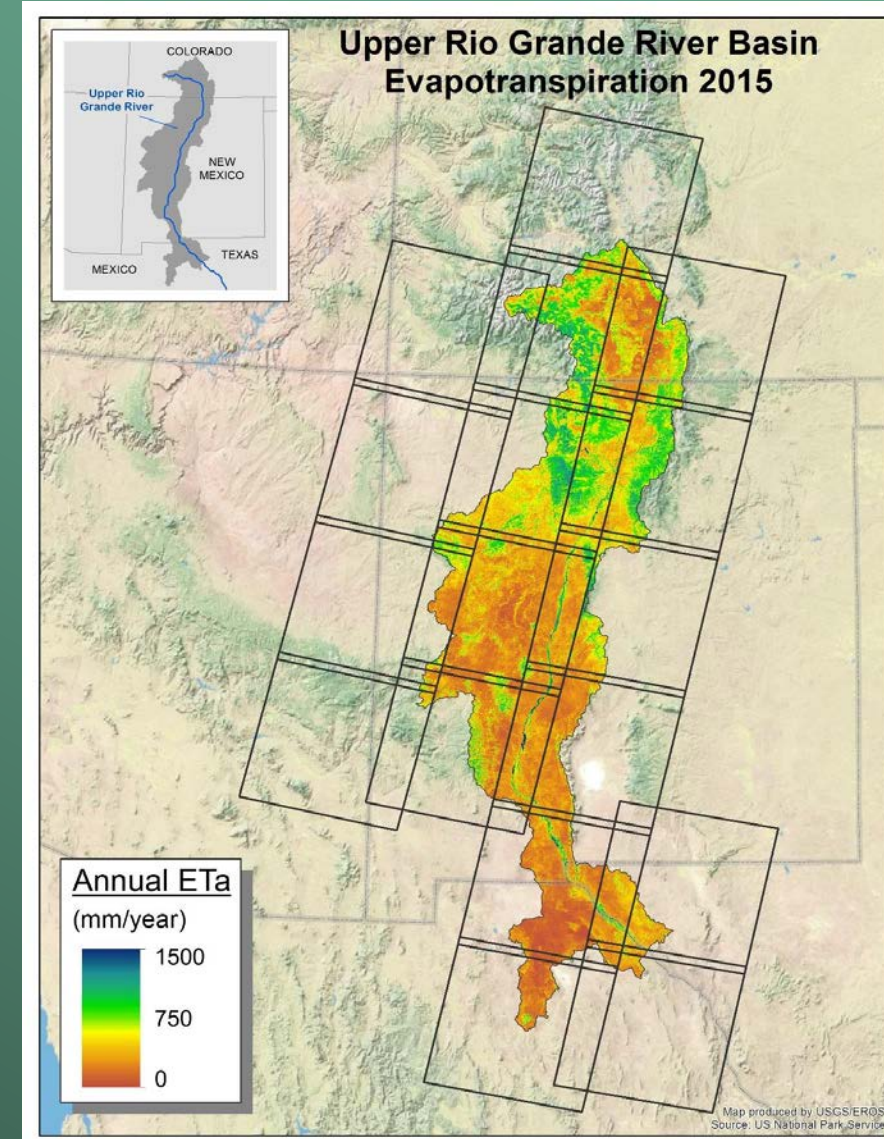
OBJECTIVE:

Quantify actual ET (ET_a) using remote-sensing-based SSEBop method at monthly scale, 100-m resolution, 1984-2015

- *The monthly ET data for the Upper Rio Grande Basin (1984-2015) uses the operational Simplified Surface Energy Balance (SSEBop) model to quantify and map ET over irrigated fields using Landsat imagery and associated weather datasets.*

PRODUCTS:

- **USGS Data Release has been published:**
<https://earlywarning.usgs.gov/ssebop/landsat>
- **Journal article**



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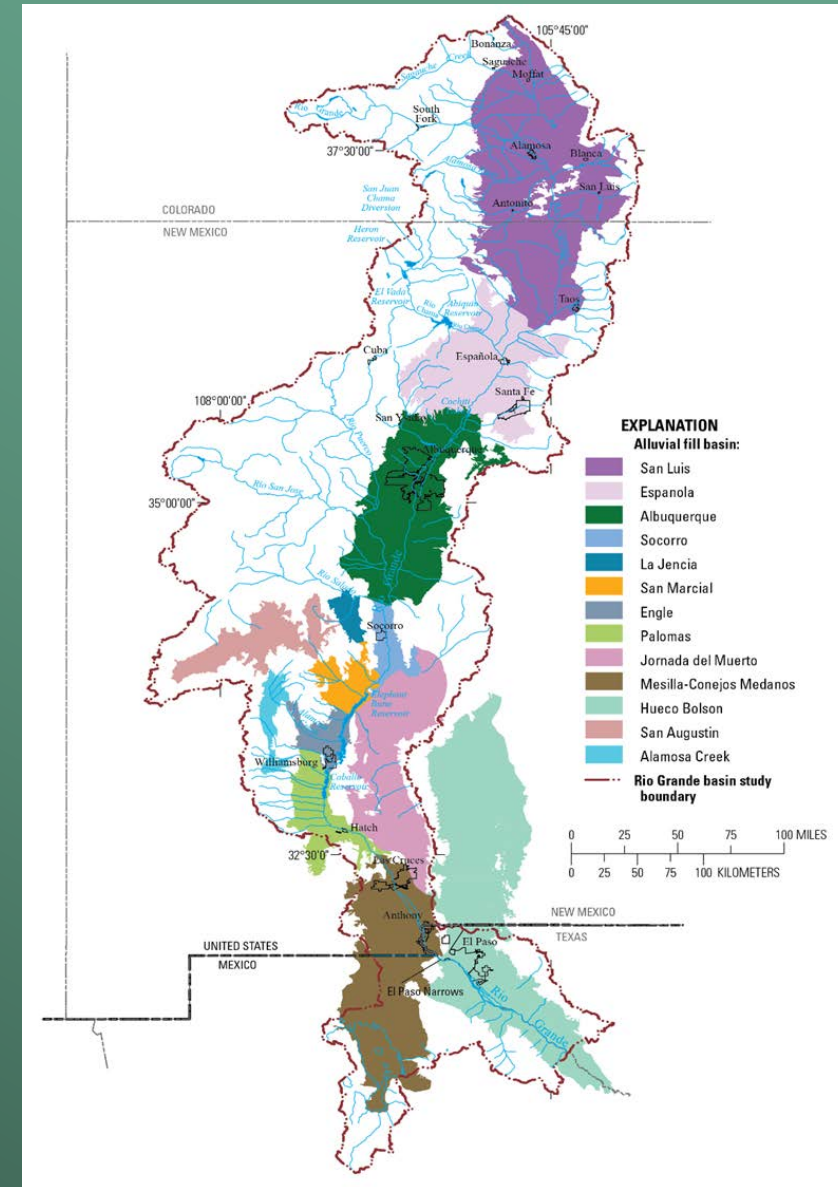
Groundwater Hydrogeologic Framework and Analysis

OBJECTIVES: Assess groundwater availability through:

- A basin-scale hydrogeologic framework
- Water-level and storage change maps
- Geostatistical water-level status and trends analysis

PRODUCTS:

- **USGS Report** containing hydrogeologic framework summary, structure data, estimated water-level surfaces and water-level change maps for selected sub-basins, statistical analysis of trends, and estimated storage changes.
- **USGS Data Release** including:
 - Water-level data*
 - Digital alluvial basin boundaries*
 - Geologic structure data used for cross-sections*
 - Hydraulic property data collected for storage estimation*



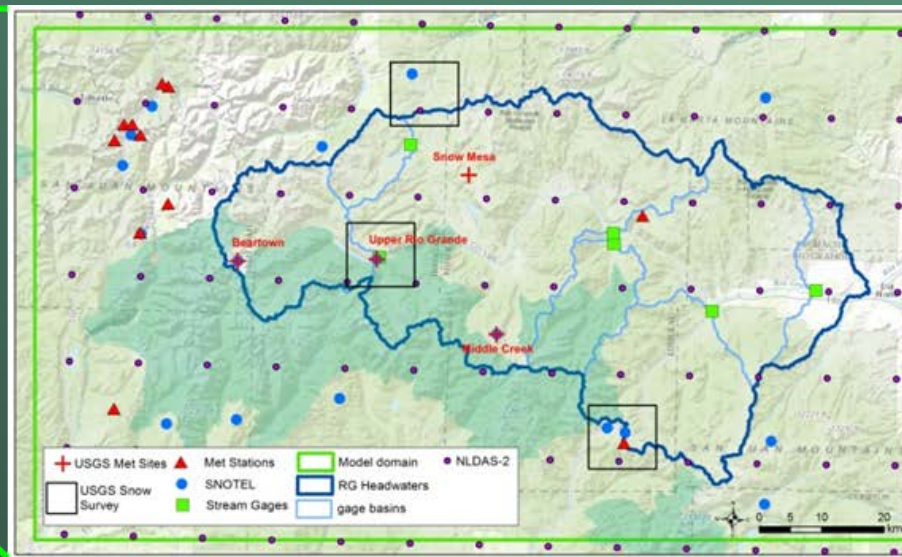
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Snow Process Monitoring and Modeling in Basin Headwaters

OBJECTIVES: Enhanced snow transects and climate station monitoring, advanced snow process modeling using SnowModel

PRODUCTS:

- **USGS Data Release** of SnowModel results published as an archived dataset
- **Journal article** highlighting modeled snow variability and representivity of basin SNOTEL gages



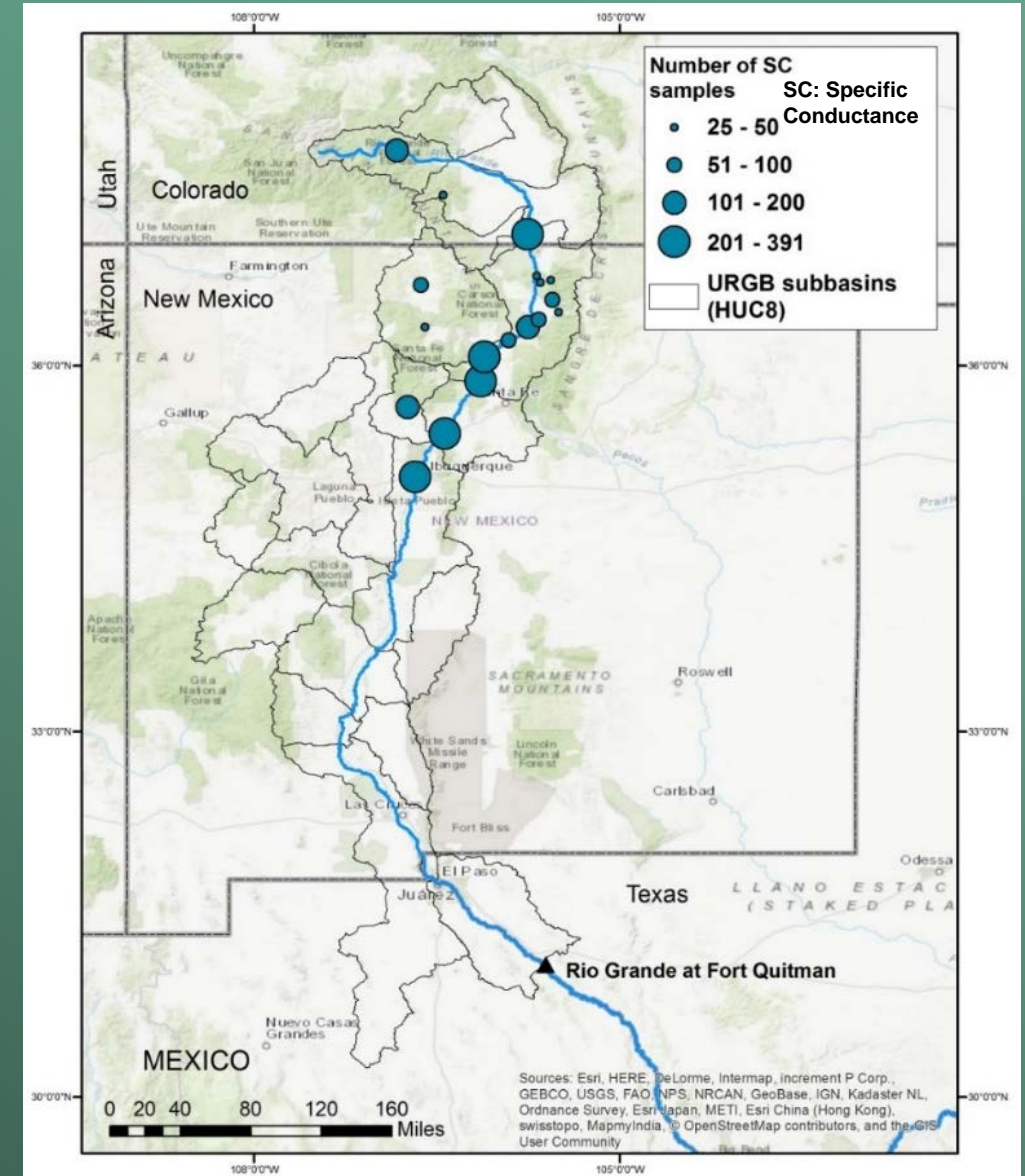
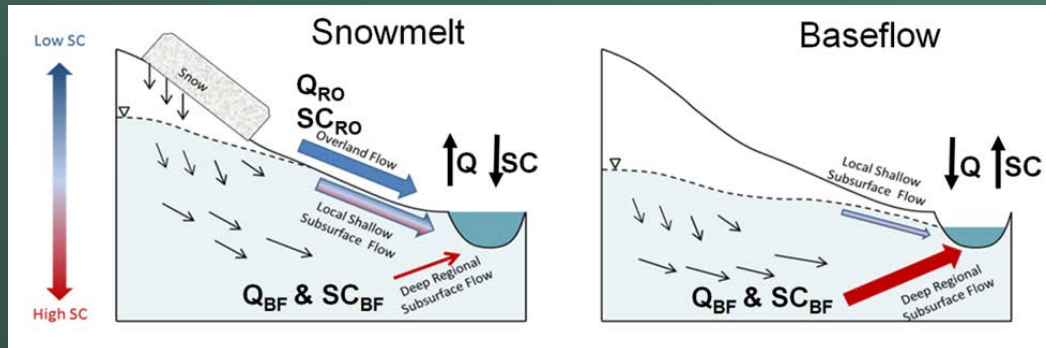
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Streamflow (Baseflow vs. Runoff) Processes

OBJECTIVES: Characterize streamflow processes using automated hydrograph and hydrochemical baseflow separation methods, analysis of baseflow variability drivers, and trend analysis

PRODUCTS:

- **USGS Data Release** of time series estimates of baseflow discharge to streams at select sites in the Basin.
- **Journal article** describing the temporal and spatial variability in baseflow discharge to streams in the Basin.



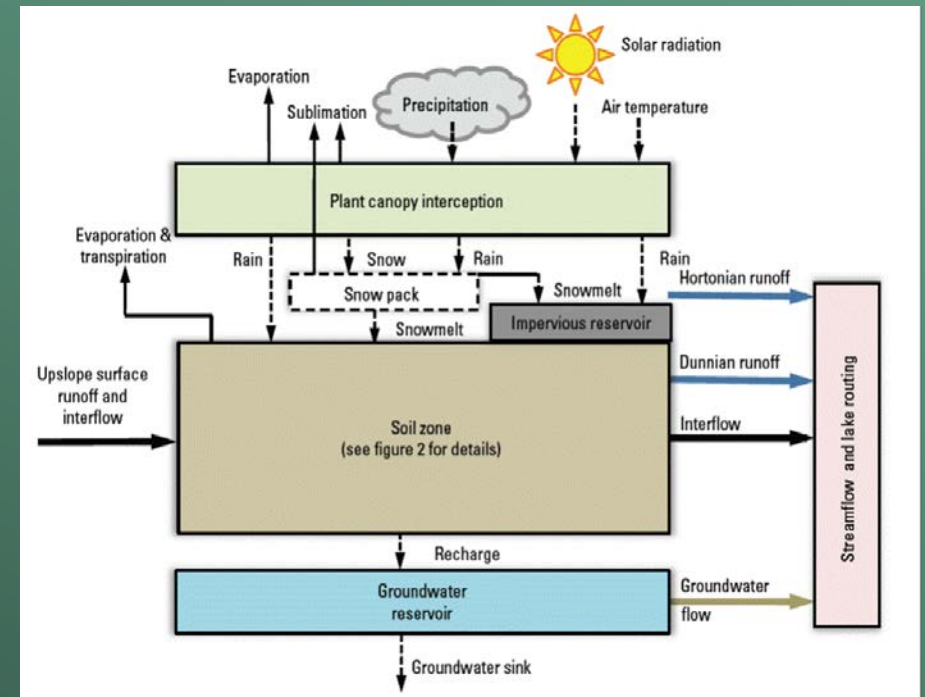
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Watershed Process Modeling with Precipitation-Runoff Modeling System (PRMS)

OBJECTIVES: Develop a calibrated Upper Rio Grande Basin watershed model using the USGS Precipitation Runoff Modeling System

PRODUCTS:

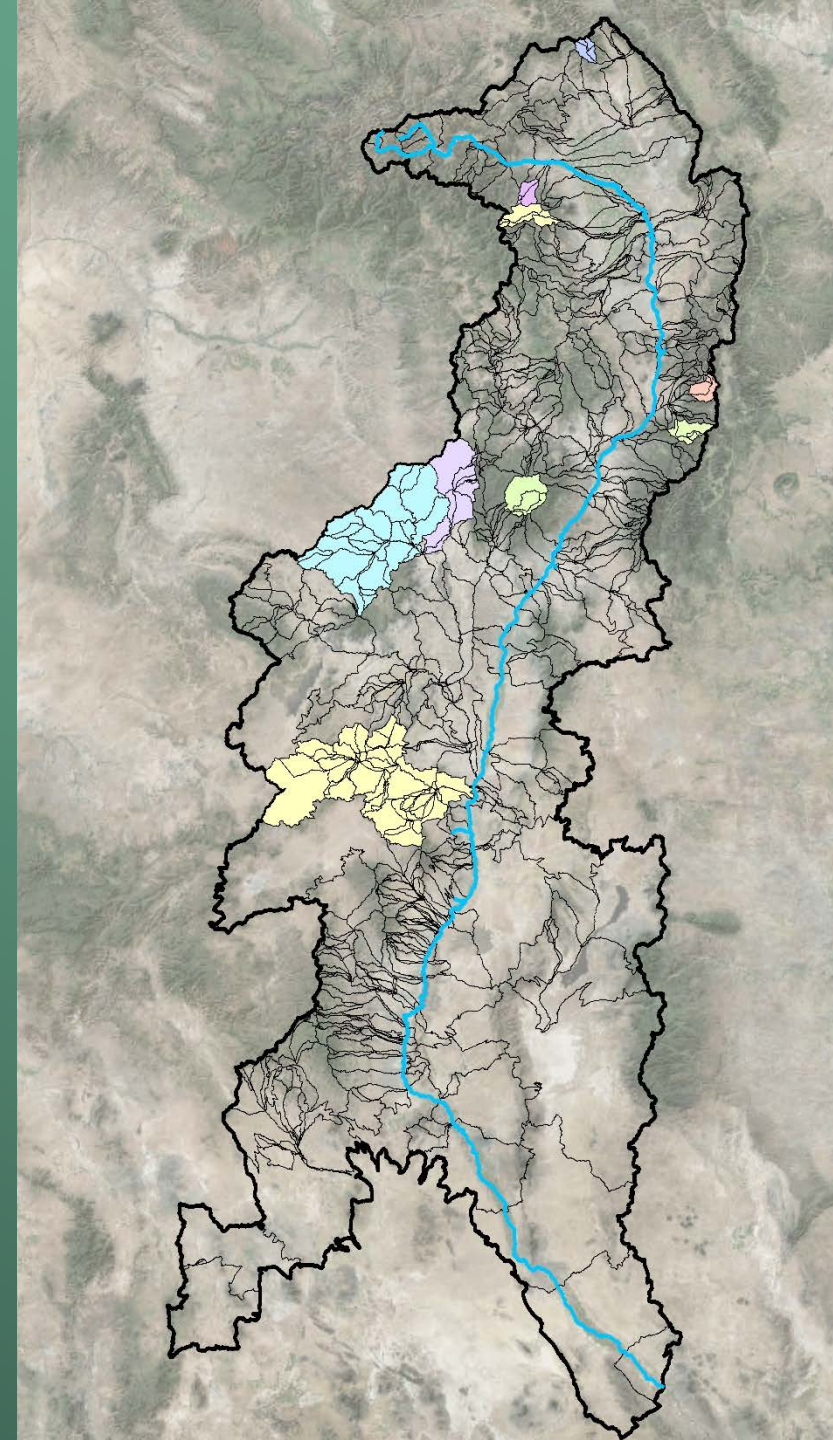
- **USGS Report** documenting Basin PRMS model development and calibration
- **USGS Data Release** with archived Basin PRMS model



(Markstrom and others, 2015)

PRMS Watershed Model

- Water and energy balance computed on 1,021 Hydrologic Response Units (HRUs) on a daily time-step
- Model calibrated to represent near-native streamflow conditions (naturalized flow)
 - 9 sub-basins selected due to relatively low anthropogenic impacts were calibrated
 - Parameters from 9 sub-basins distributed to non-calibrated HRUs based on criteria relevant to each parameter



Model Application

- Near-native flow calibration will allow for estimates of streamflow response to projected changes in temperature and precipitation to year 2100.
- Historical and future streamflow values generated by PRMS will be used to inform Basin Study
- Future scenarios based on emission scenarios (RCP), global climate models (GCM), downscaling technique