Unveiling the Watershed Webpages

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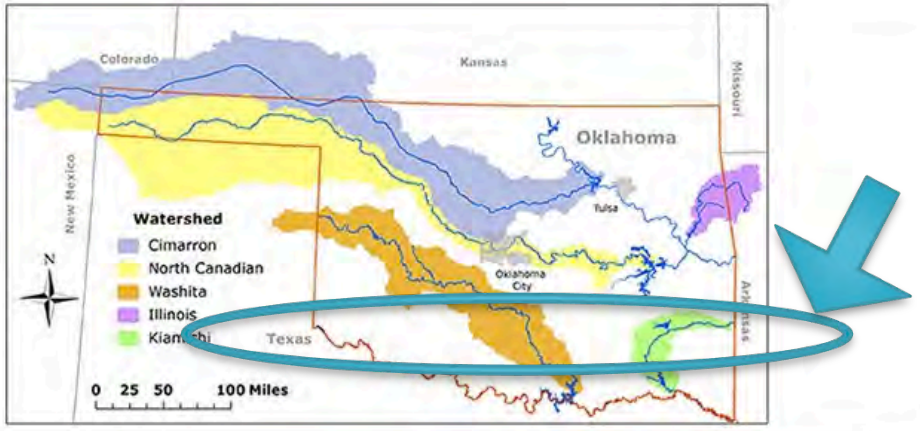
Oklahoma EPSCoR Annual State Conference

water.okstate.edu/watersheds

Oklahoma Watersheds



Here we highlight five watersheds. Four of those shown (Cimarron, Kiamichi, North Canadian, and Washita) are defined study areas for the current (2013-2018) Oklahoma Experimental Program to Stimulate Competitive Research (EPSCoR: http://www.okepscor.org).

This program is designed to increase Oklahoma's research competitiveness nationally by advancing our existing research capacity. The current project is titled, *Adapting Socio-ecological Systems to Increased Climate Variability*. Researchers from Oklahoma State University, the University of Oklahoma, the University of Tulsa, and the Noble Foundation are actively studying the complex relationships between humans, climate, and natural resources within these study areas. The project is threefold:

1. establish a state-wide socio-ecological observation network to collect data in the coupled human-natural system (such as human perceptions of climate change/extreme weather, soil moisture, water quality, etc.),
2. build a fully integrated model that can be used to better understand these complex systems and predict future scenarios based on the data obtained from the observation network, and
3. develop a decision support system that could be used by decision makers in future management decisions and researchers across Oklahoma who wish to build upon our work.

Oklahoma EPSCoR researchers have also outlined the Oklahoma City area as another one of their study areas to highlight how climate variability can impact urban and sub-urban socio-ecological systems.

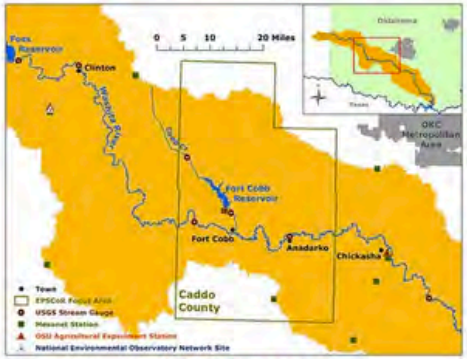
The Illinois River watershed is shown due to extensive research being performed by other Oklahoma researchers.

Learn more about the work underway in the different watersheds:

Cimarron | Illinois | Kiamichi | North Canadian | Washita

Washita River Watershed

ESPCoR Area Map:



Enlarge image.

About the Area:

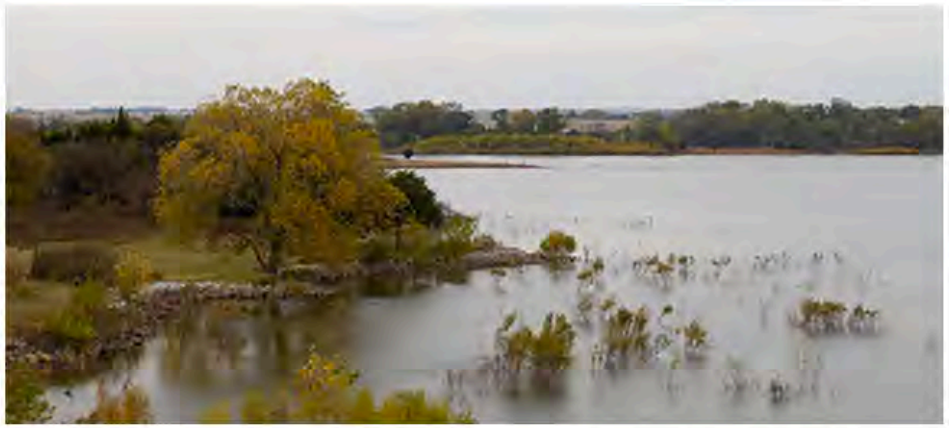
Situated mostly within Oklahoma's Cross Timbers Transition ecoregion, Caddo County's landscape encompasses a mosaic of rolling-to-level cropland, native prairie, and "improved" rangelands in its north, northwest, west-central, and southern sections.

Originating in the Texas panhandle, the Washita River enters west-central Oklahoma in Roger Mills County. From there it flows 575 miles in an east-southeasterly direction to its confluence with the Red River at Lake Texoma, in the south-central part of Oklahoma.

For more information about this region, visit our Washita River-Caddo County Region page and see our printer-

More Resources:

- Upper Washita River and Caddo County Region description
- Socio-ecological research efforts of EPSCoR researchers
- Washita River Watershed Publications
- Watershed Models
- Data/Decision Tools
- Washita River Watershed fact sheet (printer-friendly)



Washita River-Caddo County Region

Location:

Originating in the Texas panhandle, the Washita River enters west-central Oklahoma in Roger Mills County. From there it flows 575 miles in an east-southeasterly direction to its confluence with the Red River at Lake Texoma, in the south-central part of Oklahoma.

What's unique about this area?

Site selection for the present study is limited more specifically to the Upper Washita River watershed, centered around the town of Fort Cobb in Caddo County, Oklahoma. Chosen not only for its location on the north bank of the Washita River, the town of Fort Cobb lies at the river's intersection with two additional major hydraulic resources that have heavily shaped the area's development since the middle of the twentieth century. These are Fort Cobb Lake reservoir, built on a tributary of the Washita River four miles north of its namesake town, and the Rush Springs aquifer, one of Oklahoma's major bedrock aquifers. The development of the latter has been a largely private affair focused overwhelmingly on crop irrigation (though the county contains a substantial portion of non-irrigated cropland as well), while the former serves as both a recreational resource (as the principal draw of Fort Cobb Lake State Park) and the source for municipal drinking water supplies. The Washita River also serves to delineate historic and contemporary tribal boundaries, with the Wichita, Caddo, Delaware tribal jurisdiction (and former reservation) lying north of the river, and the Kiowa, Comanche, Apache jurisdiction (and former reservation) to the south. The land tenure relations that are the legacy of tribal allotment continue to shape contemporary land use patterns in the greater area.

Landscape and Natural History of the Region:

Situated mostly within the state's Cross Timbers Transition ecoregion, Caddo County's landscape encompasses a mosaic of rolling-to-level cropland (39% of the land base as of the 2012 agricultural census) and native prairie and "improved" rangelands (52.1% of the land base) in its north, northwest, west-central, and southern sections. The county's tremendous geological diversity ranges from red rock sandstone formations in the north to the limestone rangeland of the Slick Hills in the southwestern corner. The easternmost section of the county, lying in the Northwestern Cross Timbers ecoregion, contains the bottomlands of the Sugar Creek watershed (a major local tributary of the Washita) interspersed with wooded sandstone canyonlands. The county's rivers and streams are characterized by sandy, unstable streambeds and deeply incised banks of highly erodible red prairie soils. In this transitional rainfall region typified by periods of extended drought interrupted by severe flood events, the combined effects of water-induced soil erosion and wind-induced soil blowing has been the twin impetus for concerted conservation efforts, especially since the Dust Bowl era. More recently, with the development of both modified dry-land tillage practices (low and no-till) and irrigation infrastructure drawing from the Rush Springs Aquifer, water conservation has become a new focal point for area farmers and resource managers.

Authors and EPSCoR Researchers:

Tony VanWinkle, Ph.D. and Jack R. Friedman, Ph.D., University of Oklahoma

Socio-Ecological Research

Several socio-ecological research efforts related to the broader goals of OK-EPSCoR have either been completed or are on-going in the Washita-Caddo region. This research includes:

1. Long-term, in situ ethnographic research examining how different perceptions and practices related to water availability, sustainability, and conservation have been shaped by tribal identity, personal/family/regional experiences of the Dust Bowl and past droughts, politics, geography (esp. access to groundwater), and how people use the land (agriculture, ranching, etc.).
2. Economic research into the value of recreational resources in the region with a special focus on Ft. Cobb Reservoir, a substantial recreational destination in the region.
3. Research into how farmers do or do not use and/or value various conservation programs and the implications of this for a broader understanding of stewardship in the region.
4. Hydrological research on the impact of stream bank erosion in the Ft. Cobb watershed, which feeds into Ft. Cobb Reservoir. This research examines not only the broad hydrology of stream bank erosion but also involves local farmers and land-owners in the discussion by seeking to understand how they perceive stream bank erosion risks and the value of riparian forest planting as a means of mediating stream bank erosion.
5. Sociological and anthropological research into how Native American tribes perceive the risks of climate change. This research includes seeking to understand the on-going planning that tribes are making to increase resilience and to prepare for predicted consequences of climate change.
6. Substantial landscape-level analysis of important questions has been undertaken drawing on remotely sensed data. This has included research into algal blooms in Ft. Cobb Reservoir, crop-composition and productivity, and a cataloging effort to account for all of the service water in the region (as part of a statewide effort)
7. Research into the role that shelter belts – lines of trees first planted in the Washita-Caddo region in the 1930s and 1940s to help combat soil erosion that occurred during the Dust Bowl – continue to play in the region. Specifically, we are examining how these shelter belts have become part of the human perception/understanding of the landscape, how they provide ecosystems for birds and mammals, and how they do or do not inform our understanding of woody encroachment into the Plains.

Research efforts by Jack R. Friedman, Ph.D., University of Oklahoma and Tracy Boyer, Ph.D., Oklahoma State University

Washita River Watershed Publications

Washita River Watershed fact sheet (printer-friendly)

Cosh, M.H., P.J. Starks, J.A. Guzman, and D.N. Moriasi. 2014. Upper Washita River Experimental Watersheds: Multiyear stability of soil water content profiles. Journal of environmental quality, Vol. 43 No. 4, p. 1328-1333.

Garbrecht, J.D., X.C. Zhang, and J.L. Steiner. 2014. Climate change and observed climate trends in the Fort Cobb experimental watershed. Journal of environmental quality, Vol. 43 No. 4, p. 1319-1327.

Moriasi, D.N., P.J. Starks, J.L. Steiner, J.A. Guzman, P.B. Allen, and J.W. Naney. 2014. Upper Washita River experimental watersheds: Physiography data. Journal of environmental quality, Vol. 43 No. 4, p. 1298-1309.

Moriasi, Daniel N., P.J. Starks, J.A. Guzman, J.D. Garbrecht, J.L. Steiner, J.C. Stoner, P. Allen, and J.W. Naney. 2014. Upper Washita River Experimental Watersheds: Reservoir, Groundwater, and Stream Flow Data. Journal of environmental quality. Vol. 43 No. 4. p. 1262-1272.

Starks, P. J., C. A. Fiebrich, D. L. Grimsley, J. D. Garbrecht, J. L. Steiner, J. A. Guzman, and D. N. Moriasi. 2014. Upper Washita River experimental watersheds: Meteorologic and soil climate measurement networks. Journal of environmental quality. Vol. 43 No. 4, p. 1239-1249.

Starks, P. J., J. L. Steiner, D. N. Moriasi, J. A. Guzman, J. D. Garbrecht, P. B. Allen and J. W. Naney, 2014. Upper Washita River Experimental Watersheds: Nutrient Water Quality Data JEQ, Vol. 43 No. 4, p. 1280-1297.

Starks, P.J., J.L. Steiner, and A.J. Stern. 2014. Upper Washita River experimental watersheds: Land cover data sets (1974–2007) for two southwestern Oklahoma agricultural watersheds.Journal of environmental quality, Vol. 43 No. 4, p. 1310-1318.

Steiner, Jean L., P. J. Starks, J.D. Garbrecht, D.N. Moriasi, X. Zhang, J.M. Schneider, J.A. Guzman, and E. Osei. 2014. Long-term environmental research: The Upper Washita River experimental watersheds, Oklahoma, USA. Journal of environmental quality. Vol. 43 No. 4, p. 1227-1238.

Zhang, X.-C., J.D. Garbrecht, J.L. Steiner and R.L. Blazs. 2014. *Upper Washita River Experimental Watersheds: Sediment Database*. JEQ, Vol. 43 No. 4, p. 1273-1279.

OCWP Lower Washita Region Report

Washita River Watershed Models

Becker, M. F. 1998. *Steady-state simulation of ground-water flow in the Rush Springs Aquifer, western Oklahoma.* USGS, Water-Resources Investigations Report 98-4082

Becker, C.J., D.L. Runkle, and Alan Rea. 1996. *Digital data sets that describe aquifer characteristics of the Elk City Aquifer in western Oklahoma.* USGS, Open-File Report 96-449

Runkle, D.L., M.F. Becker, and Alan Rea. 1996. *Digital data sets that describe aquifer characteristics of the Rush Springs Aquifer in western Oklahoma.* USGS, Open-File Report 96-443

Data/Decision Tools

Weather

Expand All Collapse All

- Oklahoma Mesonet
- Precipitation/Temperature

Stream Flow

Expand All Collapse All

- Flow for Cobb Creek near Eakly, OK
- USGS WaterWatch

Water Demands

Expand All Collapse All

- Area Descriptions
- By Water Source
- By Water User Group
- Projected Water Demands
- More Information and Resources

Data/Decision Tools

Weather

Expand All Collapse All

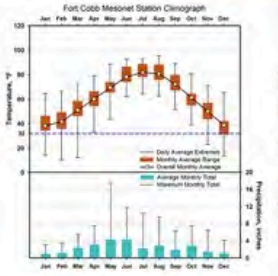
Oklahoma Mesonet

The Oklahoma Mesonet consists of 120 automated stations with at least one Mesonet station in each of Oklahoma's 77 counties. These Mesonet stations measure temperature, humidity, rainfall amounts, wind speeds, etc.

Visit the Mesonet website.

Precipitation/Temperature

A climograph such as this can give a quick introduction to the general climate pattern at a location. The Fort Cobb Mesonet station is located downstream of the dam at Fort Cobb Reservoir on the grounds of the OSU Caddo Agricultural Research Station, and is one of approximately 120 located throughout Oklahoma. More information and data from the Fort Cobb or other Mesonet stations is available through the Oklahoma Mesonet or the Oklahoma Climatological Survey websites.



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The top plot shows the overall monthly average temperature, the range of monthly averages, and the average daily temperatures. The bottom plot shows the average and maximum monthly total precipitation for the Fort Cobb Mesonet station. Precipitation data cover the period from 1/1/1994 to 11/2015, and daily average temperature the period 3/1/1997 to 11/2015.

Stream Flow

Oklahoma Water Resources Center

Data/Decision Tools

Weather

Expand All Collapse All

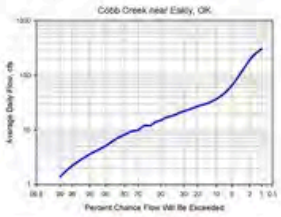
- Oklahoma Mesonet
- Precipitation/Temperature

Stream Flow

Expand All Collapse All

- Flow for Cobb Creek near Eakly, OK
  - Flow Duration Curve

    The shape of a flow duration curve, especially the upper and lower ends, is useful for understanding the hydrologic behavior of a watershed. For instance, a steep high-flow end can indicate "flashy" flows influenced by rapid runoff of rainfall, and a shallow low-flow end indicate sustained flows that can a mean a high rate of natural stream recharge from springs or groundwater, or artificial inputs from municipal sources.

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    The flow duration plot is a statistical portrayal of all recorded daily average flows, and helps to estimate the range and frequency of streamflows. It states that on average, based on the existing record, a flow of y has an x% likelihood of being exceeded.
  - Peak Flow Exceedance Curve
  - Low Flow Non-exceedance Curves
  - About Eakly, OK
  - More Information and Resources
- USGS WaterWatch

  WaterWatch provides streamgage-based maps that show the location of more than 3,000 long-term (30 years or more) USGS streamgages; feature a point-and-click interface allowing users to retrieve graphs of stream stage and flow; and highlight locations where extreme hydrologic events, such as floods and droughts, are occurring. [visit the WaterWatch site]

  Stream Gauges

  Real-time streamflow compared to historical streamflow for the day of the year. [view map]

Stream Flow

Expand All Collapse All

⊞ **Flow for Cobb Creek near Eakly, OK**

⊞ **USGS WaterWatch**

Water Demands

Expand All Collapse All

⊟ **Area Descriptions**

Ft. Cobb Reservoir Basin:

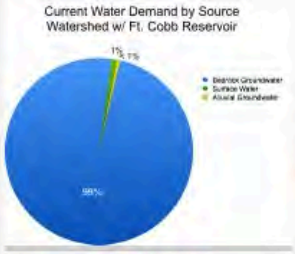
This basin is one of several smaller basins that make up the larger Washita River Watershed and is located north of the Washita River. It includes the Ft. Cobb Reservoir, but does not include the city of Ft. Cobb. This area consists of a large amount of cropland.

City of Ft. Cobb Basin:

This basin includes the city of Ft. Cobb and is located just downstream of the Ft. Cobb Reservoir. It is just one of several smaller basins that make up the larger Washita River Watershed. The area has slightly more developed land than the Ft. Cobb Reservoir Basin, but there is still a large amount of cropland in this basin as well.

⊟ **By Water Source**

Ft. Cobb Reservoir Basin:



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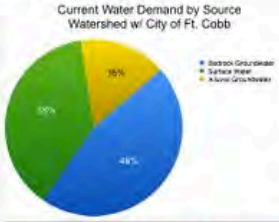
This pie chart shows that approximately 99% of the current water demand in the Ft. Cobb Reservoir Watershed, is being retrieved from bedrock groundwater. Figure adapted from the Oklahoma Comprehensive Water Plan.

City of Ft. Cobb Basin:



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This pie chart shows that in the Washita River Watershed near Ft. Cobb, over half of the current water demand is being retrieved from groundwater resources. The percentage of water being taken from surface resources is much higher in this watershed compared to the basin just to its north (Ft. Cobb Reservoir Watershed). Figure adapted from the Oklahoma Comprehensive Water Plan.

⊞ **By Water User Group**

⊞ **Projected Water Demands**

Comments? Suggestions?

- If you have any comments or suggestions for our webpages, please send an email to emma.kuster@okstate.edu

Thank you for your attention!