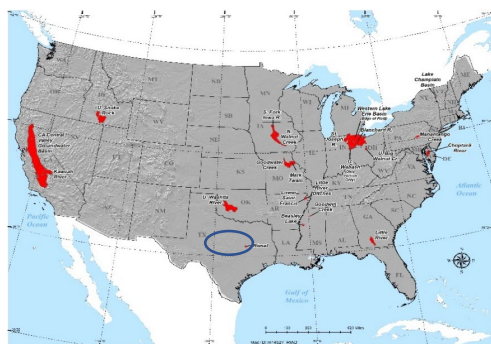




# Upper Washita River Watersheds

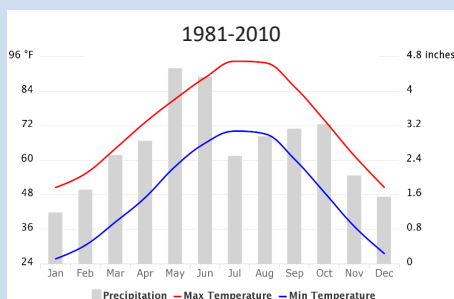
A Conservation Effects Assessment Project (CEAP) Watershed Assessment Study: A collaboration between the Agricultural Research Service and the Natural Resources Conservation Service



## Location

The Upper Washita River Watersheds (UWRW) consist of the Fort Cobb Reservoir Experimental Watershed (FCREW), the Little Washita River Experimental Watershed (LWREW), and one field study, all located in central Oklahoma.

## Temperature and Precipitation



## Major land uses

**Cropland:** Winter wheat

**Grassland:** Pasture

## Data Collection

A precipitation gauge network was installed in the UWRW in 1961. At 5-minute intervals, a weather station measures air temperature, relative humidity, rainfall, solar radiation, and soil temperature at three depths. Soil moisture is measured at 30-minute intervals. The U.S. Geological Survey monitors streamflow in collaboration with the Oklahoma Water Resources Board and ARS. From 2004 to 2007, samples were collected at the FCREW gauging stations to measure water quality variables. Beginning in 1976, surface runoff samples were collected from 8 research plots for water quality analysis.

## Fort Cobb Reservoir Experimental Watershed



Photo Courtesy: Jurgen Garbrecht

## Concerns

The Fort Cobb Reservoir and contributing stream segments were selected for study because the lake was experiencing high sedimentation rates. In addition, seasonal phosphorus (P) and nitrogen (N) loads were excessive in some stream segments and contributed to poor lake water quality.

A rapid geomorphic assessment indicated that unstable stream channels dominated the stream networks. This led to stream bank erosion that contributed to sedimentation in water bodies.

Forty five flood-retarding structures were constructed by NRCS in the LWREW from 1969-1982, with a design life of 50 years. These aging structures and those installed around the country need assessment in terms of current storage capacity and degree of sedimentation that has occurred over the years.

In the nearby North Canadian River watershed, encroachment of invasive species such as red cedar into grasslands affects beef production as well as water resources.

## Major applied conservation practices

The conservation practices (CPs) implemented by NRCS at the watershed scale apply to cropland and degraded grazing lands.

The NRCS cropland CPs include conservation cover, conservation crop rotation, contour farming, cover crop, critical area planting, diversion, forage and biomass planting, grade stabilization structure, grassed waterway, nutrient management, range planting, residue and tillage management, no-till, residue and tillage management, reduced till, residue management, mulch till, and terraces.

The NRCS CPs used on degraded grazing lands include brush management, fences, livestock pipeline, prescribed grazing, pumping plant, water well, and watering facility.

The CPs studied by ARS at plot scale include no-till systems that integrate cool season and warm season cover crop forages mixtures.

## Outcomes/Findings

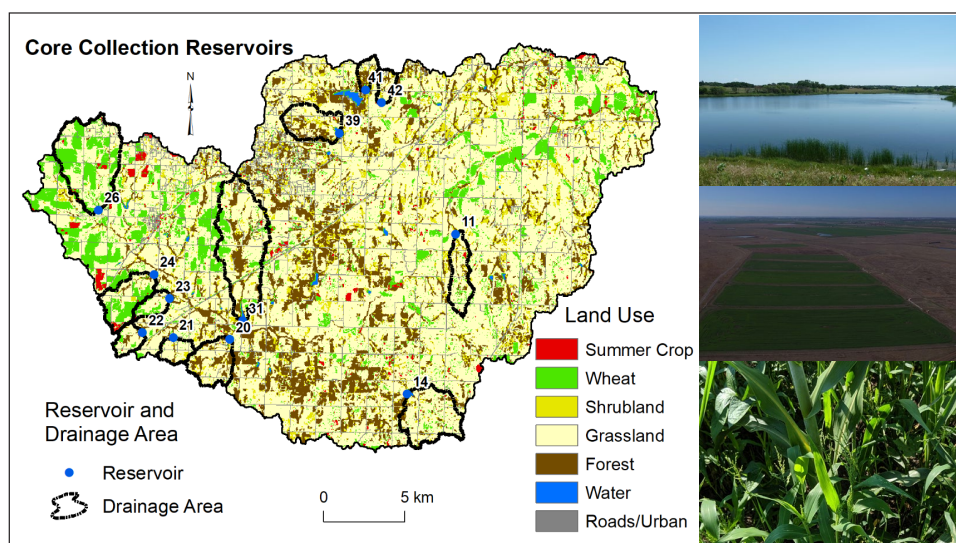
### Field to sub-watershed scale

- Compared to conventional tillage, a minimum tillage system used with a summer forage cover crop reduced suspended sediments, total P, and total N by 7%, 19%, and 31%, respectively.
- Modeling results show that the multiple CPs implemented by NRCS between 1964 and 2003 reduced soil erosion rates of the 16-km<sup>2</sup> Bull Creek subwatershed by 77% compared with rates prior to this period.
- Modeling results in the 342-km<sup>2</sup> Cobb Creek subwatershed in the FCREW showed that application of a Bermuda filter strip (BFS) along cropland borders reduced the amount of eroded overland sediment delivered into the stream by 72%. Riparian forest buffer (RF) and combined RF and BFS reduced suspended sediment at the sub-watershed outlet by 68% and 73%, respectively.
- Planting vegetation in stream banks graded at 2:1 (horizontal:vertical) side slopes in the 110-km<sup>2</sup> Five Mile Creek subwatershed was the most cost-effective stabilization technique to reduce sediment loads.

### Watershed

- Forty five flood-retarding structures were constructed by NRCS in the LWREW from 1969-1982, with a design life of 50 years. Bathymetric surveys carried out in 2012 showed that reservoir lifespans ranged from 45 to 118 years, with 11 of 12 reservoirs having a lifespan greater than the design period of 50 years (see table on the right). The higher projected lifespans were attributed to multiple CPs implemented over the years through NRCS programs.

## Upper Washita River Watersheds



Clockwise from top left: Drainage boundaries of surveyed reservoirs, photo of reservoir ID number 14, aerial photo of the Water Resources & Erosion (WRE) watersheds, mixed forage summer cover crop in one of the WRE watersheds.

Reservoir ID	Years of Operation on Survey Date	Sedimentation Rate (m <sup>3</sup> /km <sup>2</sup> /year)	Projected Lifespan (years)
11	42	181	118
14	37	368	61
20	33	526	61
21	45	294	88
22	38	873	45
23	44	305	96
24	39	265	89
26	44	557	51
31	38	423	64
39	38	288	77
41	46	410	64
42	46	320	93

### Watershed continued

- SWAT model output showed that removal of the current 8% red cedar encroachment in the 1,802-km<sup>2</sup> North Canadian River Watershed would increase water supply to Oklahoma City by 5%.
- Multiple CPs have been implemented in the FCREW since the 1950s. Analysis of sediment transport at the watershed outlet showed that average annual sediment yield was reduced by 86% in 2004-2007 compared to 1943-1948, or from 760 to 108 metric tons/year/km<sup>2</sup>.

## Collaborators and Stakeholders



## More Information

Site Lead: Daniel Moriasi, [Daniel.Moriasi@usda.gov](mailto:Daniel.Moriasi@usda.gov)

ARS Website: [ars.usda.gov](http://ars.usda.gov) NRCS website: [nrcs.usda.gov](http://nrcs.usda.gov)

CEAP Network Website: [nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap/](http://nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap/)