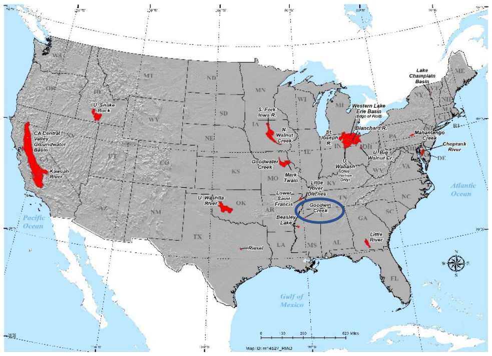
Goodwin Creek Experimental Watershed

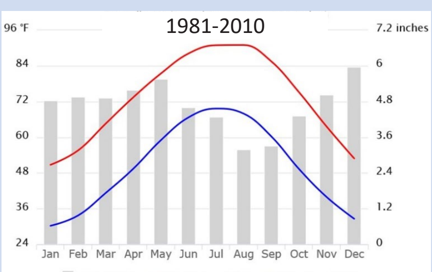
A Conservation Effects Assessment Project (CEAP) Watershed Assessment Study: A collaboration between the Agricultural Research Service and the Natural Resources Conservation Service



Location

The Goodwin Creek Experimental Watershed (GCEW) was established as a part of the "Stream-Bank Erosion Control Evaluation and Demonstration Project" authorized by Section 32 of U.S. Public Law 93-251. This 8-mi^2 watershed was chosen for its mixed land use, active upland erosion, and steep degrading channels with unstable banks. The watershed is a tributary of the Yazoo River, which ultimately flows into the Mississippi River.

Temperature and Precipitation



Average annual rainfall is 53.5", with most runoff events occurring in the winter and spring. The difference of elevation in the watershed is 190 feet with soil types closely following topography.

Major land uses

Cropland: Cotton and Soybean.
Grassland: Pasture and Hay.
Woodland: Pines and Hardwoods.

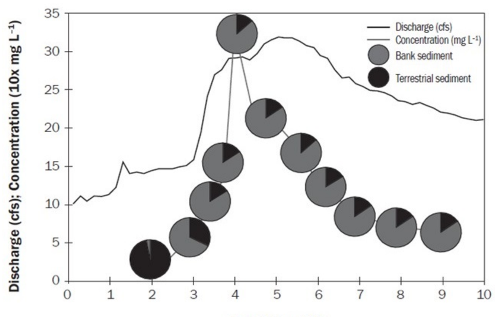
Data collection

The watershed has 19 stations that measure flow and water quality, 32 rain gauges, and one station that measures multiple weather variables.

Concerns

Sheet and rill erosion were historically the major source of sediment in Goodwin Creek. Row crop agriculture was historically practiced over the majority of the watershed, including the sloping uplands. Conservation practices have reduced row crop use to just 6% of the area, and only in the flatter part of the alluvial plains. The hillslopes were converted to forest and pasture lands, which occupy 96% of the watershed.

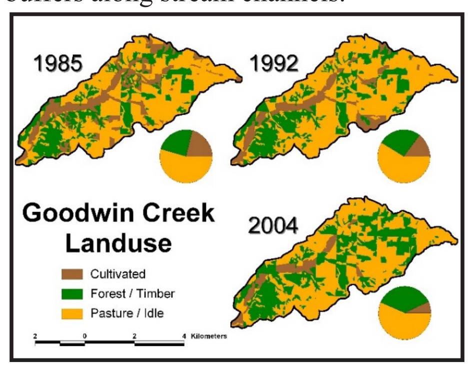
With the shift in landuse, sheet and rill erosion has been effectively controlled. However, gully erosion remains a significant problem.



Sediment sources identified using ratios of naturally-occurring radionuclides ^{7}Be and ^{210}Pb on the GCEW demonstrate that currently the major source of sediment is streambank failure and gully erosion.

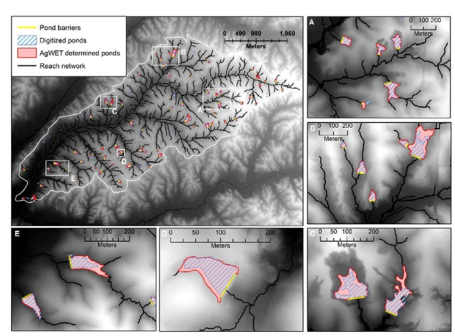
Main conservation practices used

The large land use shift that occurred between 1985 and 2004 (See land use maps below) was enabled by enrolling land in the Conservation Reserve Program (CRP). Forest restoration has resulted in 47.5 miles of riparian buffers along stream channels.



In addition in-stream structures were installed, which drain areas ranging from less than a square mile to the whole watershed (8 mi^2).

Sixty seven field ponds collect 20% of watershed runoff.



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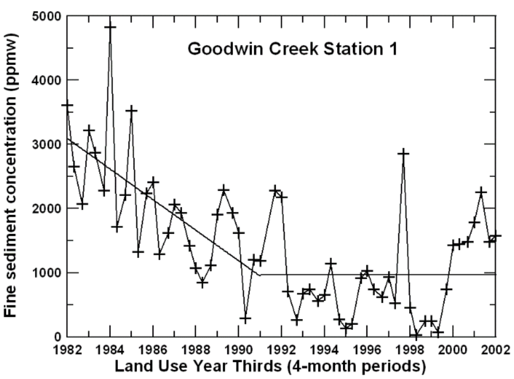
Outcomes/Findings

- The in-stream structures at several locations in GCEW have reduced total and fine sediment yields. Reductions ranged from 10% to 70%. These structures had a greater impact on sediment yields and bank stability in the upstream portions of the watershed.
- Sediment concentrations decreased from 3,000 to 1,000 ppm from 1982 to 1990 and have remained flat since 1990. This trend corresponds closely with the shift of cropland to forest and pasture and shows that CRP conditions provide long-term control of sediment .



- 78% of the fine sediment reaching the channels were derived from channel sources. This shows that total watershed erosion control requires consideration of concentrated flow sources from channels and gullies.
- Field ponds reduced the annual average runoff volume by 4% and the average peak flow by 36%. The hydrologic impacts of ponds should be considered when there are a significant number of ponds in a watershed.
- Riparian buffers reduce sediment by 60%. The reduction varies by particle size: 38% for clay, 62% for silt and 70% for sand.

Clockwise from top: A hillslope pasture used as an edge-of-field monitoring site. Dr. Tianyu Zhang surveying an ephemeral gully in crop land. Typical failing streambank.

Mechanistic field studies on subsurface erosion

GCEW has identified subsurface erosion, i.e. piping, as a major contributor to ephemeral gully erosion and streambank failure. Piping can involve flow through large lateral pores called “soil pipes” or seepage out of bank faces. Flow through soil pipes causes erosion of the inside of pipes that leads to collapse of the soil above, which forms sinkholes and gullies. Sinkholes intercept runoff that generates additional pipeflow velocities and enhanced erosion.

Collaborators and Stakeholders

US Army Corps of Engineers®

More Information

CEAP Site Lead: Ron Bingner, Ron.Bingner@usda.gov
ARS website: ars.usda.gov   NRCS website: nrcs.usda.gov
CEAP website: nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap/