“Bundled Benefits #3”

Conservation Practices As Tools To Address Water Quality And Climate Change in the North Canadian River Watershed

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for the USDA Southern Plains Climate Hub
Through an agreement with
Redlands Community College, Division of Agriculture

Summary

Bundled Benefits: Conservation Practices as Tools to Address Water Quality and Climate Change in the North Canadian River Watershed

Since the initial response to the Dust Bowl of the 1930's, the Federal Government, state and local partners, as well as private sector organizations, have invested billions of dollars to install conservation practices on privately owned lands in the United States. Often these efforts have focused on the control of soil erosion from farm and ranch land in an effort to maintain a productive agricultural base into the future. Starting with the efforts of the U.S. Department of Agriculture's (USDA) Soil Conservation Service (now the Natural Resources Conservation Service, (NRCS)) and continuing through the efforts of numerous other agencies such as the Farm Services Agency (FSA), the Environmental Protection Agency (EPA), and the U.S. Fish and Wildlife Service (USFWS), our Nation has assisted farmers, ranchers, and forest landowners with the implementation of conservation practices designed to continue the production of food and fiber while protecting our natural resource base.

These programs have shown varying degrees of success, with some of the best results unfortunately not widely known. The slowing and eventual reversal of the desertification that was underway in the Southern Plains of the United States during the 1930's is a prime example of an outstanding achievement that has been generated through these efforts. The continued reduction in erosion rates and the resulting gradual improvement of water quality have both been shown to be possible through the administration of voluntary, locally led conservation work with financial and technical assistance provided by the Federal Government. What rarely has been documented, however, is the ability of practices often implemented to address a specific problem (soil erosion) having the corresponding result of generating additional, co-benefits (controlling run-off, therefore improving water quality). This has been especially true when considering the potential positive impact that these practices can have on climate change through carbon sequestration and avoided emissions.

What follows in this report is our third attempt to highlight the dual benefits of improved water quality and reduced greenhouse gas levels in the atmosphere that can result from the implementation of conservation practices on working lands implemented in priority watersheds. The watershed we focus on in this study is a section of the North Canadian River watershed consisting of 760 square miles stretching from Canton Lake in Northwest Oklahoma to Lake Overholser in the Oklahoma City metro area. This watershed provides approximately half of the

drinking water for Oklahoma City. In addition, the river hosts boating and swimming events including an Olympic training facility located in Oklahoma City.

In Oklahoma, the nonpoint source pollution technical-lead agency, the Oklahoma Conservation Commission (OCC), uses a small watershed monitoring system designed to determine places where waters are either impacted by nonpoint source-related activities or improved through conservation programs such as those offered by USDA NRCS. NRCS and the OCC work together to identify the watersheds of high conservation practice implementation. The OCC and local conservation districts also provide additional cost-share assistance, public education, local leadership, and community outreach concerning these efforts. EPA Clean Water Act Section 319 funds are also utilized for education, outreach, and monitoring.

Through this partnership, monitoring of the conservation practices in these designated areas have shown improvements in water quality significant enough to justify the removal of this watershed from the list of impaired streams in the Oklahoma (303d list) for *E. coli*. bacteria. Additional review of the conservation practices implemented in this watershed utilizing the NRCS COMET PLANNER tool (www.comet-planner.com) also estimated that these practices generated significant reductions in greenhouse gas emissions and enhanced carbon sequestration in healthy soils. When combined, the conservation practices implemented in these designated areas showed an overall estimated reduction of 23,312 tons of carbon dioxide equivalent annually. This translates to a total estimated greenhouse gas reduction equivalent of taking 4,960 cars off the road annually[1].

It is our hope that this report helps inform discussions on the role conservation practices can and do play in protecting our Nation's environment, and that it can in some way stimulate additional action to document the multiple, positive, "bundled benefits" that these practices are currently generating on our nations working lands.

Clay Pope

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[1] Carbon dioxide equivalent reductions calculated against average typical passenger vehicle emissions rates per EPA Office of Transportation and Air Quality Fact Sheet (EPA-420-F-14-040a).

Implementing Agricultural Conservation Practices Improves Bacteria Levels In North Canadian River, Resulting In De-listing For *E. coli* With An Annual Result Of 23,312 Metric Tons Of Greenhouse Gas Reductions

Protecting and Restoring Oklahoma City's Water Supply Through Voluntary Conservation Programs

High bacteria concentrations resulted in the impairment the North Canadian River and placement on Oklahoma's Clean Water Act (CWA) section 303(d) list of impaired waters in 2006. Pollution from grazing, hay production and cropland areas contributed to this impairment. Implementing conservation practice systems to promote improved grazing and cropland management decreased bacteria levels in the river. As a result, a segment of the North Canadian River was removed from Oklahoma's 2016 CWA section 303(d) list for *E. coli*. Portions of the North Canadian River now partially support its primary body contact designated use. The conservation practices installed in the watershed have also resulted in annual reductions of 16,372 tons of carbon dioxide and 6,940 tons CO_2 E_Q of nitrous oxide (N_2O expressed in CO_2 E_Q) in the atmosphere for an overall reduction of 23,312 tons of carbon dioxide equivalent (CO_2 E_Q) per year.

Problem:

The North Canadian River is a 441-mile stream flowing from New Mexico and Texas before it flows into Lake Eufaula in eastern Oklahoma. Poor grazing and cropland management contributed to listing a 105.34 mile segment as impaired for *E. coli* in 2006 when the geometric mean of samples collected during the recreational season was 135 colony forming units/100 milliliters (CFU) (Figure 1). The primary body contact recreation designated use is impaired if the geometric mean of *E coli* exceeds 126 CFU. Oklahoma added this North Canadian River segment (OK520530000010_10) to the 2006 303(d) list for nonattainment of its primary body contact designated beneficial use.

Land use in the 760 square mile watershed of the listed segment is approximately 41 percent row crop used almost exclusively for winter wheat production. About 39 percent of the watershed is grazing lands for cattle and hay production and 15 percent is forested. Less than 5 percent of the watershed is urban land. The river provides approximately half of the drinking water for Oklahoma City. In addition, the river hosts boating and swimming events including an Olympic training facility located in Oklahoma City.

Project Highlights:
A Total Maximum Daily Load and Watershed Based Plan were completed for the watershed in 2008, but conservation districts asked the Oklahoma Conservation Commission (OCC) to work on water quality issues in the watershed in 2004. Landowners in the watershed worked with the Blaine, Central North Canadian, East Canadian and Dewey county conservation districts, the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS), USDA Farm Services Agency (FSA), and OCC to implement conservation practices through NRCS's Environmental Quality Incentives Program (EQIP), Conservation Security Program (CSP), Conservation Stewardship Program (CStwP), general conservation technical assistance program, and FSA's Conservation Reserve Program (CRP). The U.S. Environmental Protection Agency's (EPA) CWA section 319 program provided funding for conservation practices from 2007 - 2015. Oklahoma's Locally-Led Cost Share Program (LLCP) began funding practices in the watershed in 1998.

Through the installation of conservation practices, landowners improved many acres of grazing lands, which reduced runoff of bacteria and other pollutants. Conservation practices installed between 2002 and 2017 are shown in Table 1. Partners also worked through the Blue Thumb Education program to educate about problems and potential solutions in the watershed. The OCC worked with a producer in the watershed to establish a demonstration farm where conservation practices were installed and where Oklahoma State University Cooperative Extension scientists demonstrated cover crops and nutrient management modified for the unique conditions of the watershed. Workshops and field events focused on soil health, water quality, and improved management for producers, downstream citizens, and other audiences.

Results:
The OCC and the Oklahoma Water Resources Board documented decreased bacteria concentrations in the North Canadian River. Monitoring data compiled for the 2006 303(d) list showed that the North Canadian River *E coli* concentrations violated the standard when the geometric mean was 135 CFU (Figure 2). Although the geomean dropped below the criteria by the 2012 assessment, much of this data was from a severe drought period, therefore OCC waited until data from a more normal period had been collected to recommend delisting. The segment was removed from the Oklahoma 303(d) list for *E. coli* in 2016 after data from a wetter period was verified to meet standards. This change results in partial support of its primary body contact beneficial use.

In addition to water quality protection, conservation practices supported through the program also sequestered carbon dioxide by reducing soil erosion and building soil organic matter. Through these efforts, 3,193 metric tons CO^2/year of carbon credits were offered for sale in the watershed. These credits were purchased from cooperators by Western Farmers Electric Cooperative to further support establishment of water quality conservation practices.

The conversion of 42,417 acres from conventional till cropping to no-till was shown through NRCS COMET PLANNER to have an annual estimated reduction of carbon dioxide equivalent levels of 14,800 tons. The Conversion of another 6,914 acres from conventional till to reduced tillage reduced another estimated 1,200 tons of carbon dioxide equivalent as well. Conversion to prescribed grazing of 14,427 acres showed an estimated reduction of 2,600 tons of carbon dioxide equivalent. 214 acres of grassed waterways showed an estimated reduction of 240 tons of carbon dioxide equivalent while critical area plantings on 192 acres reduced carbon dioxide equivalent levels by an additional 200 tons.

Cover crop plantings on 308 acres showed another 80 tons of carbon dioxide equivalent reduction, while a combined full conversion of 1,345 acres of crop land to forage and biomass and a partial conversion to forage and biomass of another 6,548 acres showed carbon dioxide equivalent reductions of 490 tons and 1,500 tons respectively.

The planting of range on 256 acres in the watershed resulted in an estimated reduction of 87 tons of carbon dioxide equivalent while stripcropping on 1,261 acres resulted in reductions of 200 tons of CO_2 equivalent. Another 670 tons of carbon dioxide equivalent were reduced through the planting of Riparian Herbaceous Cover on 586 acres while improved nitrogen fertilizer management on 14,147 acres reduced carbon dioxide equivalent levels by 570 tons. An additional reduction of 740 tons of carbon dioxide equivalent was shown through the retirement 659 acres of marginal soils.

All totaled, conservation practices undertaken in the watershed, calculated through NRCS COMET PLANNER, show an estimated reduction of 23,312 tons of carbon dioxide equivalent annually.

Partners and Funding:

The OCC contributed at least $1,306,198 in EPA 319 funds, matched by $2,412,643 from state priority watershed funds and $335,916 from landowners to install conservation practices and conduct education programs. Approximately $240,000 additional 319 dollars supported OCC water quality monitoring in the watershed. NRCS contributed more than $470,000 through EQIP. Additional funds were provided through NRCS for CSP and CStwP and from FSA for CRP practices. In addition, landowners funded a large number of practices based on

recommendations through NRCS general technical assistance and conservation planning. Western Farmers Electric Cooperative provided $50,000 to cooperating producers to support practices that sequestered carbon in soils. Finally, the Oklahoma LCSP provided approximately $227,695 matched by $308,091 from landowners. Conservation Districts, Oklahoma's Association of Conservation Districts, Oklahoma State University Cooperative Extension, and others facilitated the successful restoration. The calculations of greenhouse gas reductions were determined utilizing the NRCS COMET PLANNER tool through a partnership effort of Oklahoma NRCS, the Oklahoma Conservation Commission and the USDA Southern Plains Climate Hub.

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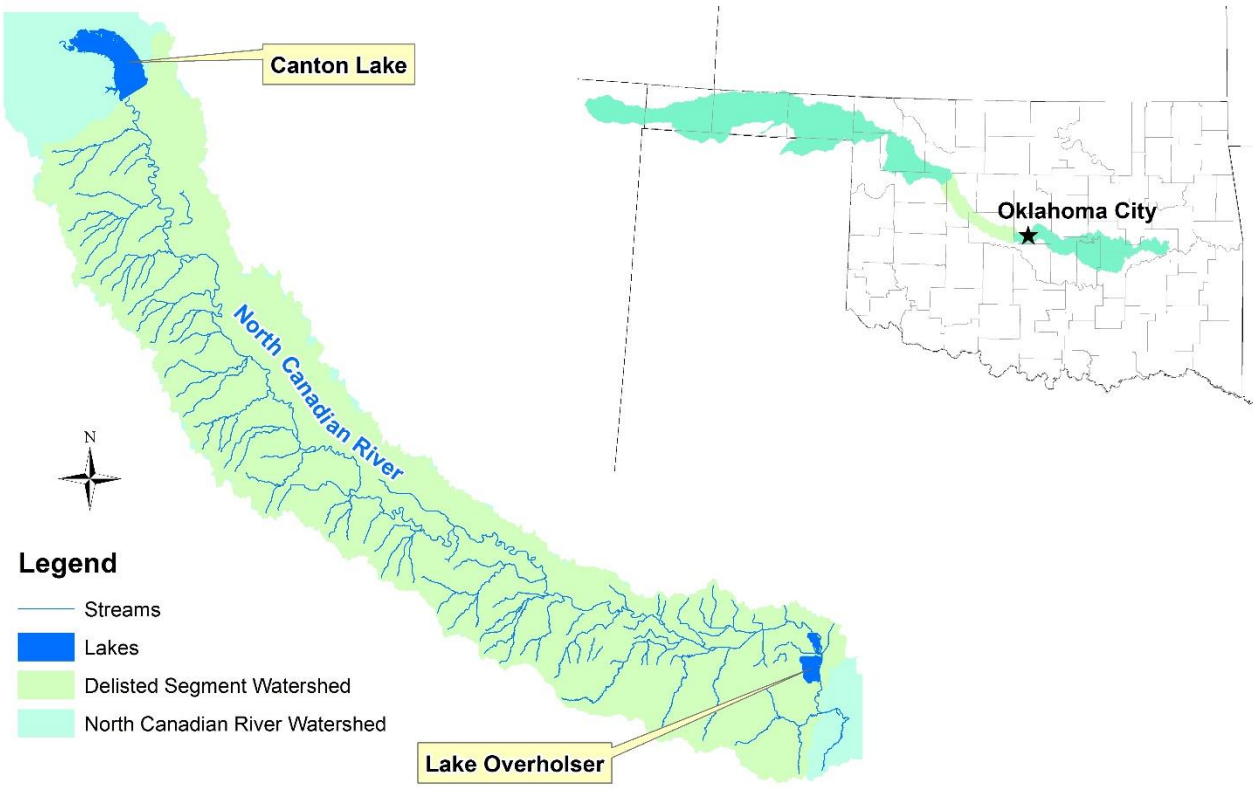

Figure 1. The delisted segment of the North Canadian River Watershed in central Oklahoma.

Table 1. Conservation practices installed in the North Canadian River watershed.

Practice Name	Amount Installed	Units	Practice Name	Amount Installed	Units
riparian area protection	586	ac.	prescribed grazing	14,427	ac.
riparian fencing	85,077	ft.	no-till	42,417	ac.
cover crop	308	ac.	no-till/strip-till	1,261	ac.
livestock pipeline	7,422	ft.	range planting	256	ac.
water well	49		brush management	3,412	ac.
conservation crop rotation	7,815	ac.	convert cropland to grass	1,345	ac.
fence	71,214	ft.	watering facility	18	tanks
upland wildlife habitat management	2,783	ac.	seasonal residue management	875	ac.
grassed waterways	214	ac.	reduced tillage	6,914	ac.
integrated pest management	23,857	ac.	grade stabilization structure	20	
forage and biomass planting	6,548	ac.	prescribed burning	88	ac.
septic system	17		livestock pumping plant	28	
terraces	18,838	ft.	conservation cover	659	ac.
contour farming	205	ac.	critical area planting	192	ac.
deep tillage	1,397	ac.	diversion	6441	ft.
nutrient management	14,147	ac.	pond	43	
rotation of supplement and feeding areas	351	ac.	grid soil sampling for nutrient management	11,710	ac.

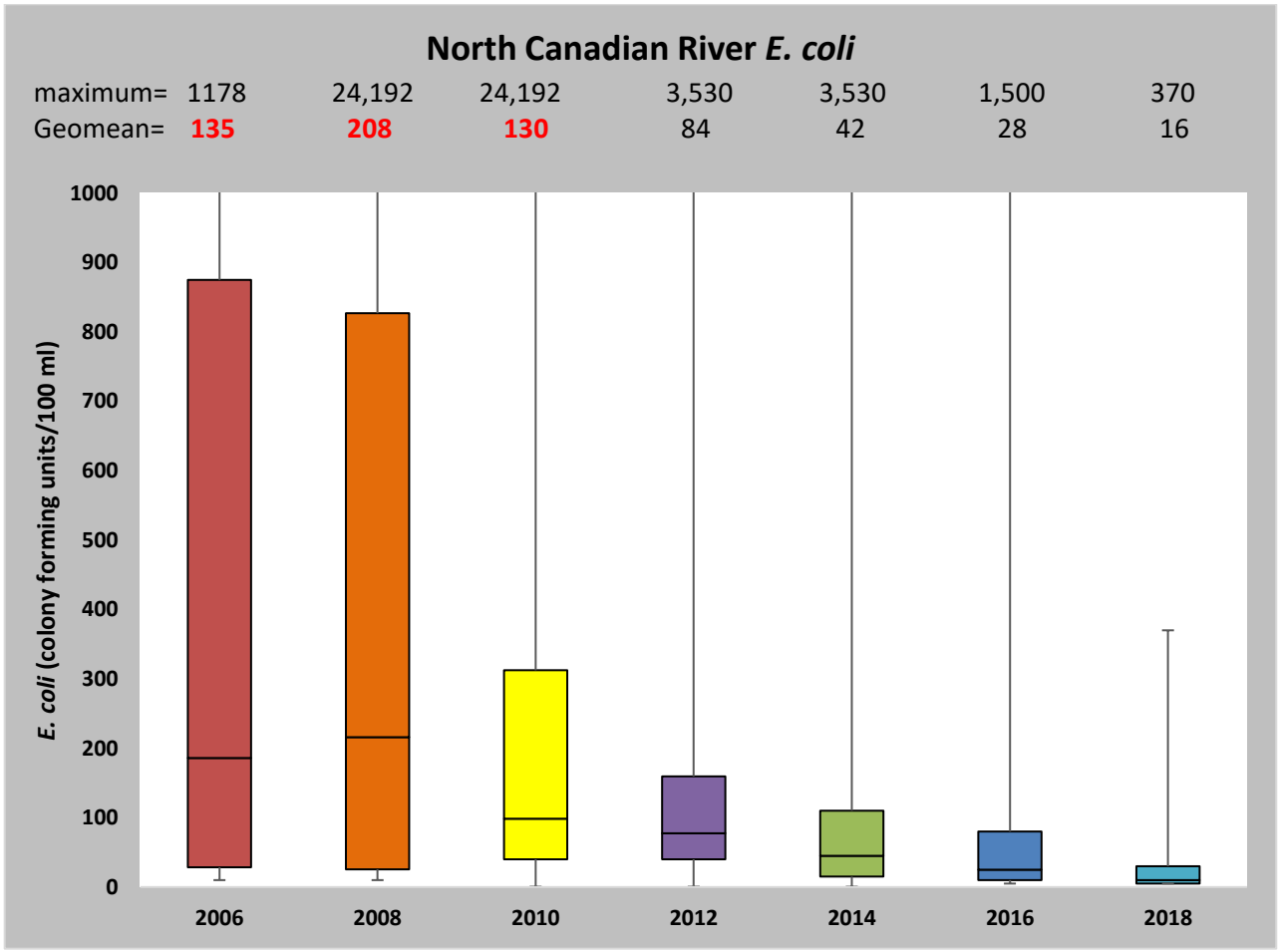

Figure 2. *E. coli* concentrations decreased with improved cropland and grazing land management in the watershed.