“Bundled Benefits”

A Kansas perspective

Conservation Practices As Tools To Address Water Quality And Climate Change: Two Case Studies in Kansas

Shanon Phillips and Clay Pope, CSP LLC,
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 Kansas: Two Case Studies in the Heartland

Multiple federal, state and local partners have invested billions of dollars to install conservation practices on privately owned lands primarily through federal programs. These initiatives began as a response to the environmental disaster that was the Dust Bowl of the 1930s and have continued to evolve to address additional resource needs in the modern era. Beginning with the U.S. Department of Agriculture's (USDA) Soil Conservation Service (now the Natural Resources Conservation Service, NRCS), and continuing through the efforts of multiple additional agencies such as the Environmental Protection Agency (EPA), the USDA Farm Services Agency (FSA), the U.S. Fish and Wildlife Service (USFWS) and others, farmers, ranchers, and other landowners have worked in partnership through voluntary programs to install conservation practices to protect natural resources and continue the production of food and fiber to feed the world.

Although some benefits of these programs are well understood (for instance, despite more severe droughts, we have not seen a return of the epic dust storms and vast environmental devastation of the 1930s), many other benefits are not well documented. For example, voluntary, locally-led conservation programs have been shown to be so effective in reducing soil erosion that alluvial fans are greatly diminished on many rivers such as the Mississippi. However, we are only beginning to capture information that documents the additional, sometimes unplanned benefits that these programs have in addressing multiple environmental challenges. For instance, reductions in the erosion of sediment and other pollutants not only preserve the fertility of agricultural lands, but also improve downstream water quality. Even more rarely documented is the potential positive impact that conservation practices can have on climate change through carbon sequestration and avoided emissions from reduced fuel and commercial fertilizer consumption.

This report presents two case studies in Kansas that highlight the dual benefits of locally led, voluntary conservation programs in protecting water quality and reducing greenhouse gas levels in the atmosphere. The installation of these conservation practices has been completed almost exclusively through Farm Bill Conservation Title Programs such as the Environmental Quality Incentives Program (EQIP) in partnership with State of Kansas Conservation Programs. In Kansas, the Kansas Department of Health and Environment uses EPA Clean Water Act Section 319 Nonpoint Source Funds to support Watershed Restoration and Protection Strategies (WRAPS) groups to address water quality impairments in priority watersheds. Local stakeholder leadership teams who use local expertise and knowledge to prescribe solutions that address water quality problems develop these WRAPS plans.

These WRAPS partnerships have installed sufficient conservation practices to make significant progress toward sediment, nutrient, and bacteria load reductions that will ultimately allow the removal of multiple streams from the Kansas Impaired Streams (303(d)) list and support healthy Kansas's streams and lakes. Additional review of the conservation practices implemented in these subwatersheds utilizing the NRCS COMET PLANNER tool also estimated significant reductions in greenhouse gases through carbon sequestration and avoided emissions through reduced fuel use. When combined, these reductions total an estimated 17,368 tons of carbon dioxide equivalent annually. This translates to a total estimated greenhouse gas reduction equivalent to taking 3,695 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.

Shanon Phillips and Clay Pope

CSP LLC, for the USDA Southern Plains Climate Hub

Implementation of Conservation Practices Reduces Nutrient and Sediment Loading to the Cottonwood River While Reducing Greenhouse Gas Levels by 9,422 Tons of CO_2 Equivalent Per Year

[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).

Segments of the Cottonwood River and its tributaries were listed on the Kansas Clean Water Act (CWA) section 303(d) list of impaired waters for causes including nutrients, sediment, sulfate, bacteria, and atrazine. Stream bank erosion and runoff of nutrients, sediment, and other pollutants from grazing and croplands contributed to these impairments. Implementation of conservation practice systems (CPs) to promote better quality grazing lands, improved animal waste management, and reduced erosion decreased sediment, nutrient and bacteria loading into the watershed. Bacteria concentrations decreased sufficiently by 2010 for 9 segments in the Cottonwood River Watershed to be removed from the 303(d) list (and documented in an EPA Nonpoint Source Success Story), but sediment and nutrient data do not yet show significant water quality improvement. However, through voluntary conservation programs, watershed partners have implemented sufficient additional conservation practices since 2011 to document significant additional progress toward nutrient and sediment load reduction goals prescribed by a 9 element Watershed Restoration and Protection Strategy (WRAPS).

The Cottonwood River Watershed drains approximately 1,696 square miles (1,085,373 acres) primarily in Chase, Lyon, and Marion counties in southeast Kansas. Marion Lake, a federal reservoir managed by the U.S. Army Corps of Engineers, is located upstream of the project area in the Cottonwood Watershed. Downstream, the Cottonwood River is a tributary to the Neosho River, which drains to John Redmond Reservoir in Kansas and Grand Lake in Northeastern Oklahoma. Seven stream and river segments in the watershed were listed as impaired on the 2010 Kansas 303(d) list due to causes including nutrients, bacteria, copper, zinc, sulfate, siltation, and atrazine. EPA approved total maximum daily loads (TMDLs) have been developed for most of these waterbodies that set load reduction goals necessary to restore water quality.

Land use in the watershed is primarily pasture and grasslands (69 percent of total) for cattle and hay production. About a fourth of the watershed is cropland (approximately 26 percent) for corn, wheat, soybean, and grain sorghum production, and approximately 3 percent is forested.

Stream bank erosion and grazing and crop land management contributed to excess nutrients, sediment, bacteria and certain pesticides in waterbodies within the watershed. Beginning in 2009, two stakeholder leadership teams (SLTs) were formed in the upper and lower Cottonwood River Watershed to address watershed concerns including water quality and flooding. These groups have received EPA 319 Funds and Kansas Water Plan funds to develop a Watershed Restoration and Protection Strategy (WRAPS) for the Cottonwood River Watershed. The WRAPS program worked with watershed citizens, representatives of local governments, natural resource agencies and organizations, public water supplies and others to develop a plan to address water quality impairments in the watershed through largely voluntary, incentive-based conservation programs. The WRAPS groups worked among themselves to recommend a suite of conservation practices that would help the watershed achieve the reduction goals set by the TMDLs. They also defined targeted areas within the watershed based on results of watershed modeling using the Soil and Water Assessment Tool (SWAT) model and based on watersheds with high priority TMDLs. The TMDL for downstream John Redmond Lake called for load reductions of 238,030 tons of sediment and 229,125 pounds of phosphorus from the Cottonwood River Watershed. The SLTs set implementation goals to reach desired sediment, nutrient and bacteria load reduction goals over the next forty years that included 12,111 acres of conservation crop rotations, 42,303 acres of grassed waterways, 57,486 acres of no-till, 45,364 acres of vegetative buffers, 10,576 acres of terraces, 12,111 acres of permanent vegetation, repair of 73,683 feet of eroding streambank among other practices.

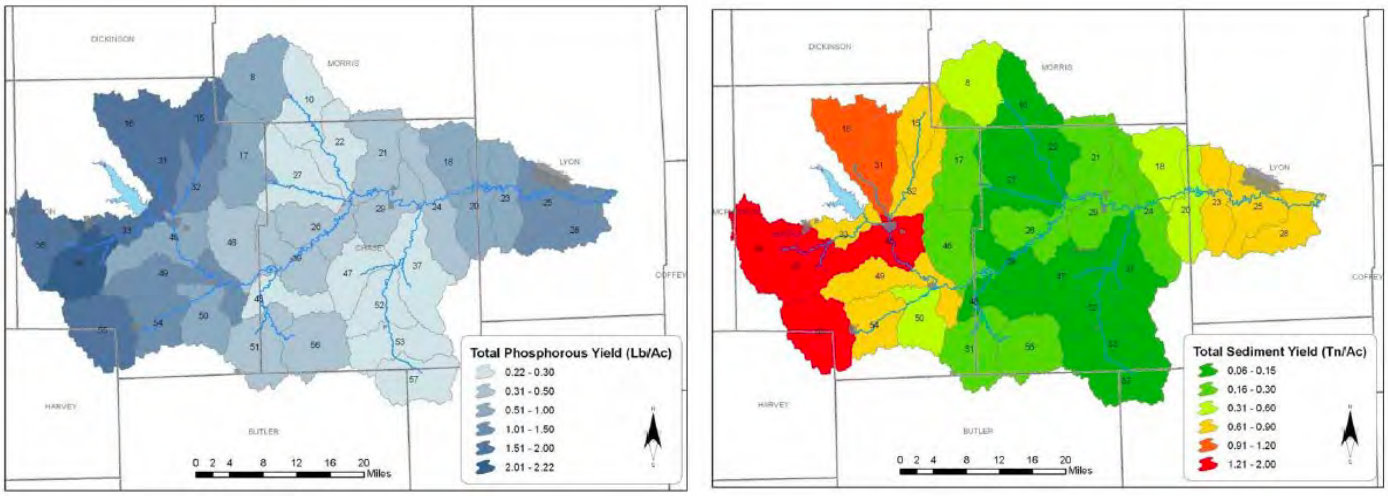

Figure 1. Predicted phosphorus and sediment yield in subwaterheds as summarized in Cottonwood River Watershed Plan.

Project Highlights:

Land managers in the watershed worked with the Chase, Marion, and Lyon county conservation districts, the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), the Kansas Department of Agriculture – Division of Conservation (KDA-DOC), the Kansas Department of Health and Environment (KDHE) and the Cottonwood WRAPS partners to implement CPs with funding from the U.S. Environmental Protection Agency (EPA) Region 7 section 319 Nonpoint Source Program (NPS), through Kansas NRCS' Environmental Quality Incentives Program (EQIP), State of Kansas cost-share dollars, and funding from the State of Kansas Water Plan.

Figure 2. Cottonwood River in Central Kansas.

From 2011to 2015, landowners installed numerous CPs to address pollution from agricultural areas. Examples of these CPs included 4,119 acres of nutrient management, 1,628 acres of conservation crop rotation, 1,612 acres of critical area planting, 1,193 acres of grassed waterways, multiple alternative water supplies, cross fencing, 4,947 acres of prescribed grazing, 6,418 acres of no-till, 5,180 acres of terraces and 3,625 acres of upland wildlife habitat management. The majority of practices installed were recommended in the WRAPS plan to address the nutrient and sediment problems and progress for many conservation practices is ahead of the schedule defined in the plan.

Results:

KDHE staff used water quality models to estimated anticipated load reduction from installed CPs to total 34,731 tons of sediment, 45,264 lb. of phosphorus, and 86,339 lb. of nitrogen per year. These numbers account for approximately 15% of the load reduction goals for sediment and 20 % of the phosphorus goal. Although instream water quality monitoring results do not yet show significant improvement in phosphorus or sediment, significant progress toward load reduction goals have been made during the first four years of implementation following the watershed plan development. Additional CPs are planned for the future and if the current pace of load reduction is maintained, it is anticipated that the watershed load reduction goals can be achieved in 20 - 27 years, which is ahead of the watershed plan goal of 40 years.

Additional climate change mitigation benefits were calculated using the NRCS COMET PLANNER tool to determine the overall impact that improved land management practices would have on carbon dioxide, nitrous oxide, and methane levels in the atmosphere. Calculations determined by COMET PLANNER

showed that conservation practices that reduced runoff of sediment and nutrients also reduced an estimated 9,422 tons of carbon dioxide equivalent per year.

Partners and Funding:
KDHE supported development of the formation and development of the WRAPS group using 319 funding from EPA Region 7. USDA NRCS, KDA-DOC, local conservation districts, and the Cottonwood River WRAPS programs cooperated to install conservation practices using a combination of NRCS, State of Kansas Cost-share dollars, funding from the Kansas Water Plan, and EPA 319 grants. To date, more than $647,769 has been used to support CP installation through voluntary cost-share programs in cooperation with landowners and land managers. Estimtes of greenhouse gas reductions were determined using the NRCS COMET PLANNER tool through a partnership effort of KDHE and the USDA Southern Plains Climate Hub.

For additional information contact:
Andrew S. Lyon
Kansas Department of Health and Environment
Andrew.Lyon@ks.gov
(785) 296-5567

Shanon Phillips
Shanon.phillips@yahoo.com
405-343-5916

Or

Clay Pope
CSP, LLC/USDA Southern Plains Climate Hub
claygpope@gmail.com
405-699-2087

Implementing Agricultural Conservation Practices Reduces Nutrient and Sediment Loading in the Delaware River Watershed with an Annual Result of 7,946 Metric Tons of Greenhouse Gas Reductions.

Streams, rivers, and lakes in the Delaware River Watershed were listed on the Kansas Clean Water Act (CWA) section 303(d) list of impaired waters for causes including nutrients, sediment, dissolved oxygen, bacteria, and atrazine. Stream bank erosion and runoff of nutrients, sediment, and other pollutants from grazing and croplands contributed to these impairments. Implementation of conservation practice systems (CPs) to promote better quality grazing lands, improved animal waste management, and reduced erosion decreased sediment and nutrient loading into the watershed. Although water quality has not improved sufficiently for delisting, partners in the watershed expect to document progress soon based on the significant progress toward load reduction goals prescribed by a 9 element Watershed Restoration and Protection Strategy (WRAPS).

The Delaware River Watershed drains approximately 1,157 square miles (740,772 acres) in Atchison, Brown, Jackson, Jefferson and Nemaha counties in northeast Kansas. Perry Lake, a federal reservoir managed by the U.S. Army Corps of Engineers, is located on the southern end of the watershed. Approximately 511 of the total 637 stream miles in the watershed and 8 lakes and wetlands were listed as impaired on the 2004 Kansas 303(d) list due to causes including nutrients, bacteria, copper, siltation, and atrazine. EPA approved total maximum daily loads (TMDLs) have been developed for most of these waterbodies that set load reduction goals necessary to restore water quality.

Land use in the watershed is primarily pasture and grasslands (51 percent of total) for cattle and hay production. About a third of the watershed is cropland (approximately 35 percent) for corn, wheat, soybean, and grain sorghum production, and approximately 10 percent is forested.

Stream bank erosion and grazing and crop land management contributed to excess nutrients, sediment, bacteria and certain pesticides in waterbodies within the watershed. Beginning in 2005, the Glacial Hills Resource Conservation and Development Region received EPA 319 Funds and Kansas Water Plan funds to develop a Watershed Restoration and Protection Strategy (WRAPS) for the Delaware River Watershed. The WRAPS program worked with watershed citizens, representatives of local governments, natural resource agencies and organizations, public waters supplies and others to develop a plan to address water quality impairments in the watershed through largely voluntary, incentive-based conservation programs. The WRAPS groups worked among themselves to recommend a suite of conservation practices that would help the watershed achieve the reduction goals set by the TMDLs. The

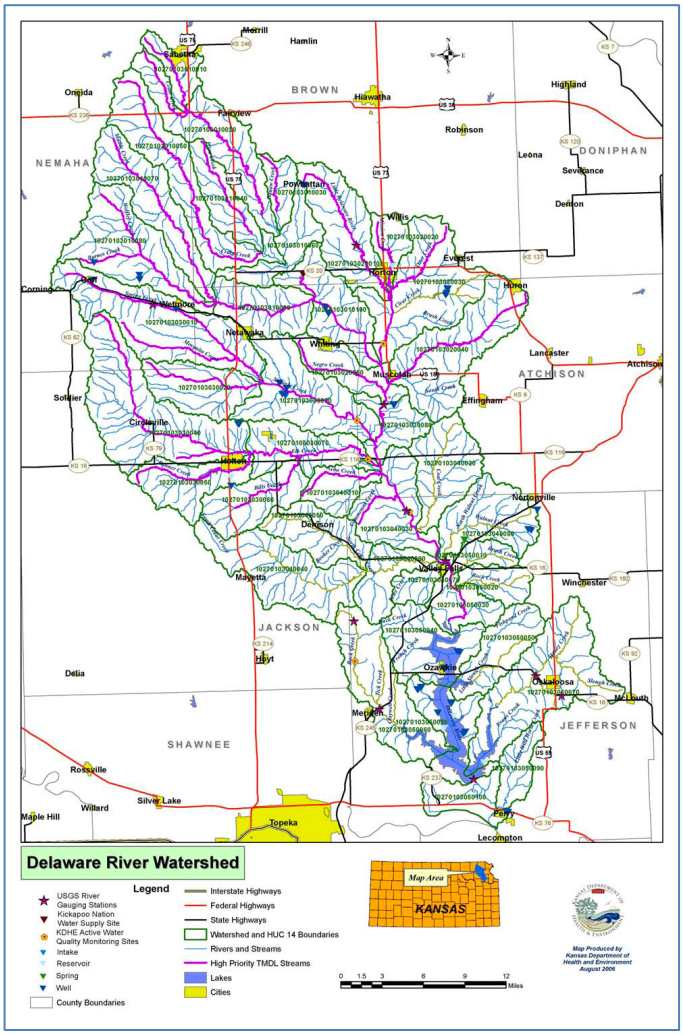

Figure 3. Delaware River Watershed. (Delaware River WRAPS, 2007).

TMDL for Perry Lake, located near the outlet of the watershed, called for load reductions of 284,860 tons of sediment, 177,102 pounds of phosphorus, and 856,570 pounds of nitrogen.

Project Highlights:
Land managers in the watershed worked with the Atchison, Brown, Jackson, Jefferson, and Nemaha county conservation districts, the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), the Kansas Department of Agriculture – Division of Conservation (KDA-DOC), the Kansas Department of Health and Environment (KDHE) and the Delaware River WRAPS program to implement CPs with funding from the U.S. Environmental Protection Agency (EPA) Region 7 section 319 Nonpoint Source Program (NPS), through Kansas NRCS' Environmental Quality Incentives Program (EQIP), State of Kansas cost-share dollars, and funding from the State of Kansas Water Plan.

From 2011to 2015, landowners installed numerous CPs to address pollution from agricultural areas. Examples of these CPs included 1,587 acres of nutrient management, 6,749 acres of conservation crop rotation, 1,583 acres of cover crops, 41,905 linear feet of cross fencing, 697 acres of grassed waterways, 1,384 acres of mulch till, 5,973 acres of no-till, 980 feet of streambank stabilization , 481,287 linear feet of terraces and many other practices (figure 4). The majority of practices installed were recommended in the WRAPS plan and progress for many conservation practices are ahead of the schedule defined in the WRAPS plan.

Figure 3. CPs installed in the Delaware River Watershed includes stream bank restoration and riparian buffer protection.

Results:
KDHE staff used water quality models to estimated anticipated load reduction from installed CPs to total 55,005 tons of sediment, 70,224 lb. of phosphorus, and 146,085 lb. of nitrogen per year. These numbers account for approximately 19% of the load reduction goals for sediment, 40 % of the phosphorus goal and approximately 17% of the nitrogen goal. Although instream water quality monitoring results do not yet show significant improvement, significant progress toward load reduction goals have been made during the first four years of implementation following the watershed plan development. Additional CPs are planned for the future and if the current pace of load reduction is maintained, it is anticipated that the watershed load reduction goals can be achieved in 10 - 22 years, which is ahead of the watershed plan goal of 30 years.

NRCS COMET PLANNER tool was used to estimate annual reduction of carbon dioxide equivalents due to select CPs. Protecting 6.86 acres of forested riparian buffer was estimated to reduce 17 tons of carbon

dioxide while nutrient management on 1,587 acres was estimated to reduce 2,800 tons of CO_2. Cover crops on 1,583 acres was shown to reduce CO_2 by 590 tons annually while critical area planting on 274 acres reduced 520 tons of CO_2 annually. Conversion from conventional tillage to no-till led on 5,973 acres led to one of the most significant reductions in CO_2 of 1,800 tons annually. Total estimated reductions from conservation practices were estimated at 7,945 tons CO_2 per year.

Partners and Funding:
KDHE supported development of the formation and development of the WRAPS group using 319 funding from EPA Region 7. USDA NRCS, KDA-DOC, local conservation districts, Glacial Hills RC&D, landowners, and the Delaware River WRAPS program cooperated to install conservation practices using a combination of NRCS, State of Kansas Cost-share dollars, funding from the Kansas Water Plan, and EPA 319 grants. To date, more than $1,413,161 has been used to support CP installation through voluntary cost-share programs in cooperation with landowners and land managers.

Calculations of greenhouse gas reductions were determined utilizing the NRCS COMET PLANNER tool through a partnership effort between KDHE and the USDA Southern Plains Climate Hub.

For additional information contact:
Andrew S. Lyon
Kansas Department of Health and Environment
Andrew.Lyon@ks.gov
(785) 296-5567

Shanon Phillips
Shanon.phillips@yahoo.com
405-343-5916

Or

Clay Pope
CSP, LLC/USDA Southern Plains Climate Hub
claygpope@gmail.com
405-699-2087