CONSERVATION RESERVE ENHANCEMENT PROGRAM

PENNSYLVANIA CREP 2012-2013 HIGHLIGHTS

PHOTO OF DAMSEL FLY IN MILLCREEK CREP BUFFER.
PHOTO COURTESY OF DEP.

OCT. 1, 2012 – SEPT. 30, 2013

CONSERVATION RESERVE ENHANCEMENT PROGRAM PENNSYLVANIA CREP 2012-2013 HIGHLIGHTS

REPORTING PERIOD: OCT. 1, 2012 – SEPT. 30, 2013

EXECUTIVE SUMMARY

Grass legume wildflower mix—CP2. Photo courtesy of FSA.

One of the commonwealth's largest and most comprehensive conservation programs, the Pennsylvania Conservation Reserve Enhancement Program (CREP) continues to lead the nation in the number of acres enrolled in the national Conservation Reserve Program (CRP). This voluntary initiative aids agricultural producers in land preservation by decreasing erosion, restoring wildlife habitat and safeguarding both ground and surface water. The original CREP agreement was signed in 1999 with the first practices implemented in 2000. A few highlights:

- Some 23,703 CREP applications have been reviewed.
- Currently, there are 11,288 contracts in place with 165,923.7 acres under contract in Pennsylvania.
- 12,046 Conservation Plans have been completed on 193,106.9 acres.
  **See page 6 for a listing of cumulative acres per practice.*
- Some 11,193 landowners have received cost-share payments from FSA and the Commonwealth of Pennsylvania:
  - FSA has provided $56,825,779 in cost-share payments.

  **See page 8 for the listing of federal and state costs shares table.*

- The Commonwealth of Pennsylvania has provided $32,479,233 for cost-share payments.

In Pennsylvania's 2012-13 CREP program year:

- 655 contracts were approved on 9,269.7 acres.

- 278.4 acres of forested riparian buffers were installed.
- 8,608.5 acres of native grasses were planted.
- $1,796,825 in direct cost-share payments were obligated by the USDA's FSA Office between Oct. 1, 2012 and Sept. 30, 2013:
    - $1,293,890 in Chesapeake Bay
    - $502,935 in Ohio River Basin
- $921,389 in direct cost-share payments were obligated between Oct. 1, 2012 and Sept. 30, 2013, by the state Department of Environmental Protection:
    - $835,259 in Chesapeake Bay
    - $86,130 in Ohio River Basin

CREP PROGRAM OVERVIEW

CREP, an offshoot of the country's largest private-lands environmental improvement program, is a partnership among farmers, both the state and federal governments, and private groups. Administered by the United States' Department of Agriculture's (USDA) Farm Service Agency (FSA), CREP provides farmers and other landowners with a sound financial package for conserving and enhancing natural resources.

A federal annual rental rate is offered, plus cost share of up to 100 percent [50 percent from FSA and 50 percent from the state Department of Environmental Protection (DEP).] These parties and the state's FSA office then developed a project proposal to address particular environmental issues and goals, such as the reduction of nonpoint source pollution in the state's water bodies as well as enhancement of wildlife habitat.

Before (left) and after (right) photos of the King Farm Buffer and manure management.

Photos courtesy of DEP.

Like CRP, CREP contracts require a 10- to 15-year commitment to keep environmentally-sensitive lands out of agricultural production. CREP provides payments to participants who offer eligible land, which are those lands that have been planted with an agricultural commodity during four out of the six years between 2002 and 2007 and have been held by the landowner for the last 12 months. Highly erodible lands (HEL) eligible for enrollment meet the following criteria:

- All pasture, hayland and cropland within 180 feet of a stream regardless of Erodibility Index (EI) value.
- All cropland within 1,000 feet of a stream with EI $\geq$ 8 and < 12.
- All cropland further than 1,000 feet from a stream with an EI of greater than 12.

A federal annual rental rate is offered, plus federal cost-share of up to 50 percent of the eligible costs to install the practice. Further, the program generally offers a federal signing incentive for participants to install specific practices.

FSA uses CRP funding to pay a percentage of the program's cost, while state government provides the balance of the funds through the Environmental Stewardship Act funds [Growing Greener (I and II)]. State government and nonprofit groups involved in the effort provide technical support and other in-kind services.

For the landowner, CREP is not just a cost-effective way to address environmental problems and meet regulatory requirements; it can provide a viable option to supplement farm income as well. CREP is convenient for farmers and other landowners because it is based on the familiar, CRP model. Enrollment is on a continuous, voluntary basis which permits farmers and other landowners to join the program at any time rather than waiting for specific sign-up periods.

CREP supports increased conservation practices that help protect streams, lakes and rivers from sedimentation and agricultural runoff. Restoring water regimes helps protect national treasures, like Pennsylvania's portion of the Chesapeake Bay and the Ohio River Basin.

The CREP partners finalized a draft proposal in 2012 to expand the program into the seven (7) counties in the PA portion of the Delaware River Basin including (from north to south): Bucks, Delaware, Lehigh, Monroe, Montgomery, Northampton and Pike. The Delaware River Basin CREP will coordinate federal, state and local efforts to address various natural resource issues throughout the

project area by seeking to retire 20,000 acres of marginal cropland, pastureland and/or environmentally-sensitive land to include: 16,000 acres of HEL practices; 2,000 acres of Riparian Forest Buffers; 1,500 acres of other buffer practices and 500 acres of wetland restoration. PA DEP and the state FSA office worked with a contractor to complete an environmental assessment in compliance with the National Environmental Policy Act for the enactment of the Delaware River Basin CREP. The Delaware River Basin CREP should be open for enrollment in 2014.

PENNSYLVANIA 2012-2013 CREP SUMMARY

In Pennsylvania, CREP initiatives are tailored to address the environmental concerns of the Chesapeake Bay and Ohio River drainages, as well as the surrounding upland habitat. The program is voluntary and offers financial incentives to encourage agricultural landowners and operators to enroll targeted environmentally-sensitive and potentially wildlife-friendly acres of pastureland and cropland. This includes the establishment of native grass stands, riparian buffers, wetlands, wildlife habitat, grass filter strips and other land improvement practices. Pennsylvania CREP has a maximum authorized enrollment of 259,746 acres across 59 counties and currently has 163,881 acres under contract for the benefit of soil, water and wildlife. CREP is a model for success in finding cooperative solutions to environmental challenges of today and has been met with overwhelming interest and support by the agricultural community. Minimum riparian buffer widths, which were 35 feet from the top of the stream bank in the lower 20 acres of the PA Chesapeake Bay CREP, rose to 50 feet with the amendments.

CREP contracts are expiring on September 30th of every year, and re-enrollment remains low due to a variety of reasons. The primary reason for low re-enrollment across the nation, as well as PA, continues to be high commodity crop prices. PA continues their aggressive outreach efforts aimed at contacting landowners prior to their contract expiration dates. FSA and partner agencies offer resources and assistance to landowners in order to determine what maintenance may be needed to keep the acreage in compliance with their current contract, as well as hopefully providing opportunities to meet the established thresholds for re-enrollment in the future.

PENNSYLVANIA CREP PRACTICE ACRE SUMMARY

SUMMARY OF CREP CONTRACTS BY PRACTICE ACRES AND OCCURENCES

As of the end of September 2013

Practice	Description	Acres	Practice Occurrences
CP1	Introduced grasses and legume planting	89,256.8	3,489
CP2	Native grass planting	29,826.2	1,604
CP3	Tree planting	21.1	4
CP3A	Hardwood tree planting	985.5	165
CP4B	Wildlife habitat corridor	23.4	3
CP4D	Permanent wildlife habitat	4,252.4	301
CP8A	Grassed waterways	248.3	254
CP9	Shallow water areas for wildlife	33.2	15
CP10	Vegetative cover already established (grass)	9,118.8	349
C12	Wildlife food plots	1,278.2	453
CP15A	Contour grass buffer strips	51.5	21
CP21	Filter strips	1,338.2	345
CP22	Riparian forest buffers	24,833.5	3,845
CP23	Wetland restoration	985.1	94
CP29	Marginal pastureland wildlife habitat buffer	1,167.5	232
CP30	Marginal pastureland wetland buffer	459.3	63
CP31	Bottomland hardwood on wetlands	2	1
TOTALS		163,881	11,238

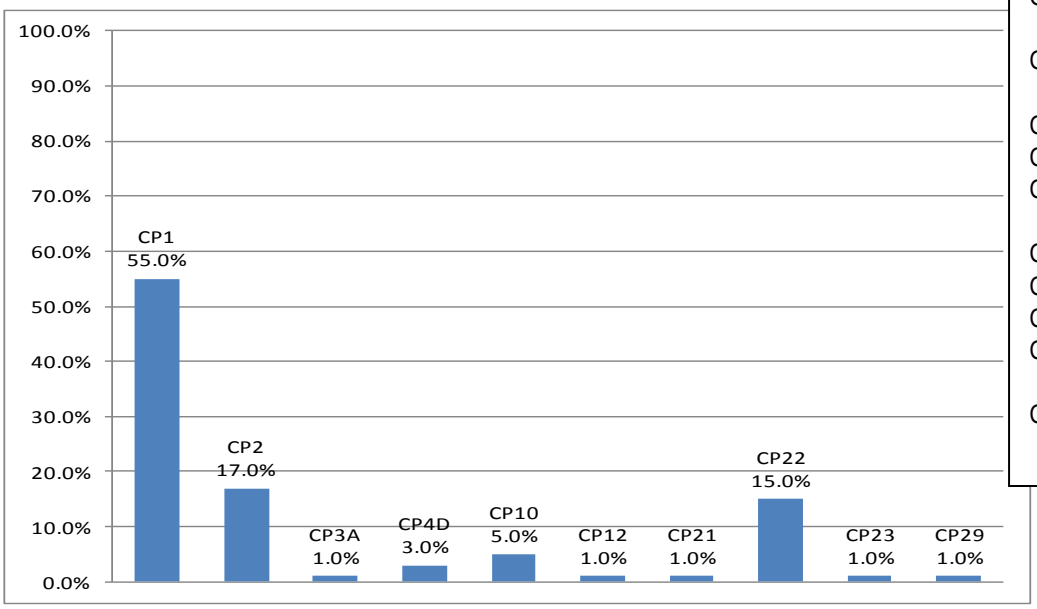
Chart modified from the USDA's FSA Summary of Active CREP Contracts by Program Year: CRP-Monthly Contracts Report. Oct. 30, 2013.

PENNSYLVANIA CREP PRACTICE ACRE SUMMARY TABLES

CP1: Introduced grasses and legume planting
CP2: Native grass planting
CP3: Tree planting
CP3A: Hardwood tree planting
CP4B: Wildlife habitat corridor
CP4D: Permanent wildlife habitat
CP8A: Grassed waterways
CP9: Shallow water areas for wildlife
CP10: Vegetative cover already established (grass)
CP11: Established trees
CP12: Wildlife food plots
CP15A: Contour grass buffer strips
CP21: Filter strips
CP22: Riparian forest buffers
CP23: Wetland restoration
CP29: Marginal pastureland wildlife habitat buffer
CP30: Marginal pastureland wetland buffer

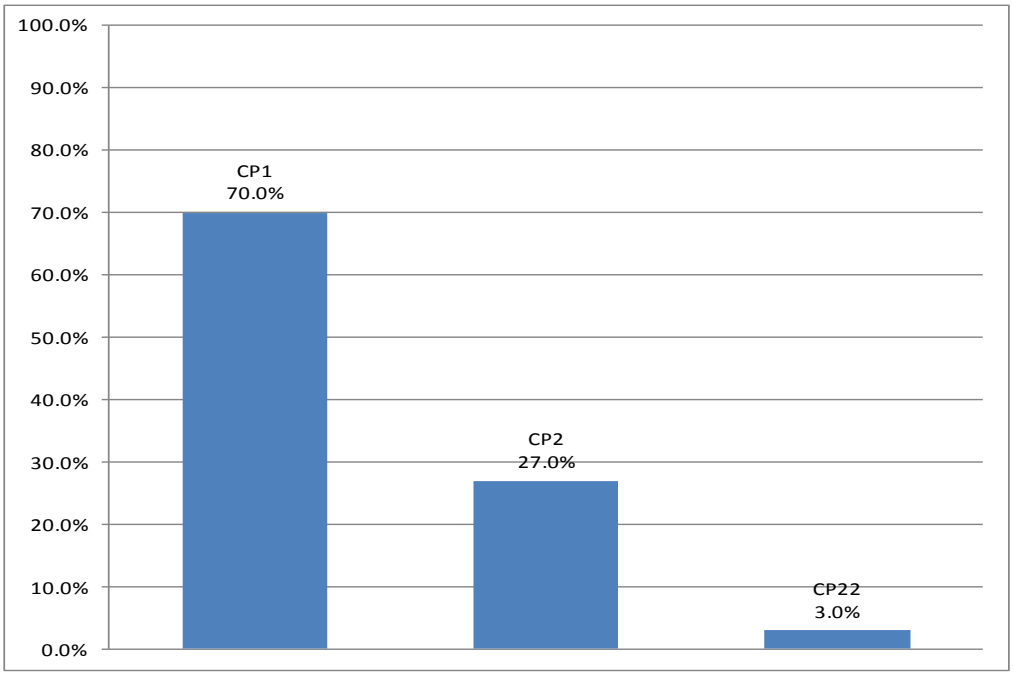
1999-2013

(CP3, CP4B, CP8A, CP9, CP15A, CP30, and CP31 are less than 1% and not reportable.)



2012-2013 (only)

(CP3A, CP4D, CP8A, CP12, CP21, CP30 are less than 1% and not reportable.)



(or no reportable activity) from 2012-2013 per acre:

CP9, CP10, CP15A, CP23, CP29

PRACTICES OUTLINED BY FEDERAL AND STATE
MAXIMUM COST SHARE PER ACRE

CREP PRACTICE	SRR INCENTIVE	COST SHARE		INCENTIVES		
		FSA	PA	SIP	PIP	MISC
CP1 – Establishment of Cool Season Grass	(1)	50%	50% up to $40 per acre (5)			
CP2 – Establishment of Native Grasses (Switchgrass Only)	(1)	50%	50% up to $65 per acre (5)			
CP2 – Establishment of Native Grasses (Mixed Varieties)	(1)	50%	50% up to $120 per acre (5)			PA Game Commission (3)
CP4D – Permanent Wildlife Habitat	(1)	50%	50% up to $160 per acre (5)			
CP8A – Grassed Waterways	150%	50%	50% up to $1000 per acre (5)	$100 per acre	40% of Eligible Costs	
CP9 – Shallow Water Area for Wildlife	(1)	50%	N/A	N/A	40% of Eligible Costs	
CP12 – Wildlife Food Plot	(1)	N/A	N/A			
CP15A – Establishment of Permanent Vegetative Cover: Contour Strips	150%	50%	50% up to $65 per acre (5)	N/A	40% of Eligible Costs	
CP21 – Filter Strips	150%	50%	50% up to $70 per acre	$100 per acre	40% of Eligible Costs	
CP22 – Riparian Buffer (Without Fencing)	150%	50%	50% up to $850 per acre (2)	$100 per acre	40% of Eligible Costs	
CP22 – Riparian Buffer (With Fencing)	150%	50%	50% up to $1250 per acre (2)	$100 per acre	40% of Eligible Costs	
CP23 – Wetland Restoration	150%	50%	50% up to $740 per acre	$150 per acre	40% of Eligible Costs	
CP29 – Wildlife Habitat Buffer (without fencing) (4)	150%	50%	None	$100 per acre	40% of Eligible Costs	
CP29 – Wildlife Habitat Buffer (with fencing) (4)	150%	50%	50% up to $400 per acre (2)	$100 per acre	40% of Eligible Costs	

CREP PRACTICE	SRR INCENTIVE	COST SHARE		INCENTIVES		
		FSA	PA	SIP	PIP	MISC
CP30 – Wetland Buffer (4)	150%	50%	None	$100 per acre	40% of Eligible Costs	
CP33 – Habitat Buffer For Upland Birds	150%	50%	50% up to $65 per acre (5)	$100 per acre	40% of eligible costs	

Disclaimer: Practices outlined by federal and state maximum cost share per acre.

NOTES:

(1) SRR Incentive varies with the weighted E1 for the eligible acres offered according to the following chart:

- $8 \leq E1 \leq 12$ 75% Incentive
- $12 < E1 \leq 20$ 150% Incentive
- $20 < E1 \leq 25$ 175% Incentive
- $25 < E1 \leq 30$ 200% Incentive
- $E1 > 30$ 225% Incentive

(2) The State of Pennsylvania cost share reimbursement is only available on Riparian Buffers that are 50 feet or more in width. In the case of CP 29, no mowing will be done in the first 50' from top of bank. The cost share will not be paid until the participant completes a PA Stream Buffer Tracking Form and submits it to the State FSA office.

(3) Incentive only available if land enrolled in CREP is also enrolled in the Pennsylvania Game Commission Farm Game or Safety Zone Program. Maximum payment to any one CREP participant is $2,999.99.

(4) Eligible only on Marginal Pastureland.

(5) Pennsylvania cost share will be provided to the limits indicated for this practice if any of the following apply:

a. The participant agrees to enroll all areas eligible along the riparian corridor on the enrolled tract in practice CP22 and/or CP29 at a minimum of 50 feet from bank.

b. The participant signs a maintenance agreement for post planting establishment on practice CP22 and/or

c. The participant has no water bodies on the offered tract but has water bodies on adjacent tract(s) and agrees to sign an agreement to maintain all existing and functioning forested buffers or enroll all eligible areas in CP 22 and/or 29 at a minimum width of 50 feet from bank on all tracts adjacent to the offered tract.

d. The participant has no water bodies on the offered tract or on adjacent tracts(s).

CREP PARTNER RESOURCES & ACTIVITIES

A. COST-SHARE ARRANGEMENTS:

Pennsylvania Department of Environmental Protection (DEP): Since 2000, Pennsylvania has obligated $35,989,106 for direct cost share payments and administration of the payments through Growing Greener Grants to PACD.

For the current reporting period, Pennsylvania DEP has obligated $921,389 for direct cost share payments to farmers through a Growing Greener grant to the Pennsylvania Association of Conservation Districts, Inc. (PACD). Of this funding, $835,259 is dedicated to the Chesapeake Bay Basin and $86,130 to the Ohio River Basin.

The Pennsylvania Game Commission (PGC): The PGC expended $2,441 on incentive payments for the establishment of native warm season grasses during the current reporting period. The PGC provided incentive payments to landowners to re-enroll into CREP totaling $224,670 in the federal fiscal year. These are in-kind costs, not non-federal match.

B. EASEMENT PAYMENTS:

Pennsylvania's CREP agreement does not require easement payments to be made by Pennsylvania. However, in 2006, the DEP refocused state participation in CREP to encourage installation of edge of stream practices such as Riparian Forest Buffers (RFBs). As part of this refocusing effort, the department requires landowners to install RFBs through CP22 and protect any existing RFBs through a **Riparian Forest Buffer Protection Land Owner Assurance** on their properties for the duration of the CREP contract (which is 15 years for the majority of participants). If landowners install and/or protect RFBs on their streams or have no streams on their tract or adjoining tracts, they are eligible for state cost share on other conservation practices that are more than 180 feet from the stream. To date, more than 573 landowners have signed agreements with DEP to protect existing RFBs. DEP's Watershed Support Staff (WSS) continue to inspect existing RFBs and have completed inspections on more than 3,082 acres of existing RFBs to date.

The purpose of the inspection is to ensure the RFBs are being protected, determine their size and composition and identify candidate RFBs for permanent protection under conservation

easement. With the exception of a very small percentage (less than 5%) of the properties inspected were all cooperating within the terms of the Riparian Buffer Protection Agreement. Those that were operating outside the agreement terms were referred to local field personnel who assisted the property owners to address any outstanding issues. In addition the opportunities presented through the CREP Riparian Forest Buffer Protection Land Owner Assurance has assisted staff in expanding the permanent riparian easement opportunities by working with other state agencies (Fish and Boat Commission and DCNR) and non-governmental organizations (NGO) partners (Western PA Conservancy and Juniata Clean Water Partnership along with Blair and Huntingdon County Conservation Districts) to target limited resources to high priority interest are within the partnership. This partnership began with a pilot on the Frankstown Branch of the little Juniata which was very successful and is expanding into other areas mainly looking at WIP and/or TMDL related planning.

Frankstown Branch Lower section of Little Juniata River, just outside Alexandria (Huntingdon County). Photo courtesy of DEP.

C. TECHNICAL ASSISTANCE:

The Natural Resources Conservation Service (NRCS):

Through an agreement with Pheasants Forever and with support from the Game Commission, NRCS funds six Pheasants Forever biologists' and one Game Commission biologist's work in the Chesapeake Bay Watershed. There is also one Game Commission biologist whose work focuses

on the Ohio River Watershed. These biologists focus on all habitats, providing service to multi-county areas. The Chesapeake Bay Foundation, with funding support from NRCS, continues to assist NRCS with riparian buffer CREP applications and contracts. These wildlife biologists, along with NRCS field staff and state office staff, assisted landowners with existing CREP contracts or with new conservation plans for new contracts. The first year, where re-enrollment options were available in the lower Chesapeake, was in 2011. Technical assistance was provided in 2013 to continue farm-field eligibility and field visits to assess the existing wildlife habitat and/or the conversion of cropland to wildlife habitat. Practices included warm season grasses and wildflowers, cool season grasses and legumes, tree and shrub habitat, and riparian buffer habitat, just to name a few. New contract holders were assisted with practice implementation. NRCS actively assists with outreach to encourage landowners to sign up for wildlife practices while conserving the natural resources on their farm.

The Pennsylvania Game Commission (PGC): The PGC private lands section chief spent about 15 percent of his time on CREP administration, for a value of $13,500. In addition, regional PGC staff assisted with coordination and administration.

The Chesapeake Bay Foundation (CBF): The CBF was awarded public and private grant monies which were used to advance CREP in the Chesapeake Bay Basin. The CBF provides five (5) field staffers to provide technical assistance on forested buffer establishment. All of these positions are located in CREP counties. Collectively they spend a strong majority of their time on CREP forested buffers. CBF also conducted outreach on behalf of CREP forested buffers including operating and servicing the 800-941-CREP phone line, and providing staff and displays about forested buffers at roughly ten (10) farm, community, and other events.

In 2012-13, CBF worked to demonstrate that farmers are willing to implement forested buffers as a condition to receive other funding which they need and want for installing agricultural BMPs (BMPs other than forested buffers). Two distinct projects involve portions of 5 counties. Additional applications for funding will bring these incentives for forested buffers in combination with Ag BMPs to 7 new counties. Farmers also had to have a current conservation plan, address all runoff concerns from animal concentration areas, including barnyards, and deal with any milkhouse waste issues. This work is helping to generate ongoing demand for forested buffers, as is continuing CBF outreach on buffers and education/training for conservation professionals in partnership with DCNR at events held at and in cooperation with Stroud Water Research Center.

Other Technical Assistance: Several existing programs in Pennsylvania support the same program goals and objectives as the PA CREP. These activities include the funding of 43 Chesapeake Bay Program technicians and six (6) engineers in CREP counties; providing Growing Greener funds to hire watershed specialists in the 59 CREP counties to assist in the development of watershed plans; and Pennsylvania Department of Agriculture (PDA) and State Conservation Commission (SCC) funding for agriculture conservation technicians in 45 CREP counties. These technicians develop and assist in the implementation of resource management plans that can include nutrient management plans and conservation plans.

D. IN-KIND SERVICES:

Financial contributions for "in-kind services" occurred throughout the reporting period. Examples include meeting with state representatives to discuss CREP and meetings throughout the CREP counties. Other activities included advertisements in numerous local newspapers and newsletters, the distribution of brochures/literature at various events as well as the display of the CREP exhibit and one-on-one interaction with farmers to promote the CREP Program.

In addition to PA CREP staff assignments made by the DEP, PACD, CBF and PGC, each of the CREP partners has provided additional in-kind support for the CREP. All of the PGC services for this reporting period are considered in-kind services, not non-federal match. PGC expended $367,438 on nine (9) positions providing TA to the CREP program in the federal fiscal year.

E. MONITORING & EVALUATION

A subcommittee of the Statewide CREP committee was formed in 2004 to discuss monitoring and evaluation of CREP practices in PA. Participants in the meeting included representatives from the Game Commission (PGC), Fish Commission (PFBC) Susquehanna River Basin Commission (SRBC), PA Department of Agriculture, and PA Department of Environmental Protection (DEP). The subcommittee discussed the requirements for monitoring as set out in CREP agreement between the USDA and the commonwealth which requires an evaluation of program success through assessment of impact on wildlife habitat and water quality.

With regard to agency responsibilities for monitoring wildlife habitat benefits of CREP practices, PGC's representative explained that his agency in cooperation with Penn State University, has established "bird" routes to monitor all bird species and mammals (rabbits only) in the original 20 CREP counties in the lower Susquehanna.

Based on this study, PGC observed that CREP has resulted in an increase in the population of four species of wintering raptors, including the Northern Harrier. In addition, CREP has made feasible the reintroduction of wild pheasants into several locations in Pennsylvania. Populations in most areas have been steadily increasing. If CREP acres can be retained over time, they will become successful wild pheasant areas. A summary of the final report entitled "Evaluating the Effects of CREP on Ring-necked Pheasants and Grassland Birds and Farmland Birds" along with the abstract of an article entitled "Association of Wintering Raptors with Conservation Reserve Enhancement Program Grasslands in Pennsylvania," published in the 2010 *Journal of Field Ornithology* can be found in Appendix C of this report. Full copies of both the report and article can be obtained by contacting Mike Pruss of the PGC at mpruss@pa.gov.

With regard to agency responsibilities for monitoring water quality, the subcommittee recognized that monitoring of all waterbodies in PA to include those in CREP counties is ongoing as part of the Instream Comprehensive Evaluation Survey (ICE). As part of ICE, in April 2007 DEP completed a 10-year program to assess all wadeable streams. The census utilized a biological assessment of the aquatic life use. Since 2007, DEP has implemented new aquatic life biological assessment methods based on the current best science. Other designated uses and non-wadeable waters continue to be assessed as resources and time permitted. As of this report, 84,571 miles of streams and rivers are assessed for aquatic life use with 67,972 miles listed as attaining that water use. Of the impaired miles, 9,801 require development of a Total Maximum Daily Load (TMDL) to reduce pollutant inputs and 6,490 have an approved TMDL. An additional 62 miles are under compliance agreements and expected to improve within a reasonable amount of time. The two largest problems are agriculture and abandoned mine drainage. The largest stressors are siltation and metals. However, other problems should not be minimized because in local areas they may impact a relatively large percentage of waters. For example, urban runoff/storm sewers are a minor problem in rural areas but major in metropolitan regions.

There are 80,525 acres of lakes assessed for aquatic life use and 43,194 acres are attaining that use. Of the impaired acres, 5,420 require a TMDL, 11,366 have an approved TMDL, and 20,544 acres are impaired but do not require a TMDL because they are not affected by pollutants. The largest problem source is agriculture and largest stressors are nutrients, suspended solids, and organic enrichment/low D.O. As stated above, smaller problems should not be minimized because they still have regional importance.

To protect the health of those who consume fish caught in the commonwealth, DEP monitors fish flesh for possible contaminants. When concentrations of substances known to be harmful to humans reach action levels, fish consumption advisories are issued to inform people of the possible dangers and the actions they can take to protect themselves. Currently there are approximately 1,318 miles of fish consumption advisories in need of TMDLs and 704 with approved TMDLs. Lake listings include 40,405 acres requiring TMDLs and an additional 5,664 with approved TMDLs. There is a statewide fish consumption advisory of no more than one meal per week for all waters to protect against the ingestion of unconfirmed contaminants. The fish consumption listings in this report have triggered action levels more restrictive than the one meal per week. It should be noted that DEP directs much of its fish tissue sampling to areas where there is a greater chance of problems. As a result, it is not surprising to see a higher number of stream miles and lake acres impaired for this use compared to the stream miles (3,323) and lake acres (28,765) attaining this use.

Aquatic life use was the original focus of the statewide surveys because with a rapid and efficient biological assessment of aquatic macroinvertebrates (insects, snails, clams, etc.) it was possible to canvas the state over a 10-year period. In addition, aquatic life use is a good measure because it is reliable as an indicator of long-term pollution problems. Since completing the statewide census for aquatic life use, DEP is emphasizing developing assessment methodologies, programs, and partnerships to increase recreational and potable water supply use assessments.

Of the 2,422 stream miles assessed for recreational use, 1,205 were attaining. There are 1,209 impaired miles requiring a TMDL and 8 with an approved TMDL. Lake recreational use was assessed for 81,959 acres with 76,836 attaining, and 5,123 impaired requiring a TMDL. The potable water supply use was assessed for 3,357 stream miles with 3,194 attaining, 151 impaired requiring a TMDL, and 12 with approved TMDLs. Lake potable water supply use was assessed for 57,953 acres with 57,941 attaining, and 12 impaired requiring a TMDL.

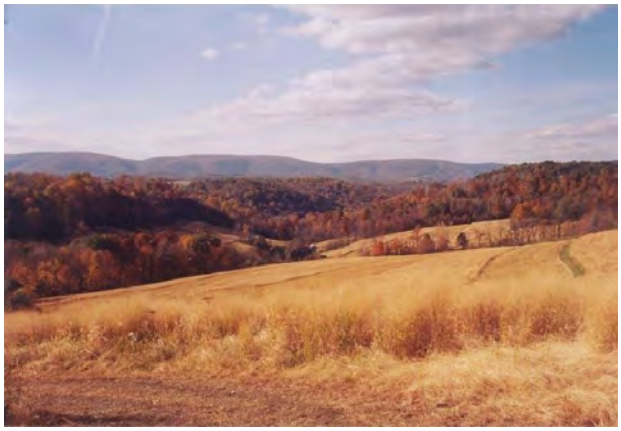
To complement DEP's ongoing evaluation of waterbodies, the CREP subcommittee decided to initiate a special long-term project for site specific water quality monitoring where water quality, stream habitat and aquatic life (macroinvertebrates and fish) could be assessed for impact by CREP practices. The subcommittee decided to look for areas that are expected to show significant (or at least easily detectable) positive change in response to riparian forest buffer

establishment, streambank fencing or other streamside improvement practices resulting from CREP. Areas where the stream is frequently trampled by livestock, but will soon be improved by CREP conservation practices would be ideal. Other criterion for the site includes landowners who would welcome sampling efforts on their property for at least five years.

DEP's Watershed Support Section (WSS) continues the project begun by the CREP subcommittee. See Appendix D for a detailed report on this project.

This report is a collaborative effort between the Pennsylvania Association of Conservation Districts, Inc. (PACD), the Pennsylvania Department of Environmental Protection (PA DEP), the Farm Services Agency (FSA), the PA Fish and Boat Commission (PFBC), Pennsylvania Game Commission (PGC), Natural Resources Conservation Service (NRCS) and the Chesapeake Bay Foundation (CBF). Questions can be directed to the PACD and individuals will be routed to the appropriate agency for further assistance.

The Pennsylvania Association of Conservation Districts, Inc. (PACD)
www.pacd.org
717-238-7223



Picutured: switchgrass, an example of CP2. Photo courtesy of FSA.

APPENDICES

APPENDIX A: CREP PARTNERS

- Chesapeake Bay Foundation: http://www.cbf.org
  - Landowner's Guide to Buffer Success: http://www.cbf.org/Document.Doc?id=257
- PA Association of Conservation Districts: http://pacd.org
- PA Department of Agriculture: http://www.agriculture.state.pa.us
- PA Department of Environmental Protection: http://www.depweb.state.pa.us
- PA Game Commission: http://www.pgc.state.pa.us
- Pheasants Forever: http://www.pheasantsforever.org/
- USDA Farm Service Agency: http://www.fsa.usda.gov
  - Summary of active contracts by program year:

    https://arcticocean.sc.egov.usda.gov/CRPReport/monthly_report.do?method=selectState&report=ActiveContractsSummaryByProgramYear&report_month=September-2012
  - Payment and practice summary by program year:

    https://arcticocean.sc.egov.usda.gov/CRPReport/monthly_report.do?method=selectState&report=ActiveCrepContractsSummaryByProgramYearWithProject&report_month=September-2012
- USDA Natural Resources Conservation Service: http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

APPENDIX B: CREP RESOURCES

- PA Department of Conservation and Natural Resources: http://www.dcnr.state.pa.us
- PA Ducks Unlimited: http://www.ducks.org/Pennsylvania/
- PA Farm Bureau: http://www.pfb.com
- PA Fish and Boat Commission: http://www.fish.state.pa.us
- PA State Conservation Commission: http://bit.ly/HAOiqz
- PSU Cooperative Extension: http://extension.psu.edu/
- USDA Natural Resource Conservation Service Resource Conservation & Development: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1042398.pdf
- Western Pennsylvania Conservancy: http://www.paconserve.org/
- Wild Turkey Federation: http://www.nwtf.org/pennsylvania/

APPENDIX C: WILDLIFE HABITAT MONITORING

Association of wintering raptors with Conservation Reserve Enhancement Program grasslands in Pennsylvania

AndrewWilson,[1*]MargaretBrittingham,[2] andGregGrove[3]

[1]*USGS, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708-4038, USA* [2]*409 Forest Resources Building, Pennsylvania State University, University Park, Pennsylvania 16802, USA* [3]*407 Chandlee Lab, Pennsylvania State University, University Park, Pennsylvania 16802, USA*

Received15November 2009; accepted5August 2010

ABSTRACT: Conservation grasslands can provide valuable habitat resource for breeding songbirds, but their value for wintering raptors has received little attention. We hypothesized that increased availability of grassland habitat throught he Conservation Reserve Enhancement Program (CREP)has resulted in an increase or redistribution in numbers of four species of raptors in Pennsylvania since 2001.We tested this by analyzing winter raptor counts from volunteer surveys, conducted from 2001to 2008, for Red-tailed Hawks(*Buteo jamaicensis*), Rough-legged Hawks(*Buteo lagopus*),Northern Harriers(*Circus cyaneus*), and American Kestrels(*Falco sparverius*). During that period, numbers of wintering Northern Harriers increased by more than 20% per year. Log-linear Poisson regression models show that all four species increased in the region of Pennsylvania that had the most and longest-established conservation grasslands. At the county scale ($N = 67$), Bayesian spatial models showed that spatial and temporal population trends of all four species were positively correlated with the amount of conservation grassland. This relationship was particularly strong for Northern Harriers, with numbers predicted to increase by 35.7% per year for each additional 1% of farmland enrolled in CREP. Our results suggest that conservation grasslands are likely the primary cause of the increase in numbers of wintering Northern Harriers in Pennsylvania since 2001.

For a full copy of this journal article, contact Mike Pruss with the Pennsylvania Game Commission at mpruss@pa.gov.

Evaluating the Effects of CREP on Ring-Necked Pheasants and Grassland and Farmland Birds

Final Report to:
Pennsylvania Game Commission
Bureau of Wildlife Management
Research Division

Cooperative Agreement ME#2390147100079235

Margaret C. Brittingham, Andrew Wilson, Sarah Pabian, Andrew Weber
Department of Ecosystem Science and Management
Penn State University
University Park, PA 16802

Scott Klinger
Pennsylvania Game Commission

ACKNOWLEDGMENTS
We thank the following fieldworkers for their hard work and loyalty over the ten year period: P. Barber, A. Bodling, G. Boone, B. Coulter, H. Hart, D. Hoffman, R. Keller, R. Koury, D. Kruel, W. Laubscher, R. Mulvihill, D. Orris, P. Robinson, D. Siefken, D. Snell and M. Ward. This research could not have been completed without the support of T. Hardisky, S. Klinger, M. Pruss, J. Dunn and C. DeLong at the Pennsylvania Game Commission, B. Isaacs and C. Johnson at the Pennsylvania USDA Natural Resources Conservation Service, and B. Foose at the Pennsylvania USDA Farm Service Agency. We also thank E. Dlugosz, F. Lichtner, J. Mohlmann, M. Oberkircher, and E. Son at The Pennsylvania State University, for their assistance. Funding was provided by the Pennsylvania Game Commission and The Pennsylvania State University Agricultural Experiment Station.

Table of Contents

The report is divided into four separate chapters each addressing a different aspect of the study. Chapter 1 has been submitted for publication and chapter 2 has been published. Tables, figures, and literature cited sections are included within each chapter.

Project Objectives and Summary
Objectives

1) Determine the effects of CREP on abundance and distribution of ring-necked pheasants and grassland and other farmland birds at the local and landscape scale.
2) Determine the effects of local and landscape habitat features on the relative abundance of pheasants and grassland and other farmland birds.
3) For routes where data are comparable, determine trends in pheasants, grassland, and farmland birds between 2001 and the most recent survey.
4) Use results to estimate the minimum amount of CREP that would be necessary to result in a detectable increase in population size for ring-necked pheasants and other grassland associated species.
5) Analyze other available data sets such as the Breeding Bird Survey, Audubon Christmas Bird Counts, and Pennsylvania Breeding Bird Atlas to determine effects of local and landscape habitat features including amount of CREP on pheasant numbers.

Project Summary

The report is divided up into 4 chapters. We were able to successfully address each objective within these chapters except for objective # 5. The numbers of pheasants reported in those other surveys were so low that it was not possible to determine effects of habitat features or CREP on pheasant numbers by examining BBS, CBC, or BBA. Below, we provide a summary of the objectives addressed and major findings from each chapter.

Chapter 1 - Conservation Reserve Enhancement Program benefits ring-necked pheasant populations in Pennsylvania but inadequate coverage to reverse declines – Chapter 1 addresses study objectives 1-4 as they pertain to ring-necked pheasants.

The Conservation Reserve Enhancement Program (CREP) in Pennsylvania was started in 2000 as a farmland set-aside program. The program is thought to produce high quality habitat for ring-necked pheasants, the populations of which are declining rapidly. We used data collected from 2001 to 2010 to determine whether CREP has indeed benefitted pheasant populations. Surveyors recorded pheasants using road-side point counts in a 20-county area in south-central Pennsylvania. Pheasants responded positively to the amount of CREP cover, with a 36 fold increase in the proportional change in abundance in areas where 100% of the farmland area within 500 m was in CREP. The effect of CREP was greatest when the surrounding landscape had both greater CREP enrollment and more farmland habitat; indicating greater benefits of new CREP habitat when clustered on landscapes with little forest cover. Although pheasants appear to benefit from CREP, they declined in abundance more than any other farmland species in the area. In addition, the amount of additional CREP coverage needed to reverse population declines is impractical (over 500,000 ha of new CREP agreements) and will need to be used in combination with other management techniques to be successful.

Chapter 2 - Mixed Responses of Farmland Birds to the Conservation Reserve Enhancement Program in Pennsylvania – Chapter 2 addresses study objectives 1-4 as they pertain to farmland and grassland bird

The Pennsylvania Conservation Reserve Enhancement Program (CREP) was initiated in 2000, and within 4 years 40,000 ha of conservation grasslands were established in southern Pennsylvania. We determined whether CREP habitat has benefitted farmland and grassland bird populations during the 10 years since the program began. From 2001 to 2010, bird surveyors conducted road-side point counts in a 20-county area in south-central Pennsylvania. We observed positive CREP effects on the abundances (in 2009–2010) and changes in abundance (from 2001–2002 to 2009–2010) of 5 species, including eastern meadowlark (*Sturnella magna*); negative CREP effects for 3 species, including vesper sparrow (*Pooecetes gramineus*); and no CREP effects for 2 species, including grasshopper sparrows (*Ammodramus savannarum*). We additionally observed changes in the size and direction of the local CREP effects (within 250 m of count locations) depending on the amount of CREP grassland or field cover in the surrounding landscape (within 5,000 m of survey routes). For example, the local CREP effect on the change in abundance of eastern meadowlarks was 15 times greater at points nested within landscapes with 9% CREP cover compared to landscapes with 1% CREP cover, indicating the potential for greater benefits of adding new CREP grasslands to areas with more CREP habitat already in the surrounding area. We conclude that more careful spatial targeting of CREP enrollment could improve the benefits of the program for farmland and grassland bird populations.

Chapter 3- Habitat use by grassland and farmland birds in an eastern agricultural landscape – Chapter 3 examines habitat use by farmland and grassland species with a use versus availability analysis to determine types of habitat preferred by different species and to determine which species actively select CREP fields.

In order to develop a comprehensive management plan for farmland birds and reduce declines of target species, we need to understand why some species are benefitting from CREP while others are not. We need to gain a better understanding of the habitat use of farmland and grassland birds across the agricultural landscape in relation to set aside programs such as CREP and other agricultural habitats, and whether use is based on availability or some habitat types are being actively selected over others. Our objective was to determine the habitat use versus availability of for a group of farmland and grassland birds across a heterogeneous agricultural landscape. Four species were associated with a range of habitats that we considered successional-shrub habitat– common yellowthroat, field sparrow, indigo bunting and song sparrow and selected these habitats at higher rates than expected by availability. Ring-necked pheasant, savannah sparrow, eastern meadowlark and grasshopper sparrow had a higher probability of

selection for pasture, hay fields and/or idled fields. Ring-necked pheasant showed a strong preference for idled field, significantly higher than all other habitat types. Of the 13 species we recorded, 11 had adequate samples sizes (N > 20) for statistical analysis and four of these species showed a statistically significant preference for CREP fields– common yellowthroat, eastern meadowlark, field sparrow, and red-winged blackbird . The remaining species surveyed with sufficient observations showed no preference for CREP. The field habitat created by enrollment in CREP is benefitting some of the farmland species but not benefitting all species equally; regionally rare and rapidly declining species such as grasshopper sparrow are not actively selecting fields enrolled in CREP. As it ages, CREP is vegetatively and structurally changing in a way that makes it less attractive for grassland species that have narrow habitat requirements. A more active management regime could certainly increase the suitability of CREP fields for grassland obligates.

Chapter 4- Successional shifts in birds and vegetation as eastern CREP fields mature . - In chapter 4 we compare the vegetation and bird community on CREP fields 10 years after enrollment.

We revisited sites originally surveyed by Wentworth in 2002-2004 and determined how the structure and composition of the vegetation had changed and whether these changes were associated with changes in the avian community. Forty-seven fields were surveyed. The vegetation on mature fields was significantly denser, averaged taller, had a thicker litter layer and more downed litter. The fields split into two groups. The CCA showed that young fields were associated with axes that were explained by bare ground, forbs and cool-season grasses. Mature fields were associated with axes explained by amount and depth of litter, woody vegetation and height of vegetation on the fields. The number of grassland obligate species detected on fields did not increase as fields matured, but both the number and abundance of shrub-scrub species increased as CREP fields matured. The results from this study highlight the importance of active management of CREP fields. With only limited management of the fields, succession occurs and the vegetation within the field shifts from a grassland to shrubs and even small trees. If CREP is to be successful at providing habitat to declining grassland birds, it will be necessary to maintain the vegetation structure at an early successional stage so that it is beneficial to grassland bird species. Options for maintaining grassland communities include periodic mowing or grazing and prescribed burns at a frequency of once every 2-3 years. The current management protocols on PA CREP have not resulted in increased grassland suitability for grassland obligates as fields matured, and without changes to the recommended management protocols CREP fields are unlikely to return to high suitability nesting areas on their own. The effects of mid-contract management (i.e. grazing, mowing, spraying) need to be studied as avenues to maintain a suitable grassland vegetative structure in Pennsylvania CREP fields.

For a complete copy of this report, contact Mike Pruss with the Pennsylvania Game Commission at mpruss@pa.gov.

APPENDIX D: WATER QUALITY MONITORING

Site Specific Water Quality Monitoring to Assess the Impact of CREP Practices

The Watershed Support Section (WSS) in the PA Department of Environmental Protection wrote a PA CREP Monitoring Study Design (Design) and Quality Assurance Project Plan (QAPP) that provides guidance for site specific water quality monitoring to assess the impact of CREP practices. The Design and QAPP cover a suite of chemical, physical and biological parameters including air temperature, water temperature, pH, conductivity, dissolved oxygen, nitrite, nitrate, ammonia, total phosphorus, total suspended solids and benthic macroinvertebrates and bacteria. A habitat assessment is performed on all sites and 100 meters of stream reach were electro fished on one site. Photo documentation is included in the protocol. The monitoring plan includes background monitoring prior to practice installation and follow-up annual monitoring after installation of the practices for as long as possible. The table below provides summary information on the sites monitored to date by the WSS.

County	Land-owner	Stream /Watershed Name
Adams	King	Unnamed Tributary to Latimore Creek
Bradford	Various	Milk Creek Watershed & Stephen Foster Lake
Centre	Walizer	Unnamed Tributary to Little Fishing Creek (known locally as Rock Run)
Northumberland	Kaufman	Schwaben Creek (tributary to Shamokin Creek)
York	McClelland	Pierceville Run

Monitoring reports follow:

Unnamed Tributary to Latimore Creek

Introduction

A CREP project is located on a dairy farm, owned and operated by Jeffrey King in Adams County. An unnamed tributary (UNT) to Latimore Creek runs through the King farm. The stream on the King farm was accessible to cattle in the pasture area until stream bank fencing, and cattle crossings were put in place along the stream as part of the CREP project. Twelve acres of riparian forest buffers were also installed as CREP Conservation Practice 22 (CP22) in December 2005 on marginal pastureland on both sides of the stream. The average width of the buffer is approximately 130 feet

and the length of the buffer including both sides of the stream is approximately 2,120 feet. By limiting cattle access to the stream, a natural herbaceous buffer also developed along the stream further enhancing the riparian buffer area.

Additional BMPs have been installed in the barnyard as a result of a comprehensive manure management plan in late 2012, which should result in additional water quality improvements in the UNT to Latimore Creek. The UNT to Latimore Creek is being evaluated for improvements in chemical and physical water quality indicators, biological indicators, habitat for aquatic organisms, and overall stream health that result from the establishment of a riparian forest buffer.

This report is based on field surveys and laboratory analyses conducted by the DEP's WSS and the PFBC, with assistance from the SRBC. From 2004 through 2013 (with the exception of 2011 when no sampling occurred), assessments were completed on both a midstream monitoring site and a downstream site on King Farm. Assessments were also conducted for a reference tributary site on another unnamed tributary to Latimore Creek. Monitoring site locations were adjusted in 2009 and are described in detail within the stream and monitoring plan description in the next section of this report.

General Stream and Watershed Description

This 3.7 mile long UNT to Latimore Creek, DEP stream code 08686, is part of the Conewago River watershed which drains into West Conewago Creek in the Susquehanna River Basin. The Latimore sub-watershed drains approximately 21 square miles while the Conewago watershed covers an area of 515 square miles. The UNT enters Latimore Creek at stream mile 3.7. Its headwaters are located in Latimore Township, York County. Land use in this drainage is mostly agricultural with scattered, wooded slopes and riparian areas. The unnamed tributary ranges in elevation from 640 feet near its headwaters to 600 feet at its confluence with Latimore Creek. Latimore Creek's respective elevation ranges from 755 to 472 feet. The tributary is described as a shallow, low gradient (<2%), freestone pasture stream. The designated use of Latimore Creek listed in Chapter 93 of the Pennsylvania Code is Cold Water Fishes (CWF).

Three monitoring sites were originally used for this study. The midstream monitoring site is located on UNT to Latimore Creek within the King Farm property and the upper part of the CREP application. The downstream monitoring site is also within the King Farm property below a cattle crossing within the lower part of the CREP application area. The original reference site is on another UNT to Latimore Creek which is located in an adjacent watershed that has an existing riparian forest buffer. The midstream monitoring site coordinates are 40^{O} 01′ 24″ N and 77^{O} 08′ 20″ W and

the downstream monitoring site coordinates are 40° 01′ 34″ N and 77° 08′ 20″ W. Coordinates for the reference monitoring site in the adjacent watershed are 40° 01′ 54″ N and 77° 08′ 20″ W.

Upstream monitoring site in existing riparian forest. Photo courtesy of DEP.

Downstream monitoring site at lower end of CREP practice on King Farm. Photo courtesy of DEP.

Monitoring sites were chosen before the completion of the CREP practice in order to capture stream conditions prior to the installation of the stream bank fencing, cattle crossings and the riparian buffer. However, after reviewing three years of stream data, seeing impacts from cattle accessibility to the stream on cattle crossings and discussing property boundaries with Mr. King, it was decided in 2009 to change the locations of the monitoring sites. The original downstream site which was below the lower cattle crossing was moved further downstream to a location adjacent to Route 94 upstream of the bridge with coordinates of 40° 01′ 37″ N and77° 07′ 59″ W. This location is at the lower end of the King property where the stream exits the CREP practice and King Farm and should give a better indication of overall impacts from the CREP practice without the influence of the cattle using the cattle crossing.

A new monitoring site was designated after looking at the area covered by the CREP practice and the property boundary discussion with Mr. King. The site is located further upstream along White Oak Road at the upper limit of the King property just above the start of the CREP practice with coordinates of 40° 01′ 22″ N and 77° 08′ 44″ W. This upstream site will give data on stream conditions before entering the CREP practice. The new upstream location will also be used as the reference site because it characterizes stream conditions prior to impacts from the cattle and the pasture area as well as CREP practice impacts. The original reference site in the adjacent watershed has become unstable with areas of erosion and bank failure within the original monitoring site reach. A mid-project monitoring project site was moved to an area just above the upper cattle crossing

with coordinates of 40° 01′ 53″ N and 77° 08′20″ W. This site will characterize stream conditions within the CREP practice including potential impacts from cattle, pastureland and the CREP practice. It was decided in 2013 to concentrate on the upstream and downstream sites to get a better understanding of the stream condition entering (upstream site) the CREP practice and changes to the stream condition after passage through the CREP practice (downstream site).
Also in 2013, surveying frequency for the two monitoring sites was increased to twice a year, early spring and fall, in order to collect more data about the effects of the CREP practice. Monitoring includes: habitat assessment (EPA Rapid Bioassessment Protocol method), macroinvertebrate screening (presence/absence/abundance screening to order/some family level), flow measurements (flow meter or float method), pictures, bacteria sampling (lab analyses for E. coli, fecal coliforms and Enterococci) and water chemistry (field and lab analysis). After collecting data for an additional three to five years at the increased frequency, a final report will be compiled and released.

Water Quality Indicators
Physical/Chemical Parameters

Methods: The protocols outlined in PA CREP Monitoring Study Design and QAPP were used to monitor a core set of parameters including water temperature, pH, dissolved oxygen, conductivity and stream flow in the field. Water samples were collected for analysis at DEP's laboratory for a suite of parameters including: alkalinity, ammonia, nitrite, nitrate, total phosphorous and total suspended solids.

Results: Data are averaged over the 2004-2005 and 2006- 2013 sampling seasons as the practice was installed at the end of 2005. The first set of data represents conditions prior to application of the CREP practice and the second set of data represents post application conditions. See Tables 1-3 for results. Data for the mid-project site show improving trends or stability at acceptable levels for alkalinity, nitrate, pH, total Phosphorus and water temperature with the greatest percentage change (-27%) for water temperature indicating that the riparian forest buffer may be positively impacting the receiving stream by cooling the waters. Data for the downstream site demonstrate improving trends or stability at acceptable levels for alkalinity, conductivity, nitrate, total phosphorus and water temperature with the greatest percentage change (21.5%) for water temperature. Dissolved oxygen remained high at 10 mg/l. These are all indications that the riparian forest buffer is positively impacting the receiving stream.

Table 1 –UNT to Latimore Creek-Averaged/Median Data Reference Upstream Site

King Farm – Adams County	2004 thru 2005	2006 thru 2013	% change
Parameter	**Average/ Median #**	**Average/ Median #**	
*Alkalinity	57.6	57.5	-1%
Ammonia -N	2.24	0.03	-98%
Conductivity (µS/cm)	215.5	207.2	-4%
*Dissolved Oxygen	9.5	9.8	+3 %
*Nitrite -N	<0.01	<0.01	0
*Nitrate -N	0.55	0.57	+1.5%
pH (pH units)	7.6 #	7.82 #	-
*Total Phosphorus	0.03	0.03	0
*Total Suspended Solids	-	5.4	-
Water Temperature (°C)	20.3	15.9	-21%
*Total Nitrogen	-	-	0.84

* Units are mg/L

Table 2 –UNT to Latimore Creek–Averaged/Median Data Mid Project Site

King Farm – Adams County	2004 thru 2005	2006 thru 2012	% Change
Parameter	**Average/ Median #**	**Average/ Median #**	
*Alkalinity	86.2	91.3	+5%
Ammonia -N	-	<0.02	-
Conductivity (µS/cm)	178	217	+21%
*Dissolved Oxygen	10.0	7.8	-23%
*Nitrite-N	<0.01	<0.01	0
*Nitrate-N	0.55	0.41	-15%
pH (pH units)	8.14 #	7.98 #	-
*Total Phosphorus	0.027	0.040	+48%
*Total Suspended Solids	-	4.2	-
Water Temperature (°C)	20.3	14.9	-27%

*Units are mg/L

Table 3 –UNT to Latimore Creek–Averaged/Median Data
Downstream Site

King Farm – Adams County	2004 thru 2005	2006 thru 2013	%Change
Parameter	**Average/ Median #**	**Average/ Median #**	
*Alkalinity	98.2	97.5	<1%
Ammonia-N	-	<0.02	-
Conductivity (µS/cm)	201.5	228.0	+13%
*Dissolved Oxygen	10.0	10.7	+6%
*Nitrite-N	<0.01	<0.01	0%
*Nitrate-N	0.06	0.39	+33%
pH (pH units)	7.82#	7.7 #	-
*Total Phosphorus	0.029	0.025	+13%
*Total Suspended Solids	-	8.5	-
Water Temperature (°C)	20.3	13.4	-34%
*Total Nitrogen	-	-	0.91

*Units are mg/L

Biological Indicators

Macroinvertebrates

Methods: Because the instantaneous nature of grab samples precludes more than a general comparison to applicable water quality criteria, the indigenous aquatic community can often serve as a better indicator of long-term conditions and is used as a measure of ecological significance. Macroinvertebrates were collected and assessed annually from 2004 through 2010 and in 2013, using presence/absence/abundance observations from a streamside bioassessment protocol based on the Isaac Walton League's Save Our Streams survey. The protocol generates a water quality rating score based upon diversity and sensitivity to pollution with organisms identified to taxonomic order in most cases and taxonomic family in some cases. The water quality rating follows: Good = Total score > 40; Fair = Total score between 20 and 40; Poor = Total score <20.

Sampling locations and changes to those locations are consistent with those for other parameters as described previously in this report.

Results: Water quality scores began a trend upward at the mid project and downstream sites in 2009 and 2010 possibly indicating that treatment from the growing riparian buffer was having a positive impact on the aquatic biological community. However, in 2013 the sampling at these same sites resulted in samples that produced very low water quality scores. The cause for this is unknown at this time. There will be further study and sampling in 2014 to try to determine the cause. See

Table 4 for the individual scores.

Table 4: Water Quality Rating Scores Based on Macroinvertebrate Sampling

King Farm – Adams County Site	2004	2005	2006	2007	2008	2009	2010	Spring 2013	Fall 2013
Reference/Upstream	**41.9**	**18.1**	**20.8**	**28.0**	**21.7**	**39.7**	**28.0**	**18.4**	**8.6**
Mid Project	**31.8**	**20.0**	**28.3**	**40.9**	**37.7**	**48.2**	**44.0**	**-**	**-**
Downstream	**22.3**	**35.9**	**28.0**	**15.6**	**21.0**	**27.1**	**41.6**	**14.0**	**16.7**

Fish

Methods: Fish populations were assessed annually in September at both the CREP monitoring site within the King Farm and the reference tributary site from 2004-2008. A portable backpack electrofishing unit was used to conduct the fish assessments within approximately 100 meters of stream reach at each of the sampling sites.

All fish were collected from three electrofishing passes at each site and held in separate live bags. Fish were subsequently identified by species, counted, and released back into the waterway. Fish population estimates were calculated by using the removal method between electrofishing passes.

Results: The results of our sampling effort can be found on Tables 4 and 5. At the reference site, a total of 13 different fish species were observed during the five-year study period (Table 5). The fish species composition was dominated by blacknose dace, longnose dace, creek chub, white sucker and central stoneroller. Fish population estimates (N) ranged from 588 in 2005 to 1028 in 2007 (Table 4). Overall, it was judged that the fish populations at the reference site fluctuated but were similar during the 2004-2008 sampling period.

At the CREP application site within the King Farm, a total of 18 different fish species were observed during the five-year study period (Table 5). The fish species composition was dominated by blacknose dace, longnose dace, creek chub, white sucker, central stoneroller, tessellated darter, banded killifish and bluntnose minnow. There were six additional fish species observed during the 2006-2008 sampling period, which is indicative of improved habitat conditions as a result of the riparian corridor treatment associated with the CREP project. Fish population estimates ranged from 1,288 in 2006 to 2,556 in 2005 (Table 6).

Both the stream width and fish population estimates generally declined subsequent to the riparian corridor improvement project at the King Farm. The narrowing of the stream channel is a common result once livestock are precluded from entering the waterway and the stream banks are given

the time to re-vegetate and adjust themselves to address the natural morphology of the respective affected stream system. There are several explanations for the decline in fish numbers. First, the open and shallow habitat conditions prior to the stream bank fencing project supported large numbers of juvenile fish representing approximately eight different fish species. As the steam channel narrowed, deepened and the fish habitat improved with the addition of overhead cover, it was observed that the percentage of adult fish representing these eight species increased while the percentage of the juvenile fish decreased. It should also be noted that the six additional fish species that were observed post-treatment (Table 6) probably replaced habitat space previously dominated by the common fish species at this sampling site. If similar fish studies are planned to assess riparian corridor improvement projects, it is recommended to collectively weigh the fish captured from each of the electrofishing passes in order to calculate biomass estimates. Fish biomass estimates would be an additional data result that may help explain any biological changes between pre and post project conditions.

Table 5 Fish population estimates from one sampling station on an unnamed tributary stream

(Reference Site) to Latimore Run, Adams County, September 2004-2008 Sampling Date					
Species	**2004**	**2005**	**2006**	**2007**	**2008**
Blacknose dace	520	311	517	594	620
Longnose dace	39	50	45	29	36
Creek chub	174	180	162	104	201
White sucker	59	24	82	139	17
Central stoneroller	7	17	140	127	103
Blue spotted sunfish	1	-	-	-	1
Bluegill	-	1	21	20	19
Northern hogsucker	-	2	1	-	-
Cutlips minnow	-	1	-	-	-
Common shiner	-	1	-	-	-
Tessellated darter	1	1	2	14	6
Brown trout	-	-	-	1	-
Bluntnose minnow	-	-	-	-	4
Total Fish Pop. Estimate (N)	801	588	970	1028	1007
Sampling Site Length (m)	113	105	100	100	100
Sampling Site Width (m)	4.29	3.36	4.03	2.69	2.87
Sampling Site Area (ha)	0.049	0.035	0.040	0.027	0.029

Table 6 Fish population estimates from one sampling station on an unnamed tributary Stream (CREP Site/King Farm) to Latimore Run, Adams County, September 2004-2008

Sampling Date					
Species	**2004**	**2005**	**2006**	**2007**	**2008**
Blacknose dace	1430	1544	690	784	311
Longnose dace	27	124	35	8	1
Creek chub	255	263	170	242	170
White sucker	103	48	50	42	31
Central stoneroller	160	238	137	251	171
Tessellated darter	127	81	33	41	16
Bluegill	5	-	8	-	31
Northern hogsucker	1	14	-	-	4
Cutlips minnow	-	5	6	7	9
Banded killifish	149	126	103	327	216
Margined madtom	1	-	-	-	-
Bluntnose minnow	116	113	49	141	255
Pumpkinseed sunfish	-	-	6	-	-
Greenside darter	-	-	1	-	2
Brown bullhead	-	-	-	1	-
Green sunfish	-	-	-	5	7
Spotfin shiner	-	-	-	-	33
Common shiner	-	-	-	-	76
Total Fish Pop. Estimate (N)	2374	2556	1288	1849	1333
Sampling Site Length (m)	100	107	100	100	100
Sampling Site Width (m)	2.92	2.27	2.27	1.73	1.83
Sampling Site Area (ha)	0.029	0.024	0.023	0.017	0.018

Bacteria

Methods: Water samples were collected for analysis at DEP's laboratory for a suite of parameters including: Fecal coliforms, Enterococci, and E. coli and were analyzed by DEP's laboratories.

Results: See Tables 7-9 for results. Data for the downstream site are averaged over the 2004-2005, and 2012-2013 sampling seasons for the upstream and downstream sites as the practice was installed at the end of 2005. Data collection for the midstream site ended in 2012, so data is presented as the 2004-2005 and 2006–2012. The upstream site changed in 2006. So data for this site is presented as 2006-2010 and 2012–2013. The first set of data represents conditions prior to the application of the CREP practice. The other sets represent post application conditions. The bacterial numbers for the reference/upstream site indicate that there is a bacterial problem even before the stream reaches the King Farm. The mid project and downstream sites indicate that there is additional contamination entering the stream from the cattle on the King farm. The manure management plan that is being implemented currently on the King Farm should address this problem and affect future monitoring results. Monitors will walk the stream reach in 2014 in an attempt to determine the source of the bacterial contamination.

Table 7 – Reference / Upstream Site

Core Parameters	2006 thru 2010 Average	2012-2013 Average
Fecal coliforms*	2768	1603
Enterococci*	160	587
E. coli*	2876	2772

* Colony forming units per 100 ml

Table 8 –Mid Project Site

Core Parameters	2004 thru 2005 Average	2006 thru 2010 Average	2012
Fecal coliforms*	650	2132	690
Enterococci*	340	674	610
E. coli*	650	2148	1700

* Colony forming units per 100 ml

Table 9 - Downstream Site

Core Parameters	2004 thru 2005	2006 thru 2010	2012 - 2013
	Average	Average	Average
Fecal coliforms*	1800	5939	5330
Enterococci*	520	2282	2015
E. coli*	1700	4672	7050

* Colony forming units per 100 ml

Habitat Assessment

Method: Habitat assessments, like biological samplings, were conducted at all three sites using the Environmental Protection Agency's "Rapid Bioassessment Protocol for Use in Streams and Wadeable Rivers – Second Edition." The evaluator scores the stream, streambanks and riparian vegetative zone for a variety of 10 parameters that are integral to the protection and enhancement of habitat for aquatic species of macroinvertebrates and fish. Each parameter receives between 0 and 20 for a total possible score of 200. Table 10 below shows the total scores for each site. The mid project and downstream sites show improvement in habitat due to the impact of the growing riparian forest buffer.

Table 10: Habitat Assessment Scores

King Farm - Adams County	Total Habitat Assessment Scores									
Site:	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2012**	**Spring 2013**	**Fall 2013**
Reference/Upstream	125	125	133	132	140	154	147	142	144	130
Mid Project	112	112	154	160	161	152	149	160	-	-
Downstream	92	92	151	144	120	135	134	151	155	144

Summary and Recommendations

Over the course of nine years of monitoring the UNT to Latimore, data for the mid project site shows improving trends for alkalinity, conductivity, dissolved oxygen, nitrate, pH and water temperature with the greatest percentage change (27%) for water temperature indicating that the riparian forest buffer may be positively impacting the receiving stream. Data for the downstream site shows improving trends or stability at acceptable levels for alkalinity,

conductivity, nitrate, total phosphorus and water temperature with the greatest percentage change (-34%) for water temperature. Dissolved oxygen remained high at 10.7 mg/l. These are all indications that the riparian forest buffer is positively impacting the receiving stream.

Water quality scores based on the macroinvertebrate community, began a trend upward at the mid project and downstream sites in 2009 and 2010 indicating that treatment from the growing riparian buffer may be having a positive impact on the aquatic biological community. However the results in 2013 indicate a problem that is affecting the biological community.

The bacterial numbers for the reference/upstream site indicate that there is a bacterial problem even before the stream reaches the King Farm. The mid project and downstream sites indicate that there is additional bacterial contamination entering the stream on the King farm. The manure management plan that is being implemented currently on the King Farm should address this problem and affect future monitoring results.

The mid project and downstream sites show improvement in habitat due to the impact of the growing riparian forest buffer.

Fish population estimates generally declined subsequent to the riparian corridor improvement project at the King Farm through 2008. No additional fish sampling was done after 2008. The narrowing of the stream channel is a common result once livestock are precluded from entering the waterway and the stream banks are given the time to re-vegetate and adjust themselves to address the natural morphology of the respective affected stream system. There are several explanations for the decline in fish numbers. First of all, the open and shallow habitat conditions prior to the stream bank fencing project supported large numbers of juvenile fish representing approximately eight different fish species. As the steam channel narrowed, deepened, and the fish habitat improved with the addition of overhead cover, it was observed that the percentage of adult fish representing these eight species increased while the percentage of the juvenile fish decreased. It should also be noted that the six additional fish species that were observed post-treatment (Table 6) likely replaced habitat space previously dominated by the common fish species at this sampling site. If similar fish studies are planned to assess this project, it is recommended to collectively weigh the fish captured from each of the electro-fishing passes in order to calculate biomass estimates. Fish biomass estimates would be an additional data result that may help explain any biological changes between pre- and post-project conditions.

Overall, water quality is showing improvement that is attributed to the exclusion of cattle from

the stream and the establishment of a riparian forest buffer on both sides of the stream. Due to recent improvements within the study area (a comprehensive manure management plan on the King Farm) further positive impacts to the stream are expected.

UNNAMED TRIBUTARY TO LITTLE FISHING CREEK (LOCALLY KNOWN AS ROCK RUN)

Rock Run is the local name for an officially unnamed tributary to Little Fishing Creek. The entire tributary is in Walker Township, Centre County and it is listed in Chapter 93 of the Pennsylvania Code with a designated use of High Quality Cold Water Fishes (HQ-CWF). As a result of the 2005 CREP project put in place at the Walizer Tree Farm, the stream has been evaluated yearly for improvements in water quality, habitat for macroinvertebrate organisms, bacteria load and overall stream health. The Vonada Farm, just upstream of the Walizer Farm, also entered into a similar stream protection effort in 2007. This updated report is based on data collected by field surveys conducted by the Department beginning in 2006 through 2011.

This CREP project encompasses an area of about 2.41 acres, wherein a riparian buffer zone consisting of grass and mostly natural woody shrub vegetation has been established. Grass in the riparian area near the Walizer barn, and later on the Vonada Farm was re-established mostly naturally, by excluding cattle from the zone. The newly established riparian zone is minimally 35 feet in width on both sides of the stream and is estimated to be 1,500 feet in length. The segment of stream within the project totals approximately 1,700 feet in length, and is typically about 3 to 12 feet in width. The 200-foot reach near the mouth remains wooded with mature trees on the right side of the stream, facing upstream. A sampling site in the wooded area upstream of all agriculture is not part of the CREP project but is monitored as a reference to the project. This area was virtually undisturbed until late in 2009 when many of the hemlock trees nearby were cut down and sold for lumber because the owner was concerned about damage from the woolly adelgid, and feared a substantial financial loss if the trees were to die from the infestation.

The photos above show the extent of the lumbering activity in the headwaters area of Rock Run. Both photos courtesy of DEP.

Since 2009, the Vonada barnyard area has been improved by establishing a limited access stream crossing site and grass plantings. The Vonada riparian area has been improved by establishing tree plantings in the riparian area and cattle exclusion from it. Each farm has installed an improved access to the water and stream crossing areas for the herds.

In-Stream Habitat

In-stream habitat was assessed from 2006 through 2011 using the EPA Habitat Assessment parameters. As hoped, and despite logging activity, there was no significant change in total score for habitat at the headwaters site which served as a reference site. There was a 9% improvement in the final overall habitat score at the Vonada Farm site (going from 149/200 to 163/200) and a 5% improvement in the final overall habitat score at the Walizer Farm site (going from 132/200 to 138/200). Increased (worsening) embeddedness and sediment deposits near the mouth were observed near the end of the study in 2011. This actually lowered the final habitat score at the mouth by about 10% in 2011 when compared to earlier scores. The reason for the additional sediment is uncertain but it is possible that logging in the headwaters or project work that occurred upstream disturbed loose soil which was deposited near the mouth of the stream.

Macroinvertebrate Collections

Macroinvertebrate collections were analyzed using five metrics: Taxa Richness, Modified Ephemeroptera, Plecoptera and Trichoptera (EPT) Index, Modified Hilsenhoff Biotic Index, Percent Dominant Taxa, and Percent Modified Mayflies. Over time, some improvement in the number of sensitive taxa at the site on the Vonada Farm and the site behind the barn on the Walizer Farm occurred. the effects of sediment remain and macroinvertebrate scores have not improved there. Even with some improvements, when compared to the headwaters reference

site, no downstream site is close to the 80% comparability that would indicate an unimpaired condition. The table below shows the macroinvertebrate scores and comparability of the monitored sites.

Macroinvertebrate Metrics and Scores

	STATIONS			
1-Mouth		**2 Walizer**	**3 Vonada**	**4 – Head/Ref**
METRIC				
1. TAXA RICHNESS	24	20	12	19
Biol. Cond. Score	8	8	2	8
2. MOD. EPT INDEX	10	9	3	13
Biol. Cond. Score	7	5	0	8
3. MOD. HBI	4.46	4.74	5.16	1.95
Biol. Cond. Score	0	0	0	8
4. % DOMINANT TAXA	23	44	69	56
Biol. Cond. Score	8	8	6	8
5. % MOD. MAYFLIES	21	18	10	72
Biol. Cond. Score	0	0	0	8
TOTAL BIOLOGICAL CONDITION SCORE	23	21	8	40
% COMPARABILITY TO REFERENCE	58	53	20	

Water Chemistry Improvements

Over the course of five years of monitoring Rock Run, data shows significant improvements in ammonia, nitrate and phosphorus. Overall, the bacteria counts have dropped significantly as have suspended solids. In the final analysis of this CREP project, water quality is showing improvement that is attributed to the exclusion of cattle from the stream and the establishment of riparian grasses on both the Walizer and Vonada Farms. Due to two recent changes within the study area (logging and septage application) some effects on the stream could occur. Any future studies on Rock Run should find the data acquired in this study very useful for comparative purposes.

MILL CREEK WATERSHED & STEPHEN FOSTER LAKE

Stephen Foster is located in Mount Pisgah State Park in Bradford County west of Towanda. Mill Creek was dammed in 1977 to form the 78-acre lake; the watershed covers about 11 square miles

of mostly agricultural lands (58%). The Park hosts approximately 150,000 annual visitors for the lake's recreational opportunities, including boating and an exceptional bass and panfish fishery.

Stephen Foster Lake was plagued with algae blooms and sedimentation just a few years after its impoundment in 1977. After a Clean Lakes Phase 1 Study was completed in 1995 identifying the source and extent of the pollution problems, the lake was placed on the State's List of Impaired Waters, and a TMDL document was completed in 2001. The watershed assessment indicated agricultural and streambank Best Management Practices (BMPs) were needed to improve water quality and to reduce pollutant loads.

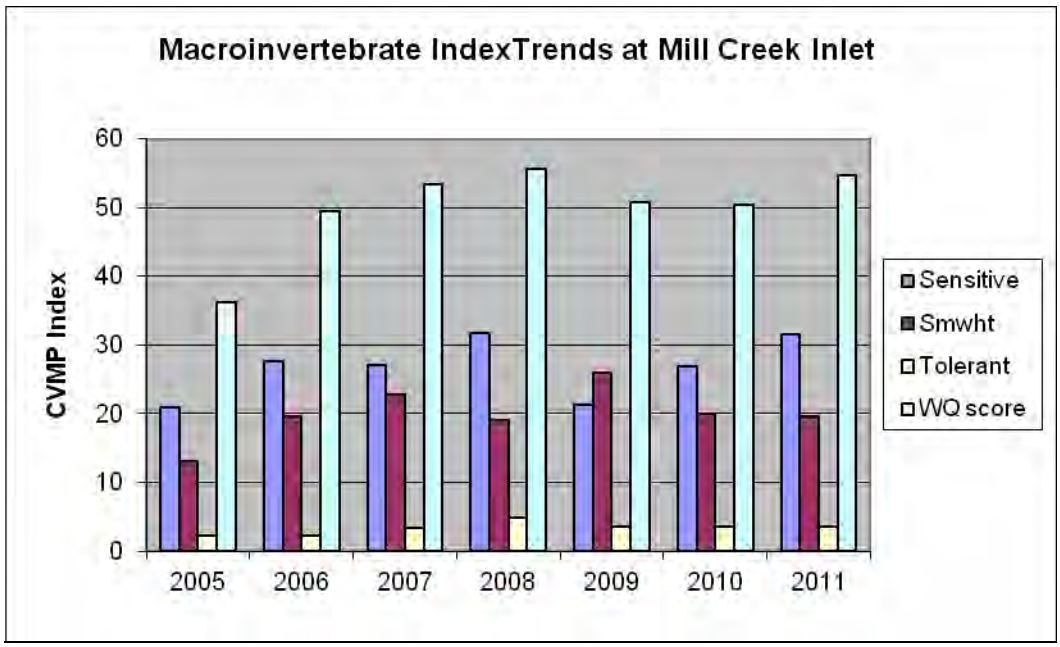
During the next 10 to 12 years of watershed improvements, stakeholders in the Mill Creek watershed had installed a wide variety of agricultural Best Management Practices (BMPs) as well as a 2,500 feet stream channel restoration project. Agricultural BMPs included animal waste control, barnyard runoff management systems, and exclusion fencing. More recently, since 2003, riparian buffer plantings under the Conservation Reserve Program (CREP) were implemented on 20 sites (892 acres) amounting to 6.8 miles of stream buffered. Overall, more than $1.5 million restoration funds were garnered from both state and federal sources including Growing Greener, EPA's 319 Program, Environmental Quality Incentive Program (EQIP), CREP, PA Act 6, and the Chesapeake Bay Program along with matching funds from landowners.

A riparian forest buffer planted through CREP at the lower end of Mill Creek where it flows into the lake. Photo courtesy of DEP.

Efforts of the stakeholders have resulted in improved water quality conditions in Stephen Foster Lake as well as in Mill Creek. A significant reduction of phosphorus loading to the lake was detected by ongoing sampling of the watershed. A 2010 report completed by Princeton Hydro

indicates that the total growing season phosphorus load has been reduced from a 1994 - 1995 average of approximately 3,750 lbs. to a 2005 - 2009 average of approximately 450 lbs. Biological improvements are also notable at most of the monitored stations. Sensitive types of macroinvertebrates have increased at the lower end of Mill Creek where it flows into the lake (see bar chart below). The water quality rating follows: Good = Total score > 40; Fair = Total score between 20 and 40; Poor = Total score <20.

Monitoring during the past 3 years have indicated that the indices have fluctuated but there has been improvement in the total water quality score which was below 40 in 2005 and reached 50 and above in subsequent years.



Since the successful implementation and observed water quality improvements in Mill Creek, in-lake BMPs were targeted to address the in-lake conditions. In 2011, two 15 ft x 12 ft artificial wetland islands were placed in the forebay to establish more wetland area for nutrient uptake in the area. The islands are a relatively new and innovative technology, and only a few have been installed statewide. Initial plantings were impacted by waterfowl but were replanted before winter set in. The consultant, Princeton Hydro, is monitoring nutrient uptake by established islands in another lake so that reductions may be applied to these islands in the future.

Wetland Island planted and installed on Stephen Foster Lake. Photos courtesy of DEP.

Also implemented in the spring of 2011 was an extensive buffered alum treatment in an effort to control internal nutrient loads from the lake sediments. Poly-aluminum chloride was used to combine with and lock up phosphorus in the water column and in the upper layers of lake sediments, with the net result of reducing available in-lake phosphorus, limiting algae blooms.

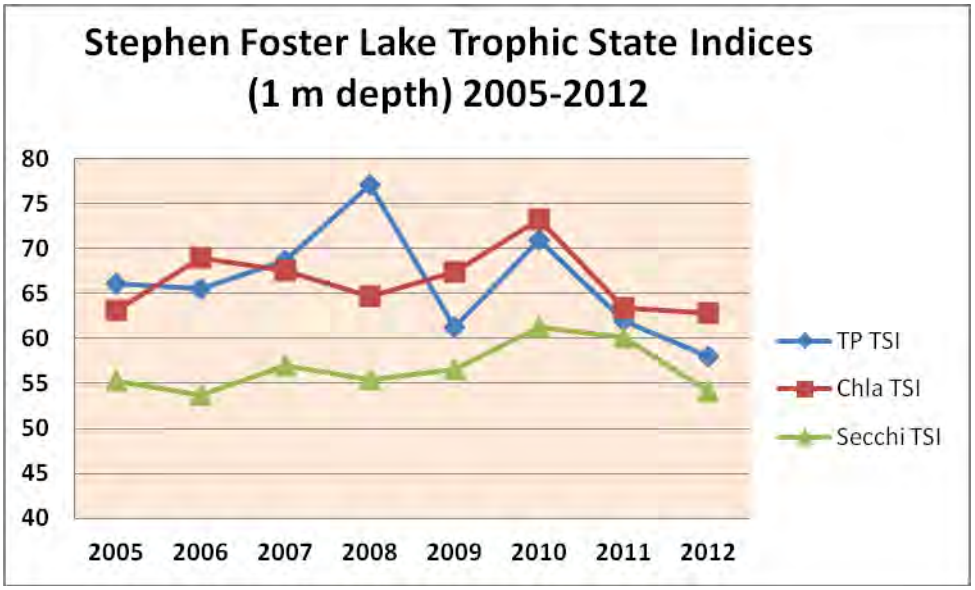
Boat for monitoring and treatment of Stephen Foster Lake. Photo courtesy of DEP.

Lake water quality samples were collected over the 2011 and 2012 growing season to determine efficacy of the alum treatment. Unfortunately the second half of May 2011 was extremely wet in northcentral PA. Rainfall was recorded every day from the 15th to the 31st of May 2011, and some storms were strong. Much sediment in the form of total suspended solids came into the lake from the watershed. Lake monitoring in June and August showed that high pHs in surface waters and low dissolved oxygen below 3m depth were pervasive in the lower lake. However four parameters showed improvements over pre-alum conditions (previous years): surface and bottom water total phosphorus (TP), Secchi depth, and chlorophyll-a levels.

Post alum in-lake surface TP concentrations were from 33% to 46% lower than previous TP concentrations. Summer bottom water TP concentrations were from 14% to 64% lower than pre-treatment. Secchi depth values generally improved (i.e. showed greater clarity) in 2011 and 2012 data compared to earlier years (see chart). Chlorophyll-a concentrations were 42% lower during the first half of the season, and were lower than nuisance conditions observed in the past, particularly in 2010.

Inter-annual Trophic State Index (TSI) data were compared with historical data, to elucidate biological activity of the lake on a relative basis. The index was calculated on TP, Secchi, and chlorophyll-a values. TSI's greater than 50 indicate high productivity (eutrophic conditions) while values greater than 65 represent hypereutrophic conditions, typically associated with nuisance conditions such as algal scums and impaired aesthetics.

The 2012 TSIs were the lowest on each parameter since 2005. Based on TP TSI values, the lake shifted from hypereutrophic in the mid-1990's to eutrophic conditions since 2005. After alum treatment, the seasonal average TP TSI was trending downward at 62 (2011) and 58 (2012). Secchi TSIs were lowest in 2012 at 53. Chlorophyll-a results also recorded the lowest TSI since 2005. The lake will continue to be sampled through 2013 to document efficacy and improvements.



Heavily vegetated stream bank as result of CREP practice in Mill Creek Watershed. Photo courtesy of DEP.

PIERCEVILLE RUN

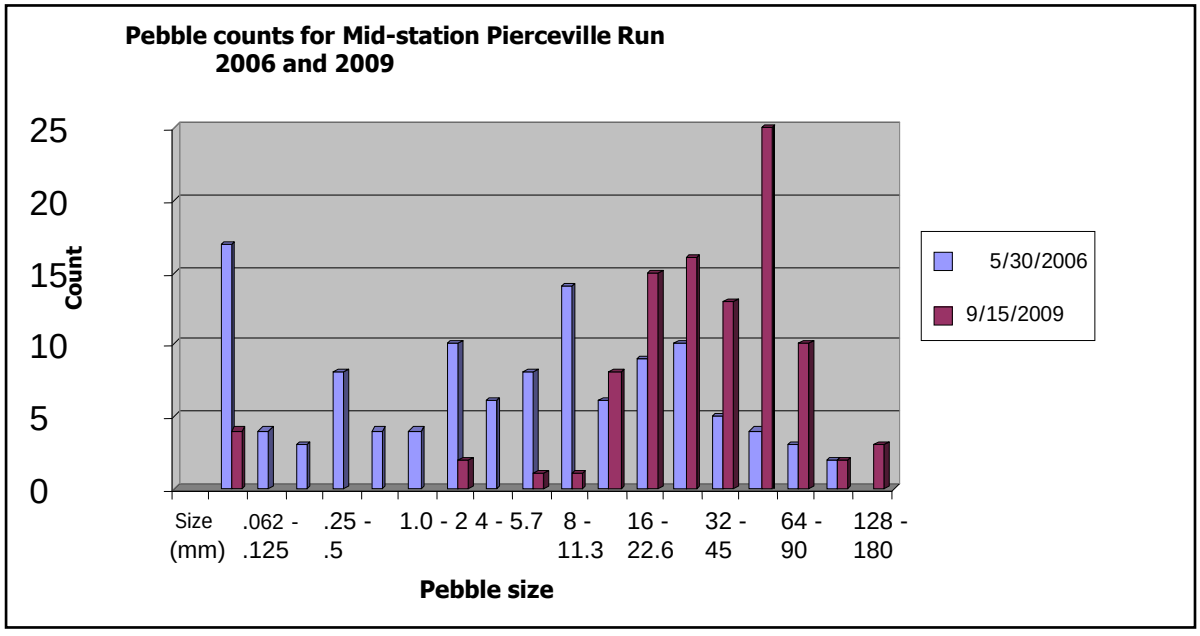
Pierceville Run flows 2.67 miles through hilly farmland in southern York County in State Water Plan Subbasin 7H (Lower Susquehanna River). It joins Centerville Run, which then flows into the South Branch Codorus Creek just north of Centerville, PA. Land use in this 6.7-square-mile- area of York County is a mix of crop fields and pasture along with forested patches. There are no urban areas in this sub-watershed. The stream was assessed as "high priority" for restoration during a full South Branch watershed assessment project sponsored by the Izaak Walton League's Chapter 67 (IWLA) under a 319 Non-Point Source grant in 1999. Streambank erosion in Pierceville Run was significant with 3 to 4 foot vertical banks eroding up to 1.5 feet/year.

Two stations on the reach were also assessed for habitat and macroinvertebrate conditions by DEP in 1999, resulting in the 2002 Impaired Aquatic Life Use listing on the Integrated Report due to agriculture, leading to "siltation and flow alterations" (i.e. unstable stream banks resulting in extensive stream migration). A TMDL for the entire South Branch watershed was approved by EPA in 2003. The TMDL addressed excessive nutrients, siltation, and suspended solids as impairments to the stream. Pierceville Run impacts were singled out as 'Allocation 4' for targeted reductions as follows: Phosphorus reductions needed for farmland and streambanks, 2,387 lbs/year (or 73% reduction); sediment reductions for farmland and streambanks, 1.54 million lbs/year (42%).

The IWLA secured a 319/Growing Greener Grant in 2003 to design and restore 2,271 linear feet

of Pierceville Run using natural stream channel design. The project, implemented in 2006, improved flow regimes and aquatic habitat by grading and stabilizing streambanks using numerous in-stream rock structures, and by installing an extensive riparian buffer including grasses, forbs and 600 trees under the PA CREP managed by the York County Conservation District. After project completion, the estimated sediment savings for this reach was reported at 700 tons/year (2272 ft. x .308T/linear ft. average erosion rate in project area) in the final report (July 2006). This amounts to 9% of the TMDL sediment load reduction needed for the entire South Branch Codorus Creek watershed.

DEP's WSS staff has been monitoring this project for macroinvertebrates, habitat and pebble counts since the spring of 2006. Water chemistry was added in 2007. Staff developed and used stream restoration protocols that track trends of change over time. The riparian area is no longer used for grazing and has become more stable. Besides visual observations and photo documentation that indicate greatly improved habitat, data is documenting improvements in pebble counts: the trend is towards larger gravel and cobbles, which provides increased living space for macroinvertebrates. Just before construction (May 2006), the mid-station substrates were 34% sand-silt, 62% pebbles and 4% cobbles. By September 2009, the percentages were 4%, 81% and 15% respectively.



In 2011, the two stations on the reach were reassessed for habitat and macroinvertebrate conditions. The results show improvements sufficient to remove the stream from the impaired list of waters. This stream was delisted in the 2012 Integrated Waters Report. This indicates a major success for CREP and the other grant programs that facilitated this stream and habitat improvement. An American Bittern was observed in the CREP buffer on Pierceville Run during the stream re-assessment. See the following photo:

American Bittern in CREP buffer on Pierceville Run. Photo courtesy of DEP.

SCHWABEN CREEK (NORTH BRANCH) KAUFFMAN FARM CREP

The North Branch Schwaben Creek is a small tributary to Schwaben Creek, which in turn flows into Mahanoy Creek, which flows to the Susquehanna River. Most of the length of Schwaben Creek parallels State Route 3010, running from east to west through the agricultural valley near the village of Rebuck in Northumberland County. The North Branch Schwaben Creek joins Schwaben Creek and is approximately one mile southeast of the Kauffman Farm CREP project. The entire Schwaben Creek basin is listed in Chapter 93 of the Pennsylvania Code with a designated use of Trout Stocking (fishery) and Migratory Fishes (TSF-MF). Schwaben Creek is also listed by the DEP as impaired due to sediment.

The Kauffman Farm is a small family-operated farm that works the land for crops and maintains a slight flock of assorted fowl, but it is primarily oriented toward raising a small herd of

pastured beef cattle. Prior to 2004 the cattle had unrestricted access to North Branch Schwaben Creek. In response to the need for better stream protection, a CREP stream riparian buffer project was put in place in 2004 on the property. The original Kauffman Farm riparian buffer project totaled a length of about 1,600 feet of buffer on North Branch Schwaben Creek, but in addition to this, there are two small unnamed tributaries on the farm which are also part of the managed stream buffer, adding an additional 2,000 feet of length, bringing the farms buffered stream length to approximately 3,600 feet. The newly established riparian zone is minimally 50 feet in width on both sides of the creek. While not part of this project, the next farm upstream (The Jim Fesner Farm, an operation similar to the Kauffman Farm) is also maintaining a stream riparian buffer of approximately 1,700 feet to the upstream point where Kulp Road (T391) crosses the North Branch Schwaben Creek. Upstream of this point, the stream enters a small woodlot, becomes very small, low flow (possibly intermittent) headwaters.

For our present CREP monitoring effort, the stream is being evaluated yearly at several points on the Kauffman Farm for improvements in water chemistry, stream temperature, bacteria load, and instream habitat for macroinvertebrate organisms, as well as riparian quality, and overall stream health. A headwater site in the previously mentioned woodlot will be monitored as a reference or control site. The first data for the present CREP monitoring effort was collected in July 2012 and evaluation of that data is now completed and reported here. Monitoring (and yearly updates) will continue for a total of 5 years and a final report will be offered in 2017.

Over the summer of 2012 the Kauffman Farm was visited multiple times for three primary reasons: 1) to collect water samples for testing for bacteria and water chemistry; 2) to measure stream flow; and 3) to deploy long-term water temperature data loggers. A fourth reason of much internal interest was to assess the riparian conditions by utilizing a new method called the Systematic Riparian Assessment method as drafted by DEP's Bureau of Conservation and Restoration. The Department is currently determining the utility of the method.

BACTERIA

Fecal coliform, E. coli, and enterococci bacteria are used as indicators of a stream contamination because they are commonly found in human and animal feces. They can be good indicators of the effectiveness of livestock exclusion and riparian enhancement efforts, as livestock (and their feces) are restricted in their ability to gain direct access to the stream.

Although fecal coliforms are generally not particularly harmful to the health of most organisms themselves, they indicate the possible presence of pathogenic bacteria, viruses and protozoa that could also live in human and animal digestive systems. Therefore, the presence of fecal-related bacteria in a stream suggests that pathogenic microorganisms are potentially present as well, and that water contact recreation such as swimming, or use for livestock watering could pose a health risk. In other words, fecal bacteria are useful for indicating that there is a corresponding potential for disease causing agents to be in the water. The Department of Environmental Protection has used fecal coliform bacteria as its indicator for many years, while the Environmental Protection Agency and the Health Department recommends using *E. coli* as an indicator of health risk from water contact. *E. coli* is a species of fecal coliform bacteria that occurs in the gastro-intestinal tract of warm-blooded animals. It occurs in high densities in warm-blooded animal (and human) feces and has been used as an indicator of fecal contamination for many years. It does not grow in natural environments under ordinary circumstances. There is a close correlation between high *E. coli* counts and the incidence of gastroenteritis (digestive tract illness) at swimming areas. Most strains of *E. coli* are not disease causing bacteria, but their presence signals the possible presence of viruses and other pathogens. Lastly, some entities see *enterococci* as another useful form of indicator bacteria.

For contact such as swimming the standards are such that these numbers should not be exceeded: **Fecal coliform** Standards for human recreational contact are set that a single sample is not to exceed 400CFU (Colony Forming Units) per 100ml, or have a 5-sample geometric mean exceeding 200CFU per 100ml, where the samples are collected at least a day apart within a 15-30-day period. **E. coli** Standards are set that a single sample is not to exceed 406CFU per 100ml, or have a 5-sample geometric mean exceeding 126CFU per 100ml, where the samples are collected at least a day apart within a 15-30-day period. There is no official set PA or EPA standard for **Enterococci.** An accepted target of <35 is sometimes employed by some other states and private entities, and academic interests for enterococci as an indicator of disease and stream health continues. In laymen's terms, it is the case that for all three indicator bacterial forms, the lower the number the better.

Sampling for fecal coliform bacteria and E. coli was done five times at each site. For a more thorough evaluation each site was also sampled twice for enterococci. Sampling for fecal coliform and E. coli was done on a schedule that would meet the frequency requirements for

determining a geometric mean. Geometric means were calculated for all sites. This is useful in determining if there are sites with chronically high levels of bacteria. All of the results are depicted in Table 1. Sites Kk1 and Kk2 are not meeting any of the bacteria count goals. Bacteria counts show that the small tributary (Kk2) is conveying the highest concentration of fecal bacteria. This small run is in close proximity to a barnyard which has potential to be a leading source of the feces. Initially, in order to indicate an improvement, the goal for bacteria on the farm is to have a lower geometric mean at sites Kk1 and Kk2, and to maintain the already good numbers present at site Kk5. The next step after achieving site specific improvements will be for the water leaving the property at site Kk1 to be carrying no more bacteria than the water entering the farm at site Kk3. The ultimate goal, of course is to meet Water Quality Standards criteria, wherever standards exist. The same is true for all other water chemistry factors and indicators of stream and watershed health.

TABLE 1. BACTERIA ANALYSIS RESULTS and flow measurement
F.Col = Fecal Coliforms, **e.coli** = Escherichia coli, **Ent** = Enterococci
All samples collected July & August 2012

Site >	Kk1 F.Col.	Kk1 e.coli	Kk1 Ent	Kk2 F.Col.	Kk2 e.coli	Kk2 Ent	Kk3 F.Col.	Kk3 e.coli	Kk3 Ent	Kk4 F.Col.	Kk4 e.coli	Kk4 Ent	Kk5 F.Col.	Kk5 e.coli	Kk5 Ent
	540	630		800	840		60	60		10	55				
	1000	920		890	1200		60	100					40	20	
	430	620	2400	4100	2300	2400	70	80	2400	80	20	390	10	60	100
	6000	6000	2400	6000	6000	2400	230	330	1600	280	410	2000	170	230	1100
	360	450		630	490		340	200		660	710		30	90	
										360	340		10	10	
GEO. MEAN >	**871**	**994**	**2400**	**1616**	**1468**	**2400**	**115**	**126**	**1960**	**140**	**161**	**883**	**29**	**48**	**332**

Kk1= the downstream site where the stream exits the Kauffman Property @ N 40.72492, W -076.69593
Kk2= trib1 near pond on Kauffman Farm @ N 40.72579, W -076.69569
Kk3=upstream of Kauffman boundary (at Jim Fesner Farm lane, where stream enters the Kauffman Farm property @ N 40.72909, W -076.68646
Kk4=(control site) upstr of project in woodlot upstr. of Kulp Road (T391) crossing.@ N 40.72579, W -076.69217
Kk5=trib2 @ upper Kauffman Farm @ N 40.72777, W -076.69321

Site > Date >	Kk1 26 July 2012	Kk2 26 July 2012	Kk3 26 July 2012	Kk4 27 July 2012	Kk5 27 July 2012
FLOW >	101 Gallons Per Minute	6 GPM	75 GPM	13 GPM	20 GPM

FLOWS

In general the North Branch Schwaben Creek is a low-flow stream, especially in the summer months. Anecdotally, it is not known to dry up and become intermittent at the Kauffman Farm (Kk1), but has been known to become intermittent at site Kk4 in times of drought. Flows are

measured primarily for the purpose of quantifying any pollutants for which calculating loading would be of interest. Flow is also of importance to maintaining aquatic life. To the farmers, it is critical for livestock watering.

WATER CHEMISTRY

The parameters of most interest in this project are those that are associated with agricultural practices or directly related to or indicative of the problems associated with The North Branch Schwaben Creek. They are all listed in Table 2, along with the results of the analysis, the interpretation of each result, and the goal and aim for each over the next several years. The parameters that are of greatest concern are highlighted in Table 2. Many other parameters (mostly metals) were tested at site Kk1. All of the metals tested for are within normal range and meeting standards in the cases where standards exist. Therefore the metals will not be reported on other than to say that metals are not problematic and are meeting standards. Periodic monitoring for them will continue and any anomalies that might occur would then be reported upon.

TABLE 2. WATER CHEMISTRY ANALYSIS RESULTS, INTERPRETAQTION, AND GOALS

Site -> Kk1 Date -> 07/26/2012

Description	Results	Interpretation	GOAL (Aim)
CHLORIDE	3.8 MG/L	acceptable	Maintain (<1500 MG/L)
T ORG CARBON	1.54 MG/L	acceptable	Maintain/monitor
Hardness T	35 MG/L	Naturally low; acceptable	Maintain or increase
BOD5 INHIB	0.80 MG/L	acceptable	Maintain/monitor
SETT SOLIDS	<0.2 ML/L	acceptable	Maintain/monitor
ALKALINITY	23.6 MG/L	Naturally low; marginally acceptable	Maintain or increase (>20 MG/L)
NITROGEN TOT	2.11 MG/L	Prefer lower	Decrease (0.9 MG/L)
T SUSP SOLID	<5 MG/L	acceptable	Maintain (<10 MG/L)
RESIDUE TOT	82 MG/L	acceptable	Maintain (<1000 MG/L)
TURBIDITY	2.62 NTU	acceptable	Maintain or decrease
PHOSPHORUS T	0.039 MG/L	Prefer lower	Decrease(<0.02 MG/L)
NITRITE-N	<.01 MG/L	acceptable	Maintain
Nitrate-N	1.92 MG/L	Prefer lower	Decrease (0.60mg/L)
AMMONIA-N T	0.02 MG/L	Prefer lower	Decrease (<0.2 MG/L)
MAGNESIUM T	3.295 MG/L	acceptable	Maintain (<5.0 MG/L)
MANGANESE T	29.0 UG/L	acceptable	Maintain (<1000 ug/L)
CALCIUM T	8.583 MG/L	Naturally low; Prefer higher	Maintain or increase

Due to the local geologic materials, hardness is naturally low. Associated in the same way, alkalinity, and calcium are also naturally low, but at marginally acceptable levels. It would be desirable to maintain or increase these amounts; however, apart from introducing limestone to the stream or surrounding watershed there is no practical way to do that. At the present levels

of alkalinity, the stream does have some buffering capacity against acids and the present levels are not compromising the health of the stream.

The other group of parameters of high interest is the nutrients, which are depicted in Table 2 as Nitrogen Total, Nitrite-N, Nitrate-N, Ammonia-N T, and Phosphorus Total. None of these parameters are alarmingly high, however, both Nitrogen Total and Phosphorus Total are elevated above average or natural levels that are typically observed across the state and we would prefer to see lower levels. The goal in all cases regarding the nutrient parameters is to keep them as low as possible, and especially not to have them elevated by application of animal manure in or near the stream, and to avoid using excess chemical fertilizers. As the riparian zones become more mature and more time passes with cattle having limited access to the stream we should see the hoped for decrease in nutrients. Future monitoring and reporting in subsequent years will update conditions in bacteria and water chemistry, flow, long-term water temperature data, and include an assessment of the riparian conditions as determined by utilizing the Systematic Riparian Assessment method now being refined by PADEP Bureau of Conservation and Restoration.