United States Department of Agriculture
Natural Resources Conservation Service

Helping People Help the Land

June 2010

Conservation Effects Assessment Project

CEAP Highlights

Agriculture Secretary Tom Vilsack announced the availability of the highly anticipated CEAP-Cropland study on the effects of conservation practices on cropland in the Upper Mississippi River Basin (UMRB) on June 16.

"This study confirms much of what USDA already knew about the effectiveness of conservation practices," Vilsack said. "For the first time, however, we now can quantify the extent to which conservation practices are reducing sources of nonpoint source pollution. This study will allow USDA to design and implement conservation programs to better meet the needs of farmers and ranchers. Results from this study show we have made good progress in reducing sediment and pesticide losses from agricultural land in the basin. However, we have made fewer gains in reducing nutrients."

The UMRB cropland study was designed to (1) quantify the effects of conservation practices commonly used on cultivated cropland in the region, (2) evaluate the need for additional conservation treatment, and (3) estimate the potential gains that could be attained with additional conservation treatment.

Assessment of the Effects of Conservation Practices on Cultivated Cropland in the Upper Mississippi River Basin

The study is part of the Conservation Effects Assessment Project (CEAP), a multi-agency USDA-led effort to quantify the environmental effects of conservation practices.

The results of the study lead to the following conclusions for the UMRB:

- *Computer modeling simulations indicate that conservation practice use in the UMRB has made good progress toward reducing sediment, nutrient, and pesticide losses from farm fields. However, significant conservation treatment is still needed to reduce nonpoint agricultural sources of pollution to acceptable levels.*
  - *Use of soil erosion control practices is widespread, but the most vulnerable acres require additional conservation practices.*
  - *Complete and consistent use of nutrient management practices is generally lacking; 62 percent of the acres require additional treatment to reduce the loss of nitrogen or phosphorus from farm fields.*
  - *The most critical conservation concern is the loss of nitrogen through leaching on half of the cropped acres.*
  - *Treatment of erosion alone can exacerbate the nitrogen leaching problem by re-routing surface water to subsurface flow pathways.*
  - *Nitrogen leaching loss is controlled by pairing erosion-control practices with nutrient management practices for rate, form, timing, and method of application.*
  - *Conservation practices have the greatest effect on the more vulnerable acres.*

- About 38 percent of the acres are adequately treated for sediment, nitrogen, and phosphorus loss. Conversely, about 62 percent of the acres still require additional conservation treatment to reduce sediment and/or nutrient losses to acceptable levels.

- Model simulations suggest that adequate treatment for all resource concerns is rarely achieved with single practice solutions. Full treatment of the most vulnerable acres will require a *suite* of conservation practices designed to—
  - ◊ *avoid* or limit the potential for loss by consistently using nutrient management practices (appropriate rate, timing, *and* method) on *all* crops in the rotation;
  - ◊ *control* overland flow and concentrated flow; and
  - ◊ *trap* materials leaving the field using appropriate edge-of-field mitigation.

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- Nutrient management is especially important for acres with erosion control treatment because some of the surface water that carries nitrogen and phosphorus in solution is rerouted to subsurface loss pathways, where it is more difficult to treat. A significant portion of the nutrients in

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Permanent Cover Benefits Grassland Birds of the Great Plains

Geospatial land cover analysis tools and species-specific habitat models developed by the Playa Lakes Joint Venture (PLJV) as part of the CEAP-Wildlife national assessment component provide a means of quantifying the contribution of long-term conservation cover to meeting population goals for important grassland birds of the shortgrass prairies. A copy of the full PLJV report is available at http://www.nrcs.usda.gov/technical/nri/ceap/library.

Summary Findings

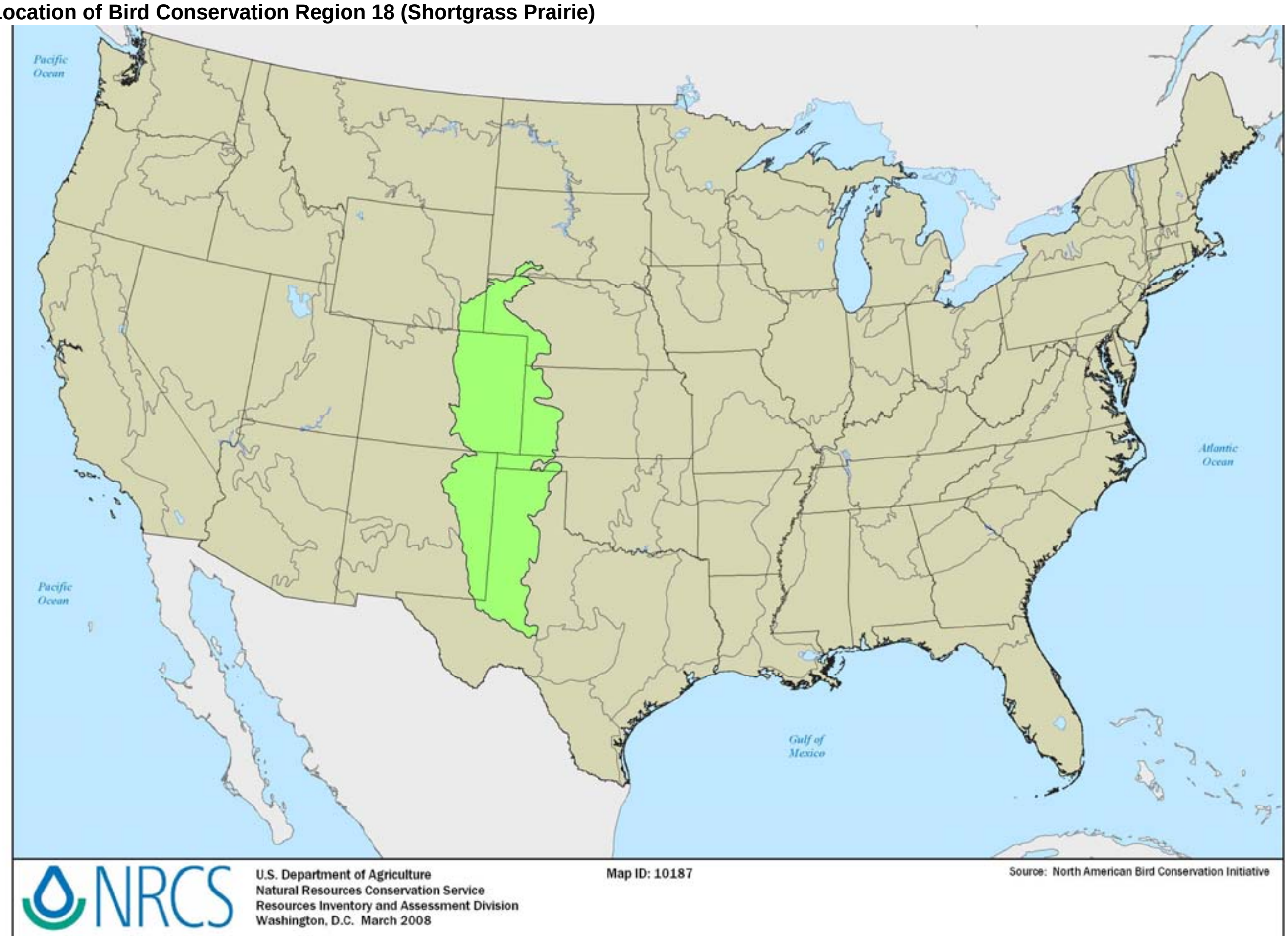
- Approximately 6.1 million acres were enrolled in the Conservation Reserve Program (CRP) in the shortgrass prairie regions of Nebraska, Colorado, Kansas, Oklahoma, New Mexico, and Texas. Conservation cover established on these lands provides important grassland habitat for priority bird species associated with this landscape.
- Geospatial land cover analysis tools and species-specific habitat models developed by the Playa Lakes Joint Venture (PLJV) provide a means to quantify the contribution of grasslands established through the conservation cover practice to meeting population goals for important grassland birds.
- The species showing the greatest benefit from conservation cover establishment in this region was the grasshopper sparrow; CRP enrollments contribute more than 27.5 percent of the grasshopper sparrow's population goal for the shortgrass prairie Bird Conservation Region (BCR18). Also noteworthy, conservation cover enrollments contribute over 10 percent of the lesser prairie-chicken population goal for the BCR.
- Some species, such as the mountain plover, benefit little, if at all, from conservation cover establishment because they prefer sparse, short-stature vegetation over taller, denser grasses typically established through programs such as CRP.
- Conservation cover established on former croplands that occur near existing grasslands improved the quality of these existing grasslands by increasing the size of large blocks of grass. This improvement contributes nearly 4 percent of the population goal for lesser prairie-chickens in the shortgrass prairie portion of Texas.

Recommendation

Strategically planning spatial implementation of conservation cover practices through CRP or other conservation programsand managing cover on established grass have the potential to improve the ability of conservationists to support priority grassland bird populations in the Great Plains.

For additional information, contact the CEAP-Wildlife Coordinator, Charlie Rewa, at 301-504-2326 or charles.rewa@wdc.usda.gov.

Location of Bird Conservation Region 18 (Shortgrass Prairie)



Town Brook Watershed, New York: Assessing BMPs for Phosphorus Reduction

The CEAP Town Brook Watershed study is evaluating the impact of best management practices (BMPs) for phosphorus (P) reduction in New York's Cannonsville Reservoir. The reservoir, the largest of the reservoirs that supply drinking water to New York City, is at risk of eutrophication due to P loading. BMPs implemented on a whole- farm basis include crop rotation and tillage, barnyard improvements, manure management and export, nutrient management, fencing, and filter/buffer strips. Since implementation of the BMPs, there has been a reduction in the P load observed in the Cannonsville Reservoir.

Findings

The CEAP project work has found that very small areas of the watershed or periods of time are responsible for the majority of the nonpoint source pollution. For example, analysis of P runoff losses in the Town Brook watershed indicated that approximately 70 percent of the runoff was generated on 25 percent of the land area and that 16 percent of the watershed was responsible for 85 percent of the P loss. These results indicate that management of the landscape in agricultural watersheds such as these needs to focus on relatively well defined areas that lie at the intersection of hydrologically active areas (runoff source areas) and pollutant source areas.

Methodology

The research team utilized these results in conjunction with economic data about watershed management strategies to devise a methodology for choice and placement of the BMPs on a farm, which ensures that the farmer is using BMP strategies to reduce P loading cost-effectively. Farms in the basin differ in physical characteristics such as size, proximity to water bodies, topography, and runoff source areas, as well as management characteristics such as crop rotation schedules, manure spreading plans, and dairy herd size. In addition to physical differences, different costs are associated with specific BMPs and their placement, and these differences factor into farmers' decisionmaking.

The researchers are exploring different policy scenarios and determining the optimal choice and placement of BMPs on farms to decrease P loading. To do this, they are using the Variable Source Loading Function (VSLF) and Soil and Water Assessment Tool (SWAT) models, cost information gathered from a BMP database, and interviews with farmers and farm planners. Much of this work has focused on the development of the modeling and analysis methodology, and is generally applied and tested at the sub-watershed scale (up to 40 km^2).

The research team paired the Cannonsville SWAT model (calibrated to data from a pre-BMP period), which serves as the pre-BMP estimate of watershed conditions, with the actual watershed data observed after the implementation of BMPs in the basin. The pairing separated the impact of changes in weather or other exogenous environmental variables from the changes in P loading resulting from BMPs. The statistical analysis indicated that the BMPs in fact did significantly improve water quality.

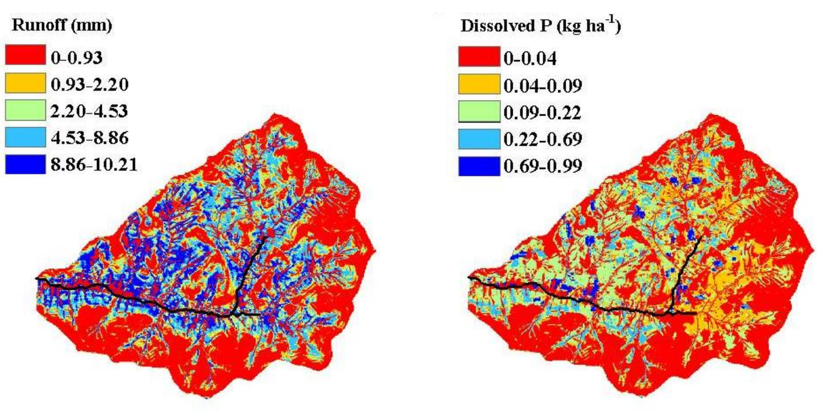
The researchers developed two versions of the SWAT 2005 model for the Cannonsville watershed. The first version is the conventional SWAT2005 model, and the second incorporates variable source area (VSA) hydrology. The researchers compared the results of the two models to evaluate the maximum impact on phosphorous loading that could be achieved by relocating corn production out of wet regions and into drier regions of the watershed, something that is not possible with the original SWAT model. They also analyzed the impact of buffer strips and are now examining economic aspects of that option. They are also examining the impact of future changes in BMPs on phosphorous loadings with both the conventional SWAT model and with the VSA SWAT model.

Expected Impact

The modeling and cost analysis provide a cost-effective means of determining the relative risk of nutrient transport and nonpoint source pollution for a given management or development scenario. By incorporating VSA hydrology, model results provide farmers and watershed managers more accurate information on different zones within farms that have a high propensity for P loading so they can focus BMP strategies.

In addition to different modeling changes, the researchers analyzed different BMP scenarios including manure spreading, crop rotation, and riparian buffers and how different combinations can reduce P loading. Cost analysis will explore the impact of farmer decision-making on water quality outcomes, and how this can affect P loading. The combined results ultimately influence zoning regulations and public policy regarding agricultural environmental management of small and large rural watersheds.

Spatial distribution of runoff (left) and phosphorus loss (right) in the Town Brook Watershed.



Easton, Z.M., D.R. Fuka, M.T. Walter, D.M. Cowan, E.M. Schneiderman, and T.S. Steenhuis. 2008. Re-Conceptualizing the soil and water assessment (SWAT) model to predict runoff from variable source areas. Journal of Hydrology. 348: 279-291.

Prepared from a paper by Zachary Easton, Tammo Steenhuis, and Christine Shoemaker, Cornell University. For more information: Lisa Duriancik, CEAP Coordinator, at 301-540-2304 or lisa.duriancik@wdc.usda.gov. Visit the Cannonsville CEAP Project Web site at http://soilandwater.bee.cornell.edu/research/CEAP/CEAP.htm.

CEAP Rangeland Research 2006–09

Although the CEAP-Grazing Lands national assessment component was the last of the CEAP components to be started, in 2006, it has already begun to yield tangible results in advance of expected publication this year of the rangeland and pastureland literature syntheses. Following is an overview of the products that the CEAP research effort on rangeland has produced to date.

- From 2006 to 2009, CEAP funding leveraged an additional $3 million in funding for research by ARS, by the National Institute of Food and Agriculture (NIFA—formerly the Cooperative State Research, Education, and Extension Service [CSREES])—and by other Federal agencies.

- Between 2007 and 2009, 20 CEAP rangeland articles were published in peer-reviewed journals, with another 10 articles submitted and awaiting review and acceptance.

- Twenty-eight abstracts have been published from presentations on CEAP rangeland research at conferences or symposia.

- CEAP-supported research on rangeland led to publication of two book chapters, three conferences or symposia, and three technical publications.

Current CEAP rangeland modeling efforts conducted by the Agricultural Research Service (ARS) (see map below) focus on development of tools that can be implemented at the landscape scale by NRCS State and field offices. These include—

- **RHEM (Rangeland Hydrology Erosion Model),** which predicts the risk of soil erosion, calculate peak flow rates, and total quantity of runoff. RHEM should be available to NRCS in 2010, for development of tools that will benefit the field.

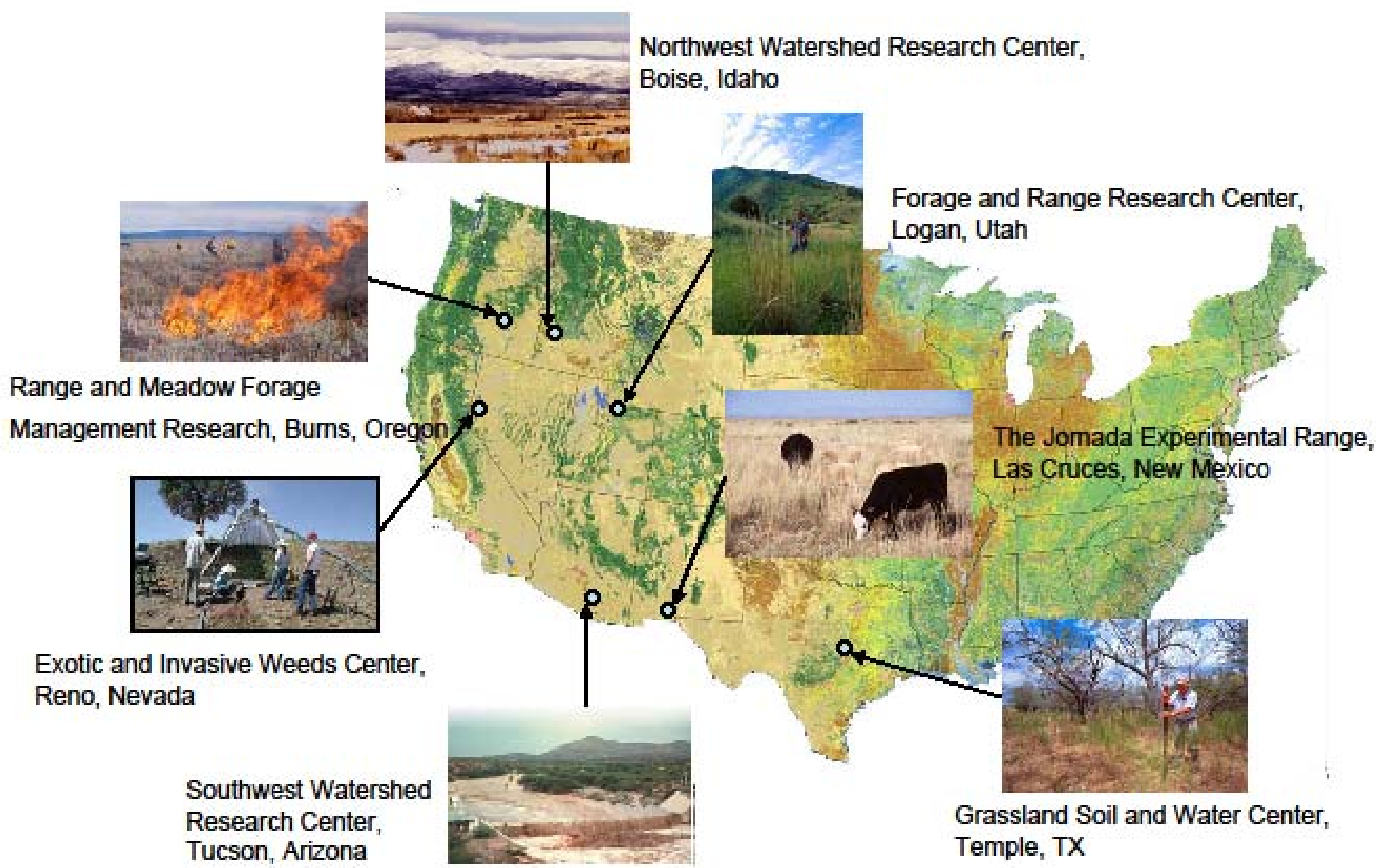
- **ALMANAC (Ag Land Management Alternatives with Numerical Assessment Criteria)** plant growth tool, which can be used to estimate plant community response to a range of environmental stressors.

- **WEPPCAT (Water Erosion Prediction Project Climate Assessment Tool),** which allows evaluation of climate change impacts.

- **KINEROS2** (Kinematic Erosion and Runoff Model), which will integrate the RHEM and ALMANAC models into the Soil and Water Assessment Tool (SWAT) to produce reliable national and regional estimates of the benefits of rangeland conservation enhancements.

For more information, contact Leonard Jolley, CEAP-Grazing Lands Leader, at leonard.jolley@wdc.usda.gov.

USDA-ARS research stations that are contributing to CEAP rangeland findings



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subsurface flows is eventually delivered to lakes, streams, and rivers through seepage, artificial drainage systems, and groundwater return flow.

- Simulation of additional conservation treatment suggests that, by augmenting conservation practices already in use with needed improvements in nutrient management on under-treated acres in the region, nitrogen savings could be more than doubled.
- Even when fully treated, however, some of the most vulnerable acres will have unacceptable losses, especially during years with extreme weather events. For these acres, a change in the cropping system, land-use change, or establishment of long-term conserving cover may be necessary to reduce water quality impacts.

River Basin Cropland Modeling Study Reports

The remaining reports in the cropland series are expected to be released during the remainder of this year. When the series is complete, the reports will have covered the entire area of the lower 48 States. Following are the river basins and water resource regions in the series.

- *Upper Mississippi River Basin*
- Ohio-Tennessee River Basins
- Mid-Atlantic Water Resource Region (includes Chesapeake Bay and Delaware River watersheds)
- New England Water Resource Region
- South Atlantic-Gulf Water Resource Region
- Missouri River Basin
- Arkansas-White-Red River Basins
- Texas Gulf Water Resource Region
- Lower Mississippi River Basin
- Great Lakes
- Souris-Red-Rainy Water Resource Regions
- Pacific Northwest Water Resource Region
- Western Water Resource Region

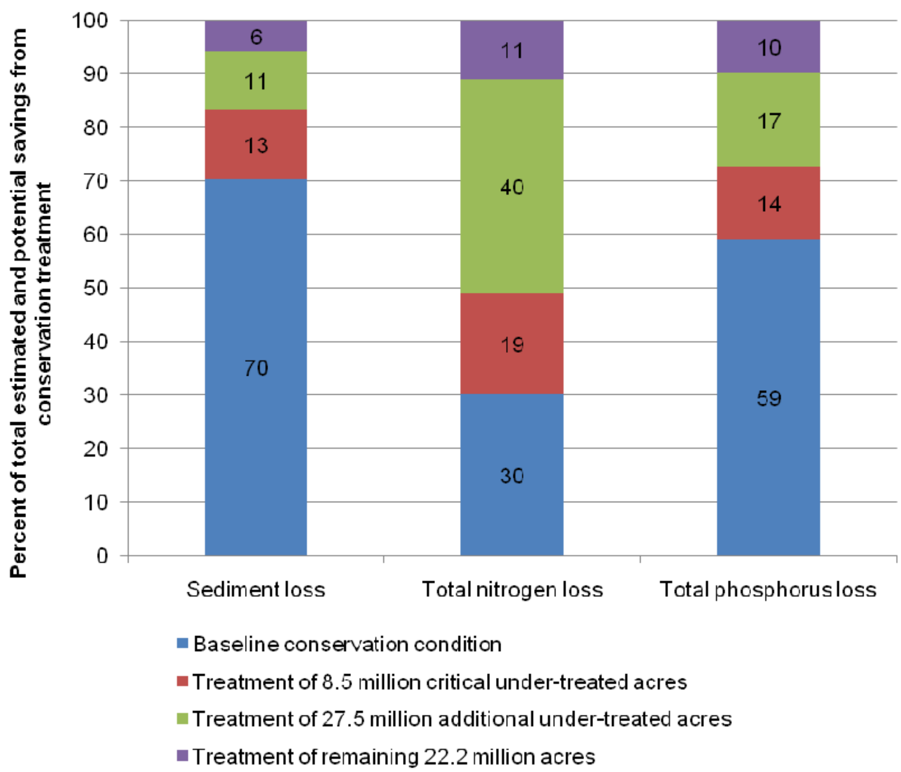
Potential Gains from Further Conservation Treatment

The chart below provides a convenient way to envision the potential gains from further conservation treatment; it contrasts the potential sediment and nutrient savings to estimated savings for the conservation practices currently in use. The no-practice scenario represents losses without any conservation practices, and a "full-treatment" condition was defined as the treatment of *all* acres with nutrient management and water erosion control practices. The difference in sediment and nutrient loss between these two scenarios was used to represent the maximum amount of savings possible for conservation treatment.

As shown in the chart, about 70 percent of the potential sediment savings are accounted for by the conservation practices already in use, as represented by the baseline conservation condition. Additional treatment of the 8.5 million acres considered to be the most critically under-treated acres in the region would account for another 13 percent of the potential sediment savings. An additional 27.5 million acres are considered under-treated, but not critically under-treated. Treatment of those acres, however, would account for only about 11 percent of the potential savings.

Similar percentages were estimated for total phosphorus savings. About 59 percent of the potential savings are accounted for by the conservation practices already in use. Additional treatment of the 8.5 million critical under-treated acres would account for another 14 percent of the potential phosphorus savings. Additional treatment of the remaining 27.5 million under-treated acres would account for another 17 percent of the potential savings.

Much less progress is evident for total nitrogen. The baseline conservation condition accounts for only 30 percent of the potential savings from conservation treatment. Treatment of the 8.5 million critical under-treated acres would account for an additional 19 percent of the potential nitrogen savings, while treatment of the remaining 27.5 million under-treated acres would account for another 40 percent of the potential nitrogen savings.



Upcoming Meetings with CEAP Connections

June 27–July 1, 2010
Joint 9th Federal Interagency Sedimentation Conference and 4th Federal Interagency Hydrologic Modeling Conference. Las Vegas, NV.
Contact Jerry Bernard, NRCS

July 18–21, 2010
Soil and Water Conservation Society
65th International Annual Conference
St. Louis, MO

The Conservation Effects Assessment Project Translating Science into Practice

The Conservation Effects Assessment Project (CEAP) is a multi-agency effort to quantify the environmental benefits of conservation practices and develop the science base for managing the agricultural landscape for environmental quality. Project findings will guide USDA conservation policy and program development and help farmers and ranchers make informed conservation choices.

The three principal constituents of CEAP—the national assessments, the watershed assessment studies, and the bibliographies and literature reviews—contribute to the evolving process of building the science base for conservation. That process includes research, monitoring and data collection, modeling, assessment, and outreach.

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Wetlands National Assessment

Assessing Wetland Ecosystem Services—The Integrated Landscape Model

The USDA Integrated Landscape Model (ILM), under development through a USDA-USGS collaboration supported through CEAP and USGS science initiatives, is designed to simultaneously quantify multiple ecosystem services at local, watershed, and landscape scales. The ILM integrates ecosystem processes, structure, and functions into regionally specific algorithms to conduct real-time monitoring, simulation modeling, and forecasting across a landscape.

The ILM will provide NRCS with the capacity to conduct analyses and provide information for three broad categories of application: accountability; assessment and conservation planning; and adaptive management. Data from USGS and ARS and university research, including long-term datasets, and USDA CEAP-supported studies are providing the biophysical foundation to develop new algorithms and models or refine existing model algorithms.

Currently, CEAP-Wetlands is supporting development of algorithms for riverine and depressional wetlands and associated uplands. CEAP-Wildlife-supported studies offer the opportunity to develop terrestrial and aquatic ecosystem components to quantify habitat and biodiversity support services. Study findings and models—the Hierarchical All-Bird Strategy database, or HABS, for example—supported through CEAP-Wildlife are also being evaluated for integration into the ILM. USGS and ARS are investigating the application of remote sensing data to monitor changes in ecosystem services due to changes in land use and management; implementation of conservation practices and programs; climate change; hydrologic dynamics, alteration and management; and other drivers of change.

The ILM modeling platform, EcoServ, is being developed through the USGS Earth Resources Observations Systems Center as an Open Geospatial Consortium (OGC) compliant system and is currently enabled through the Internet.

Eckles Retires

S. Diane Eckles, CEAP-Wetlands science coordinator, retired December 3 after 38 years of public service. Her experience in wetlands conservation spanned more than three decades.

Diane joined NRCS in 1997 as the wetlands ecologist in the former Resource Assessment and Strategic Planning Division before becoming the first NRCS CEAP-Wetlands Science Coordinator in 2004. Before joining NRCS, she was a field biologist for 19 years with the U.S. Fish and Wildlife Service, where her primary responsibility was to assess impacts to wetlands and other fish and wildlife habitats resulting from proposed Federally funded or permitted projects.

In retirement, Diane, her husband, and two dogs are continuing to make their home in Anne Arundel County, MD. Bill Effland has been assigned the technical direction and administrative duties associated with CEAP-Wetlands on an interim basis until the position is filled.