National Fish and Wildlife Foundation
Final Programmatic Report

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Project Name: Water Quality Trading (MD)

Recipient Organization/Agency: Texas Institute for Applied Environmental Research, Tarleton State University, Stephenville, Texas

Recipient Organization Web Address: http://tiaer.tarleton.edu

1) Summary of Accomplishments

In this CIG-funded project, USDA's Nitrogen Trading Tool was augmented by Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University in order estimate phosphorus and sediment losses and crop yield changes in addition to nitrogen losses. To accomplish the augmentations required, the core simulation model in the tool was changed from Nitrate Leaching and Economic Analysis Package (NLEAP) to Agricultural Policy Environmental eXtender (APEX). The tool is now called the Nutrient Trading Tool (NTT) since it provides other nutrient indicators in addition to nitrogen. TIAER researchers also augmented the trading tool with additional programming that enables linkage with RUSLE2 management files and other national databases. As part of this project, USDA staff and other collaborators in Maryland tested the augmented tool (NTT) using farm data and other information from Carroll County, Maryland.

2) Project Activities & Results

If your grant agreement included an approved logic framework, paste the logic framework table here.

Activities

- *Describe and quantify the primary activities conducted during this grant (refer back to your approved logic framework, ifapplicable).*

The primary activities conducted during this grant are outlined in the four major bullets below.

- Augment the Nitrogen Trading Tool to predict P and sediment losses and crop yields using APEX
  - A. Create a programmatic link between APEX and the existing tool.
    During this process the user-friendly interface of the Nitrogen Trading Tool was maintained. However, the routines within APEX are now used for nitrogen (N), phosphorus (P), sediment, and crop yield simulations and other subroutines in the augmented tool return APEX output to the interface of the Nitrogen Trading Tool. The procedures used to integrate APEX to the new tool, Nutrient Trading Tool (NTT) are very similar to the link between the Nitrogen Trading Tool's interface and the NLEAP model.

  - B. Develop a procedure to utilize existing Nitrogen Trading Tool databases in APEX format.

Various routines were developed to convert databases used in the Nitrogen Trading Tool to APEX format. The seamless conversion process allows NTT users to benefit from the capabilities of the APEX model within the same user-friendly interface they are accustomed to working with. Current NTT databases were used to cross check the procedure to ensure that they will work in practice. Consequently, when a user specifies baseline and alternative management options and clicks the button to generate results, they are now presented with output from the APEX model just as the output from NLEAP was presented to them in the precursor of NTT.

- Complete procedures for development of databases necessary for using the augmented NTT model for all regions of the U.S.
  - Under this major activity, procedures were developed for creating and linking management databases to the Nutrient Trading Tool (NTT) for all regions of the U.S. The procedures developed are expected to provide NTT management databases rapidly to users in all regions of the U.S. during the next NTT development project.
- Assist Maryland Department of Agriculture to validate the augmented NTT tool to predict nutrient credits for the ongoing Water Quality Trading Program in Cecil County, Maryland
  - Apply the augmented NTT to predict nutrient credits for the ongoing Water Quality Trading Program in Carroll County, Maryland. The augmented NTT tool was used in collaboration with the Maryland Department of Agriculture (MDA) to determine how NTT can be used in a trading platform to estimate nitrogen and phosphorus credits associated with various management practices applicable to farms in Maryland and other areas in the Chesapeake Bay watershed.
- Project Reports and User Manual
  - In the final phase of the project TIAER staff wrote an instructional manual for the augmented NTT program and also documented the accomplishments of the project in a final project report.

- *Briefly explain discrepancies between the activities conducted during the grant and the activities agreed upon in your grant agreement.*

All the activities agreed upon in the grant agreement were conducted before culmination of the project.

Results

- *Describe and quantify progress towards achieving the project objectives or outcomes described in your grant agreement. (Quantify using indicators from your approved logic framework, if applicable, or by using new indicators not included in the application.)*

The entire project was a significant success. The expectation of the project team was that NTT would be able to provide reasonable estimates of several key indicators (nitrogen, phosphorus, and sediment losses) associated with alternative practices. It was also hoped that the tool would be used in test mode by various researchers outside of the core NTT development team. All these expectations were met or exceeded during the project.

- *Briefly explain discrepancies between what actually happened compared to what was predicted to happen.*

While expectations were met or exceeded, it was also discovered that substantial local or user input may be required for defining baseline and alternative management practices, beyond what was anticipated. In particular, the RUSLE2 databases that form the core management data sets for NTT provide numerous alternatives from which users can build baseline and alternative management scenarios. It is not possible to programmatically specify these for the user without their input. Because of the diversity of practices at the local level, the NTT interface was augmented to allow users to edit existing (pre-defined) management options or define their own management scenarios from scratch.

- *Provide any further information (such as unexpected outcomes) important for understanding project activities and results.*

The results produced from the NTT tool will require some level of calibration in order to reasonably reflect the nutrient and sediment losses that would be measured in a given application. This calibration requirement is not a drawback of NTT, as it is required in any application that predicts nutrient and sediment losses from field-scale practices. After calibration parameters have been established through scientific research efforts, further calibration requirements would be minimized or eliminated altogether.

3) Lessons Learned

Describe the key lessons learned from this project, such as the least and most effective conservation practices or notable aspects of the project's methods, monitoring, or results. How could other conservation organizations adapt their projects to build upon some of these key lessons about what worked best and what did not?

Lessons learned from beta testing NTT show that there is significant interest in determining phosphorus credits for water quality trading, in addition to nitrogen. Thus, using APEX in NTT provides significant advantages over using NLEAP in the Nitrogen Trading Tool.

4) Dissemination

Briefly identify any dissemination of lessons learned or other project results to external audiences, such as the public or other conservation organizations.

A paper has been written and submitted to the upcoming International Water Quality Conference in Costa Rica (21st Century Watershed Technology: Improving Water Quality and the Environment), in February 2010.

5) Project Documents

a) *Attach 2-10 representative photos from the project. Photos need to have a minimum resolution of 300 dpi.*

Three photos, representing screen shots of the NTT web interface, are attached

- NTT Header-NTT_Header.jpg
- NTT welcome screen-NTT_Welcome.jpg
- Structural conservation practices screen – NTT_StructuralPractices.jpg

b) *Attach publications, GIS data, brochures, videos, outreach tools, press releases, media coverage, and any project deliverables per the terms of your grant agreement.*

Two publications are attached:

- NTT final project report
- NTT user's manual