Monitoring Edge-of-Field Phosphorus Loss To Validate a P Loss Index For The Spavinaw Creek Watershed

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Project Area Description

The Lake Eucha-Spavinaw Basin is one of several high priority basins within Oklahoma, and is in the Ozark Plateaus in northeastern Oklahoma and northwest Arkansas. Lake Eucha was constructed in the 1950's to provide a constant source of water to Lake Spavinaw several kilometers downstream on Spavinaw Creek; this impoundment series serves as a municipal water supply to Tulsa, Oklahoma, and surrounding rural communities. Lake Eucha has experienced substantial increases in nutrient concentrations over the last 25 years (Oklahoma Conservation Commission, 1997). Furthermore, taste and odor problems and the cost of water treatment chemicals have increased significantly. Specifically, this project will address edge-of-field phosphorus (P) loss in the Spavinaw Creek watershed draining into Lake Eucha.

Problem Definition

In order to address these water quality problems, a physically based phosphorus loss index is required to develop farm level nutrient and waste management plans for the pastures in the Spavinaw Creek watershed. Limits or thresholds on this physically based phosphorus loss index are based on the receiving water body, i.e. Lakes Eucha and Spavinaw.

Although there is a current P Index for pastures used in Arkansas, the applicability of the model framework has been a matter of concern. In the current index, the P source and transport (hydrology) components have not been independently validated, and therefore wide spread use of this index for evaluating the risk of P loss to downstream water resources is not warranted. A common P Loss Index is being proposed for common watersheds in Oklahoma and Arkansas, and this common index will be developed with a physically based framework allowing independent validation of the P source and hydrology components. In order for the index to become widely accepted, it is **critical** that it be validated under a variety of conditions. Extensive rainfall simulator and watershed level data exist, but edge of field monitoring data are lacking. The

proposed project will supplement other ongoing and proposed data collection studies to perform a comprehensive validation of the new common P Loss Index. In addition, materials will be developed that can be used to educate results obtained from this project to the general public and local growers.

Project Objectives

The objectives of the project are:

1. Collect edge-of-field water quality data to validate the new physically based Oklahoma/Arkansas phosphorus loss Index.

2. Using data from Objective 1, validate the P Loss index.

3. Develop education materials and conduct workshop to disseminate information.

Task 1: Construct Watersheds and Monitoring Stations

Four monitoring watersheds will be selected in the Spavinaw Creek watershed of Lake Eucha. Each watershed will contain two edge-of-field monitoring sites in permanent pasture for a total of eight monitoring sites. Paired watersheds will be used to compare some or all of the following: litter application vs. no litter application, time of application, litter application rates, soil test phosphorus levels, and possibly buffer strips or other BMPs. Earth berms will be constructed on the fields to define watershed boundaries.

Task 2: Edge-of-Field and Field Management Monitoring

A Quality Assurance Project Plan will be developed for the monitoring portion of the project and approved prior to collecting monitoring data. Twenty-four months of monitoring will be conducted using flumes and automatic samplers to capture nutrient loads from storm events. Flow weighted composite samples will be analyzed for dissolved and particulate nutrients and total suspended solids for all storm events over the period. In order to obtain the best possible data, sample handing with quick response time is essential. In addition, frequent maintenance and security of the sampling equipment will require local support. Therefore, the USDA ARS lab in Fayetteville, Arkansas is a critical component to coordinated field and water quality data collection process. Detailed data on the management of the pasture fields will also be collected. These data will include cattle density throughout the year, supplemental feed inputs, poultry litter application rate, soil sampling, management history of the fields, and other pertinent data.

Task 3: Data Analysis and P Loss Index Validation

A separate Quality Assurance Project Plan for the validation portion of the project will be developed and approved prior to performing the validation. Using the data collected in Task 2, a comprehensive validation of the phosphorus loss index will be conducted. The validation will be a comprehensive statistical analysis using the collected monitoring data and the PPM Calculator. Comparisons between the observed monitoring data and

predictions for the PPM Calculator will be conducted. Details on the methods and goodness-of-fit criteria will be given in the Quality Assurance Project Plan.

Task 4: Develop Education Materials

Materials will be developed in this project that will be used in extension programs to educate producers and the general public. Two fact sheets will be developed before the end of the project period. The first fact sheet will address the relationship between phosphorus and water quality. The second fact sheet will detail how to use the PPM Calculator for manure nutrient management. In addition, a training workshop on the PPM Calculator will be conducted targeted to the Cooperative Extension and Conservation District personnel.

Task 5: Final Report

A detailed final report will be developed.

Budget by Task

Task	*Federal*	*State*	*Total*
Task 1 Construct Watersheds and Monitoring Stations	$140,000	$93,333	$233,333
Task 2 Edge-of-Field and Field Management Monitoring	$124,377	$82,918	$207,295
Task 3 Data Analysis and P Loss Index Validation	$40,000	$26,667	$66,667
Task 4 Develop Education Materials	$9,000	$6,000	$15,000
Task 5 Final Report	$20,000	$13,333	$33,333
TOTAL	$333,377	$222,251	$555,628

Measure of Success

The success of the project will be based on the successful validation of the phosphorus loss index using water quality and field monitoring data collected from this project. The success of the project will also be based on the completion of quality education materials to disseminate these results. The ultimate measure of success for this project is the application of the physically based P loss index to the Spavinaw Creek watershed and the acceptable improvement in water quality in Lakes Eucha and Spavinaw.

Milestones and Time Frame

Initiate Project	February 1, 2005
Monitoring Quality Assurance Project Plan	April 1, 2005
Validation Quality Assurance Project Plan	April 1, 2005
Locate watersheds and secure lease agreements	March 1, 2005
Construct watersheds and monitoring stations	June 1, 2005

Begin Monitoring	July 1, 2005
Complete Data Collection	June 30, 2007
Data Analysis and P Loss Index Validation	September 30, 2007
Education Materials	September 30, 2007
Final Report Submission	September 30, 2007

Outputs

Quality Assurance Project Plan for Monitoring Data
Quality Assurance Project Plan for Validation
Water Quality Monitoring Data
Field Management Data
Education Materials
Final Report

BUDGET

P Index Validation Study 1-12-2005

	Year 1 Federal	Year 1 State	Year 2 Federal	Year 2 State	Year 3 Federal	Year 3 State	Total Federal	Total State
Salary								
Daniel Storm, Professor	$0	$18,377	$0	$18,377	$0	$18,377	$0	$55,131
Assistant Researcher (0.25 FTE)	$15,000	$0	$16,800	$0	$17,640	$0	$49,440	$0
Student Hourly	$3,000	$0	$3,000	$0	$3,000	$0	$9,000	$0
Benefits								
Daniel Storm (@34.91%)	$0	$6,415	$0	$6,415	$0	$6,415	$0	$19,246
Assistant Researcher (@39.51%)	$5,927	$0	$6,638	$0	$6,970	$0	$19,534	$0
Student Hourly (@1.68%)	$50	$0	$50	$0	$50	$0	$151	$0
Materials and Supplies								
Watershed Construction	$10,000	$0	$0	$0	$0	$0	$10,000	$0
Office Supplies and Publications	$595	$0	$500	$0	$1,500	$0	$2,595	$0
Flumes	$8,000	$0	$0	$0	$0	$0	$8,000	$0
Travel	$3,000	$0	$3,000	$0	$3,000	$0	$9,000	$0
Equipment								
Autosamplers	$40,000	$0	$0	$0	$0	$0	$40,000	$0
Contractual								
Land Lease	$4,000	$0	$0	$0	$0	$0	$4,000	$0
Subcontract - USDA ARS	$79,016		$50,325		$52,317		$181,658	
Total Direct Costs	$168,588	$24,792	$80,313	$24,792	$84,476	$24,792	$333,377	$74,377
Less subcontract >$25,000	$54,016		$50,325		$52,317		$156,658	$0
Total Modified Direct Cost	$114,572		$29,988		$32,160		$176,720	$0
Indirect Costs 51.8% MTDC	$38,628	$12,842	$15,534	$12,842	$16,659	$12,842	$70,821	$38,527
Waived IDCs	-$38,628	$51,471	-$15,534	$28,376	-$16,659	$29,501	-$70,821	$109,348
Total Costs	$168,588	$76,263	$80,313	$53,168	$84,476	$54,293	$333,377	$222,252