

Report as of FY2010 for 2009KS71B: "Sediment Baseline Assessment "

Publications

Project 2009KS71B has resulted in no reported publications as of FY2010.

Report Follows

Sediment Baseline Assessment

Project Number: 2009KS71B

Start Date: 1/1/2009

End Date: 2/29/2012

Funding Source: 104B

Focus Categories: Sediments, Water Quality

Descriptors: Sediment, Assessment, Sediment Load, Reservoir Sedimentation, Banner Creek Lake

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Project Class: Research

I: Technical Report

a:

Problem Statement

This sediment baseline research plan is a comparative watershed study. Seven characteristics in each of the study watersheds were compared and contrasted to determine 1) process/setting/sources of sediment, 2) potential management measures to reduce sediment movement and transport and 3) a monitoring method to measure management impact effectiveness. The study watersheds were selected based upon availability of existing information from previous research efforts in the candidate watersheds and presumed large differences in the range of sediment loads between them. Each study watershed is of comparative size and located within the same ecoregion in Kansas.

Generally, the term 'baseline' in this study plan refers to the existing sediment load transported with a watershed. A target condition also exists where the sediment load in a watershed is minimized given watershed size and ecoregion in Kansas. For the purposes of this study, that target condition is defined by the smallest baseline sediment load of the study watersheds.

The seven watershed characteristics for assessment are: geomorphology, hydrology, and geology/soils, which comprise the physical setting and process portion of the baseline assessment methodology; riparian condition and land use which encompass the management opportunities in the watersheds and; and biology and chemistry which will be used to assess the

current condition and then measure movement toward the desired outcome in the streams and lakes of the watersheds.

The characterization of each of the study watersheds is intended to relate those characteristics to the sediment loads in each watershed. Ultimately, the management goal is to change the characteristics in watersheds with larger sediment loads to something that emulates the characteristics in watersheds with smaller sediment loads and use the monitoring to determine the management practice effectiveness toward that reduction.

In 2005, the Kansas Water Office (KWO) in consultation with the Watershed Restoration and Protection Strategy Workgroup developed a Sediment Management Strategy Outline that provided a summary of the sediment issues in the state that needed to be addressed prior to the development of comprehensive statewide sediment management plan. The sediment issues in that strategy outline were created to be topics for sediment research.

The intent of the research on each of those sediment issues is to enhance the knowledge and understanding of each of the issues. This is important because management and policy decisions will be made at the state level with this enhanced knowledge and understanding to ultimately improve the effectiveness of practices and programs in reducing the adverse impacts of sediment on Kansas lakes and streams. Results of the research on each sediment issue will be used to drive sound, scientifically-based management and policy decisions. Kansas Water Resource Institute (KWRI) convened a sediment conference in 2006 to discuss sediment issues in the state. Experts from all research institutions in the state were invited to attend, review and discuss the sediment issues in the Sediment Management Strategy Outline. The result of that conference was the assignment and creation of sediment white papers (available at <http://www.oznet.ksu.edu/library/Sedimentation.htm>) which reviewed the current state of knowledge and identified areas where additional studies were still necessary.

In 2008, the KWRI convened a follow-up sediment conference to review the sediment white papers and initiate the production of research methodologies on three of the six sediment issues identified in the original Sediment Management Strategy Outline. The issue of identifying a baseline sediment load within various physiographic and geologic setting in Kansas was one of those three sediment issues address at that conference. Five additional meetings have been coordinated by the KWO in 2008 to continue this effort to create a Sediment Baseline Assessment Work Plan. This research work plan represents the result of that effort.

The Baseline Sediment Assessment Workgroup selected three watersheds for the sediment baseline study ranging in drainage area size from just over 19 square miles to over 8 square miles. Two of the three study watersheds are located in the Perry Reservoir drainage area (1,117 square miles) and all three are in the Western Corn Belt Plains ecoregion of Kansas. The watersheds drain into reservoirs at the lower end of each watershed. Those lakes are Banner Creek Lake, Centralia Lake and Atchison County Lake. Previous studies and data collected at these lakes indicate a good mix of probable sediment sources and relatively wide range of sediment loads delivered to the study lakes. Bathymetric surveys to assess the current state, trend and spatial variability of sediment are scheduled for Banner Creek, Centralia Lake and Atchison

County Lakes in State Fiscal Year 2010.

Objectives and Methods

Part 1. Physical Setting and Process: Geomorphological Assessment

I. Channel Evolution Assessment in the Banner Creek, Centralia, and Atchison County Lake Watersheds - Bryan Young and Bruce McEnroe, KU Department of Civil, Environmental, and Architectural Engineering

This component of the Sediment Baseline Research program focuses on aerial reconnaissance of streams in the three subject watersheds (the watersheds for Atchison County Lake, Banner Creek Lake, and Centralia Lake). The objective is to identify channel evolution stage using the aerial imagery.

Helicopter videography was collected for all three watersheds in March, 2009. This video, along with digital stills, has been georeferenced and made available to other team members in a geographic information system (GIS). Digital still frames have been extracted from the video at representative locations along the streams; these stills have also been made available in the GIS.

Determination of the stage of channel evolution for each stream is underway. Each digital still has been classified for a range of geomorphic characteristics. These characteristics are being analyzed to group adjacent stream segments with similar qualities. Once stream segments have been identified, a channel evolution stage will be assigned by project personnel.

Efforts during the current reporting period (3/1/2010 – 2/28/2011) focused on a) manual interpretation of historical aerial photographs and on b) geomorphic surveys conducted by The Watershed Institute (TWI). GIS was used to digitize stream centerlines, impoundments, and impoundment watersheds for historical aerial photographs for all three watersheds. The dates for these photographs range from the 1940s through 2008. TWI performed complete geomorphic surveys at select locations in the three watersheds. A total of thirteen geomorphic surveys were conducted during the current reporting period; three more surveys are planned.

a. Publications:

Work in progress was presented at two conferences (oral presentation, no proceedings):

Shelley, John; C. Bryan Young; Bruce M. McEnroe, 2010, "Helicopter-based Videography for Channel Evolution Stage Determination," presented at the World Environmental & Water Resources Congress 2010, Providence, Rhode Island.

Young, C. Bryan; John Shelley; Bruce M. McEnroe, 2010, "Understanding Stream

Evolution using Aerial Imagery,” presented at Water and the Future of Kansas, Topeka, Kansas.

b. Information Transfer Program:

The GIS database of digital photographs and videos have been made available to the research group on the Kansas Water Office website.

c. Student Support:

This research supported three undergraduate research assistants and one graduate research assistant in the department of Civil, Environmental, and Architectural Engineering at the University of Kansas.

Consulting work on Geomorphology Surveys - Brock Emmert, Watershed Institute

TASK 1: SITE SELECTION

Use information—hydrology, litho-stratigraphy, channel evolution determination—gathered by USGS, KGS, and KUCE to help focus reach-scale geomorphology site selection. TWI would also complete a brief field reconnaissance to finalize survey sites. TWI recommends that the geomorphology sites overlap with other field investigations and sites be selected to capture the greatest variety of physical settings.

TWI recommends at least five reach-scale surveys for Banner Creek Reservoir and Atchison County Lake. For Centralia Lake, TWI recommends eight geomorphology surveys—four in each subbasin.

TASK 2: DATA COLLECTION.

TWI will survey the physical dimensions of the channel to determine the dimension, pattern, and profile of the bankfull or channel forming discharge. In addition, TWI will document streambank stability characteristics (bank angle, rooting depth and density, bank composition, bank height ratio, and bank toe protection) to rate the erosion potential within the survey reach. TWI will also note general conditions of the riparian corridor such as corridor width, density, and list the dominant species.

TWI will install monuments for monitoring streambank and streambed erosion at each site. This will validate erosion predictions from geomorphology survey.

TASK 3: DATA ANALYSIS.

TWI will use the quantitative, objective survey data to classify each stream reach according to the

Rosgen Stream Classification of Natural Rivers. For the streambank stability data, TWI will use the Bank Erodibility Hazard Index (BEHI) to rate the bank erodibility and predict an annual erosion rate. TWI will also complete the Pfankuch Stream Stability Evaluation based on field data. Finally, TWI will summarize stream stability ratings for each survey that will validate the channel evolution stage.

TASK 4: MONITORING

In order to validate erosion predictions, TWI will complete a three-year monitoring effort. At each survey, TWI will establish benchmarks for monitoring changes in the stream cross section and profile, lateral erosion, and erosion/deposition of the streambed. TWI will collect field data on a quarterly basis and provide a quarterly summary of the findings. Monitoring can also be continued (if desired) to measure the success/changes if BMP are implemented.

An economy of scale applies to this approach, making aerial videography a good candidate for use on larger watersheds in the future.

Part 2. Land Use and Riparian Assessment - Dan Devlin and Will Boyer, KCARE, KSU, and Kyle Mankin, Dept. of Biological and Agricultural Engineering, KSU.

TASK 1: Obtain and analyze existing GIS databases.

Using available GIS databases determine and map land use, land cover, and, to the extent possible, management practices on the three watersheds. These databases are available from Data Access & Support Center (DASC), USDANRCS, USDA-FSA, USDA-NASS, and USGS. Data collected will include digital orthoimagery, soils data (SSURGO), digital elevation (DEM), land use and cover, crop information, and other geo-referenced databases.

TASK 2. Verify and augment information using local experts.

Once the available GIS databases have been collected and compiled, the next task is to meet with local experts to verify, validate, and augment the data. Local personnel from Extension, NRCS, Conservation Districts, and WRAPS SLT groups will be relied upon to review the preliminary soil, land use, and best management practice information. Incorporating this local knowledge is necessary to ensure that all data that is reported is accurate and up to date. This local expert group will also be relied upon to offer their guidance and expertise in the direct observation survey, which takes place next.

TASK 3. Conduct a survey of the area, making direct observations of land use and riparian and streambank condition, and ground-truthing the information from Tasks 1 & 2. Since soil surveys were completed for most counties in Kansas in the 1970's, more than thirty years ago, and cropland management has drastically changed during that period of time, maps need to be updated and more detail added. A watershed survey needs to be conducted to input geo-referenced field data into tablet computers on crop rotations, current conservation and tillage practices (and conditions), grazing lands conditions, and other relevant information. This will be done on a field by field basis for all crop fields and grazing lands within the watersheds.

Outputs: 1) land cover/land use map for watersheds; 2) map of elevation for watersheds; 3) acres of cropland, grazingland, and urban area, in watersheds; and 3) map of location and extent of conservation practices implemented in the watersheds, which would include terraces and waterways (and their condition), range conditions, no-tillage practices, etc.

Results and Their Significance.

Part 1. Physical Setting and Process: Geomorphological Assessment

I. Channel Evolution Assessment in the Banner Creek, Centralia, and Atchison County Lake Watersheds - Bryan Young, KU Department of Civil, Environmental, and Architectural Engineering

II. Consulting work on Geomorphology Surveys - Brock Emmert, Watershed Institute

TASK 1: SITE SELECTION

TASK 2: DATA COLLECTION.

TASK 3: DATA ANALYSIS.

TASK 4: MONITORING

Part 2. Land Use and Riparian Assessment - Dan Devlin and Will Boyer, Department of Agronomy, KSU, and KCARE, KSU.

TASK 1: Obtain and analyze existing GIS databases.

GIS databases were obtained to map land use, land cover, and management practices. These data were collected and used included digital orthoimagery, soils data (SSURGO), digital elevation (DEM), land use and cover and crop information. Reports containing the geographical data were distributed at two quarterly sedimentation meetings at the Kansas Water Office in Topeka.

TASK 2. Verify and augment information using local experts.

County extension agents other local experts were met with and their local knowledge was added to the databases.

TASK 3. Conducted a field by field survey of the three watersheds, making direct observations of land use, and ground-truthing the information from Tasks 1 & 2.

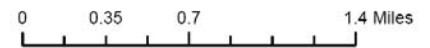
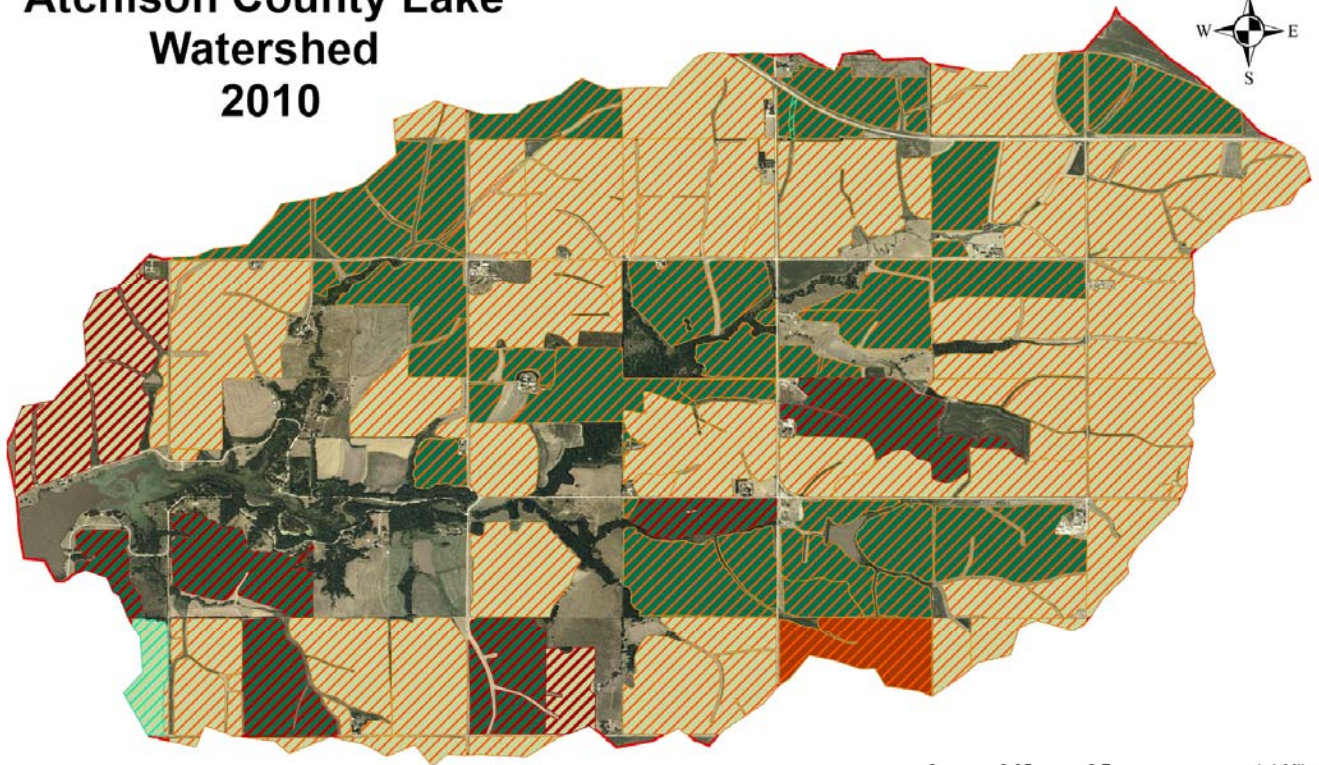
Outputs that have been developed and available: 1) land cover/land use maps for watersheds; 2) map of elevation for watersheds; 3) acres of cropland, grazingland, and urban area, in watersheds; and 3) maps of location and extent of conservation practices implemented in the watersheds, which included terraces and waterways (and their condition), range conditions, no-tillage practices, etc.

**Summary of 2009 Land Use, Tillage Practices, Terraces, and Grassland in
Atchison County Lake, Banner Creek Lake, and Centralia Lake**

		Atchison County Lake	Banner Creek Lake	Centralia Lake
Acres in Cropland Percent of Watershed		3,835 (66.2%)	459 (3.8%)	5,425 (60.4%)
Percentage of the Cropland in the Watershed				
CROP	Soybeans	55.5	61.0	52.5
	Corn	44.1	16.3	33.7
	Wheat	0.3	16.7	11.2
	Other	None	None	2.7
Percentage of Cropland in the Watershed				
TILLAGE PRACTICES	No till	81.0	14.9	61.6
	Reduced till	7.8	None	11.6
	Conventional till	10.2	67.3	22.2
	Not determined	0.9	17.7	4.7
Percentage of Cropland in Watershed				
TERRACE TYPE	Terraced with waterways	41.5	52.1	71.9
	Terraced with tiles	46.8	15.7	19.3
	No terraces	3.5	26.8	2.6
	Not determined	8.1	5.4	6.1
Percentage of Cropland in Watershed				
TERRACE CONDITION	Excellent	32.1	70.9	37.9
	Average	66.8	4.1	47.5
	Needs Rebuilding	1.1	None	13.3
	Not determined	None	25.0	1.4

		Atchison County Lake	Banner Creek Lake	Centralia Lake
Acres in Grassland Percent of Watershed		290 (5.0%)	8,815 (72.1%)	1,405 (15.7%)
Percentage of Grassland in Watershed				
GRASSLAND	Grazed	75.8	67.5	73.3
	Hayed	15.8	27.4	7.2
	CRP	0	0.5	13.2
	Other	8.4	4.6	6.3
Percentage of Grassland in Watershed				
GRASSLAND CONDITION	Excellent	11.0	42.4	28.9
	Fair to Good	75.9	52.3	71.1
	Poor	13.0	5.3	None
Acres in Other Uses (lakes, ponds, roads, homesteads) Percent of Watershed		1,671 (28.8%)	2,956 (24.1%)	2,148 (23.9%)

Atchison County Lake Watershed 2010



CROP, %cropland

- soybeans, 61%
- corn, 37%
- wheat, 2%

TILLAGE, %cropland

- no till, 86%
- reduced till, 1%
- conventional till, 13%





Centralia Lake Watershed 2010

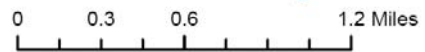


CROP

- soybeans 48%
- corn 41%
- wheat 9%
- other 2%

TILLAGE

- no till 71%
- reduced till 7%
- conventional till 22%



Publications:

This research did not result in any publications during Year 2 of the project.

Information Transfer Program:

The GIS database of digital photographs and videos are on the Kansas Water Office website. All data and results from **Part 2. Land Use and Riparian Assessment** has been placed on the Kansas Water Office website. There were also three public presentations of the information and results to Kansas water professionals. A presentation was also given at the Water and Future of Kansas Meeting.

Student Support:

This part of the study supported one undergraduate and one graduate student.