Kentucky Green River Conservation Reserve Enhancement Program

Annual Program Accomplishment Report (CEP-68R)

FFY 2006

November 15, 2006

I. Executive Summary

The Green River is the most biologically diverse and rich branch of the Ohio River system. The greatest aquatic diversity occurs in a 100-mile section of unhindered river that flows from the Green River Reservoir Dam through Mammoth Cave National Park (the world's longest and most diverse cave system) in south central Kentucky. This section of the Green River Watershed includes 917,197 acres in the counties of Adair, Barren, Edmonson, Green, Hart, Metcalfe, Russell, and Taylor. Data indicates that agricultural runoff contributes high levels of sediment, nutrients, pesticides, and pathogens to the Green River and Mammoth Cave Systems. There are currently seven species listed as endangered by the U.S. Fish and Wildlife Service in the Green River System. In addition, the project area also includes several ecosystems recognized as Endangered Ecosystems of the United States, including native prairies, hardwood savannahs, canebrakes, and old-growth deciduous forest.

On August 29, 2001, the U.S. Department of Agriculture (USDA) and the Commonwealth of Kentucky agreed to implement a Conservation Reserve Enhancement Program (CREP) on the section of the Green River referenced above to restore up to 100,000 acres. The Kentucky Chapter of the Nature Conservancy is a primary contributor, offering permanent easements to landowners in addition to CREP contracts, and offering public relations and BMP implementation assistance. The Kentucky Department of Fish and Wildlife Resources (KDFWR) is a contributor, offering wildlife biologists and cost-shared positions with NRCS to assist landowners and promote the program to enhance participation in CREP. The Kentucky Division of Conservation was designated as the state administrative contact agency for Green River CREP, and distributes state cost share and incentive payments to landowners.

A spring located on the Green River within the CREP Region. Photo courtesy of Joe Meiman, Mammoth Cave National Park

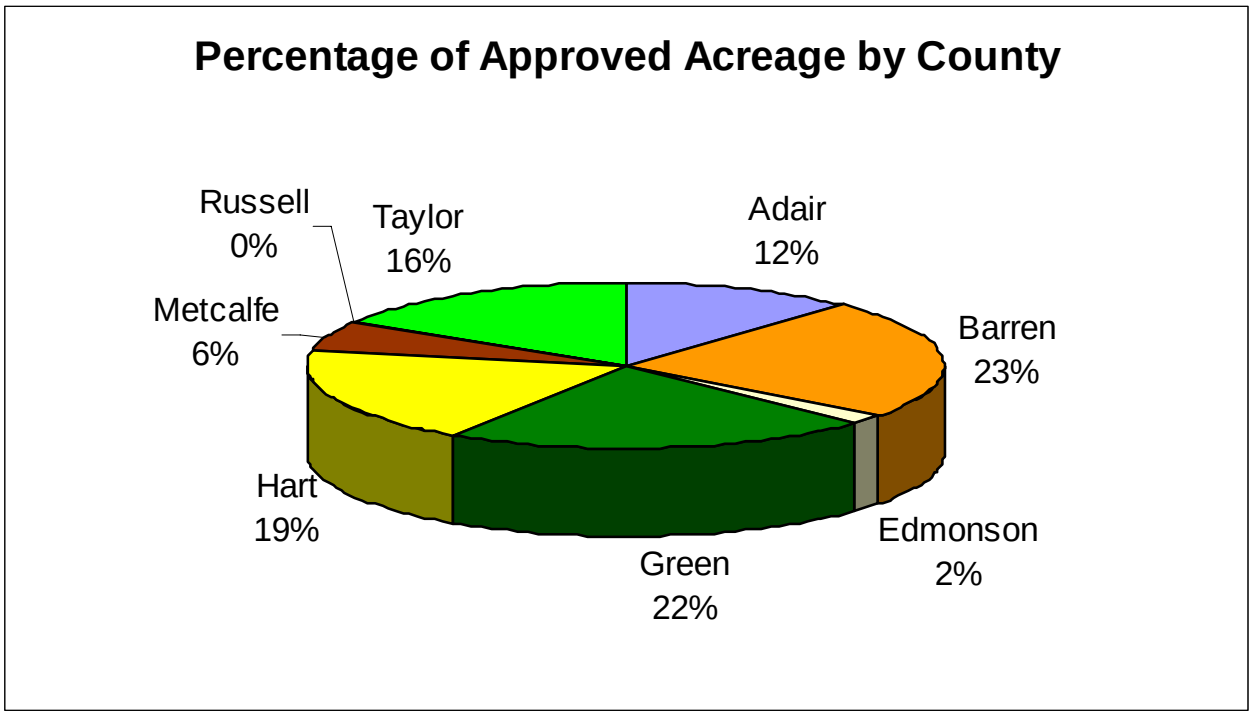
FFY 2006 has continued to show steady enrollment into the program, with total acreage enrolled during this FFY slightly higher than in the previous one. In the previous years since program initiation, the overall acreage enrolled has been slightly higher each year, as individual counties "spiked" with regards to interest and enrollment during different fiscal years. Although that trend did not continue from FFY 2004 to FFY 2005 (during which numbers dropped somewhat), we continue to observe a steady interest and enrollment. Processes with regards to working the program have become more streamlined and homogenous, and many in the general public are seeing the benefits of this program from those that previously enrolled. Because the initial "spikes" occurred in the primary counties, and because, to some degree, of speculation on the proposed changes to this program that will make it a more effective and practical program for this area, the enrollment has seen a leveling effect. This program has become a more common topic of discussion and is known more within the region now than ever before. The proposal for programmatic changes and geographic expansion is currently in the final phases of approval, and when these changes are incorporated into the Green River CREP, it is widely speculated that landowner participation will greatly exceed levels observed within the region to this point.

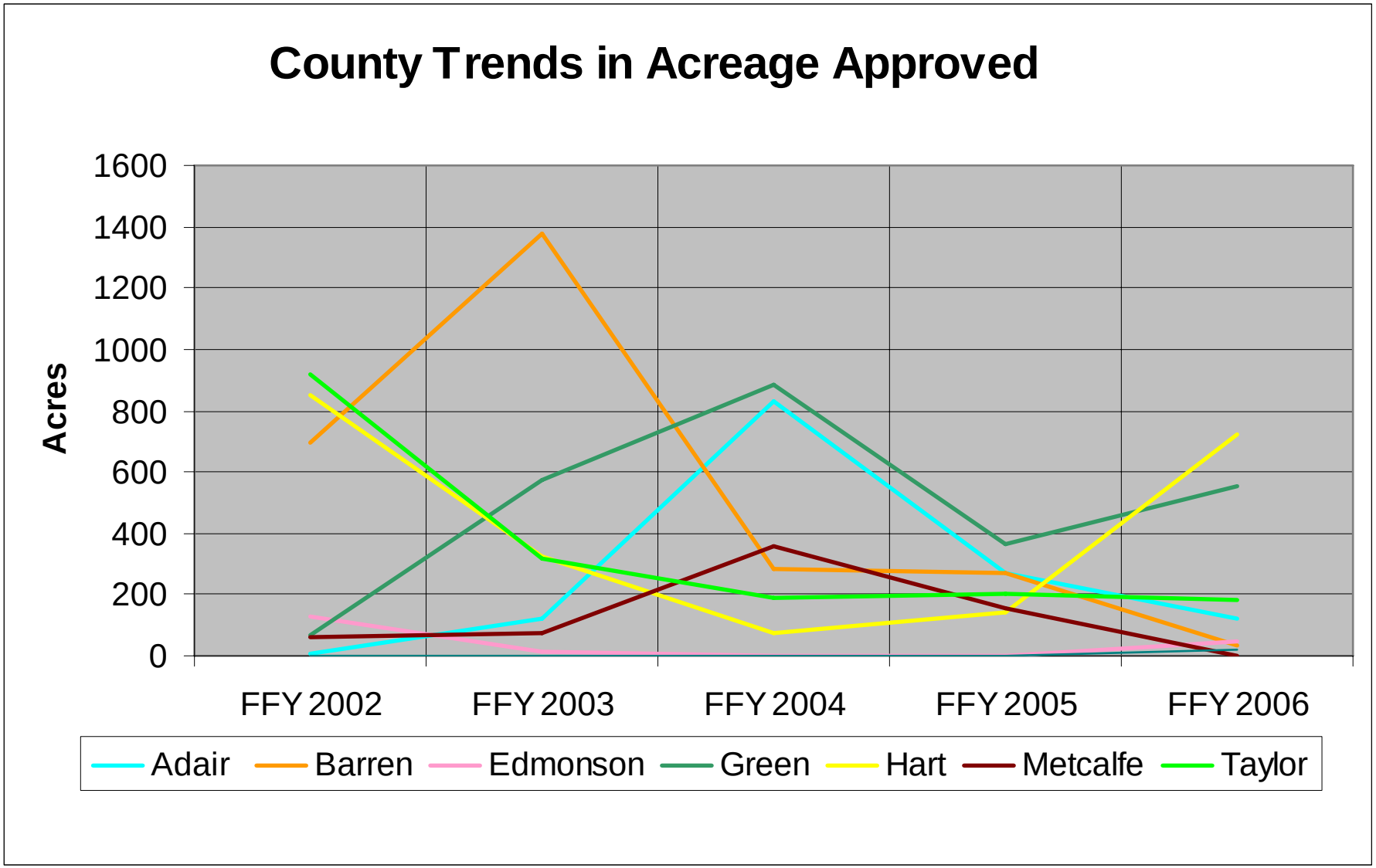
During FFY 2006, the Green River CREP had 102 contracts approved, totaling 1,683.7 acres. Green and Hart Counties enrolled a majority of the acreage during this FFY (76% of acreage enrolled), and Taylor County also did well during the fiscal year. Of the contracts enrolled to this point, the Riparian Buffer (CP22) and Native Warm Season Grass Plantings (CP2) are dominant practices. These two practices account for 94% of the enrolled acreage. An in-depth statistical breakdown of the program is provided on the following pages.

Air photo of Green River within CREP Region. Photo courtesy of Richie Kessler, TNC

Total Acreage per County per FFY

County	Total Acreage by FFY					Cumulative Total
	FFY 2002	FFY 2003	FFY 2004	FFY 2005	FFY 2006	
Adair	4	124.6	827.6	270.1	121	1,347.30
Barren	695.3	1,375.10	282.9	267.3	32.7	2,653.30
Edmonson	129.8	16	0	0	45.3	191.1
Green	66.1	571.5	881.7	367.1	554.6	2,441.00
Hart	850.9	323.9	75.2	139.4	722.2	2,111.60
Metcalfe	59.9	75.5	359.6	153.6	0	648.6
Russell	0	0	0	0	22.7	22.7
Taylor	915.6	319.5	189.7	200.2	185.2	1,810
Total	2,721.60	2,806.10	2,616.70	1,397.70	1,683.70	11,225.80




County Trends in Acreage Approved
Acres
1600
1400
1200
1000
800
600
400
200
0
FFY 2002
FFY 2003
FFY 2004
FFY 2005
FFY 2006
Adair
Barren
Edmonson
Green
Hart
Metcalfe
Taylor

Cumulative Program Acreage/Contracts by County

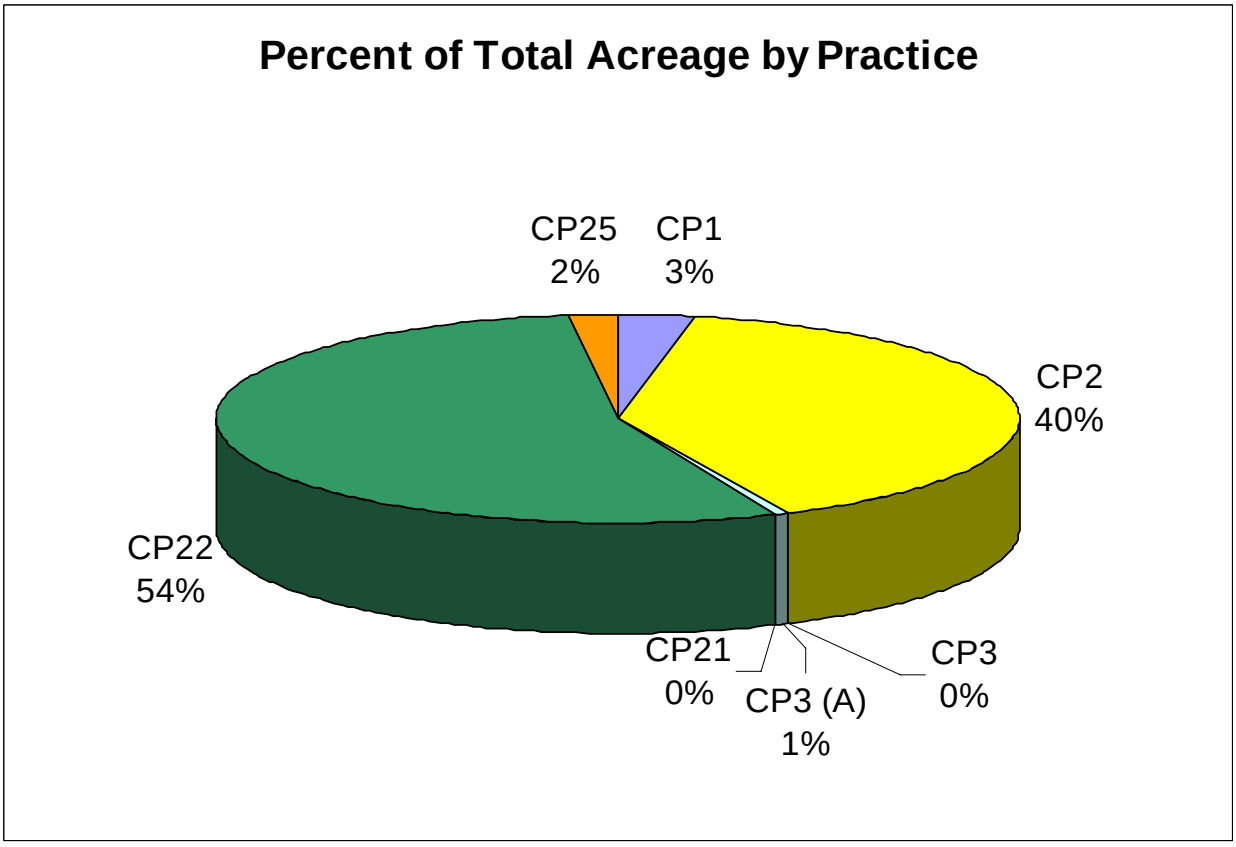
County	Approved Contracts		
	Practice	Number	Acres
Adair	CP1 Introduced Grasses	1	4
	CP2 Native Grasses	8	193.7
	CP3A Hardwood Tree Planting	3	6.8
	CP22 Riparian Buffer	115	1063.9
	CP25 Rare/Declining Habitat	2	78.9
Barren	CP1 Introduced Grasses	1	2.7
	CP2 Native Grasses	63	2353.8
	CP3 Tree Planting	1	15.5
	CP3A Hardwood Tree Planting	1	0.5
	CP22 Riparian Buffer	27	280.8
Edmonson	CP1 Introduced Grasses	4	161.1
	CP2 Native Grasses	2	29
	CP21 Filter Strip	1	1
Green	CP1 Introduced Grasses	1	16.3
	CP2 Native Grasses	9	287.3
	CP22 Riparian Buffer	115	2068.7
	CP25 Rare/Declining Habitat	1	68.7
Hart	CP1 Introduced Grasses	6	150.1
	CP2 Native Grasses	14	671.9
	CP22 Riparian Buffer	54	1289.6
Metcalfe	CP1 Introduced Grasses	2	22
	CP2 Native Grasses	13	431.1
	CP22 Riparian Buffer	20	195.5
Russell	CP22 Riparian Buffer	7	17.6
	CP25 Rare/Declining Habitat	3	5.1
Taylor	CP2 Native Grasses	24	501.5
	CP3A Hardwood Tree Planting	3	53.8
	CP22 Riparian Buffer	102	1202.3
	CP25 Rare/Declining Habitat	2	52.6

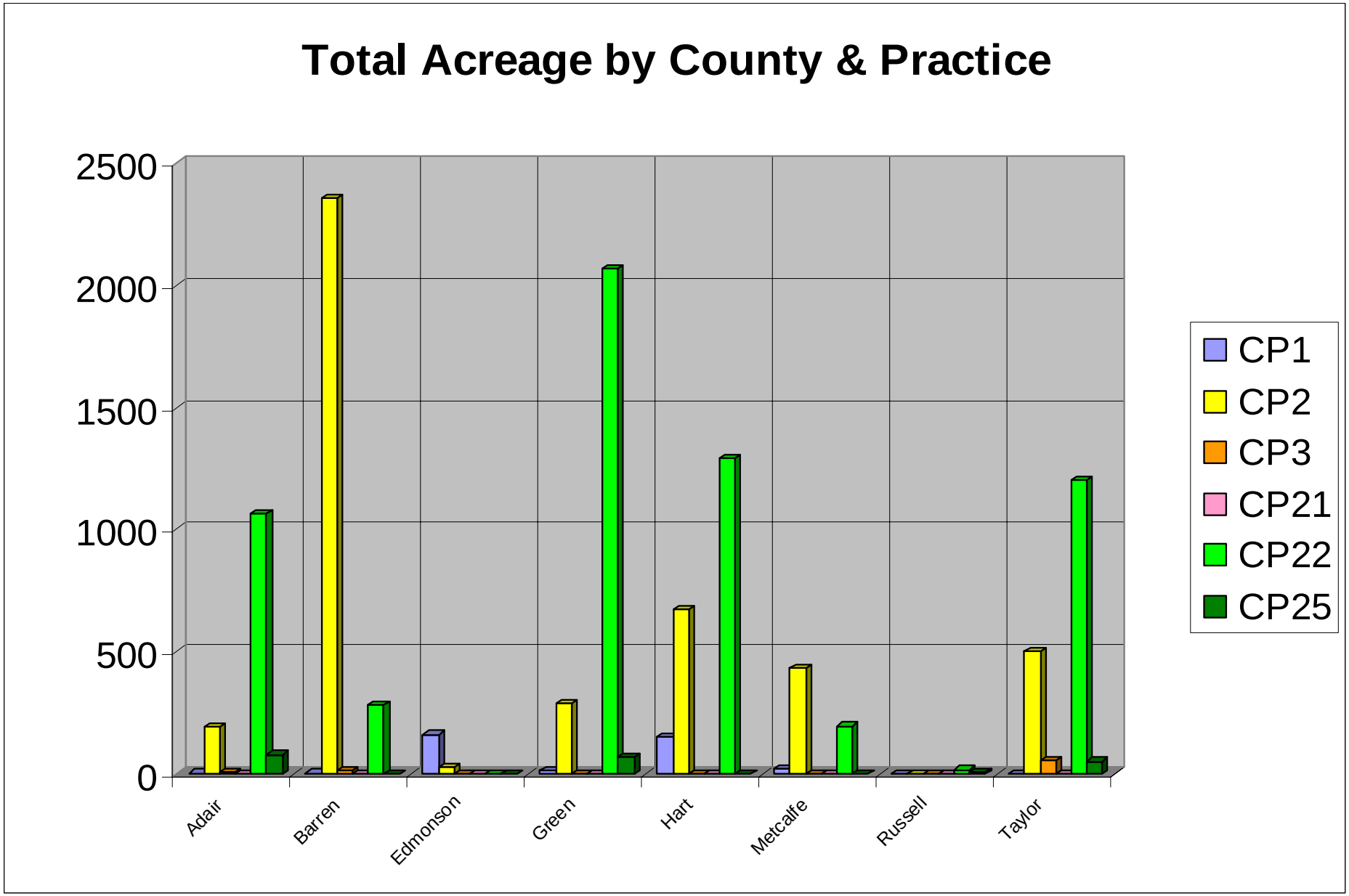
Totals	All	605	11225.8

Cumulative Total Contracts and Acreage by Practice

Practice Code	Approved Contracts		
	Practice	Number	Acres
CP1	Introduced Grasses/Legumes	15	356.2
CP2	Native Warm Season Grasses	133	4468.3
CP3	Tree Planting	1	15.5
CP3 (A)	Hardwood Tree Planting	7	61.2
CP21	Filter Strip	1	1
CP22	Riparian Buffer	440	6118.3
CP25	Rare and Declining Habitat	8	205.3

Totals	All	605	11225.8




Total Acreage by County & Practice
2500
2000
1500
1000
500
0
Adair
Barren
Edmonson
Green
Hart
Metcalfe
Russell
Taylor
CP1
CP2
CP3
CP21
CP22
CP25

Program Cumulative Payment Summary

County	Average Acres/Contract	Avg. Rental Rate/Acre	Incentive Paid Per Acre	Total Estimated Cost-Share	Avg. Cost-Share $/Acre
Adair	10	$100	$46	$483,656	$359
Barren	30	$111	$46	$441,982	$169
Edmonson	32	$104	$41	$20,447	$108
Green	19	$126	$60	$541,763	$213
Hart	29	$132	$60	$279,220	$141
Metcalfe	19	$103	$44	$87,787	$149
Russell	2	$98	$47	$3,066	$171
Taylor	13	$120	$56	$321,397	$197
Region	19	$118	$53	$2,179,318	$200

FFY 2006 Payment Summary

County	Average Acres/Contract	Avg. Rental Rate/Acre	Incentive Paid Per Acre	Total Estimated Cost-Share	Avg. Cost-Share $/Acre
Adair	12	$104	$49	$109,901	$335
Barren	31	$116	$48	$20,504	$132
Edmonson	NA	NA	NA	NA	NA
Green	16	$117	$54	$148,509	$275
Hart	50	$119	$50	$71,733	$145
Metcalfe	NA	NA	NA	NA	NA
Russell	2	$98	$47	$3,066	$171
Taylor	10	$124	$59	$56,543	$324
Region	17	$115	$52	$410,256	$238

Stream Miles Buffered by Green River CREP

County	Miles of Stream Buffered
Adair	43.2
Barren	8
Edmonson	0
Green	43.5
Hart	24.8
Metcalfe	7.9
Russell	0.8
Taylor	28.5
Total	156.7

II. State and Local Partners' Financial Contribution

The Kentucky Chapter of The Nature Conservancy
(TNC)

Richie Kessler, the Green River Director, TNC, submitted the following written summary and financial contribution chart of TNC's activity during FFY 2006:

TNC continues to be an active partner in the Green River CREP program. We continue to offer assistance to local USDA offices and are constantly promoting the program locally in addition to offering permanent conservation easements on riparian buffers.

CREP Promotion and Landowner Assistance

TNC has conducted dozens of landowner visits to promote the program and assist landowners in enrollment. We hired on contract Mr. Terry Partin, who recently retired as FSA CED for Adair County. Terry has conducted at least 35 site visits himself April-October, 2006. We have worked with a number of local radio stations and have multiple

CREP PSA's running on them to a wide audience within the CREP area. One station alone has ~ 28,000 listeners in the CREP area. We also worked with the CREP coordinator, with partner input, to produce a tri-fold, six-panel CREP brochure which will be made available to all partners for distribution within the project area. TNC along with Mammoth Cave RC&D and Mammoth Cave National Park funded an initial printing of 5,000.

CREP Easements

During 2006 the CREP easement value was adjusted from $480 to $650 per acre. Most positive results from increased interest in the easement at the higher value will most likely not be seen until the next federal fiscal year. Nevertheless, CREP easements were recorded on 6 properties covering nearly 100 acres and permanently protecting over one mile of river frontage. This is ~ 16% of the total enrolled riparian buffers for the period. Cumulative totals for riparian buffers protected by the CREP easement are 597 acres and 11.33 linear miles of stream bank permanently protected. Easements account for ~ 10% of the total acreage enrolled in riparian buffers to date.

Financial Summary

For Federal Fiscal Year October 1, 2005 – September 30, 2006:

Administrative Costs (incl. Salaries/Benefits, Travel, Contracts, and Indirect costs):

$53,002.59

Easement Acquisitions: $56,129.75

Grand Total Expenditures for Period: $109,132.34

Cumulative Grand Totals Through Sept. 30, 2006:

Administrative (inc. Salaries/Benefits, Travel, Contracts, and Indirect, etc):

$244,772.25

Easement Acquisitions Cumulative Through Sept. 30, 2006:

$287,487.25

Grand Total Cumulative Expenditures through Sept. 30, 2006: $532,259.50

Kentucky Department of Fish and Wildlife Resources (KDFWR)

The Kentucky Department of Fish and Wildlife Resources has been a key partner in field implementation of the Green River CREP. KDFWR has contributed man-hours from several field positions, including KDFWR/NRCS Liaisons, private lands biologists, and three CREP Biologists. KDFWR personnel adopted many duties working both directly with landowners and with NRCS District Conservationists. These biologists also helped with the physical establishment procedures, such as on site guidance and delivery of seed drills, spray equipment, etc. These biologists also initiated landowner contacts, and coordinated and/or assisted with field days and informational meetings. A rough estimate of more than 287 man- hours were worked on CREP by the Private Lands Biologist and NRCS Liaison positions alone. The three CREP Biologists (two of which were vacated during this FFY), which CREP is their primary job function, and one Farm Bill Biologist which is located within the proposed CREP area and is assisting in local counties, worked more than 1,821 man-hours.

The above referenced CREP Biologists, which are supervised by KDFWR in partnership with NRCS (and some funding from USFWS), has greatly aided in the following tasks for this program: assisting with program promotion, planning, contract writing and modifications, on-site measurements and practice layout; site visits during practice installation; practice evaluation, final and annual status reviews; providing technical guidance on vegetation plantings which includes site preparation, planting, and post-planting management to ensure successful stand establishment; and assisting District Conservationists with writing and/or modifying participants' contracts.

Additional costs to KDFWR not covered by the above referenced activities are as follows: cost shared portion of funding for CREP Coordinator position - $17,500; cost share provided to landowners for implementation/management of CREP practices - $39,255.

Mid-contract maintenance on CREP Native Grass site in Barren County, KY – Photo Courtesy of Barren County NRCS Office

Kentucky Division of Forestry (KDOF)

The Kentucky Division of Forestry has been primary in providing technical assistance and guidance with tree planting practices within the Green River CREP. In addition to the tree planting specific practices (CP-3A), all riparian buffers (CP-22) are required to have a minimum of 50’ or 100’ of trees planted (depending on stream order) adjacent to the water body. In addition to technical guidance and assistance, KDOF personnel have also assisted landowners with tree seedling orders, most of which are through our State nursery.

Kentucky Division of Conservation (KDOC)

The Kentucky Division of Conservation is the state contact agency for the Green River CREP. The Division administers the financial portion of CREP (state cost share and incentive payments), and works closely with local conservation districts and partner agencies in the promotion and administration of the program. In addition, the Green River CREP Coordinator works through, and is partially funded by, the KDOC. The Division has also administered funding for the hiring of the three Green River CREP Technicians located within the region. The following is payment information on state contributions to CREP contracts:

County	TOTAL Contracts	TOTAL Dollars
Adair	**110**	**$215,892.00**
Barren	**79**	**$340,199.00**
Edmonson	**6**	**$15,357.00**
Green	**136**	**$349,876.75**
Hart	**68**	**$189,267.90**
Metcalfe	**50**	**$103,225.00**
Russell	**0**	**$0.00**
Taylor	**119**	**$306,723.00**
Totals:	**568**	**$1,520,540.65**

Kentucky CREP MATRIX

				Federal						State [5/]
Code	**Practice**	**Land Eligibility Criteria**	**Land Use Criteria [6/]**	**Base CS** %	**PIP** %	**SIP** ($10/AC/YR) (1 TIME)	**SRR Incentive** (ac/yr) (% x SRR)	**Maintenance No Water Development**	**Maintenance Fence/ Water Development**	**STATE CS** %
CP-1	Introduced Grasses and Legumes	HEL [1/]	CH	50			50	$5/ac/yr		25
CP-2	Native Grasses	HEL [1/]	CH	50			75	$5/ac/yr		25
CP-3	Tree Planting	HEL	CH	50			100	$5/ac/yr		25
CP-3A	Hardwood Tree Planting	HEL [1/ 2/]	CH	50			100	$5/ac/yr		25
CP-4B	Permanent Wildlife Habitat (Corridors)	HEL	CH	50			75	$5/ac/yr		
CP-4D	Permanent Wildlife Habitat	HEL	CH	50			75	$5/ac/yr		
CP-8A	Grassed Waterways, Non-easement	NA	CH	50	40	X	75	$5/ac/yr		25
CP-9	Shallow Water Areas for Wildlife	NA	CH	50	40		75	$5/ac/yr		
CP-10	Veg.Cover--Grass--Already Established	HEL [3/]	CH	0			NA	$5/ac/yr		
CP-11	Veg. Cover--Trees--Already Established	HEL [3/]	CH	0			NA	$5/ac/yr		
CP-12	Wildlife Food Plots	HEL	CH	0			NA	NA		
CP-15A	Contour Grass Strips	NA	CH	50	40		50	$5/ac/yr		25
CP-21	Filter Strips	NA	CH	50	40	X	75	$5/ac/yr	$9/ac/yr	25
CP-22	Riparian Buffers	NA	CH/MP	50	40	X	100	$5/ac/yr	$9/ac/yr	25
CP-23	Wetland Restoration	NHE	CH	50 [4/]			100	$5/ac/yr		
CP-25	Rare and Declining Habitat	HEL	CH	50			100	$5/ac/yr		

[1/] NHE land is eligible on acreage buffering a non-cropped wetland

[2/] NHE land is eligible on scour erosion areas & must be planted in hardwoods only.

[3/] Previous CRP contract acreage

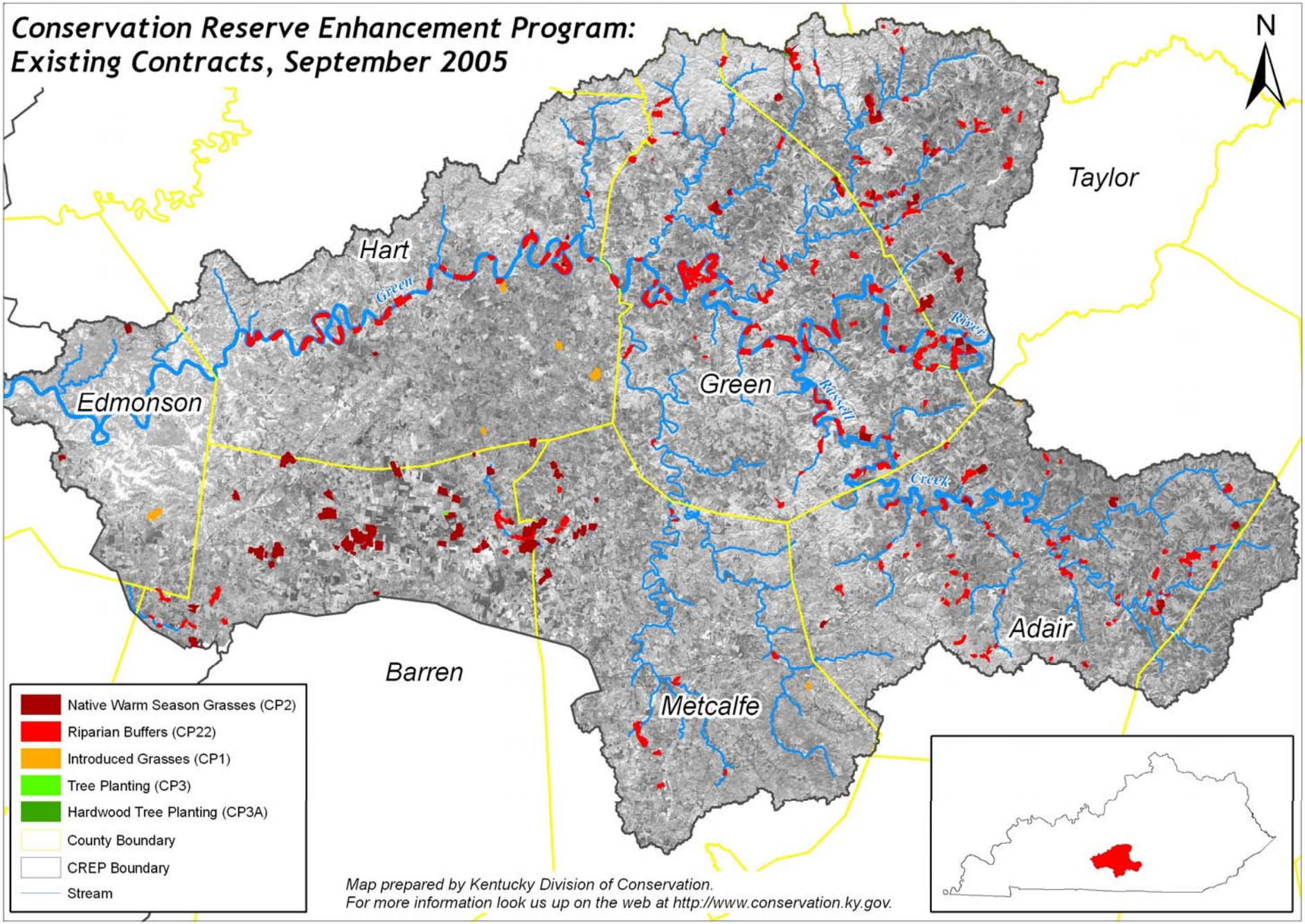
[4/] An additional one-time 25% Cost-Share Incentive is optional

[5/] Additional Incentives may apply, see state incentives below.

[6/] CH: Crop History; MP: Marginal Pastureland

Non-Federal Commitments	
Easements:	**State Incentives (Based on cost of installing practice)**
Permanent - $400/acre lump sum or installments	**75% when land will be entered into a permanent easement**
35 year supplemental contracts - $300/acre lump sum or installments	55% for land entering a 35 year supplemental contract for lands enrolled as riparian buffers or wetland restoration
15 year supplemental contracts - $150/acre lump sum or installments	50% for land entering a 15 year supplemental contract regardless of the practice.
No supplemental contract or easement	25% Incentive for non-easement contracts

Cost Share:
75% cost-share for practices not eligible for federal CRP (limited point access to streams for livestock; water lines and tanks)(funded KCREP3)
KCREP3 - Requirements: Not eligible if landowner is eligible for CREP cost share. Eligible land is restricted to areas within the approved CREP boundary, but does not meet FSA program eligibility criteria for CREP. Eligible lands must be in pasture and adjacent to streams being accessed by livestock. Fence must be installed at the edge of existing tree lines or at the top of the bank at a minimum. If buffer areas already exist, they do not have to be enhanced to meet federal CREP guidelines or NRCS practice standards to be eligible for CREP. **NOTE**: Federal cost-share can not exceed 100% from all sources. State cost-share cannot exceed 75% from all sources.


Conservation Reserve Enhancement Program:
Existing Contracts, September 2005
N
Taylor
Hart
Green River
Edmonson
Green
Russell Creek
Adair
Barren
Metcalfe
Native Warm Season Grasses (CP2)
Riparian Buffers (CP22)
Introduced Grasses (CP1)
Tree Planting (CP3)
Hardwood Tree Planting (CP3A)
County Boundary
CREP Boundary
Stream
Map prepared by Kentucky Division of Conservation.
For more information look us up on the web at http://www.conservation.ky.gov.

III. Monitoring and Evaluation

The following monitoring summary was submitted by Dr. Scott Grubbs, Western Kentucky University:

ANNUAL REPORT

Assessing changes across spatial and temporal scales due to conservation practices associated with the Kentucky Conservation Reserve Enhancement Program in the Upper Green River Basin

Annual report submission to:

National Resources Conservation Service

771 Corporate Drive, Suite 210

Lexington, KY 40503-5479

Project director:

Scott Grubbs, Ph.D.

Department of Biology and Center for Biodiversity Studies

Western Kentucky University

Bowling Green, KY 42101

Date:

November 20, 2006

Background

In 2001 the Upper Green River Basin was established as the geographic entity of Kentucky's U.S.D.A. Conservation Reserve Enhancement Program (CREP). The main goal of the nearly 40,000 ha Kentucky CREP is to reduce nonpoint source pollution loading (e.g., sediment, industrial fertilizer) into the mainstem of the Upper Green River and principle tributaries by recruiting landowners into incentive-based 10-15 yr. cooperative agreements of best management practices aimed to eliminate riparian-based agricultural and animal husbandry practices. Specific measurables that are incorporated in CREP goals are multifaceted and include (a) 10% reduction of sediment, nutrients, and pesticides entering the river and its tributaries from agricultural sources, (b) enhancement of aquatic and riparian habitat, (c) enhancement of aquatic wildlife populations habitat, (d) restoration of riparian habitat corridors, (e) reconnection of landscape-level ecological processes, (f) establishment of riparian buffers around sinkholes, (g) restoration of non-riparian wetlands, and (h) protection and restoration of subterranean ecosystems.

Outline of individual tasks

Task 1: NRCS/CREP GIS mapping and analysis activities

Task 2: Hydrology, sediment and water quality activities

Task 3: Direct terrestrial monitoring activities

Task 4: Project enhancements and pilot studies

Task 5: Seminars and workshops

Task 1 Progress Report: NRCS/CREPGIS mapping and analysis activities, 2006

Task 1 Manager: Ouida W. Meier, Ph.D., Center for Biodiversity Studies, Western Kentucky University

Workplan Overview: GIS mapping and analysis of land use in the Upper Green River Basin, and to begin to analyze historic and project water quality and biological data.

- **Activity 1: GIS mapping and analysis of land use in the Upper Green River Basin**

  In anticipation of the CREP expansion proposal being approved, my lab has begun working with the expanded area for some facets of our analyses. We also produced maps for NRCS use during development of the expansion proposal, including considerations of stream order and selected regions for wider (100-ft) widths.

  Last year my lab has made very good progress in our task of GIS Mapping and Analysis. This year we proceded with updated National Agricultural Imagery Program 2004 aerial images, and the final Kentucky Land Cover Dataset product. Forested riparian corridors within a 1000' buffer have been hand-selected along the mainstem of the Green River from the Green River Lake dam to the confluence with the Nolin River. Tributary watersheds have been evaluated for land use classifications within 1000', 300', 100', and 50' buffers. These evaluations have also been created for the watersheds associated with the major tributaries, and for buffered streams by stream order within these watersheds. This was a very time-consuming process, and we are pleased to have the results for further analyses with water quality parameters from different sources. Variations by major tributary watershed are already apparent, and we expect these analyses to help us predict which watersheds might be releasing more contaminants (pesticide, nutrients, sediment, etc.) than others, and to test those predictions. Other gradients are also being tested as potential correlates of water quality measurements. The results of some of these observations and preliminary analyses are listed in the Presentations section, and a number of maps are provided in the Maps section. Higher resolution imagery of these maps is available upon request (ouida.meier@wku.edu).

- **Activity 2**: **Analysis of historic and project water quality and biological data**

  We have been able to locate and download available USGS and Ky DOW (EPA STORET) water quality data. We also have in hand, full UGWW data, selected Ky DOW aquatic biological data, and some regional data from UK. There are additional USGS, MACA, and DOW water quality data that should be available, and those have been requested. GIS data reflecting CREP enrollment contracts is not being released by NRCS or FSA at this time since it requires full review and correction by each county, but we are trying again to obtain preliminary data. Selected water quality data collected internally within the project by Dr. Grubbs' task through has recently been released, and we look forward to the opportunity to analyze these data.

  Dr. Meier serves as the chair of the Science Advisory committee for Upper Green River Watershed Watch, the Kentucky Waterways Alliance Green River Basin delegate, and a member of the Green River Basin Management Team. Watershed Watch data have proven

useful this year, and now have retrospective data available for 1999-2005; some of the maps illustrating analyses underway are reproduced here. I am also currently a member of the Kentucky Watershed Modeling Information Portal Technical Advisory Group. These service efforts allow contact with other agencies and groups working in the basin to integrate our work with complementary efforts by others, and have ready access to data and information coming out of these groups. With these data either in hand or on the way, we can move to the challenge of working the data into a common format, noting differences in sampling methods, regimes, and sites.

Dissemination of information in professional and regional settings is a deliverable of both major facets of this grant task. Presentations and posters presented at meetings are listed below, as are other activities engaged in to support this project.

Presentations, posters, manuscripts (1 Oct 2005 – 30 Sept 2006)

Butler, J. Michael, Albert J. Meier, Ouida W. Meier, Benjamin Hughes. 2005. Bank characteristics and the occurrence of erosion slumps in the Green River, Central Kentucky. Poster presented at the Kentucky Academy of Sciences annual conference, Nov. 2005 (1st place student poster in ecology).

Grubbs, Scott A., Ouida W. Meier, and Albert J. Meier. 2005. Factors influencing the distribution of lotic fish assemblages in the Upper Green River - Kentucky CREP region. Presentation at the Kentucky Academy of Sciences annual conference, Nov. 2005.

Meier, Ouida, Albert Meier, and Scott Grubbs. 2005. The Upper Green River Biological Preserve A Partner in Restoring a World-Class River. Presentation at the Kentucky Academy of Sciences annual conference, Nov. 2005.

Meier, Ouida, and Albert Meier. 2005. The Upper Green River Biological Preserve: A Partner in Restoring a World-Class River. Invited presentation at the 8th Annual Southeast Watershed Forum and 3rd Annual Kentucky State Watershed Roundtable, Bowling Green, Kentucky, Nov. 2005.

Meier, Ouida and Kami MacDonald. 2006. Upper Green River Watershed Watch 2005 Data Review. UGRWW annual conference, 17 February 2006. Data analysis - display and presentation.

McCadney, DeAnna and Ouida Meier. 2006. Upper Green River Watershed Watch Data Review: Fecal Coliform Patterns, 1999-2005. UGRWW annual conference, 17 February 2006. Data analysis - display and presentation.

Hughes, Benjamin and Ouida Meier. 2006. A GIS assessment of riparian corridor characteristics and environmental variables along the upper Green River in Kentucky. Sigma Xi student conference, Western Kentucky University, 8 April 2006. Abstract and poster.

MacDonald, Kami and Ouida Meier. 2006. Upper Green River Watershed Watch data analysis. Sigma Xi student conference, Western Kentucky University, 8 April 2006. Abstract and poster.

Meier, Ouida W. 2006. Assessing changes across spatial and temporal scales due to conservation practices associated with the Kentucky Conservation Reserve Enhancement Program in the Upper Green River Basin. CREP training for personnel in expanded CREP area: overview of monitoring and analysis work, 14 June 2006.

Meier, Ouida W. 2006. Assessing changes across spatial and temporal scales due to conservation practices associated with the Kentucky Conservation Reserve Enhancement Program in the Upper Green River Basin. Presentation to Soil and Water Conservation Society, Bluegrass chapter members, business meeting at Kentucky Association of Conservation Districts annual meeting, Owensboro, Kentucky, 17 July 2006.

Meier, Ouida, Benjamin Hughes, Michael Z. Miller, and Kami MacDonald. 2006. Initial GIS assessment of riparian corridor characteristics and environmental variables along the upper Green River in Kentucky. Kentucky GIS Conference, 17-19 July 2006. Abstract and poster.

Meier, Ouida W., Albert J. Meier, and Scott Grubbs. 2006. Many Datasets, One Watershed: Analyzing Patterns at Multiple Spatial and Temporal Scales. International Society for Environmental Information Sciences annual conference, Bowling Green, Kentucky, 3 August 2006. Abstract and presentation.

Meier, Ouida W., Benjamin Hughes, Michael Miller, and Kami MacDonald. 2006. Initial GIS Assessment of Riparian Corridor Characteristics and Environmental Variables Along the Upper Green River in Kentucky. International Society for Environmental Information Sciences annual conference, Bowling Green, Kentucky, August 2006. Abstract and poster (1^{st} place winner, student poster competition).

Bowers, Jonathan, Albert Meier, and Ouida Meier. 2006. Influences of Land Use, Scale, and Weather on Birds Calling. International Society for Environmental Information Sciences annual conference, Bowling Green, Kentucky, August 2006. Abstract and poster (3rd place winner, student poster competition).

Meier, O.W., A.J. Meier, and S.A. Grubbs. 2006. Landuse and stream conditions in the upper Green River watershed of Kentucky. Ecological Society of America annual conference, Memphis, Tennessee, August 2006. Presentation and abstract, Bull. Ecol. Soc. Amer.

Grubbs, S.A., O.D. Meier, and A.J. Meier. 2006. Longitudinal patterns of fish assemblages in small unregulated sub-basins: Evaluating reach- and watershed-scale parameters. Ecological Society of America annual conference, Memphis, Tennessee, August 2006. Presentation and abstract, Bull. Ecol. Soc. Amer.

Additional Products and Activities

Produced maps to assist with discussion of proposed CREP expansion at a meeting of CREP partners, 22 Nov. 2005, Division of Conservation office, Frankfort, Ky.

CREP training for personnel in expanded CREP area: delivered overview of monitoring and analysis work. Maps produced for FSA county personnel, NRCS personnel, CREP partners (100 11”x17” maps, packaged as 50 double-sided heavy-duty laminated display maps); distributed 14 June 2006.

Tours of the Upper Green River Biological Preserve (UGRBP), including Green River mussel rearing facility and CREP plantings, given to Southeast Watershed Forum attendees, 4 Nov. 2005.

CREP tour of UGRBP made available to 55 Soil and Water Conservation Society (SWCS) members, 30 October 2006; tour given by Albert Meier.

Participant in Kentucky Watershed Modeling Information Portal (KWMIP) advisory panel - planning and discussion

Upper Green River Watershed Watch (UGWW): Science Advisor; monitored two sites regularly (three times per year); end-of-year data analysis for 80-100 sites; statewide Watershed Watch Science Advisors group; Interbasin Coordinating Committee.

Student project advisor: DeAnna McCadney, independent research project, upper Green River fecal coliform analyses during 1999-2005.

Kentucky Waterways Alliance, Green River Basin Delegate

Green River Basin Management Team, member and participant

Mammoth Cave International Center for Science and Learning advisory workshop – ad hoc facilities committee

Attended training workshop, Watershed-Based Planning, Lexington, Ky; sponsored by Kentucky Waterways Alliance, 1 March 2006.

Designed and executed Aquatic Ecology event, Science Olympiad (middle and high school students), Kentucky State Finals, WKU, 22 April 2006.

Attended training workshop, National Computational Science Institute (NCSI), WKU, 4-10 June 2006; supported by WKU.

Participation with WKU Bioinformatics Center and Ogden College Sustainability Initiative.

Principal Investigator, EPA Green River Biological Diversity and Monitoring Project. This project includes significant additional sampling, monitoring, and modeling work in the upper Green River basin that will be a strong supplement to our NRCS CREP work.

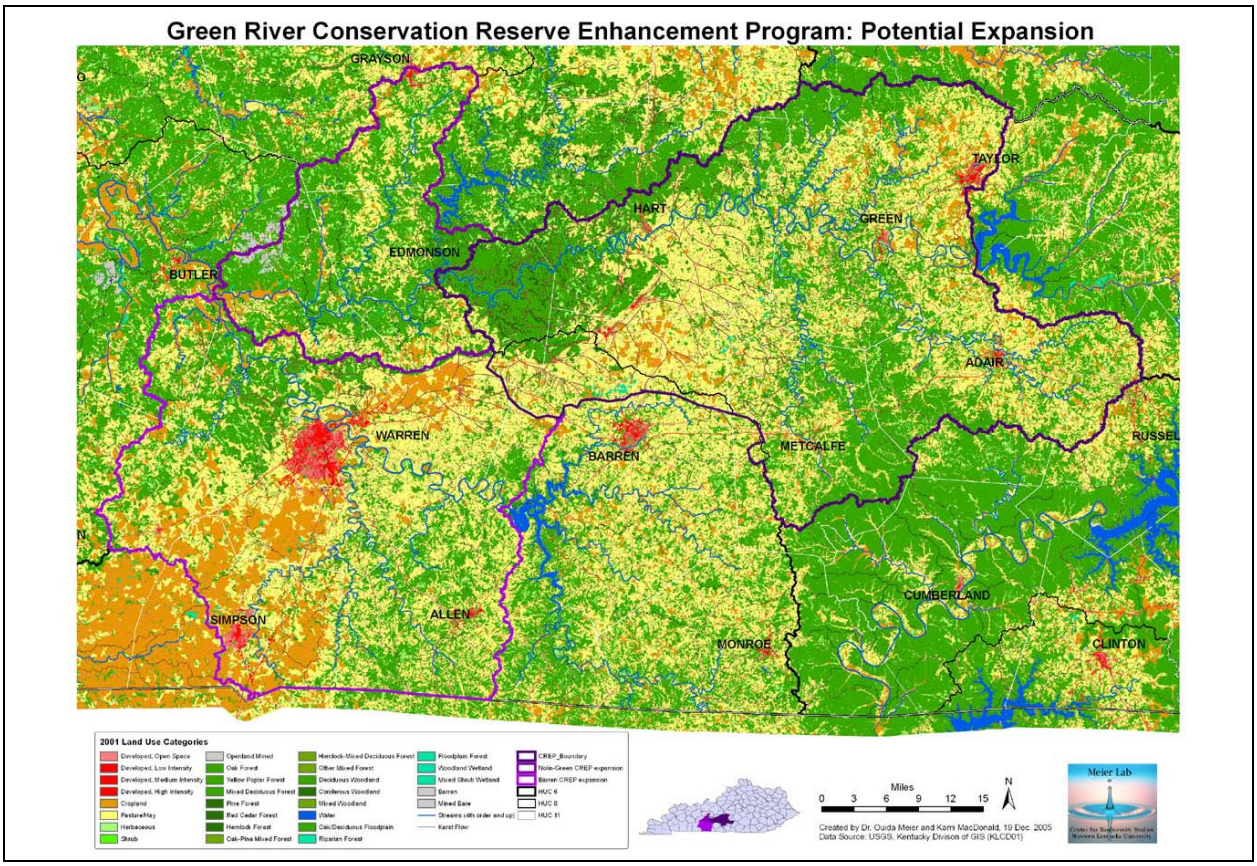
Public information display, by request, at Campus-Community Sustainability kickoff, Bowling Green, featuring Green River Conservation Reserve Enhancement Program and UGRBP projects, including CREP plantings and restoration work; 12 Oct 2006.

Attended SPARROW watershed modeling workshop, USGS, Denver, 24-27 Oct 2006; supported by EPA-funded project.

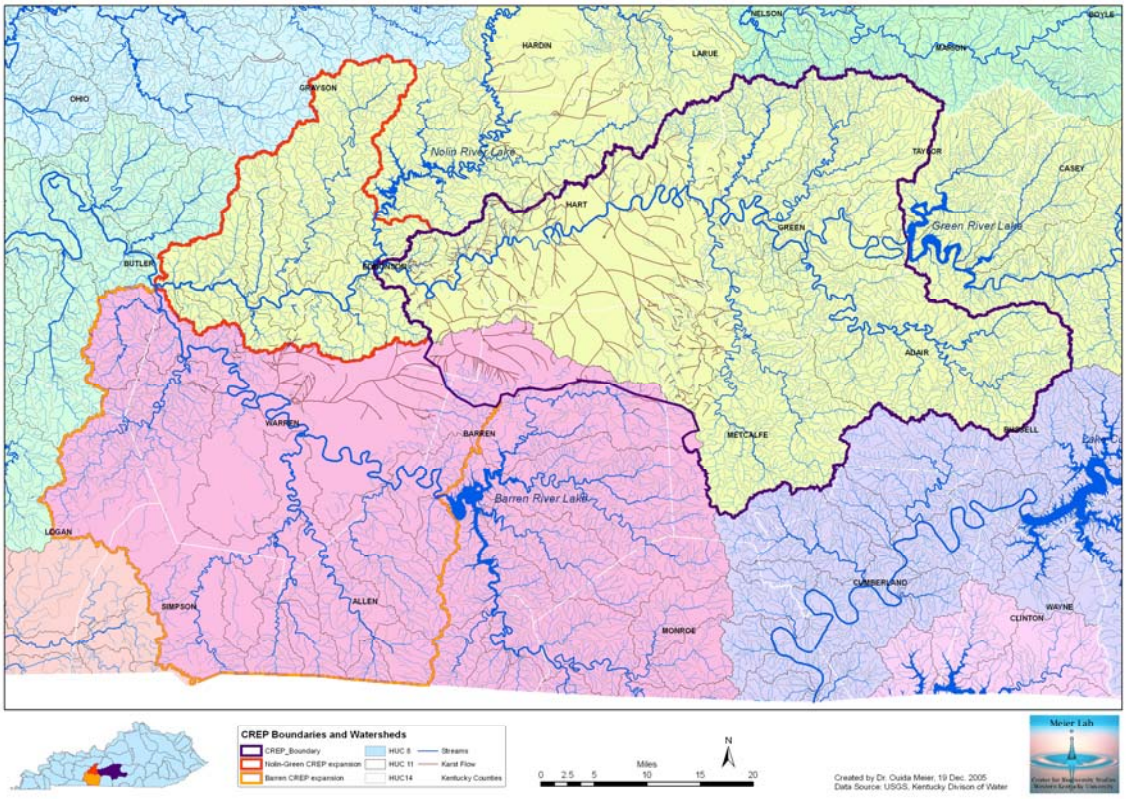
Subsequent presentations and activities, including Nov. 2006 KAS student presentations on Conservation Reserve Enhancement Program, will be listed in the next annual report.

Maps Produced: A Selection

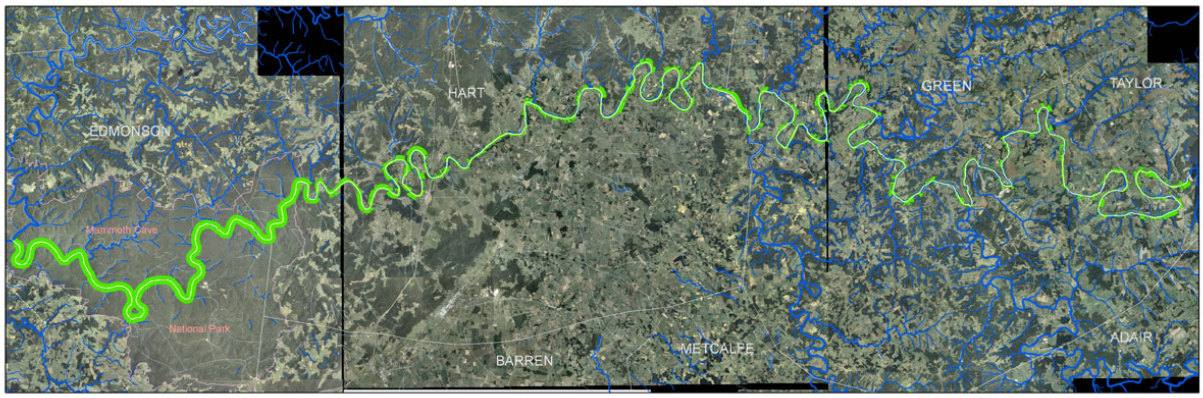
Numerous maps were produced in the course of beginning to gather and spatially analyze geographic information, field observations, and water quality data. Following is a selection of those maps.



Green River Conservation Reserve Enhancement Program: Potential Expansion



Upper Green River Mainstem:
Potential and Current Forested Riparian Corridor, 100ft Buffer

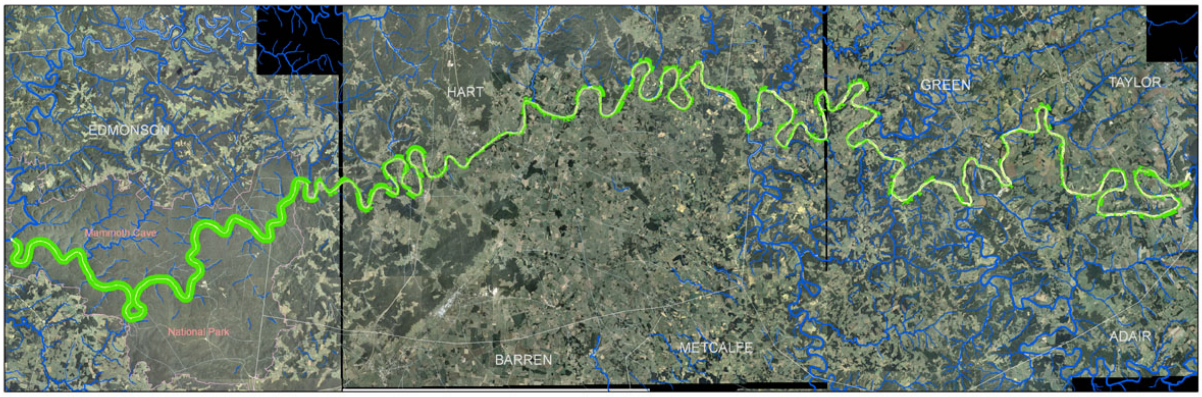


Riparian Corridor
100ft Buffer
Mammoth Cave National Park Boundaries
Ky Counties
Streams
Karst Flows

Miles
0 50 100

Cartography: Kami MacDonald and Benjamin Hughes
Created: 18 Nov 2005, in the lab of Dr. Ouida Meier,
Western Kentucky University
Data Sources: NHD, NAIP04.

Upper Green River Mainstem:
Potential and Current Forested Riparian Corridor, 300ft Buffer



Riparian Corridor
300ft Buffer
Mammoth Cave National Park Boundaries
Ky Counties
Streams
Karst Flows

Miles
0 50 100

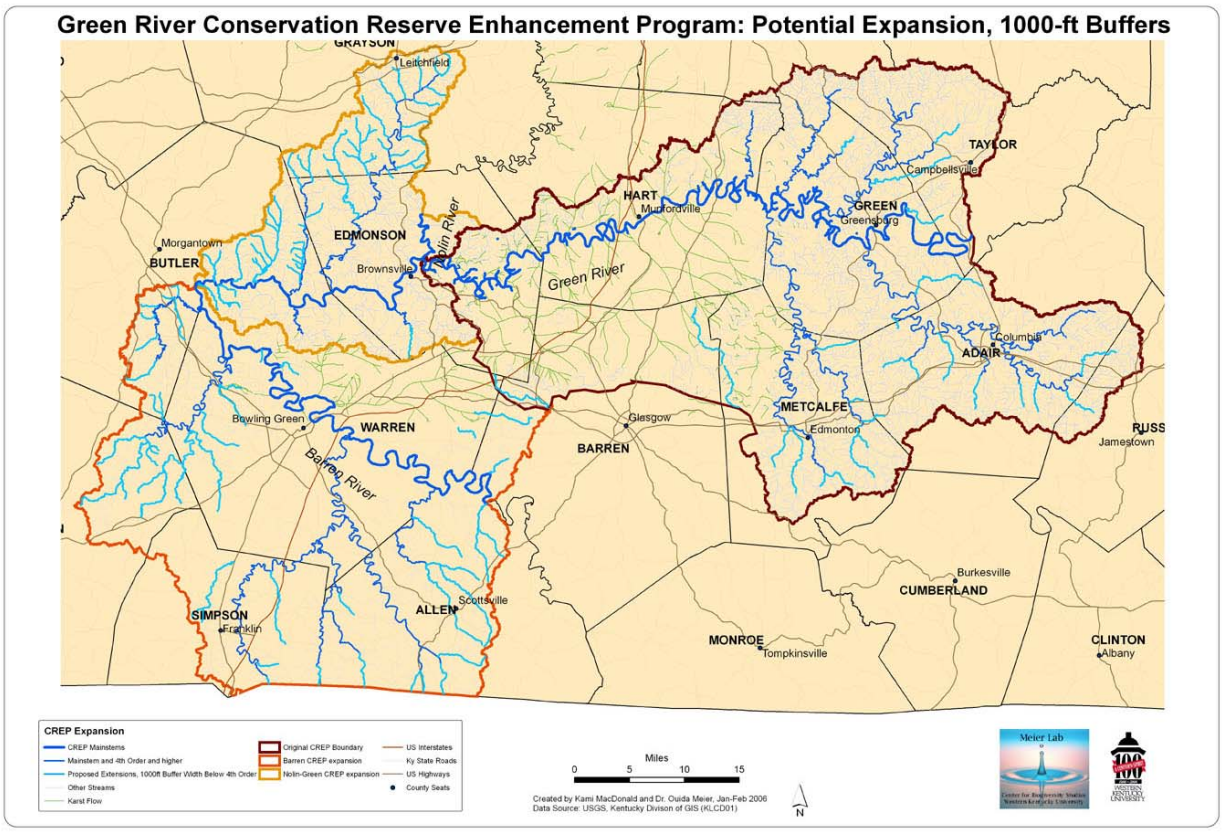
Cartography: Kami MacDonald and Benjamin Hughes
Created: 18 Nov 2005, in the lab of Dr. Ouida Meier,
Western Kentucky University
Data Sources: NHD, NAIP04.

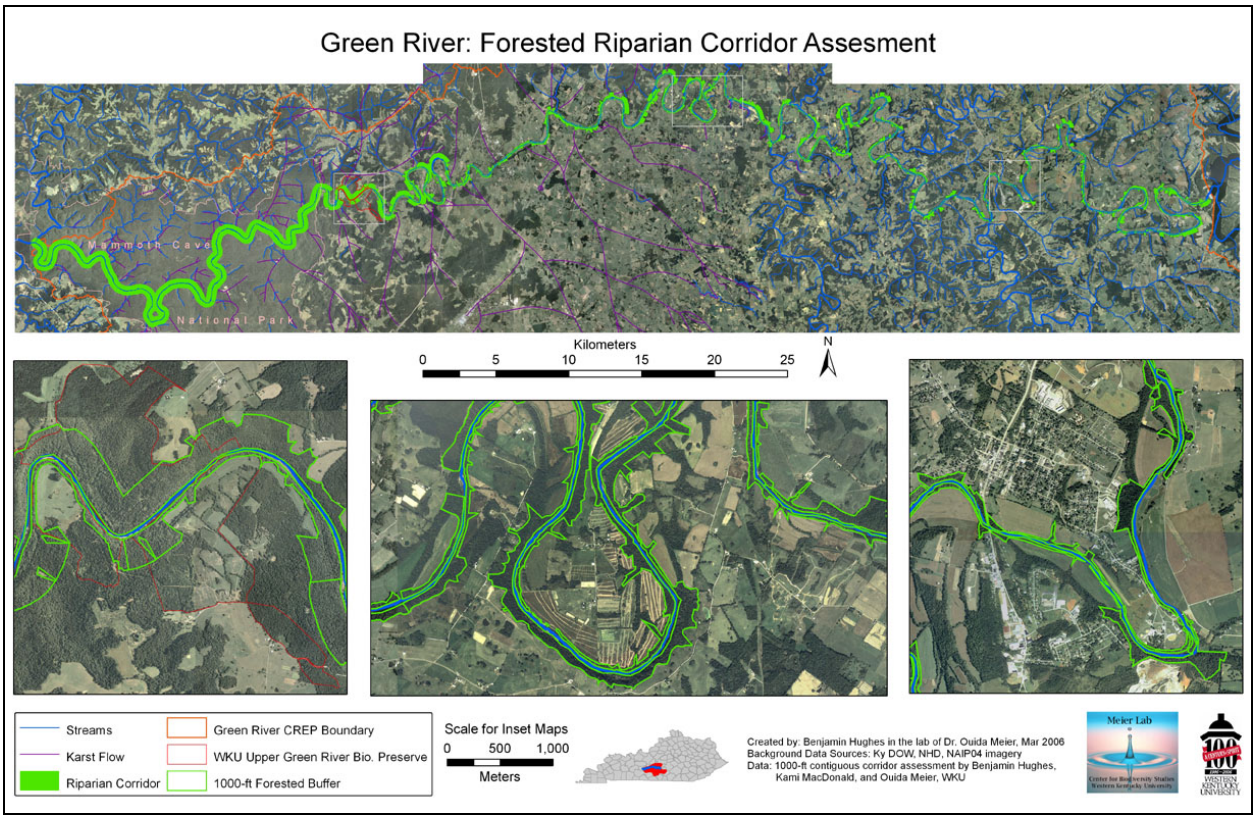
Upper Green River Mainstem:
Potential and Current Forested Riparian Corridor, 1000ft Buffer

Riparian Corridor
1000ft Buffer
Mammoth Cave National Park Boundaries
Ky Counties
Streams
Karst Flows

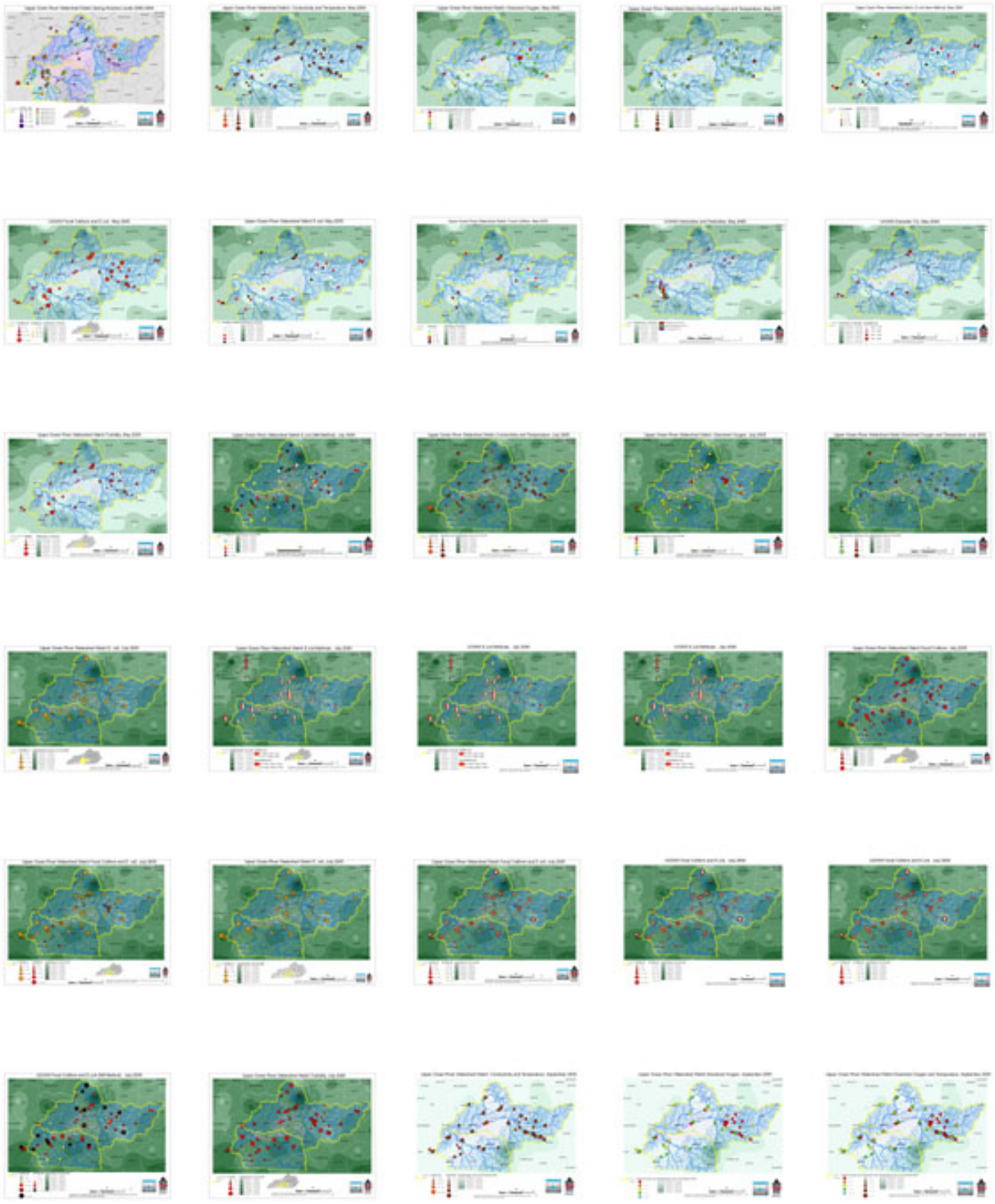
Miles
0 50 100

Cartography: Benjamin Hughes and Kami MacDonald
Created: 18 Nov 2005, in the lab of Dr. Ouida Meier,
Western Kentucky University
Data Sources: NHD, NAIP04.


Green River Conservation Reserve Enhancement Program: Potential Expansion, 1000-ft Buffers
GRAYSON
Leitchfield
TAYLOR
Campbellsville
HART
Munfordville
GREEN
Greensburg
EDMONSON
Morgantown
BUTLER
Brownsville
Green River
Nolin River
Columbia
ADAIR
METCALFE
Edmonton
Bowling Green
WARREN
Glasgow
BARREN
Barren River
RUSS
Jamestown
Burkesville
CUMBERLAND
Scottsville
ALLEN
SIMPSON
Franklin
MONROE
Tompkinsville
CLINTON
Albany
CREP Expansion
CREP Mainstems
Mainstem and 4th Order and higher
Proposed Extensions, 1000ft Buffer Width Below 4th Order
Other Streams
Karst Flow
Original CREP Boundary
Barren CREP expansion
Nolin-Green CREP expansion
US Interstates
Ky State Roads
US Highways
County Seats
Miles
0 5 10 15
Created by Kami MacDonald and Dr. Ouida Meier, Jan-Feb 2006
Data Source: USGS, Kentucky Divison of GIS (KLCD01)
N
Meier Lab


Green River: Forested Riparian Corridor Assesment
Mammoth Cave
National Park
Kilometers
0 5 10 15 20 25
N
Streams
Karst Flow
Riparian Corridor
Green River CREP Boundary
WKU Upper Green River Bio. Preserve
1000-ft Forested Buffer
Scale for Inset Maps
0 500 1,000
Meters
Created by: Benjamin Hughes in the lab of Dr. Ouida Meier, Mar 2006
Background Data Sources: Ky DOW, NHD, NAIP04 imagery
Data: 1000-ft contiguous corridor assessment by Benjamin Hughes, Kami MacDonald, and Ouida Meier, WKU
Meier Lab

Upper Green River Watershed Watch data analysis, 2005 and selected 1999-2005.





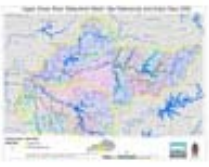




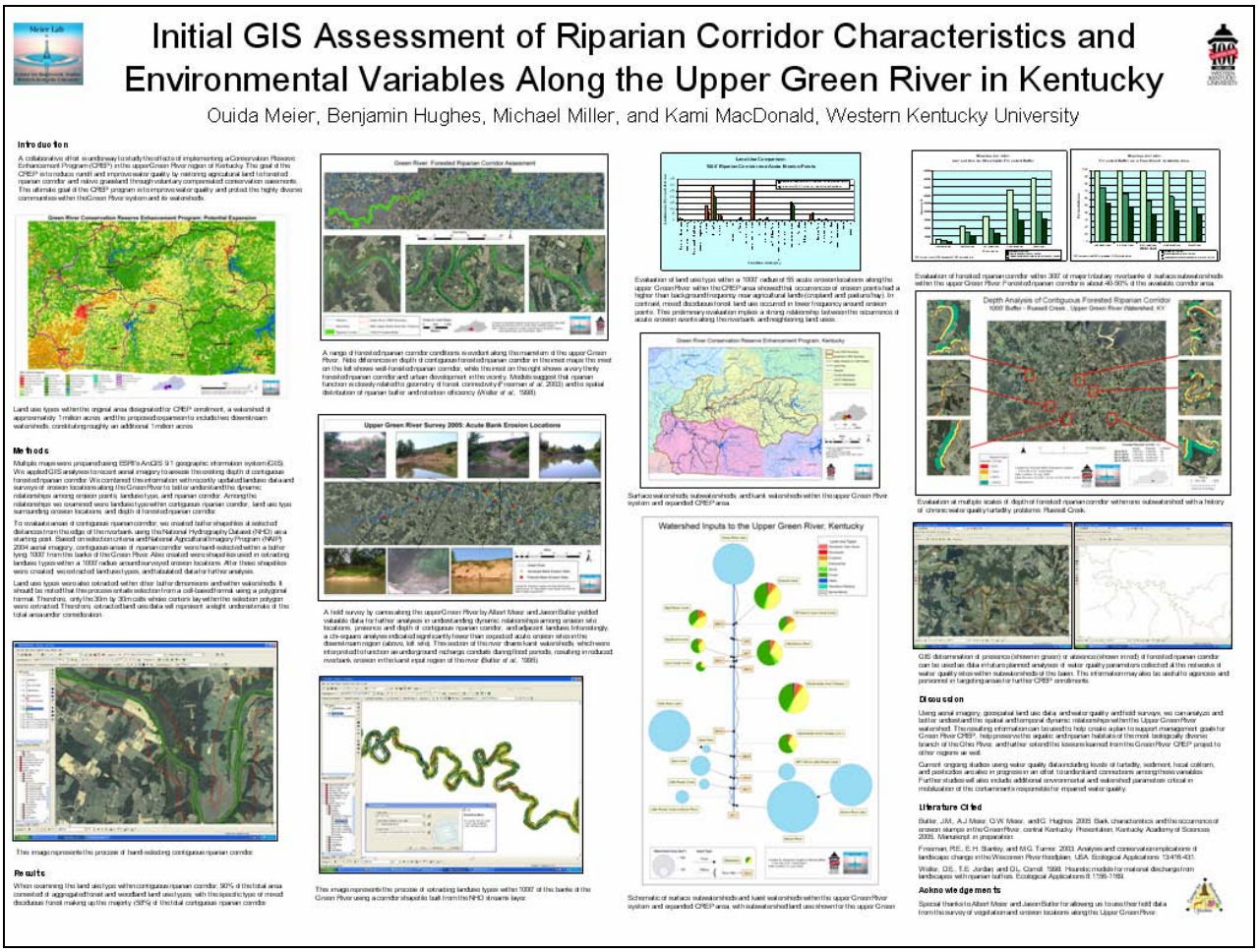






Images accompanying discussion of importance of including karst in CREP protection.



Task 2

Hydrology, sediment and water quality activities

Task 2 Manager

Stephen Kenworthy, Ph.D., Department of Geography and Geology, Western Kentucky University

Workplan overview

Task 2 will assess the effects of changes in land use and implementation of soil conservation practices on patterns of sediment transport and storage in the Upper Green River basin. The project involves: 1) field measurements of suspended sediment fluxes on the Green River and from surface and subsurface tributaries to estimate modern rates of transport and short-term

storage, and 2) characterization of flood plain sediments and patterns of channel migration to estimate historical rates of sediment remobilization and storage. Understanding the historical and modern patterns and rates of sedimentation will help resource management agencies to maximize the environmental benefits of soil conservation efforts in the Upper Green River basin. Four projects have been established, with brief descriptions and documentation of products:

1. Analysis of historical patterns of channel migration and field surveys of in-channel and floodplain sediment storage

This activity will document the distribution of sediment stored in the GR valley between Green River Lake and Mammoth Cave National Park, and assess historical patterns of bank erosion and sedimentation in the UGR valley. To determine the potential for conservation practices to achieve the desired reductions in sediment supply, estimates of sediment supply from bank erosion and remobilization of in-channel sediment deposits are required.

Update – *Channel Mobility and Bank erosion*: Analysis of digital aerial photographs of the reach between Green River Lake and Russell Creek, spanning the time period between 1953 and 1997 have been completed. The analysis suggests minor channel widening, over the 50 year period. Significant changes in island configurations are the predominant type of channel planform change. Examples of severe bank erosion and associated channel migration in the tailwater reach above Greensburg are limited, although one monitored site on an island in Penitentiary bend has retreated ~2 m during the spring of 2006. Summary of channel changes in relation to hydrologic records will be summarized in a gradate thesis completed in Spring 2007 (Sarah Rehkopf).

Update – *Characterization of Alluvial Deposits*: Field samples of bank materials in eroding exposures of floodplain alluvium and core samples from floodplain deposits at four primary locations have been collected during summer 2006. Characterization of deposit thickness is derived from borehole depths and available well log records. Grain size analysis of samples is ongoing, and samples of organic material for radiocarbon dating have been collected and analyzed. Interpretation of the observed patterns in floodplain sediment storage in relation to late Quaternary environmental history and historical land use changes will be summarized in a graduate thesis (Juan Herrera) completed in Spring 2007.

Products – Two presentations to date

Presentations

a. *Longitudinal and Local Variability in Streambed Habitat Characteristics, Upper Green River, Kentucky.* Stephen Kenworthy, American Geophysical Union Joint Assembly, May 2006, Baltimore, MD.

b. *Geomorphological effects downstream of the Green River Lake Dam, Green River, South Central Kentucky.* Sarah Rehkopf, Association of American Geographers Annual Meeting, March 2006, Chicago, IL.

2. Streamflow gauging and suspended sediment collection @ 3 mainstem Green River sites (Mammoth Cave Ferry, Munfordville, Greensburg)

This activity will quantify water and fine sediment flux at key points in the river system, allowing sediment contributions from different portions of the watershed and short-term patterns of fine sediment transport and storage to be estimated.

Update – *Greensburg monitoring site*: USGS stream gauging activities are ongoing. Data are available from the USGS KY Water Science Center in Louisville. Suspended sediment sample collection has been limited owing to budget constraints. Continuous turbidity monitoring has been ongoing since October 2005. Data analysis is planned for FY 2007.

Update – *Munfordville monitoring site*: USGS stream gauging activities are ongoing. Data are available from the USGS KY Water Science Center in Louisville. Suspended sediment sample collection has conducted during 4 flow events since April 2006. Installation of continuous turbidity monitoring equipment has been delayed owing to logistical problems. An alternate site at the Upper Green River Biological Preserved may be selected for sediment flux monitoring.

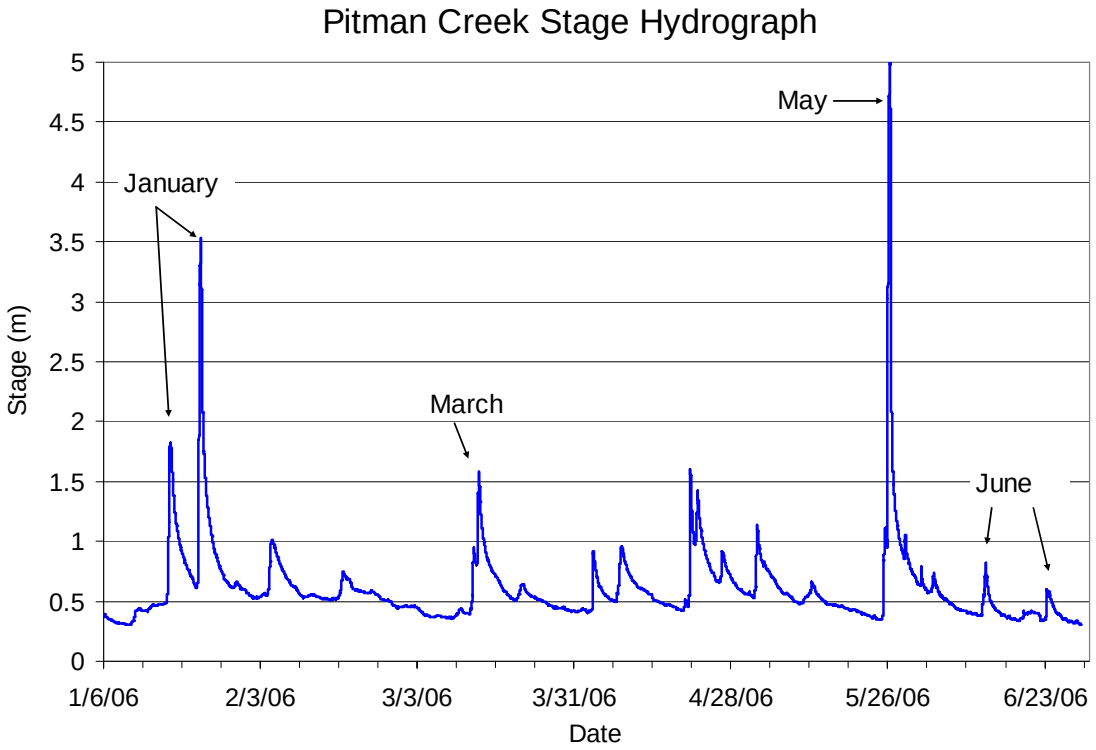
Update – *Mammoth Cave Ferry monitoring site*: Funding for USGS stream gauging and continuous water quality monitoring activities at this site was allocated through Dec 2005 only. Data collection has been continuous however, but funding limits may preclude continued operation of this site by the USGS. Data are available upon request from the USGS KY Water Science Center in Louisville.

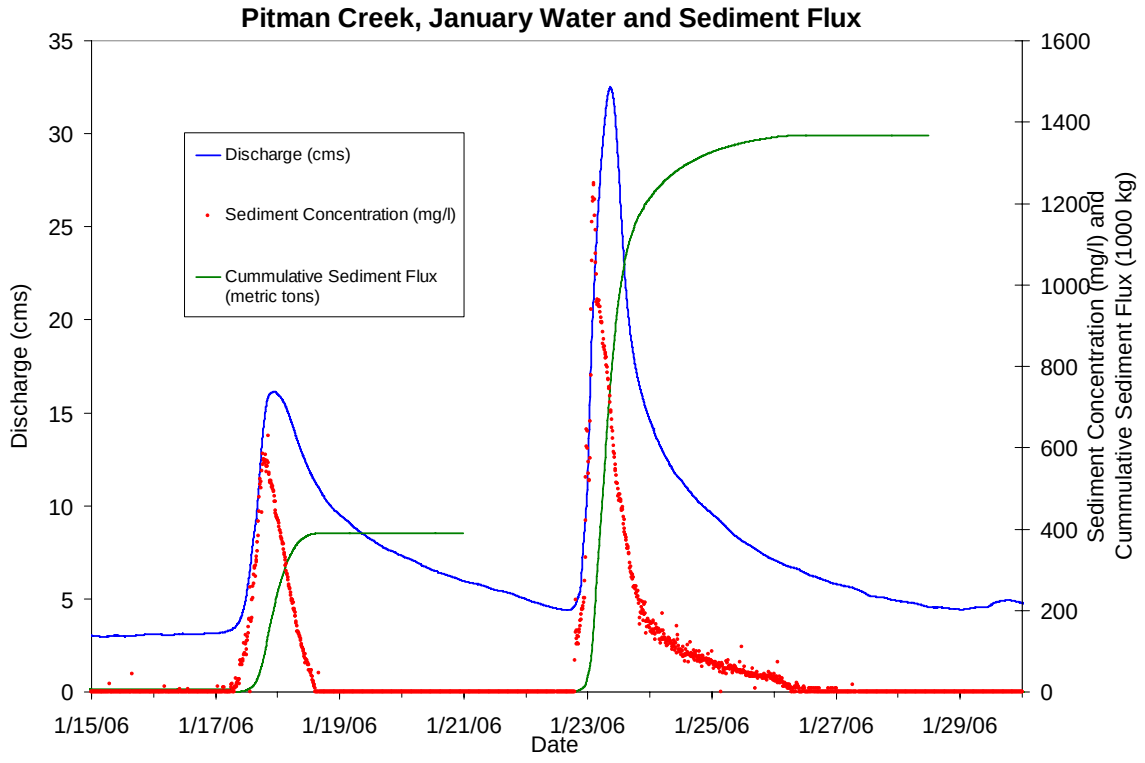
Products – No presentations or publications to date.

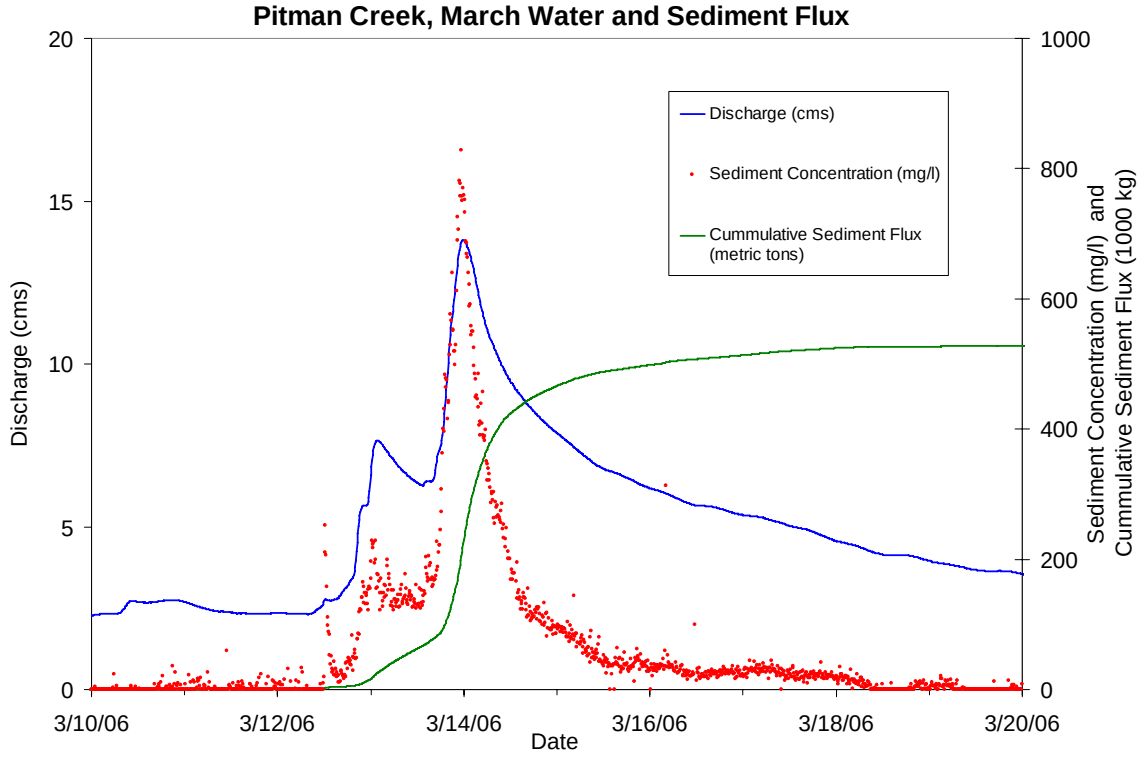
3. Flow gauging and suspended sediment collection @ Green River surface tributary site

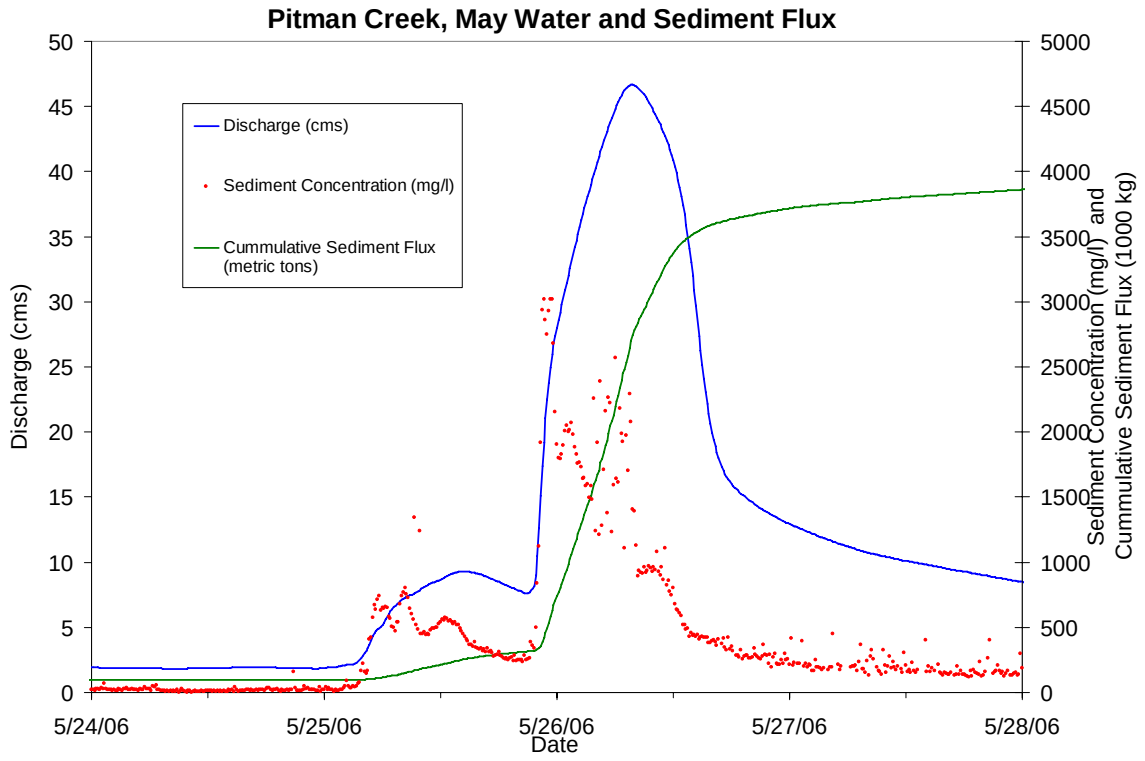
This field effort will quantify water and fine sediment flux from Pitman Creek, which drains most of Green and Taylor counties. These data will constrain water and sediment budget estimates for the Green River, and serve to assess the efficacy of soil conservation efforts in the tributary watershed.

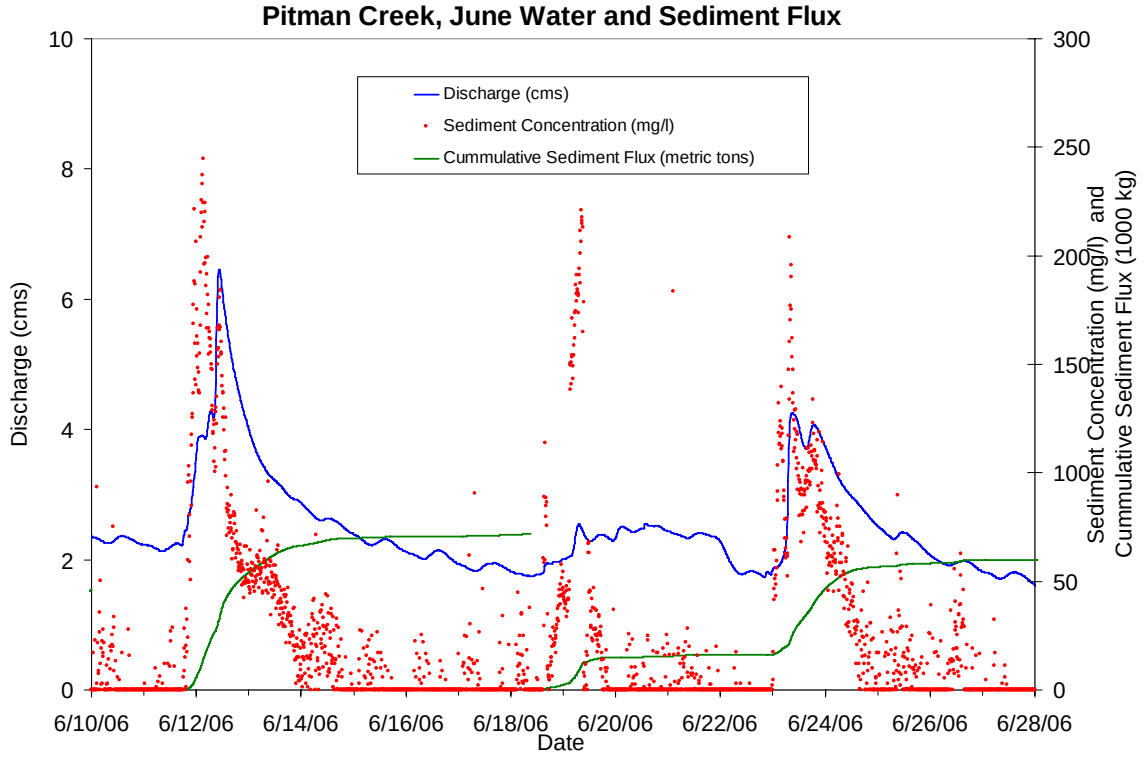
Update – *Pitman Creek monitoring site*: Data collection activities at Pitman Creek are ongoing. The record now spans the period since September 2005, and includes continuous records of river stage and water temperature and turbidity. Several significant flow events have occurred over the periods of record (see accompanying figures). The complete data set is available upon request. An automated water sampler programmed to sample according to observed turbidity levels was installed in August 2006. Samples collected during storm events have been analyzed for fine sediment concentration and will be used to calibrate suspended sediment load estimates from records of stage and turbidity. Preliminary results of this analysis are illustrated below.




Pitman Creek, January Water and Sediment Flux
Discharge (cms)
Sediment Concentration (mg/l)
Cummulative Sediment Flux (metric tons)
Discharge (cms)
Sediment Concentration (mg/l) and Cummulative Sediment Flux (1000 kg)
Date
0
5
10
15
20
25
30
35
0
200
400
600
800
1000
1200
1400
1600
1/15/06
1/17/06
1/19/06
1/21/06
1/23/06
1/25/06
1/27/06
1/29/06


Pitman Creek, March Water and Sediment Flux
Discharge (cms)
Sediment Concentration (mg/l)
Cummulative Sediment Flux (metric tons)
Discharge (cms)
Sediment Concentration (mg/l) and Cummulative Sediment Flux (1000 kg)
Date
0
5
10
15
20
0
200
400
600
800
1000
3/10/06
3/12/06
3/14/06
3/16/06
3/18/06
3/20/06


Pitman Creek, May Water and Sediment Flux
Discharge (cms)
Sediment Concentration (mg/l)
Cummulative Sediment Flux (metric tons)
Discharge (cms)
Sediment Concentration (mg/l) and Cummulative Sediment Flux (1000 kg)
0
5
10
15
20
25
30
35
40
45
50
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5/24/06
5/25/06
5/26/06
5/27/06
5/28/06
Date


Pitman Creek, June Water and Sediment Flux
Discharge (cms)
Sediment Concentration (mg/l)
Cummulative Sediment Flux (metric tons)
Discharge (cms)
Sediment Concentration (mg/l) and Cummulative Sediment Flux (1000 kg)
0
2
4
6
8
10
0
50
100
150
200
250
300
6/10/06
6/12/06
6/14/06
6/16/06
6/18/06
6/20/06
6/22/06
6/24/06
6/26/06
6/28/06
Date

Products – Two presentations to date

Presentations

a. *Sediment Fluxes from Pitman Creek, a Tributary of the Green River in Western Kentucky.* Charles Trodick and Stephen Kenworthy, Geological Society of America Annual Meeting, October 2006, Philadelphia, PA.

b. *Sediment Monitoring Efforts in the Upper Green River Basin in Support of the Kentucky Conservation Reserve Enhancement Program*. Stephen Kenworthy, Kentucky Water Resources Research Institute Annual Symposium, March 2006, Lexington, KY.

4. Subsurface flux and water quality monitoring

Logsdon River monitoring site: This field effort will the quantify water and sediment fluxes and water quality from a Logsdon River, a subsurface tributary (karst groundwater basin) to Green River. These data will further constrain water and sediment budget estimates, and will reflect the effectiveness of conservation practices in improving water quality in karst areas.

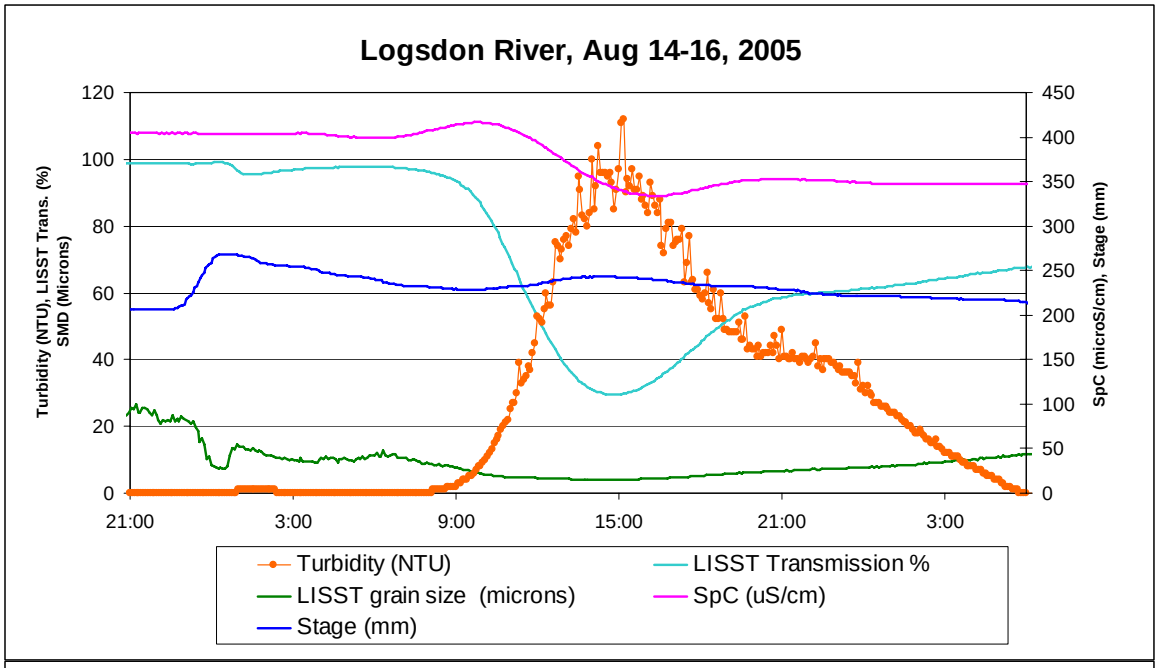
Update – Continuous flow and water quality monitoring at Logsdon River, a cave stream within the Turnhole karst basin in Barren and Edmonson Counties, has been ongoing since August 2005. Flow stage and flow velocity are monitored via acoustic Doppler velocimetry. Turbidity, temperature, specific conductivity and pH data are recorded by a multi-sensor water quality sonde. Suspended sediment concentration and grain size are monitored via Laser In-Situ Scattering and Transmissometry (LISST) technology. Data from two flow events are illustrated below. In September 2006, an automated water sampler programmed to sample according to observed turbidity levels was installed at the monitoring site. Samples collected during storm events will analyzed for fine sediment concentration and used to calibrate suspended sediment load estimates from records of stage and turbidity. Analysis of the flow and water quality data from Logsdon River is ongoing.

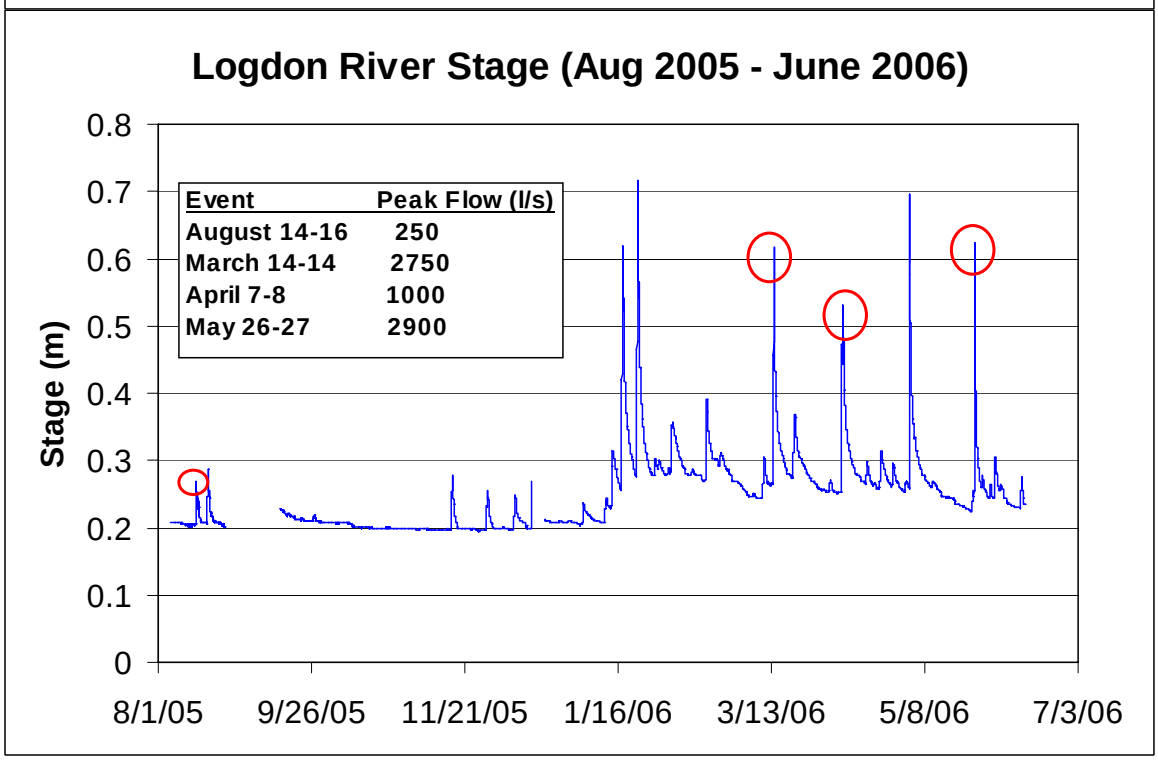
Products – One presentation to date

Presentations

a. *Water and Suspended Solids Flux Monitoring in a Karst Conduit, Turnhole Spring Basin,*

Mammoth Cave, Kentucky. Stephen Kenworthy, Geological Society of America Annual Meeting, October 2006, Philadelphia, PA.





Task 3

Direct terrestrial monitoring activities

Task 3 manager

Albert J. Meier, Ph.D., Department of Biology, Western Kentucky University

Three projects have been established, with brief descriptions and documentation of products:

1. Analysis and mapping of stream bank vegetation of the Green River

Our CREP/NRCS monitoring responsibilities within the Upper Green River Basin are to map streamside vegetation along the Green River and conduct point-based vegetation surveys.

Update – Streamside vegetation along the main stem of the Green River within the CREP area has been mapped. Locations of severe stream bank erosion have been mapped (Fig. 1), and distribution of switchcane (*Arundinaria gigantea*), a species that is particularly good at controlling erosion, has been mapped (Fig. 2). A lower proportion of severe erosion locations occur within the karst drainage area down stream from the Little Barren River than upstream. Within the area upstream of the Little Barren proportionately more severe erosion sites are located where stream side buffers are thin. No significant difference was found in the karst drainage area below the Little Barren River.

We have completed the point-based surveys of riparian vegetation. Overstory dominants include boxelder (*Acer negundo*), silver maple (*Acer saccharinum*), black walnut (*Juglans nigra*), slippery elm (*Ulmus rubra*), and green ash (*Fraxinus pennsylvanica).* Spicebush (*Lindera benzoin*) and elderberry (*Sambucus canadensis*) were the most abundant shrubs, and the herb layer was dominated by nettles (*Laportea canadensis*), wingstem (*Verbesina alternifolia*), and ground-ivy (*Glechoma hederacea*).

Products – no presentations or manuscripts to date

2. Bio-acoustic monitoring of riparian corridor wildlife

Our CREP/NRCS monitoring responsibilities within the Upper Green River Basin are to develop catalogs of bird and frog calls, set up 20 recording stations, gather calls for at least two seasons, analyze calls, and relate calling to landscape level land use.

Update – Digital catalogs of regional amphibians and birds have been developed. Automated recorder controllers have been designed and produced in house. The recorders were used in the riparian zone in the spring and summer of 2006. Data collected to date numbers 4,107 audio tracks comprising in excess of 200 hours of recordings. This methodology shows great promise as a consistent method for surveying both birds and amphibians. Analysis of recordings is on going, however, post-dawn surveys have been completed. An important finding is that we found greater influences of the landscape surrounding the recorders at 500 meters than at 100 meters. This finding suggests that narrow riparian buffers may not be sufficient to positively influence avian use of the Green River, and strongly supports the choice of the USDA to extend buffers to 1000 feet from major streams. We need a digital GIS layer of CREP installation boundaries are to accurately estimate the influences of CREP.

Products – Three presentations to date

Presentations

a. *Influences of land use, scale, and weather on birds calling.* J. Bowers, O. Meier, and A. Meier 2006, 5th Annual Conference of the International Society for Environmental Information Sciences, August 2006, Bowling Green, KY
b. *Monitoring riparian bird community composition using acoustic autosampling: Significance of adjacent land use?* C. Hamilton, J. Bowers, O. Meier, A. Meier, and B. Miriam, Kentucky Academy of Science, November 2006, Morehead, KY.
c. *Influences of land use, scale, and weather on bird acoustic signaling.* J. Bowers, C. Hamilton, O. Meier, A. Meier, and B. Miriam. 2006. Kentucky Academy of Science, November 2006, Morehead, KY

3.Analysis of Restoration of Grasslands

Our CREP/NRCS monitoring responsibilities within the Upper Green River Basin are to compare vegetation, bird use, and small mammal use of CREP fields with that of hayfields and barrens.

Update – We have completed vegetation surveys for CREP fields and hay fields for spring, summer, and early fall. In each of 10 sample sites, vegetation sampling was conducted in one

control treatment plot (pasture) and in one experimental treatment plot [native grassland plot (i.e. CREP plot)]. A transect was established by extending a meter tape parallel to the long axis of the plot. Vegetation sampling was performed in 1-m^2 quadrats (1m x 1m) spaced every tenth meter along the transect (e.g. 0m, 10m, 20m from transect origin). A total of 10 quadrats were sampled in each plot for a total of 200 quadrats (100 quadrats in control treatment plots and 100 quadrats in experimental treatment plots). Presence of all vascular plant species rooted in each quadrat was recorded to estimate site composition and species richness. In addition, number of stems (and/or culms, pedicels, peduncles) at each of three heights (25cm, 75cm, and 100cm) was recorded in each 1-m^2 quadrat to assess structural heterogeneity within sites. Vegetation data were entered into spreadsheets and were stratified by treatment. The multivariate statistical program PC-ORD version 5.0 (MJM Software Design, Gleneden Beach, Oregon) was used in all data analyses.

Results of this study indicate CREP treatment plots are higher in total plant species richness and native plant species richness than are control plots (i.e. pastures). Structural heterogeneity also differed considerably between control and experimental treatment plots. Control treatment plots displayed relatively high structural heterogeneity in summer and relatively low structural heterogeneity in spring and fall. Conversely, experimental treatment plots were characterized by relatively high structural heterogeneity in summer and fall and relatively low structural diversity in spring. Temporal differences in structural heterogeneity between the two treatment groups is attributable to the differing flowering phonologies of nonnative C_3 perennial grasses (dominant in pasture plots) and native C_4 perennial grasses.

Vegetation in CREP fields differed substantially from that of hay fields. CREP fields were dominated by Indian grass, horseweed, goldenrod, eastern daisy fleabane and partridge pea. It is interesting to note that of the dominants only Indian grass and partridge pea were planted. Hay fields were dominated by fescue, orchard grass, and bluegrass. The greater abundance of forbs, and particularly of large-seeded legumes, in CREP fields is particularly noteworthy. Partridge pea is favored by quail and other game birds. The over-dominance of Indian grass in many of the CREP fields is an issue of concern. The Indian Grass out competes other species and is prone to lodging. We must recommend reductions in seeding rates for this aggressive competitor.

Breeding bird surveys conducted in CREP fields and hay fields found greater nesting by dicksissels and blue grosbeaks in CREP fields. However, many species made greater use of CREP fields than hay fields including sparrows, indigo buntings, quail, and swallows. We found increased use by insectivorous birds of CREP fields over hay fields to be particularly interesting.

We have established 10 monitoring locations on private CREP sites and adjacent improved pastures in Taylor and Greene counties, where we have established arrays of Sherman live traps and are monitoring populations. We are also preparing to do transect counts for eastern cottontails (*Sylvilagus floridana)*.

Products – no presentations or manuscripts to date

Task 4

Project Enhancements and Pilot Studies

Task 4 manager

Scott Grubbs, Ph.D., Department of Biology and Center for Biodiversity Studies, Western Kentucky University

Workplan overview

My CREP/NRCS monitoring responsibilities within the Upper Green River Basin reside with biological and ecological assessments that focus on fish and macroinvertebrate communities. This is my sixth summer of conducting field research and has involved comprehensive biological monitoring and collection of environmental parameters. Monitoring activities has been established on each of 60 stream segments, including 14 along the mainstem of the Upper Green River and 46 collectively from each of the subbasins (mainly Russell Creek, Big Pitman Creek, Little Barren River, and Big Brush Creek).

Seven projects have been established, with brief descriptions and documentation of products:

1. Longitudinal distribution of macroinvertebrates along the Upper Green River

This project is collaboration with Dr. Stephen Kenworthy (Department of Geography and Geology, WKU). Sampling sites have been established at 10 segments from immediately below the Green River Lake through Western Kentucky University's Upper Green River Biological Preserve (and not through Mammoth Cave National Park as originally proposed). Quantitative macroinvertebrate sampling will occur during baseline flow conditions. Replicate samples (n = 4) will be taken at three scales (1, 10, and 50 m^2) in each segment and related to (a) local-scale hydrologic (e.g., surface velocity) and geomorphic parameters (e.g., % embeddedness), (b)

temperature (e.g., mean daily temperature), and (c) selected nutrient parameters (e.g., mean nitrate levels).

Update – *Influence of spatial scale and local-scale hydrologic, geomorphic, and thermal variability on macroinvertebrates communities along the mainstem of the Upper Green River*:

Products – no presentations or manuscripts to date

2. Distribution of mussels in the Upper Green River Basin

Little information exists regarding quantitative distribution of riverine mussels in any of the principle subbasins (e.g., Russell Creek). Quantitative (numbers of individuals per unit area) or semiquantitative sampling (numbers of individuals per unit effort) for mussels will occur during baseline flow conditions during the summer 2005. A subcontract will be established with Mammoth Cave National Park because of the need for technical assistance.

Update – This work was subcontracted through Mammoth Cave National Park (MCNP), continued through summer 2006, and all sampling was conducted by MCNP personnel. Sampling focused on each of the 46 subbasin stream segments and did not include the mainstem of the Upper Green River. Presence-absence sampling has been completed for 44 segments and I will soon be meeting with MCNP personnel to obtain this first dataset.

Products – no presentations or manuscripts to date

3. Assessing relationships between lotic crayfish assemblages and environmental variables of central Kentucky's Upper Green River Basin.

Sampling for crayfish started in May 2006 and focused on all 46 subbasin stream segments. The mainstem of the Upper Green River was not sampled. Sampling has occurred in riffles (areas of the stream bottom with shallow water and flowing rapidly over coarse substrates) and runs (shallow portions of the stream with relatively smooth flow and may or may not have coarse substrates). Each segment's riffle areas were categorized either as gravel-cobble (n = 26) or cobble-small boulder (n = 20). Ten 10 replicate samples have been taken per segment and an additional 10 replicate samples from larger boulders were also conducted only within the cobble-small boulder segments.

Update – All crayfish have been identified to species and carapace length per individual measured. A t-test compared crayfish densities between segments with gravel-cobble and cobble-small boulder segments, with both all individuals and individuals with carapace length > 15mm (large) and both revealed non-significant differences. In addition, a 1-way ANOVA comparing densities (both all and large) between individual subbasins also revealed non-significant differences. The results of both the t-test and 1-way ANOVA indicate that density data can be pooled since there is not a substratum- (excluding the large boulders) or subbasin-specific effect. A t-test comparing crayfish density (all and large) from the pooled substrates vs. large boulders from the subset of segments revealed non-significant differences, indicating that the largest geomorphic features alone did not provide more habitat space to support higher crayfish densities. Data analyses addressing species abundance patterns and their relationship to environmental parameters is in progress.

Products – one presentation since 2005 but no manuscripts to date

Presentations

a. *Assessing relationships between lotic crayfish assemblages and environmental variables of central Kentucky's Upper Green River Basin*. Eva Ngulo and Scott A. Grubbs, Kentucky Academy of Science, November 2006, Morehead, KY.

4. Basin-wide assessments.

These involve a set of data analyses that parallel the fish data analyses (see below), yet focus on macroinvertebrate communities and are likewise in progress.

Products – no presentations or manuscripts to date

5. Constancy of riverine macroinvertebrates within Mammoth Cave National Park

Constancy, as persistence and stability, of macroinvertebrate assemblages inhabiting the Green River at Mammoth Cave National Park, Kentucky, was evaluated based on data collected in 1993-1995 and 2001-2002. Macroinvertebrates were sampled from seven common sites across three hydrologic zones (erosional, transitional, impounded) using two artificial substrate samplers (Hester-Dendy multiplate samplers and rock baskets). Hester-Dendy samplers are used to mimic macroinvertebrate colonization of wood. Mean daily discharge was the only environmental data common to the two studies. Both persistence (similarity based on taxa

presence) and stability (similarity according to relative abundance) were low, and this general lack of constancy was reflected across local (site) and reach (hydrologic zone) spatial scales. Additionally, the data revealed that the macroinvertebrate assemblages were less persistent than stable. Longer colonization periods of the 2001 and 2002 datasets and the less variable hydrologic regime for the 2002 summer period were implicated as two possible reasons for this discretion. Because the two datasets included both summer and autumn data, multiseasonal bias was also assessed. Although there was a fair degree of between-study seasonal similarity, there was insufficient evidence to conclude that the autumn data introduced temporal noise. An assessment of longer (prior) versus shorter (current) colonization lengths was conducted during July/August 2004 with Hester-Dendy samplers only and occurred also in July/August 2006 solely with rock baskets. These data analyses will be forthcoming.

Products – One presentation since 2005 but no manuscripts to date

Presentations

a. Constancy of riverine macroinvertebrates at Mammoth Cave National Park. Scott A Grubbs, The Nature Conservancy- Upper Green River Conference, April 2006, Campbellsville, KY.

6. Distribution of riverine fishes in the Upper Green River Basin

Extensive sampling for stream and riverine fishes has occurred by S. Grubbs in the Upper Green River Basin since 2001. Each of the 53 samplings segments (see above) had been sampled twice, either once each in 2001 and 2002, once each in 2001 and 2003, or twice in 2003. With the inclusion of the additional Green River and subbasin segments, there is now the need to conduct fish sampling in the same manner as the 53 segments between 2001 and 2003. Each of the nine new segments (three Green River and six subbasin) will be visited twice in summer or autumn 2005.

Update – Sampling has been completed (in August 2005) for each of the 60 segments on two separate occasions. Data analyses are assessing the impact of land-use practices, especially pasture-hay and row cropping activities. Three sets of data analyses are ongoing, and one has been completed resulting in the submission of a manuscript to a peer-reviewed scientific journal (see below).

Products – Five presentations (since 2005) and one submitted manuscript

Presentations

a. *Lotic fish assemblages in Kentucky's Upper Green River Basin: implications of watershed size and land-use patterns.* Scott A. Grubbs, Ouida D. Meier, and Albert. J. Meier, Kentucky Academy of Science, November 2006, Morehead, KY.
b. *Longitudinal patterns of fish assemblages in small unregulated subbasins: evaluating reach- and watershed-scale parameters*. Scott A. Grubbs, Ouida D. Meier, and Albert. J. Meier, Ecological Society of America, August 2006, Memphis, TN.
c. *Factors influencing lotic fish assemblages in the Upper Green River – Kentucky CREP region.* Scott A. Grubbs, Ouida D. Meier, and Albert. J. Meier, Kentucky Academy of Science, November 2005, Richmond, KY.
d. *Longitudinal profile of the fish assemblage of a 4th-order stream in the Nolin River Basin, Kentucky*. Christopher Thomas and Scott A. Grubbs, Kentucky Academy of Science, November 2005, Richmond, KY.
e. *Factors influencing lotic fish assemblages in the Upper Green River – Kentucky CREP region.* Scott A. Grubbs, Ouida D. Meier, and Albert. J. Meier, North American Benthological Society, November 2005, New Orleans, LA.

Manuscripts

a. *Longitudinal patterns of fish assemblages in small unregulated subbasins: evaluating reach- and watershed-scale parameters*. Scott A. Grubbs, Ouida D. Meier, and Albert. J. Meier, submitted and revisions pending (Hydrobiologia)

Abstract: Fish assemblage relationships with environmental parameters were studied in four small unregulated subbasins in the speciose Upper Green River Basin of central Kentucky, U.S.A. One subbasin drains into a tributary of the Green River and produced the lowest species (28) richness. The three other subbasins drain directly into the Green River and supported 41 – 62 species. Parameters were partitioned into watershed- and reach-scale spatial categories. Fish richness was positively correlated with watershed area for the two largest subbasins and for the three Upper Green River subbasins combined. Watershed area per stream segment and stream-size related environmental parameters at the reach scale produced the highest loadings of a Principle Components Analysis (PCA). Overall, both PCA Axes 1 and 2 for all subbasins were reflective either of watershed area or stream-size parameters. Small loadings were produced by all watershed-scale land-use

parameters and all reach-scale water chemistry parameters. A Detrended Correspondence Analysis (DCA) performed for each subbasin showed that several fish species were associated mainly either with small, upland segments or conversely the largest, deeper segments. Each subbasin yielded significant correlations between the environmental PCA loadings and fish assemblage DCA site scores. These results indicated that within the regional scale, and in absence of steep disturbance gradients, stream fish assemblages can reflect natural hydrologic and geomorphic gradients.

7. Triazine levels in the Upper Green River Basin

Assessment of triazine pesticide levels throughout the Upper Green River Basin during spring and autumn 2003 revealed subbasin-specific patterns of inputs of triazines into individual tributaries. Sampling and quantification of triazines will occur twice monthly from May through August at 11 mainstem Upper Green River and 24 subbasin tributary sites.

Update – Although 53 sampling sites in the Upper Green River Basin to monitor and assess the effectiveness of CREP, only the 35 sites briefly indicated above were originally characterized by land-use analyses. This work will be extended to include the additional 18 subbasin sites, three more recently-established sites along the mainstem Upper Green River, and six new 3rd- or 4th-order subbasin sites that are clearly impacted by agricultural practices at the local scale. All triazine sampling and analyses will proceed only during summer 2005. In total, there are 14 sites along the Green River and 46 subbasin sites monitored for triazine levels.

Products – no presentations or manuscripts to date

Task 5

Seminars and workshops

Task 5 manager

Albert J. Meier, Ph.D., Department of Biology, Western Kentucky University

Update – Dr. Rafael Marquez has presented a seminar and workshop on bioacoustic monitoring. Additional seminars are planned for spring 2007 including more on bioacoustics and grassland restoration.

IV. Recommendation

Partner Listing:

USDA Farm Service Agency
USDA Natural Resources Conservation Service
The Office of the Governor
The Kentucky General Assembly
The Kentucky State Nature Preserves Commission
The Kentucky Soil and Water Conservation Commission
Kentucky Division of Conservation
Kentucky Division of Forestry
Kentucky Division of Water
The Kentucky Department of Fish and Wildlife Resources
The Nature Conservancy
Mammoth Cave National Park
Kentucky's Soil and Water Conservation Districts
Western Kentucky University

Thanks to the partner agencies and organizations for their commitment to this project and to the landowners and natural resources of this unique area. Also, thanks to those partner agency personnel that supplied information for the completion of this report.

The Kentucky Green River CREP is continuing with moderate success, and with the imminent acceptance of the proposed changes currently in the approval process, this program should have a very bright future. With 11,225 acres enrolled, over $23 million to be paid to local landowners on these existing contracts, and 157 miles of stream bank in conservation use, a difference has already been made in the local area. In addition to the programmatic changes that are being requested, an additional geographic area of the Green River Basin is being proposed for the Green River CREP Region downstream of our current boundaries. With our experiences and working knowledge of this program, more effective training and public relations will be utilized; this should energize the local population and staff for continued and increased success of this program. There are already individual landowners in the existing counties that have committed to entering land into this program once these changes are incorporated. In addition, public relations planning is already occurring for our proposed new area, and the local populations are already inquiring about this outstanding opportunity.

Cattle lounging in the Green River.
Photo courtesy of Joe Meiman, Mammoth Cave N.P.

Green River bank with slump. Photo courtesy of J. Meiman

Bottomland in desperate need of conservation. Photo courtesy of R. Kessler, TNC. Areas such as those on this page are types of land that will be targeted by ongoing and future CREP efforts.