Efficacy of Edge-of-Field Conservation Practices From ARS-CEAP Watersheds

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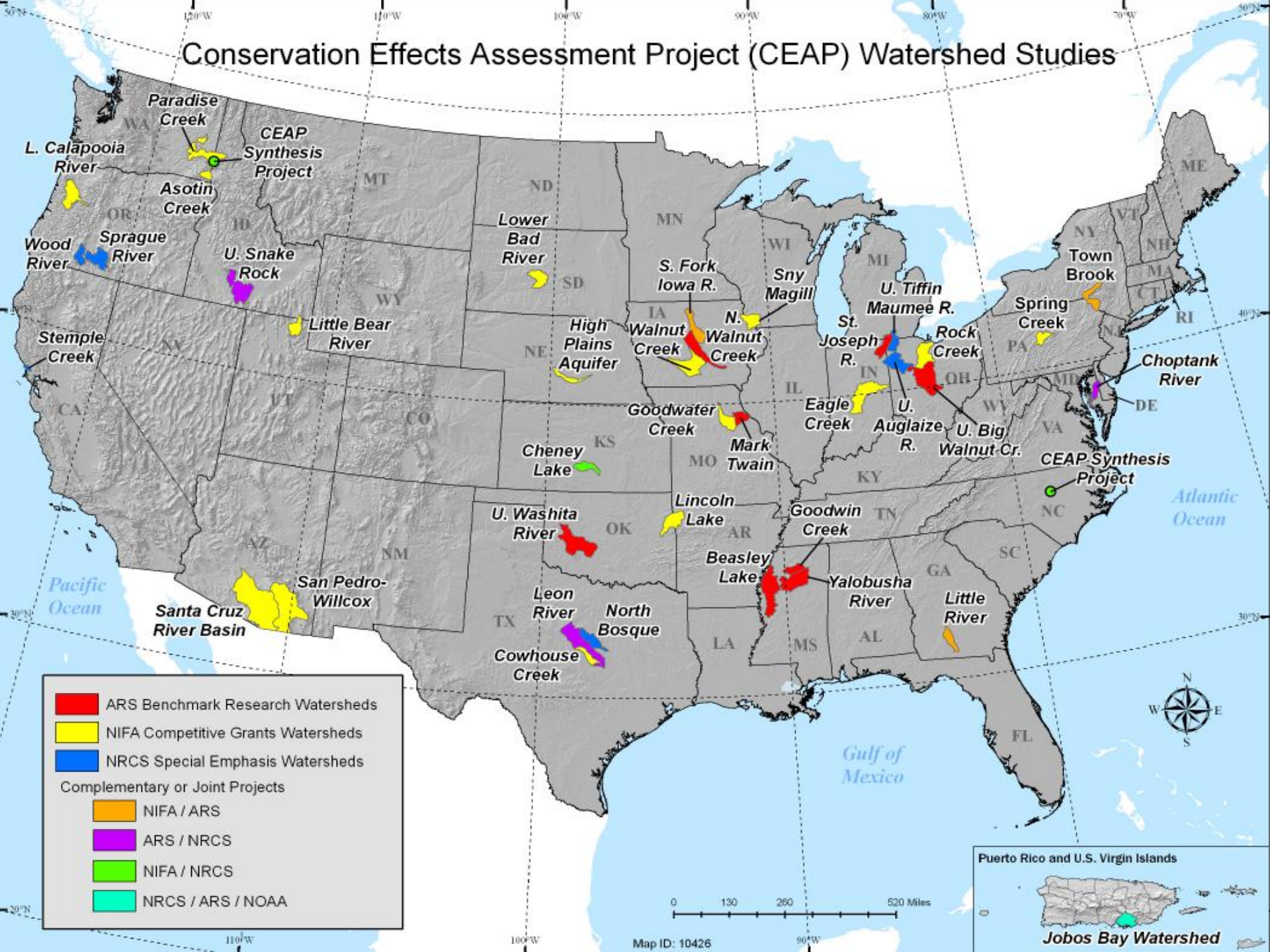
Conservation Effects Assessment Project (CEAP) Watershed Studies



14 ARS “Benchmark” Watersheds

Challenges

(Tomer and Locke, 2011)

- Conservation practices not targeted to critical sources and pathways for contaminants

- Sediments carried by streams often originate from channel and bank erosion, rather than from fields

- Timing lags, historical legacies, and shifting climate often mask effects of practice implementation

- WQ management strategies addressing single contaminants don't consider inherent trade-offs among multiple contaminants

Edge-of-Field Practices

- Focus on vegetation
  - Riparian buffers / zones and VBS*
  - CRP*
  - Grassed waterways
  - Stiff-grass hedges
  - Constructed wetlands*
  - Drainage ditches*

Riparian Buffers

LITTLE RIVER WATERSHED, GA

Using SWAT

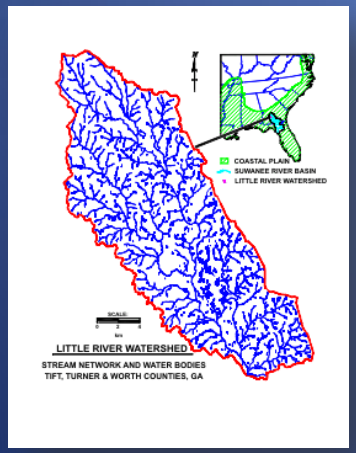
Total sediments decreased 20.5%

Total phosphorus decreased 19.5%

Total nitrogen decreased 7%

(Cho et al. 2010)

Single greatest contributor to NPS pollutant reduction in the Little River Experimental Watershed may be the current level of riparian forest cover.



Riparian Buffers

JOBOS BAY WATERSHED, PR

Using REMM & APEX

Total sediment yield decreased 24%

Total N & P load decreased ~30%

(Williams et al. *submitted*)

Simulations indicated tropical storms and hurricanes contributed at least 63% of total sediment and nutrient loads.

Vegetated Buffer Strips

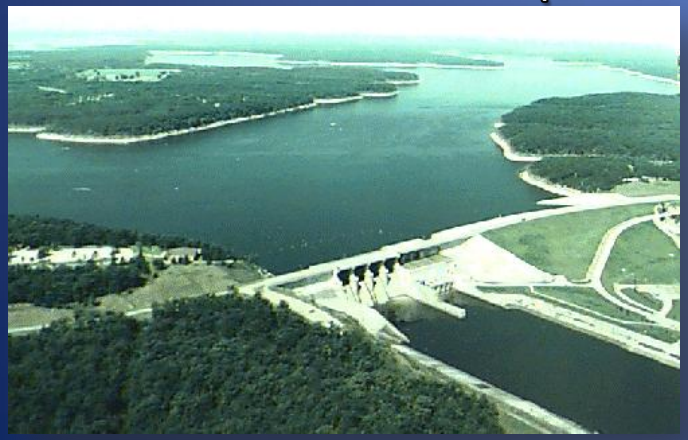
MARK TWAIN LAKE / SALT RIVER BASIN, MO

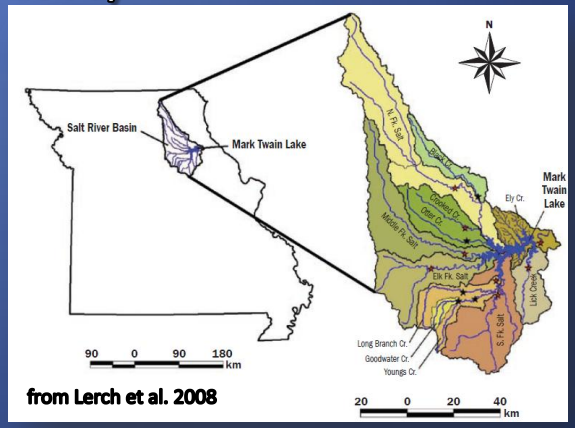
Rainfall simulation using Mexico silt loam

75-80% removal of atrazine, glyphosate and metolachlor by 4 m native VBS

4 m native VBS had greater herbicide transport reduction than 8 m of the two tall fescue VBS designs

(Lin et al. 2007; Lerch et al. 2008)





from Lerch et al. 2008

Riparian Buffer – Vegetated Buffer Strip

COBB CREEK SUBWATERSHED, UPPER WASHITA, OK

Using SWAT

Using 10 m bermudagrass filter strips =

72% reduction of avg. annual sediment yield in subbasin

Using 10 m riparian forest buffer =

68% reduction of SS concentrations at subwatershed outlet

(Moriasi et al. 2011)

Riparian Buffer – Vegetated Buffer Strip Combination

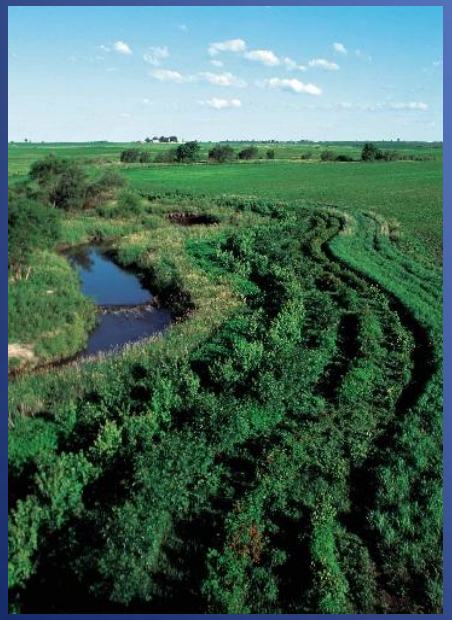
COBB CREEK SUBWATERSHED, UPPER WASHITA, OK

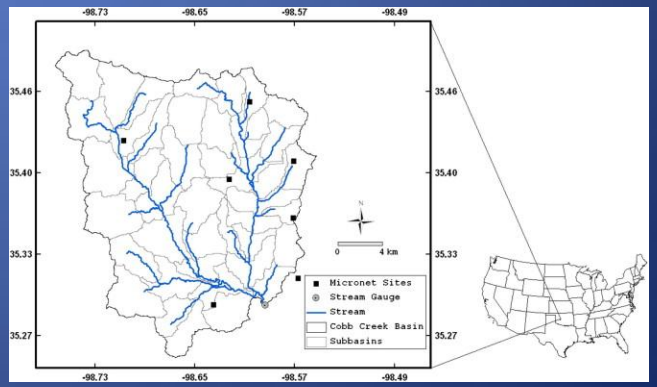
Using SWAT

Combining Riparian Buffer + VBS =

73% reduction in SS concentration at subwatershed outlet

(Moriasi et al. 2011)





CRP

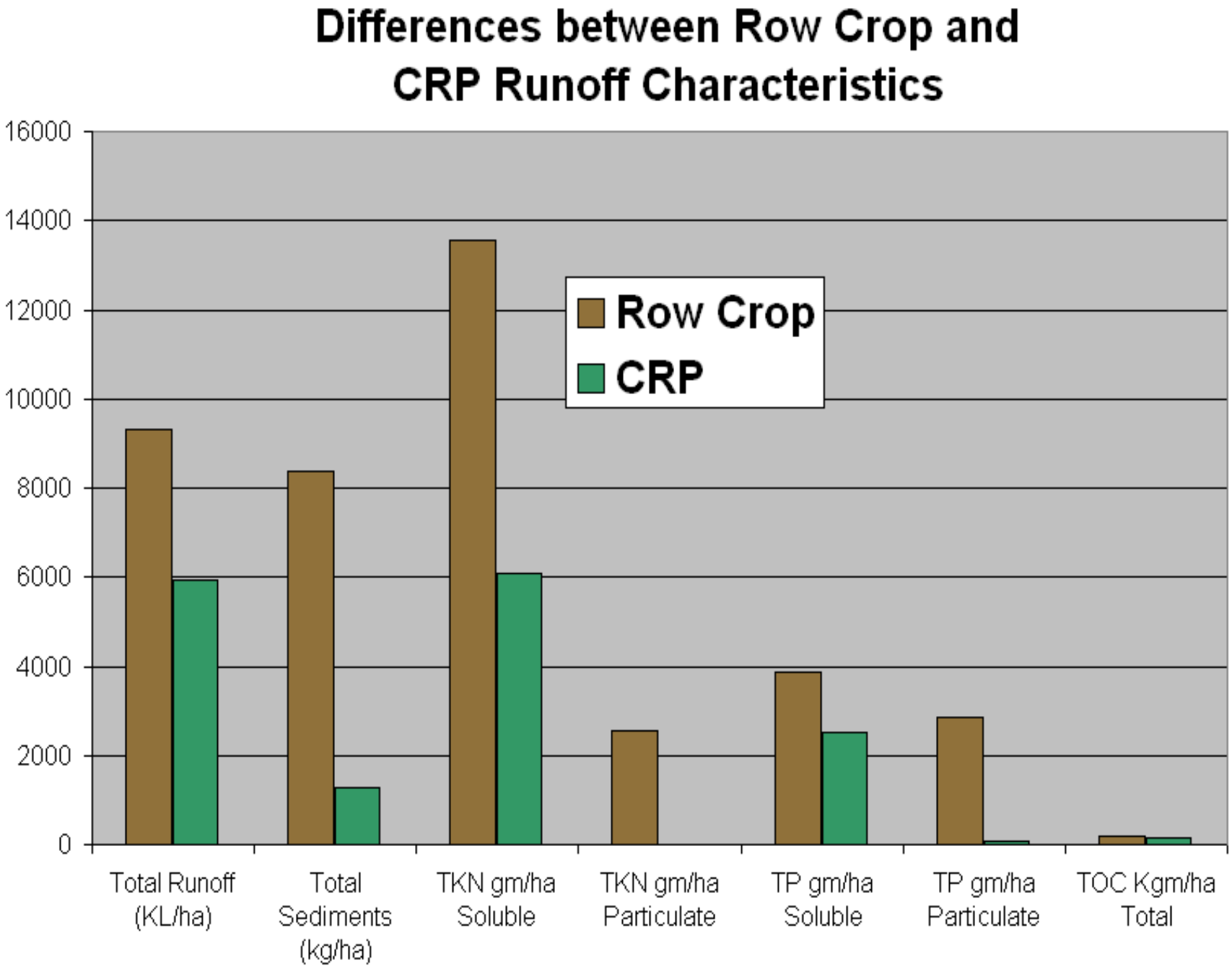
BEASLEY LAKE , MS

Total Sediments Decreased 85%

Nutrients Decreased 28%

(Cullum et al. 2010)

Year	Rain (mm)	Runoff (mm)		Sediment Yield (kg/ha)	
		Crop	CRP	Crop	CRP
2005	298	217	40	320	54
2006	632	311	170	2071	789
2007	631	365	119	1810	213
2008	487	158	146	4161	234
Total	**2047**	**1051**	**476**	**8362**	**1290**


Differences between Row Crop and CRP Runoff Characteristics
16000
14000
12000
10000
8000
6000
4000
2000
0
Row Crop
CRP
Total Runoff (KL/ha)
Total Sediments (kg/ha)
TKN gm/ha Soluble
TKN gm/ha Particulate
TP gm/ha Soluble
TP gm/ha Particulate
TOC Kgm/ha Total

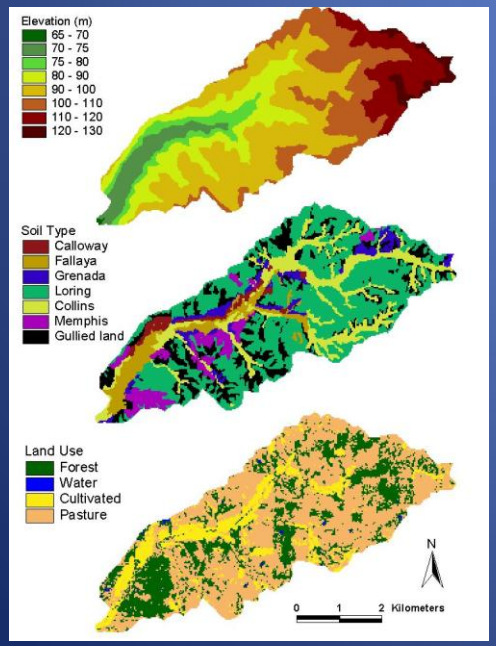
CRP

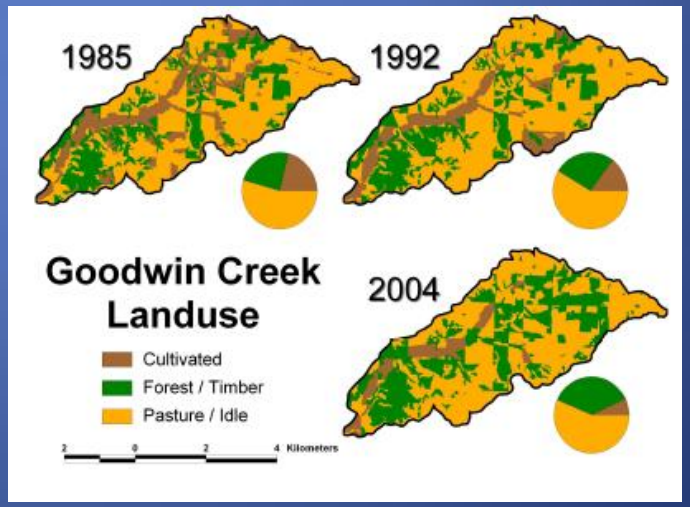
GOODWIN CREEK, MS

Reducing cultivated land from 26% to 8% in watershed

Decreased total sediment concentration by 63% between 1982-1990

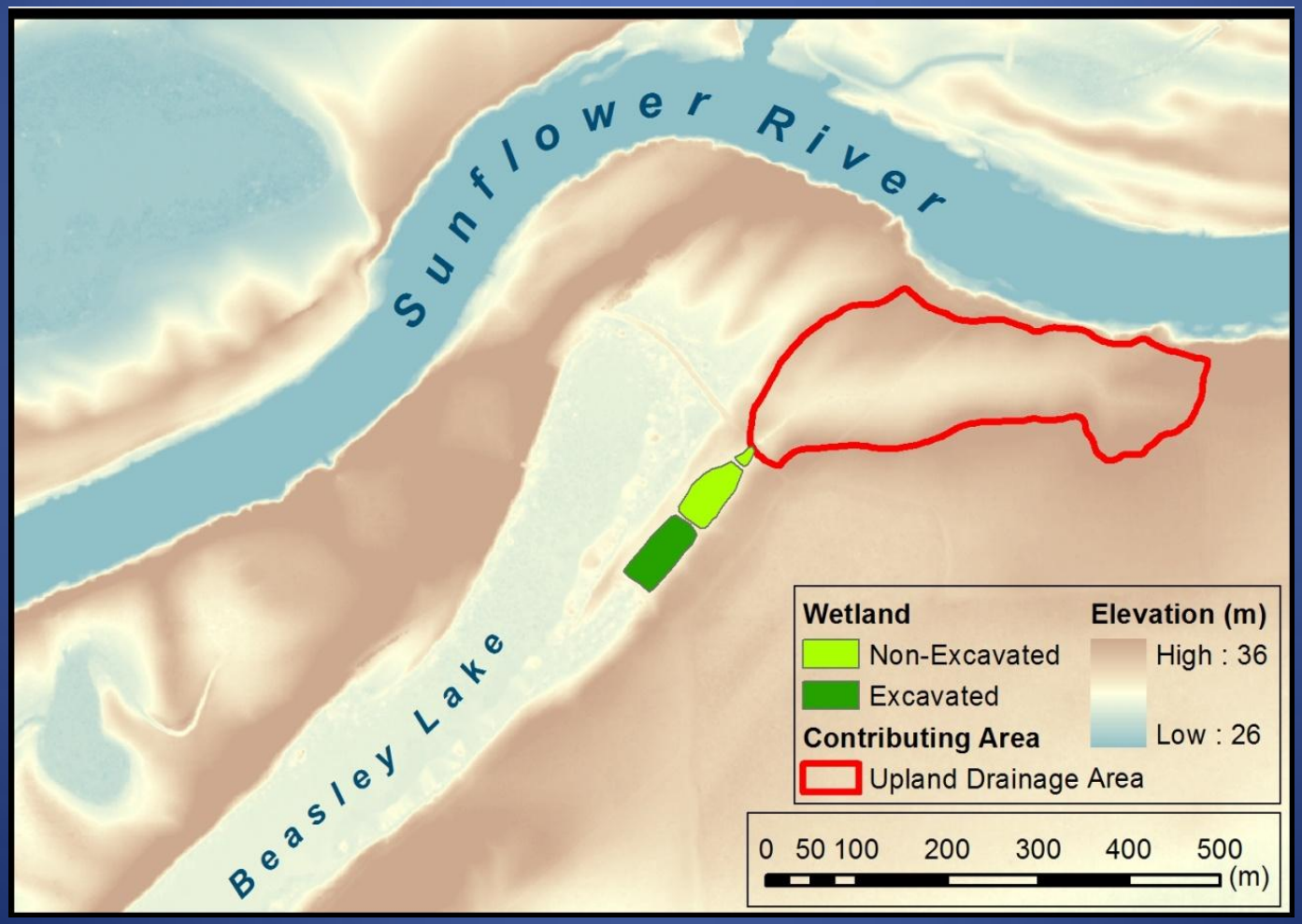
(Bingner 1998)





Constructed Wetlands

BEASLEY LAKE, MS



Constructed Wetlands

BEASLEY LAKE, MS

- 43% of measured diazinon mass in plant material
- 49% of measured lambda-cyhalothrin mass in plant material
- 76% of measured cyfluthrin mass in plant material
- Wetland dimensions of 215 m x 30 m required to mitigate 1% pesticide runoff from 14 ha contributing area
- 32% decrease in atrazine and 22% decrease in flumeturon concentrations observed over 9 d

(Moore et al. 2007; Moore et al. 2009; Locke et al. 2011)

Drainage Ditches

BEASLEY LAKE, MS

- 61% of measured atrazine concentrations in plant material
- 87% of measured lambda-cyhalothrin concentrations in plant material
- 50 m sufficient distance to mitigate pesticide concentrations

(Moore et al. 2001)

Drainage Ditches

BEASLEY LAKE, MS

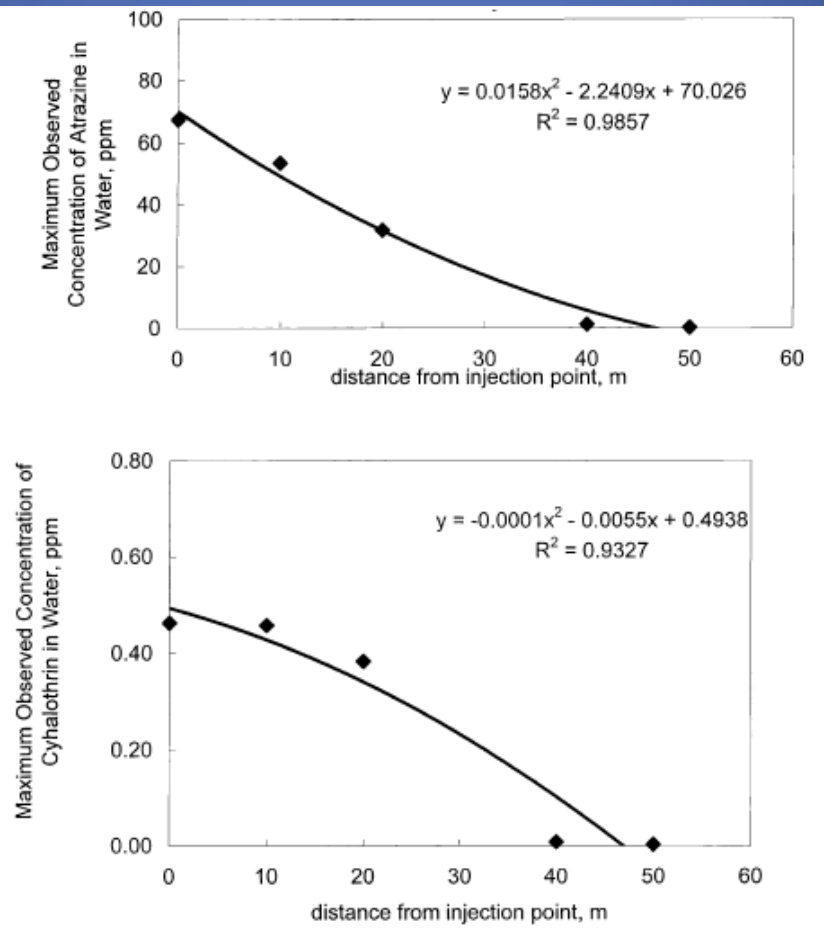


Fig. 1. Predictions of required distance for mitigation of atrazine and lambda-cyhalothrin.

Future Challenges…

- More data needed on current and additional watersheds
- Linkages needed between conservation practices and water quality improvement
- Better dissemination of CEAP products among watersheds