Best Management Practices in the CEAP Goodwater Creek Watershed: What, Where, Why, and How Much?

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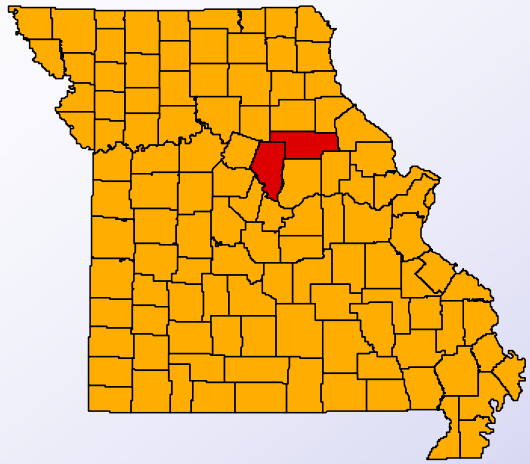
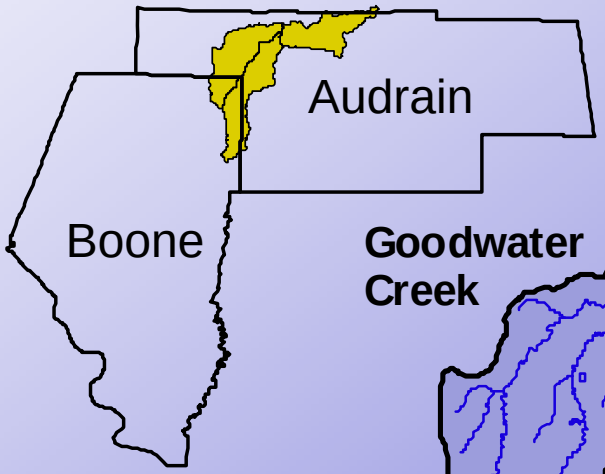
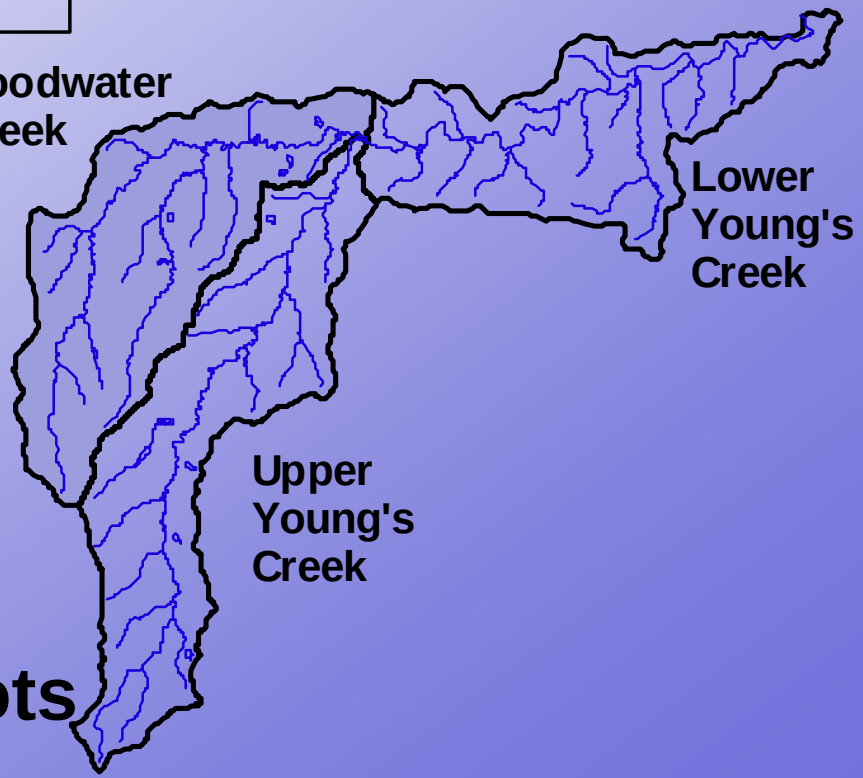
Goodwater Creek Experimental Watershed



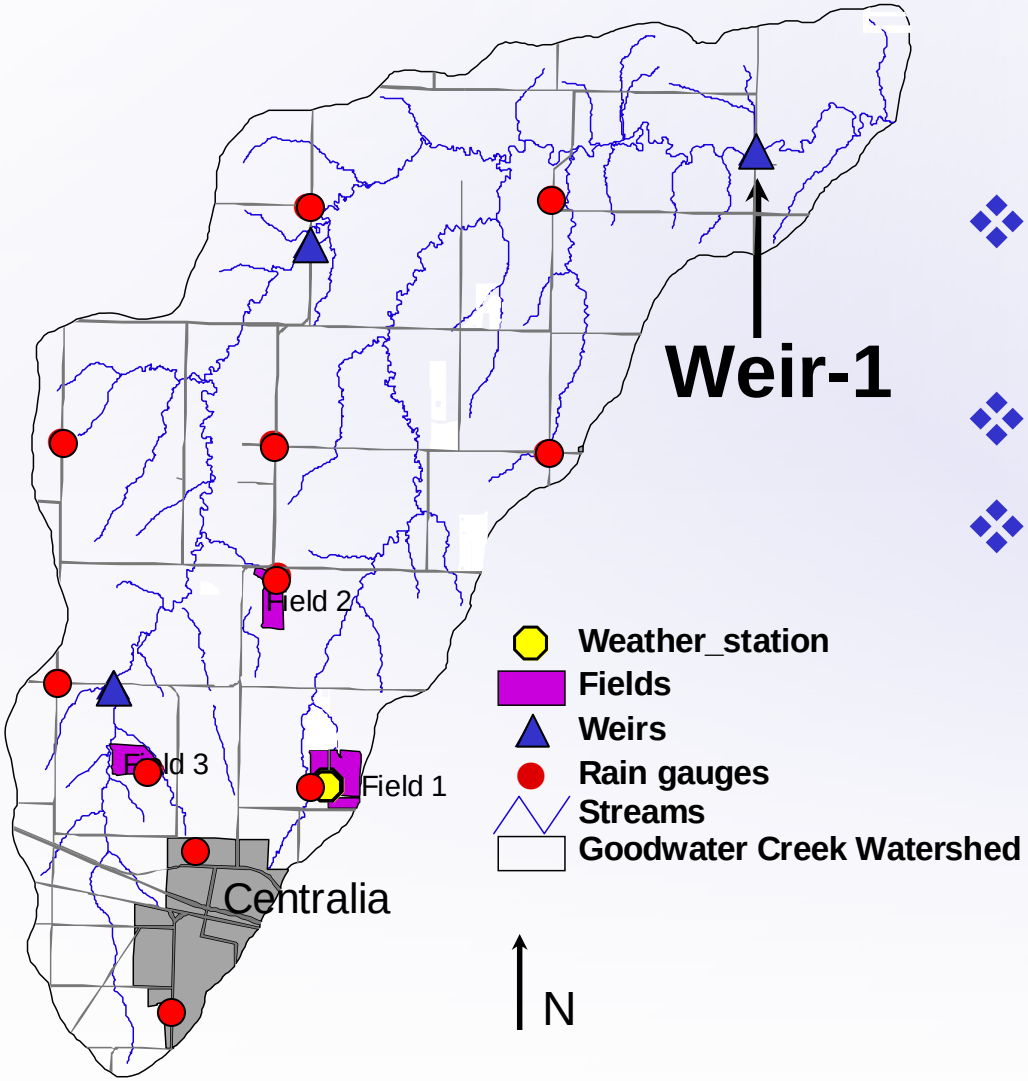




72 km^2
16,000 acres
Location of MSEA plots

February 2008

Goodwater Creek Experimental Watershed



- **Claypan 15 to 45 cm below surface**
- **0-3% slopes**
- **Land use**
  - 74% Row Crops
  - 6% Woodland
  - 18% Grassland
  - 2% Urban

Questions / Objectives

- What practices are in place?
- Did it make a difference?
- Why have farmers decided to implement these practices?
- How can we do better? How much is needed to reduce pesticide and nutrient loadings?

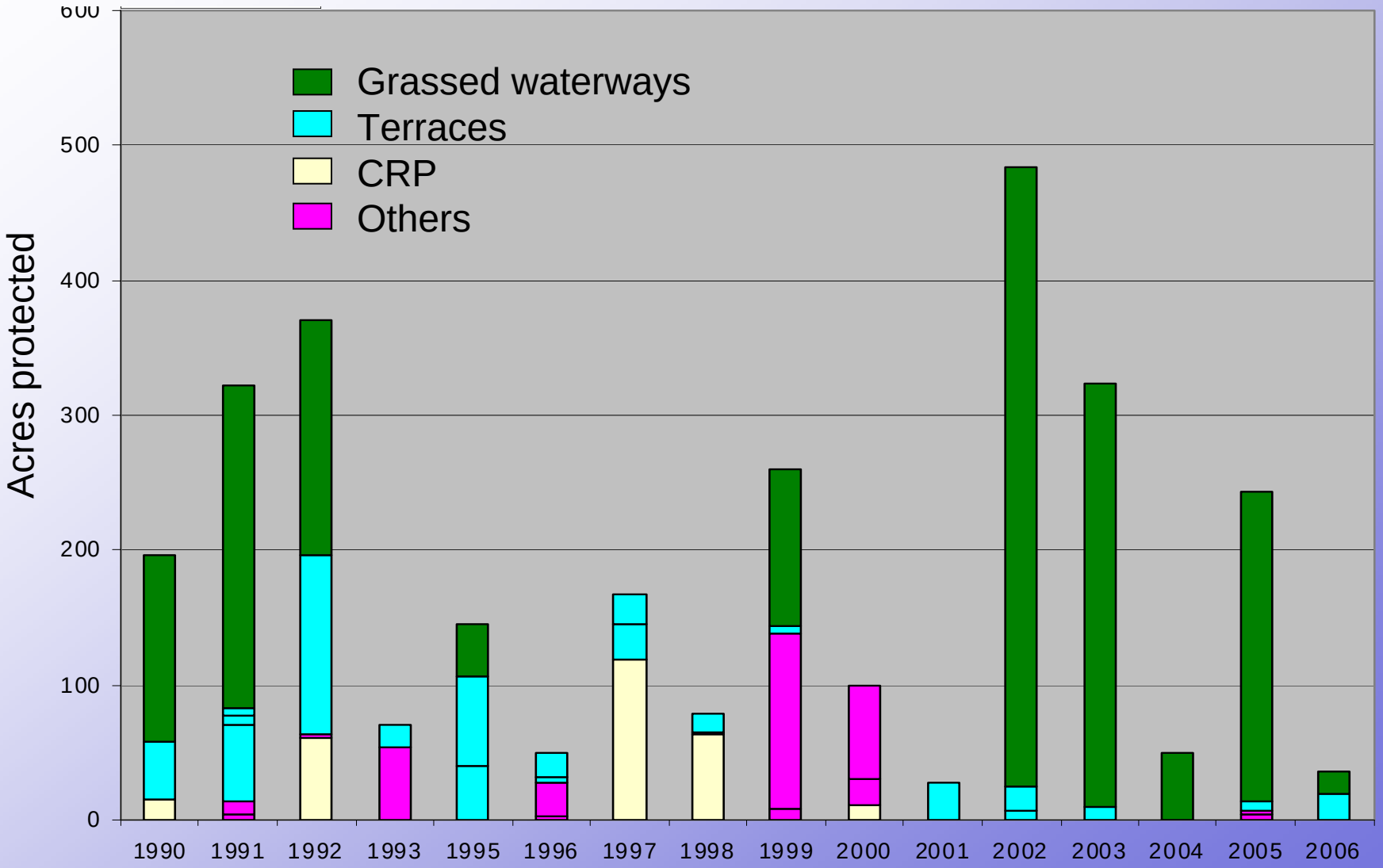
Methods

- Data analysis
  - NRCS: type, location and installation date of BMPs.
  - Survey of 18 producers in the watershed:
    - ✓ **Farm 27,400 acres.**
    - ✓ **5,000 acres in the watershed (~35% of watershed farm land)**
  - Herbicide water quality data since 1992.
- Modeling
  - SWAT model of the watershed
    - ✓ **calibration from 1993 to 1997**
    - ✓ **validation based on 1998 to 2003 (will be updated to 2006)**
    - ✓ **Run several scenarios**

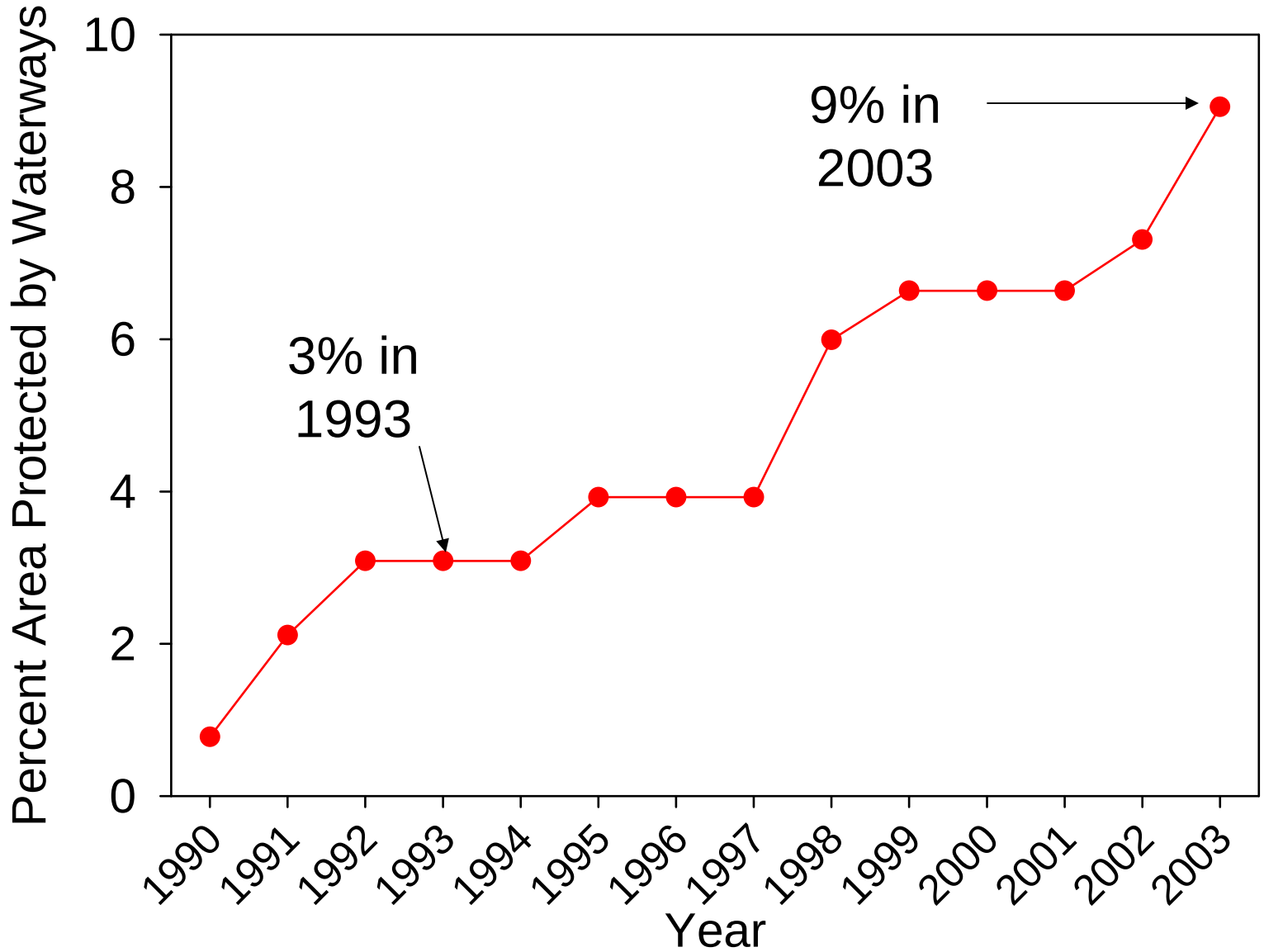
Assessment of Practices

NRCS Input and Producer’s Survey

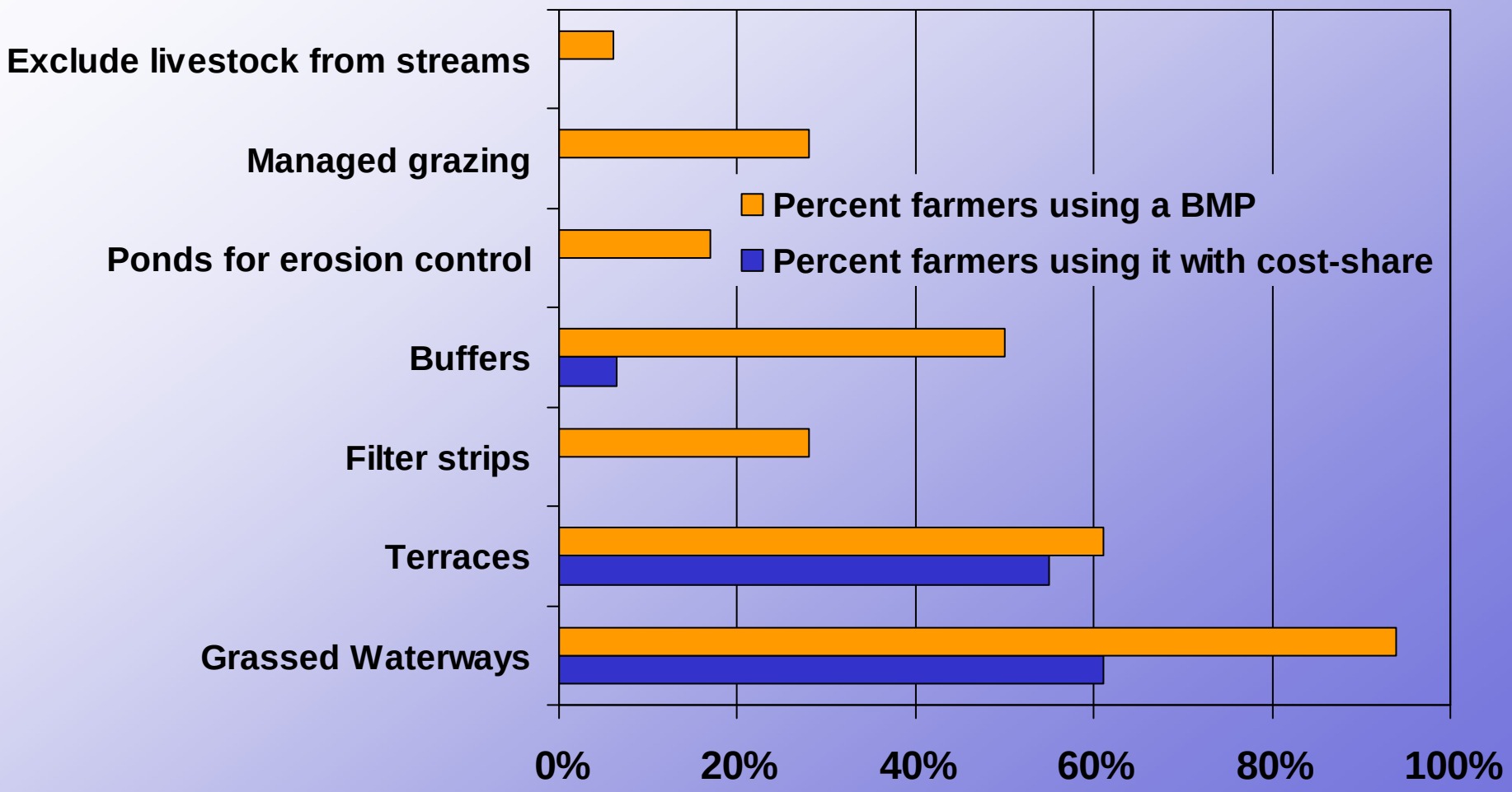
Acres protected by BMPs



Grassed Waterways



BMPs: Survey results



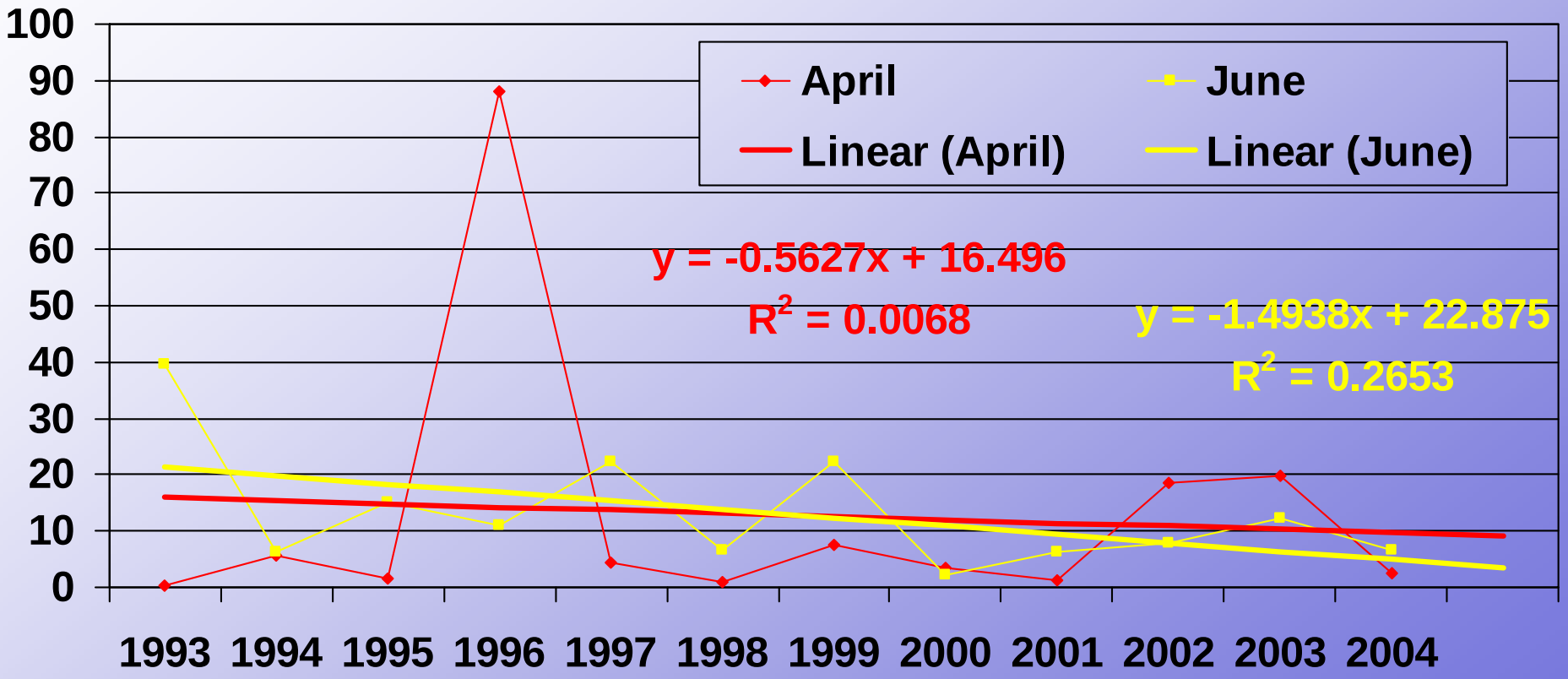
Effect Assessment

Stream Data Analysis

Methods

- Breakpoint flow data → daily flow values
- Sample concentrations (grab and auto sampler) → daily loads
- Monthly loads / average monthly flow → monthly flow weighed concentrations

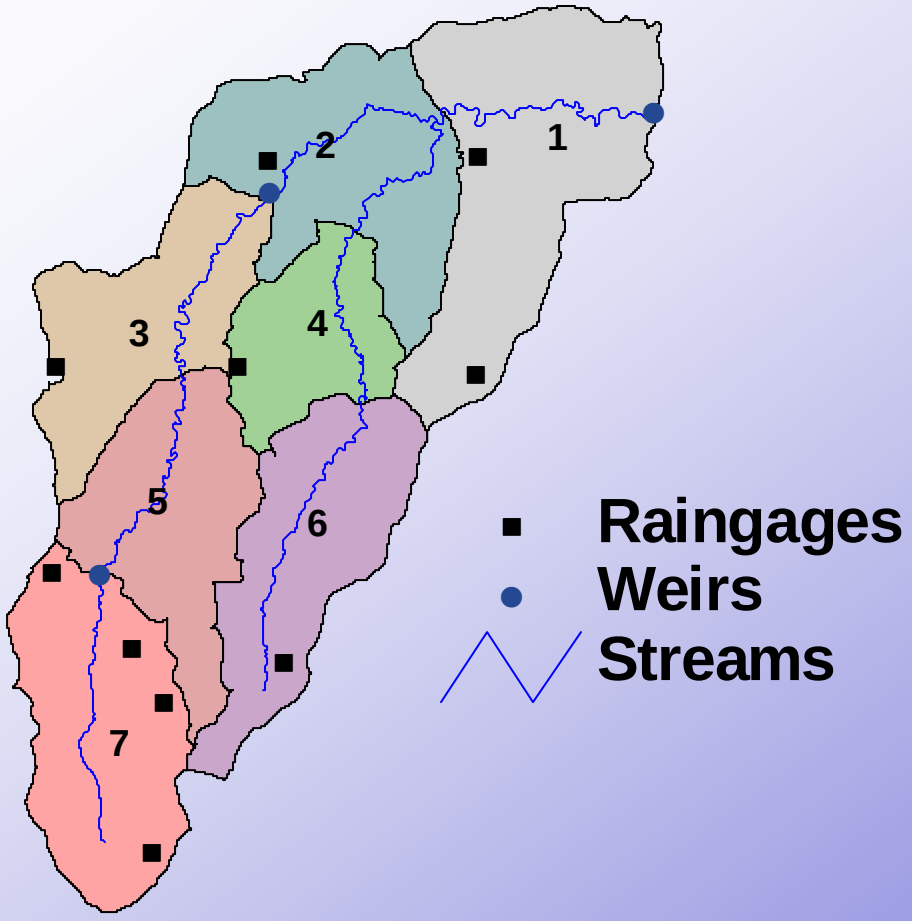
Atrazine Monthly Flow Weighted Concentrations



Effect Assessment

SWAT Modeling

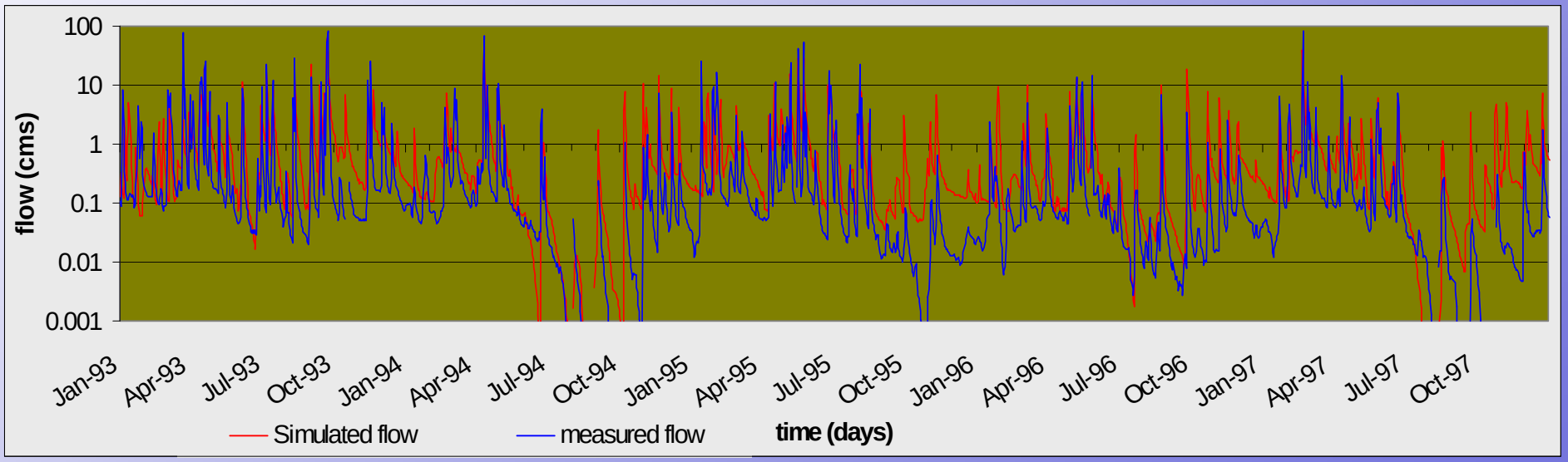
SWAT Modeling



- 7 subbasins
- 7 cropping tillage systems including corn, soybeans, wheat, sorghum, grassland + residential
- Calibration 93-97
- Validation 98-03

Flow Calibration

	R^2	Nash-Sutcliffe
Weir 1	0.53	0.53
Weir 9	0.61	0.60
Weir 11	0.65	0.59



Scenarios on Atrazine Losses

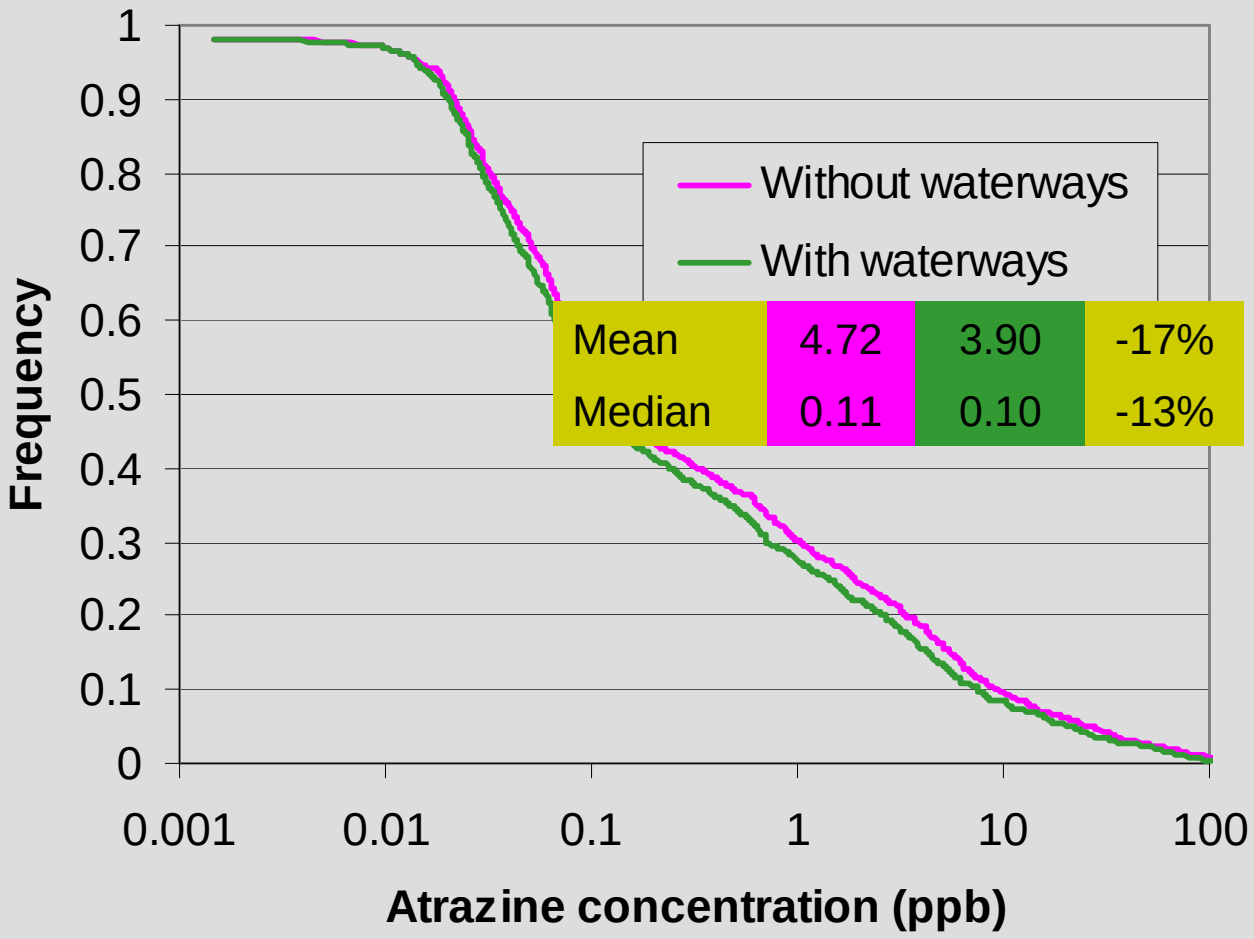
- **Temporary results: atrazine calibration not satisfactory**
- **2 scenarios: with and without grassed Waterways**
  - 338 ha (15%) of watershed protected
  - Divided between the tillage systems and the 7 subbasins.
  - Assumed all applied to corn acreage

Impact of Waterways at Weir 1

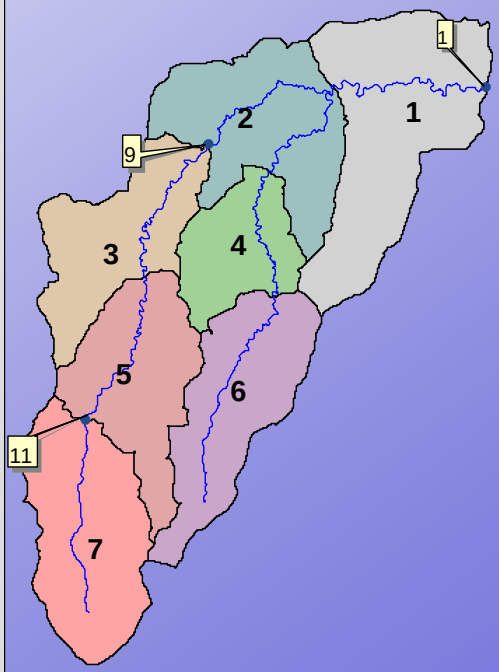
Simulated Atrazine concentration	April, May, and June, 30 years		
	Baseline	Added waterways	Difference
Mean (ppb)	2.76	2.24	- 19%
Variance	310	199	- 36%
Seasonal load (kg)	23.7	19.3	-18%

Impact of Waterways 1993-2003

Preliminary results **"Weir 1"** All subbasins

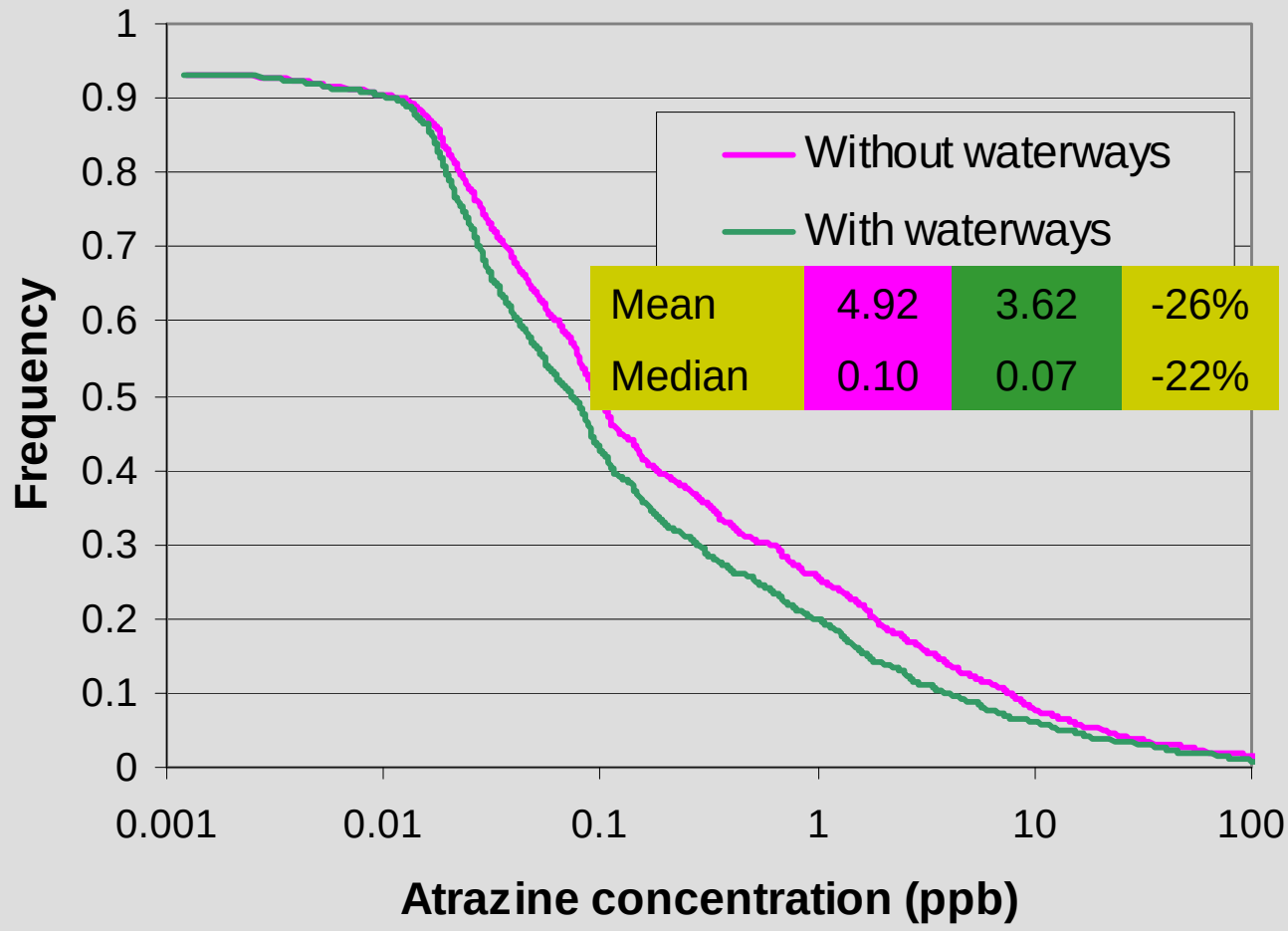


Mean	4.72	3.90	-17%
Median	0.11	0.10	-13%

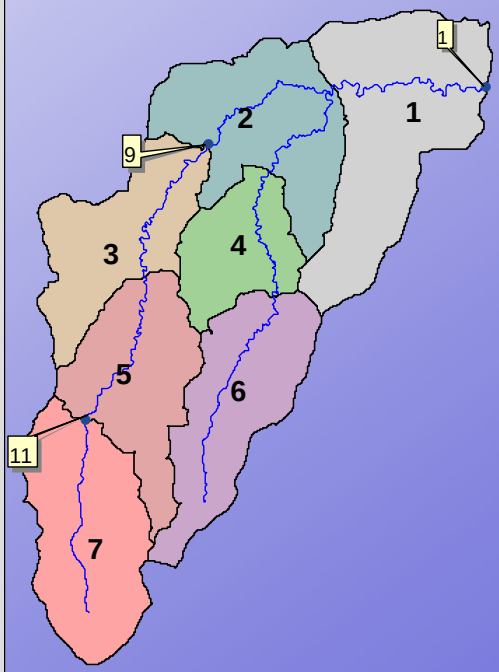


Impact of Waterways 1993-2003

Preliminary results **Weir 9** Subbasins 3, 5, 7

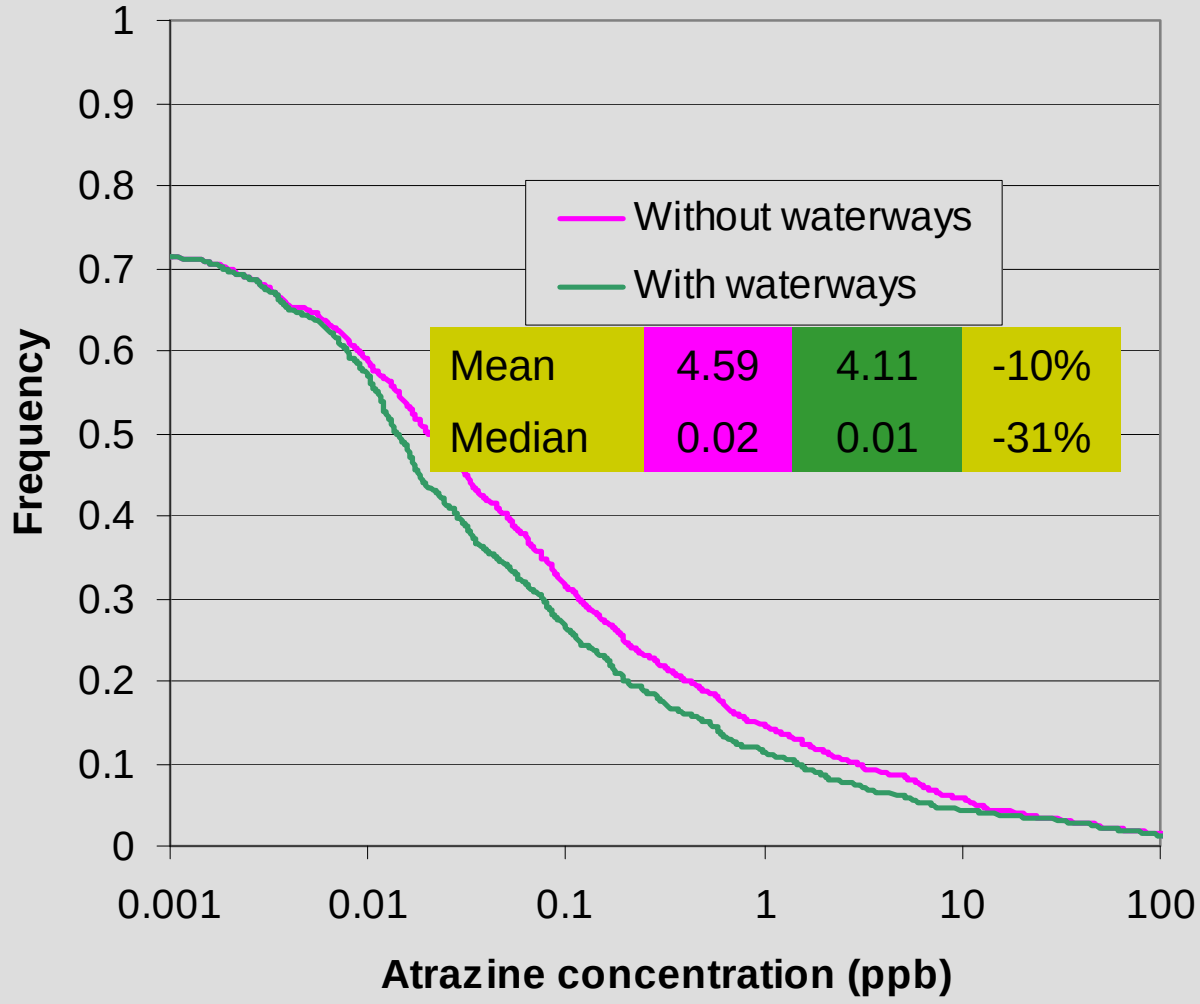


Mean	4.92	3.62	-26%
Median	0.10	0.07	-22%

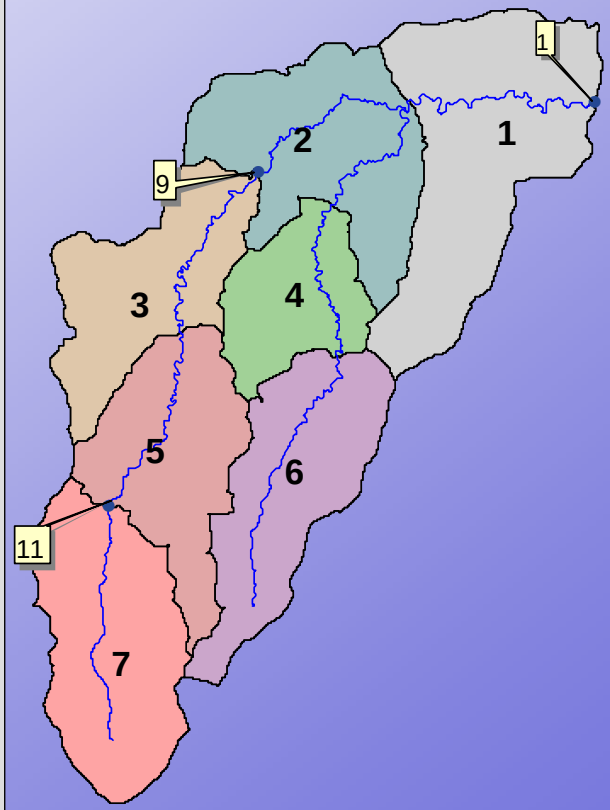


Impact of Waterways 1993-2003

Preliminary results **Weir 11** Subbasin 7



Mean	4.59	4.11	-10%
Median	0.02	0.01	-31%



How can we do better?

What drives producer’s choice?
How do they decide?
Where do they get their information?
Why do they change their behavior?

Herbicide Choice

What was listed in the top three factors that affect choice of herbicides

- 1992

1. Cost
   64% (16)
2. Performance
   48% (12)
3. Recommendation
   24% (6)

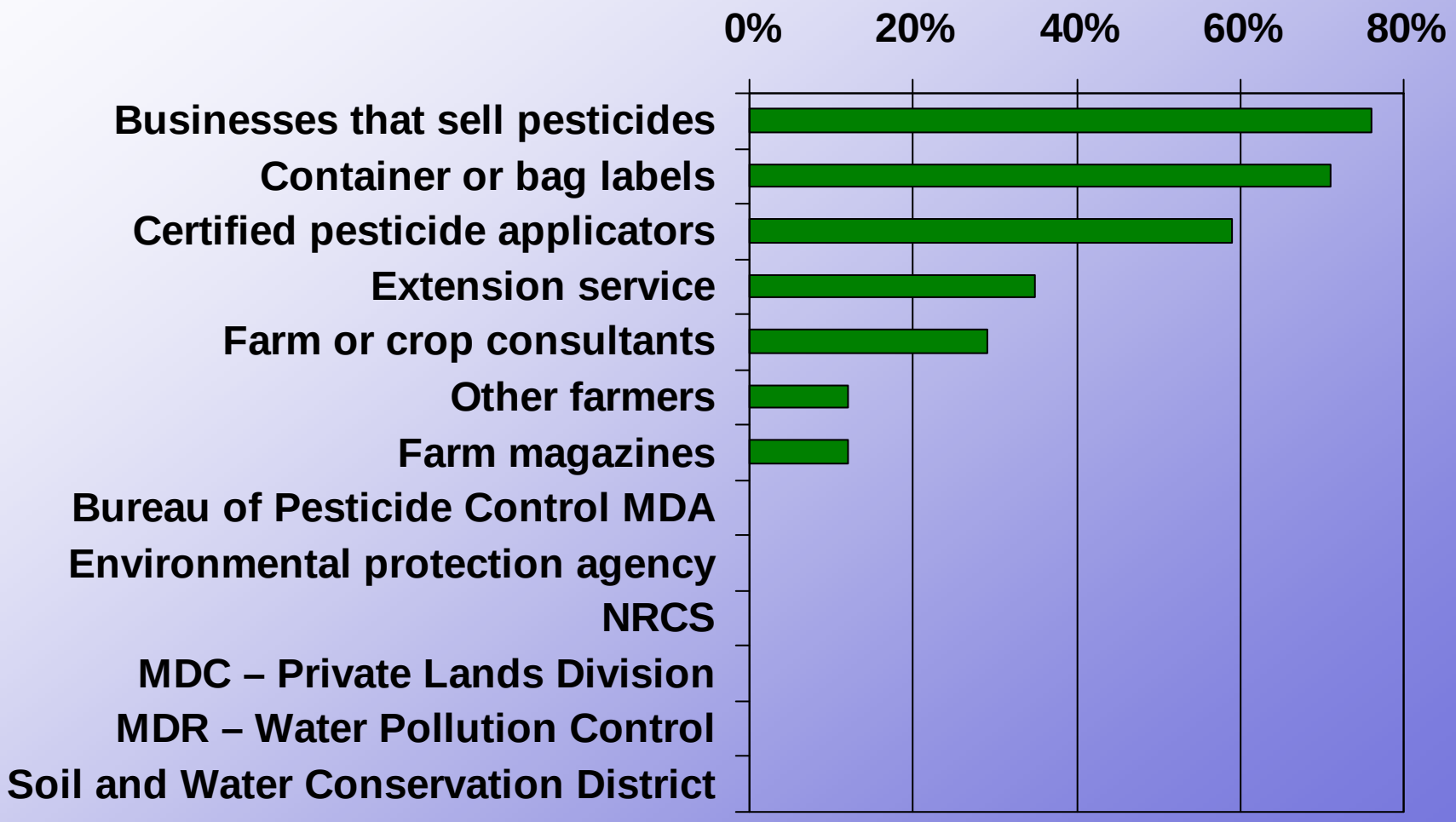
- 2006

1. Cost
   100% (18)
2. Performance
   92% (13)
3. Weed type – Problem severity
   69% (9)

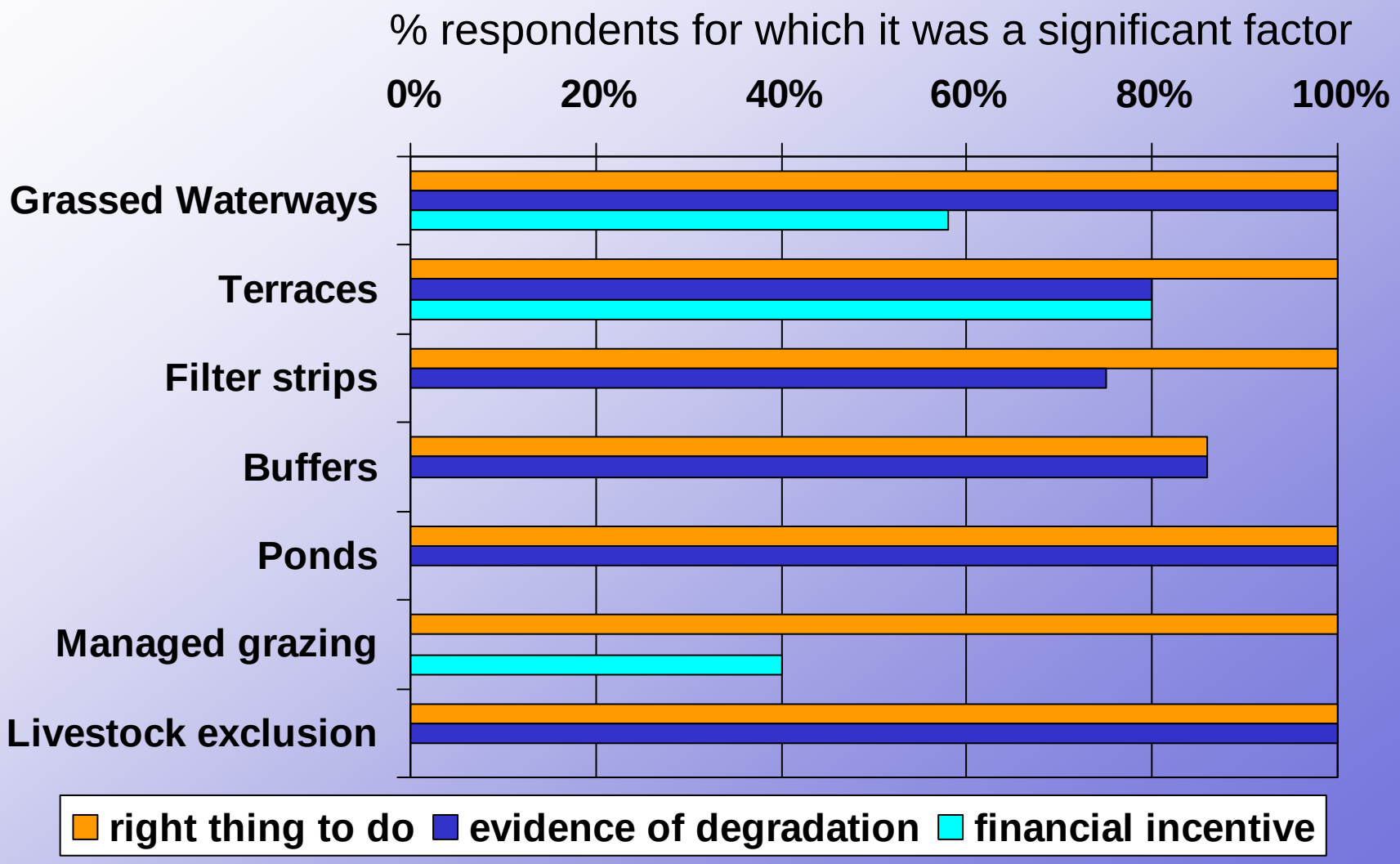
How do farmers decide?

- **Bio-physical factors key in deciding:**
  - Which herbicides (especially performance)
  - Fertilizer rates (esp. soil tests)
  - Methods and timing of fertilizers (soil conditions)
- **External factors key in deciding:**
  - Herbicides rates (label)
  - Timing / method of herbicide application (esp. weather)
  - Form of fertilizers (esp. cost)

Who do they list in the top 3 reliable sources of information?



What were the decisive factors?



Conclusions

- **Difficult to see a clear trend due to past efforts, either using water quality data analysis or modeling.**
- **An important factor for implementing a BMP was the evidence of degradation**
  - Need self-evaluation tools for farmers
- **Need to develop a watershed management plan.**
  - Definition of an objective
  - Define the number of acres to be protected