Determination of Factors to Explain Atrazine Decrease in the Goodwater Creek Experimental Watershed

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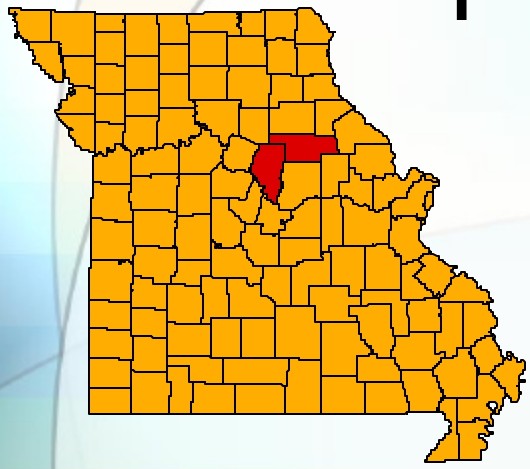
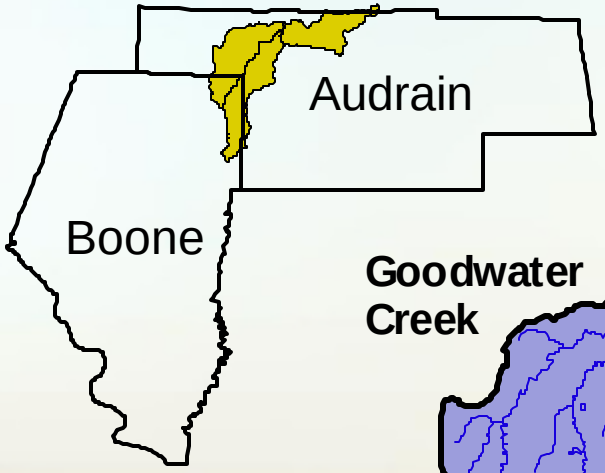
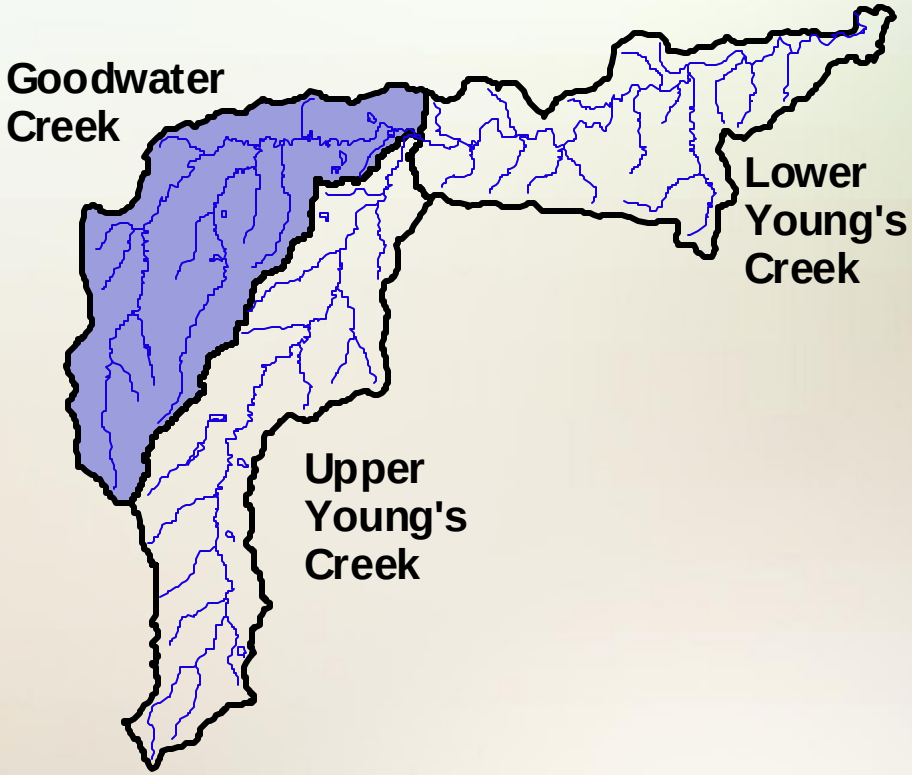
Goodwater Creek Experimental Watershed







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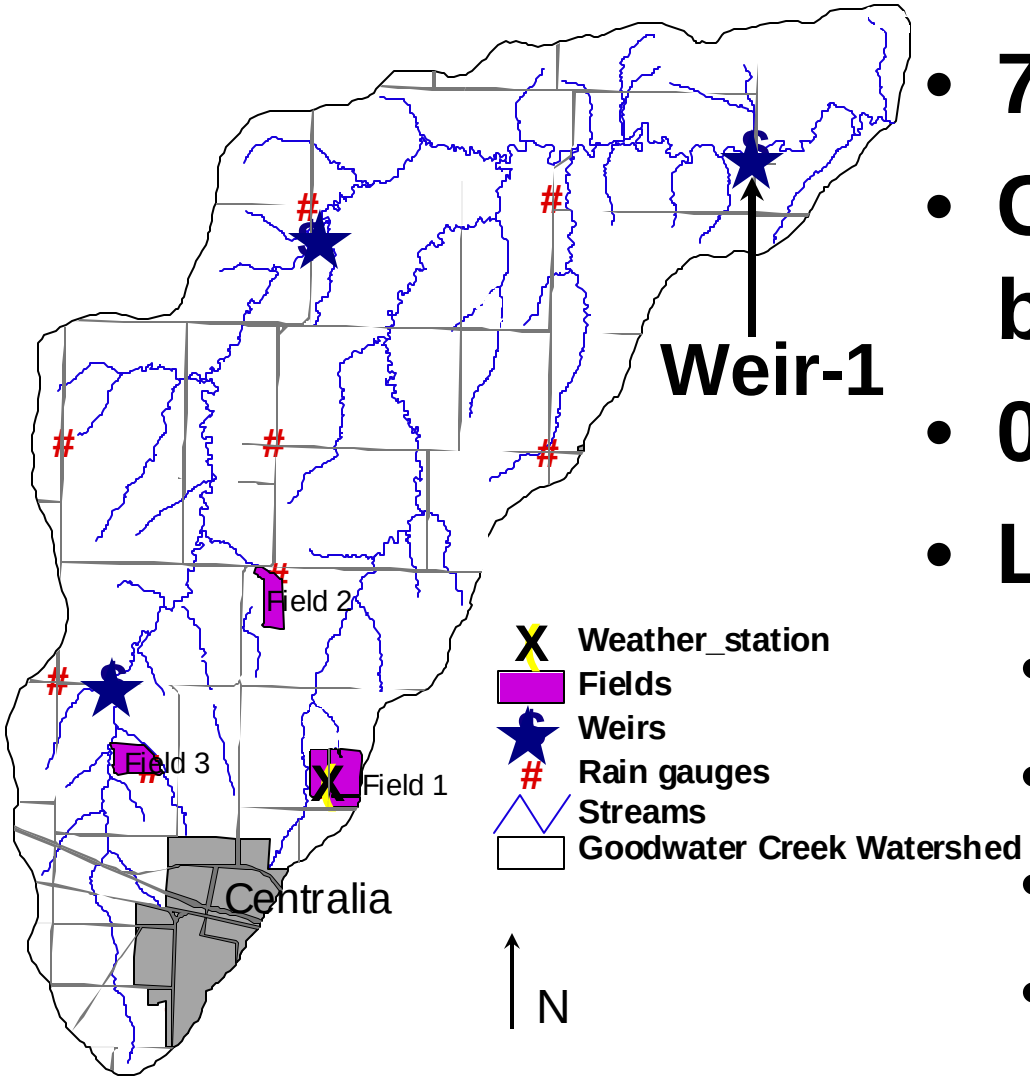


- **7,250 ha**
- **Claypan 15 to 45 cm below surface**
- **0-3% slopes**
- **Land use**
  - **70% Row Crops**
  - **10% Woodland**
  - **10% Grassland**
  - **10% Urban**

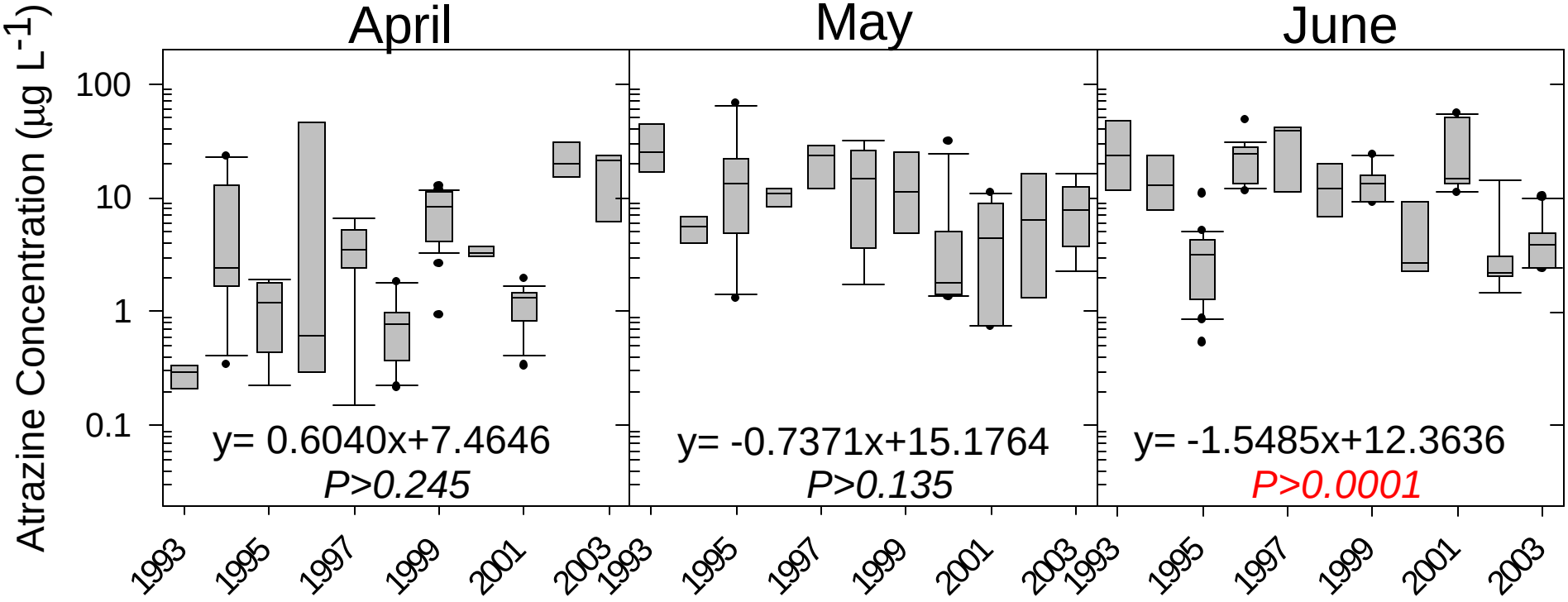
Objectives

- **Use statistical analysis to determine trends in weather, runoff, and water quality.**
- **Use SWAT model to estimate the impact of different factors on atrazine**

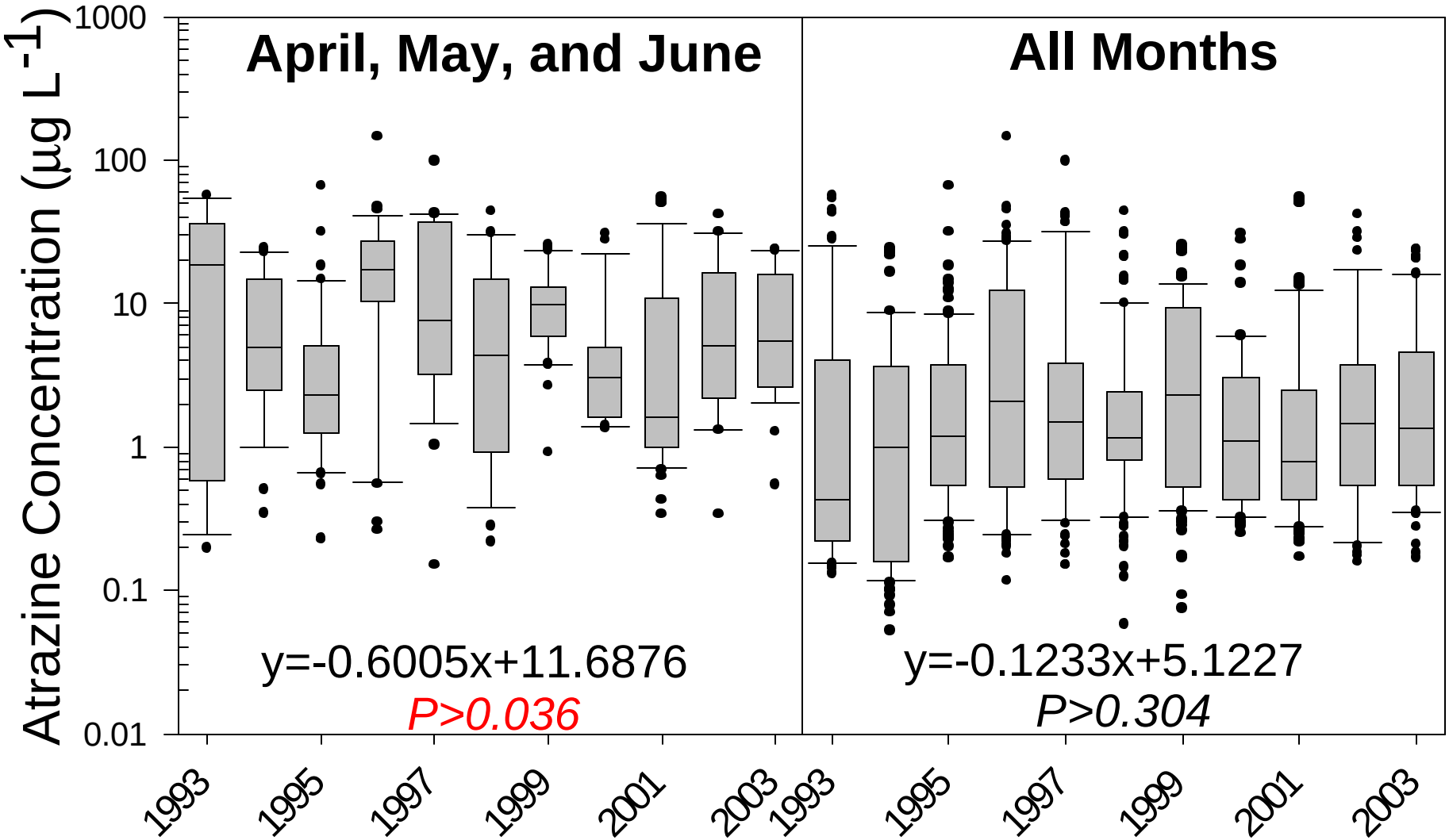
Atrazine

- **Conventional and conservation tillage**
  - **2.25 kg/ha after planting**
  - **Alternatively, 1.25 kg/ha with follow up in June**
- **No-till**
  - **1.12 kg/ha 1 month prior to planting**
  - **1.25 kg/ha 1 to 2 weeks after planting**

Atrazine Concentration

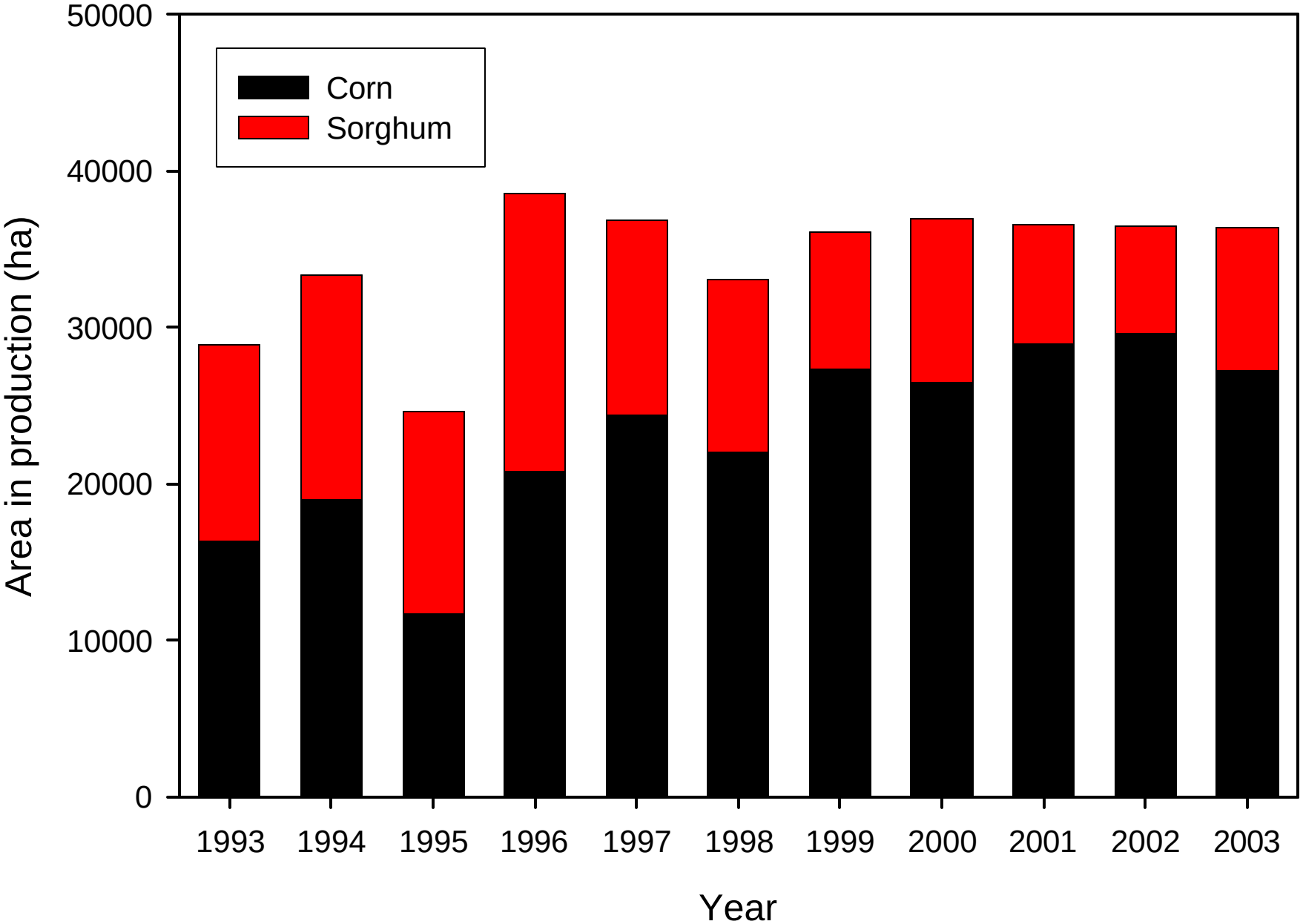


Atrazine Concentration

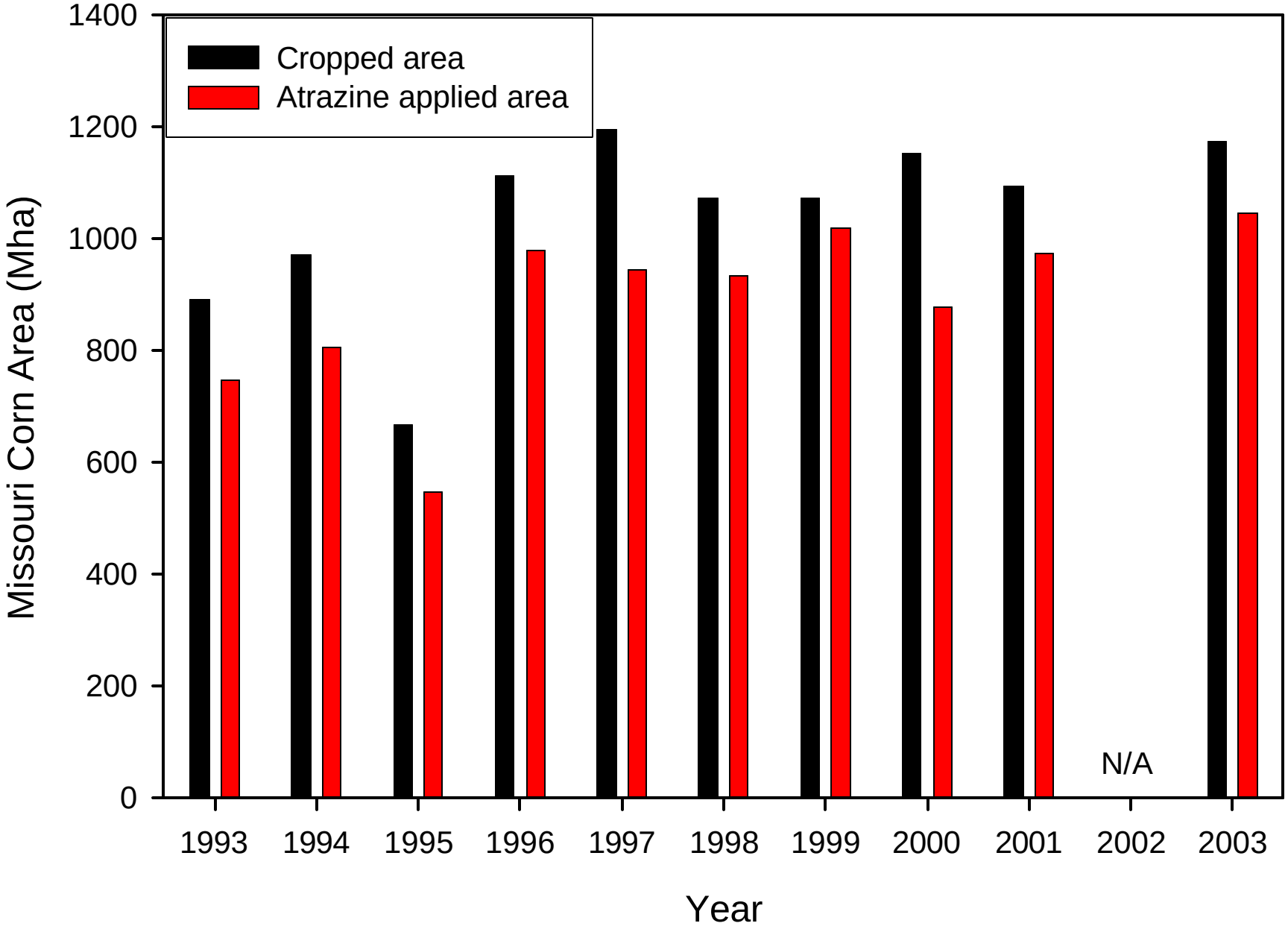


What factors influence atrazine loss?

Audrain County Crops

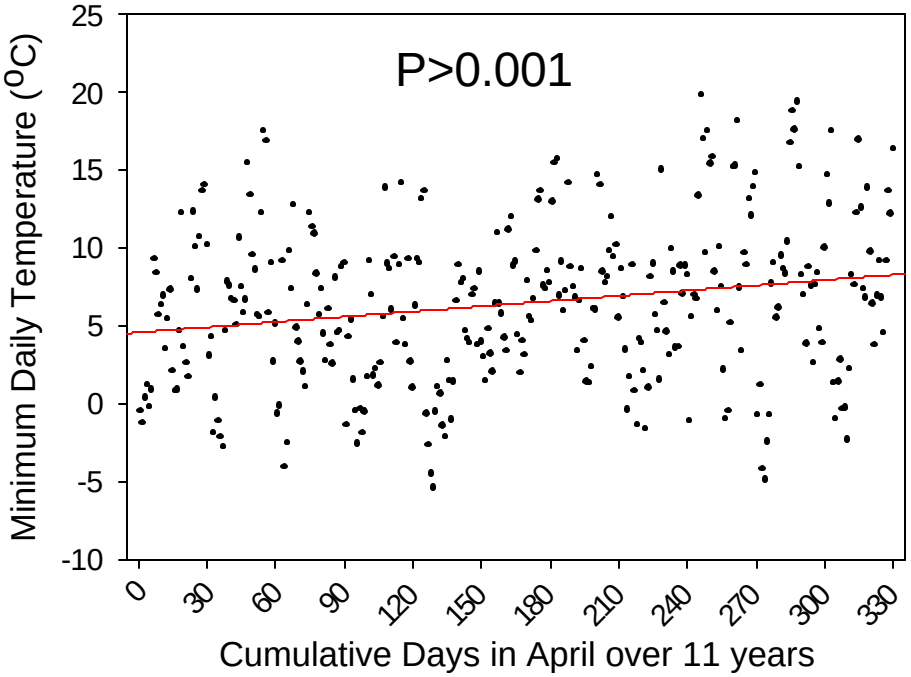


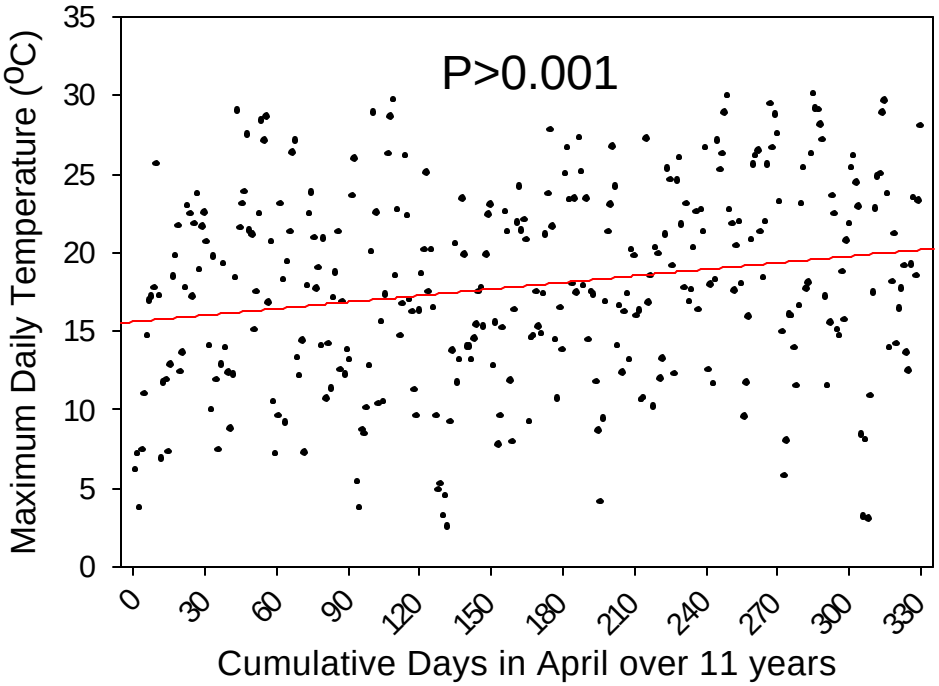
Corn Applied Atrazine



Temperature

Increases of temperature in April



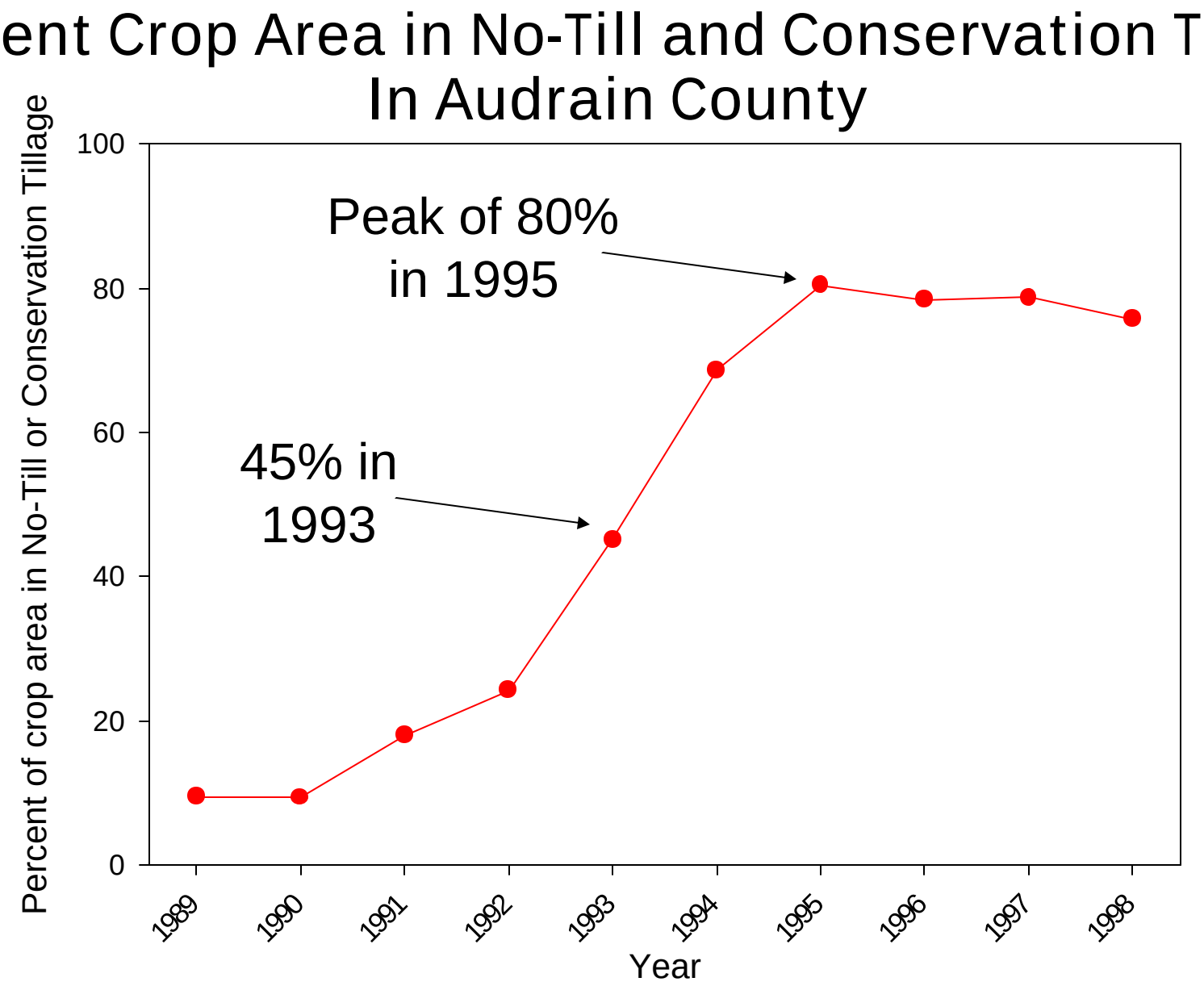


Warmer for all 12 months
(Tmax P=0.003, Tmin P=0.108)

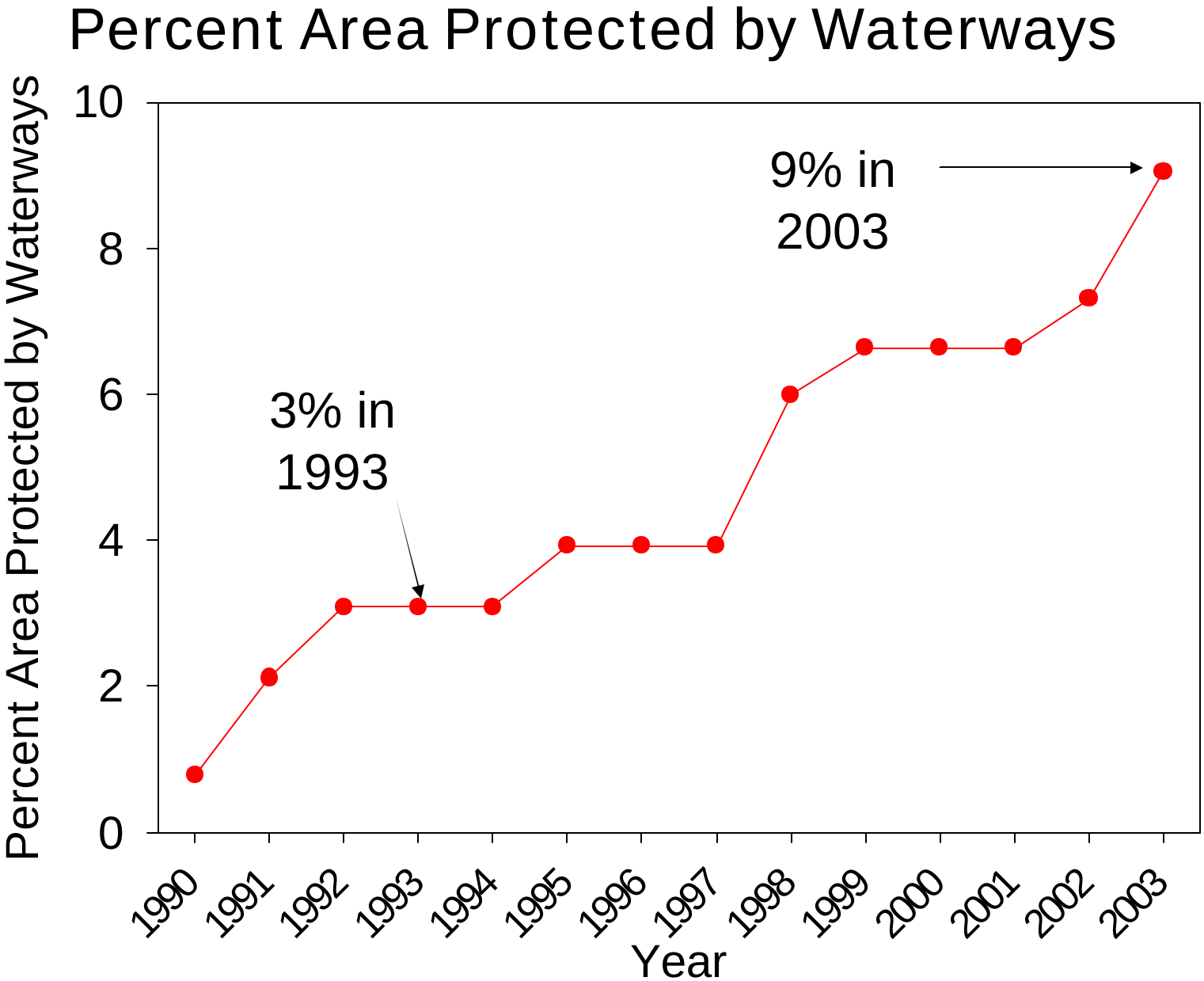
Precipitation and Runoff

- **Decrease in Precipitation**
  - **Drier in April (P=0.117)**
  - **Earlier planting**
- **Decrease in Runoff**
  - **Less Runoff in April (P=0.134)**
  - **Less Runoff for all 12 months (P=0.132)**

Conservation Tillage



Grassed Waterways



Can processed based modeling help explain impact of interacting factors?

Baseline Model

- **SWAT model**
- **Flow calibrated**
- **Specific planting dates for each year**
- **Atrazine management dependent on tillage system**
- **Measured Atrazine half-life: 12 days**
- **Other pesticide parameters at default**

Results: Atrazine Trends

	Data (all factors)		Model (weather)	
April	↗	P=0.245	↘	P=0.136
May	↘	P=0.135	↗	P=0.085
June	↘	P<0.0001	↘	P=0.002
April, May & June	↘	P=0.036	↗	P=0.942
All Months	↘	P=0.304	↗	P=0.630

Scenarios

- **Grassed Waterways**
  - **326 ha (4.1%) of Corn acreage protected**
  - **Divided between the 3 tillage systems and the 7 subbasins**
- **Tillage Distribution for Corn**

	1993	1995
No Till	34%	43%
Conservation Tillage	23%	30%
Conventional Tillage	43%	27%

Conservation Technology Information Center (CTIC) data

Impact of Waterways

Simulated Atrazine concentration	April, May, and June		
	Baseline	Added waterways	Difference
Mean	11.94	8.87	- 26%
Median	0.22	0.19	- 13%
Variance	1852	1100	- 40%

Impact of Tillage

Simulated Atrazine concentration	April, May, and June		
	More tillage (1993)	Less tillage (1995)	Difference
Mean	12.03	12.81	+ 6%
Median	0.20	0.23	+ 15%
Variance	1957	2186	+ 12%

Conclusions

- **Decreasing trends in June and season of April, May, June.**
- **The SWAT model estimates that grassed waterways reduced the atrazine concentrations by 26% on average.**
- **The SWAT model estimates that tillage practices of 1995 increased atrazine concentration by 6% relative to 1993 practices.**

Conclusions

- **SWAT can reproduce trends seen in June observed data.**
- **SWAT output indicates that small changes in the acreage of waterways and tillage system types are affecting atrazine loss.**
- **Next:**
  - **Impact of pesticide management**
  - **Analysis of sediment and nutrient data**

Thank you