

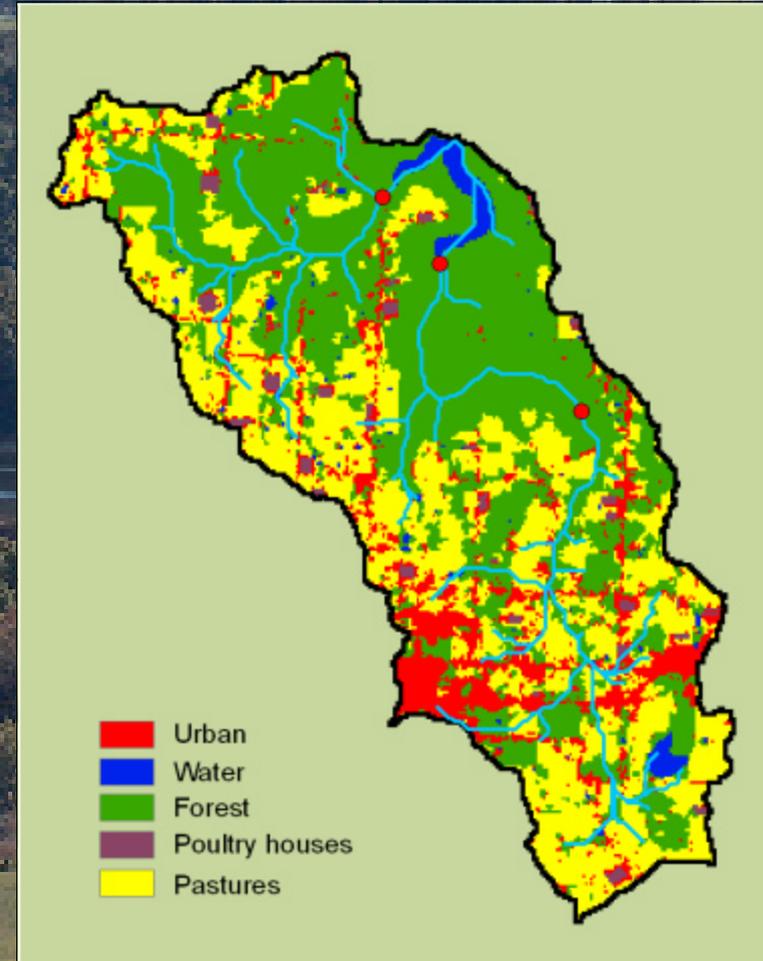
Effectiveness and optimization of BMPs in improving water quality from an agriculturally dominated watershed

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Study site description

- Size - 32 km²
- Land use
 - Pasture 36%
 - Forest 39%
 - Urban 11%
- Primary concern - Phosphorus
- Monitoring – flow, WQ; (1992 – present)
- Tributary Illinois River



Issues in the Lincoln Lake Watershed

- Land application of animal manure
- Land use changes
- Effects of land use changes combined with/vs BMP implementation on water quality



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- Optimize BMP selection and placement to maximize WQ improvement and agric. sustainability
- Better educate stakeholders for watershed mgt decision making



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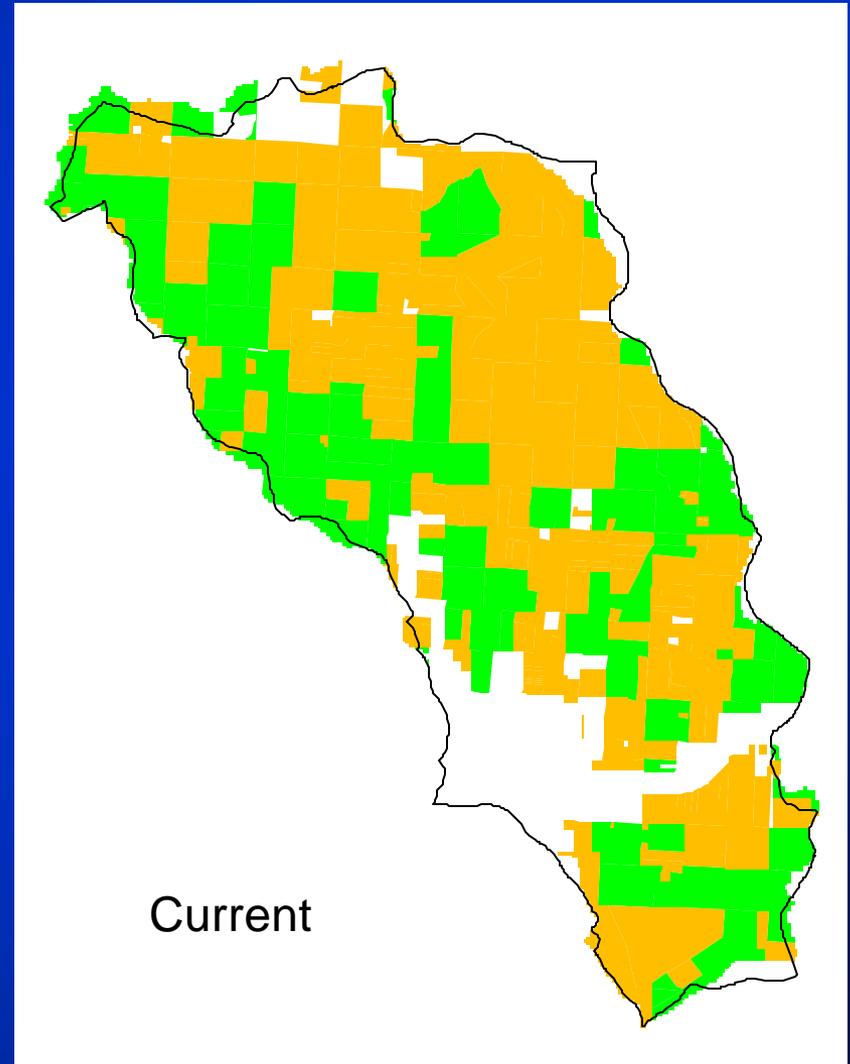
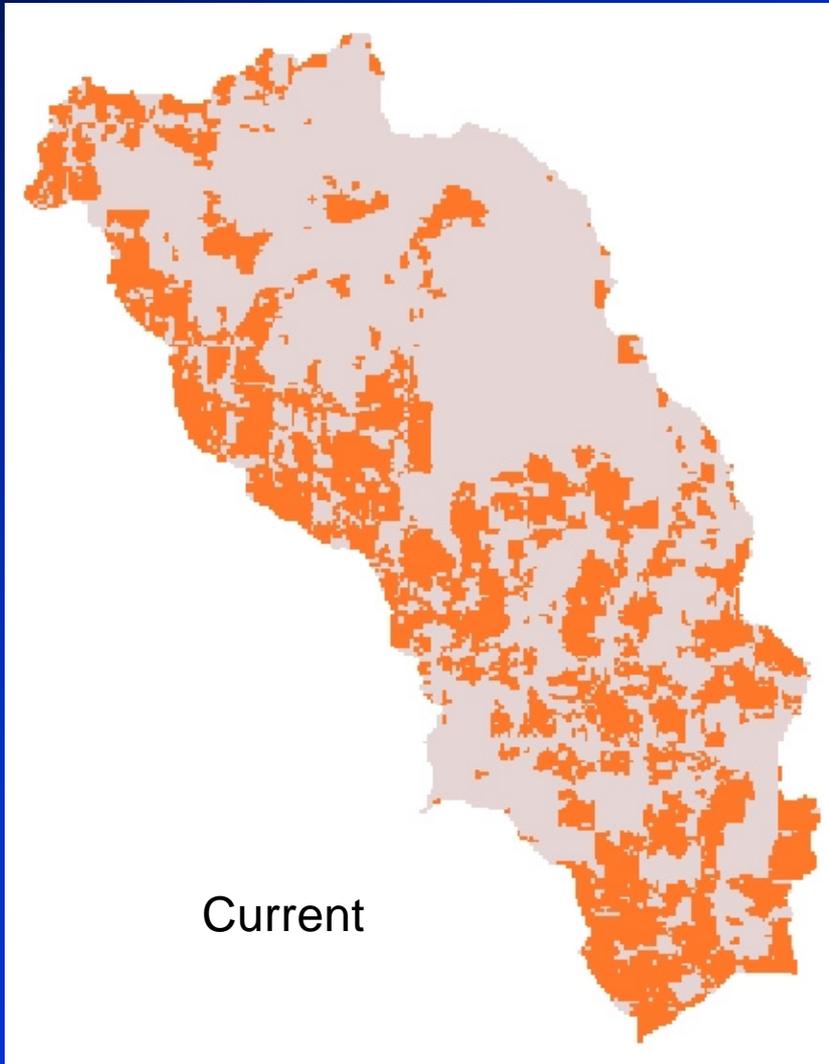
Approaches

- Synthesize historic watershed land use, BMP, and water quality data
- Model water quality impacts of BMPs, land use changes
- Conduct surveys to determine stakeholder perceptions on water quality, pollutant sources and BMPs

Land use and BMPs(1992-present)

	% of watershed Area					
Land use	1992	1994	1996	1999	2001	Current
Urban	3	4	7	8	11	12
Forest	39	44	40	37	45	39
Woody	7	7	9	14	5	10
Pasture	47	43	41	38	36	36
Poultry	1	1	1	1	1	2
BMPs	<1	1	3	6	7	34

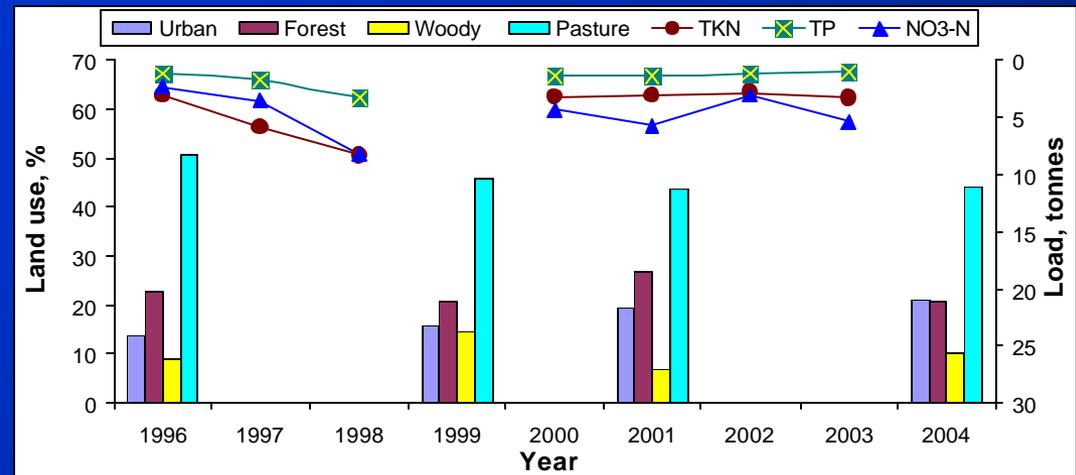
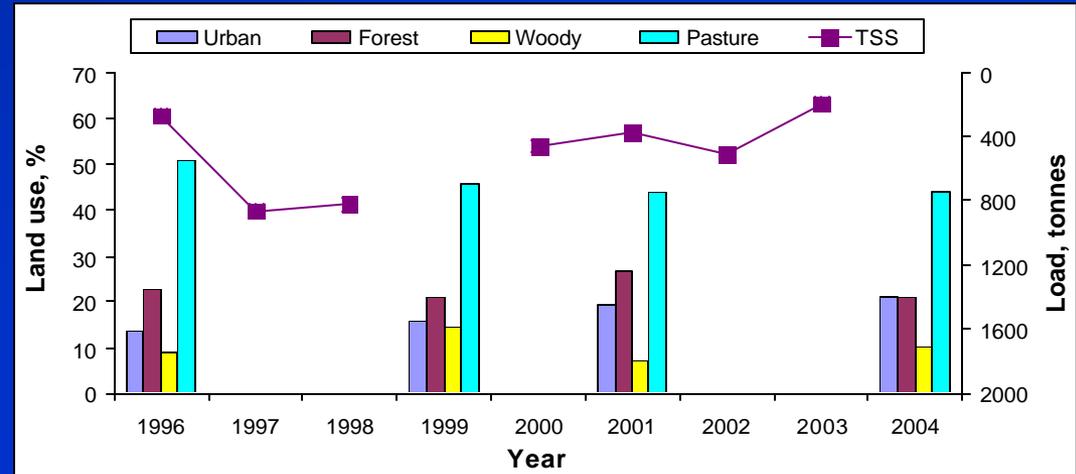
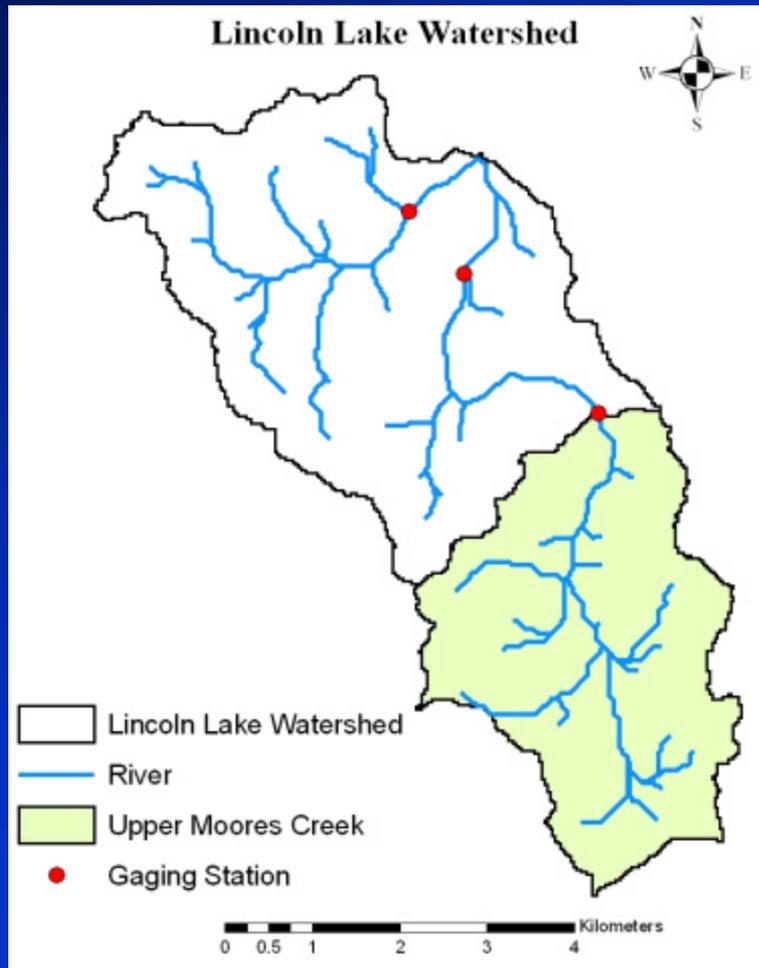
Land use and BMPs(1992-present)



Pastured areas

BMPs implemented

Land use and water quality



Modeling – Soil and Water Assessment Tool (SWAT)

- Daily time step, continuous simulation, watershed scale model
- Distributed, process-based
- Simulates water movement, sediment loss, and nutrient losses:
 - ❖ Locations within the watershed
 - ❖ Watershed outlet
- Flexibility in watershed discretization

Modeling - SWAT

Base data

Topography, Land use
Center for Advanced Spatial
Technologies (UARK)

Soils
UARK soil survey

Land Management

Washington Co. producer data

Measured data

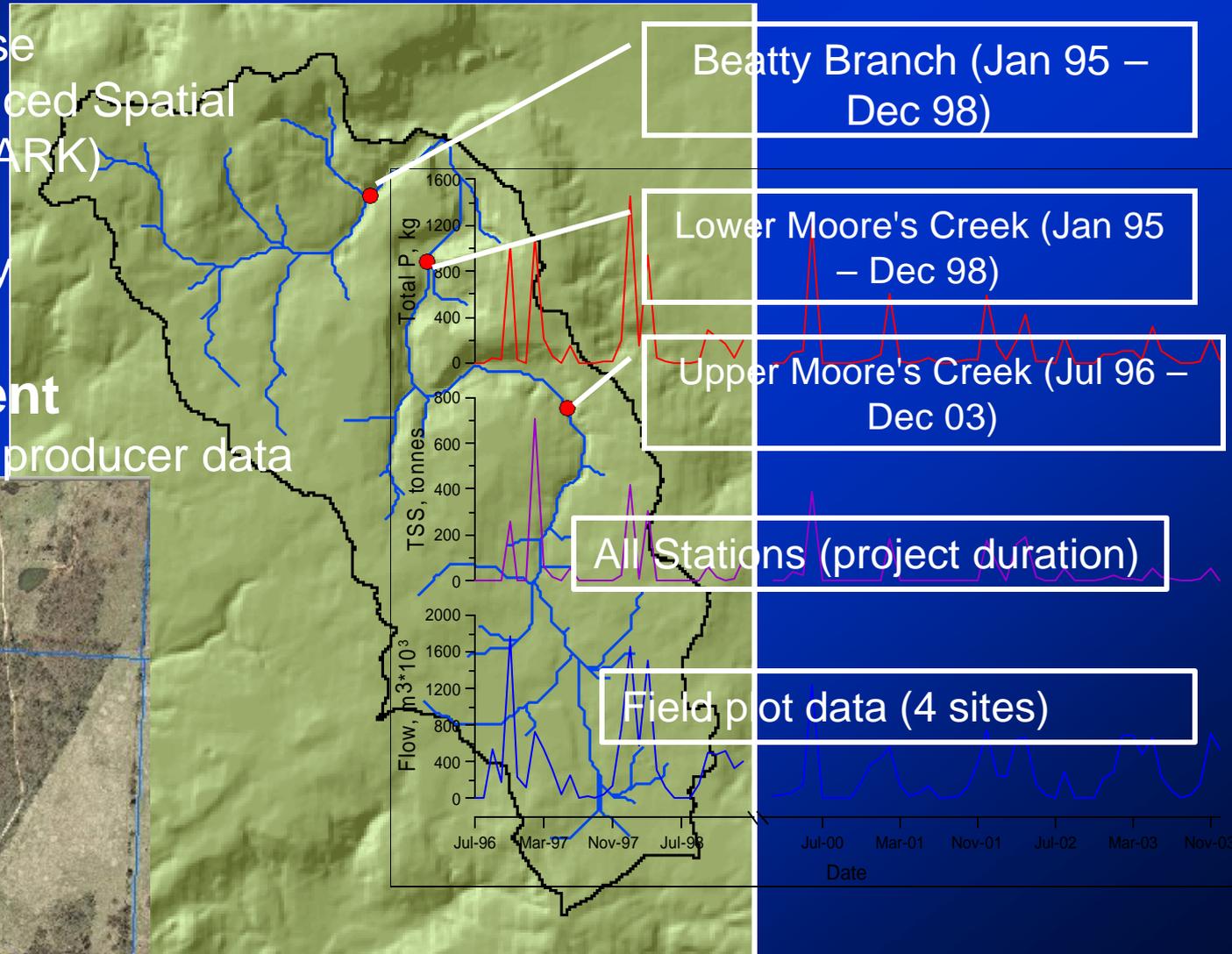
Beatty Branch (Jan 95 –
Dec 98)

Lower Moore's Creek (Jan 95
– Dec 98)

Upper Moore's Creek (Jul 96 –
Dec 03)

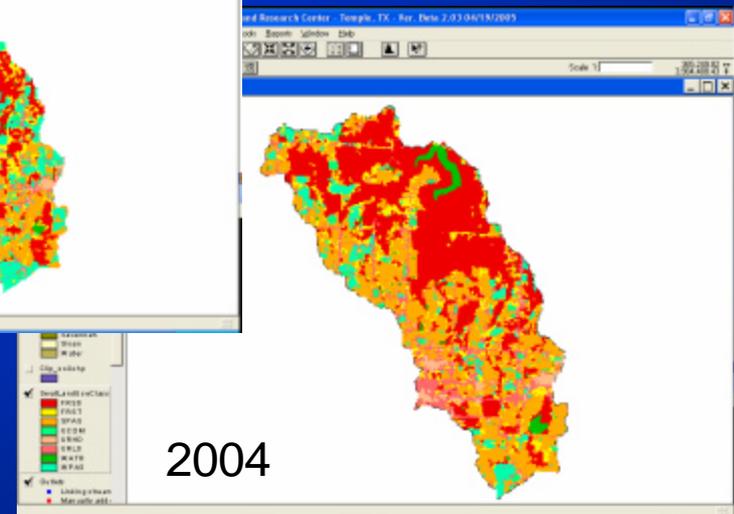
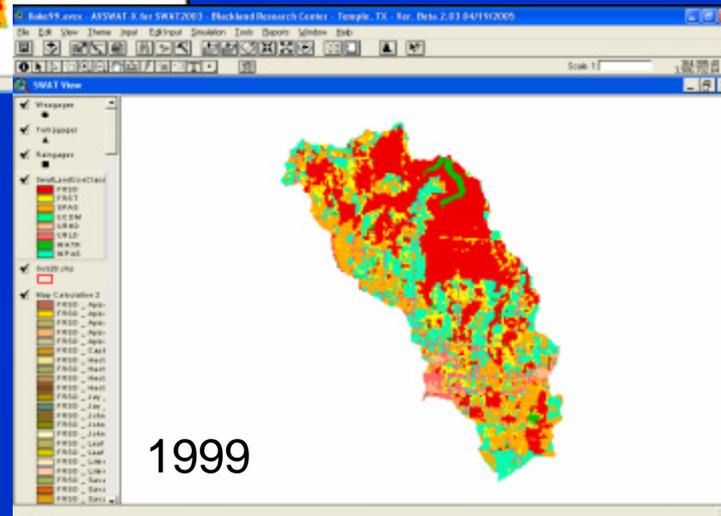
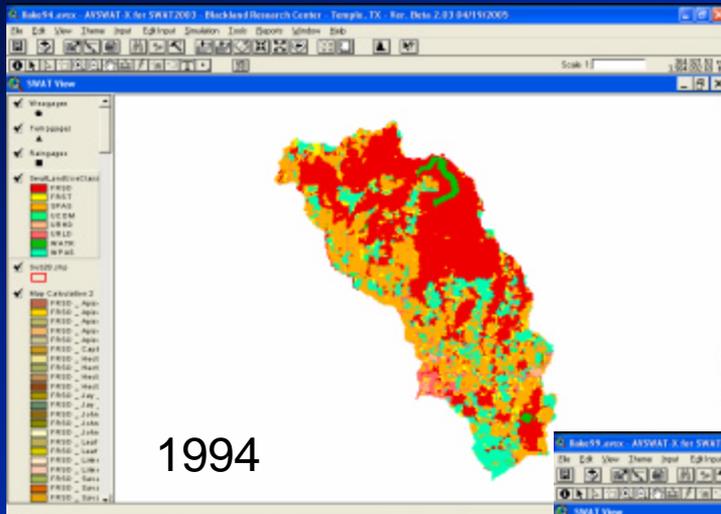
All Stations (project duration)

Field plot data (4 sites)

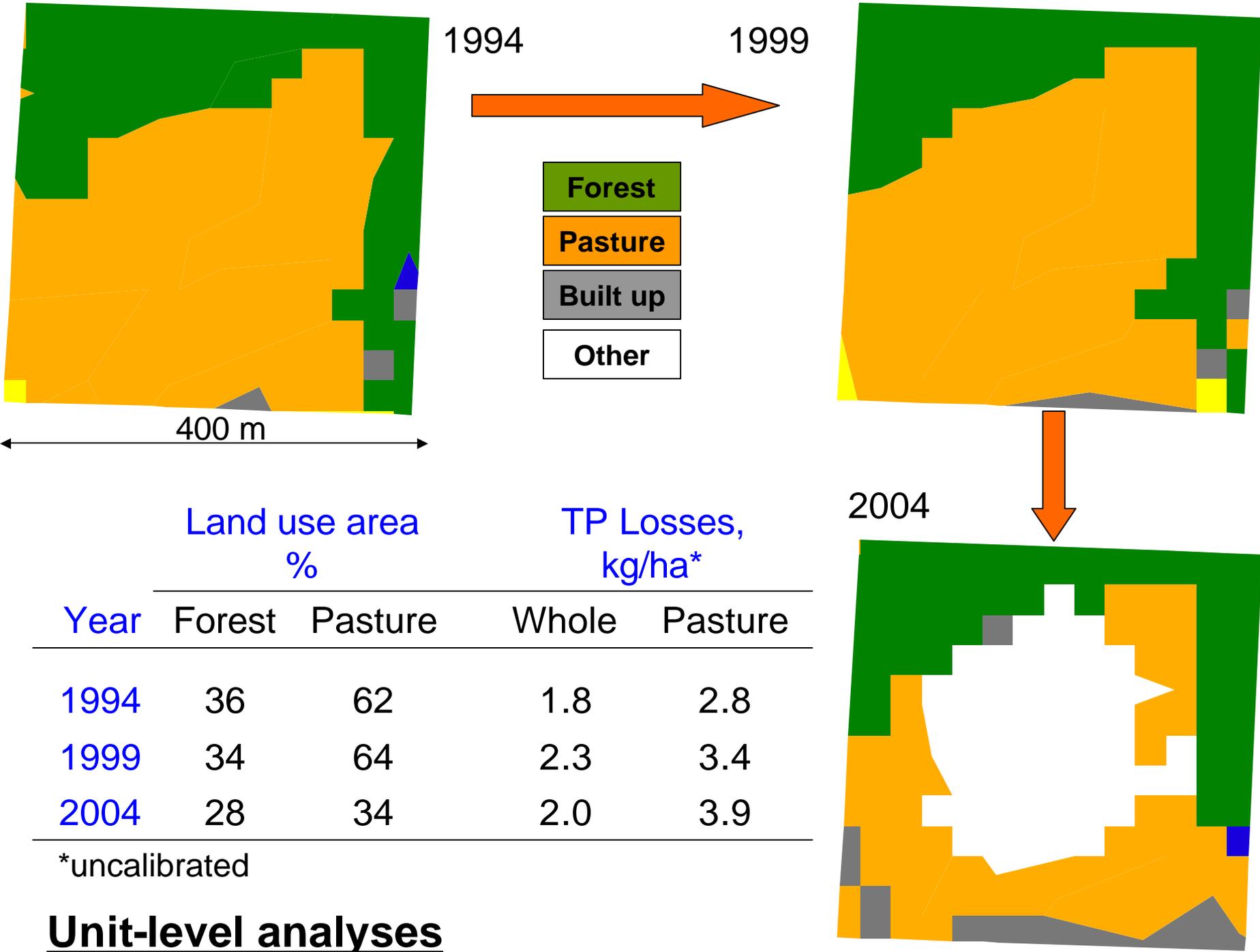


Modeling - SWAT

Different model set up for each period
Captures transition to urban land use
Transition to and from pastures

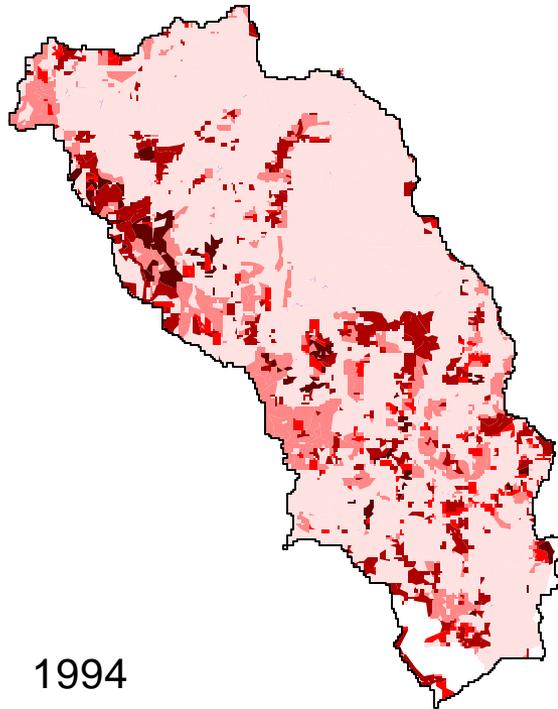


System established to track units over the years

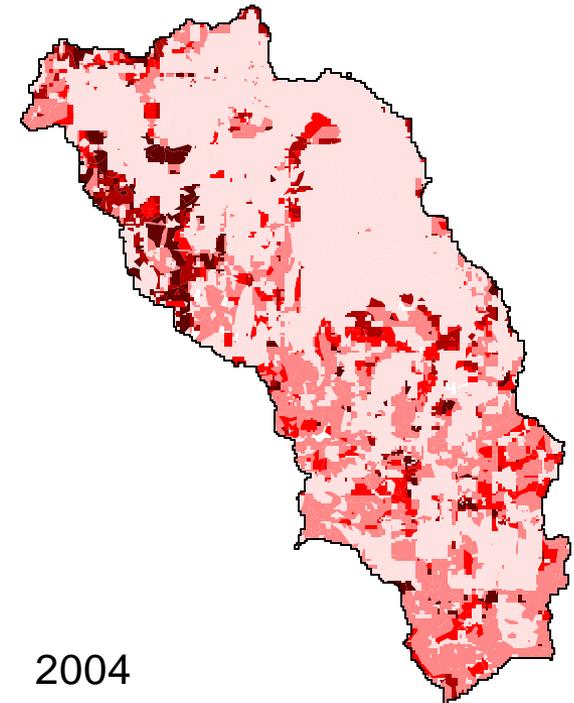
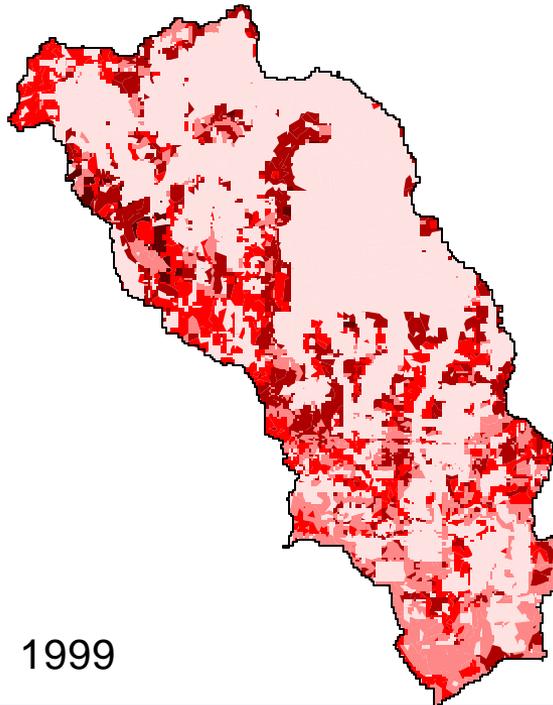
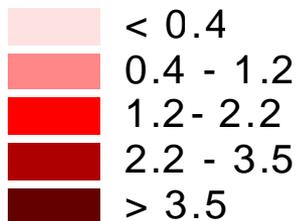


Modeling - SWAT

Big picture – whole watershed*



Total P, kg/ha



*Preliminary, uncalibrated

2004

Stakeholder surveys

Ag stakeholders:

- 63 of 75 - 84% response rate
- Most farmers that were contacted / reached agreed to do survey

Non-Ag stakeholders:

- 70 out of 239 - - 29% response rate
- Four individuals mailed back surveys blank

Stakeholder perceptions

Group	... is a large contributor (% respondents)	
	Agric stakeholders	Non-agric stakeholders
New construction	52	38
Industry	29	25
City sewer system	26	28
Other groups	57	18
Agriculture	5	42

Stakeholder perceptions

Group	... is an effective practice (% respondents)	
	Agricultural	Non-Agricultural
Soil test	86	70
Manure instead of commercial fertilizer	82	46
Fertilizer application based soil test results	80	63
Pasture grass mgt	82	54
Comprehensive Nutrient Management Plan (CNMP)	52	52

Way forward

- Continue modeling of water quality impacts of BMPs, land use changes
- Perform scenario assessments based on stakeholder perceptions, optimization
- Identify cost-effective ways to manage water quality
- Educate stakeholders on linkages among BMPs and water quality response

Questions

