Targeting Critical Areas and Scheduling Implementation

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Treat the Right Problems with the Right Solutions in the Right Places

How do we get there?

Identifying Critical Areas in Your Watershed

Definition of a Critical Area: Where watershed efforts need to be targeted to have the greatest impact on water quality.

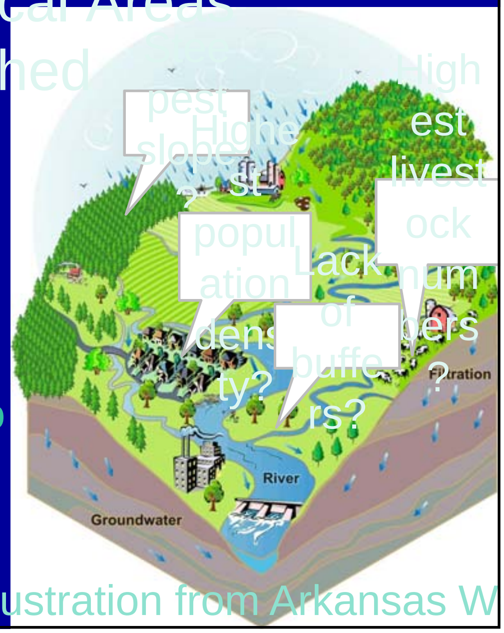


Illustration from Arkansas W

Getting it right

- Critical areas
- Delivery System (who, what)

Solving Water Problems

Use biophysical measures to identify vulnerable locations within problem area.

↓

Assess salient behaviors in these locations to determine where disproportionality may be occurring.

↓

Gain understanding why inappropriate behaviors are occurring in these locations.

↓

Design intervention effort based on this understanding.

Objective

To remediate a significant amount of water quality degradation from nonpoint sources using existing policy, knowledge, and methods through the incorporation of the “human dimension” in a rigorous and scientifically valid fashion.

So what are some options for identifying critical areas?

Critical Area Types

- Restoration:
- Protection:

Critical Areas Identification

"Within a WMP and following the EPA guidelines, critical areas should be identified as one or a combination of the following descriptions:

1. 12 digit HUCs or smaller geographic areas where a particular pollutant needs to be addressed to meet the water quality goals of the WMP.
2. Specific region within a 12 digit HUC or smaller geographic area where a particular source(s) is contributing a pollutant of concern and needs to be addressed to meet the water quality goals of the WMP.
3. Specific source(s), anywhere in the project area, that are contributing a pollutant of concern."

Critical Areas Identification Options

1	2	3
Defined by geographic area (usually HUCs or subwatersheds)	Combination	Defined by Source
Example: Mudbug Watershed	Example: Livestock access to streams in Mudbug Watershed	Example: Locations where livestock have access to streams

Critical Areas Identification Options

1

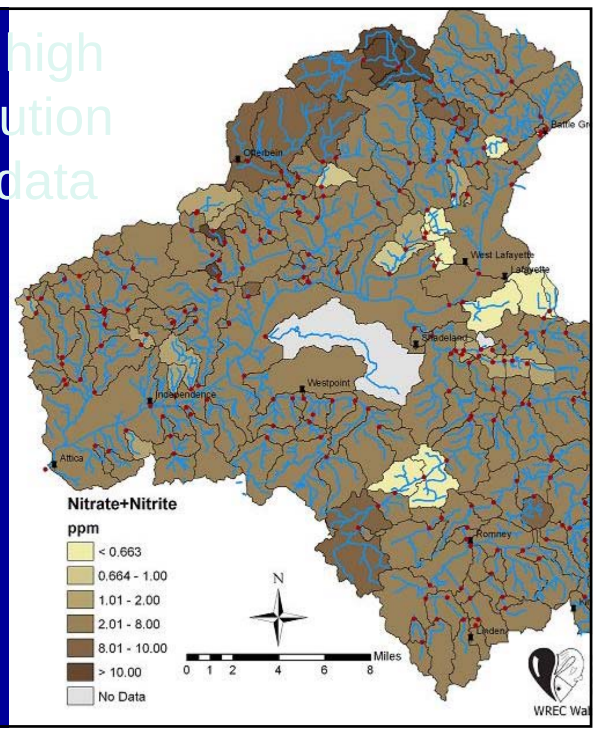
Defined by geographic area (usually HUC or subwatershed)

Makes sense if you

- Have monitoring data that differentiates locations
  - high spatial resolution
  - shows one watershed with higher yields (concentration or load/area)
- Have a very homogenous land use

Example of high spatial resolution monitoring data

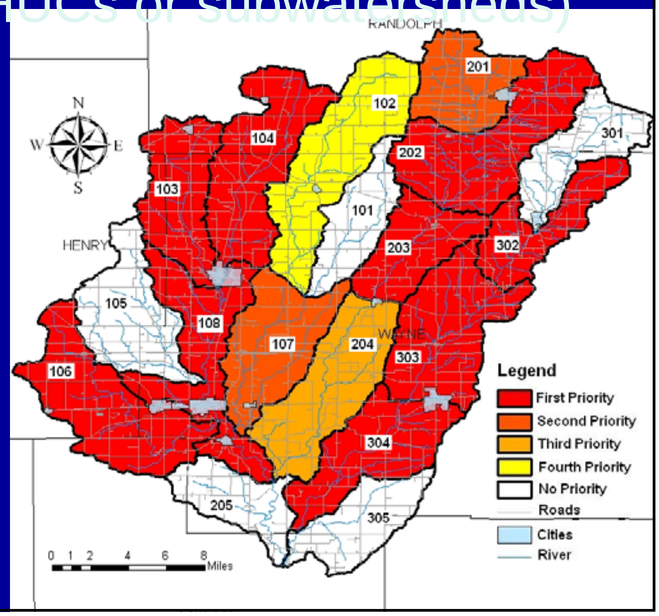
- Define geographic areas if you have monitoring data that can differentiate locations



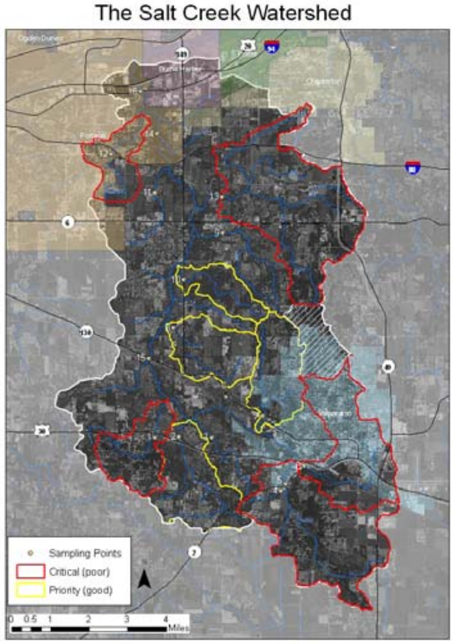
1. Defined by geographic area (usually HUCs or subwatersheds)

Example:

Five priority levels of HUCs defined in a large watershed



The Salt Creek Watershed



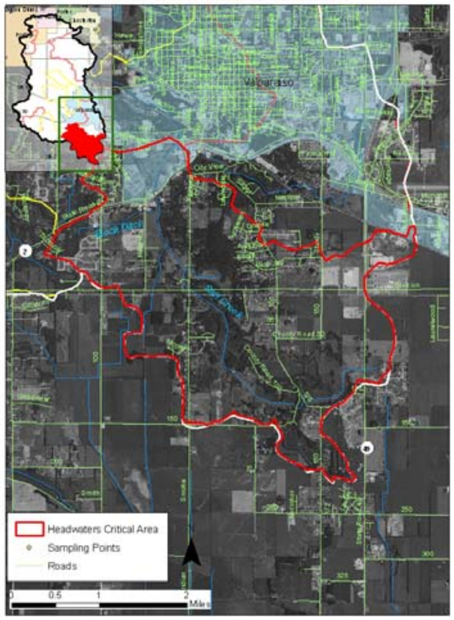
Critical and Priority Areas

Critical Areas (Red)
•Need treatment to improve existing poor water quality

Priority Areas (Yellow)
•Need protection to protect relatively good water quality

Based upon:
- historic water quality data,
- current water quality data,
- confirmed sources,
- projected future development,
- and causes of impairment.

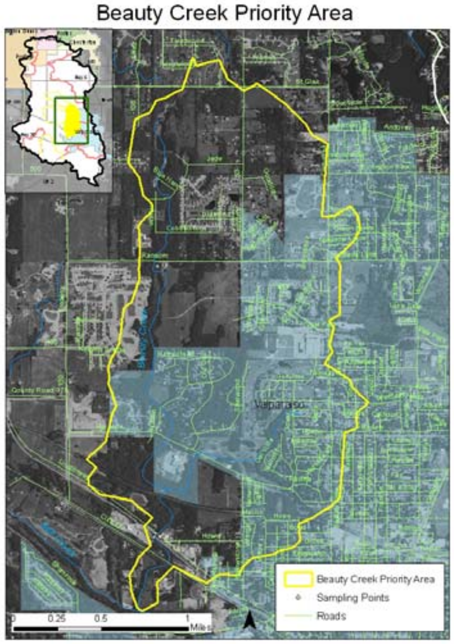
Headwaters Critical Area



Salt Creek Headwaters

- •Highest average *E. coli* concentration
- •Highest average TSS concentration and loading rate
- •High nutrient loading rates
- •Low DO
- •Poor habitat rating

Beauty Creek Priority Area



Beauty Creek

- •Lowest average *E. coli* concentration
- •Lowest average TSS concentration and areal loading rate
- •Relatively low nutrient concentrations
- •Highest habitat rating

Critical Areas Identification Options

Makes sense if

- you know that there are particular behaviors that people are willing to change
- "the time is right" for grants to fund a particular solution to a source
- your monitoring data is sparse or concentrations in all areas are similar

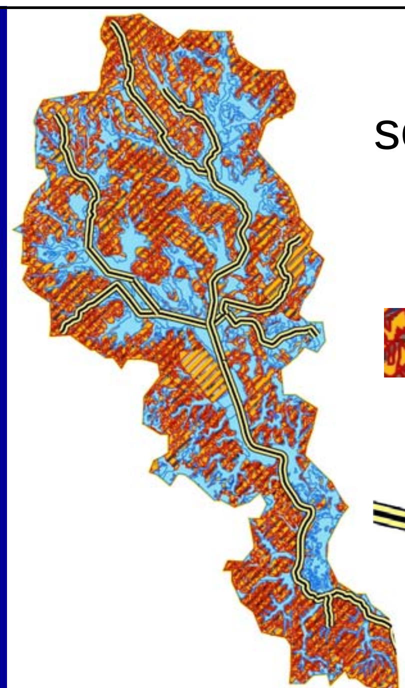
3

Defined by source of pollution to address

Examples:

Cropped fields without cover crops

Lawns that receive P fertilizer

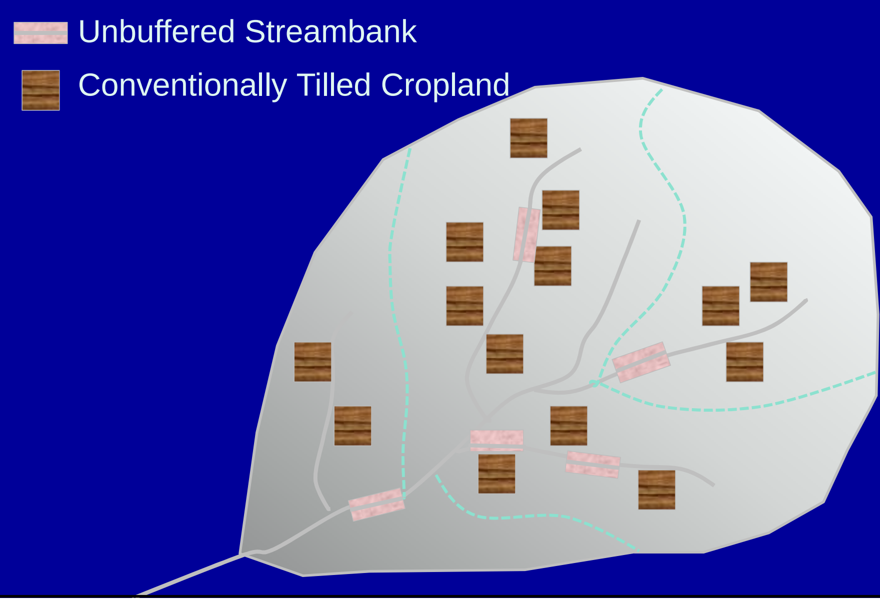


3. Defined by source of pollution to address

Highly erodible areas contributing to the high levels of suspended sediment and nitrate found throughout the watershed.

Riparian areas in need of buffers and filter strips to provide wildlife habitat and water quality improvements.

Where are the critical areas?



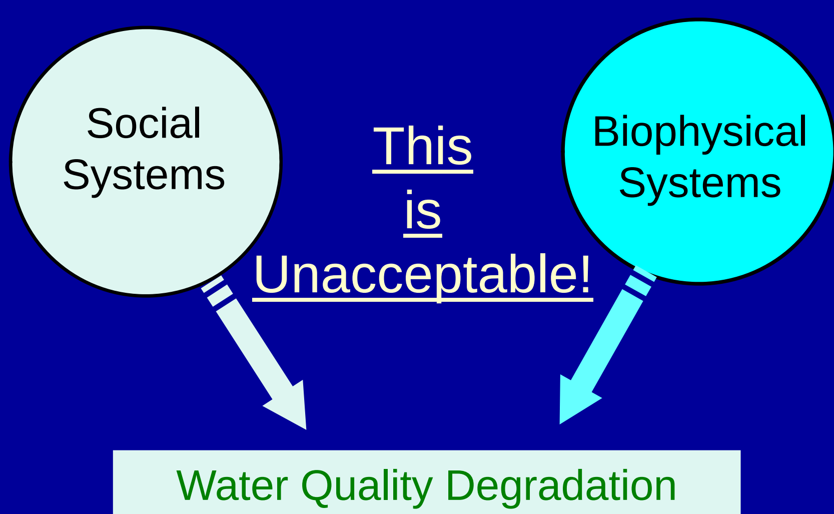
Biophysical Approaches to NPS Pollution

1. Heterogeneity between agricultural systems is recognized along biophysical dimensions. Variation is examined on the dimensions of climate, hydrology, soils, biology, and prevailing agronomic techniques. The human element is assumed to be a constant relative to profit maximizing behavior. Aquatic system impacts are determined by the interaction between the biophysical characteristics and system-wide production techniques.

Social Approaches to NPS Pollution

2. A social science perspective where the emphasis is on markets, institutions, economic behavior, culture, and technology adoption processes all of which are examined largely independent of the biophysical setting. Variation in attitudes, beliefs, institutional structures, and market processes are viewed as the primary determinant of agriculture's impact on aquatic systems while largely ignoring specific biophysical settings.

Approaches to NPS Pollution



How to Address This Dilemma

1. Base planning efforts on the fact that land user behaviors vary significantly, even when engaging in the same type of land use.
2. Use biophysical models and science to determine what land user behaviors need to be assessed.
3. Focus on disproportionality in your initial efforts.

Disproportionality

Any <u>assessment</u> in a water quality or quantity program needs to try and account for <u>disproportionality</u> as it should become the focus of any intervention effort that is intended to solve problems.

Why Assess Behaviors?

Behavior relative to the environment varies significantly – from saint to sinner.

* If we want to advance science, then we need to assess the full spectrum.
* If we want to manage programs, then we need to assess receptive audiences within the program area.
* If we want to solve water problems, then we begin with those making disproportionate contributions.

Inappropriate Behaviors

What is the explanation for inappropriate behavior in vulnerable or susceptible biophysical settings?

1. Technological "leakage"
2. Tradition/Community norms
3. Market Rationality
4. Ignorance
5. Scale Incongruence
6. Others?

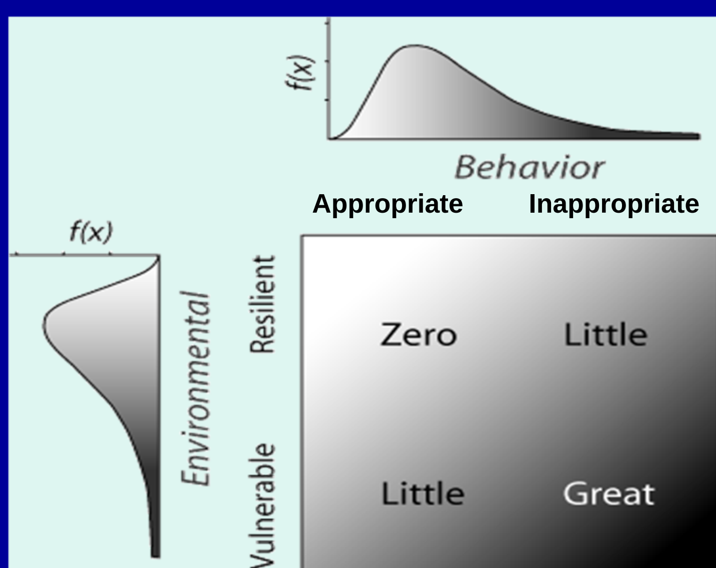
Disproportionality

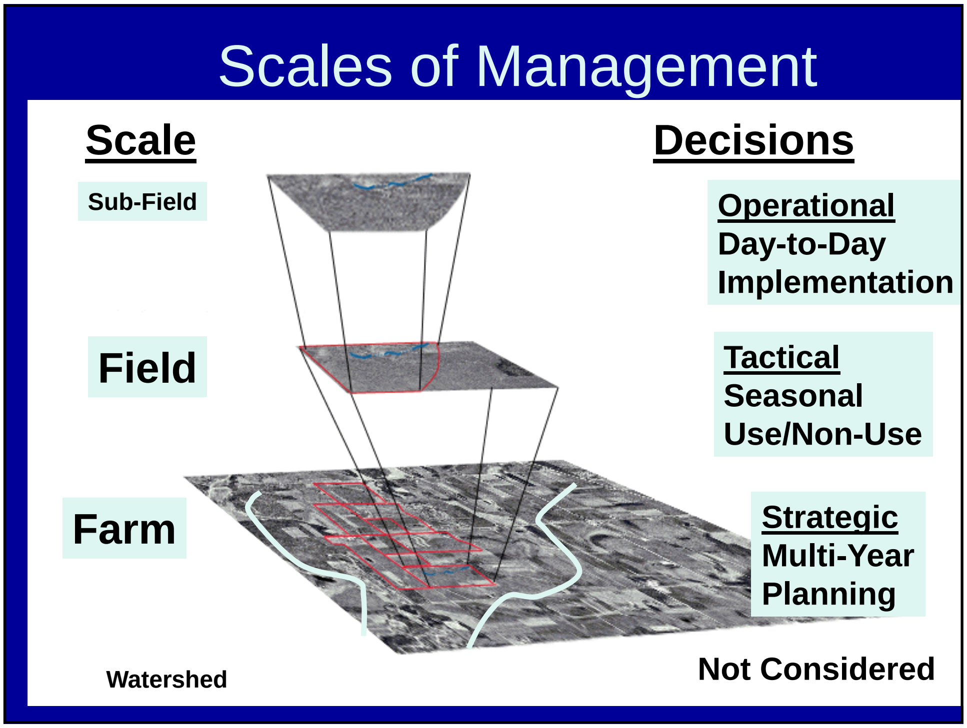
Egregious behaviors in a well-buffered setting may have an insignificant impact on degradation processes.

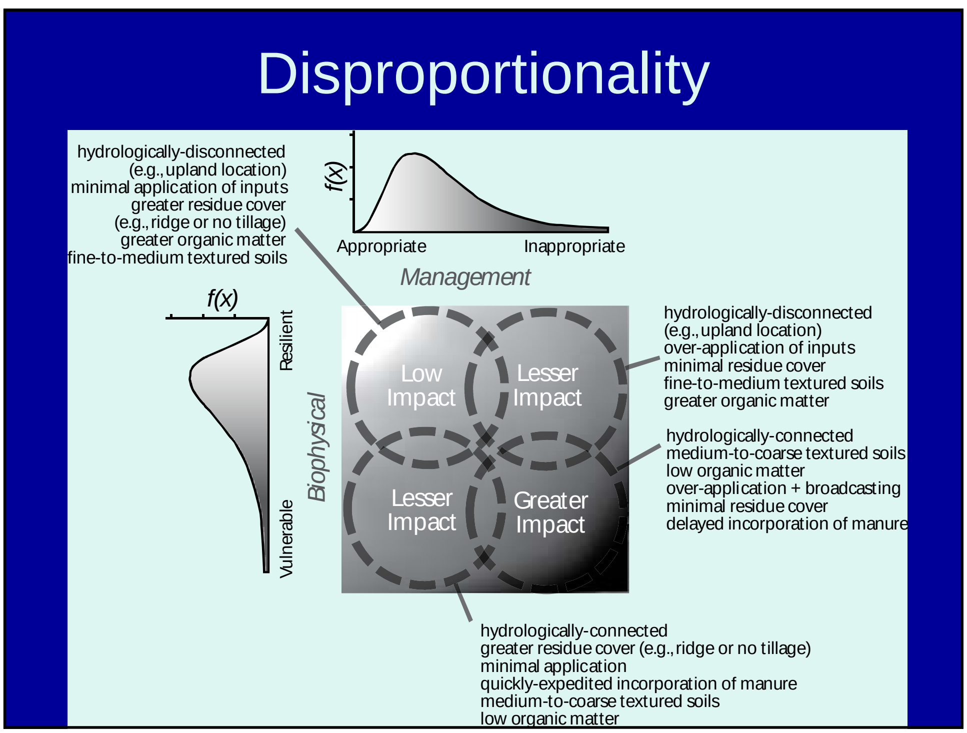
“Normal” behaviors in a vulnerable setting may have a significant impact on degradation processes.

Disproportionality emerges out of scale-specific interactions between human and biophysical attributes.

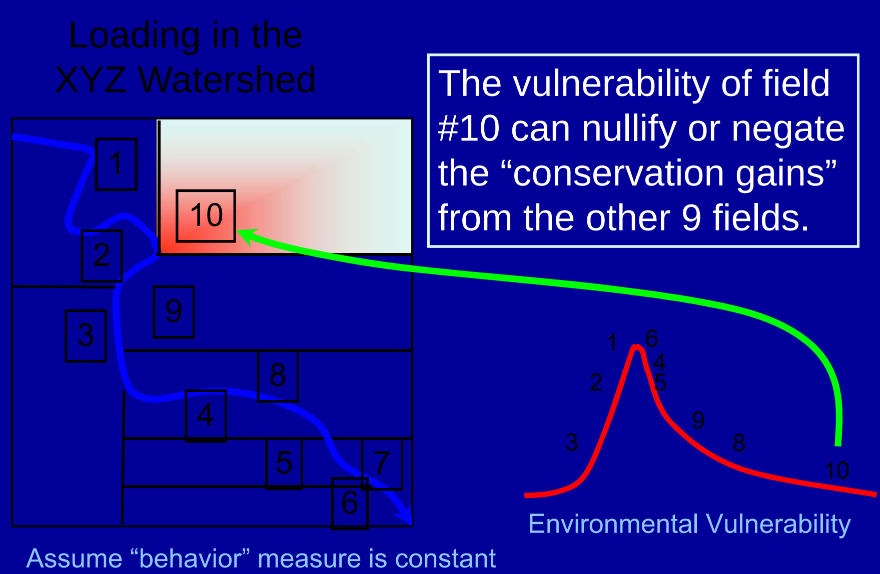
Disproportionality



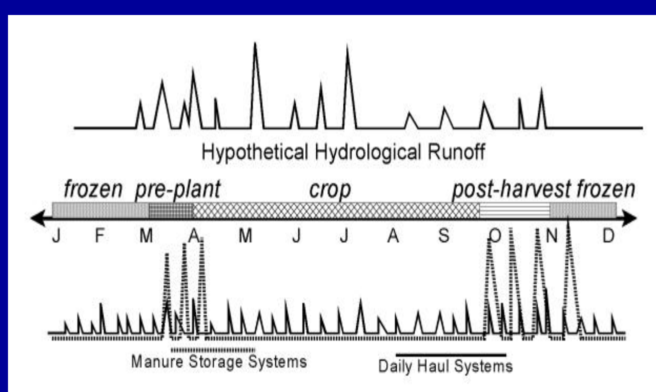

Scales of Management
Scale
Decisions
Sub-Field
Operational
Day-to-Day
Implementation
Field
Tactical
Seasonal
Use/Non-Use
Farm
Strategic
Multi-Year
Planning
Watershed
Not Considered


Disproportionality
hydrologically-disconnected
(e.g., upland location)
minimal application of inputs
greater residue cover
(e.g., ridge or no tillage)
greater organic matter
fine-to-medium textured soils
f(x)
Appropriate
Inappropriate
Management
f(x)
Resilient
Vulnerable
Biophysical
Low Impact
Lesser Impact
Lesser Impact
Greater Impact
hydrologically-disconnected
(e.g., upland location)
over-application of inputs
minimal residue cover
fine-to-medium textured soils
greater organic matter
hydrologically-connected
medium-to-coarse textured soils
low organic matter
over-application + broadcasting
minimal residue cover
delayed incorporation of manure
hydrologically-connected
greater residue cover (e.g., ridge or no tillage)
minimal application
quickly-expedited incorporation of manure
medium-to-coarse textured soils
low organic matter

Example of Diverse Biophysical Resources

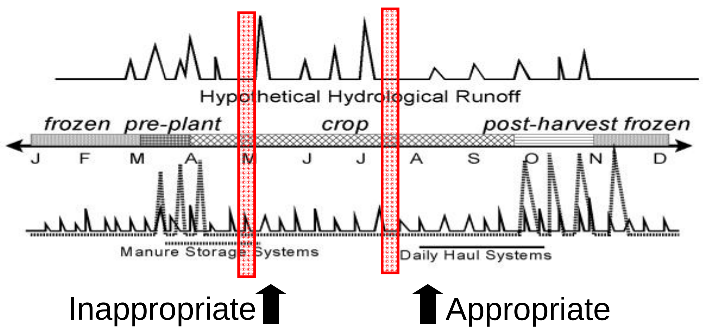


Temporal Scales of Management

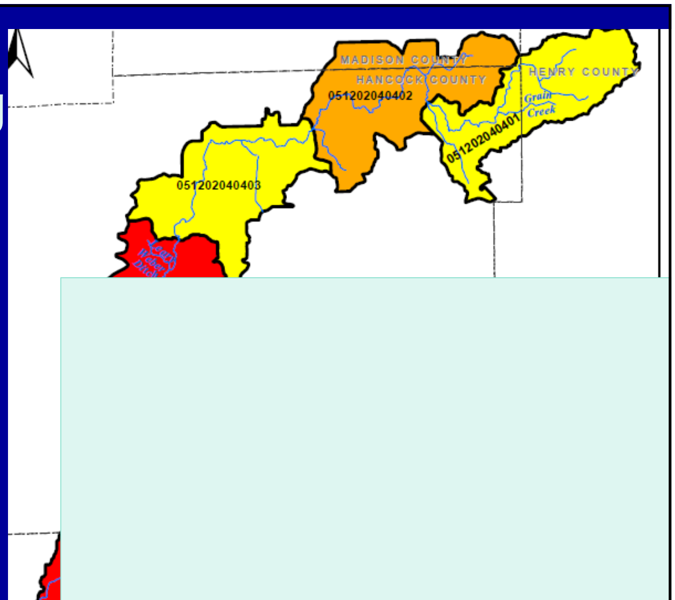


Variation in climate and hydrologic patterns induce changes in the spatial and temporal attributes of manure distribution decisions.

Same Behavior, Different Time



Does modeling help define critical areas?

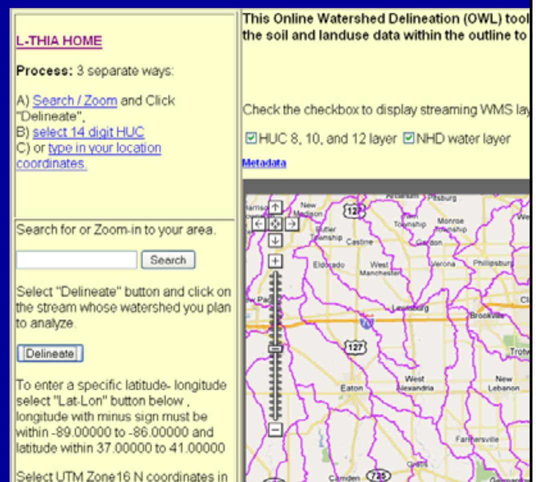


HUC 12	HUC Name	Acreage	Current Nitrogen Load lbs/year
51202040401	Sugar Creek-Pee Dee Ditch	13,257	86,218
51202040402	Sugar Creek-Marsh & Trees Ditch	15,541	101,250
51202040403	Sugar Creek-Barrett Ditch	14,091	86,718

Models are useful, but perhaps not for critical area definition

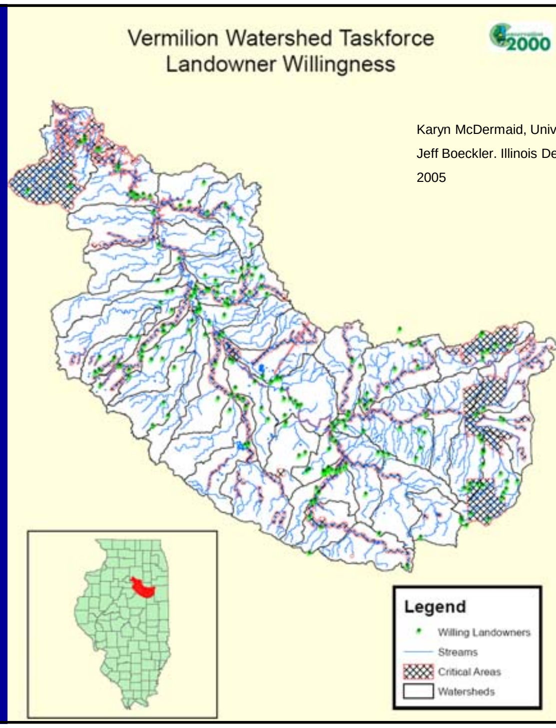
Useful for

- Load estimation
- Load reduction estimation
- If we are confident in load reduction, can use models to see where load **reduction** is greatest



Delivery System administrative goals driving environmental protection

- Critical areas not being addressed – not going out to the critical area
- Partial treatment of problems –scope and BMPS
- Not all problems being addressed
- Landowner capacity not developed



Karyn McDermaid, University of Illinois
Jeff Boeckler. Illinois Department of Natural Resources
2005

Table 21. Landowner survey: Willingness to install best management practices (N = 606).

BEST MANAGEMENT PRACTICES	PERCENT RESPONDING: Willing to install, with both technical and financial assistance
Cropland	
Habitat improvement	23
Nutrient management	15
Conservation easements	13
Wetland installation	12
Reduced-tillage program	10
Grassland	
Habitat improvement	17
Pest management	14
Native grass planting	12
Nutrient management	13
Conservation easements	10
Burning grassland	6
Woodland	
Habitat improvement	15
Timber stand improvement	13
Tree planting	13
Pest management	11
Conservation easements	8
Timber harvest	4
Burning	4
Streamside	
Plant a buffer with trees and/or shrubs	19
Route field tile drainage to a treatment wetland	18

Karyn McDermaid, University of Illinois
2005

Table 23. Landowner survey: Interest in letting volunteer groups install practices (N = 606).

	PERCENT RESPONDING			
INTEREST	Yes	Maybe	No	No response/ don't know
Let a volunteer group install a grassland/prairie	8	19	52	22
Let a volunteer group install a wetland	5	14	58	23
Let a volunteer group install a riparian buffer	8	19	50	23
Let land be used for research demonstrations	9	28	45	17

Karyn McDermaid, University of Illinois
2005

Table 26. Landowner survey: Self-reported obstacles to implementing conservation practices (N = 317).

OBSTACLE	Number of comments
Lack of money/costs	124
Maintaining productivity	37
Lack of government funding/incentives	30
Lack of time	17
Problems with cost-share	14
Lack of knowledge	12
Government regulations/interference	12
Lack of technical assistance	12
Lack of equipment	9
Drainage	9
Absentee landowner won't approve	8
Uncooperative neighbors	6
Erosion	6
Lack of labor	4
Flooding	4
Taxes	4
Red tape with government assistance	3
Wildlife damage	2
Tillage	2
Weeds	1
Tenant won't do	1

Karyn McDermaid, University of Illinois
2005

Identifying Implementation Sites in Critical and Priority Areas

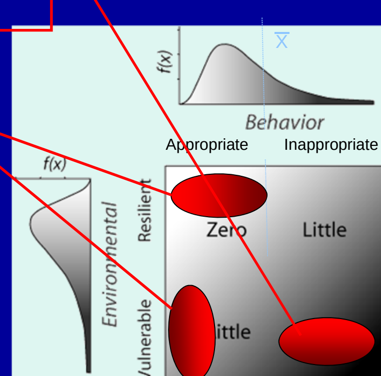
Challenges

- *Logistically difficult – ownership, physical rquirements*
- *Potentially expensive – cheaper to prevent*

What Should be the Focus of NPS Control Efforts?

Focus on Solving Problems

Focus on Managing Programs



What characteristics cause watershed efforts to have the greatest impact on water quality?

- A source of pollution is causing a real problem
- We can identify the location it comes from
- A possible solution exists
- Land owner is willing to make a change

- This location or source is the **biggest** problem

Conclusion

We have the capacity and knowledge to address the "human dimension" of water problems in a robust and valid fashion.