

Adoption, Maintenance and Implementation of BMPs: Implications for Nutrient Trading Programs

Dr. Douglas Jackson-Smith

Chesapeake Bay Program - STAC Workshop

May 14, 2013



Brief History of NPS WQ Approaches

- 20-30 years of effort; modest results

Load Trends in Nitrogen and Phosphorous				
River	Nitrogen		Phosphorus	
	1985-2010	2001-2010	1985-2010	2001-2010
Susquehanna	Improving	Minimal	Minimal	Degrading
Potomac	Improving	Minimal	Improving	Minimal
James	Minimal	Minimal	Degrading	Degrading
Rappahannock	Minimal	Minimal	Degrading	Degrading
Appomattox	Minimal	Minimal	Degrading	Degrading
Pamunkey	Minimal	Minimal	Degrading	Degrading
Mattaponi	Minimal	Minimal	Minimal	Minimal
Patuxent	Improving	Improving	Improving	Minimal
Choptank	Minimal	Minimal	Degrading	Degrading

Minimal Trend - total change less than or equal to 10%
 Improving Trend - total load reduction greater than 10%
 Degrading Trend - total load increase greater than 10%

Brief History of NPS WQ Approaches

- Rough scientific consensus = problem not technical, but social
 - Sources/causes known
 - Solutions (BMPs) exist
 - Behavior = limiting factor
 - Social sciences = asked to fix the problem
- *Side note = my view is that innovations in BMPs still required*

Brief History of NPS WQ Approaches

- WHAT TO DO?
- Different Approaches to behavioral change
 - Education & Awareness = necessary but insufficient
 - Voluntary incentive programs = inefficient & weak (particularly if not targeted)
 - Mandatory regulations = politically infeasible & difficult to enforce

Solution?

- Nutrient Trading Programs
 - Voluntary
 - Relies on market forces
 - THEORY:
 - Provides stronger incentives/rewards with less public investment
 - More efficient (if well designed)

Vulnerabilities in Nutrient Trading Programs

- Relies on good models of BMP benefits
 - Assumes a BMP is a BMP
 - Assumes a BMP's net impact is known
- Assumes an adopted BMP is implemented & maintained

TODAY: Talk about social science research that addresses these vulnerabilities

Representation of BMPs in Models

- BMPs treated as uniform structures or behaviors that have clear definition
- BMP impacts assumed to be constant and predicabile
 - Similar pre-BMP conditions
 - Hard-wired BMP impact coefficients
- Trading programs use these models to assign values to BMPs in different places

What is a BMP?

- Seems fairly straightforward
- Technical definitions exist (NRCS codes)
- Operationalization of BMPs in research models reflects ideal-type scenarios
 - Poor behavior as baseline
 - BMP used as designed
- Empirical research suggests a gap...

The Many Faces of a BMP Waste Storage Facility (313)

- “A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure. The storage facility is a component of a planned agricultural waste management system”
- IN MODELS: Implementation associated with fixed reduction in pollutant loadings

Waste Storage Realities

- Diverse types of storage facilities installed across farms within a watershed
- NOT JUST A STRUCTURE
 - Impact of the BMP depends on associated behaviors
 - Changes in manure handling and nutrient management practices



Waste Storage Realities

- RESEARCH: Management behaviors on farms with this BMP are extremely diverse
 - Idea is that storage allows environmentally optimal manure application behavior
 - Many of those receiving cost-shared facilities still spread manure daily
 - Logistical constraints prevent farmers from being able to spread manure on all fields in their Nutrient Management Plan

Assumptions about BMP Impacts

- Coefficients attached to BMPs in process models assume a certain % change in pollutant outputs
- Assumption of constant impact coefficients depends on:
 - Consistent BMP reality (*see above*)
 - Full implementation & Maintenance of BMPs (*see below*)
 - Consistent pre-BMP behaviors

Pre-BMP Conditions

- Determines net BMP impact
- Models often ignore diversity & complexity in farmer behavior
- Two examples
 - Fertilization practices
 - Dietary practices

Estimated Rates of Nitrogen Application on WI Corn Fields

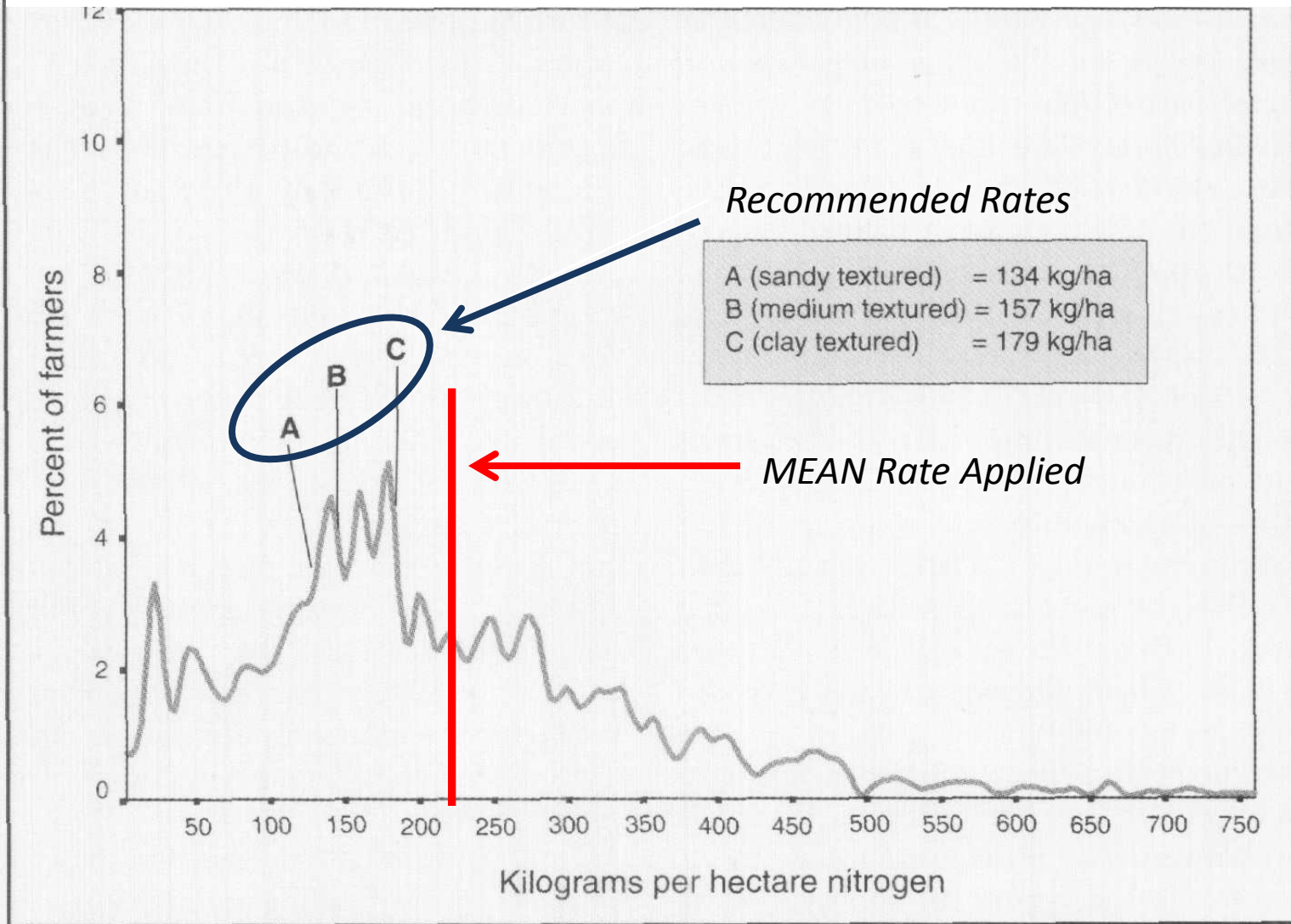
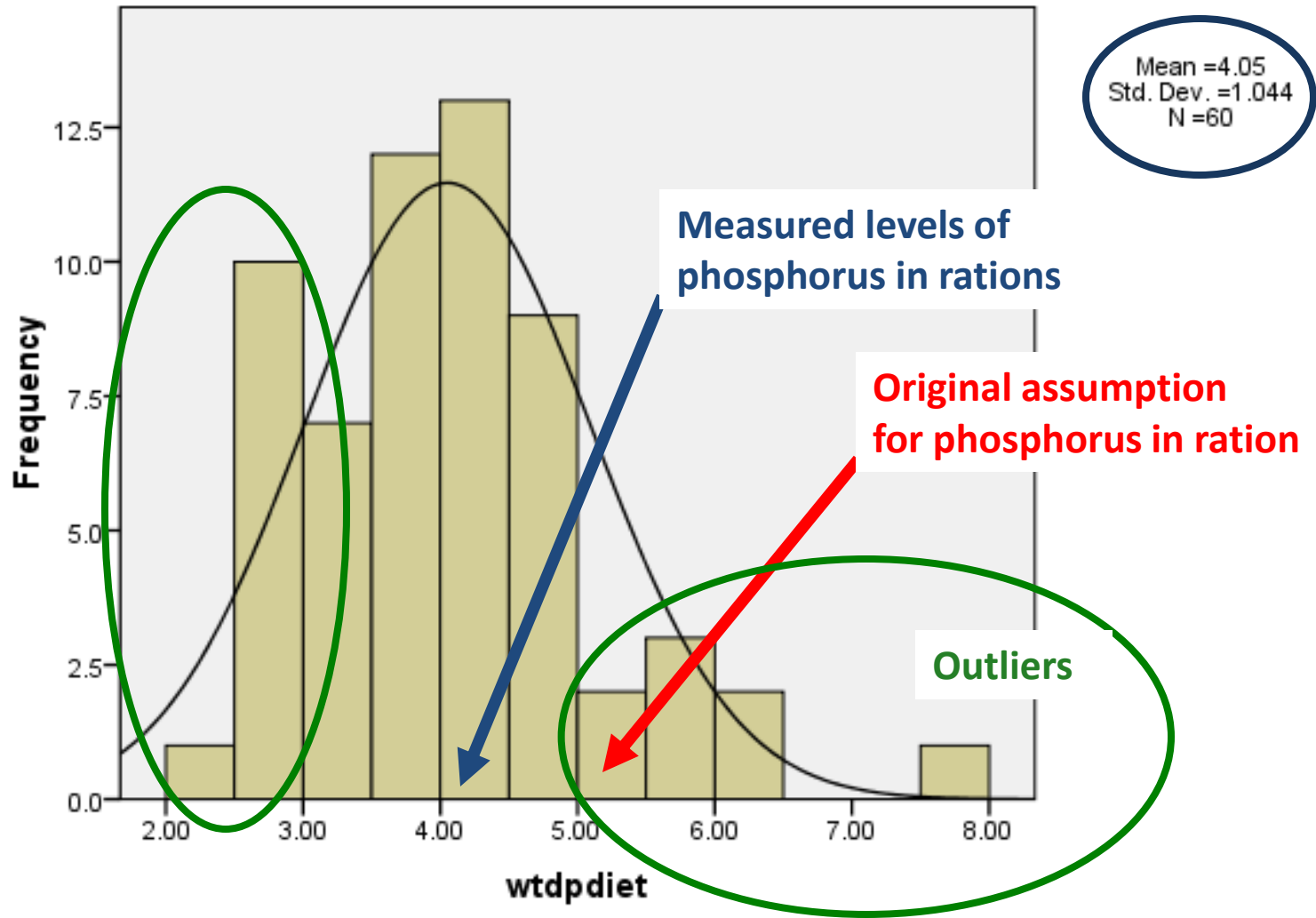


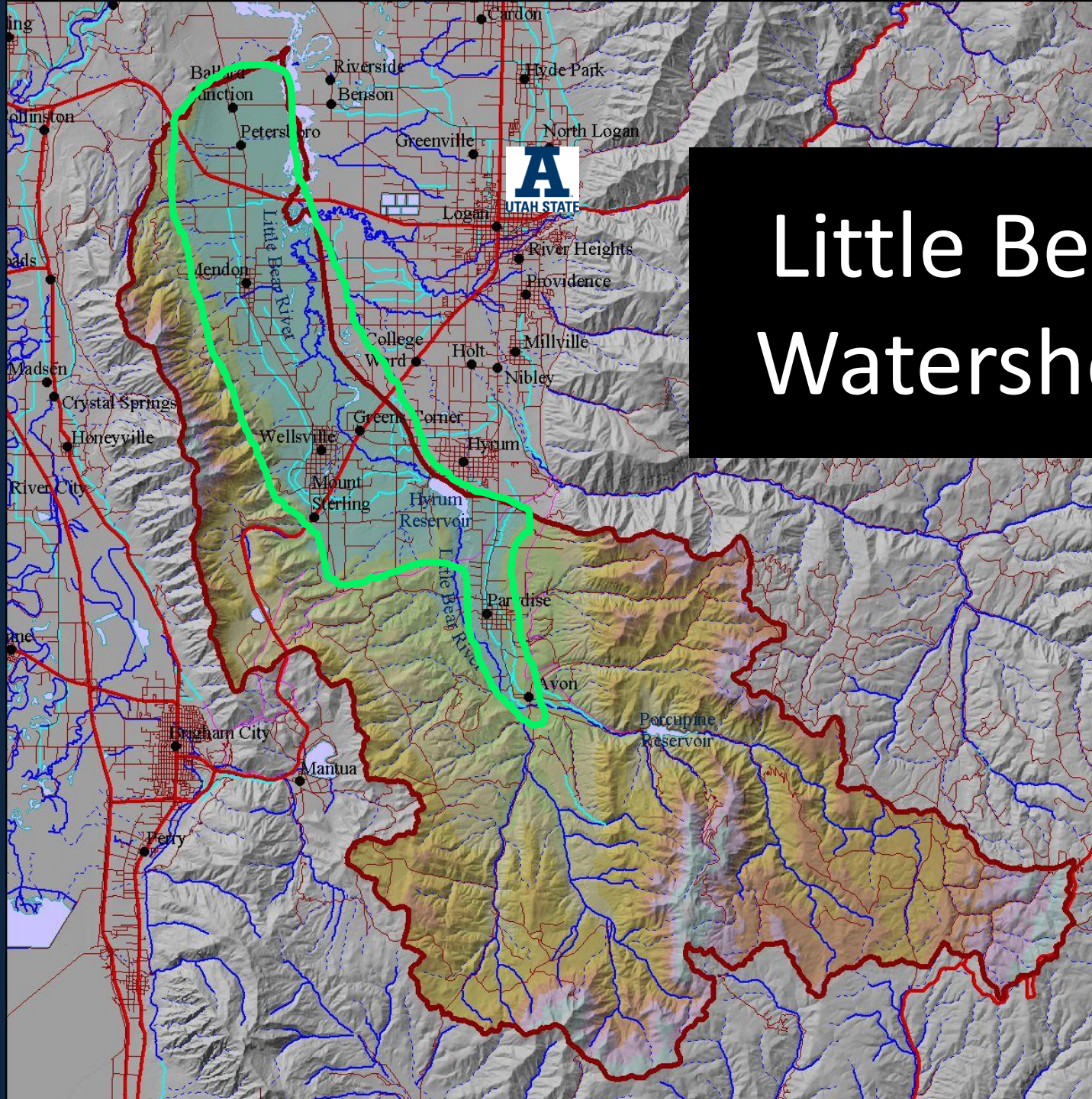
Figure 1. The rate of nitrogen application in corn (based on 1,781 respondents). Mean amount of nitrogen applied was 219 kg/ha, while the mean recommended amount was 176 kg/ha. This includes nitrogen from all sources (starter, 28% N solution, urea, anhydrous ammonia, other commercial fertilizers, legumes and manure). SOURCE: Shepard 2000

Dietary Practices

- Study of representative WI dairy farms
- Problem = understand drivers of excessive phosphorus feeding
- Expert knowledge going in = farmers feed 0.5%, should feed 0.38%
- Findings:
 - Assumptions for baseline behavior wrong
 - Wide range of actual current behavior

Histogram



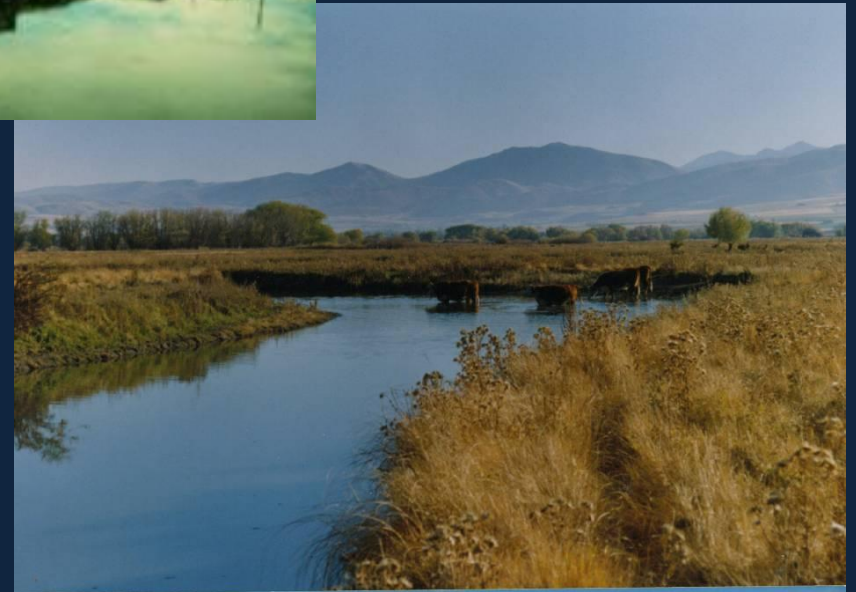


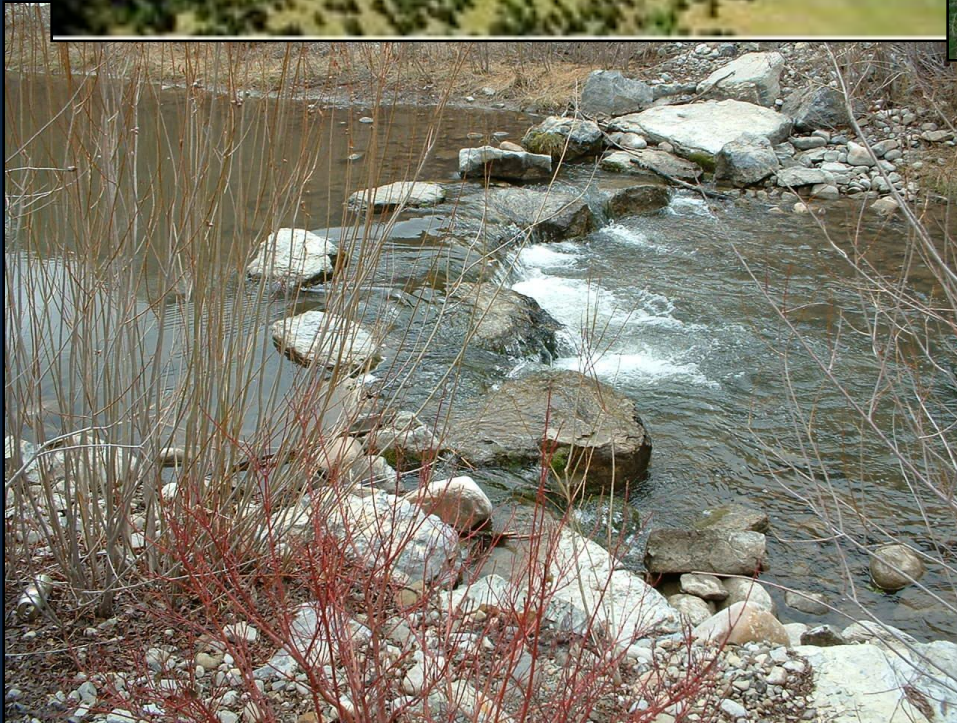
Little Bear Watershed

LBR Landscape



Pre-treatment problems: Bank erosion, manure management, flood irrigation problems

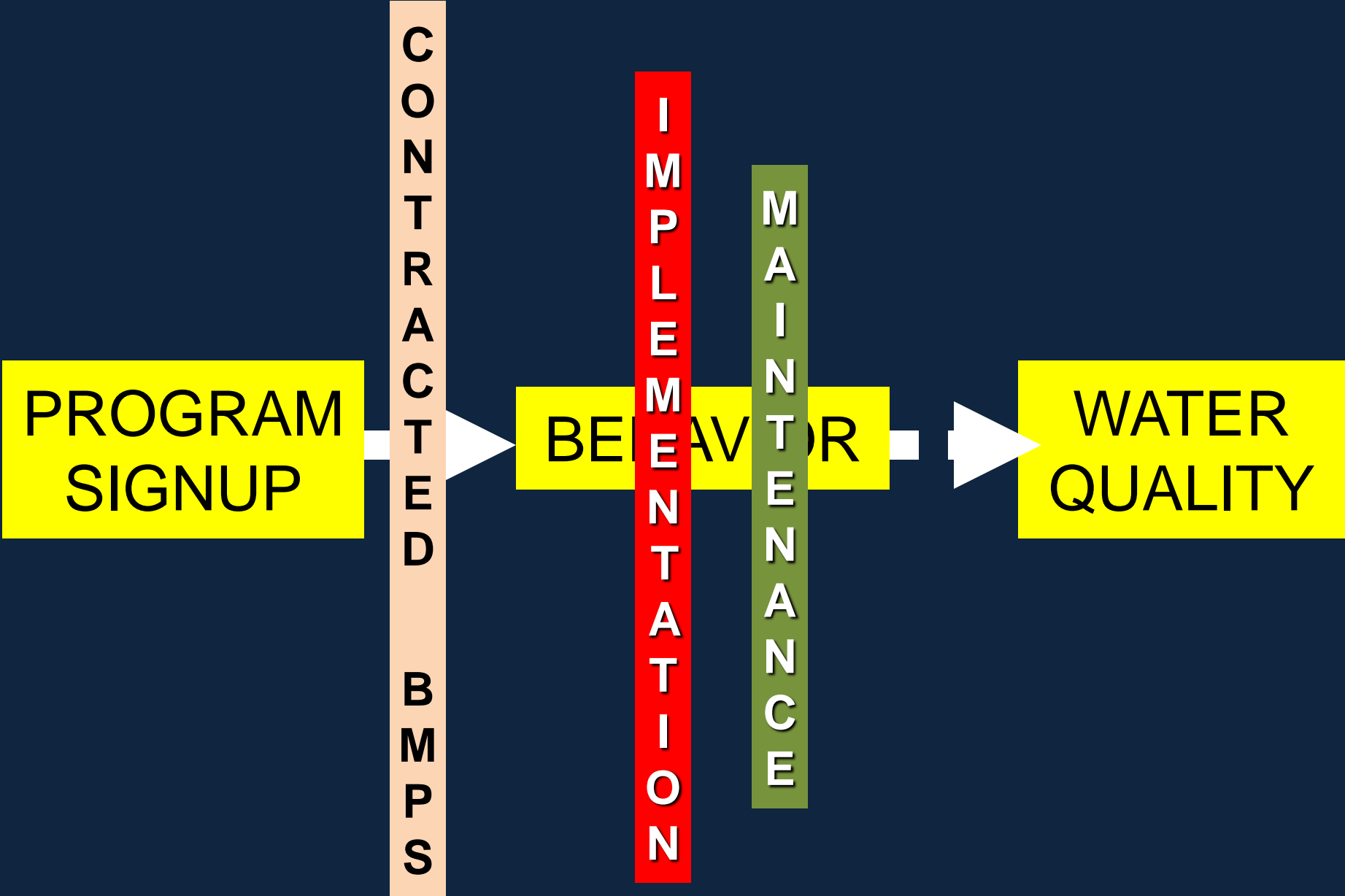




Focus of BMPs: REDUCE PHOSPHORUS LOADINGS

- Bank stabilization & river restoration,
- Improved grazing and manure management
- Improved irrigation management

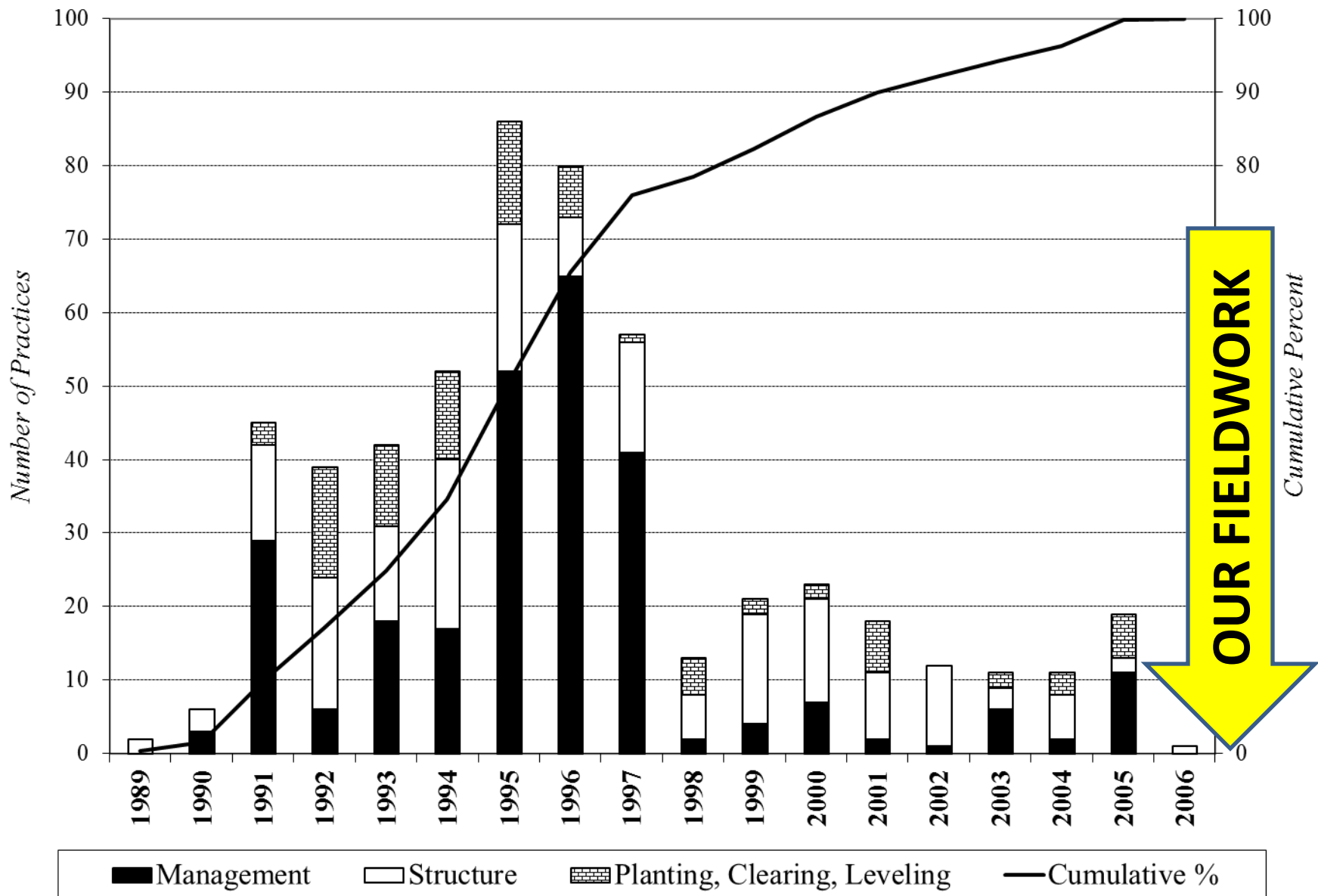
Socioeconomic Component



Methods

- **Gather formal practice info** from NRCS files
 - Went through every file – **90 landowners**
 - Create master list of practices (**871 total**)
 - Copied key maps for interviews
- **Conduct field interviews** with participants
 - Validate file information
 - Contacted 70 of 90 participants
 - 55 agreed to be interviewed
 - 61% of all landowners; 79% of those we contacted
 - Conducted field interviews - ~90 minutes
 - Detailed discussions about BMP experience

Bulk of BMP Implementation in 1990s



Most Common Management BMPs

Practice Name	Total BMPs in Files
Upland Wildlife Habitat Management	57
Pasture and Hayland Management	55
Irrigation Water Mgmt.	53
Prescribed Grazing	44
Record Keeping	32
Conservation Crop Rotation	25
Planned Grazing System	25
Waste Utilization	21
Deferred Grazing	18
Pest Management	16
Brush Management	16
Waste Management Systems	13
Residue and Tillage Mgt (aka Cons Tillage)	12
Nutrient Management	10
Access Control	8

**49% of
total**

Most Common Structural BMPs

Fence	91
Irrigation Water Conveyance Pipe	33
Waste Storage Facility	25
Streambank and Shoreline Protection	24
Sprinkler System	21
Spring Development	20
Watering Facility (trough)	16
Stream Channel Stabilization	15
Structure for Water Control	10
Pond	8

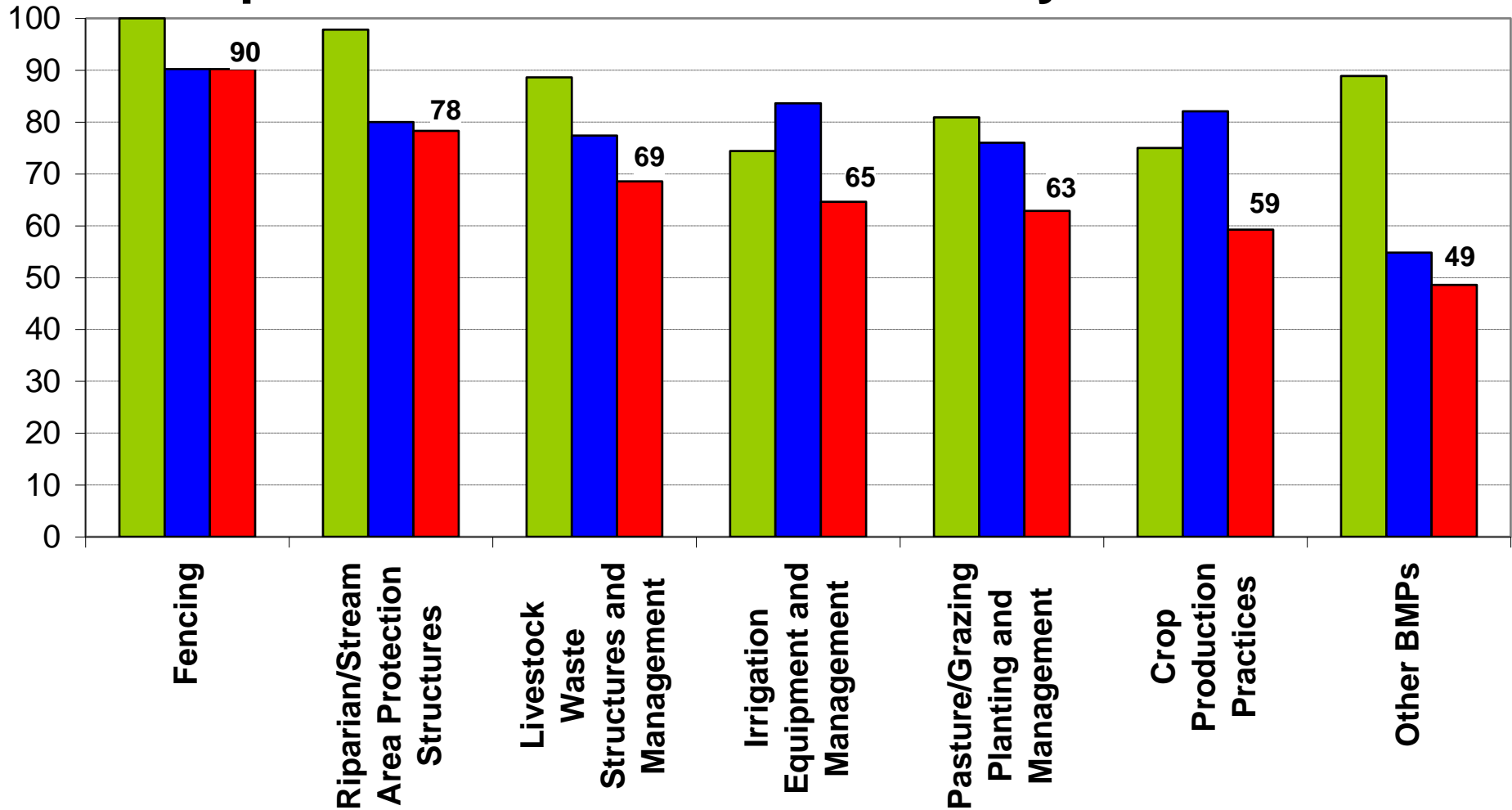
Findings - Implementation

- Individual BMPs
 - **83% of BMPs successfully implemented**
 - Reasons for non-implementation (17%)
 - Some cases – not recognized as contracted BMP
 - Many – management practices that did not change behavior (based on interview discussion)
- Farm-Level
 - **32% farms implemented all BMPs**
 - 60% farms implemented more than ½

Maintenance of BMPs

- Is it still there? If not, why not?
- Overall –
 - **21% of implemented BMPs not still there**
 - Combined with non-implemented practices =
1/3 of all originally contracted BMPs not currently there
- Why not maintained?
 - No longer farming or sold land – 32%
 - Still farming, no longer use – 68%

Implementation & Maintenance by BMP Focus

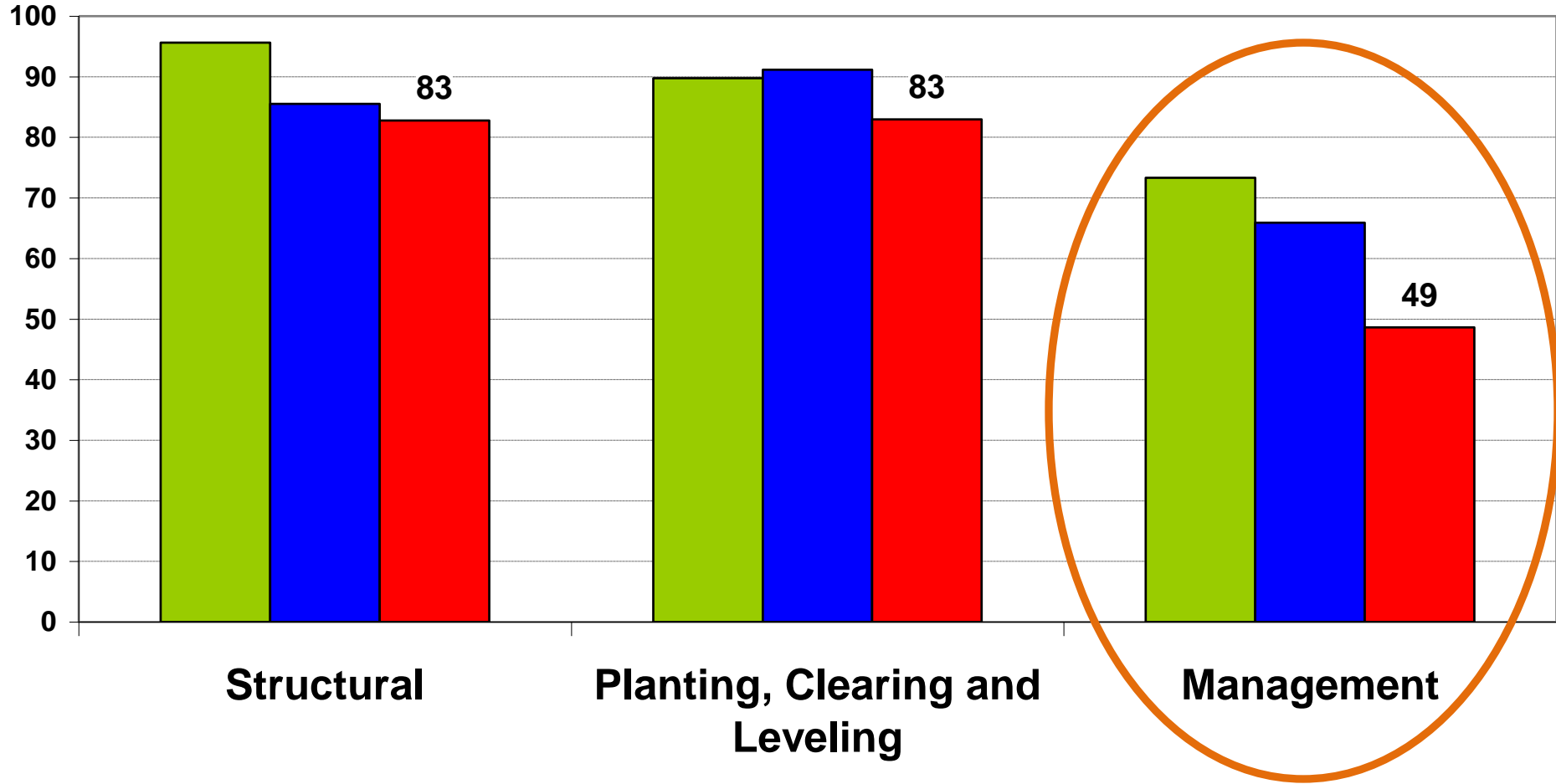


 Percent implemented

 Percent maintained

 Percent original BMPs still there

BMP Implementation & Maintenance by "Type"



■ Percent implemented

■ Percent maintained

■ Percent original BMPs still there

Similar Results in Other Places

- Formal review of 319-funded watershed projects in Utah
- Other CEAP projects
- Other published studies (Bracmort et al 2004)

Implications

- Formal program files are an imperfect guide to actual BMP use
 - *Fieldwork is required to know what is done*
- Do not assume all BMPs are implemented in same way
 - *Understand variation in actual BMP use*
 - *Use in development of trading program*
- Do not assume all BMPs are maintained through time
 - *Incentivize maintenance and adaptation*
 - *Account for changes in land use, farm size*

Implications

- Good news:
 - Producers did not discontinue BMP use because they did not like them
- Not so good news:
 - Management BMPs had the shortest lifespan
 - Management behaviors = heart of most watershed conservation programs
(Chesapeake Bay Goal Line 2025)
 - Failure to fully implement & maintain behavioral changes can undermine success

Big Q: How can management BMPs be implemented more effectively?


- **Post-BMP implementation follow-up visits**
 - Not just to ‘verify’ use – but to gather info on obstacles to use (adaptive mgt model)
- **Participatory development of mgt plans**
 - Wisconsin model – intensive series of workshops with individual producers
 - Greater ownership of plans
 - Greater adaptive capacity
 - More labor intensive

Recommendations for Development of Trading Programs

- **Document Pre-BMP Behaviors**
 - FOR MODELS: Surveys can document both AVERAGES and DISTRIBUTIONS
 - FOR CONTRACTS: Establish baseline behaviors on cooperating farms
- **Document Post-BMP Implementation & Maintenance**
 - INVEST IN FOLLOW UP with cooperators

Recommendations (cont.)

- **INCENTIVIZE IMPROVED MANAGEMENT**
 - Has to be more than requirement for a management plan
 - Producer involvement yields more lasting changes and impacts
 - Puzzle: How build producer ownership & adaptive management into trading program requirements without losing control of outcomes?



Thank you!
Questions?

doug.jackson-smith@usu.edu