

Implementation and Maintenance of WQ BMPs

A sociological study of cooperator
behavior in the Little Bear River
watershed

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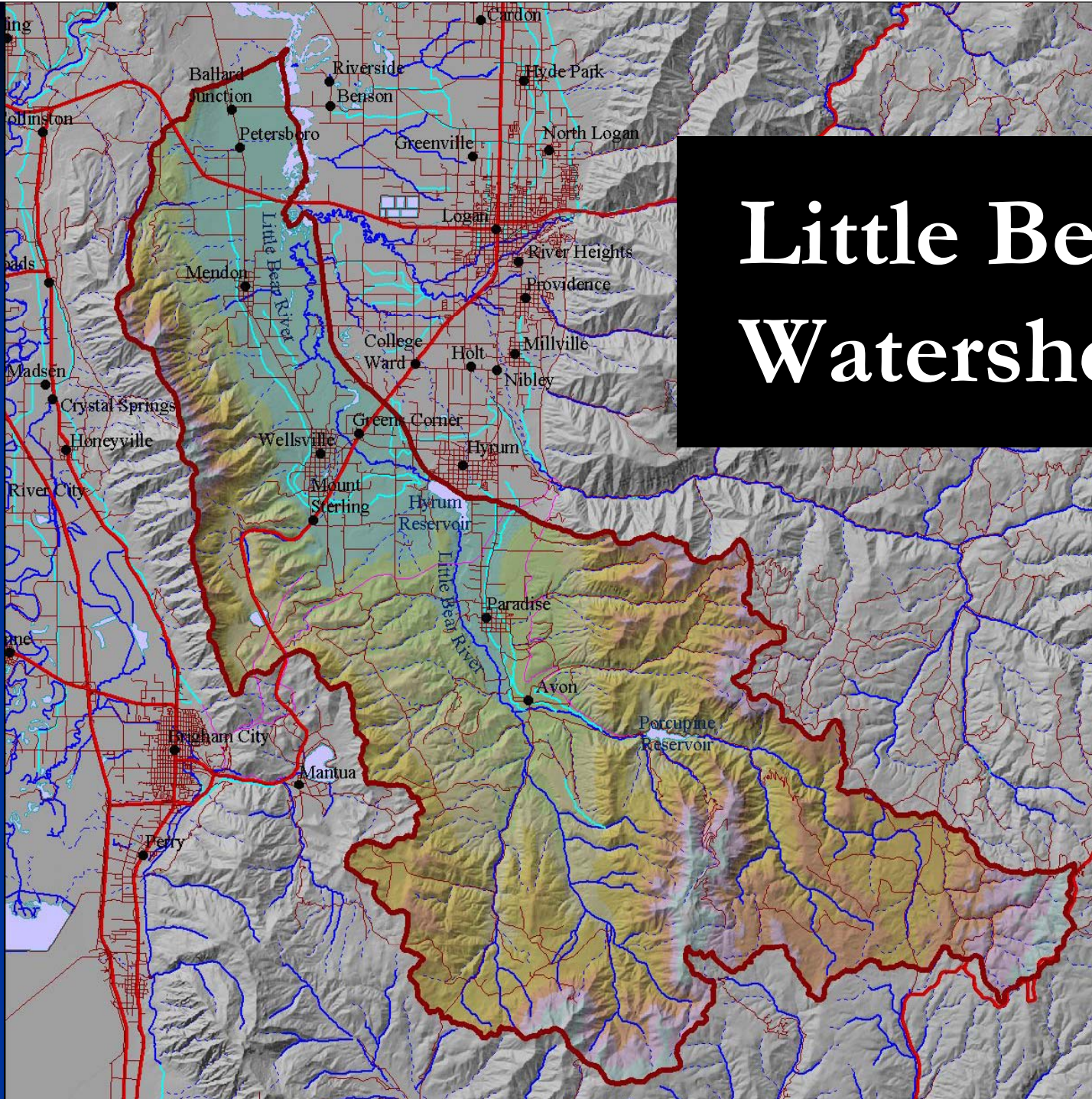
Background

- Conservation Effects Assessment Program (CEAP)
 - USDA national assessments
 - USDA/ARS field sites
 - Competitive Grant program (initially 4 states)
- Utah State Proposal:
 - Little Bear River Watershed
 - Priority Watershed 1990-2003
 - Significant in-stream WQ monitoring data available

Little Bear Watershed

- Big problem = phosphorus runoff in river
- 74,000 ha of primarily agricultural lands
 - 70% is grazing land and forests
 - 19% is irrigated cropland
 - 7% is dry cropland
 - > 50 dairies & many beef/horses
- Experiencing rapid population growth
 - 32% increase between 1990 and 2000
 - Higher increase (46.7%) in unincorporated areas

Little Bear Watershed





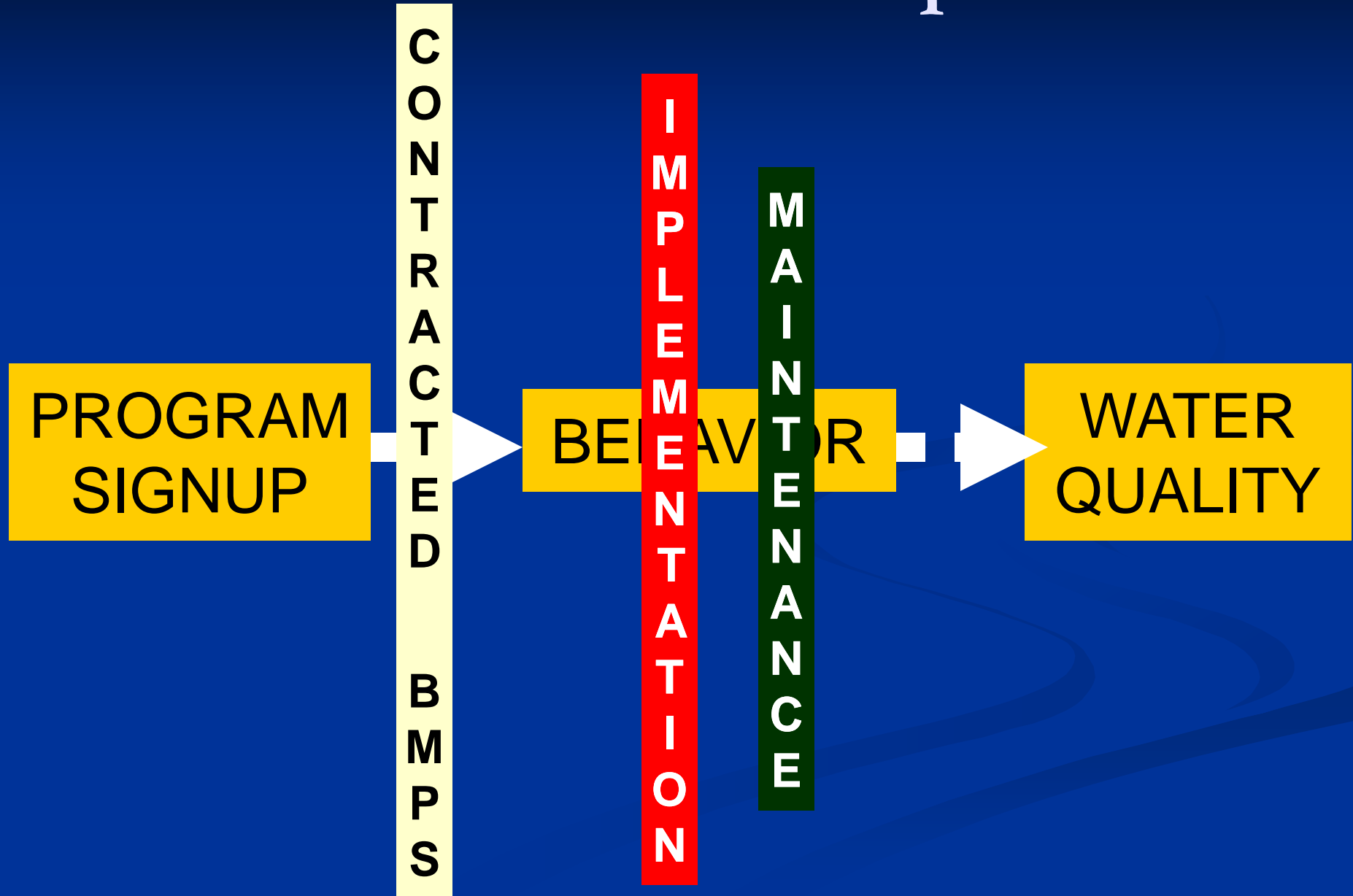


USU CEAP Project

Core Question:

*Did the Conservation
Programs Have a Measurable
Impact on Water Quality in
Little Bear River?*

Socioeconomic Component



Socioeconomic Methods

- **Gather formal practice info** from NRCS files
 - Locate in time & space
 - Code attributes
- **Conduct field interviews** with participants
 - Validate file information
 - Learn about experience
 - Before, during & after participation in LBR projects

NRCS File Information

- Worked in county USDA/NRCS office (~ 9 months)
- Went through every file associated with Little Bear River Watershed project – **90 landowners**
- Observations
 - Challenge to create master list of practices (**871 total**)
 - Variability in quality & content of files
 - Ambiguities often clarified by NRCS staff
- Copied key maps for interviews
- Summarized information on spreadsheet
 - There were 65 practice types

Interview Methods

- Advance letter sent
- Phone contact made to set up interview
- USDA/USU Confidentiality Agreement requires Informed Consent Form to be signed
- Face to face interviews conducted in field
- Status of Interviews
 - 80 sent letters as of July 2007
 - 58 interviews completed (44 included today)
 - Most of rest = deceased or no good current address

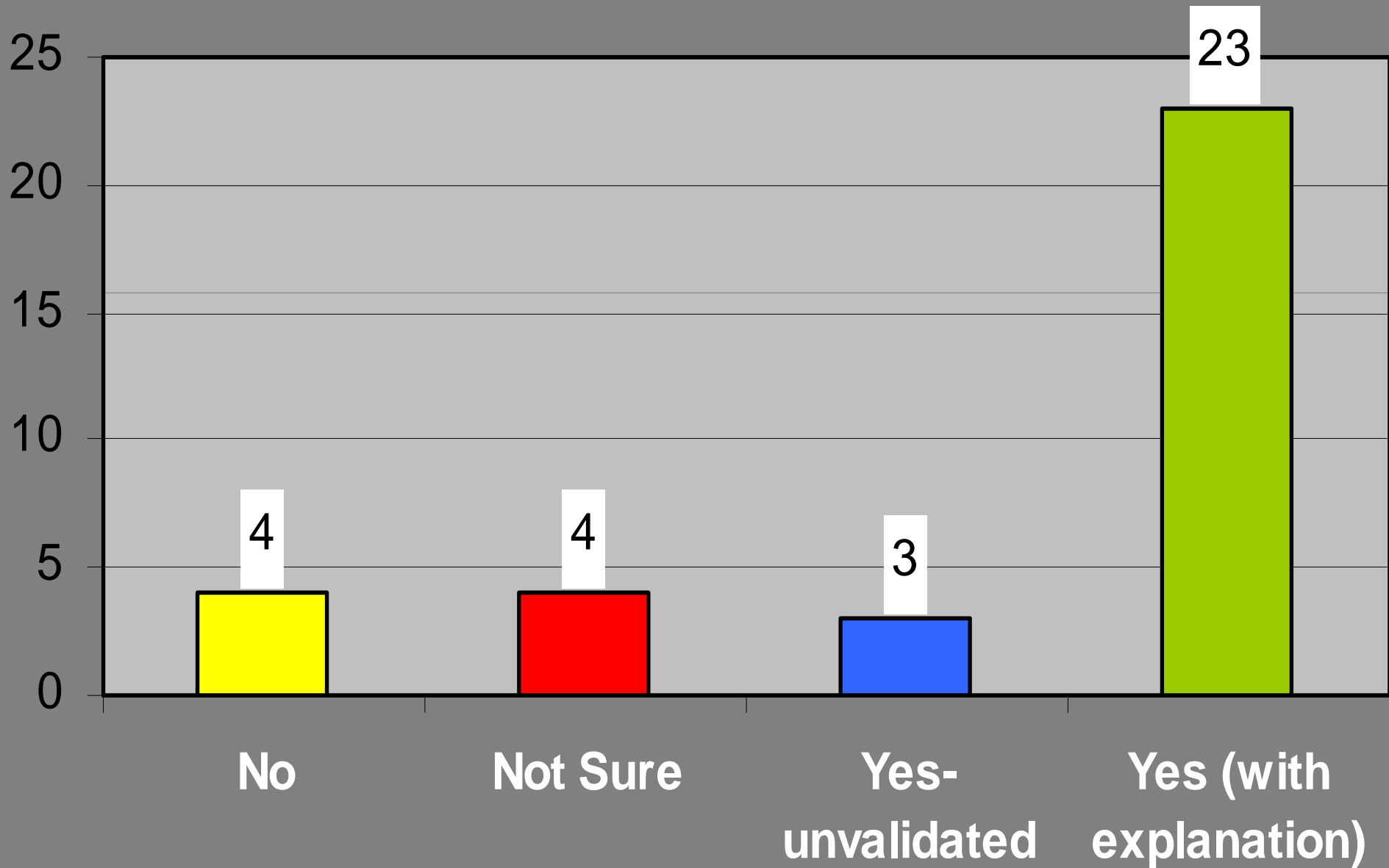
Interview Content

- Review maps & list of file practices
- For each major cluster of practices
 - What exactly was done?
 - Why select this practice?
 - What was it supposed to accomplish?
 - How easy or difficult was it to implement?
 - Did it work like expected?
 - Did it require major changes in the rest of operation?
 - Costs and benefits associated with the practice?
 - Were you able to continue using this practice (after the original contract ran out)?
 - Any changes made to the practice?
 - Is practice still being maintained? Is it still there?

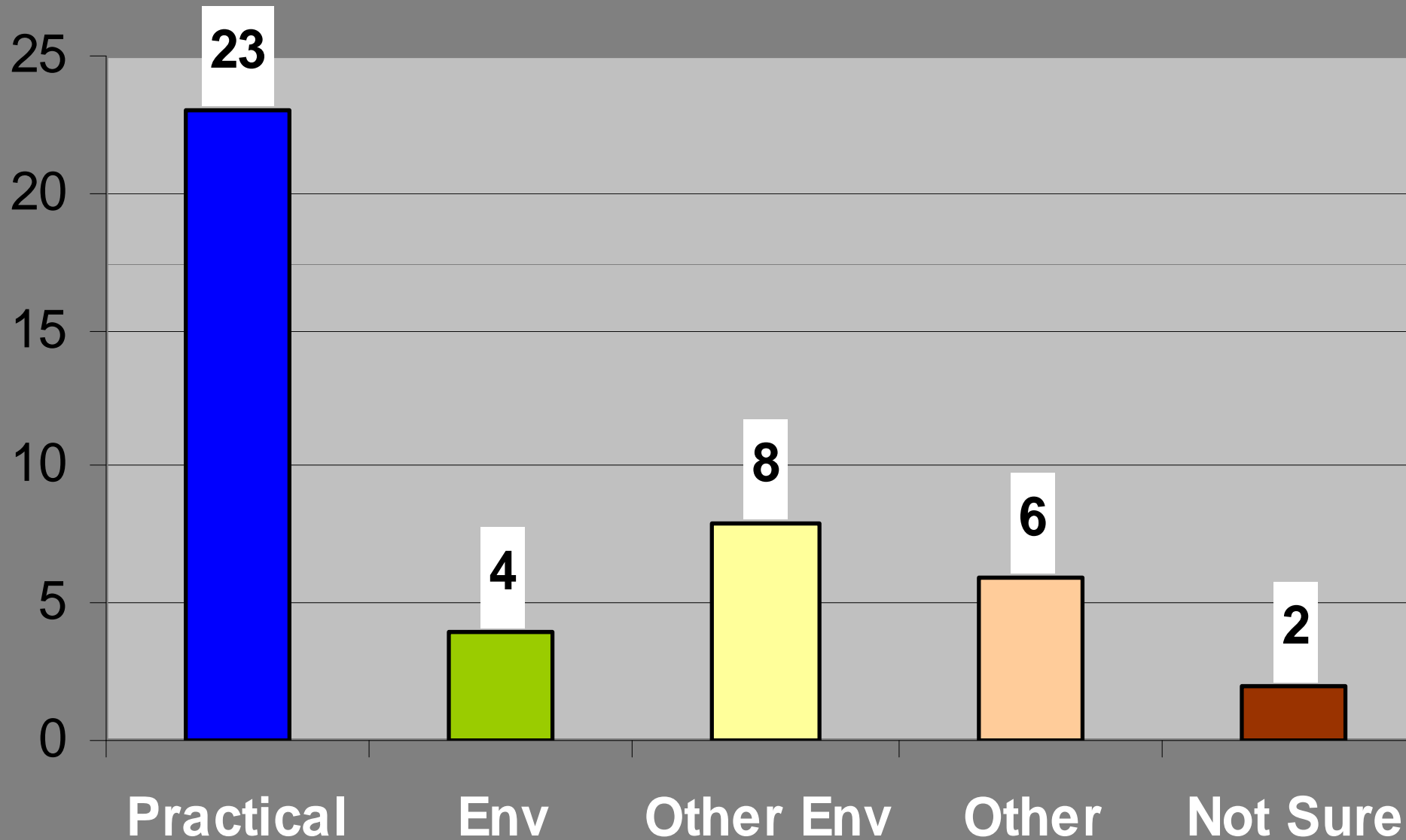
Post-Interview Analysis

- After each interview, in-depth qualitative narratives are typed
- Themes were given quantitative codes and placed into a spreadsheet (always done with other interviewer present)
- Themes identified both inductively and deductively
 - ‘Status’ themes—mostly deductive
 - ‘Why’ themes—mostly inductive

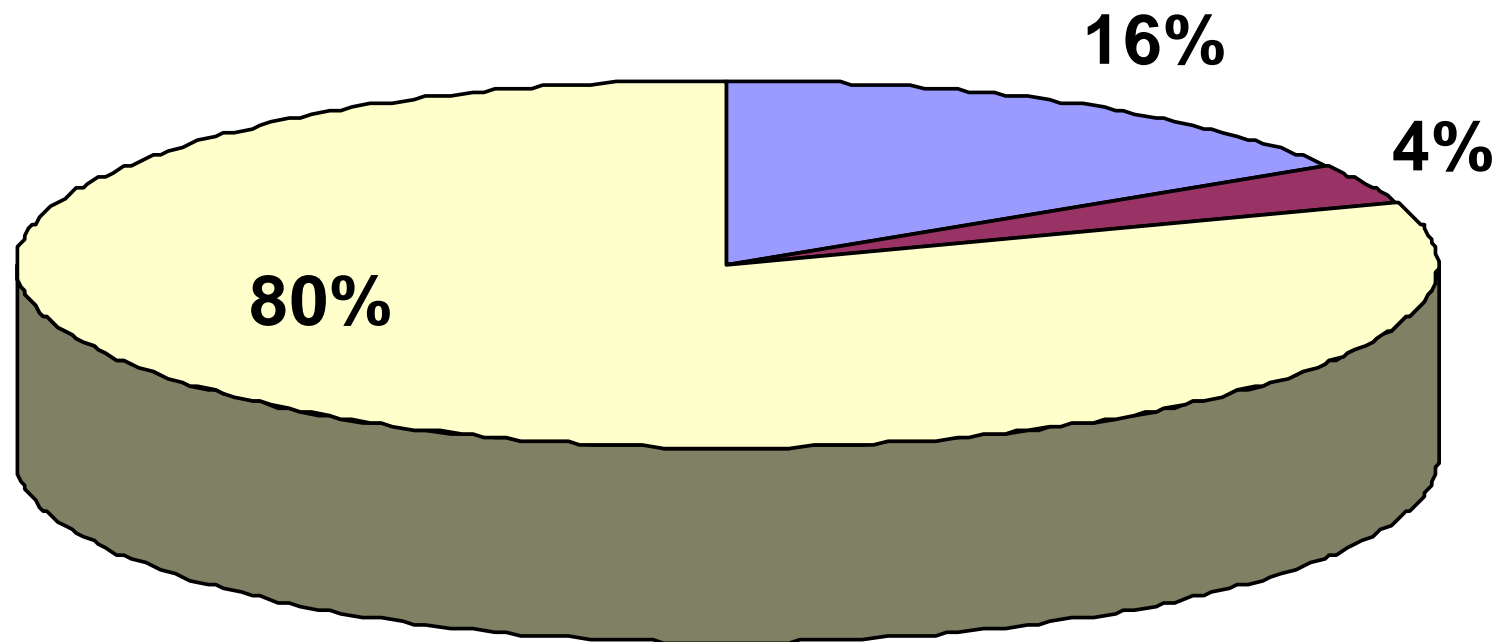
Believed there was WQ Problem (N=34)



Motivations for Participation (N=43)



Practice Implementation Status (N=470)



- Never Implemented (N=74)
- Partially Implemented (N=17)
- Fully Implemented (N=379)

Farm-Level Implementation (n=44)

- 27% (12) fully implemented all practices
 - 39% (17) fully implemented 75-99%
 - 22% (10) fully Implemented 50-74%
 - 11% (5) fully implemented <50%
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- **In other words, ~73% had at least one practice that was not fully implemented**

Does BMP Practice **Type** Matter?

■ **STRUCTURES (35%)**

- fences, waste storage facilities, sprinklers, etc...

■ **MANAGEMENT (44%)**

- Irrigation water management, nutrient management, waste utilization, etc...

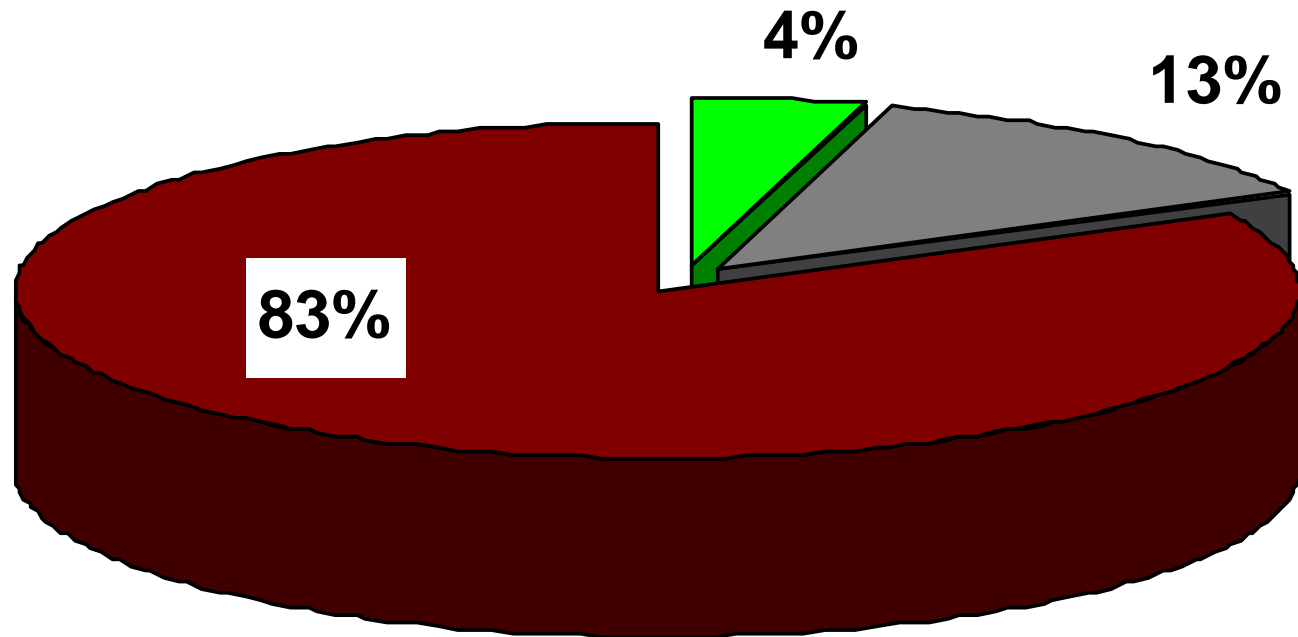
■ **PLANTING (15%)**

- planting grasses, filter strips, trees, etc...

■ **CLEARING (5%)**

- Clearing and snagging, land clearing, etc...

Practices Not Fully Implemented (N=91)



- Structures (N=4)
- Plantings (N=12)
- Management (N=75)

Reasons for Not Fully Implementing Practices

- No recollection of agreeing to do it, or discussing it with NRCS employee (N= 46)
- Ignored the advice that was given (N=10)
- Tried to implement but practice failed (N=9)—nearly all planting practices.
- Did not meet our research team's interpretation of objective (N=26)

Logistic Regression Model for Implementation

Independent Variables	Model 1		Model 2		Complete Model	
	B	Exp(B)	B	Exp(B)	B	Exp(B)
Practice Type						
Structure	3.609	36.915***	4.397	81.191***	4.839	126.359***
Planting	0.945	2.573*	0.941	2.563*	0.892	2.441*
Clearing (Management)	20.622	9.04E+08	21.229	1.66E+09	21.417	2E+09
Farm Characteristics						
Age 55 and Older			-1.809	0.164***	-1.936	0.144***
>100 aces			0.832	2.297***	1.336	3.805**
Successor (1=Yes)			0.654	1.923	1.411	4.099**
Dairy (1=Yes)			-1.627	0.197***	-1.100	0.333**
FarmDependence			0.600	1.822	0.143	1.154
Rent (1=Yes)			0.427	1.532	-1.007	0.365*
Motivation						
Environmental					2.224	9.246***
-2 Log likelihood	313.52		266.86		244.68	
Nagelkerke R Square	0.27		0.42		0.49	

*= p<.05, ** p<.01, and ***p<.001

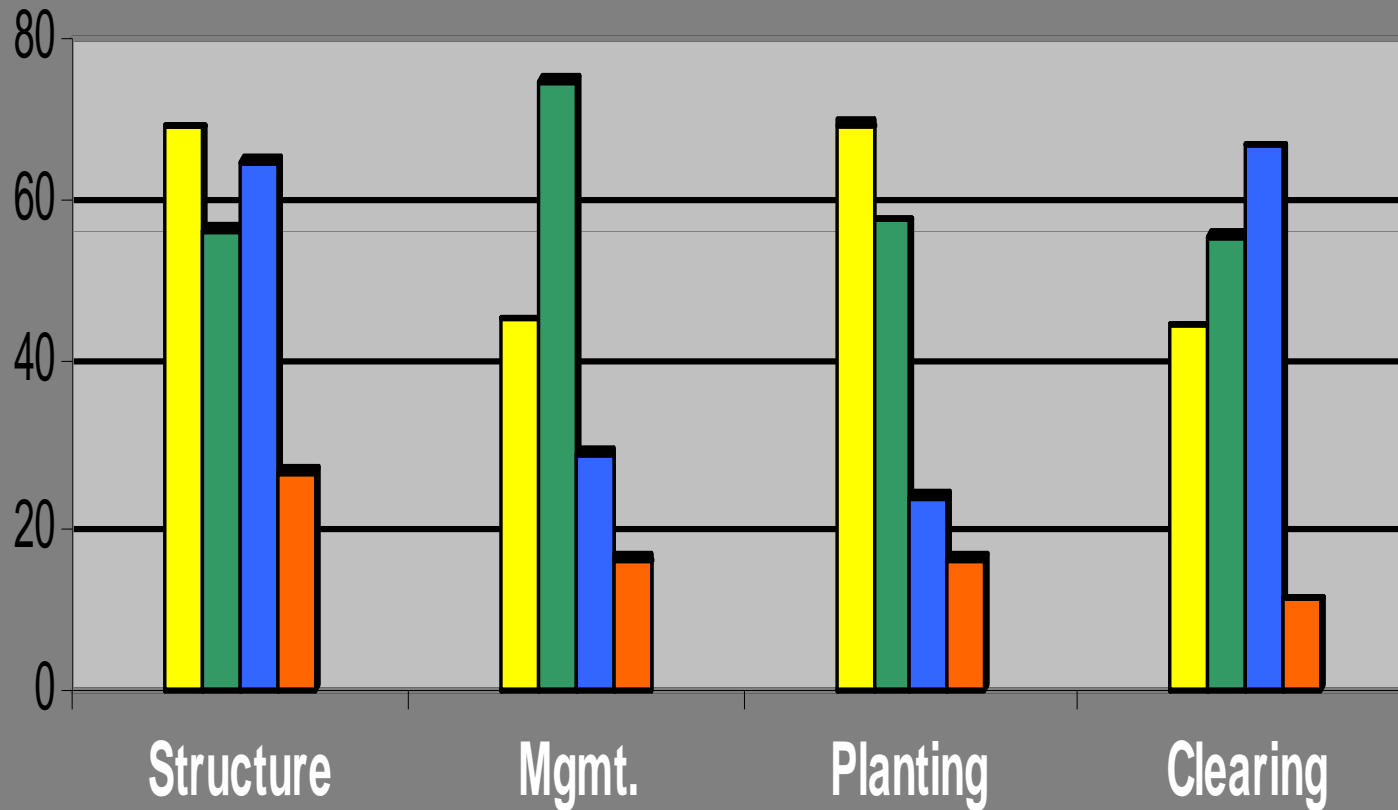
Factors Associated with HIGHER Implementation Rates

- Structure & Planting Practices (contrasted with Management)
- Younger operators
- Larger acreages
- Farms with successors
- Non-dairy operations
- Owned land
- Environmental motivations

Interpreting Low Implementation

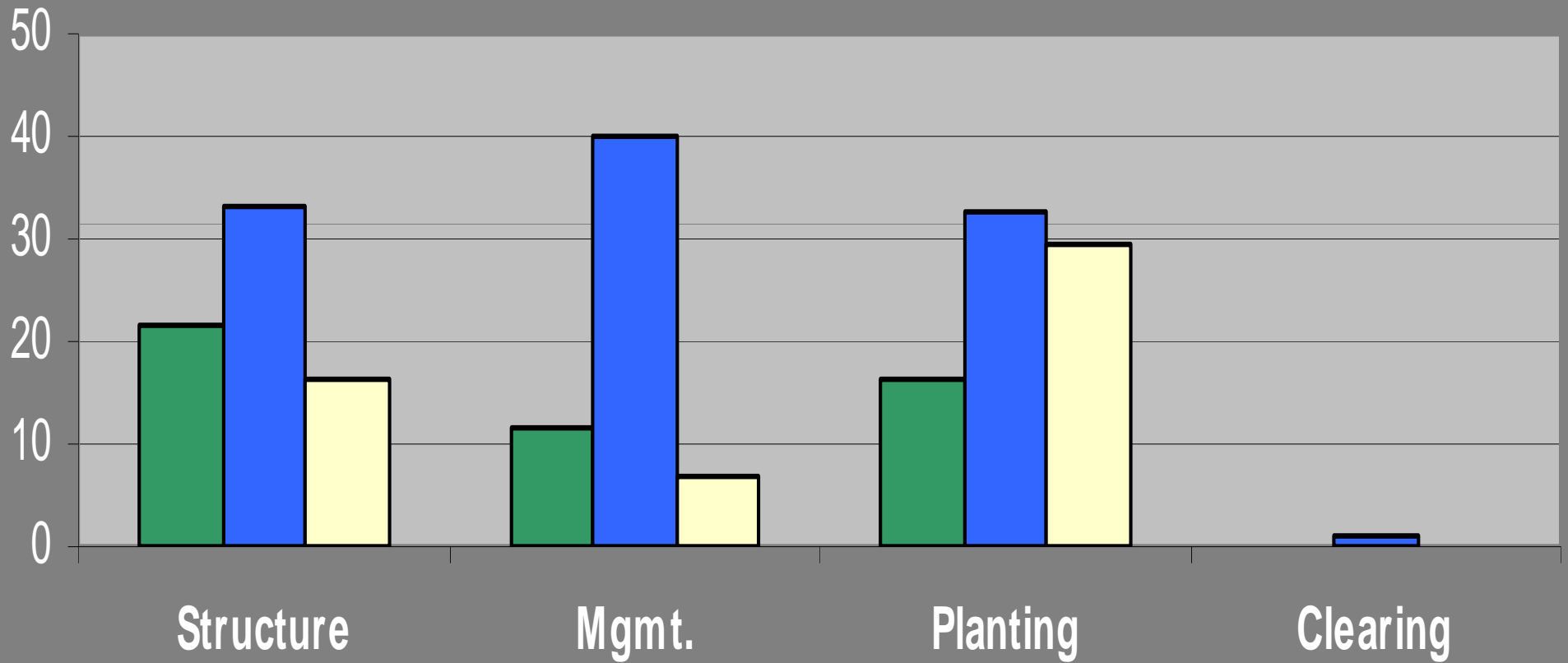
- Caution required
 - Recall errors? – up to 14 years ago
 - Not necessarily mean nothing done
 - NRCS Staff might tell different story
 - Not evidence of malfeasance or illegality

Benefits from BMPs



Environmental **Economic** **Labor** **Quality of Life**

Costs of Using BMPs



 **Economic**

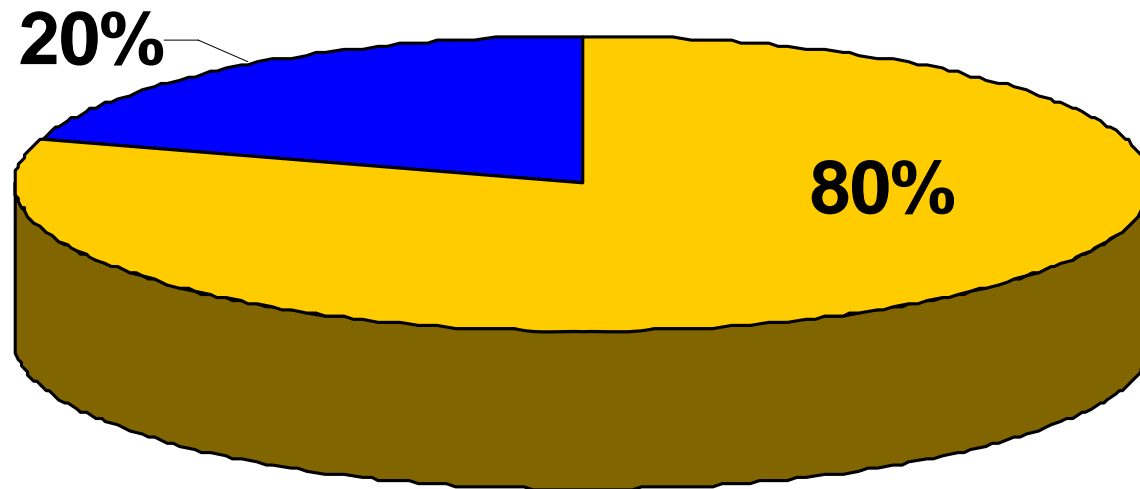
 **Labor**

 **Other**

Maintenance

- Practices that were never implemented cannot be maintained, so were removed from analysis
- Maintenance status of 11 practices could not be identified (interview cut short, or we did not ask)
- 385 Usable Practices

Maintenance Status of Practices (N=385)



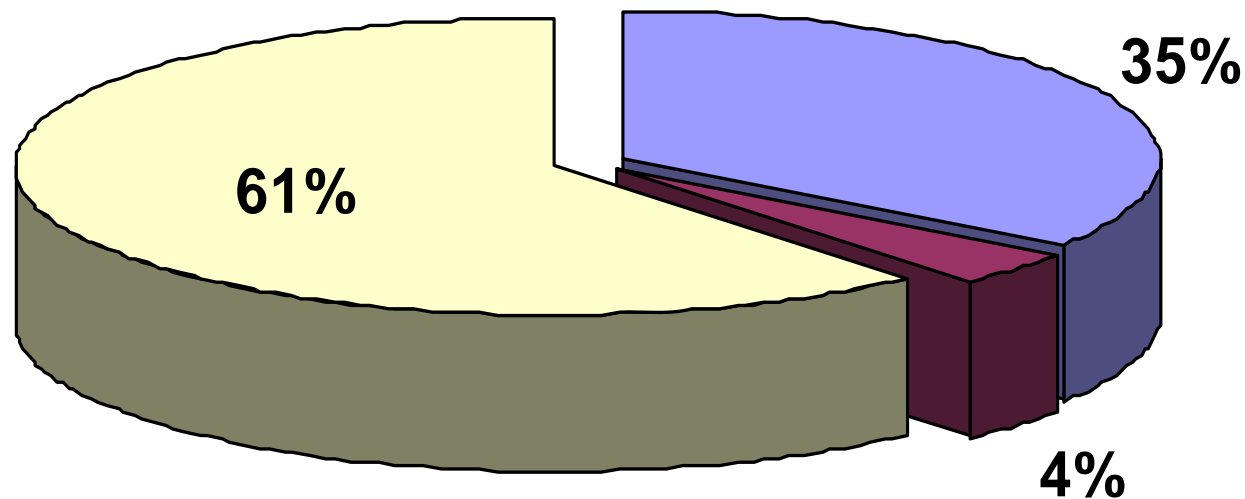
■ Maintained (N=308)




■ Not Maintained (N=77)

Farm Level (N=44)

- 46% (20) maintained all practices
 - 25% (11) maintained 76-99%
 - 14% (6) maintained 51-75%
 - 16% (7) maintained < 50%
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- **In other words, ~55% had at least 1 practice that was no longer being maintained**

Types of Practices Not Maintained (N= 75)



-  **Structure (N=26)**
-  **Plantings (N=3)**
-  **Management Practices (N=46)**

Reasons for Discontinuance

- Temporary Practice (N= 25)
- Broke, or “undone” by natural events (N=10)
- New structures replaced old structures (N=7)
- Producer no longer wanted to do it (N=7)
 - all management practices
- Undone by farm changes (usually downsizing) N=28

Independent Variables	Model 1		Model 2		Model 3		Model 4	
	B	Exp(B)	B	Exp(B)	B	Exp(B)	B	Exp(B)
Practice Type								
Structure	0.902**	2.464	0.854*	2.349	0.675*	1.965	0.704	2.022
Planting	2.205***	9.074	2.357***	10.559	2.278***	9.759	2.243***	9.421
Clearing	20.615	9E+08	20.615	9E+09	20.357	2E+08	20.792	1E+09
Farm Characteristics								
Age 55 and Older			-0.085	0.918	-0.203	0.817	0.106	1.112
>100 aces			0.014	1.014	-0.257	0.773	-0.178	0.837
Successor (1=Yes)			0.138	1.148	-0.293	0.746	-0.396	0.673
Dairy (1=Yes)			0.305	1.357	-0.095	0.909	-0.085	0.919
FarmDependence			1.367**	3.924	1.747***	5.737	2.013***	7.488
Rent (1=Yes)			-0.340	0.712	0.509	1.663	0.929	2.531
Motivation								
Environmental					-1.093**	0.335	-1.739***	0.176
Costs and Benefits								
Economic (+)							-0.103	0.902
Labor (+)							-0.672	0.511
QualityofLife (+)							0.163	1.177
Environmental (+)							1.157**	3.180
Economic (-)							0.131	1.139
Labor (-)							0.408	1.504
Quality of Life (-)							-2.894*	0.055
-2 Log likelihood	288.28		274.88		268.10		250.52	
Cox & Snell R Square	0.09		0.13		0.15		0.19	
Nagelkerke R Square	0.13		0.19		0.22		0.30	

*p≤.05, **p<.01, ***p<.001

Factors Associated with HIGHER Maintenance Rates

- Structure & Planting Practices (contrasted with Management)
- Dependence on Farm Income
- LOWER environmental motivations
- Perceived environmental benefits
- NO negative impacts on Quality of Life

Summary: Implementation

- Management practices = Low implementation
- Farm characteristics influenced the implementation process
- Motivations for participating influenced implementation
- Many producers were not aware that they were supposed to implement certain practices, or believed they were, though we determined they were not.

Summary: Maintenance

- Management Practices had highest rates of discontinuance, BUT—majority of these were “temporary practices”
- Removing these, structures had the highest rates of discontinuance
- Farm characteristics not as important (except farm dependence)
- Costs and Benefits had little to do w/ maintenance
- Farm changes were the most common explanations

Implications: Implementation

- Management practices are the heart of conservation programs
 - Failure to fully implement may have huge impacts on success
- Big Question: How can management behaviors be implemented more effectively?

Implications: Maintenance

- Good news:
 - Other than a small handful of management practices, producers did not discontinue the practices because they did not like them
- Not so good news:
 - The most commonly discontinued structures were some of the most expensive projects to implement (waste storage facilities, fences, and sprinkler systems)
- Nonfarm Development and Farm Changes are significant forces
- Will it be cost-effective in the long run?

Additional Conclusions

- Formal USDA Program files are imperfect guide to actual BMP implementation & maintenance
- Fieldwork can generate important insights into water-quality relevant behaviors
 - More accurate behavioral component of models
 - Understanding barriers to implementation & maintenance
- Face to Face Contact = particularly useful
 - Takes time & money

Questions?

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