The Virginia Agricultural BMPs Cost-Share Program:

How do voluntary environmental programs affect water quality?

by Jay Abolofia

Importance of Program

- Agriculture is a major contributor to non-point source pollution
  - Excess nutrients, pesticides, sediment, heavy metals, & toxic substances
- Agricultural sector to play significant role in Chesapeake Bay Agreement

Cost-Share Program

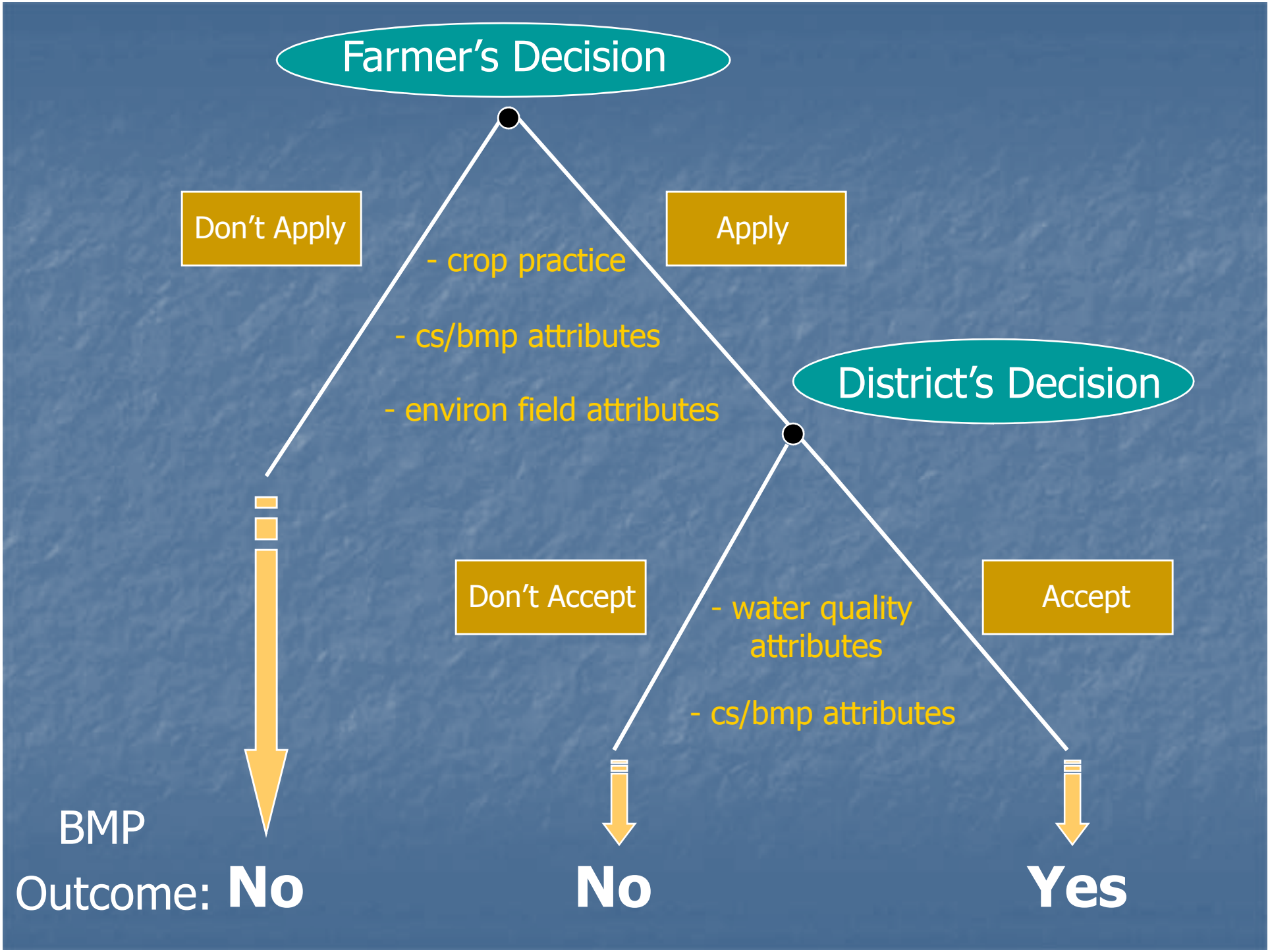
- Provides technical assistance and funds for farmers to help install BMP's
- District subsidizes BMP installation at straight per-acre rate

Program Goals

- Efficiently allocate cost-share to maximize the reduction of nutrient/sediment runoff
- Target fields that yield greatest increase in water quality per dollar spent
  - Best *'water quality' bang for the buck!*

Research Experiment

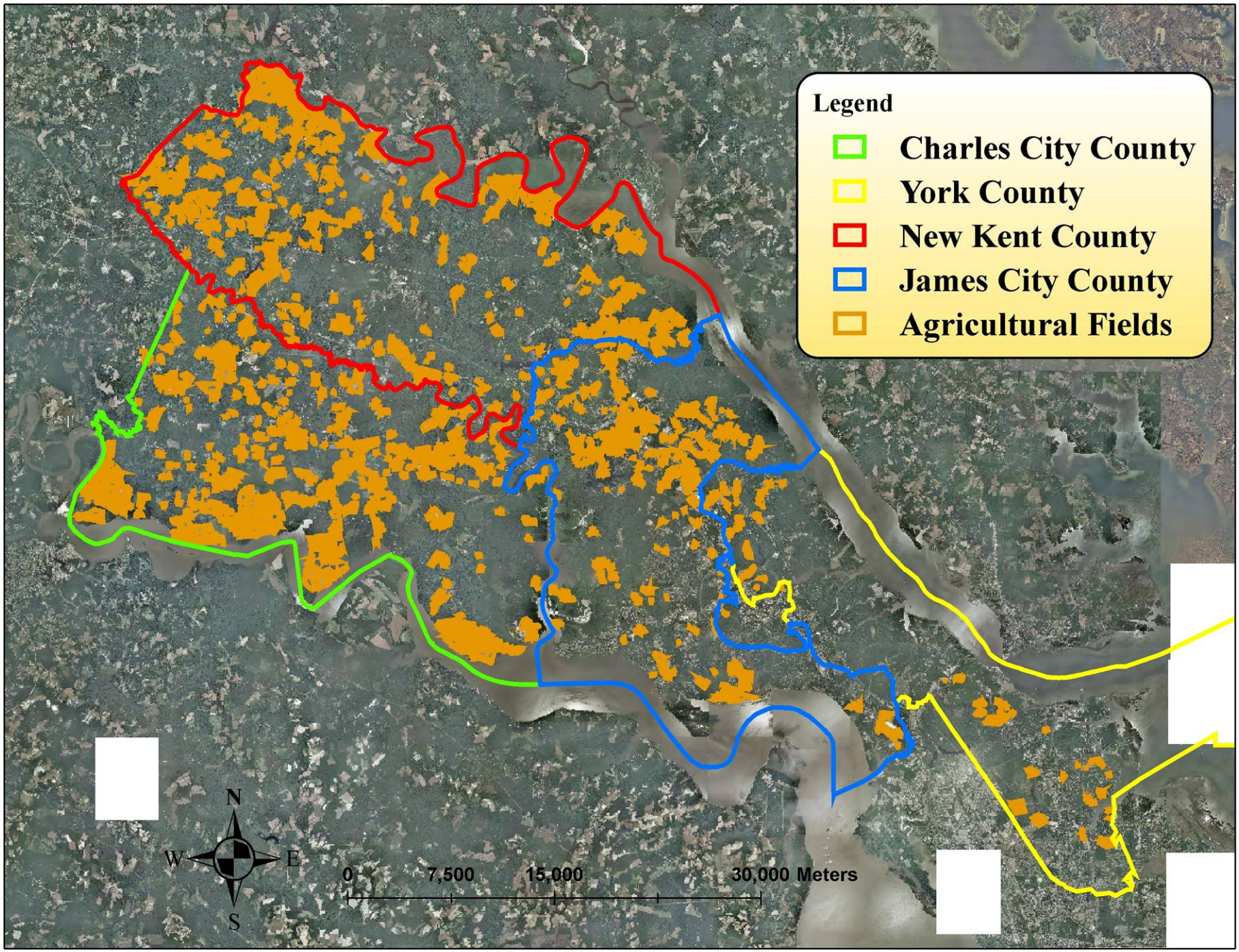
- Spatially examine environmental conditions that affect water quality
- Contrast environmental conditions with spatial patterns of cost-share BMP implementation
- Investigate:
  - Do cost-share BMP installation outcomes reflect the program's water quality goals?


Farmer's Decision
Don't Apply
Apply
- crop practice
- cs/bmp attributes
- environ field attributes
District's Decision
Don't Accept
Accept
- water quality attributes
- cs/bmp attributes
BMP Outcome: No
No
Yes

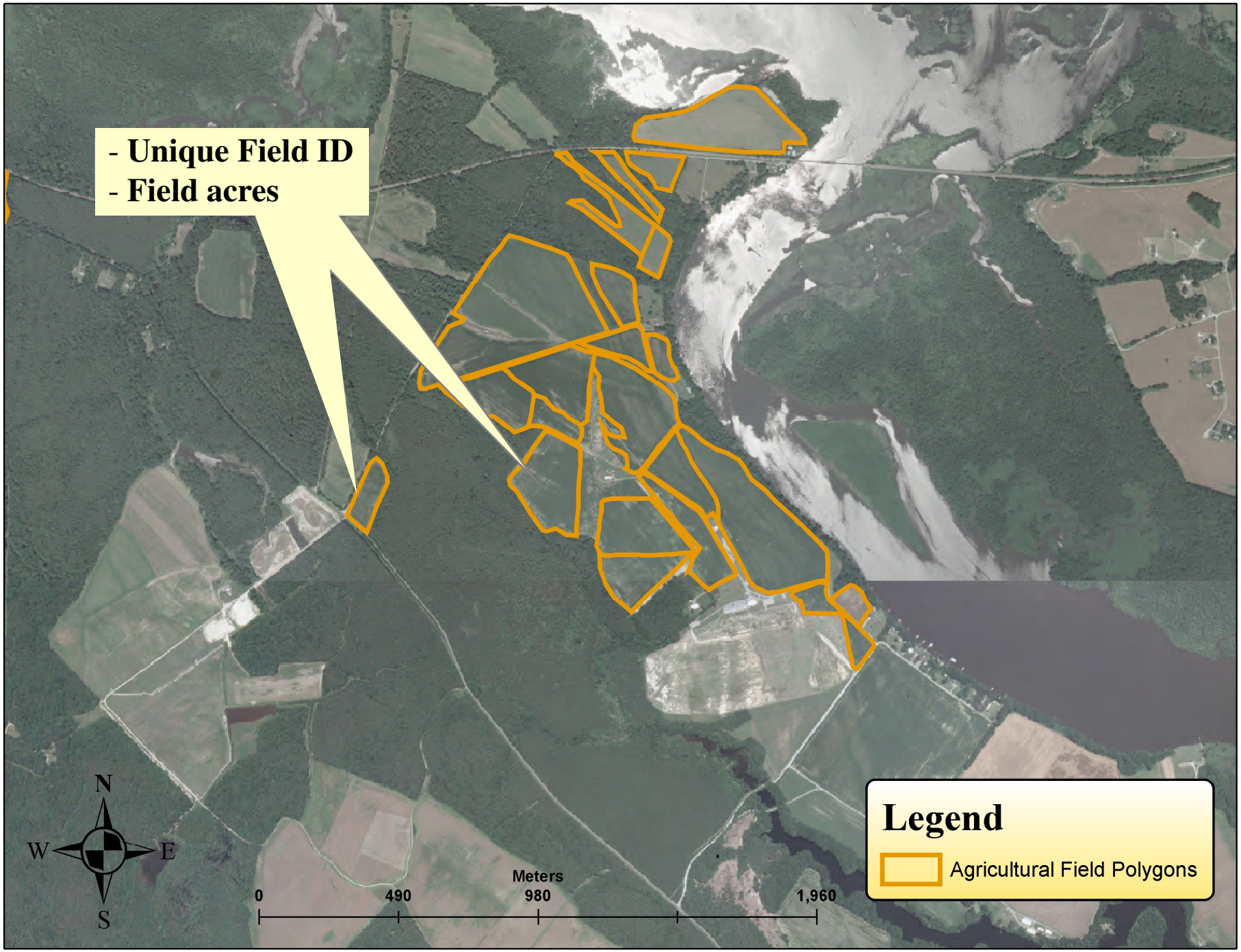
Why are environmental field attributes important?

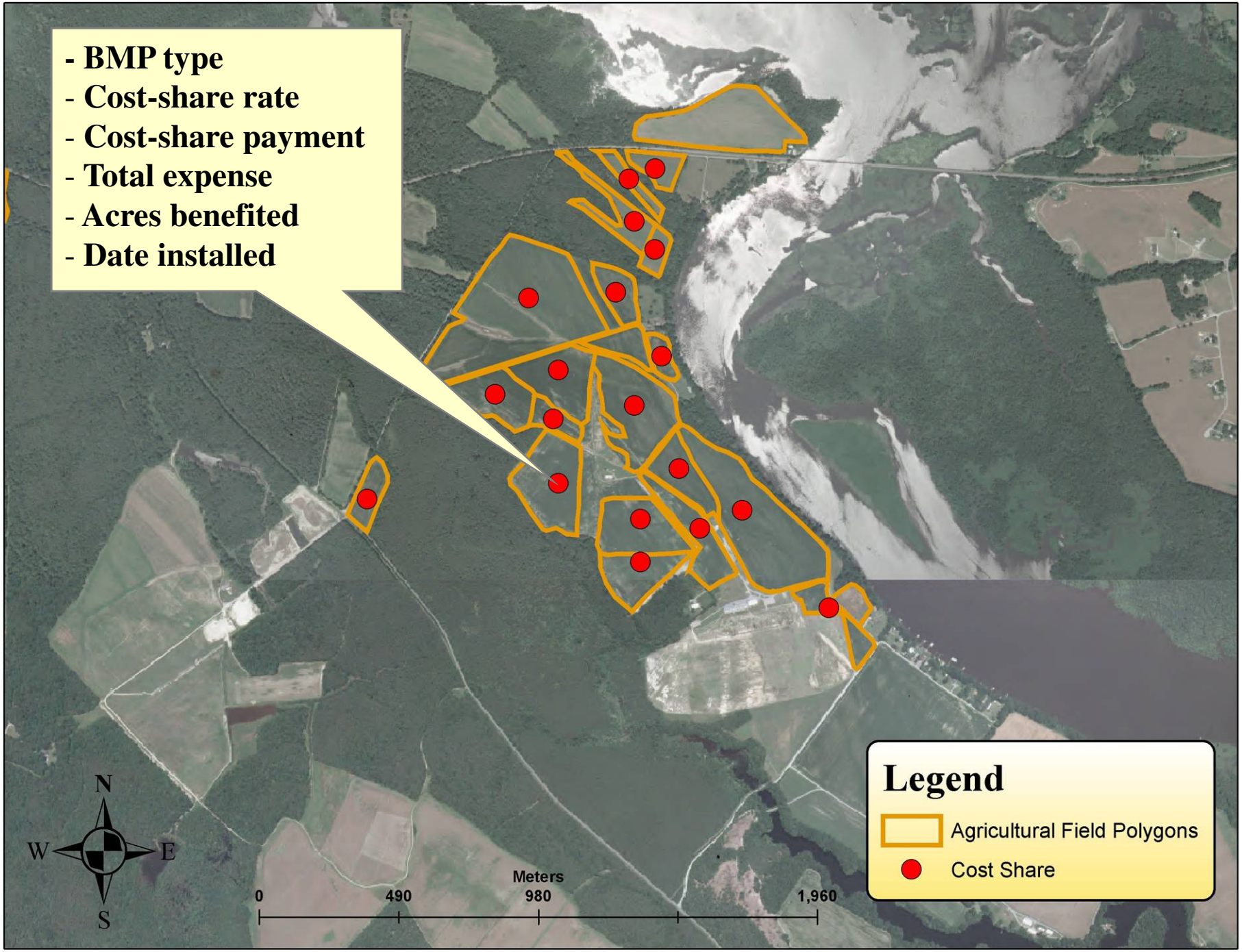
- Different characteristics relating to water quality
- Environmental field attributes should therefore dictate district's allocation of cost-share

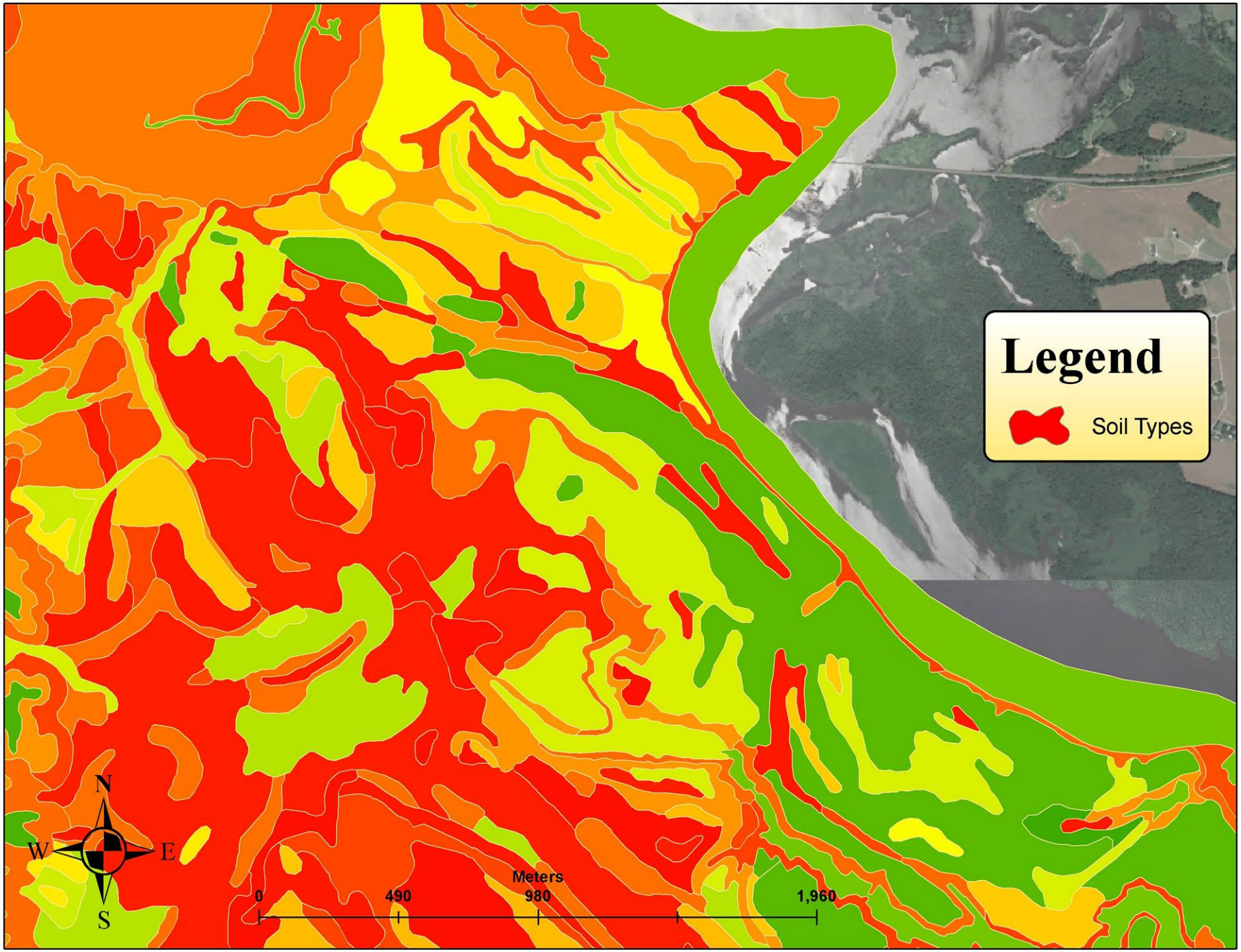
Points, Lines, & Polygons!!!

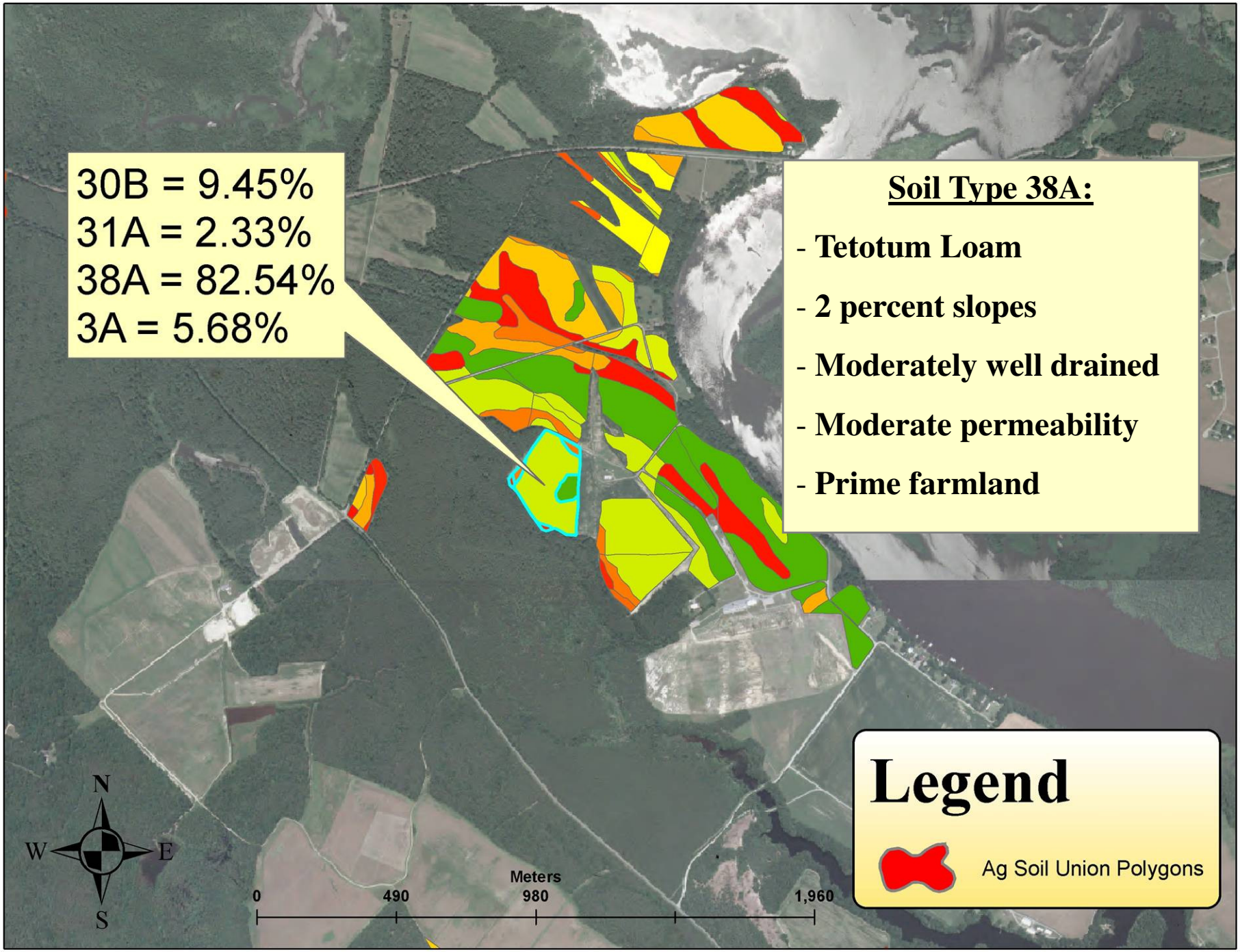

Legend
Charles City County
York County
New Kent County
James City County
Agricultural Fields
N
W
E
S
0
7,500
15,000
30,000 Meters

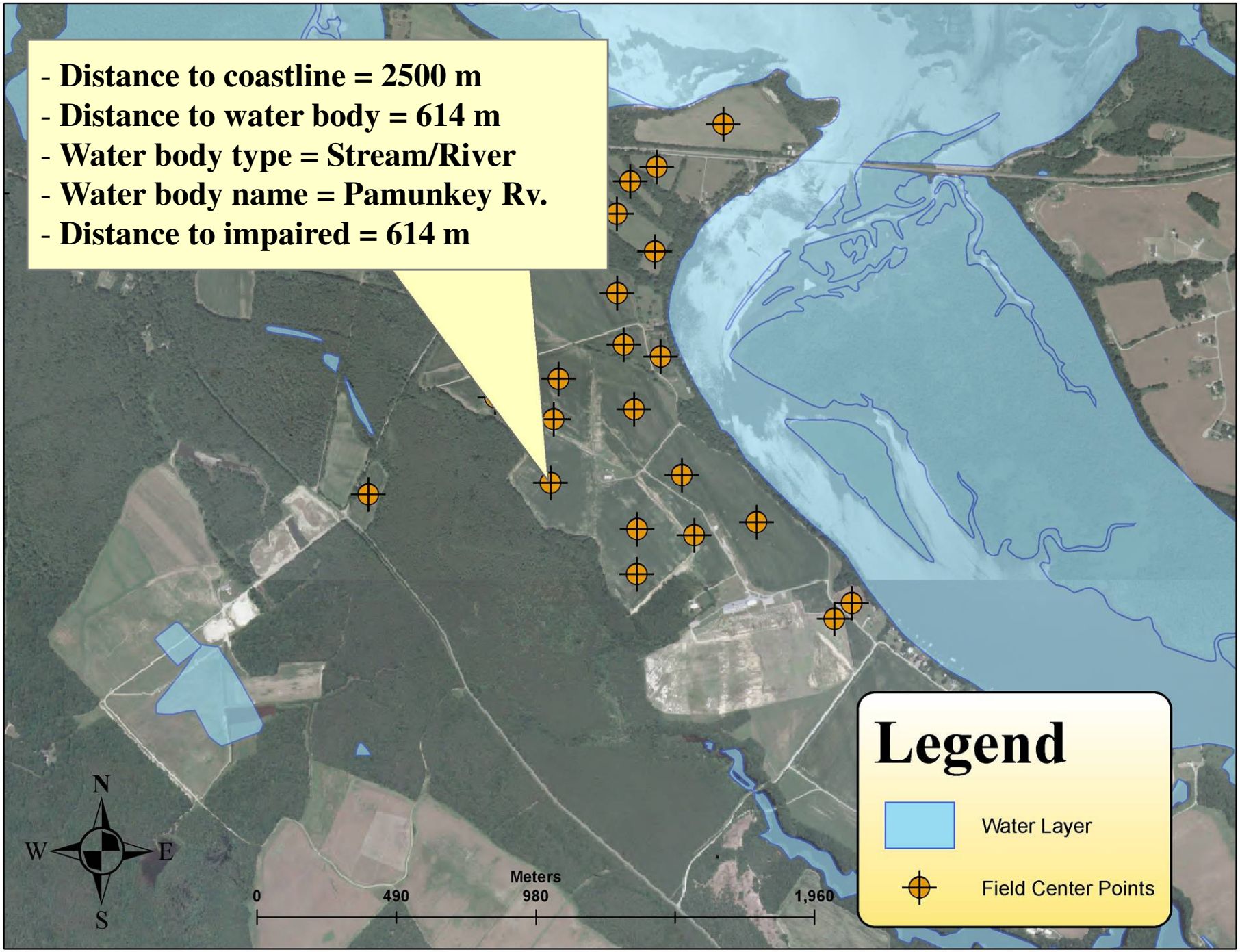

New Kent Farm
N
W
E
S
Meters
0
490
980
1,960

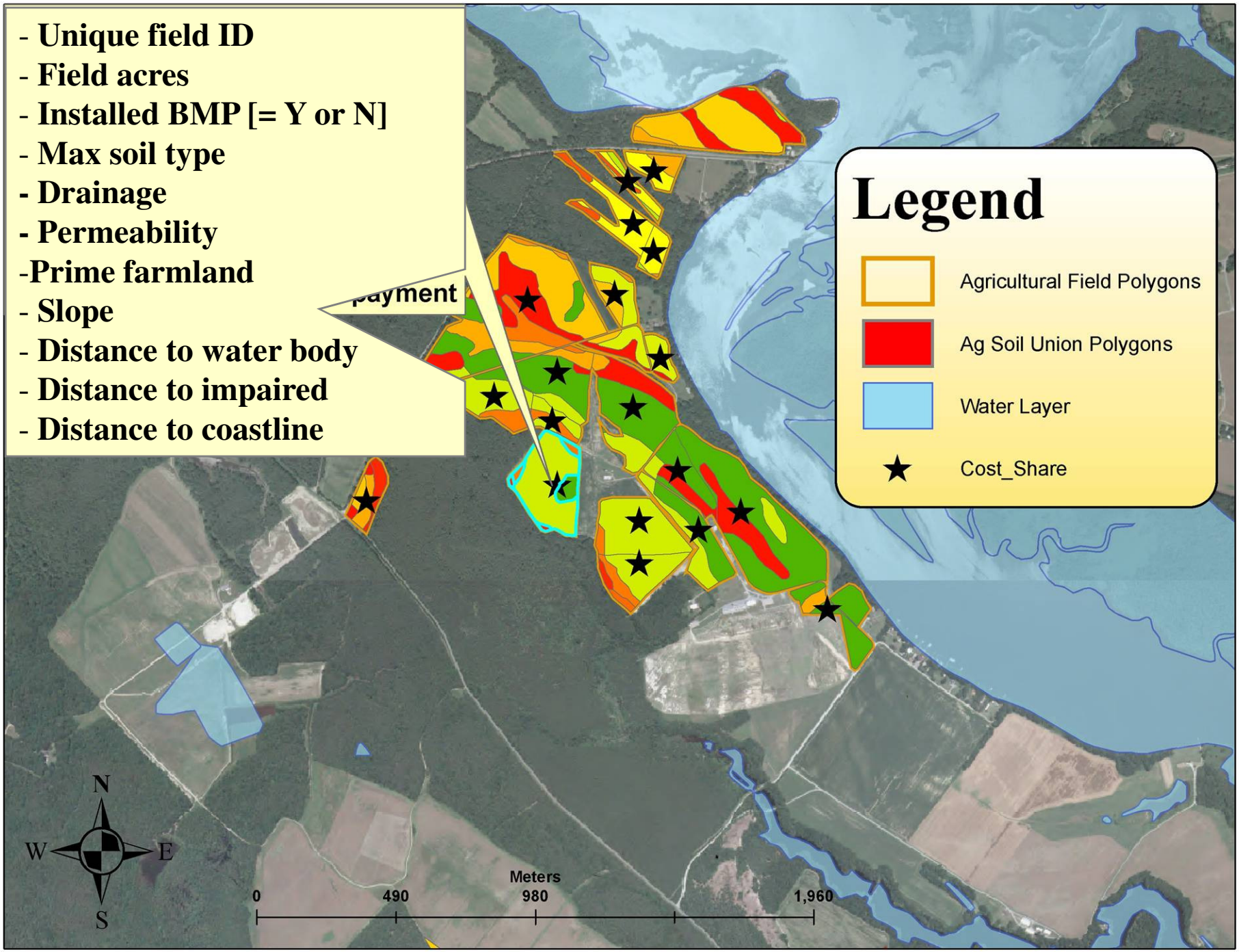

- Unique Field ID
- Field acres
N
W
E
S
0
490
Meters
980
1,960
Legend
Agricultural Field Polygons


- BMP type
- Cost-share rate
- Cost-share payment
- Total expense
- Acres benefited
- Date installed
N
W
E
S
Meters
0
490
980
1,960
Legend
Agricultural Field Polygons
Cost Share


Legend
Soil Types
N
W
E
S
Meters
0
490
980
1,960


30B = 9.45%
31A = 2.33%
38A = 82.54%
3A = 5.68%
Soil Type 38A:
- Tetotum Loam
- 2 percent slopes
- Moderately well drained
- Moderate permeability
- Prime farmland
N
W
E
S
Meters
0
490
980
1,960
Legend
Ag Soil Union Polygons


- Distance to coastline = 2500 m
- Distance to water body = 614 m
- Water body type = Stream/River
- Water body name = Pamunkey Rv.
- Distance to impaired = 614 m
N
W
E
S
Meters
0
490
980
1,960
Legend
Water Layer
Field Center Points


- Unique field ID
- Field acres
- Installed BMP [= Y or N]
- Max soil type
- Drainage
- Permeability
-Prime farmland
- Slope
- Distance to water body
- Distance to impaired
- Distance to coastline
Legend
Agricultural Field Polygons
Ag Soil Union Polygons
Water Layer
Cost_Share
N
W
E
S
Meters
0
490
980
1,960

Statistical Model

- Probit Regression Model
  - Models the probability of having an installed BMP
    - To investigate how field attributes explain participation in cost-share BMP program
- Details
  - Binary dependent variable (installed BMP = 0 or 1)
  - Field attributes represent explanatory variables
  - Given the explanatory variables, the model measures the net result of how the program targets fields

Model results

IND. VARIABLE	*SIGN*	*INTUITIVE*
field_acres	**+**	**Y**
dist_lake	**-**	**Y**
dist_cstln	**-**	**Y**
near_cstln	**-**	**N**
near_dist_imp	**-**	**Y**
slope_num	**-**	**N**
perm_poor	**-**	**N**
drain_poor	**-**	**N**
prime_farm	**-**	**Y**

Predicted probabilities for installed BMPs

drain_poor	Probability
N	25%
Y	21%

perm_poor	Probability
N	27%
Y	22%

Predicted probabilities for installed BMPs

slope_num	Probability
0	26%
2	25%
4	24%
6	23%
10	21%
25	14%
50	7%

Conclusions

- Cost-share BMP program seems to be working in many respects
  - Targeting larger fields
  - Dismissing fields significantly far from lakes/coastline
- But, there is room for improvement
  - Steep slopes
  - Poorly drained soils
  - Soils with poor permeability
  - Prime farmlands (75% of district fields)

THANK YOU!

Tim Russell
Rob Hicks
Jim Wallace
Brian Noyes