Tools to Improve Placement of Conservation Practices in Watersheds

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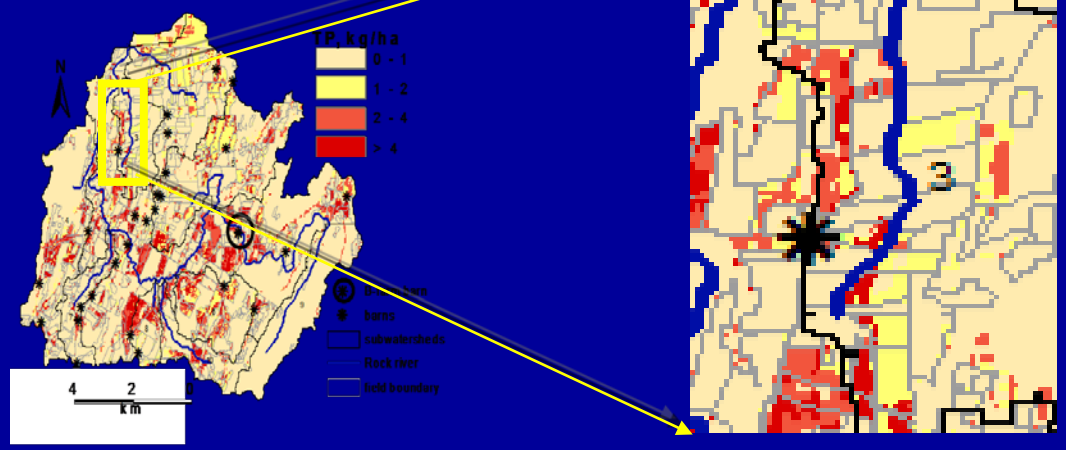
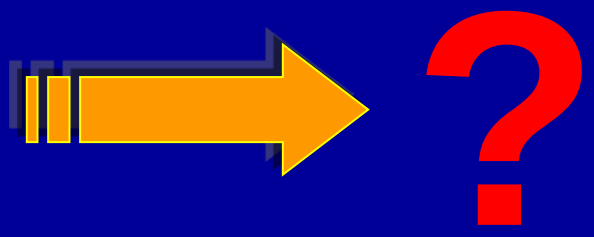
Understanding Conservation Effectiveness in Agricultural Watersheds: Key Questions

- Which conservation practices are most cost effective for improving water quality? Where are they most effective?
- How can we use spatial technologies to predict/assess performance of conservation practices?
- What tools do conservationists need to identify new measures that can improve agricultural and environmental outcomes?

Bridging Watershed and Farm Scales

Watershed Model Results Vs. Farm Implementation



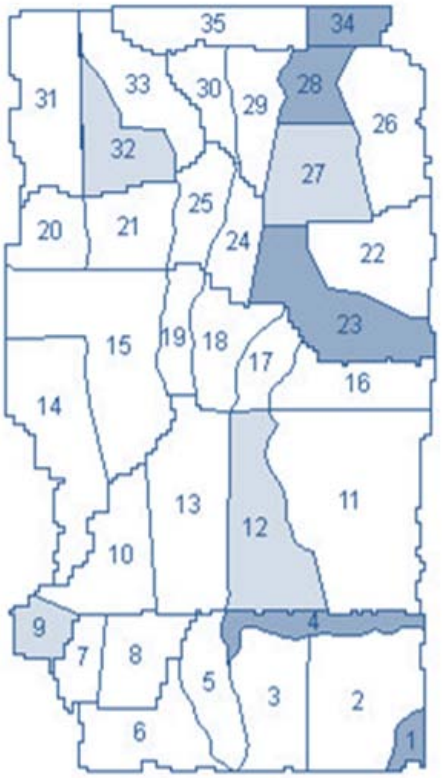


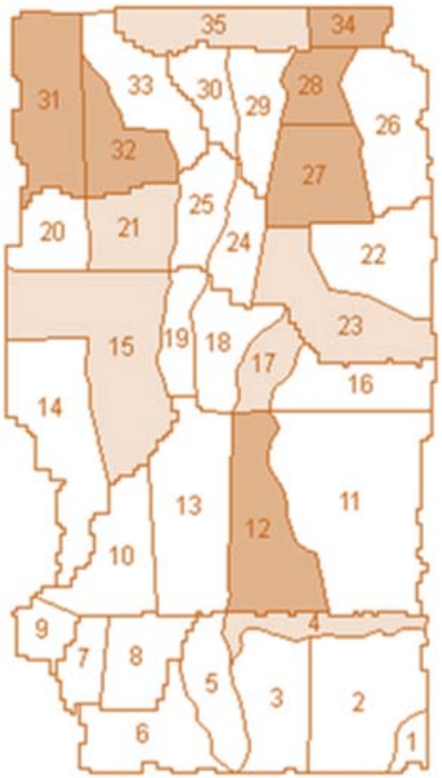
- **Data resolution and quality**
- **Technology transfer and stakeholder involvement**
  - Watershed as planning with communities vs. farm-level application – business planning

Bridging between field and watershed scales: Four examples employing modeling and spatial observation

1. Field scale simulations of erosion and pesticide movement lead to watershed scale recommendations – Missouri (1:MO)
2. Use of remote sensing data to map effectiveness of cover crop practices – Maryland (2:MD)
3. Estimating nitrate-N reductions from wetlands sited with LiDAR: water quality trading implications - Illinois (3:IL)
4. Improving nutrient use efficiency at farm scale increases likelihood of adoption of conservation measures – New York (4:NY)

MO claypan soils: Maps of critical source areas delineated by APEX model output





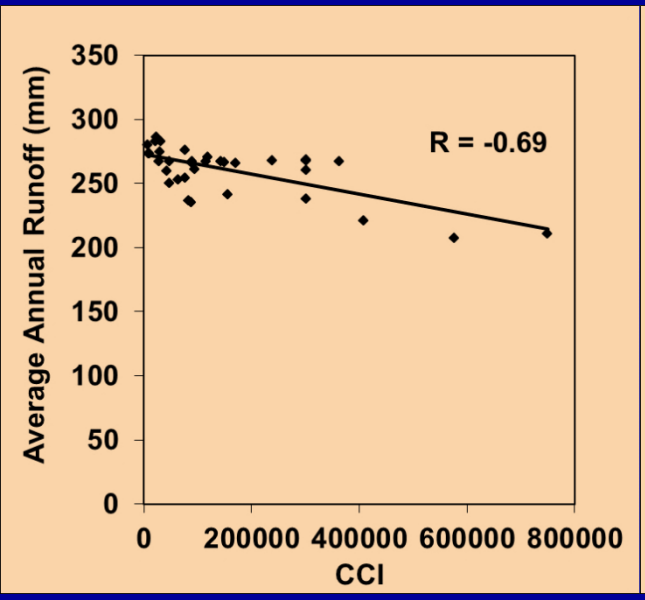
Runoff **Atrazine** **Sediment**

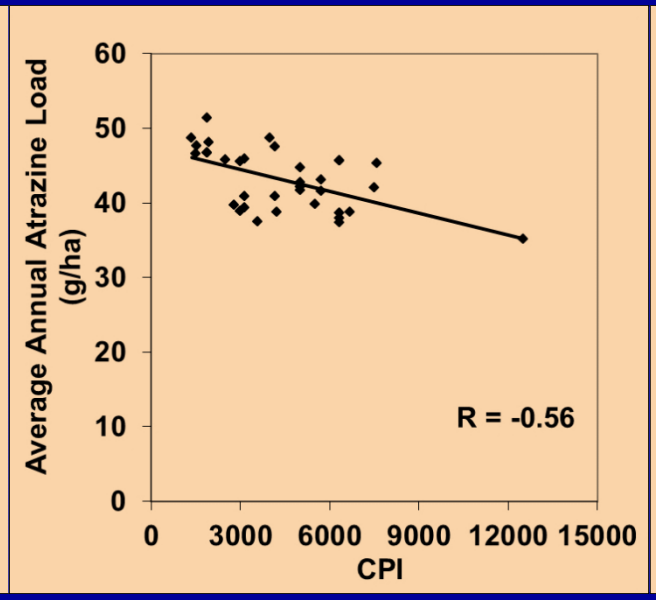
1:MO

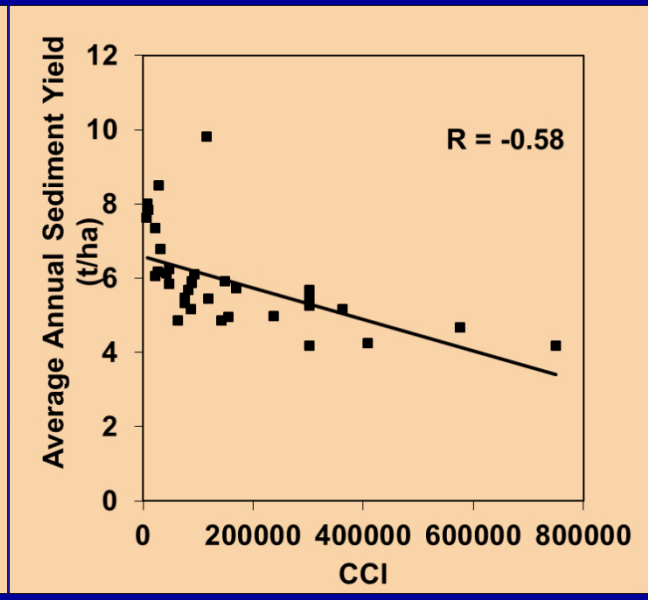
Use of soil/landscape indicators to map critical areas

Two indices that best predicted areas generating greatest loads:

CCI= Ksat * CPI, where CPI= Claypan depth / Slope

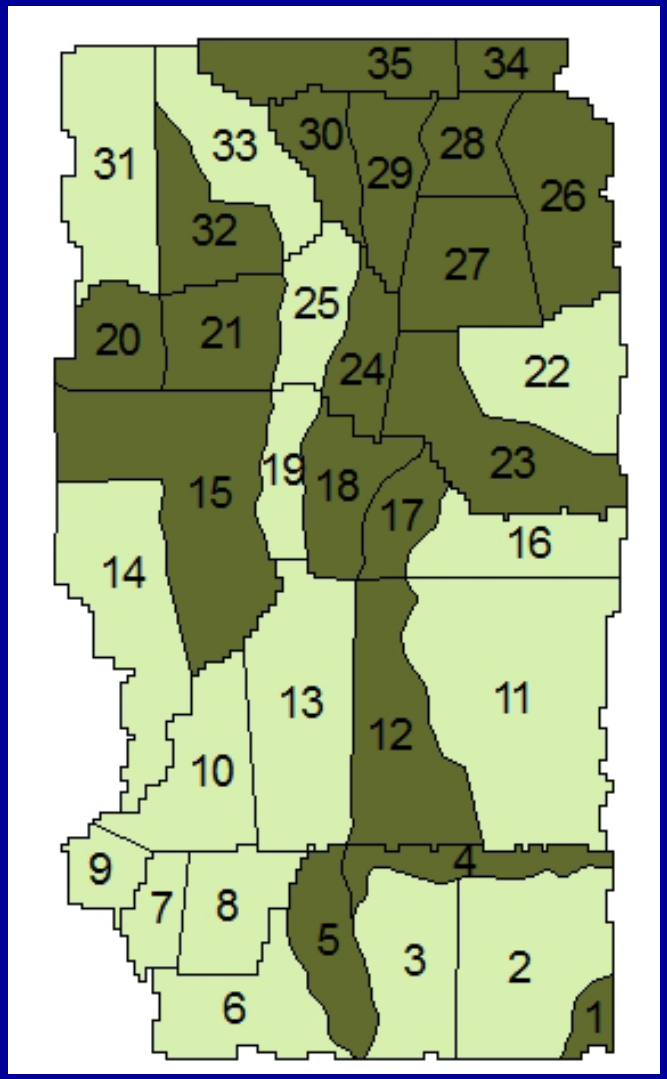




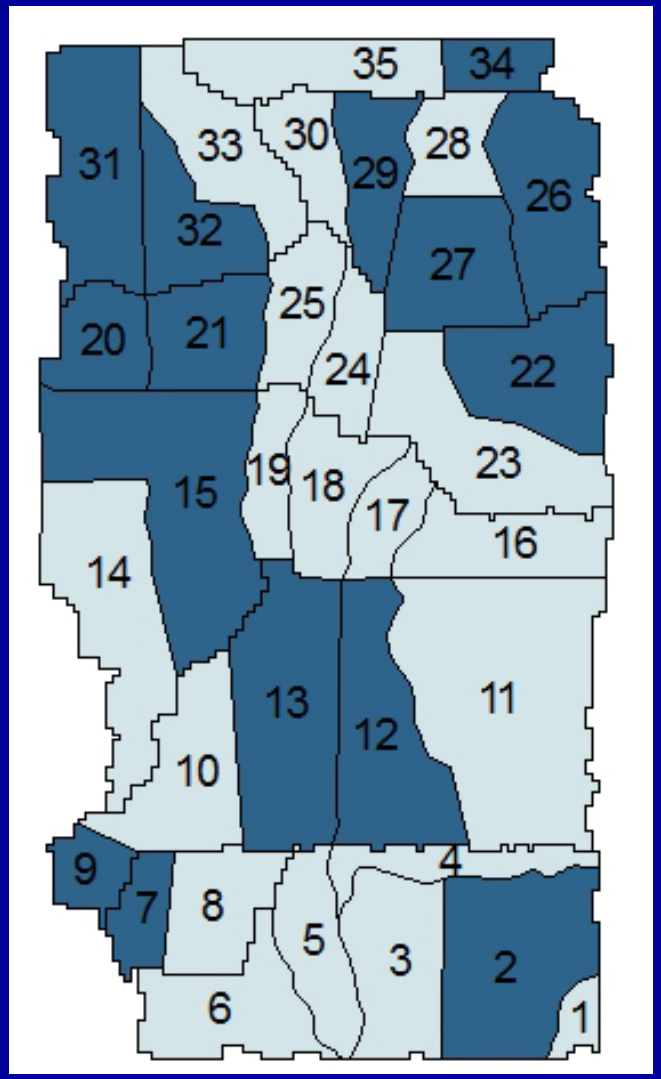


1:MO **Runoff** **Atrazine** **Sediment**

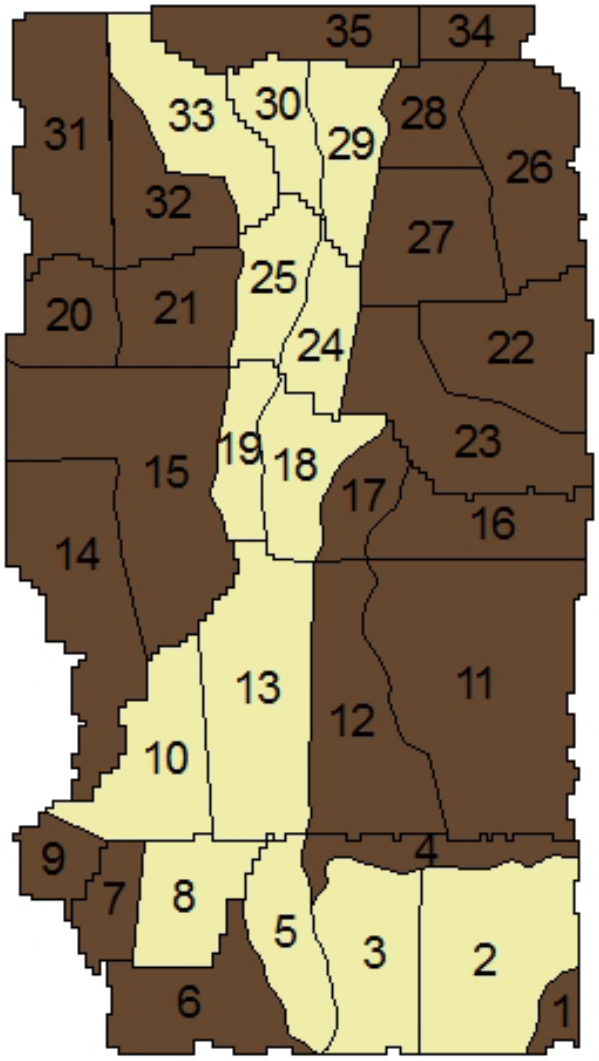
CSAs Delineated by Index



CCI



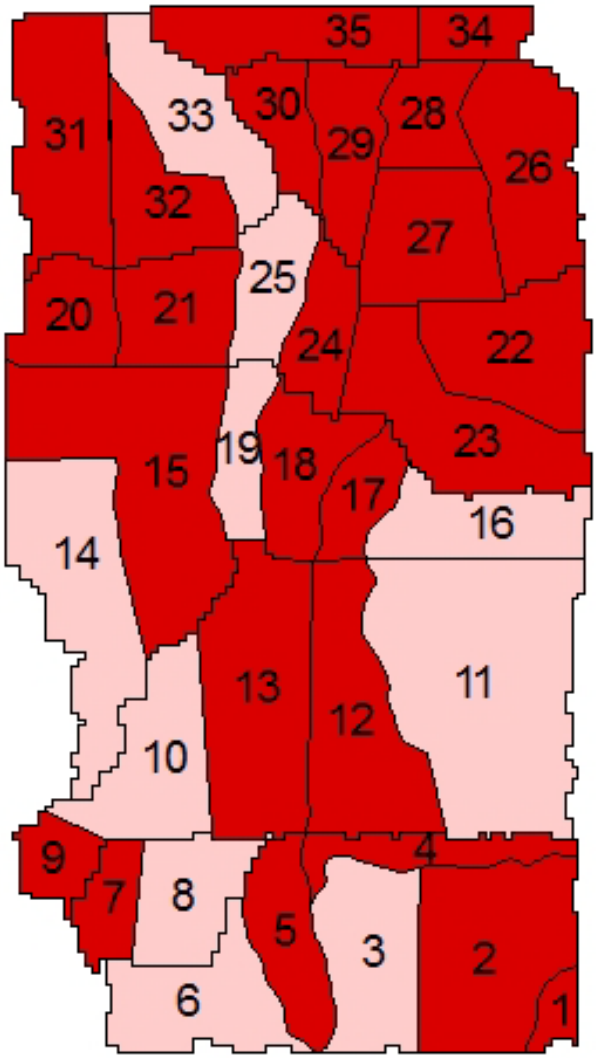
CPI



APEX delineated CMAs

Non critical

Critical



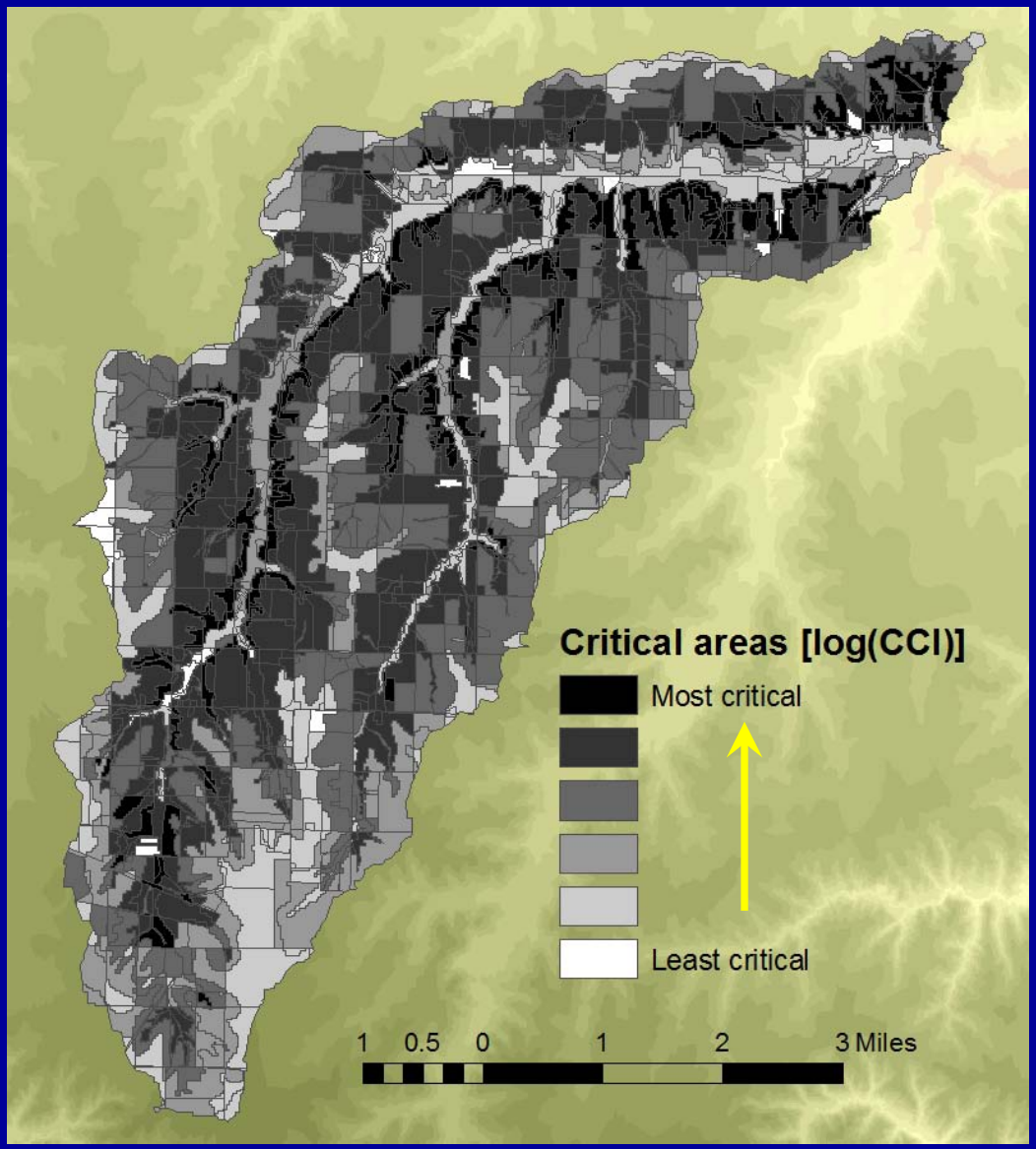
INDEX delineated CMAs

Non critical

Critical

1:MO

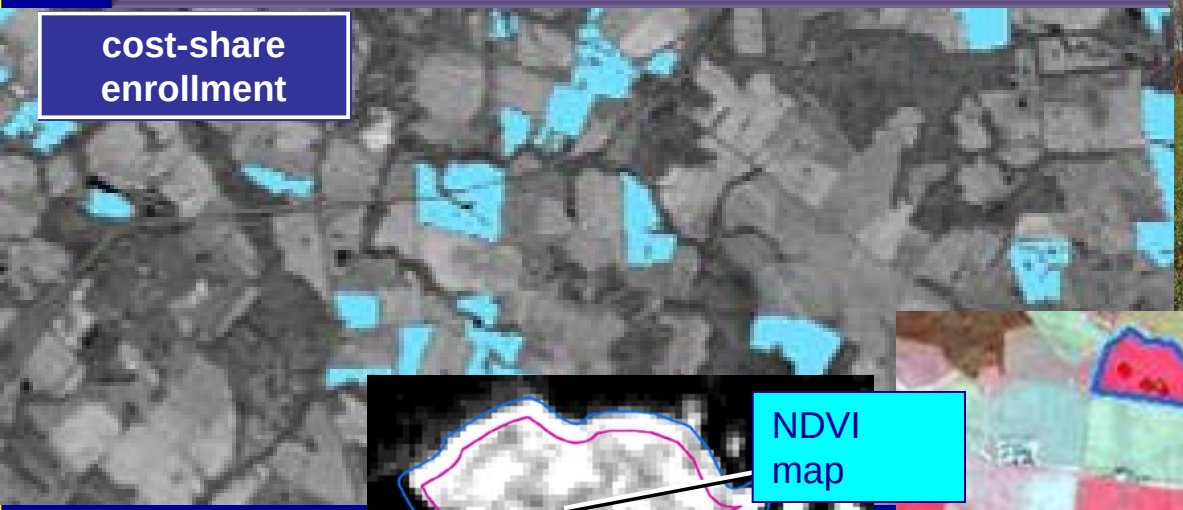
Critical areas in Goodwater watershed

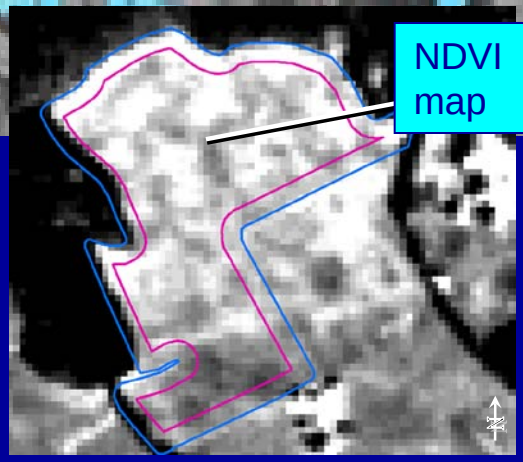


1:MO

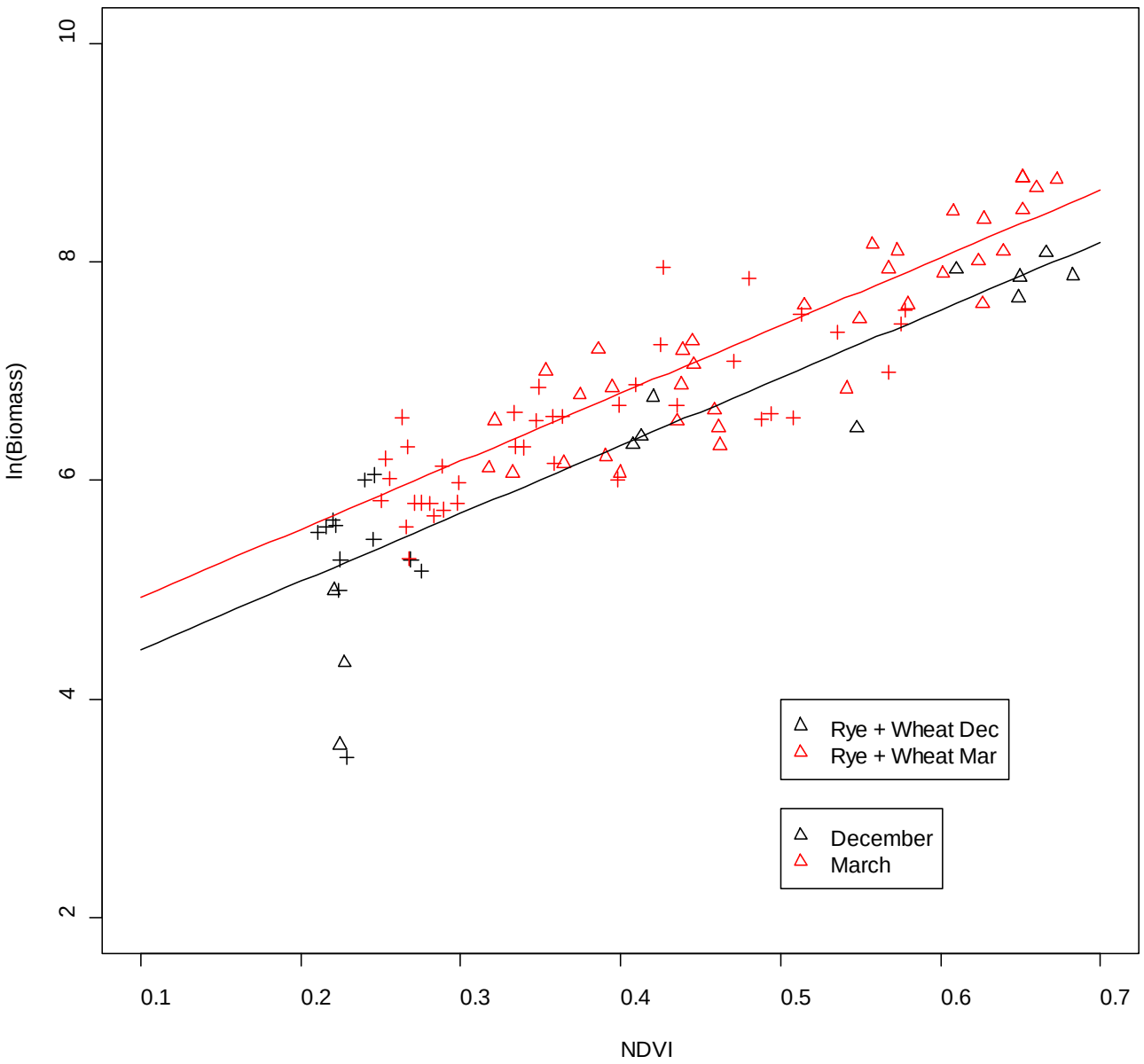
2:MD

Developing the calibration

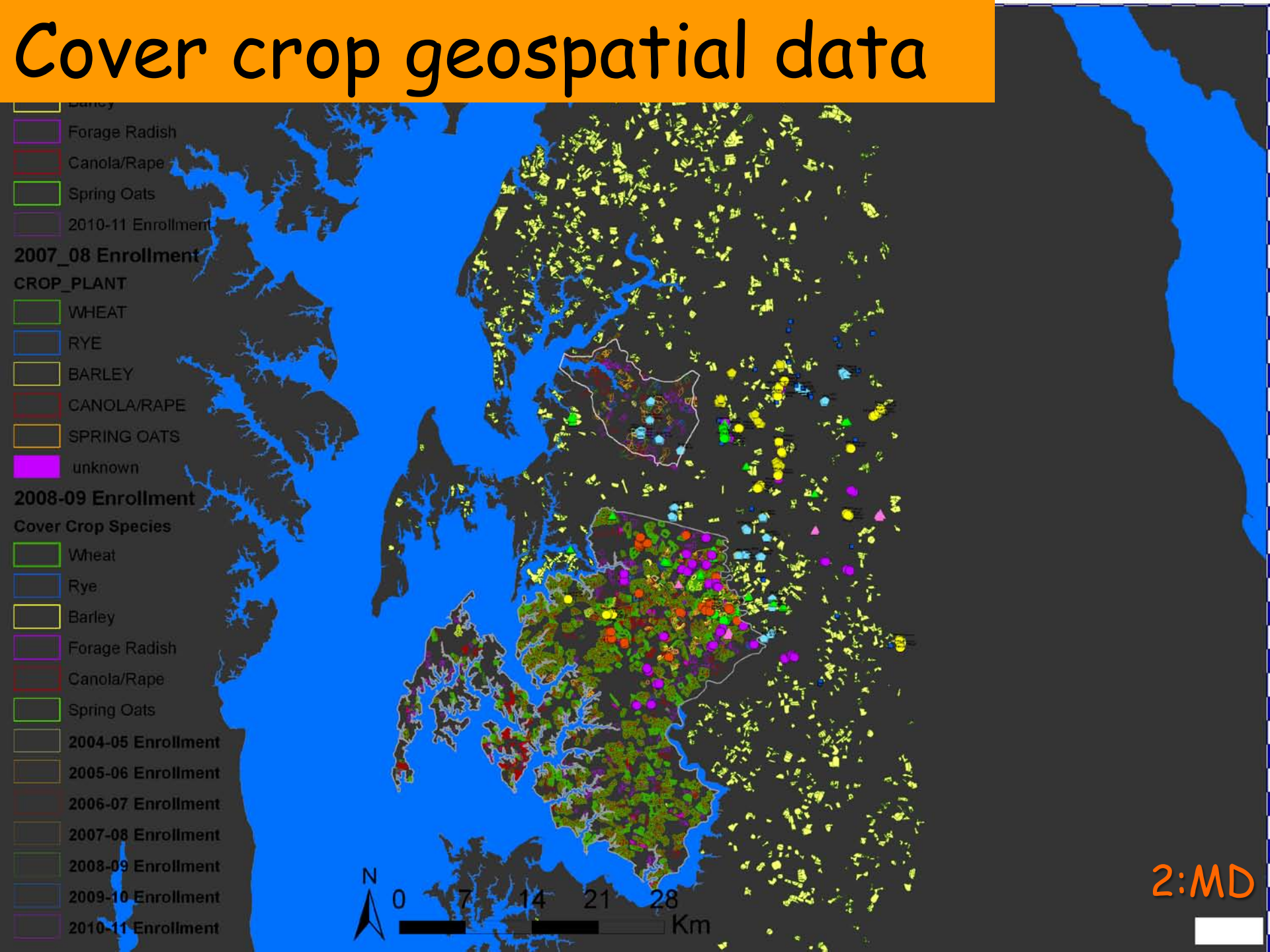




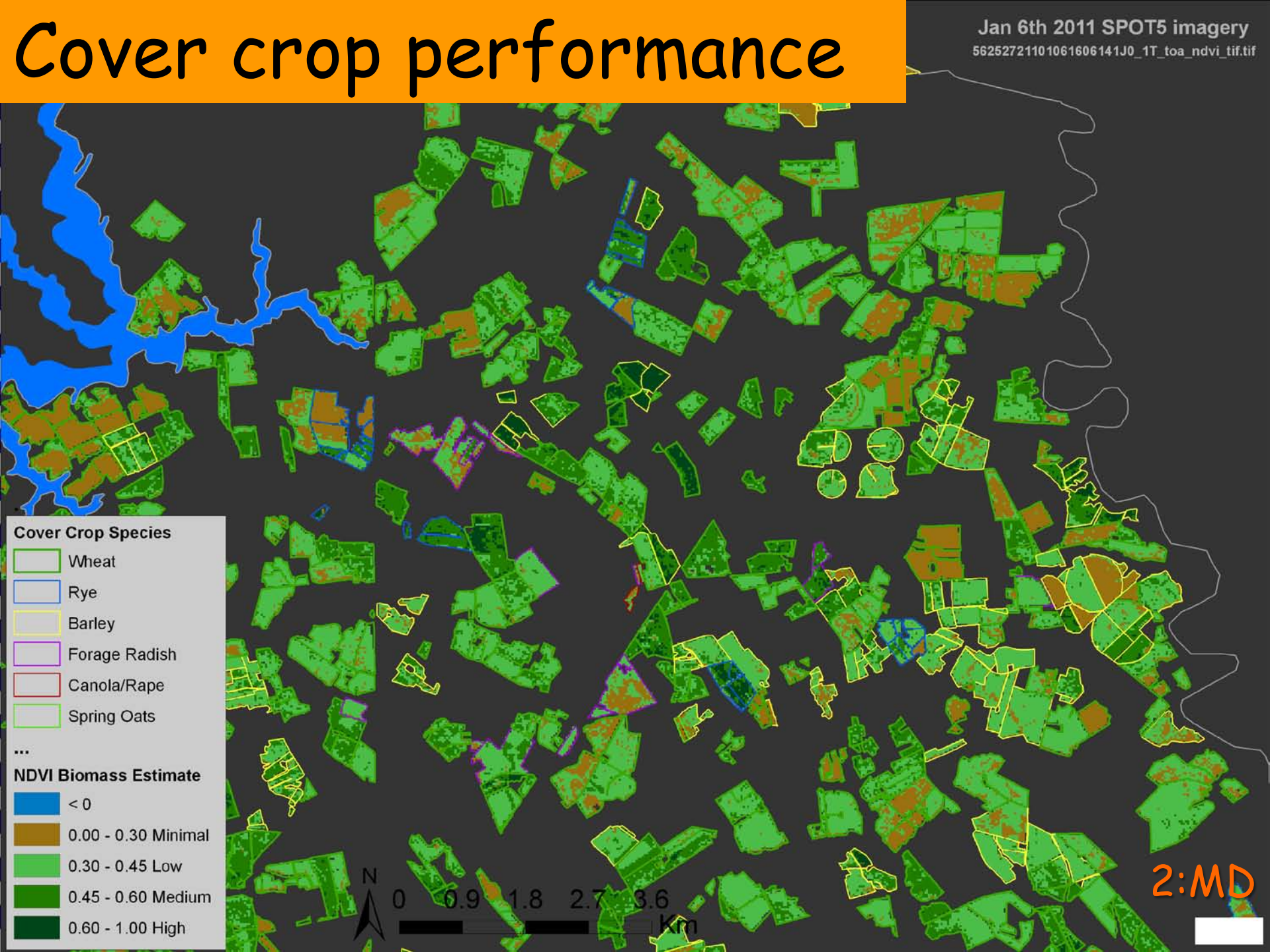
Establishing relationships between satellite derived vegetation index (NDVI) and cover crop biomass production


ln(Biomass)
10
8
6
4
2
0.1
0.2
0.3
0.4
0.5
0.6
0.7
NDVI
Rye + Wheat Dec
Rye + Wheat Mar
December
March

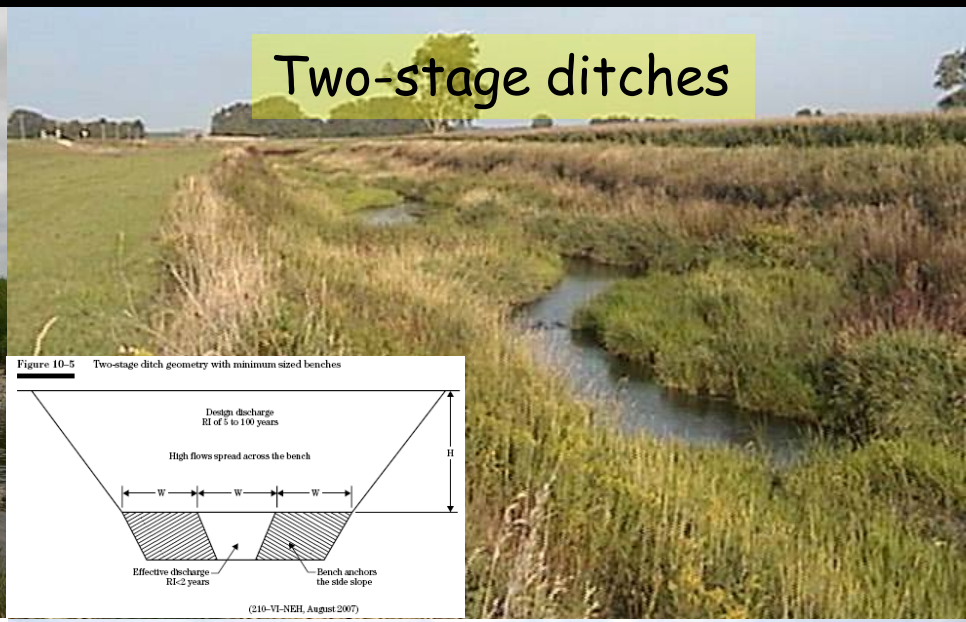
Cover crop geospatial data

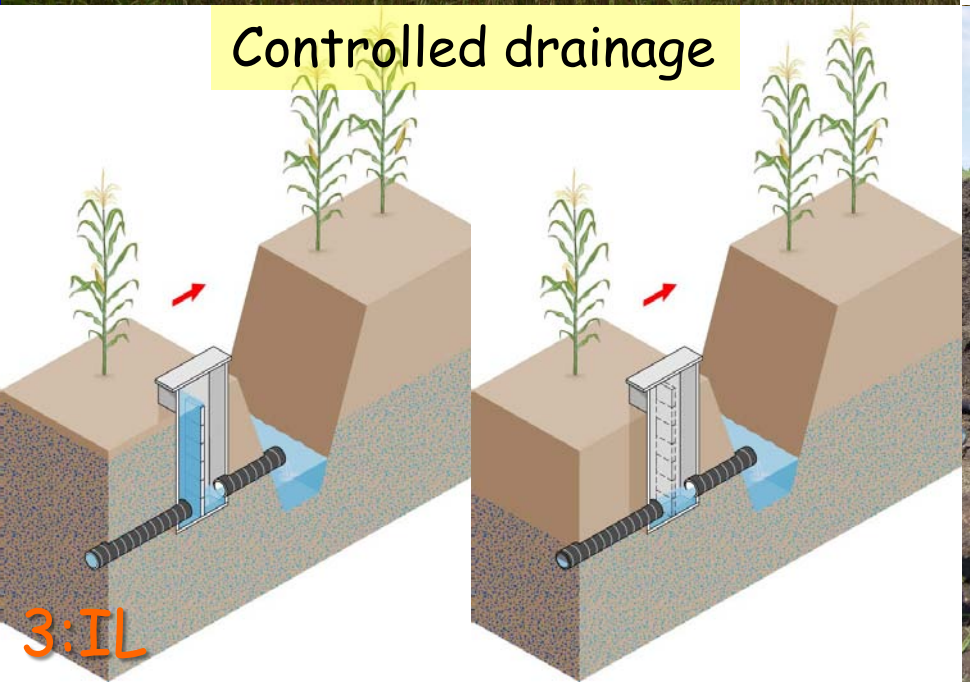


Cover crop performance



Improving Water Quality in Tile Drained Watersheds with Conservation Practices



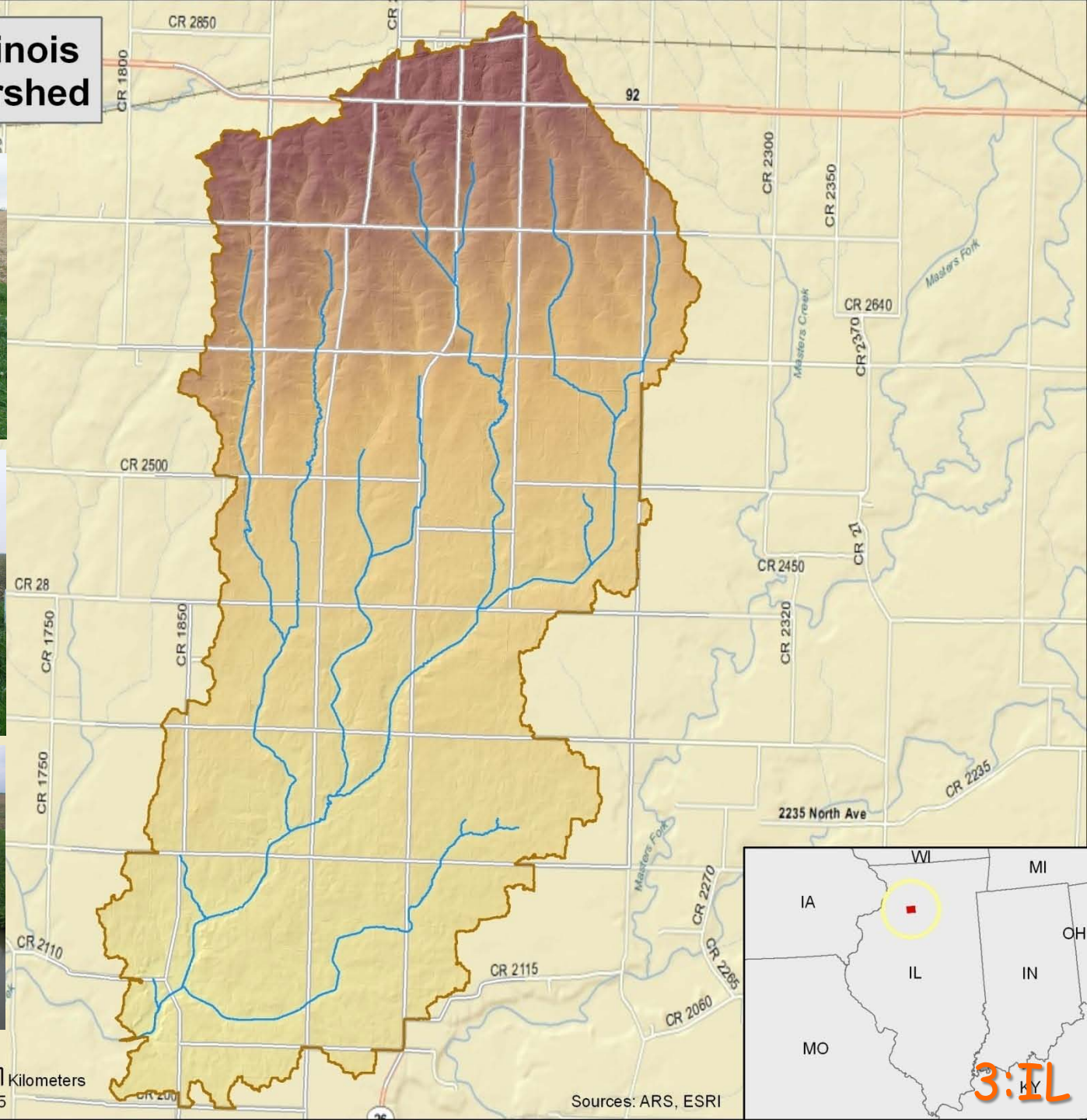


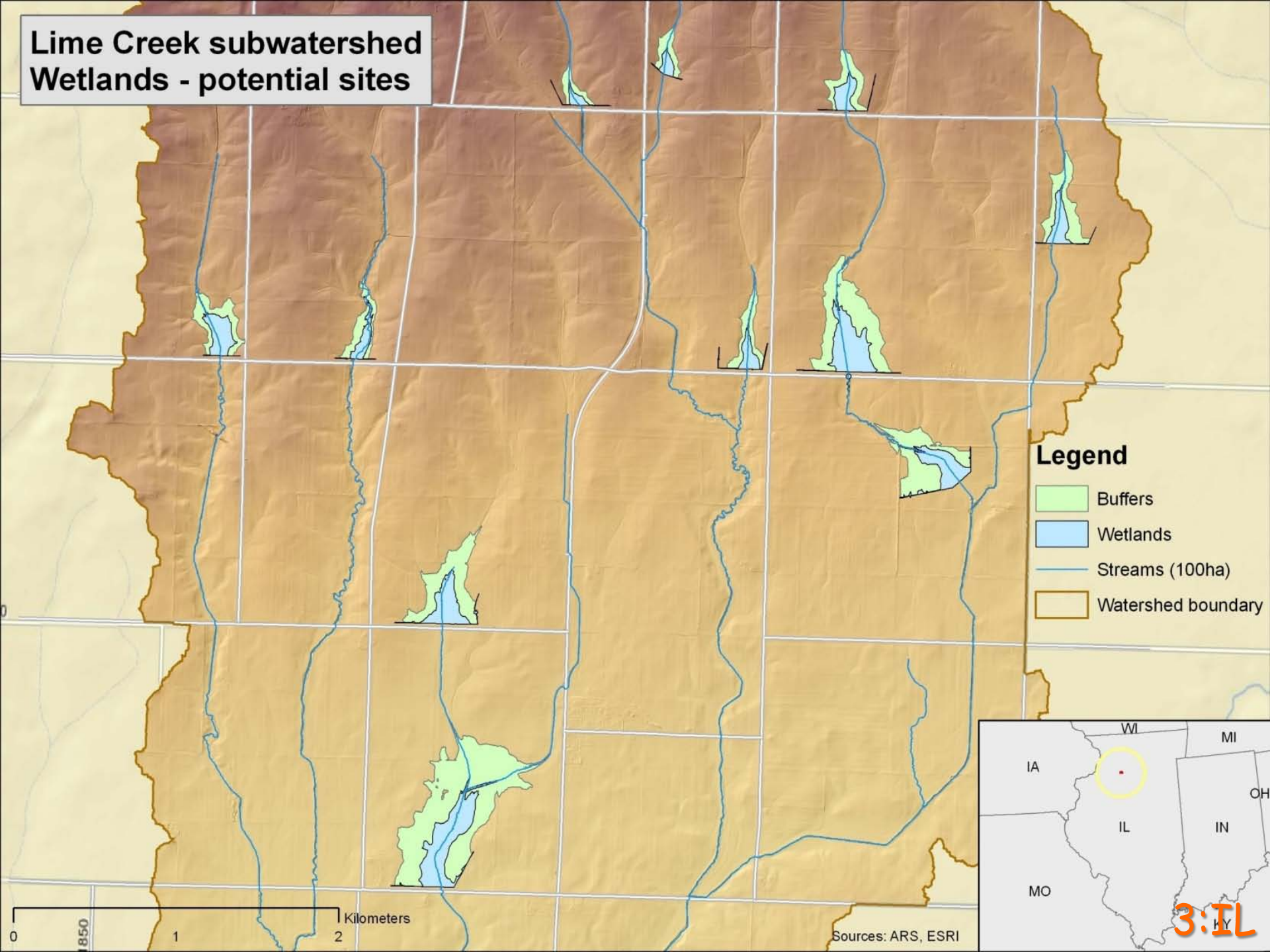
Big Bureau Creek, Illinois
Lime Creek subwatershed

Upper Watershed

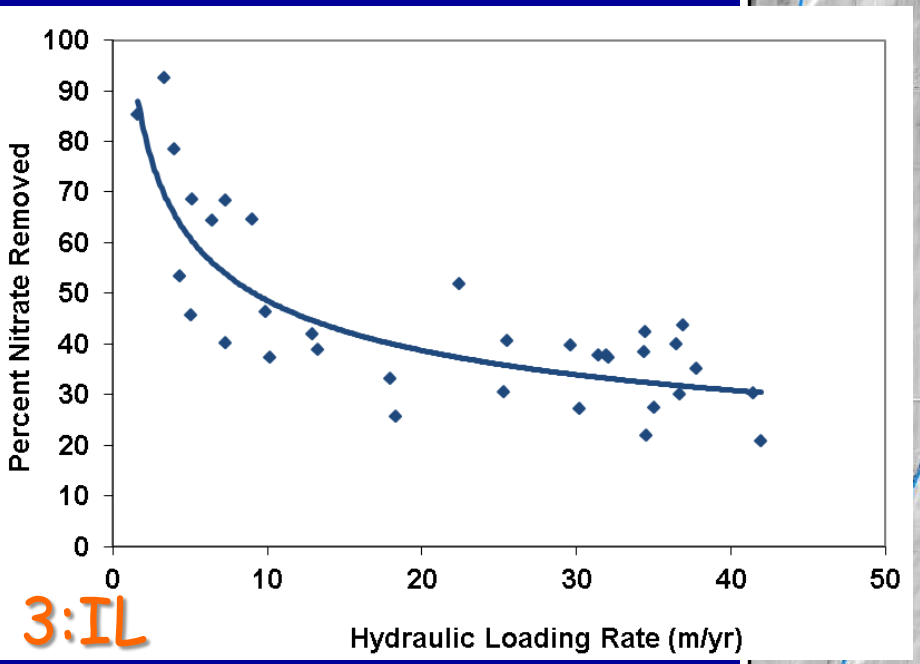
Middle Watershed

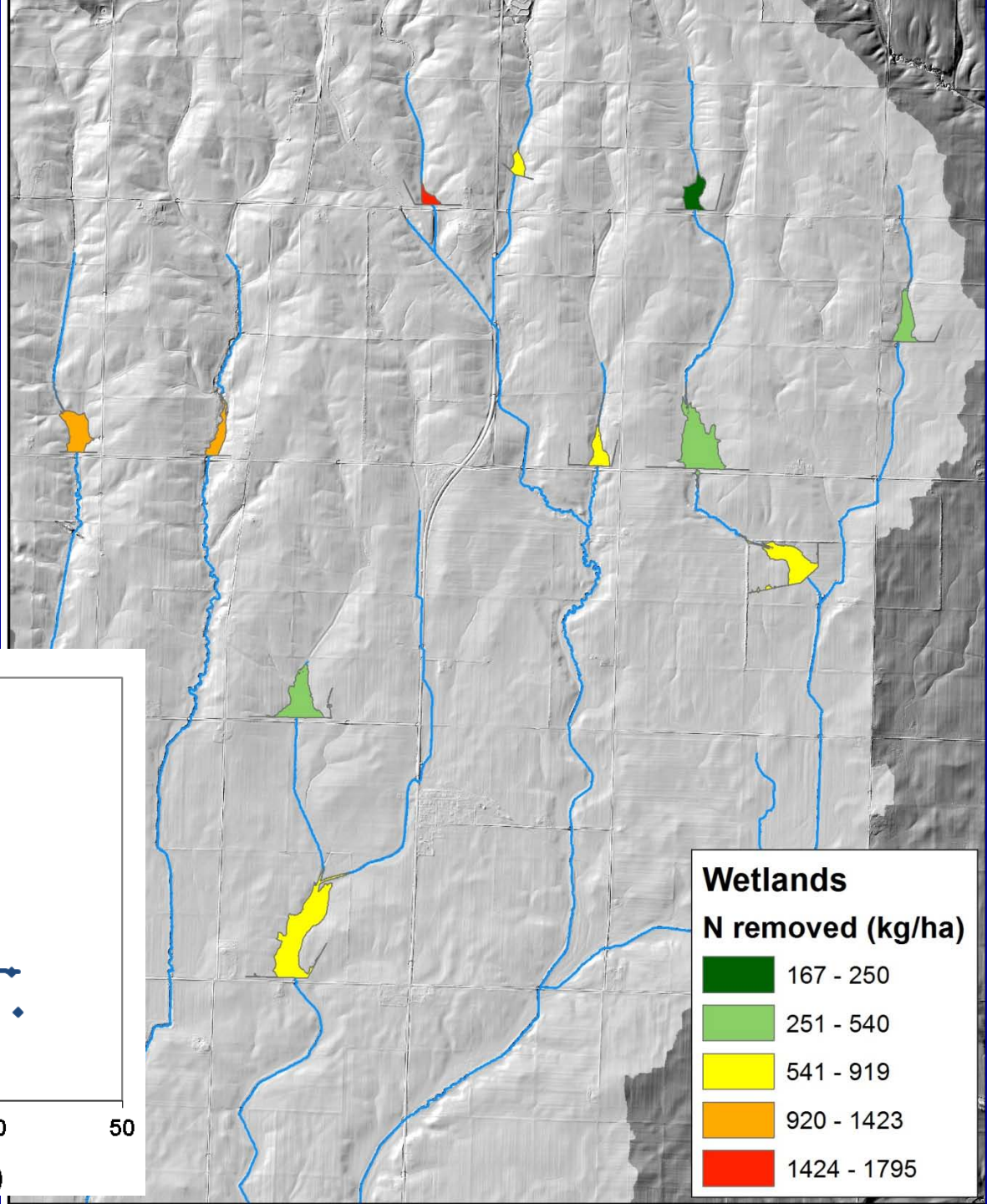
Lower Watershed




Lime Creek subwatershed
Wetlands - potential sites
Legend
Buffers
Wetlands
Streams (100ha)
Watershed boundary
0
1
2
Kilometers
Sources: ARS, ESRI
WI
MI
IA
OH
IL
IN
MO
KY
3:IL

Variation in Estimated Mass Nitrate-N Removals

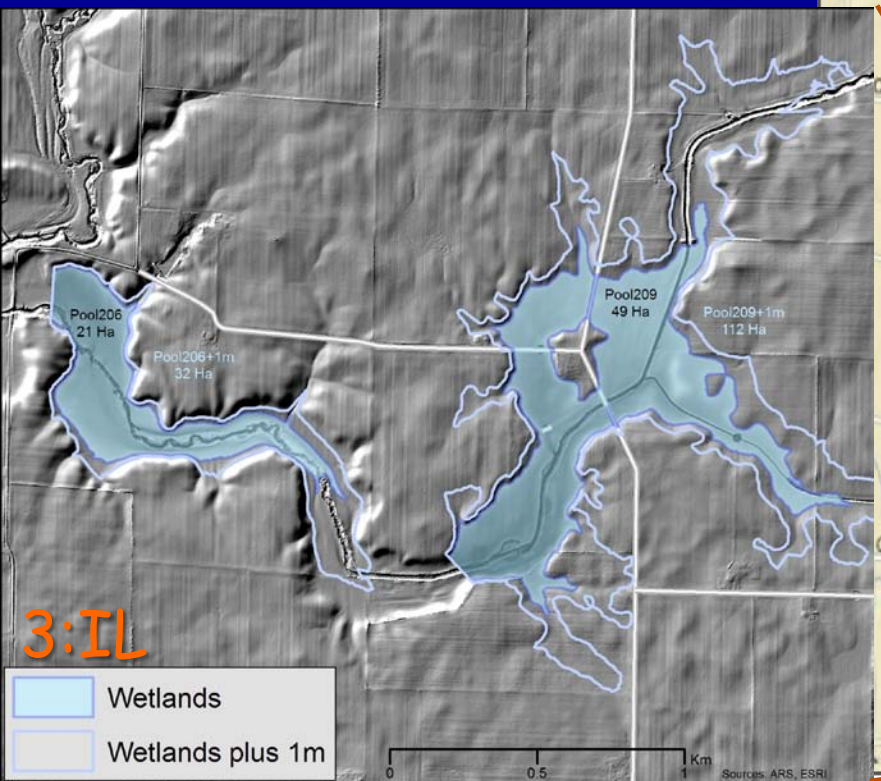


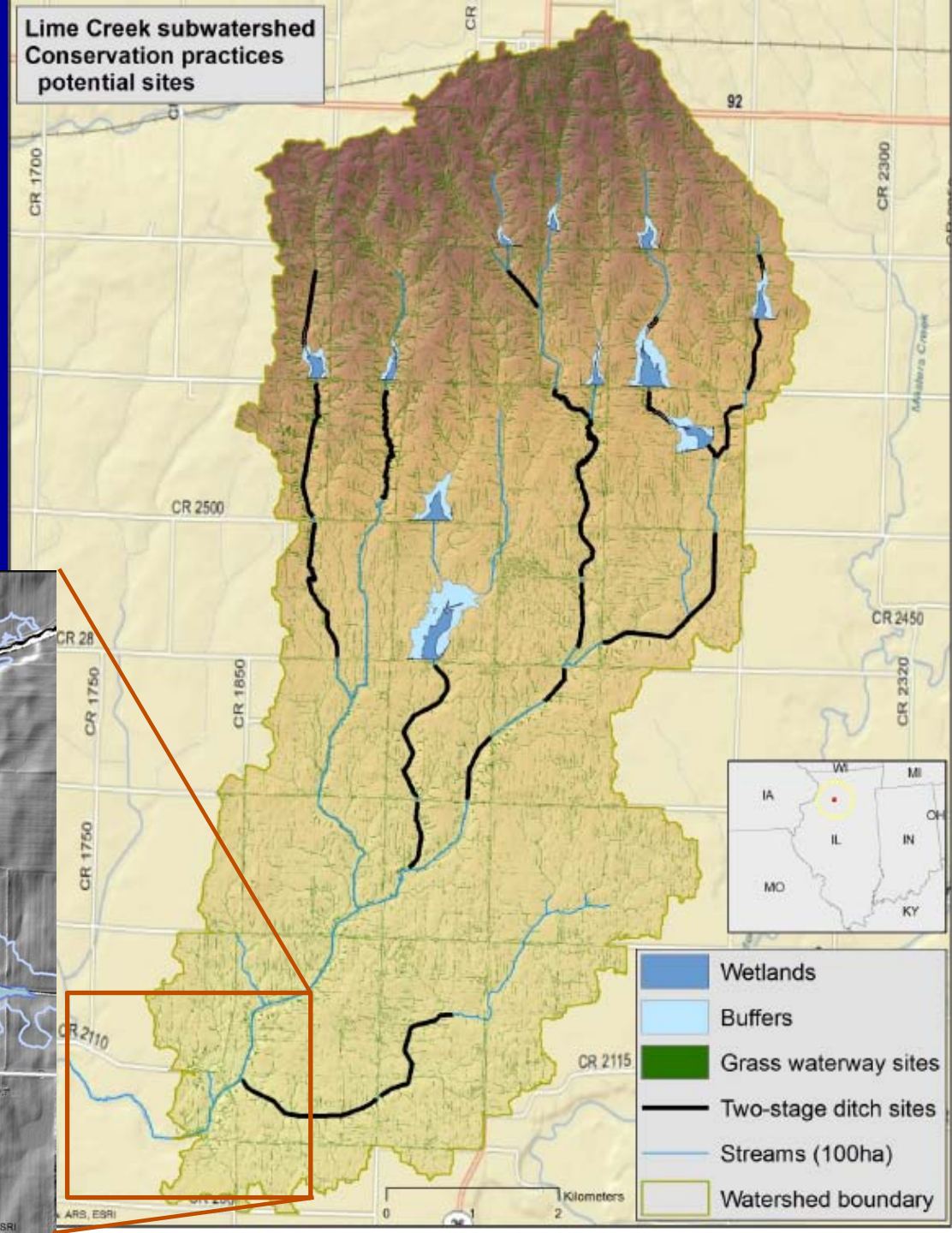


3:IL

Development of conservation planning scenarios:

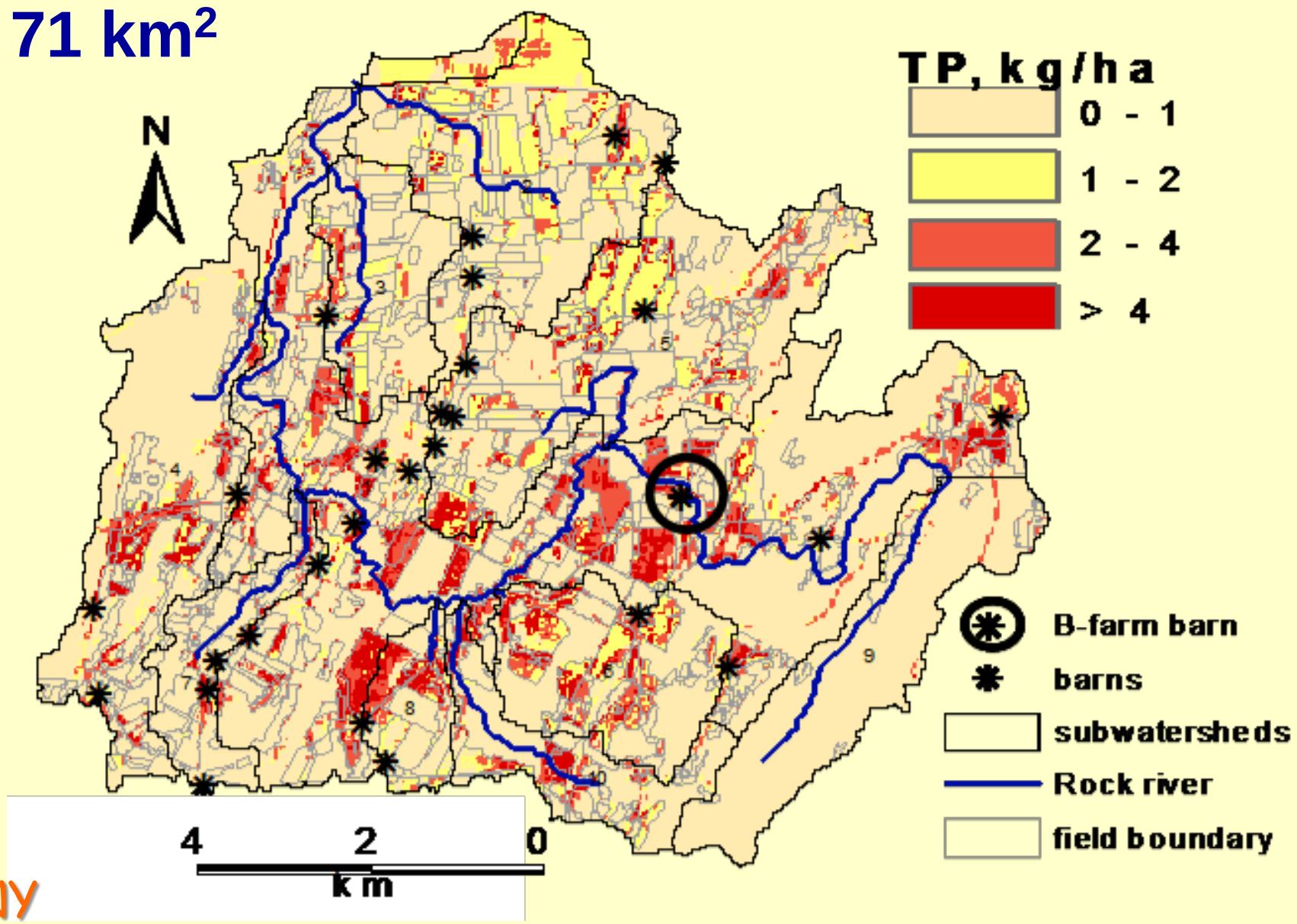
1. Multiple practices
2. Large wetland at outlet





Lake Champlain subbasin

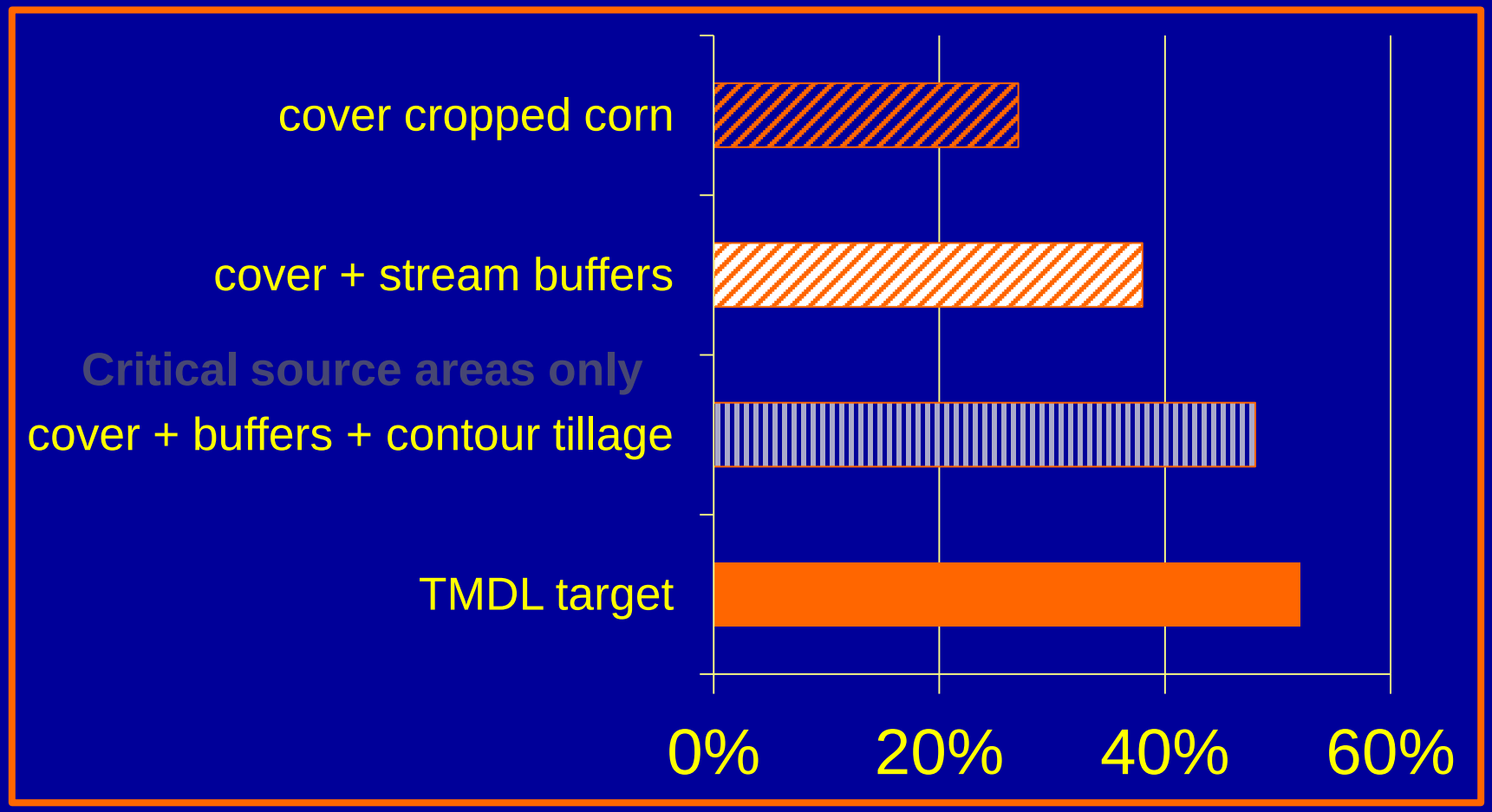
71 km²



4:NY

Watershed-level impact

P loss at outlet: % _____ from baseline



4:NY

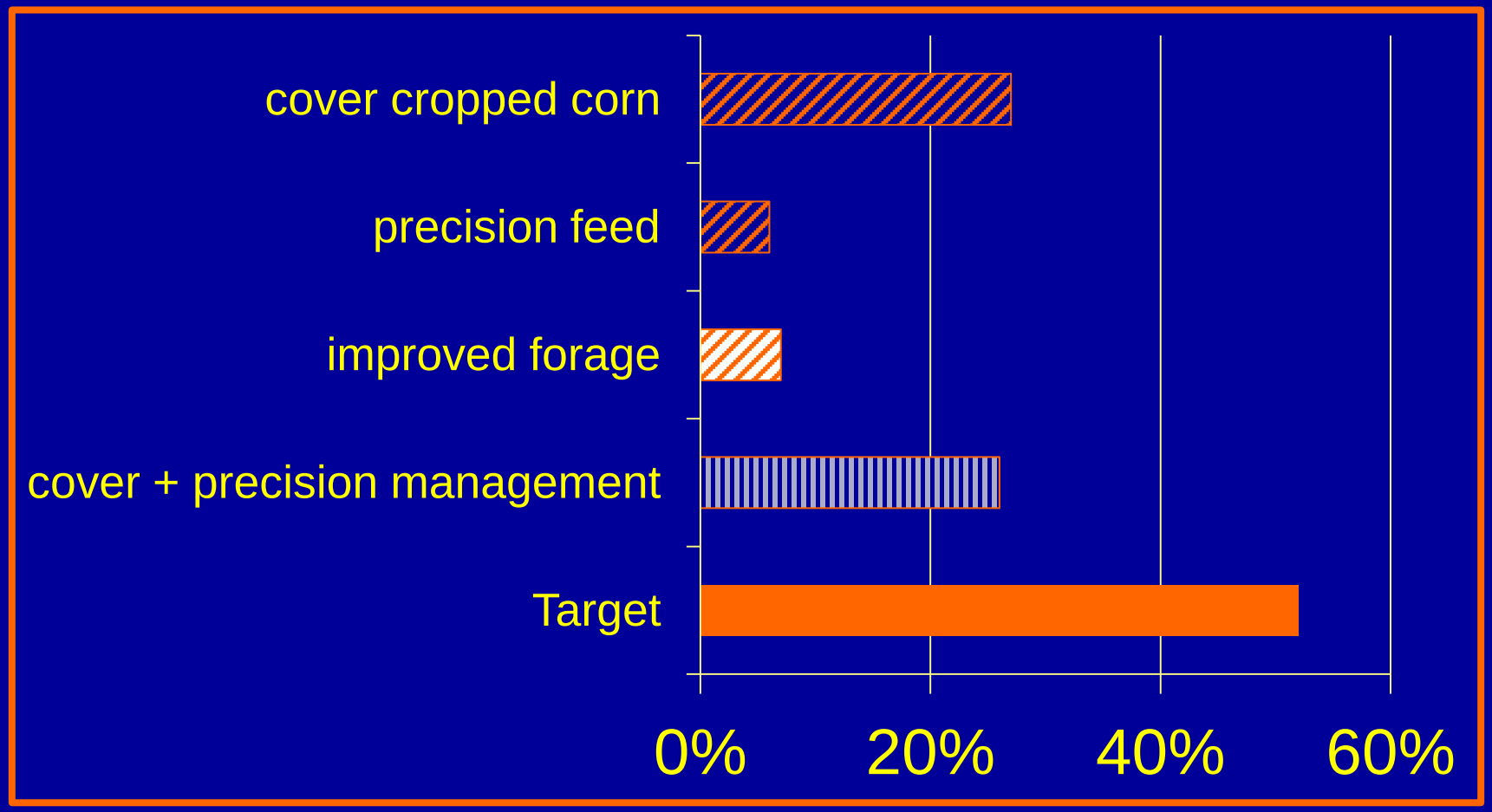
Assessment at the farm-level

% *change* from baseline

	Soil-P build-up	Off-farm P Loss	Farm Net Return
Cover crop	+1.0	-75	-113
Stream buffer	+0.8	-22	-69
Precision Management + Buffer	**-11**	**-11**	**+213**

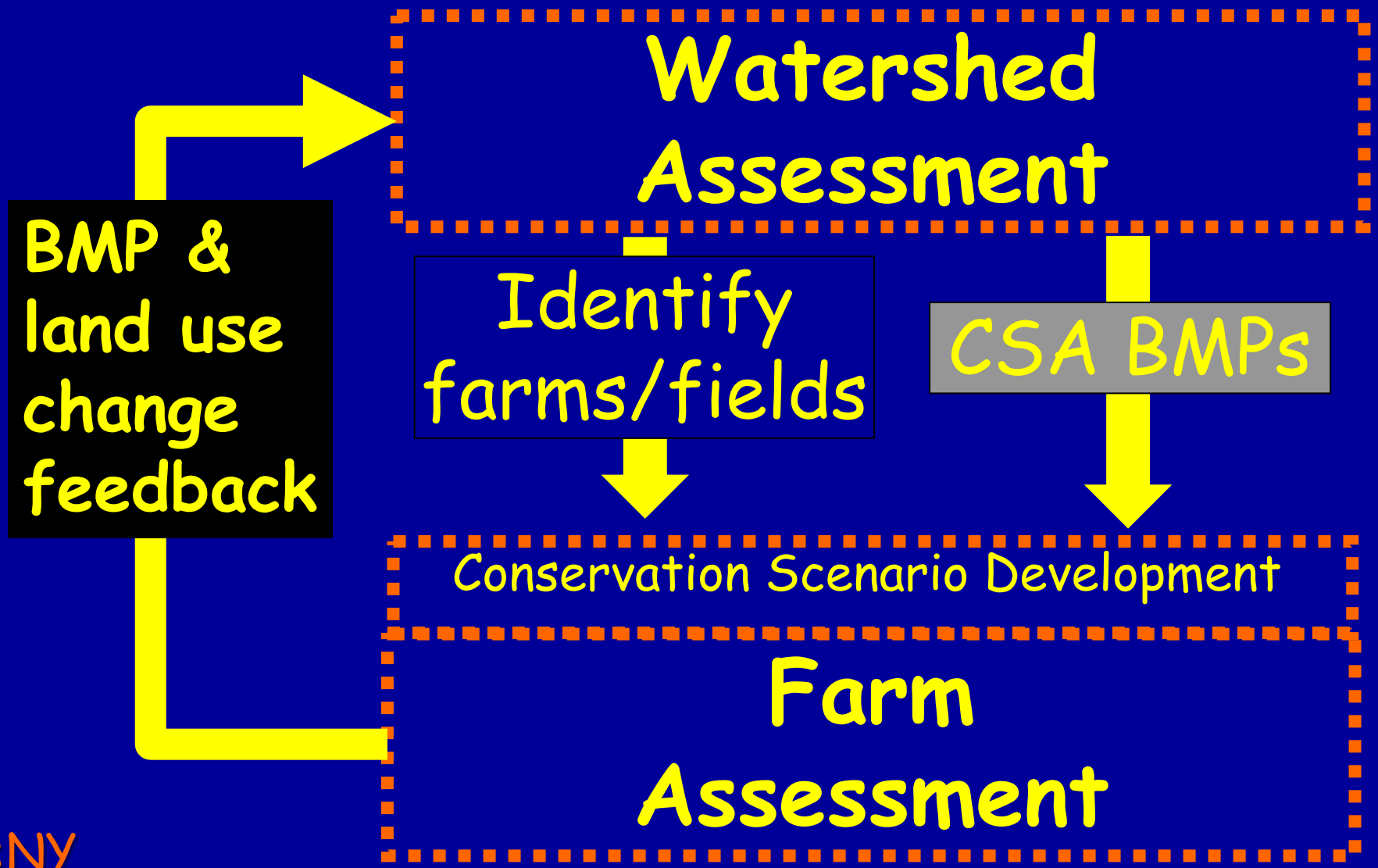
Watershed-level reassessment

P loss at outlet: % *decrease* from baseline



4:NY

Integrated framework for conservation assessment



Conclusions

- Optimizing conservation planning in watersheds will require farm and field scale information.
- A variety of approaches can help translate from watershed to farm scale.
- Quality geospatial data (soils, terrain, land use) and stakeholder involvement are critical to success.
- Integrating of models with spatial data provides feedback to assess effectiveness of conservation practices at watershed scale, enabling adaptive management approaches.