National Biological Assessment and Criteria Workshop

Advancing State and Tribal Programs

Coeur d'Alene, Idaho
31 March – 4 April, 2003

WET 101

Monitoring and Assessment Data Use and Application: Establishing Common Measurement Endpoints for Ambient Assessments

Juniata Case Study

Presented by

Rob Brooks

Penn State Cooperative Wetlands Center

Primary Goals

- Technical preparation necessary for improved coordination of SW and wetland monitoring programs
- Regionalization of existing monitoring and assessment tools for wetlands
- Use of monitoring and assessment tools for improved restoration and mitigation
- Provision of training
- Source of information on monitoring and assessment tools

Developing the Science behind a State Monitoring Program

Denice Heller Wardrop

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Special thanks to Doreen Vetter, EPA OWOW, Mary Kentula, EPA WRP (Art Spingarn, EPA III) and Ken Reisinger, PA DEP

Why on a watershed basis?

- Watersheds are more efficient unit financially, socially, ecologically
- Accounting Unit (AU) for Integrated 303(d)/305(b) Reporting
- Conceptually attractive for local managers

Why/Why Not Wetlands?

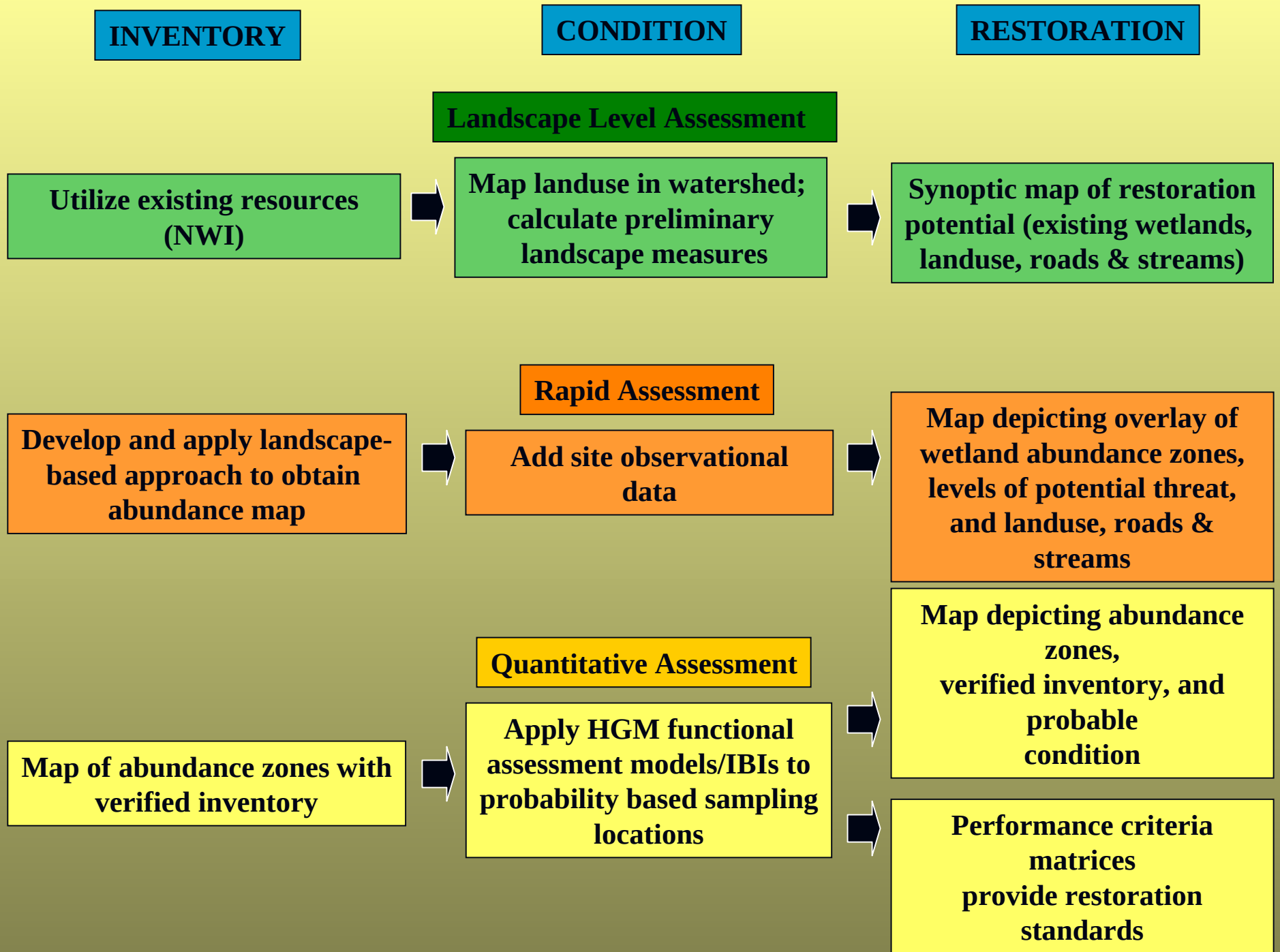
- Defined as “waters of the U.S.”
- Section 305(b) requires assessment every two years
- Advances in wetland assessment (e.g., HGM, IBIs, EPA-EMAP)
- Methods that are easily implementable and scientifically defensible
- Representative sample is difficult
- Potential cost may be inordinately high

What's the immediate problem?

- Not all decisions call for the same level of information
- Need multi -level assessment methodology
- Need representative sample

Questions

- How do we find the wetlands? (Inventory)
- How do we assess their ecological integrity? (Condition)
- How do we use this information to improve condition? (Restoration)


INVENTORY
CONDITION
RESTORATION
Landscape Level Assessment
Utilize existing resources (NWI)
Map landuse in watershed; calculate preliminary landscape measures
Synoptic map of restoration potential (existing wetlands, landuse, roads & streams)
Rapid Assessment
Develop and apply landscape-based approach to obtain abundance map
Add site observational data
Map depicting overlay of wetland abundance zones, levels of potential threat, and landuse, roads & streams
Quantitative Assessment
Map depicting abundance zones, verified inventory, and probable condition
Map of abundance zones with verified inventory
Apply HGM functional assessment models/IBIs to probability based sampling locations
Performance criteria matrices provide restoration standards

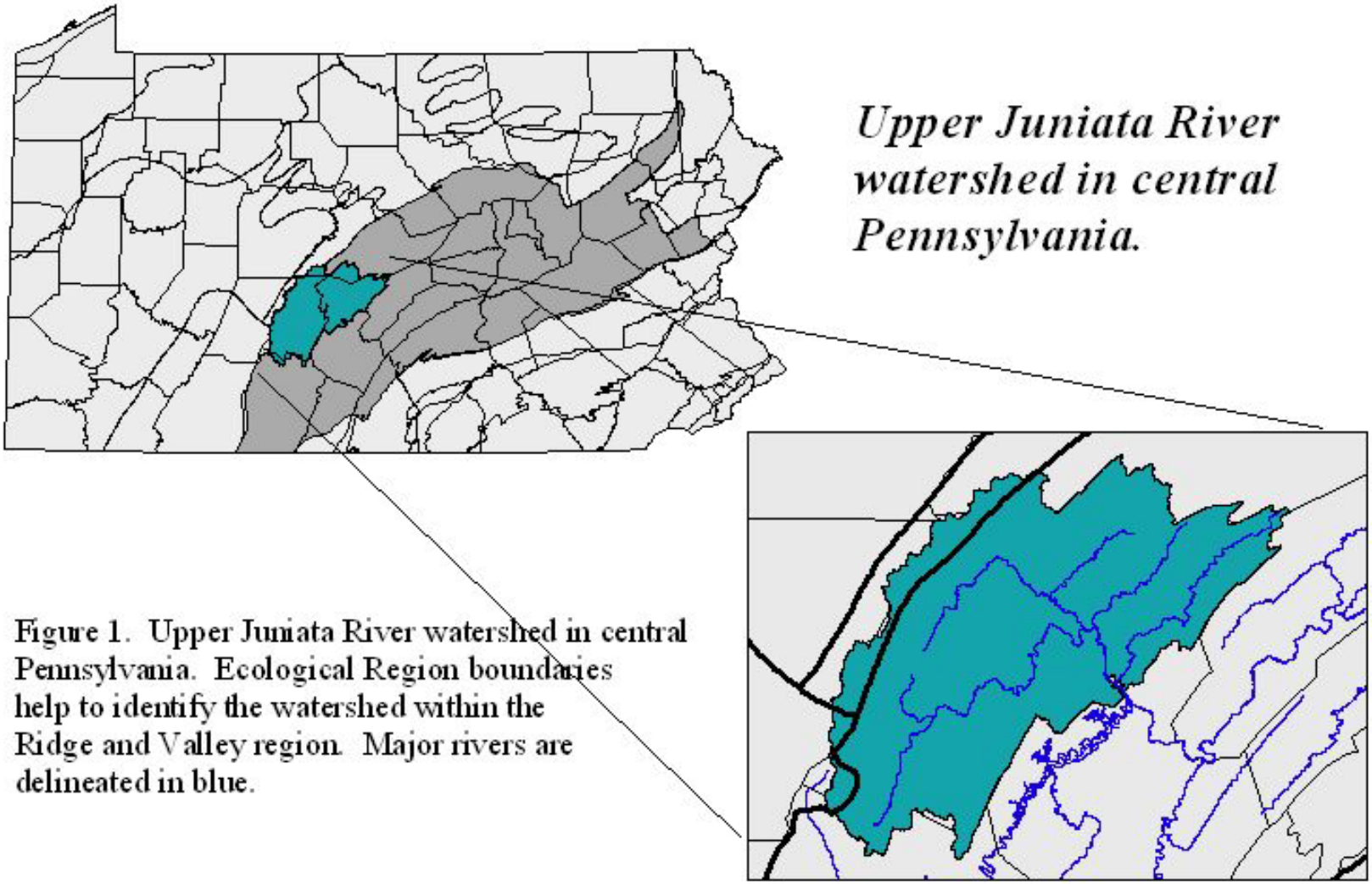


Figure 1. Upper Juniata River watershed in central Pennsylvania. Ecological Region boundaries help to identify the watershed within the Ridge and Valley region. Major rivers are delineated in blue.

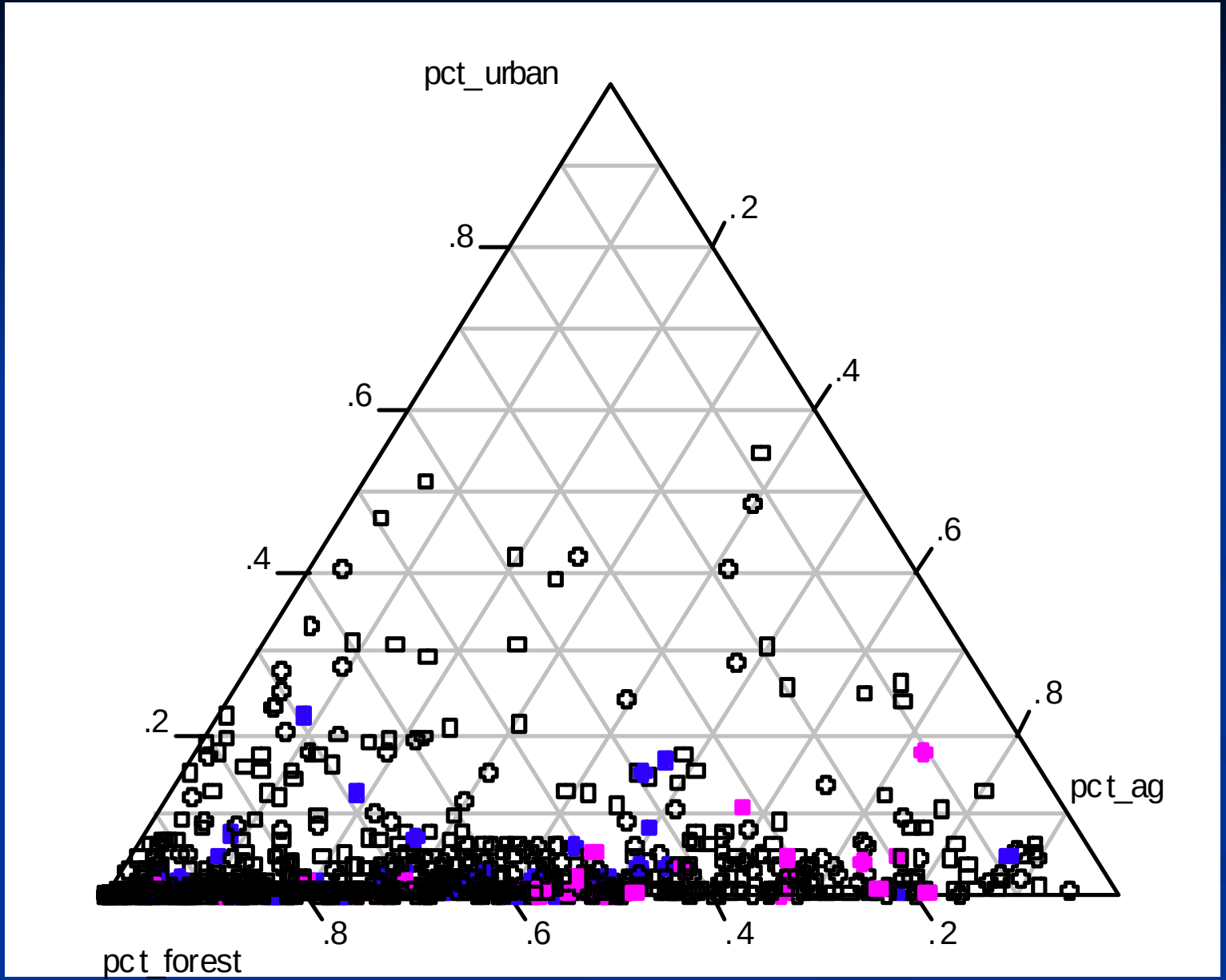
Landscape Level Assessment

Forested is our reference standard

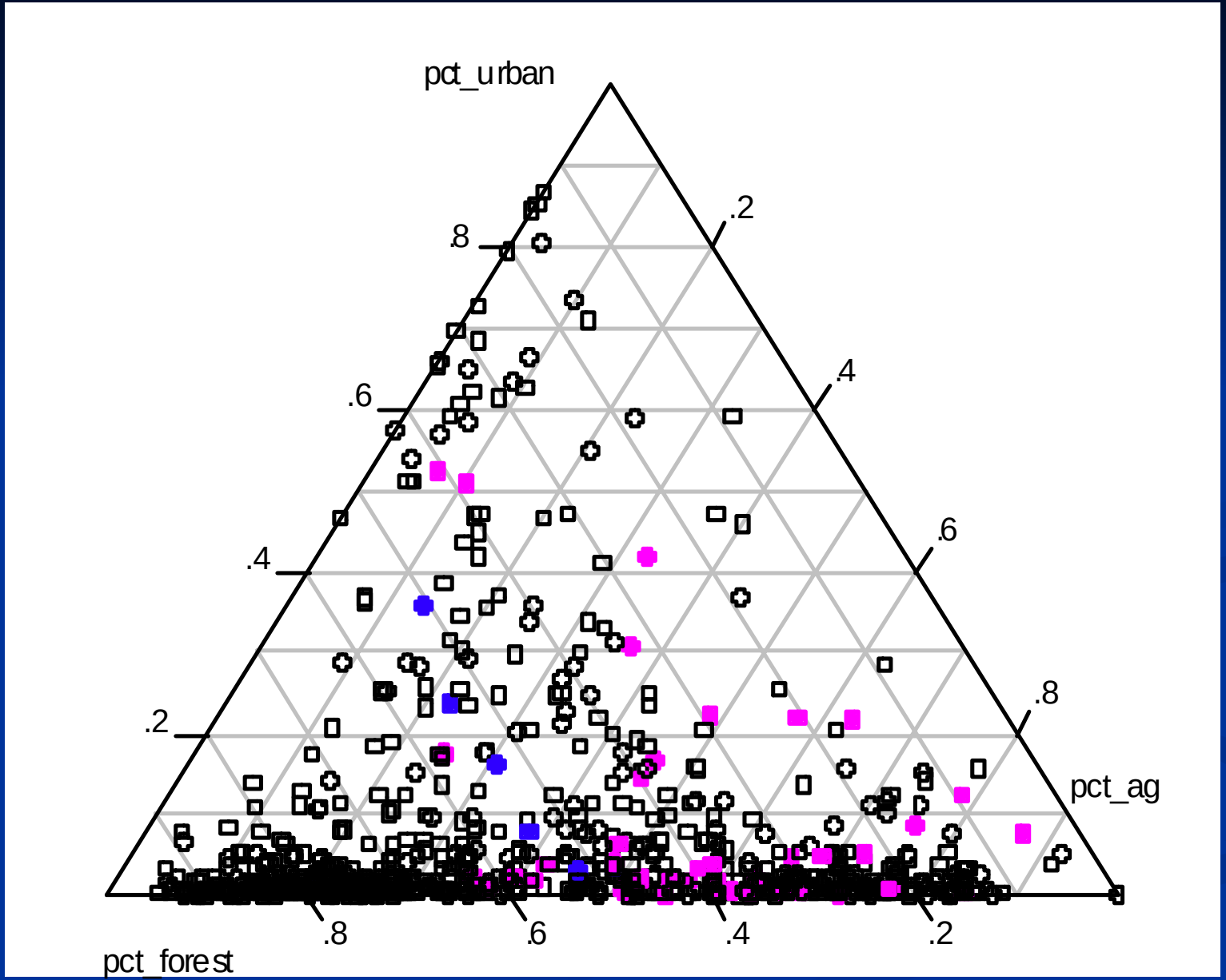
Agricultural Use is a Major Activity

That Exerts Its Influence to Varying Degrees

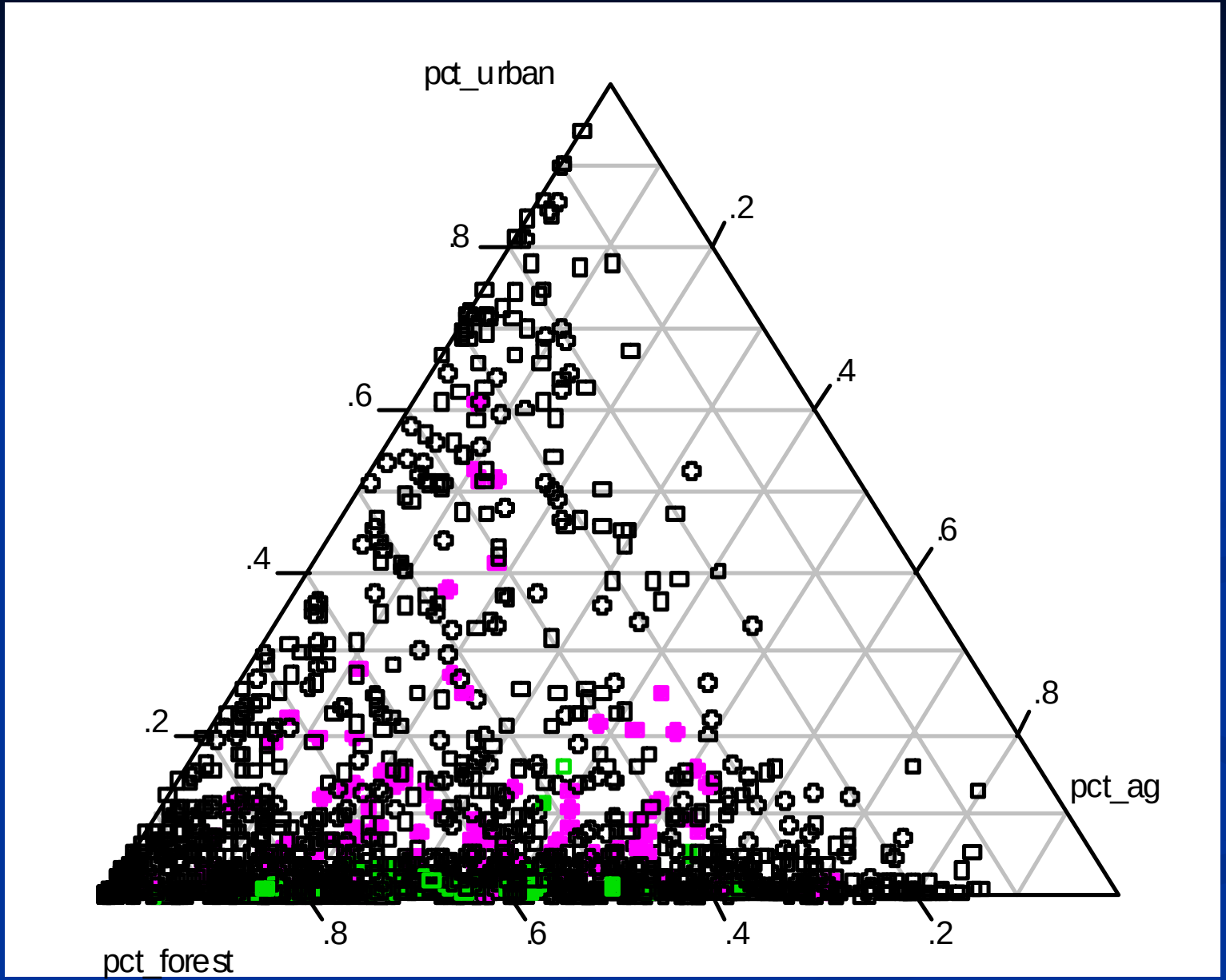
Ridge and Valley Watersheds

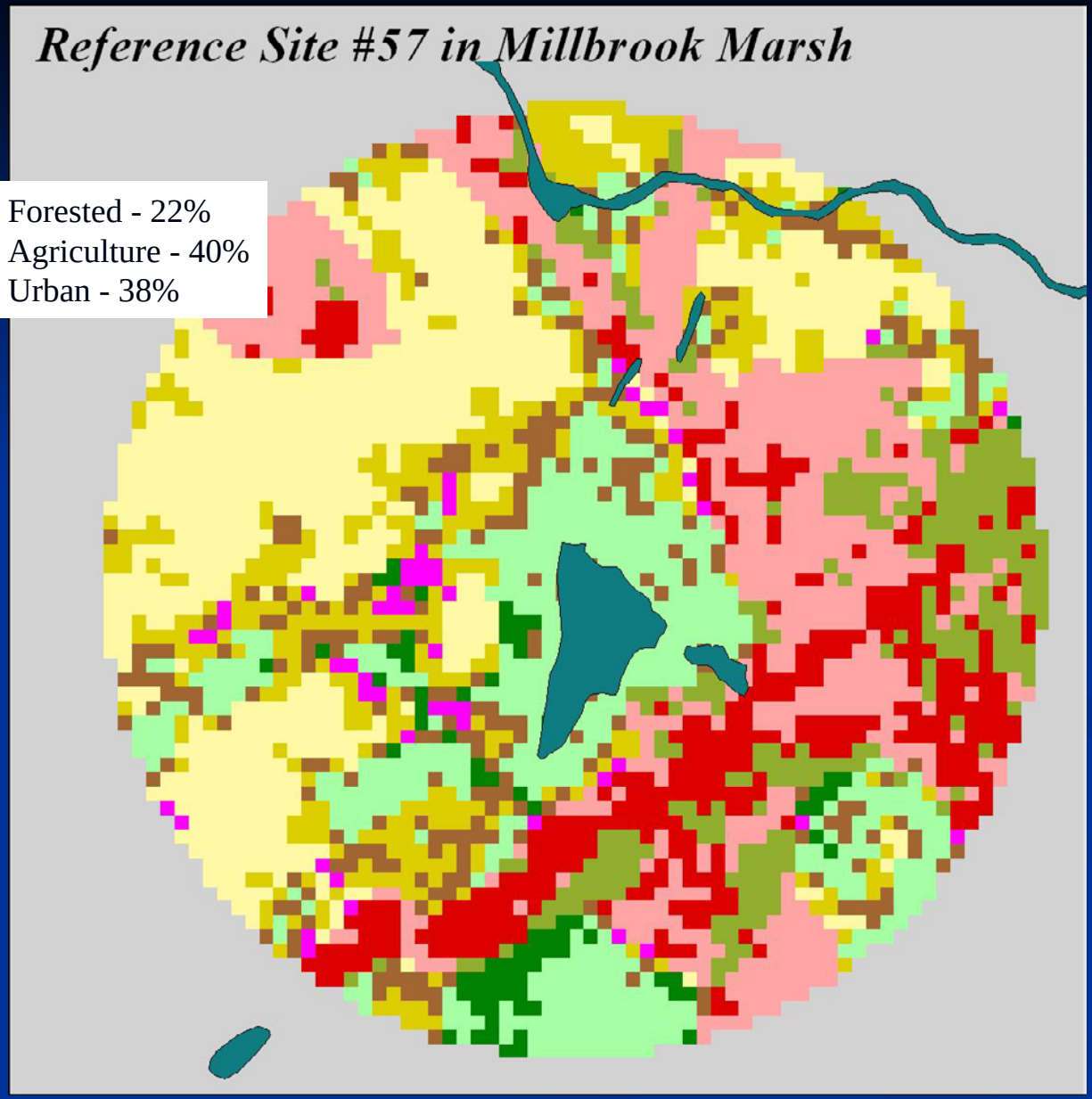


Piedmont Watersheds

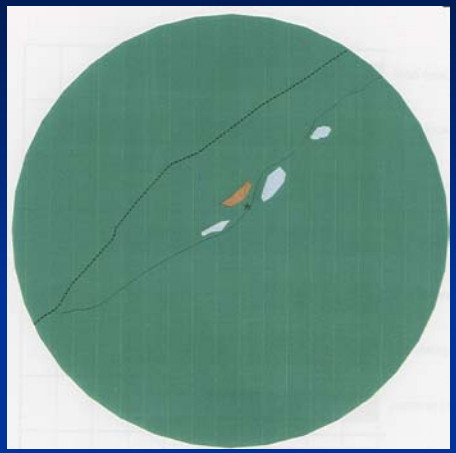


Coastal Plain Watersheds




Reference Site #57 in Millbrook Marsh
Forested - 22%
Agriculture - 40%
Urban - 38%

Land Use Patterns



%For=96
MFPS=302
SDI=0.2
RD=8

%For =25
MFPS=3
SDI=1.1
RD=8

%For =41
MFPS=55
SDI=1.6
RD=24

%For =17
MFPS=3
SDI=1.7
RD=47

Rapid Assessment

STRESSOR CHECKLIST

Stressor Score: _____

Site Name: _____ Site Number: _____ Date: _____

Buffer Type*:	Buffer Width: >100	30-100	10-30	3-10	0-3
Natural Forest	14	12	10	8	6
Shrub/Sapling	12	10	8	6	4
Perennial Herb	10	8	6	4	2
Other	0	0	0	0	0

*If exactly one-half of two buffer types, take half the sum

Buffer Width _____ (m) Buffer Score _____

Buffer Type

☐ Natural Forest ☐ Perennial Herb

☐ Shrub/Sapling ☐ Other (list) _____

Hydrologic Modification

Score: _____ *(Score = the number of checked boxes)*

- ☐ Ditch
- ☐ Tile Drain
- ☐ Dike
- ☐ Weir/dam *Type:* _____
- ☐ Stormwater inputs/culvert
- ☐ Point source (non-stormwater)
- ☐ Filling, grading, dredging (of wetland/waterbody or immediate buffers)
- ☐ Road bed/railroad
- ☐ Dead/dying trees
- ☐ Other _____

Sedimentation

Score: _____

- ☐ Sediment deposits/plumes
- ☐ Eroding banks/slopes
- ☐ Active/recently active adjacent construction, plowing, heavy grazing, or forest harvesting
- ☐ Siltlines on ground or vegetation
- ☐ Urban/road stormwater input/culvert
- ☐ Dominant presence (>50% of vegetation) of sediment tolerant plants (see list)
- ☐ Other _____

Dissolved Oxygen

Score: _____

- ☐ Excessive density of aquatic plants or algal mats in water column
- ☐ Excessive deposition or dumping of organic waste (e.g., leaves, grass clippings, woody debris, etc.)
- ☐ Direct discharges of organic wastewater or material (e.g., milkhouse waste, food-processing waste, other wastewater sources)

Contaminant Toxicity

Score: _____

- ☐ Severe vegetation stress
- ☐ Obvious spills, discharges, plumes, odors
- ☐ Wildlife impacts (e.g., tumors, abnormalities, etc.)
- ☐ Adjacent industrial sites, proximity of railroad
- ☐ Other _____

Vegetation Alteration

Score: _____

- ☐ Mowing
- ☐ Grazing
- ☐ Tree cutting (> 50 % canopy removal)
- ☐ Brush cutting (mechanized removal of shrubs/saplings)
- ☐ Removal of woody debris
- ☐ Aquatic weed control (mechanical or herbicide)
- ☐ Excessive herbivory (deer, muskrat, geese, carp, etc.)
- ☐ Dominant presence (>50% of the vegetation) of exotic or aggressive plant species (see list)
- ☐ Evidence of chemical defoliation
- ☐ Other _____

Eutrophication

Score: _____

- ☐ Direct discharges from agricultural feedlots, manure pits, etc.
- ☐ Direct discharges from septic or sewage treatment systems
- ☐ Heavy or moderately heavy formation of algal mats
- ☐ Dominant presence (>50% of vegetation) of nutrient tolerant species (e.g., uniform stands of exotic/aggressive species - see list)
- ☐ Other (e.g., signs of excess nutrients - methane odor, dead fish, etc.) _____

Acidification

Score: _____

- ☐ AMD discharges
- ☐ Adjacent mined lands/spoil piles
- ☐ Excessively clear water
- ☐ Absence of expected biota
- ☐ Other (e.g., abnormally low pH measure) _____

Turbidity (if high conc, check both boxes)

Score: _____

- ☐ High concentration of suspended solids in water column
- ☐ Moderate concentration of suspended solids in water column

Thermal Alteration (if high temp, check both boxes)

Score: _____

- ☐ Significant increase water temperture
- ☐ Moderate increase in water temperature

Salinity

Score: _____

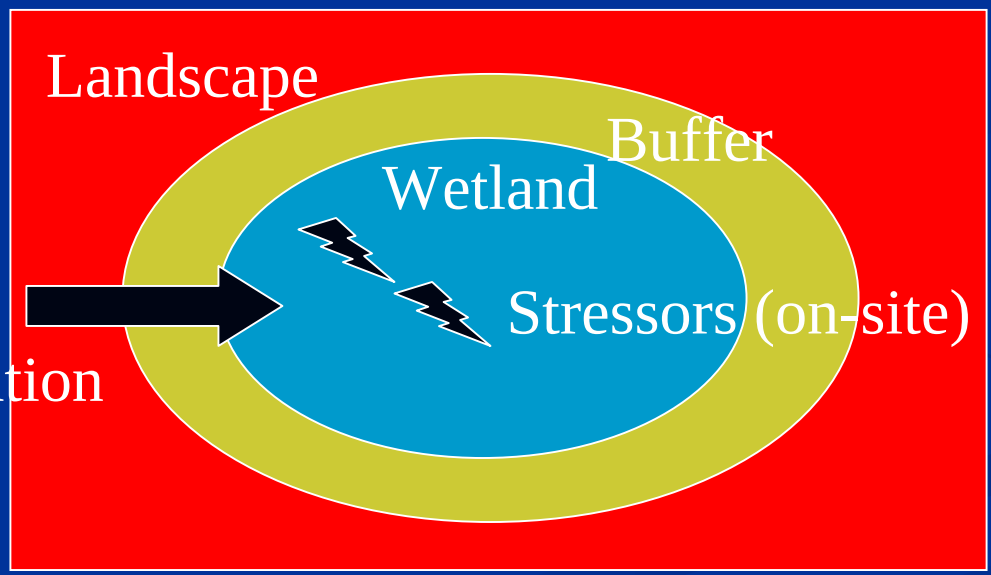
- ☐ Obvious increase in concentration of dissolved salts

Stressor Checklist

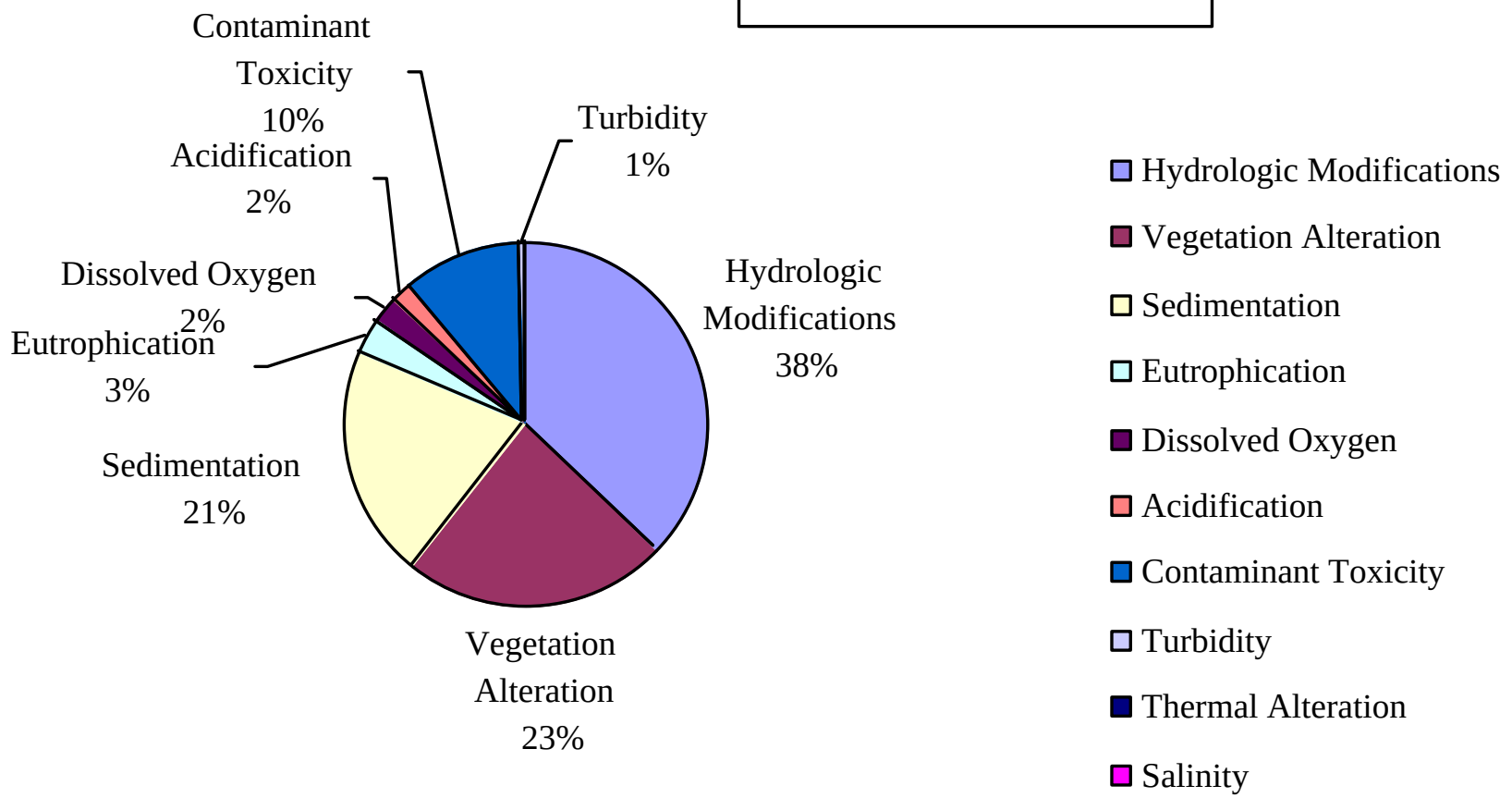
- Hydrologic Modification
- Sedimentation
- Dissolved oxygen
- Contaminant toxicity
- Vegetation alteration
- Eutrophication
- Acidification
- Turbidity
- Thermal Alteration
- Salinity

Rapid Assessment Score

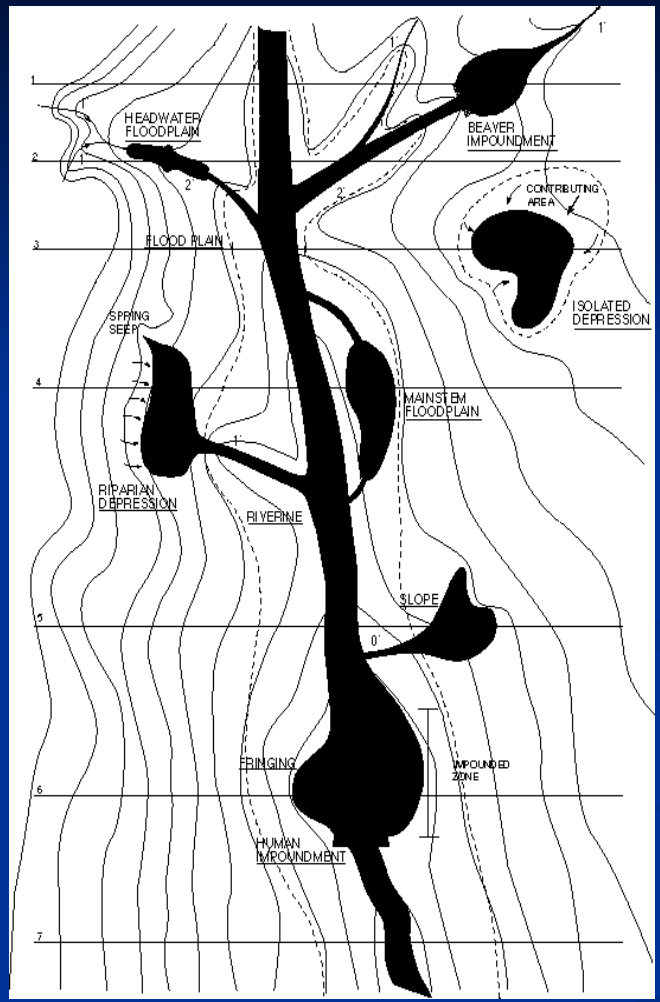
- Combination of landscape, buffer, and site-specific stressors
- Score=Buffer+(%For*WF)-Buffer Hits



Juniata Stressors
All Sites



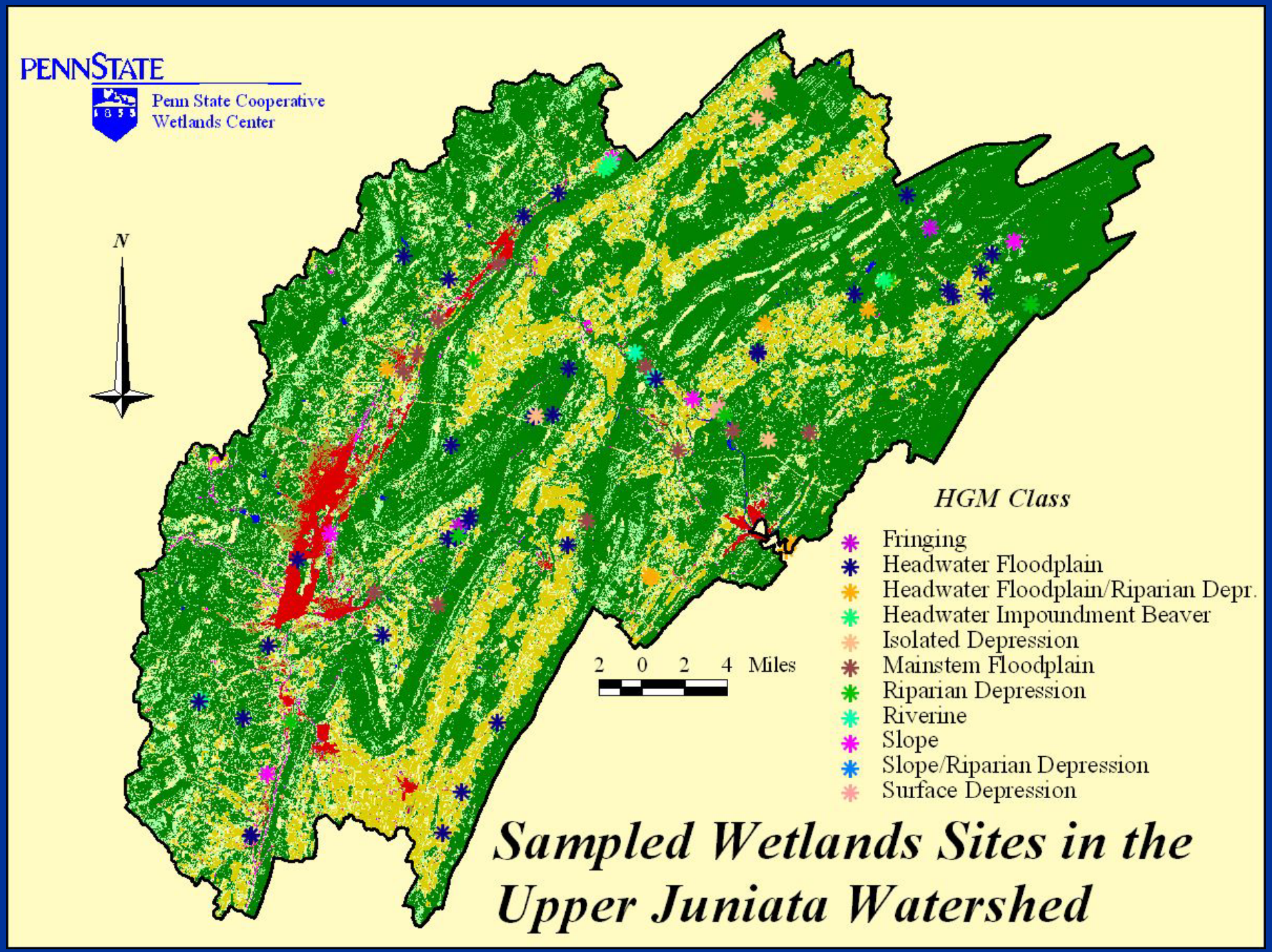
Headwater Floodplain



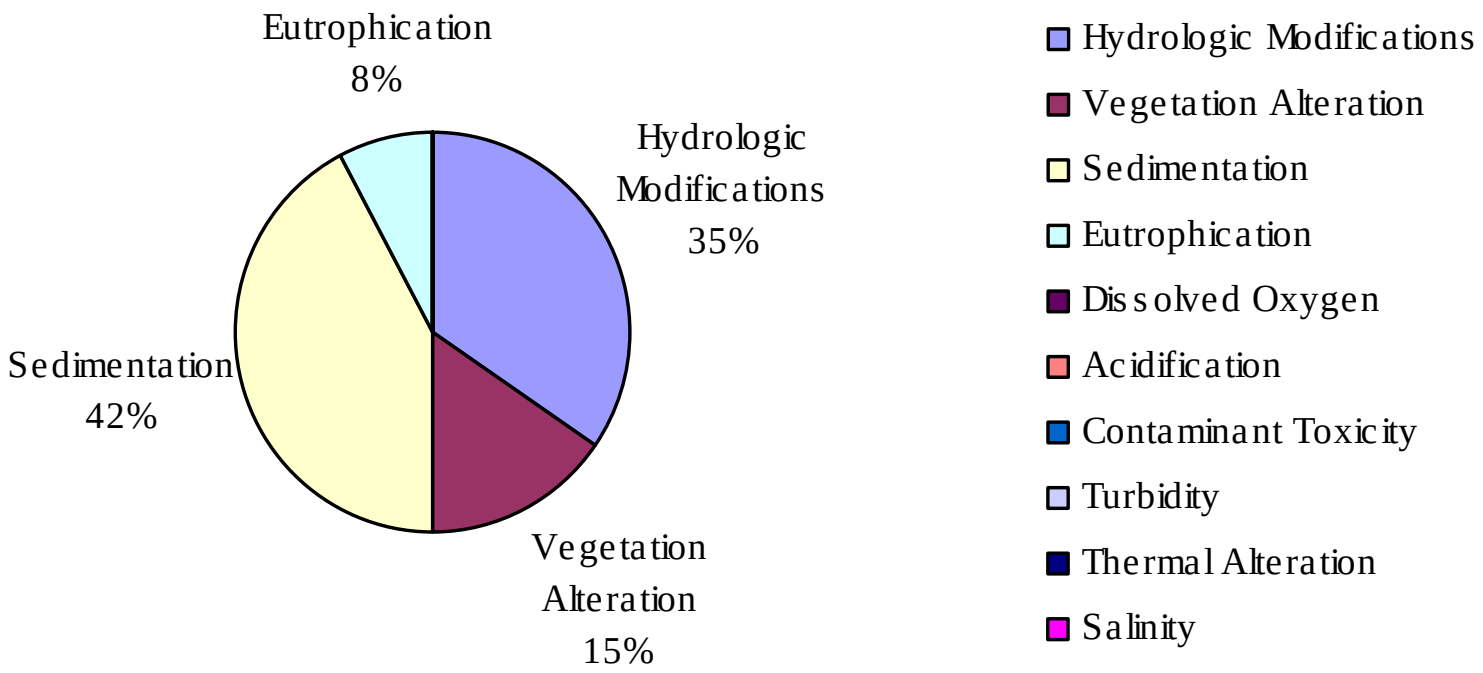
Mainstem Floodplain

Riparian Depression

Slope


PENNSTATE
Penn State Cooperative
Wetlands Center
N
2 0 2 4 Miles
HGM Class
Fringing
Headwater Floodplain
Headwater Floodplain/Riparian Depr.
Headwater Impoundment Beaver
Isolated Depression
Mainstem Floodplain
Riparian Depression
Riverine
Slope
Slope/Riparian Depression
Surface Depression
Sampled Wetlands Sites in the
Upper Juniata Watershed

Reference Sites - Stressors
Headwater Floodplains

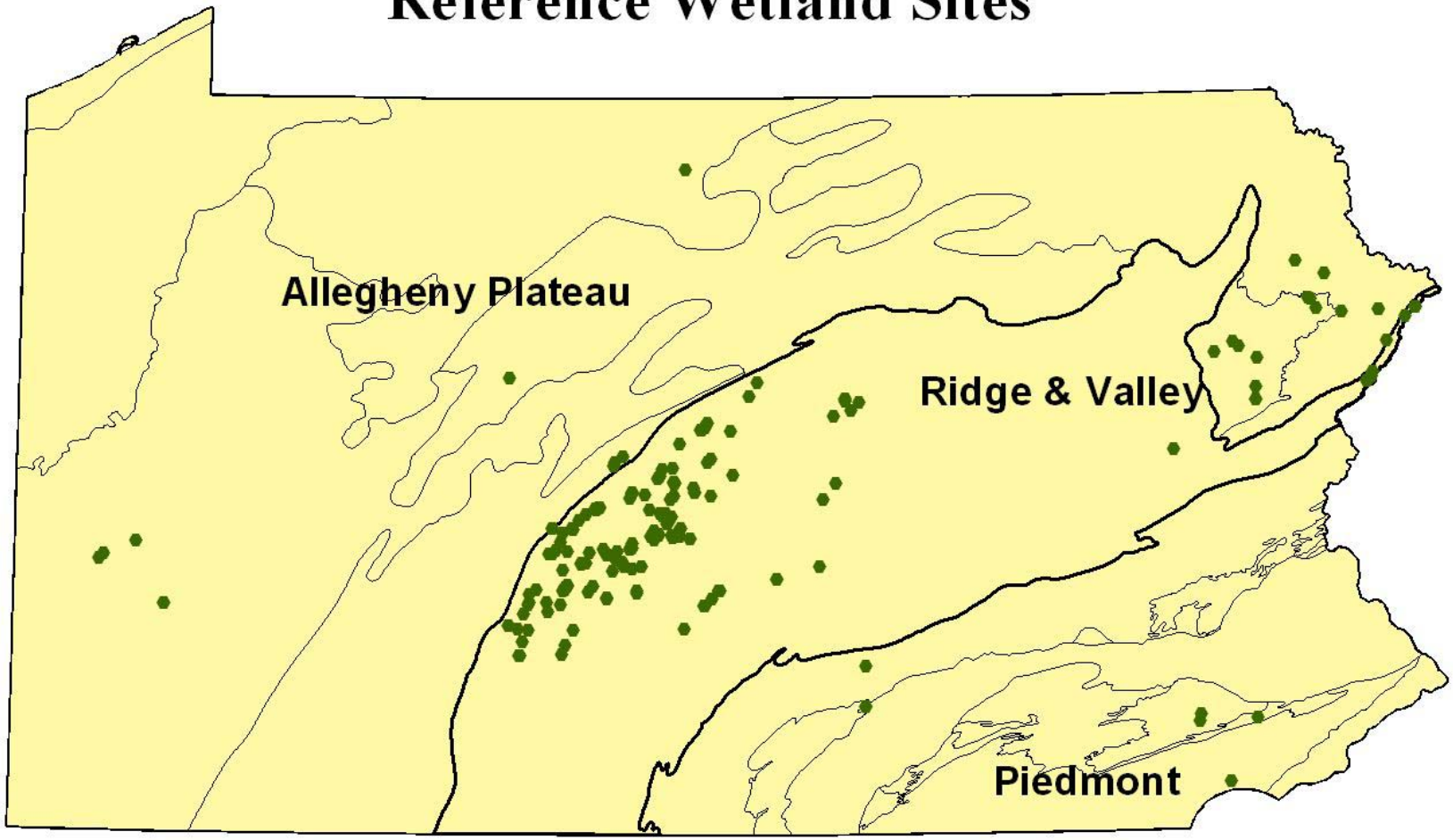


Quantitative Assessment

Quantitative Assessment

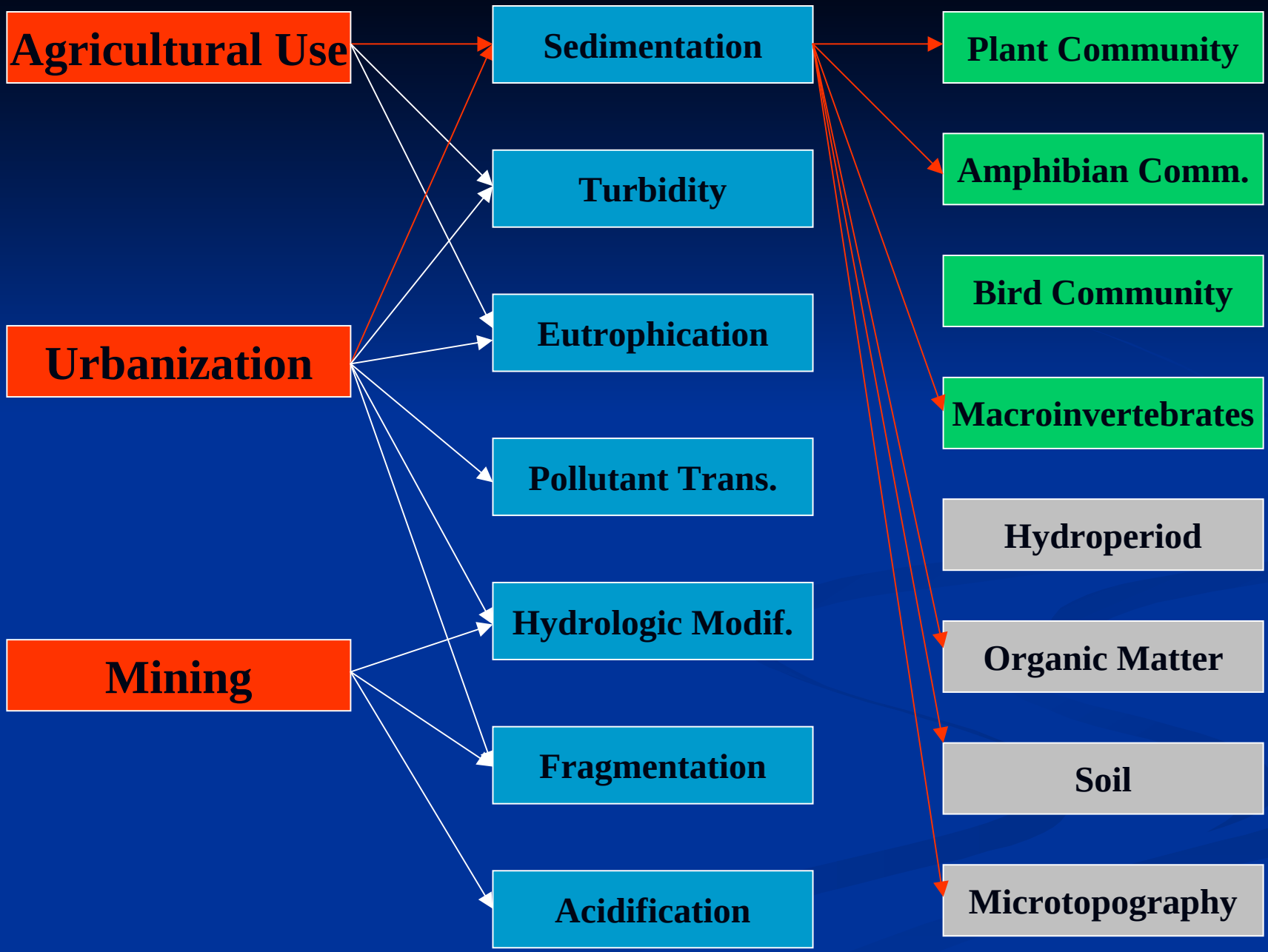
- Complete suite of HGM functional assessments
- IBIs
- Combination of both
- Other biological data
- Only F9, Maintenance of Characteristic Plant Community Composition, shown here

Reference Wetland Sites



Why have reference sites?

- Expand the scientific knowledge base
- Describe the variability of natural systems
- Characterize effects of disturbance
- Measure long-term successional trends
- Provide alternatives to experimental controls
- Design and performance standards for restoration
- Suitable as educational and training sites
- Largest jump in knowledge occurs with the first twenty!!


Agricultural Use
Urbanization
Mining
Sedimentation
Turbidity
Eutrophication
Pollutant Trans.
Hydrologic Modif.
Fragmentation
Acidification
Plant Community
Amphibian Comm.
Bird Community
Macroinvertebrates
Hydroperiod
Organic Matter
Soil
Microtopography

HGM Functional Assessment Models for Wetlands

- Energy dissipation/Short term SW detention
- Long term SW storage
- Interception of groundwater

- Cycling of redox-sensitive compounds
- Solute adsorption capacity
- Retention of inorganic particulates
- Export of organic particulates
- Export of dissolved organic matter

- Plant community structure and composition
- Detritus
- Vertebrate community structure and composition
- Invertebrate community structure and composition
- Maintenance of landscape-scale biodiversity

F9 - Maintain of Native Plant Community

General form of the model is:

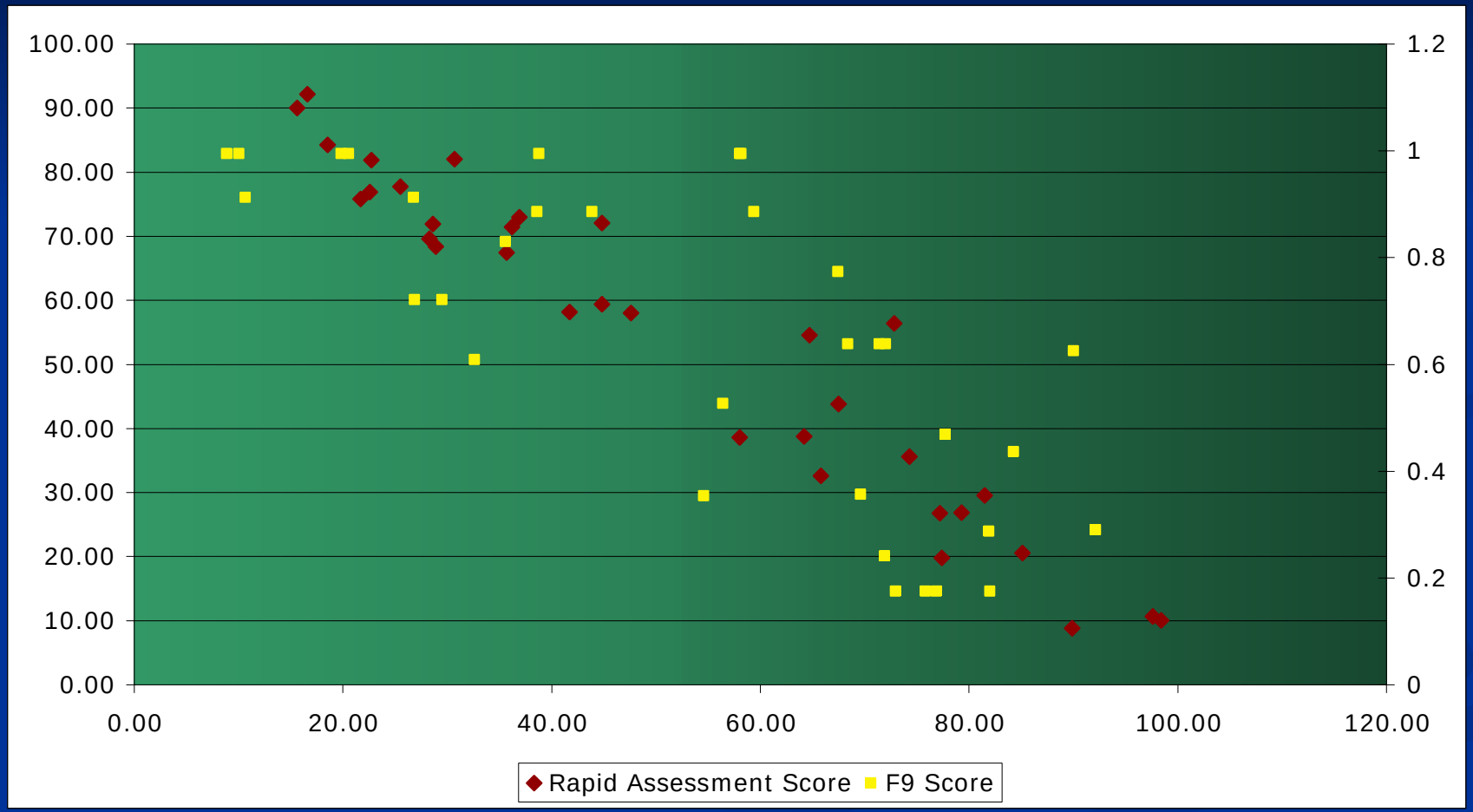
$FCI = [(V_{SPPCOMP} * 0.66 + V_{REGEN} * 0.33) + V_{EXOTIC}]/2$, where;

$V_{SPPCOMP}$: Floristic Quality Assessment Index (FQAI)

V_{REGEN}: regeneration of native tree species

V_{EXOTIC}: percent exotic species

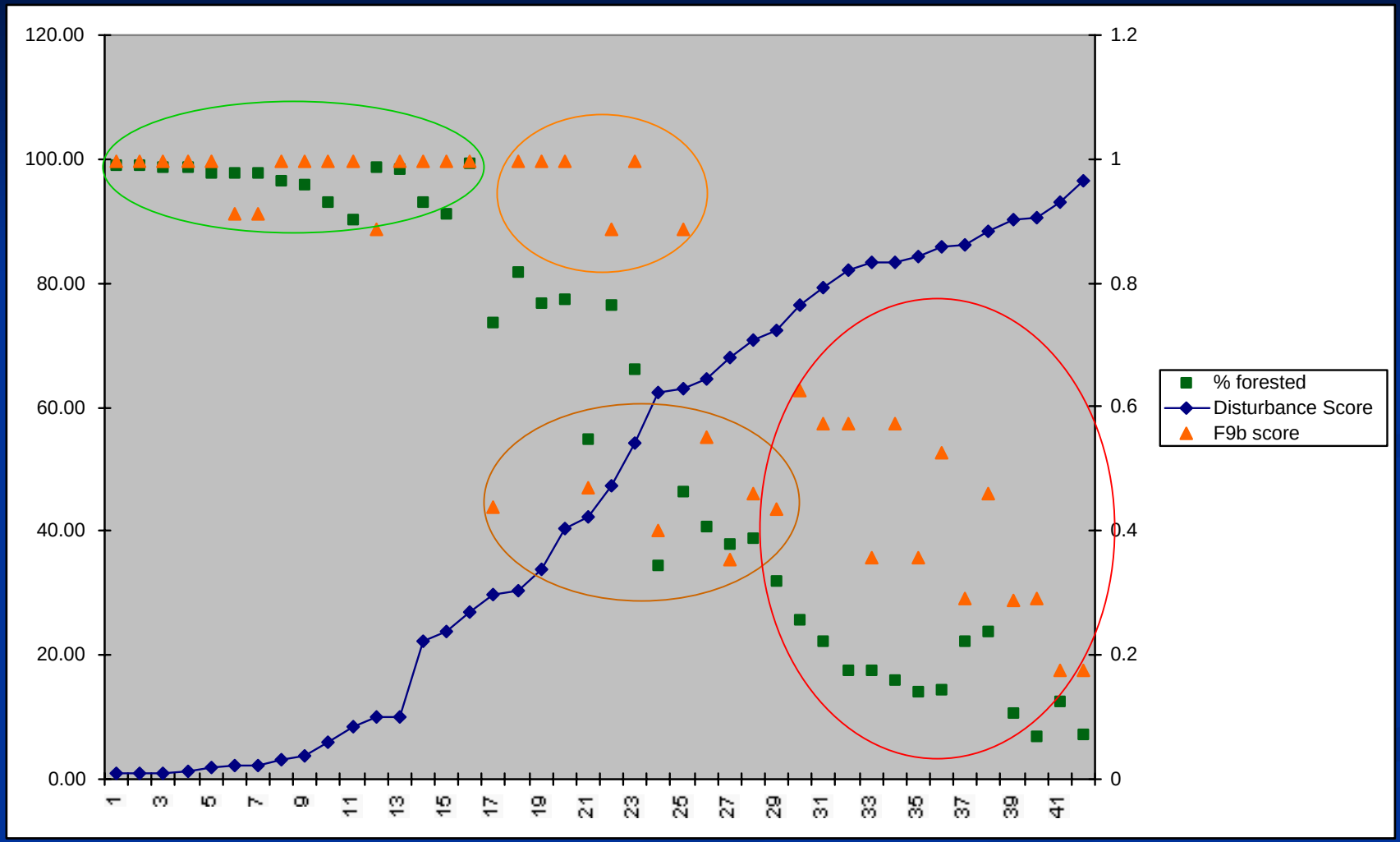
Upper Juniata Headwater Floodplains



How do the results compare?

Correlation Categories	All Sites (n=83)	Headwater Floodplains (n=33)
Landscape/Rapid	0.95	0.96
Landscape/F9	0.48	0.69
Rapid/F9	0.53	0.74

Comparison of Levels I, II, III - All Juniata Sites



Conclusions

- Multi-level approach was described and verified at each level
- Each level is informative
- There are choices

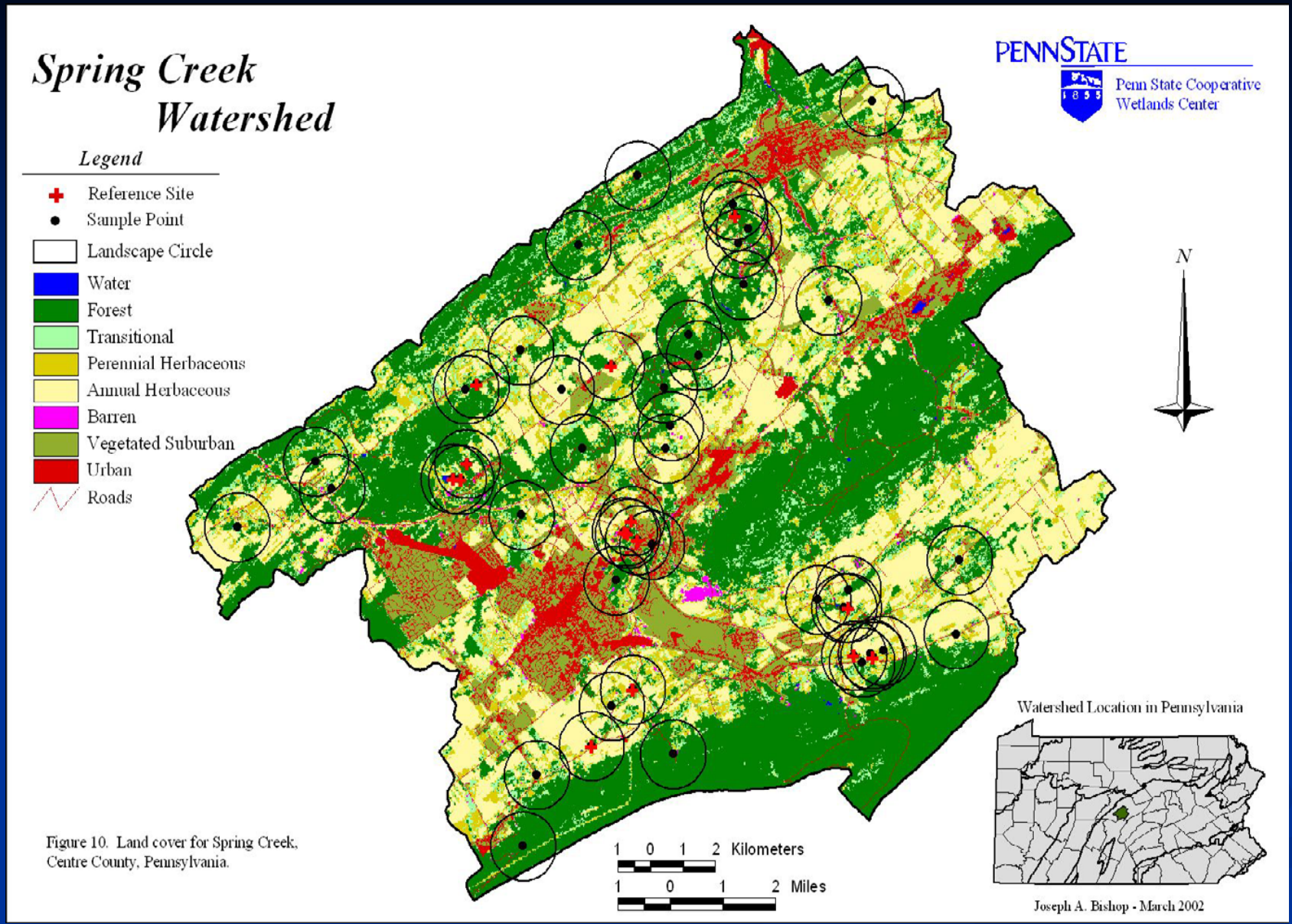
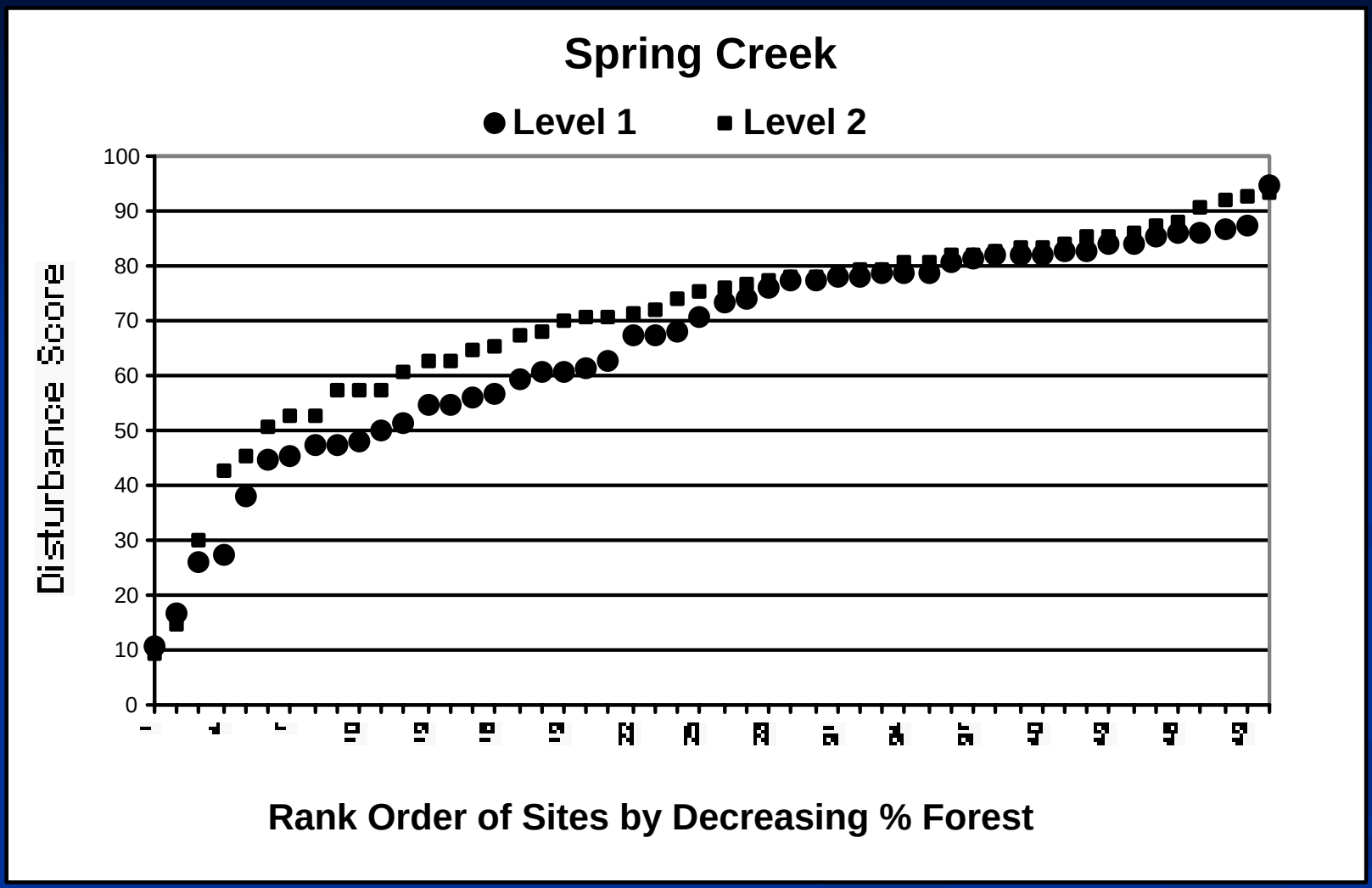
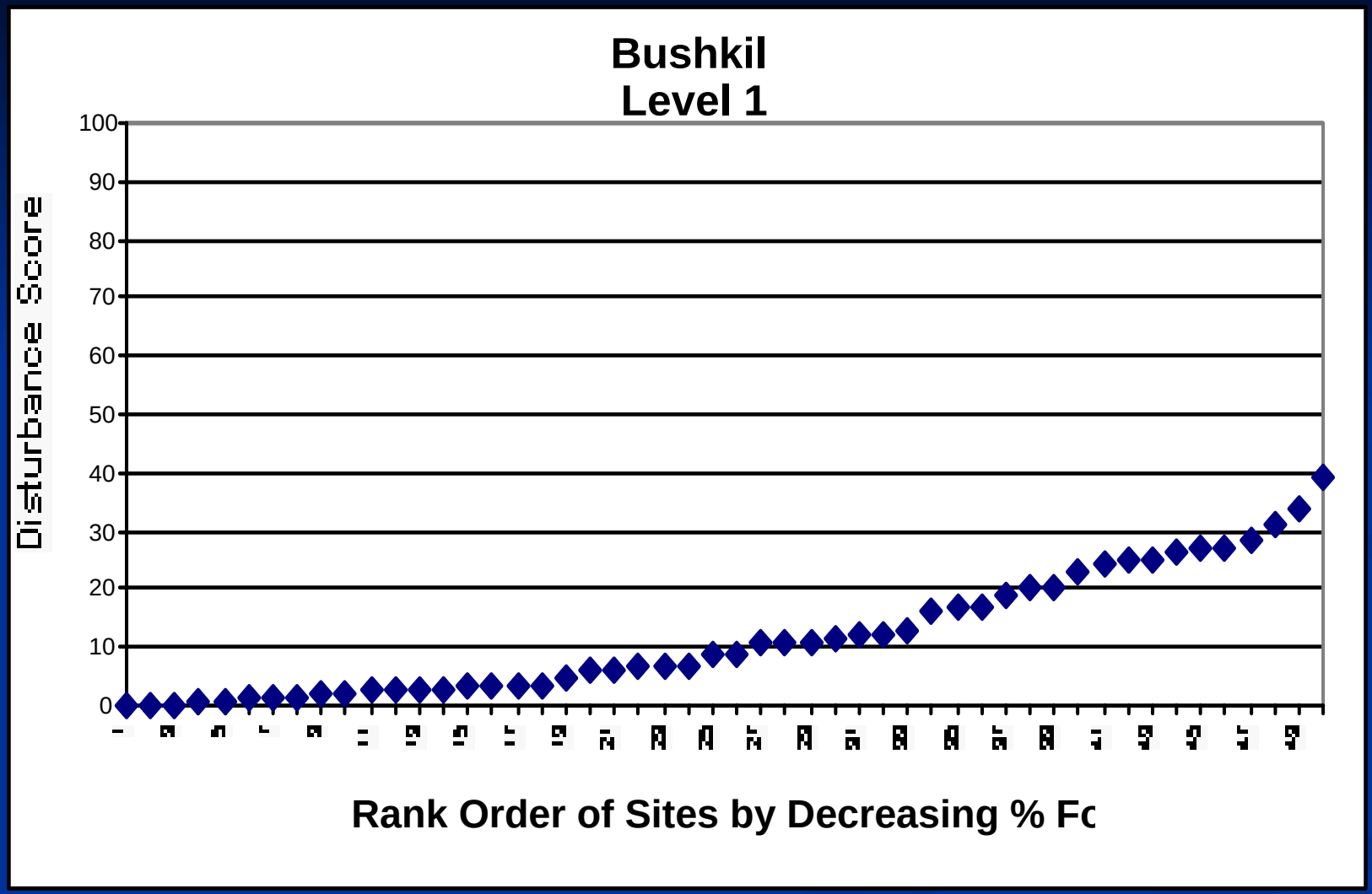


Figure 10. Land cover for Spring Creek, Centre County, Pennsylvania.


Spring Creek
Level 1
Level 2
Disturbance Score
100
90
80
70
60
50
40
30
20
10
0
Rank Order of Sites by Decreasing % Forest


Bushkil
Level 1
Disturbance Score
100
90
80
70
60
50
40
30
20
10
0
Rank Order of Sites by Decreasing % Fc

Simulated Application Process for Pennsylvania 2003-2010

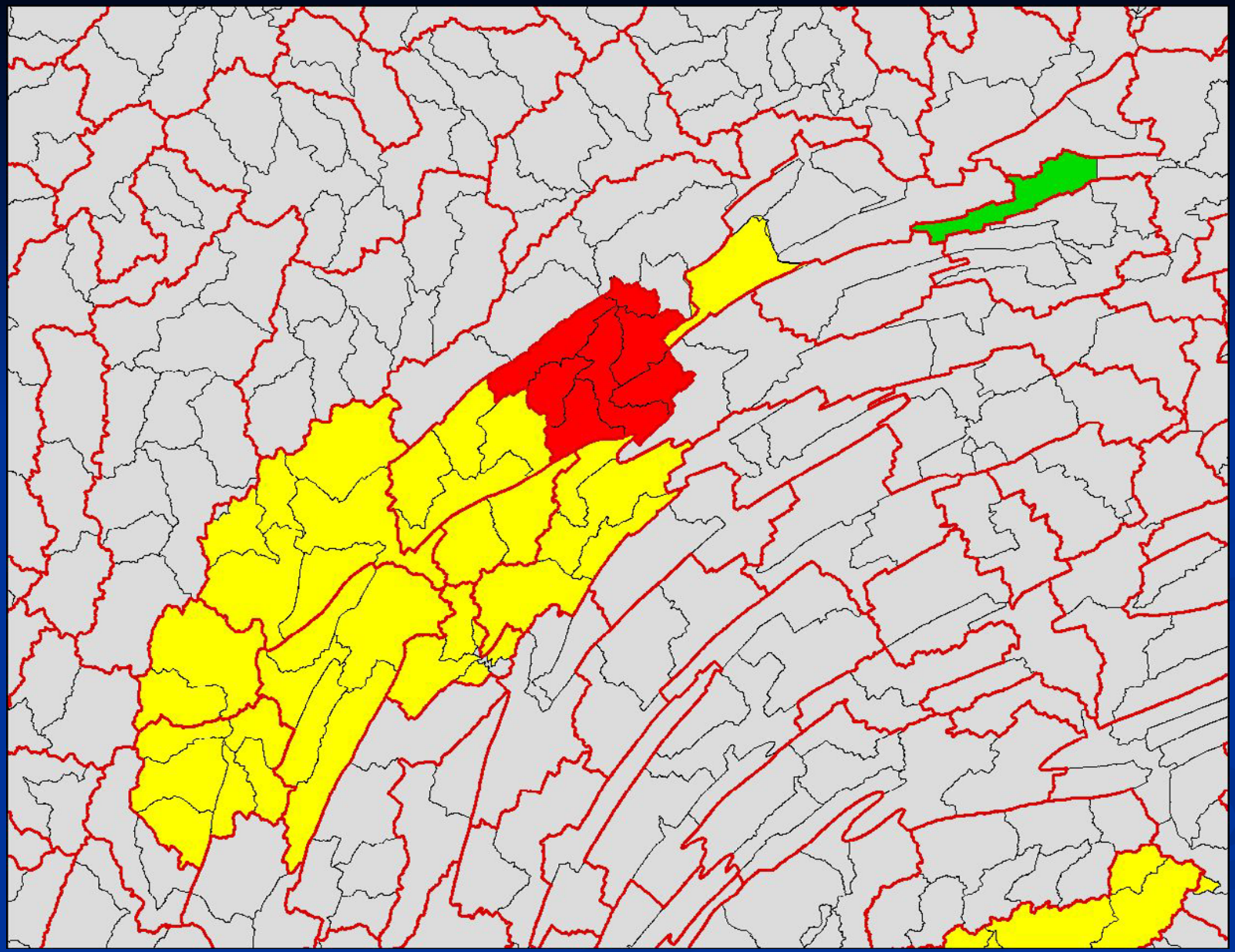
- 2003 - Protocol tested and training begins
- 2004 - Training field season
- 2005 - Process operational; each PADEP region (6) applies Level 1 or Level 2 process to wetlands in the top 20% of priority watersheds; coordinated by PADEP Central Office with assistance from CWC
- 2006 - Process is repeated for next quintile (20-40%) of watersheds
- 2007 - Process is repeated for next quintile (40-60%) of watersheds
- 2008 - Process is repeated for next quintile (60-80%) of watersheds
- 2009 - Process is repeated for final quintile (80-100%) of watersheds; 5-year summary report compiled, and would include assessment of restoration success
- 2010 - Process is repeated beginning with the “new” top 20% list

How This Could Work:

- Minimum anticipated level of effort by each PADEP regional office:
  - Level 1 - 20% of watersheds assessed (50 NWI wetlands/watershed)
  - Level 2 - minimum of 150 wetlands assessed per year (5 wetlands/day x 30 field days)
    - 150 Level 2 wetland condition assessments (represents three large watersheds)
  - Level 3 - minimum of 10 wetlands assessed per year (1 wetland/day x 10 day)
    - 10 Level 3 wetland condition assessments

How This Could Work (continued):

- 150 Level 2 wetland condition assessments (represents three large watersheds)
  - 150 wetlands x 6 regional offices x 5 years = 4500 Level 2 wetlands/cycle
- 10 Level 3 wetland condition assessments
  - 10 wetlands x 6 regional offices x 5 years = 300 Level 3 wetlands/cycle



Wetland Assessment/TMDL Link