Modeling and Ranking Wetland Functions, Condition, and Land Acquisition Priority

- Building the Model
- Examples of Metrics
- Applications

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WVDEP Water Quality Standards & Assessment Section

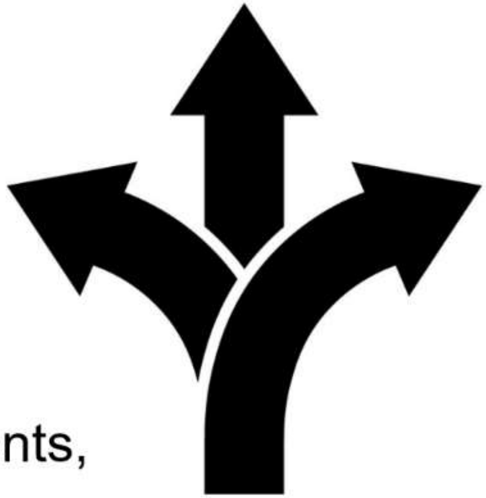
Building the Model

Goal: robust, repeatable, rapid assessment
for regulation, status & trends, restoration, and conservation

Building the Model

Ecological integrity & wildlife habitat: 50%

Water quality: sediment, nutrients, pollutants: 25%

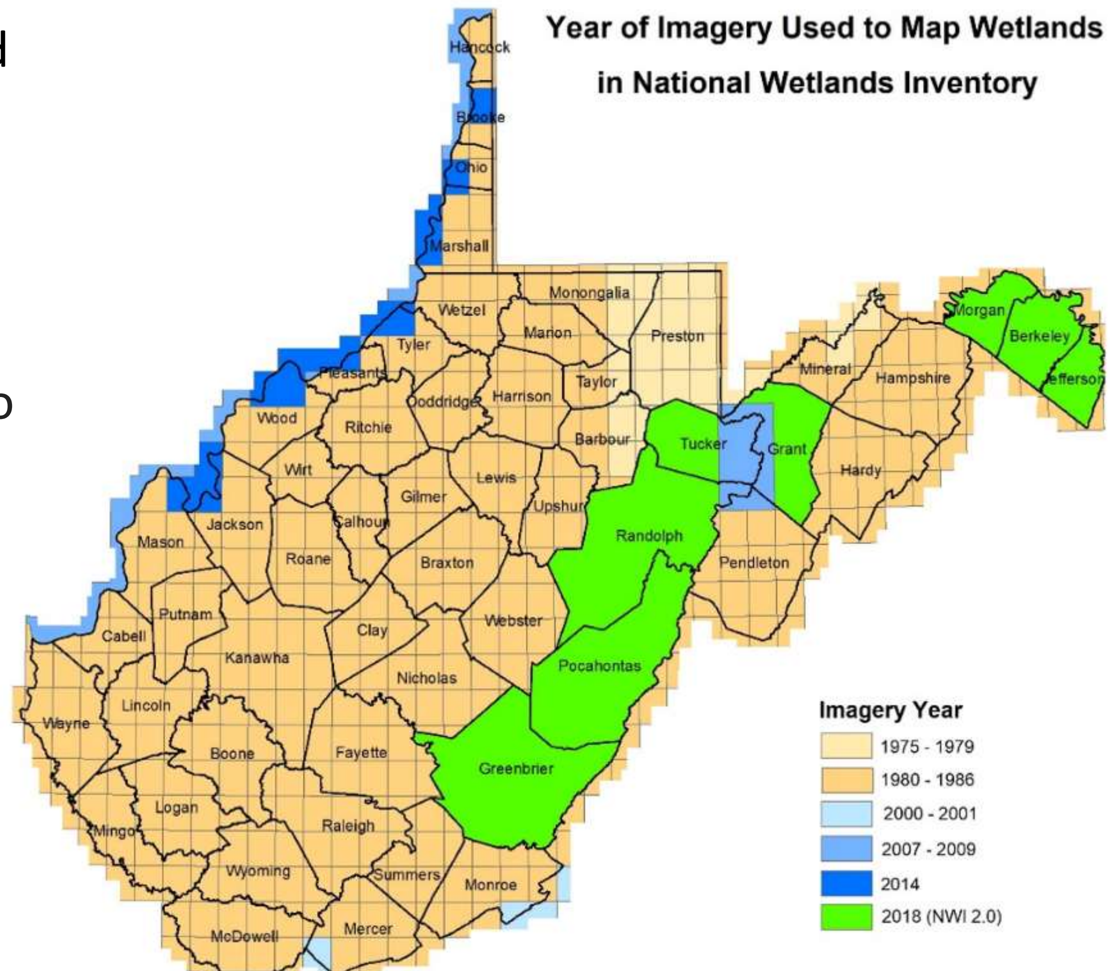


Flood attenuation, baseflow: 25%

3 metric groupings

Essential Data: Wetland Maps

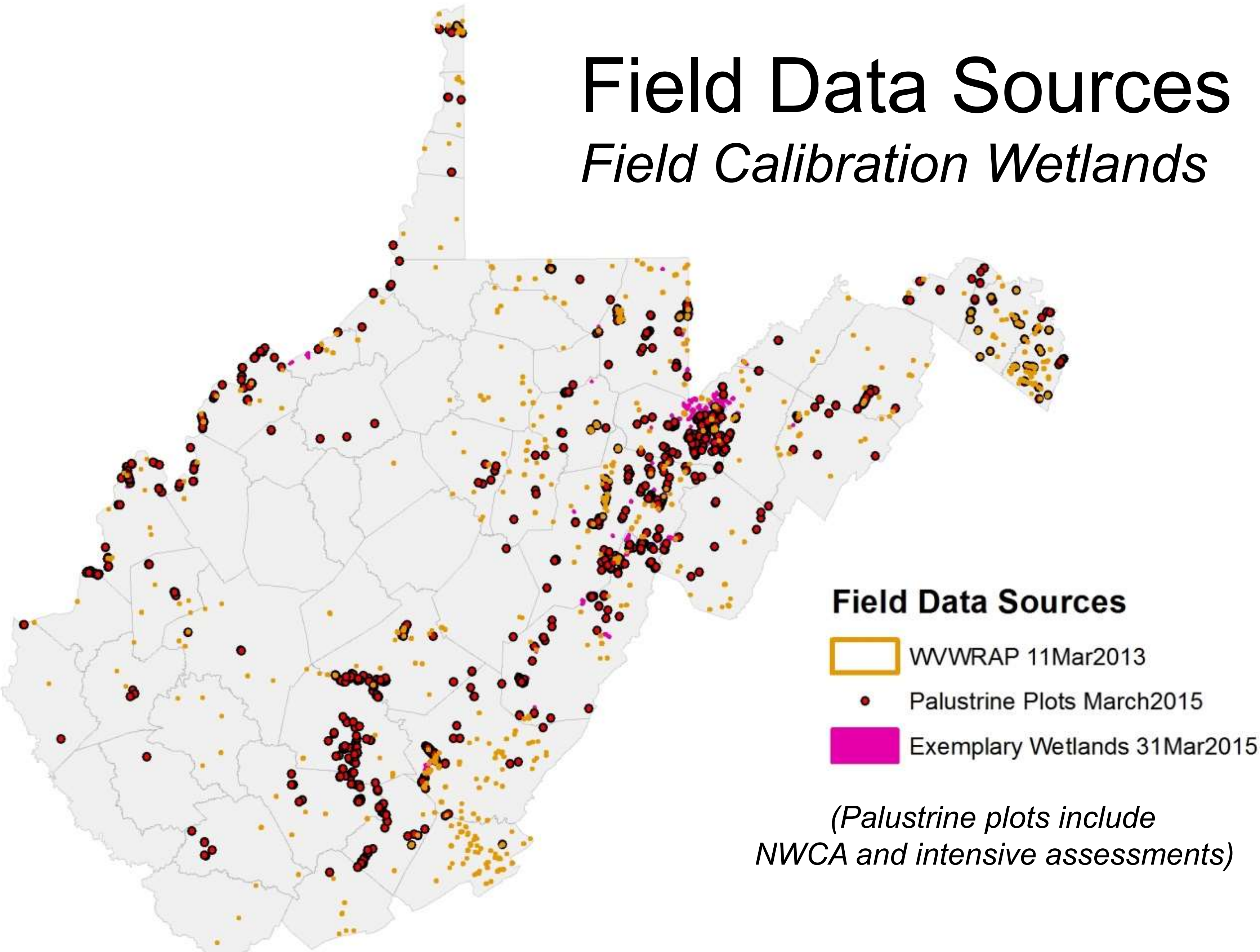
- Most of West Virginia's wetland mapping is more than 40 years old.
- Created calibration set of 2000 field-sampled wetlands distributed across ecoregions to develop metrics
- With Q2 LiDAR & hi-res leaf-off aerial photos, maps now being updated



Status map prepared by WVDEP/DWWM Watershed Assessment Branch, 8 March 2021.

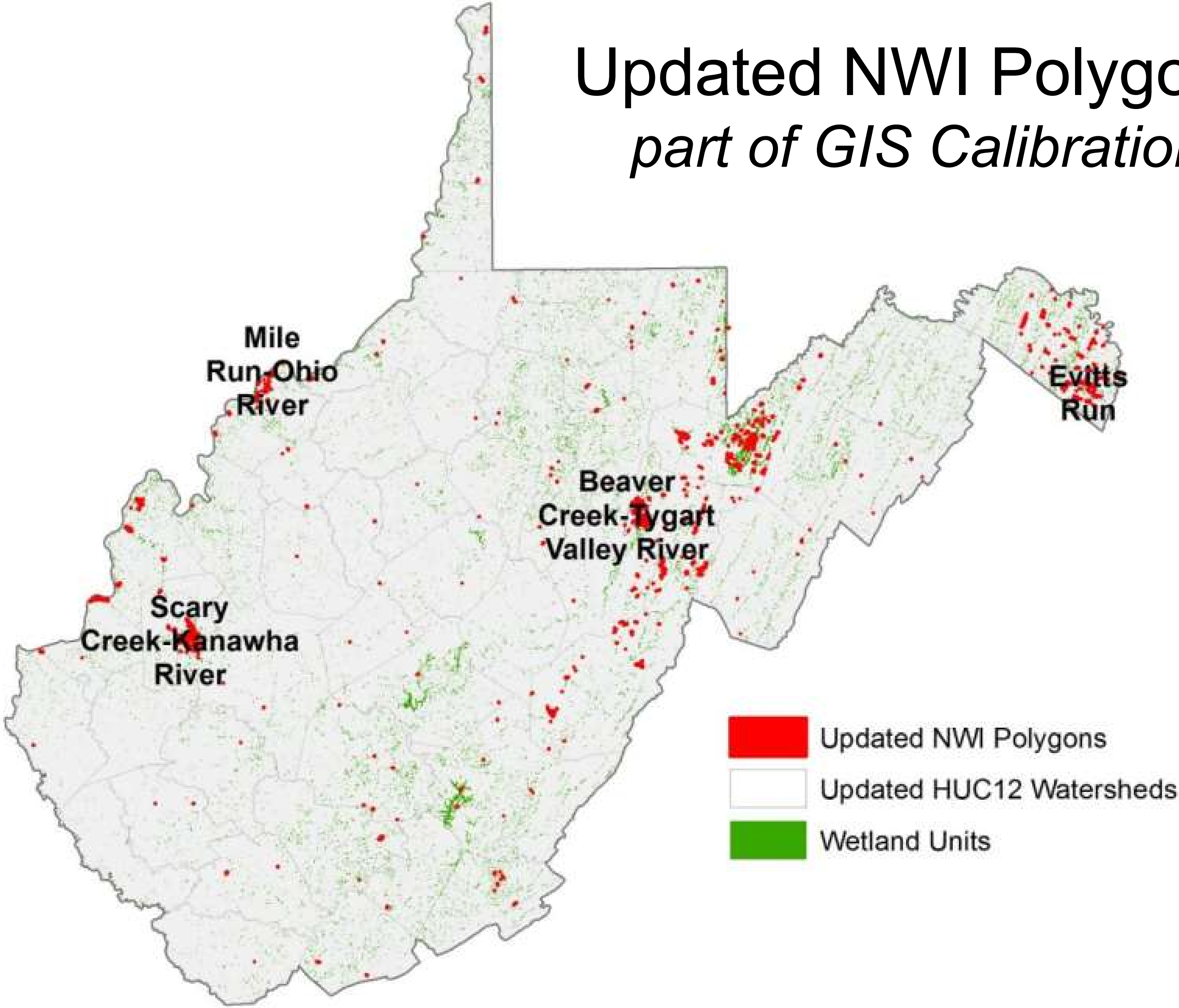
Field Data Sources

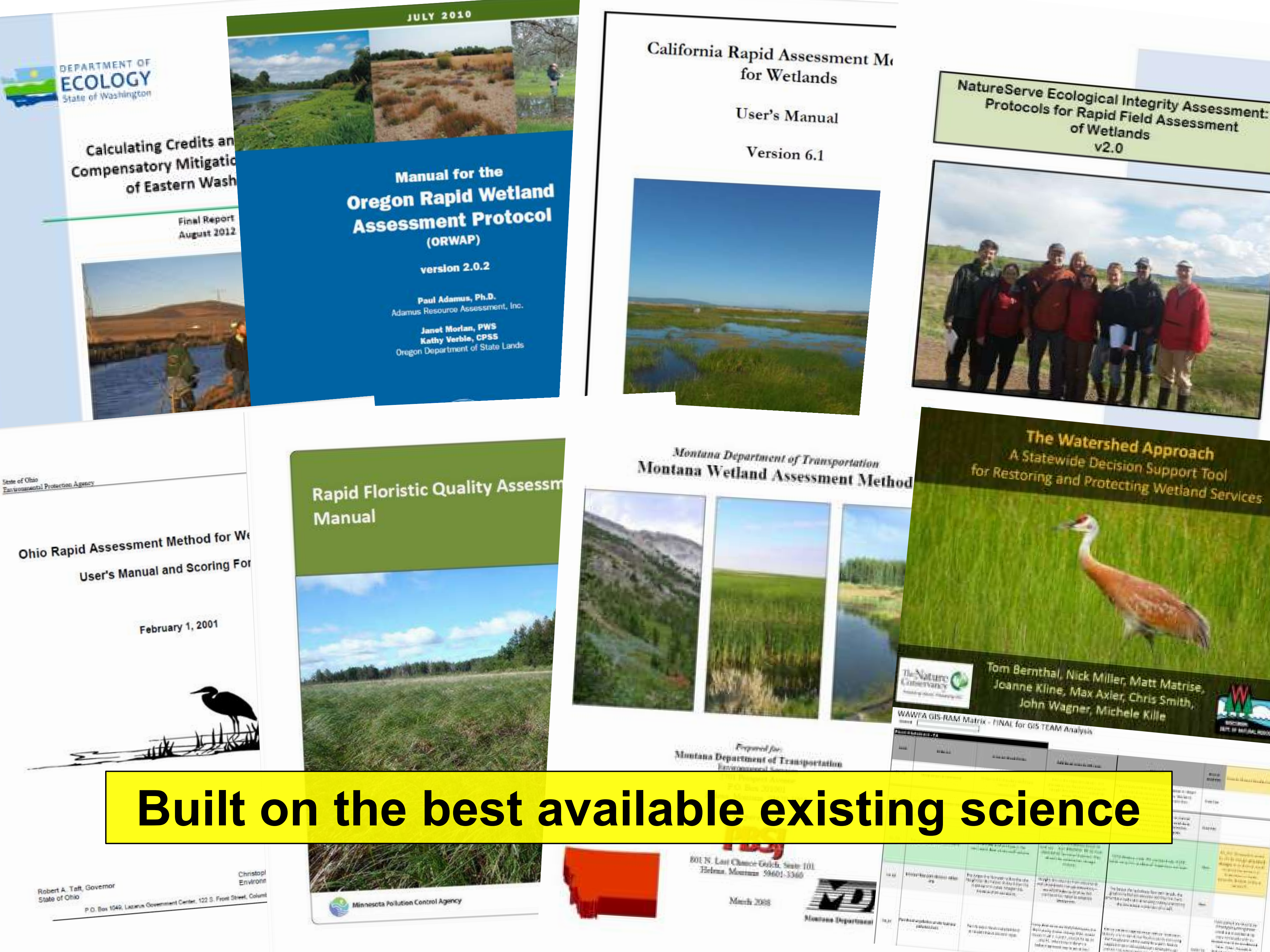
Field Calibration Wetlands



(Palustrine plots include NWCA and intensive assessments)

Updated NWI Polygons
part of GIS Calibration




DEPARTMENT OF ECOLOGY State of Washington
Calculating Credits an
Compensatory Mitigatio
of Eastern Wash
Final Report
August 2012
JULY 2010
Manual for the
Oregon Rapid Wetland
Assessment Protocol
(ORWAP)
version 2.0.2
Paul Adamus, Ph.D.
Adamus Resource Assessment, Inc.
Janet Morlan, PWS
Kathy Verble, CPSS
Oregon Department of State Lands
California Rapid Assessment M
for Wetlands
User's Manual
Version 6.1
NatureServe Ecological Integrity Assessment:
Protocols for Rapid Field Assessment
of Wetlands
v2.0
State of Ohio
Environmental Protection Agency
Ohio Rapid Assessment Method for We
User's Manual and Scoring For
February 1, 2001
Robert A. Taft, Governor
State of Ohio
Rapid Floristic Quality Assessm
Manual
Minnesota Pollution Control Agency
Montana Department of Transportation
Montana Wetland Assessment Method
Prepared for:
Montana Department of Transportation
March 2008
The Watershed Approach
A Statewide Decision Support Tool
for Restoring and Protecting Wetland Services
Tom Bernthal, Nick Miller, Matt Matrise,
Joanne Kline, Max Axler, Chris Smith,
John Wagner, Michele Kille
The Nature Conservancy
WAWFA GIS-RAM Matrix - FINAL for GIS TEAM Analysis
Built on the best available existing science

…we looked only at tested, validated methods & metrics

WVWRAM: 75 metrics

Land Acquisition Score

	Intrinsic Potential	Landscape Opportunity	Value to Society
Water Quality	vegetation, soil, hydrology	50 m buffer, contributing watershed	public use, planning
Flood Attenuation	vegetation, soil, hydrology	50 m buffer, contributing watershed	economic risk
Habitat/ Ecological Integrity	vegetation, soil, hydrology	50/300/1000 m buffer, perimeter, contrib. watershed	investment, public use, access

Regulatory Function Score

Condition Score

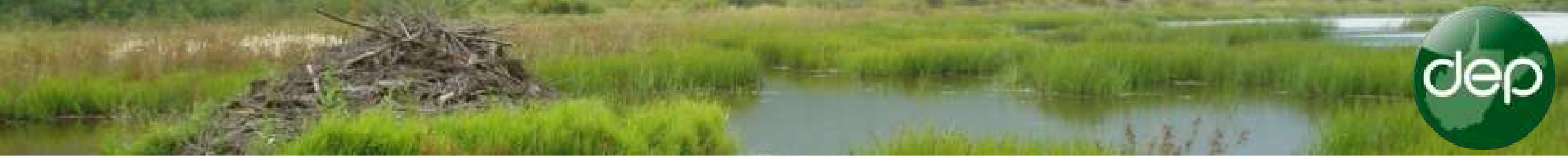
Water Quality

Intrinsic potential to provide function

- Vegetation cover and persistence
- Surface depressions
- Surface water outflow
- Organic soils
- Seasonal ponding, slope, wetland/upland interface
- Headwater location

Landscape opportunity (function score only)

- Discharges to the wetland
- Land use disturbance, 50 m buffer & contributing watershed
- Roads and railroads
- Impaired waters, algal blooms, powerboat use



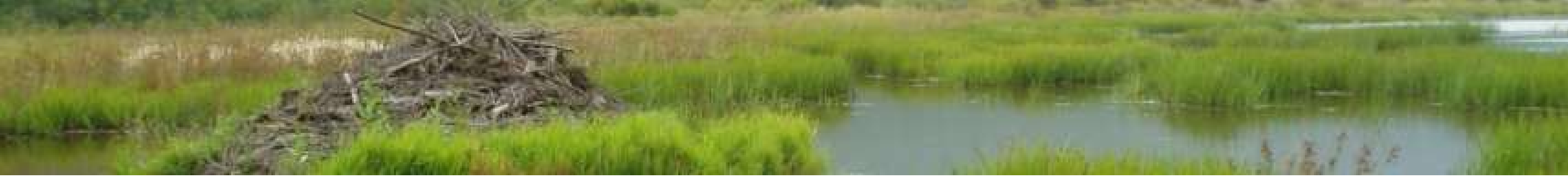
Flood Attenuation & baseflow

Intrinsic potential to provide function

- Vegetation cover and structure
- Runoff and storage
- Surface water outflow
- Median percent slope
- Headwater location
- Connectivity to historic floodplain

Landscape opportunity (function score only)

- Overland flow delivered to wetland



Habitat & Ecological Integrity

Intrinsic potential to provide function

- Vegetation (structure and floristic quality)
- Hydrology (intact regime, floodplain connectivity)
- Soils
- Structural patches

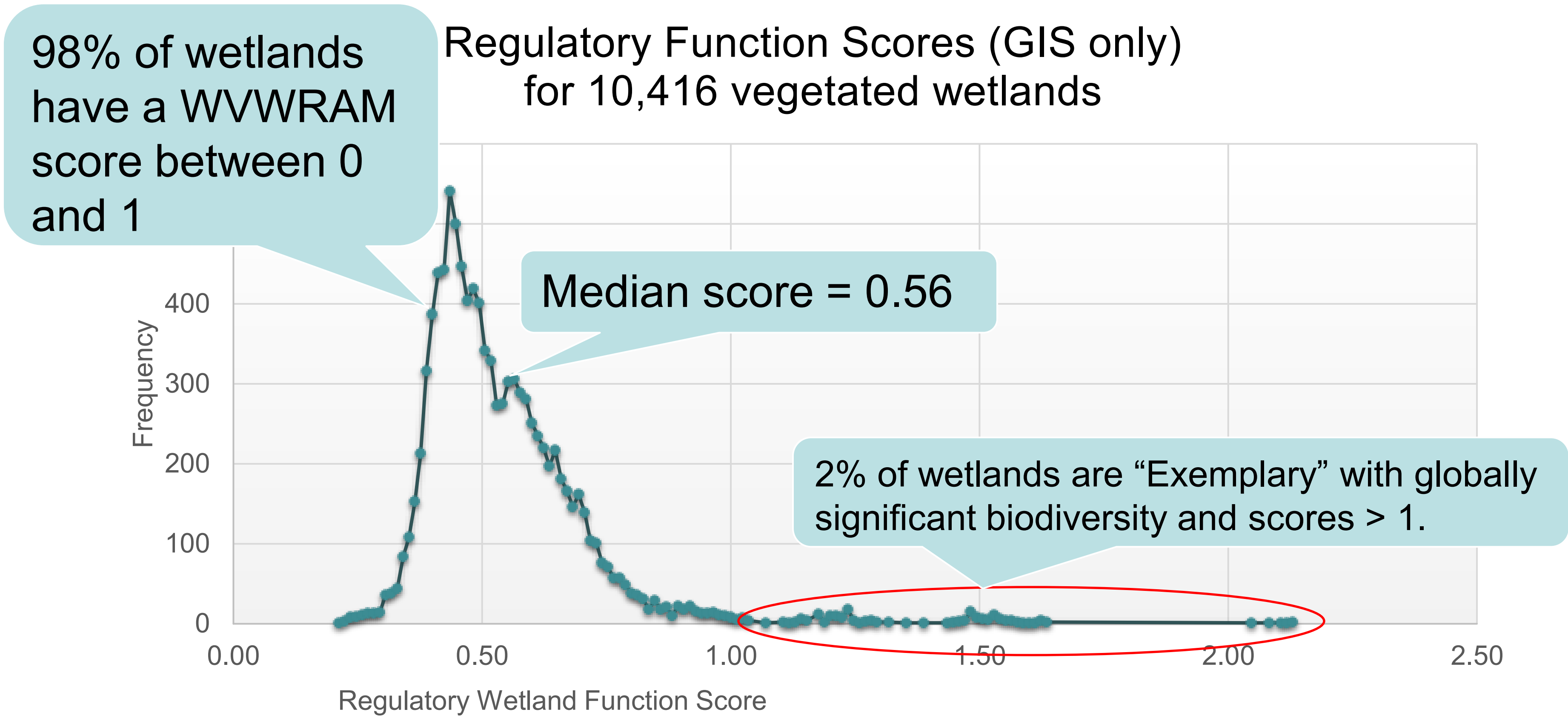
Landscape opportunity

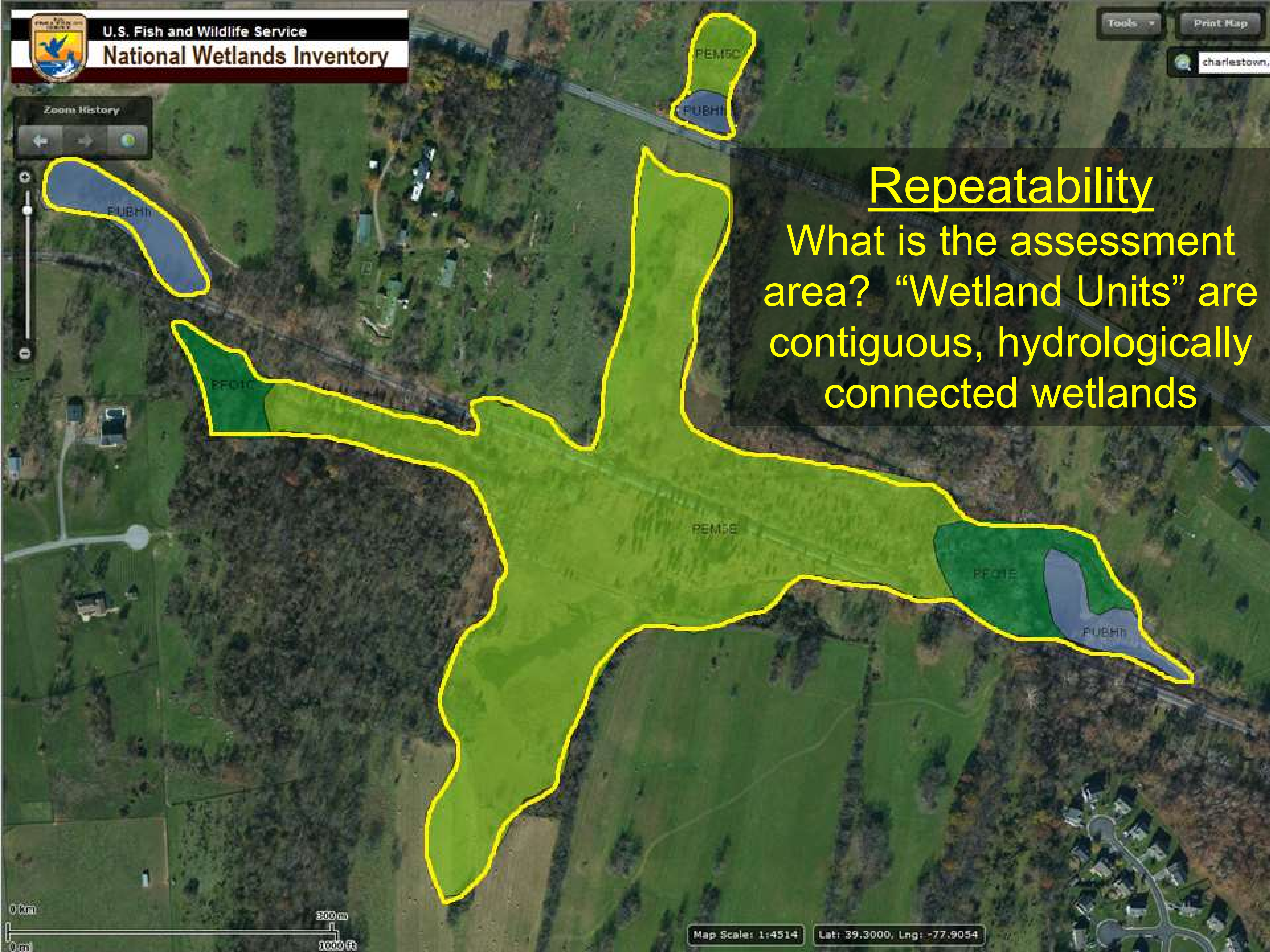
- Buffer and landscape integrity
- Landscape-level hydrologic connectivity
- Landscape-level ecological connectivity

Special Conservation Concern override

- Up to 100% of score (applies to 2% of wetlands)

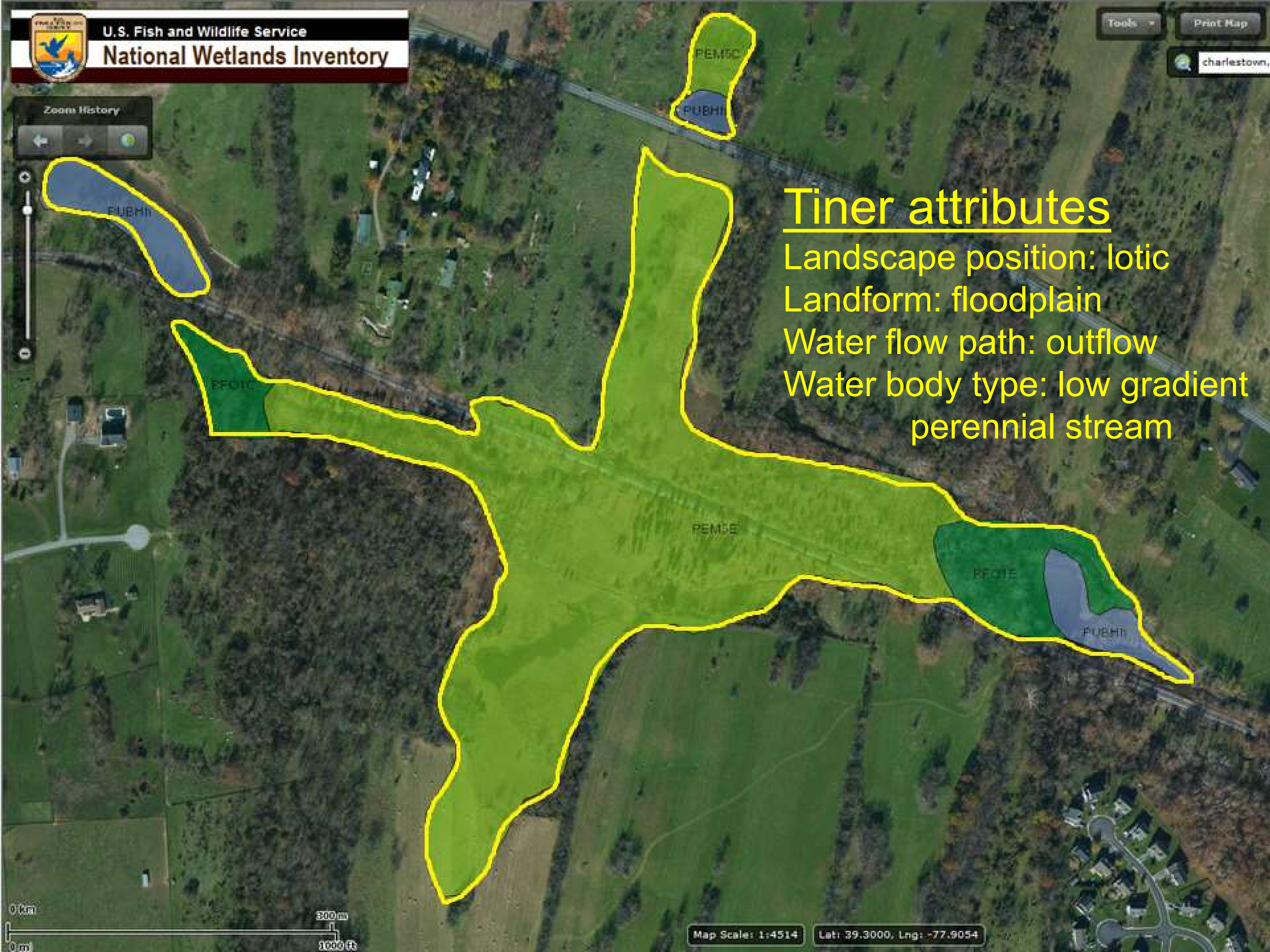
Let’s deter impacts to high-functioning wetlands!





Repeatability

What is the assessment area? “Wetland Units” are contiguous, hydrologically connected wetlands



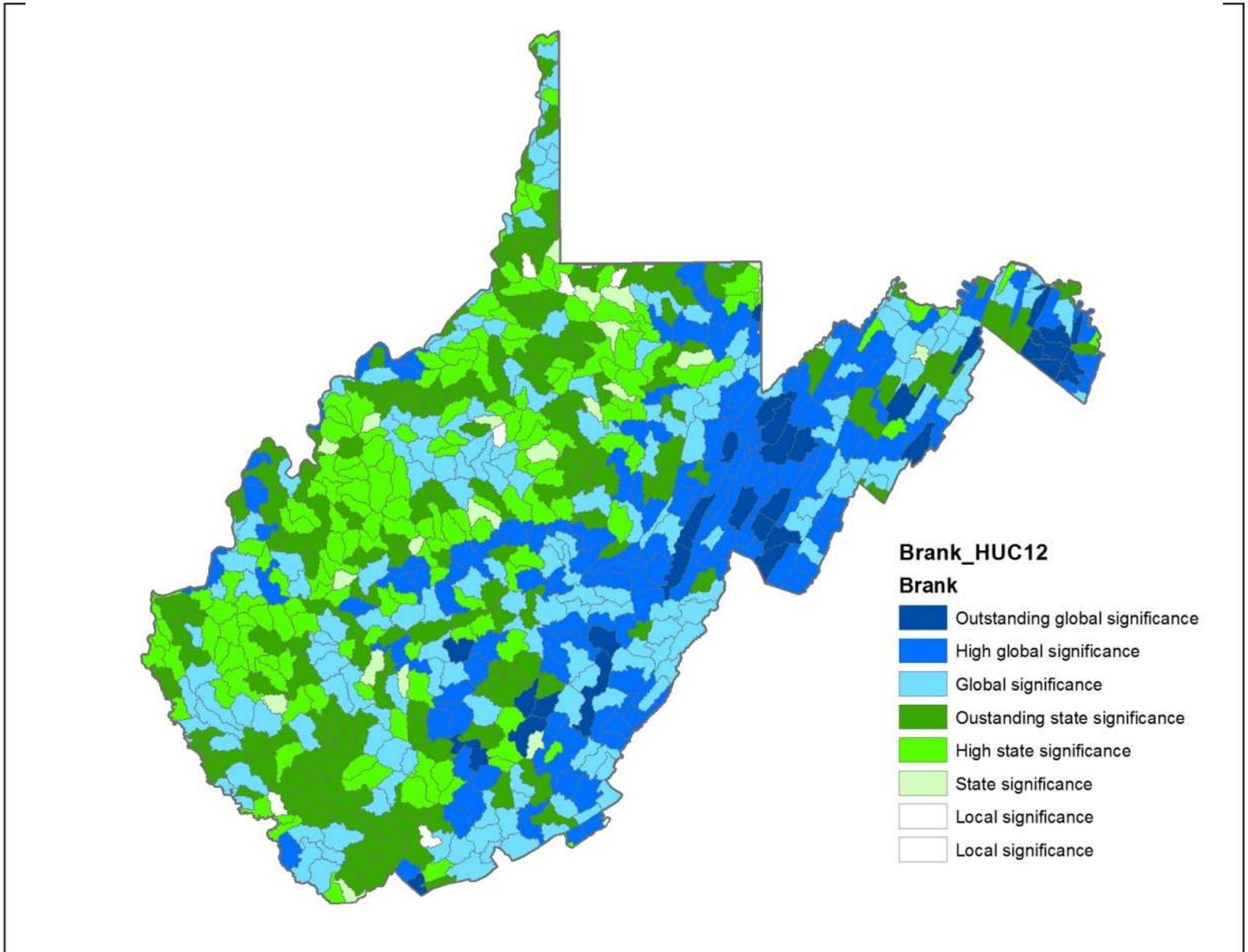
Tiner attributes

Landscape position: lotic
Landform: floodplain
Water flow path: outflow
Water body type: low gradient perennial stream

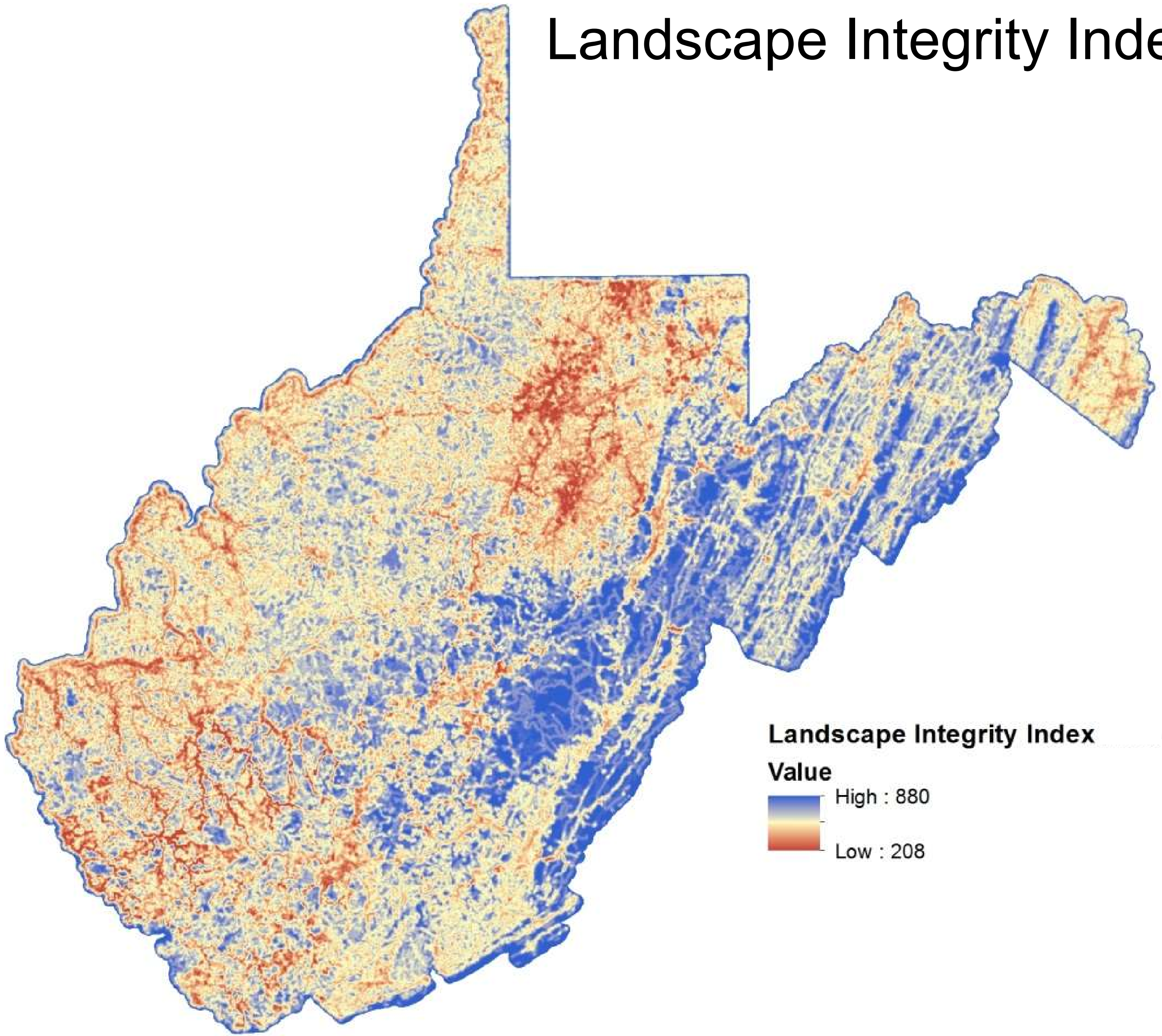
Source data: 62 statewide GIS datasets

- Biodiversity
- Ecosystems
- Elevation
- Geology
- Hydrology
- Imagery
- Infrastructure
- Jurisdiction
- Landcover
- Landform
- Soils
- Stressors

Watershed Biodiversity Ranks

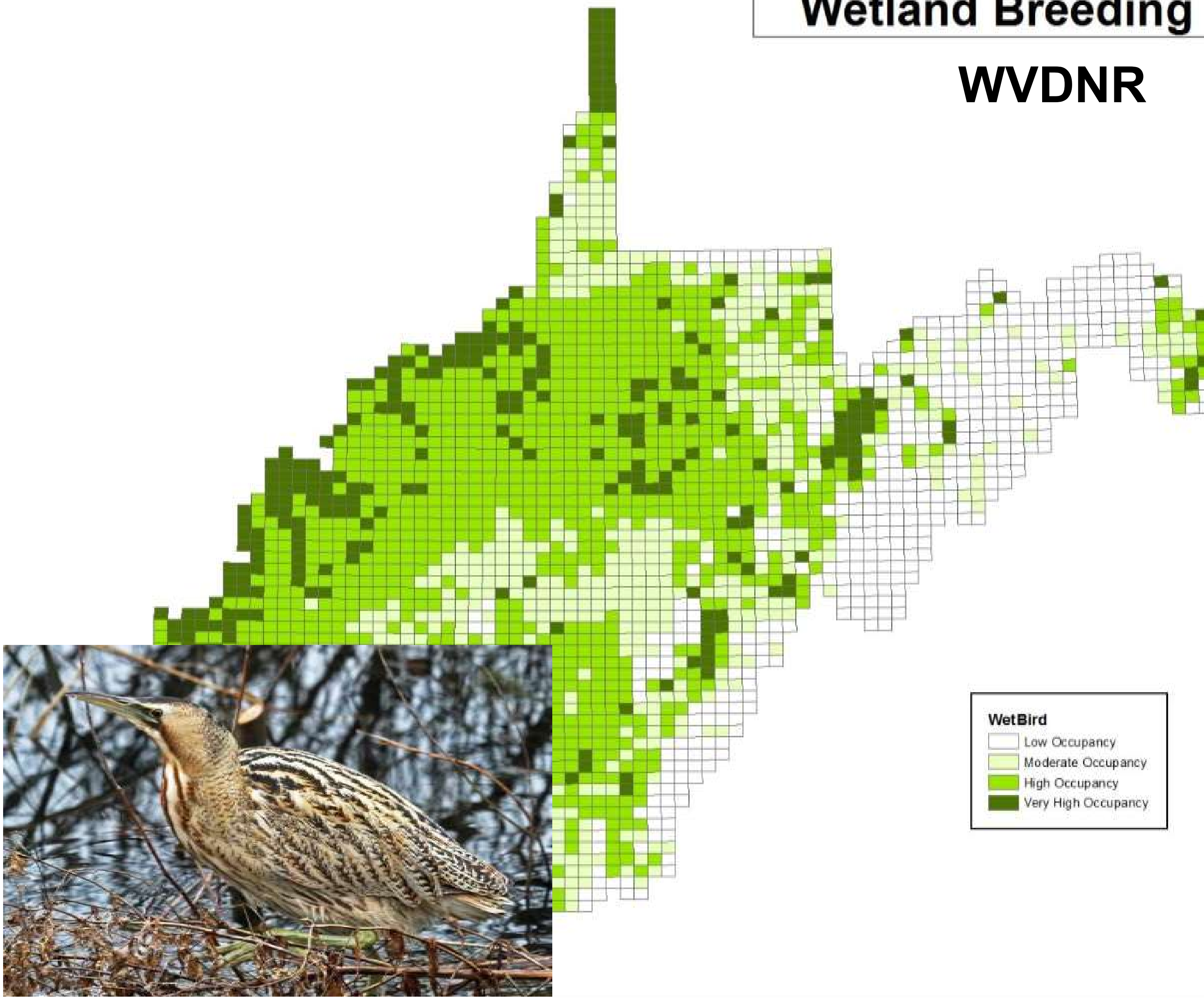


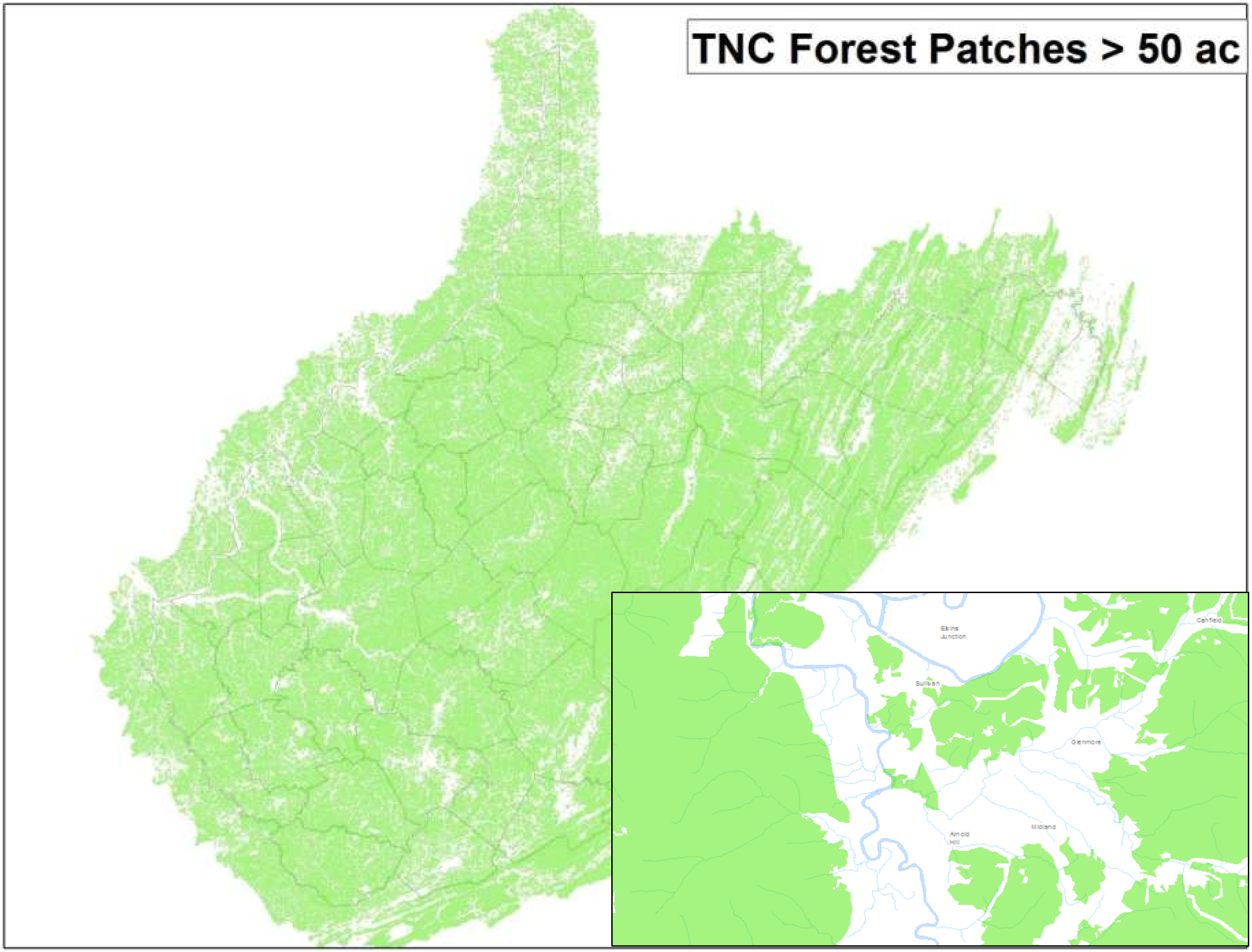
Landscape Integrity Index

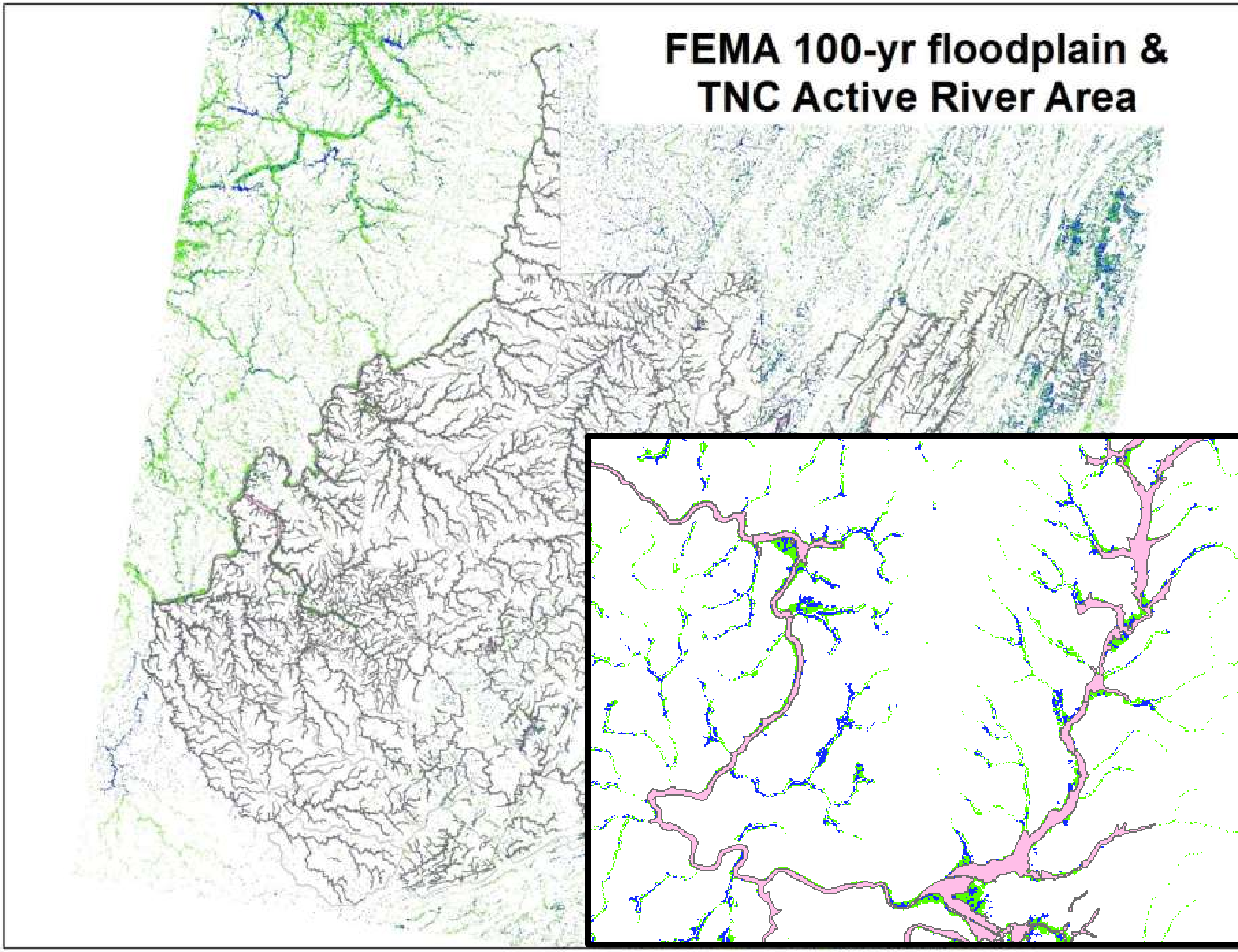


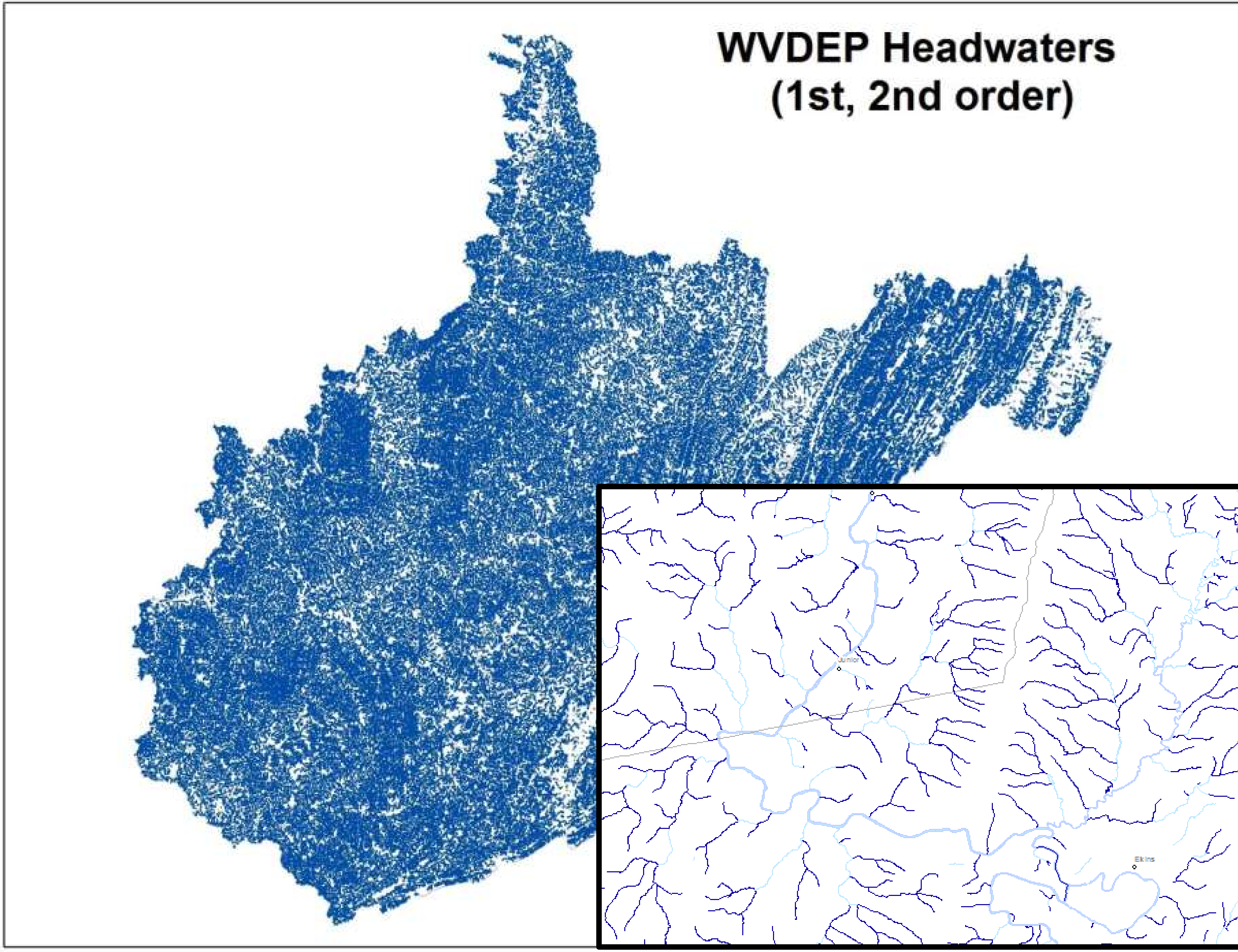
Wetland Breeding Birds

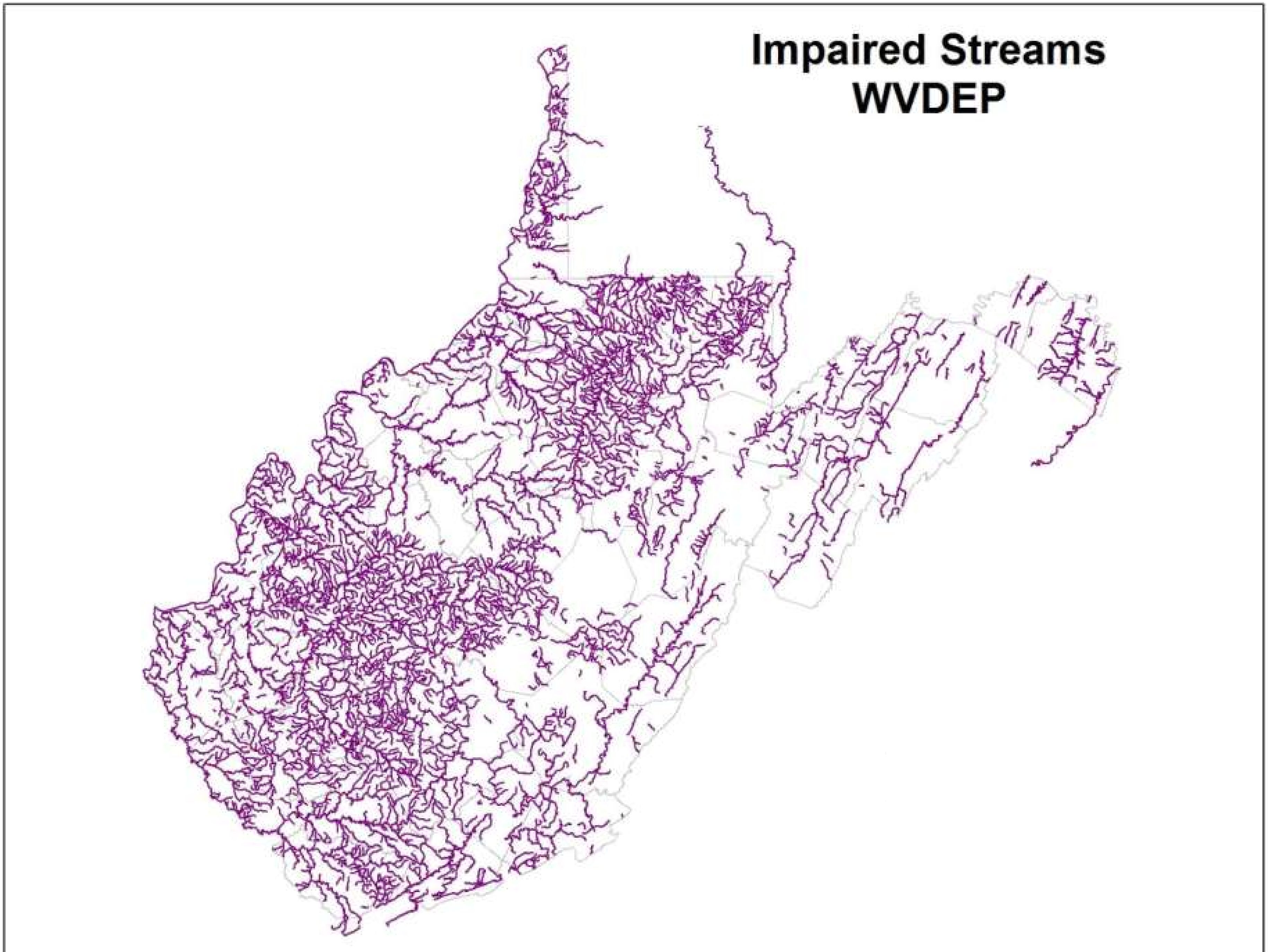
WVDNR

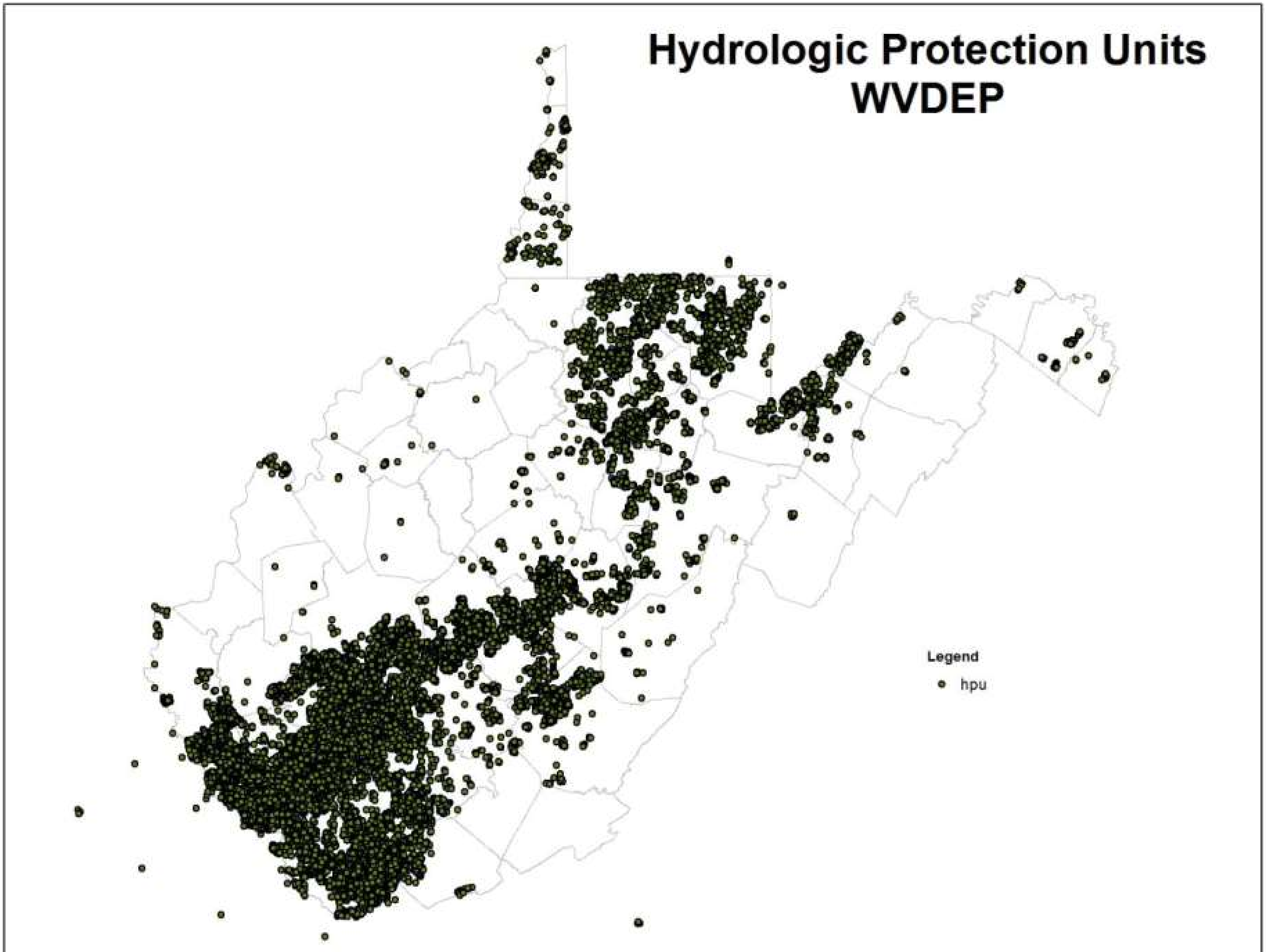


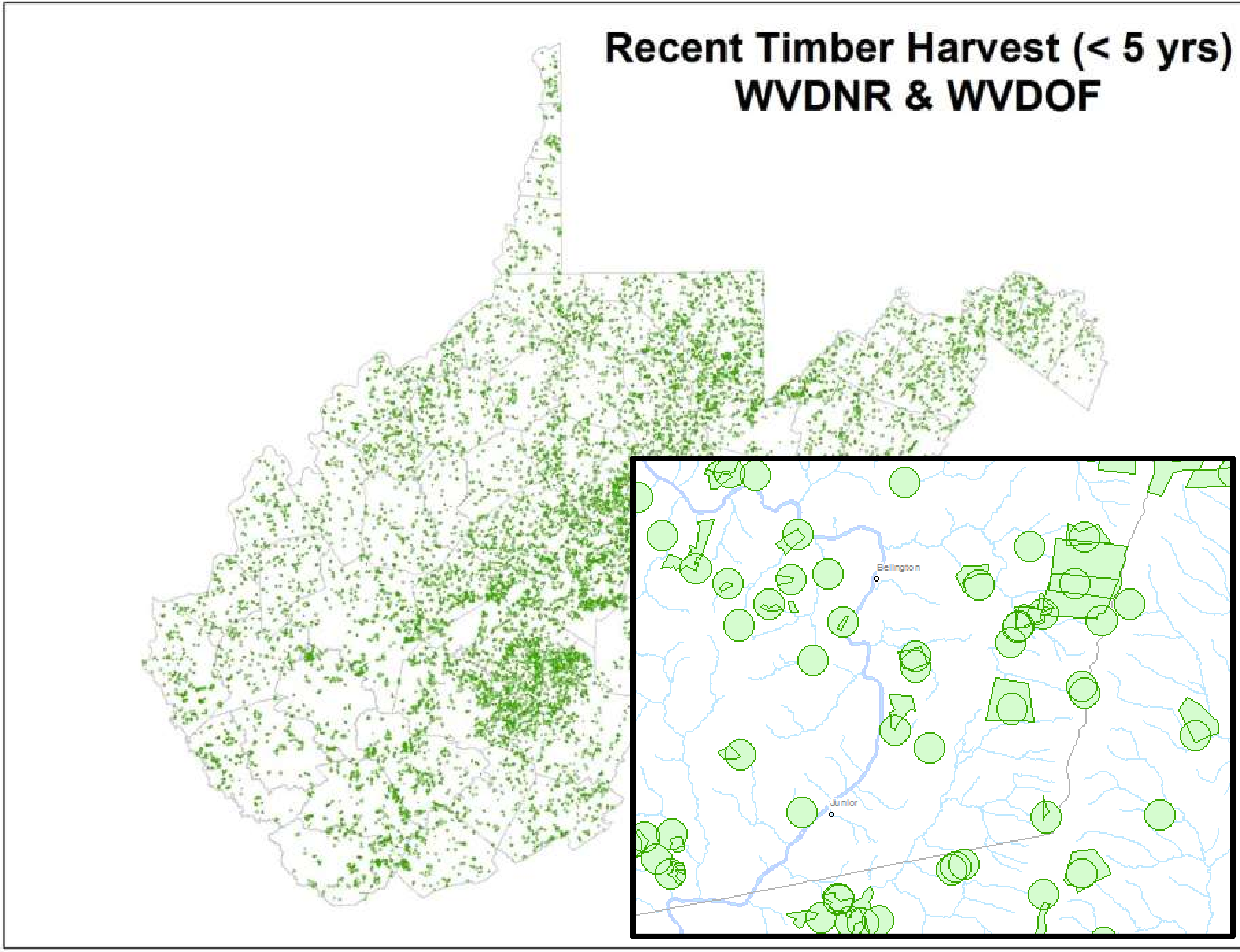

TNC Forest Patches > 50 ac
Elkins
Junction
Canfield
Sullivan
Glenmore
Midland
Arnold
Hill


FEMA 100-yr floodplain &
TNC Active River Area


WVDEP Headwaters
(1st, 2nd order)
Junior
Elkins

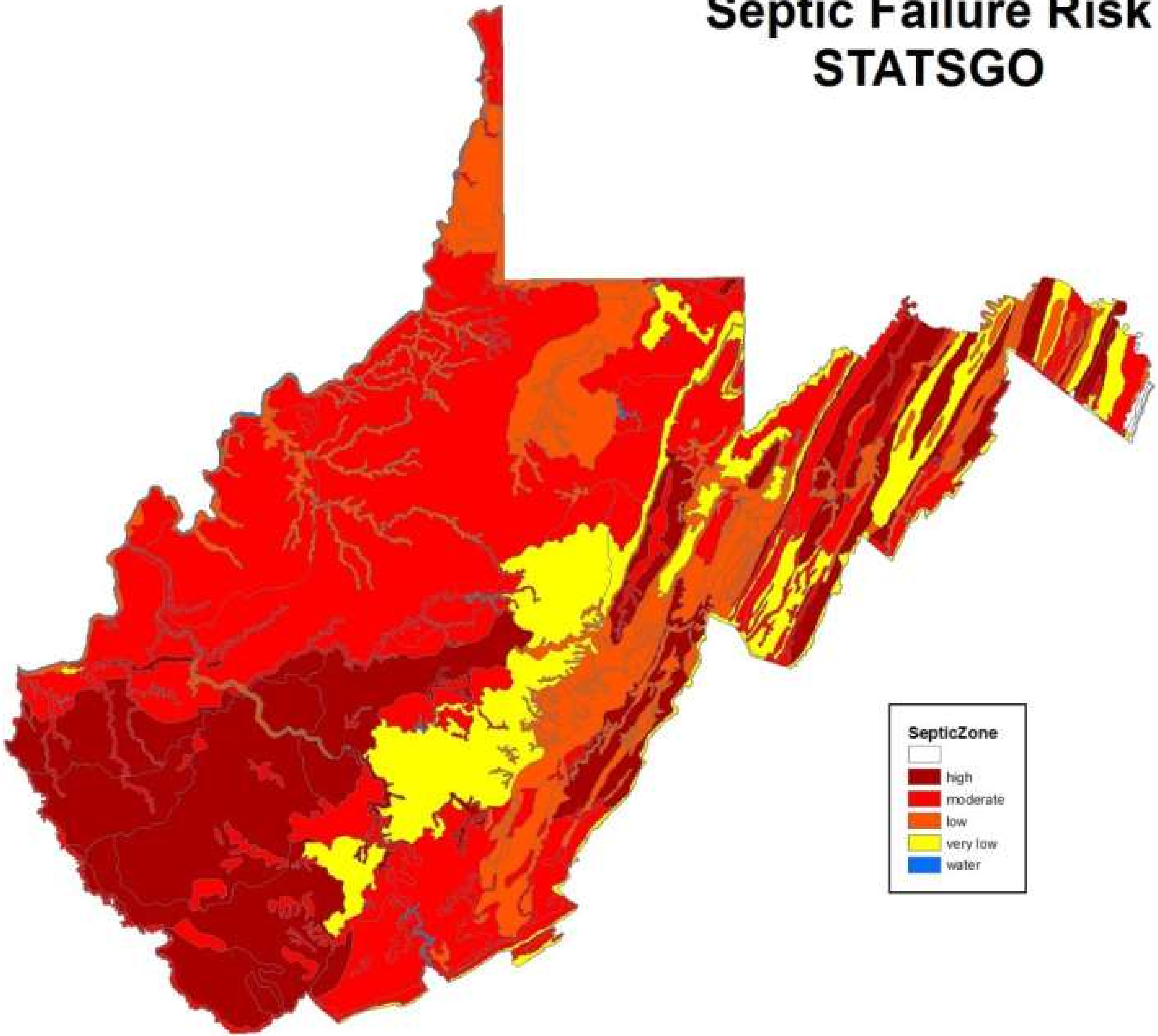

Impaired Streams
WVDEP

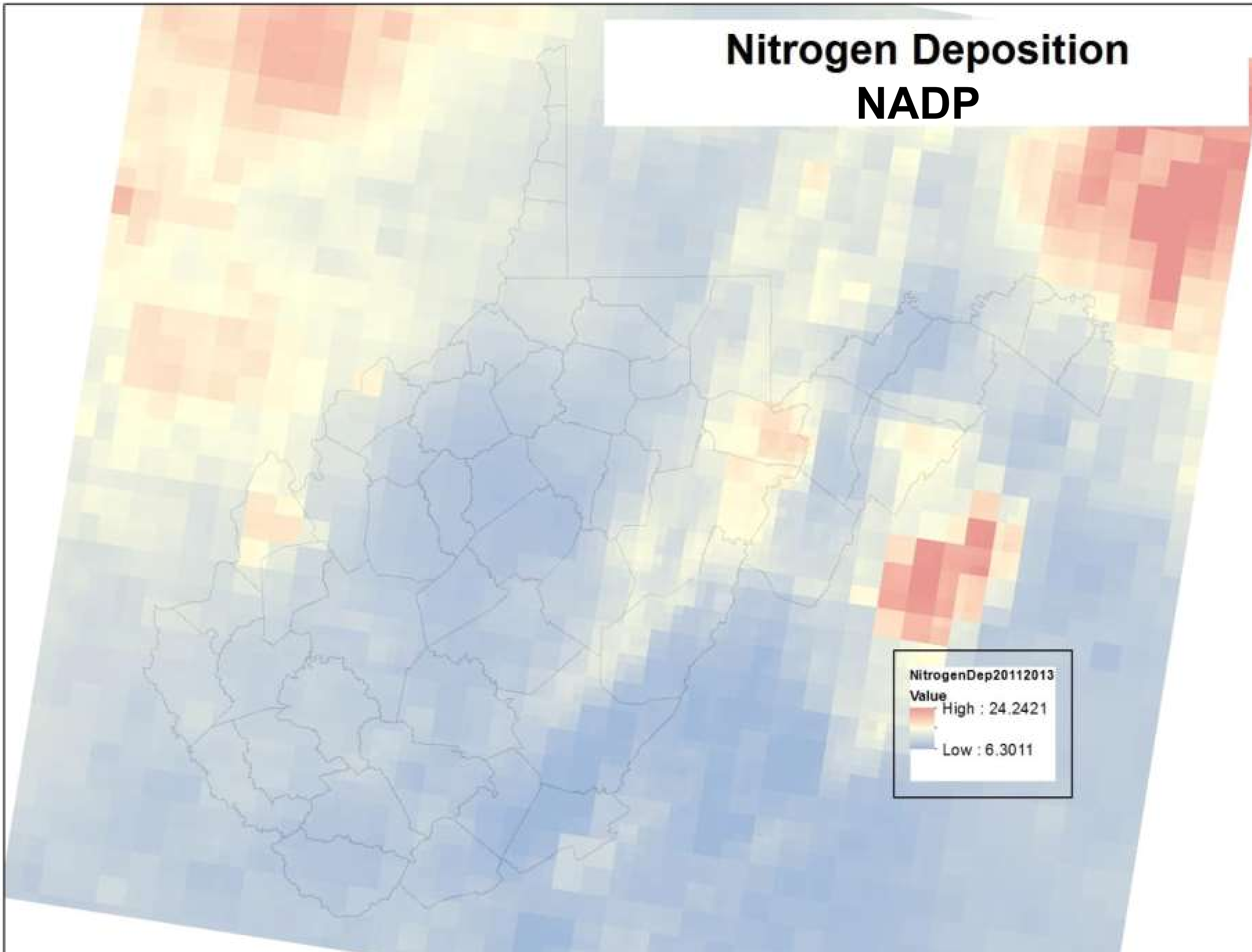

Hydrologic Protection Units
WVDEP
Legend
hpu



Recent Timber Harvest (< 5 yrs)
WVDNR & WVDOF
Belington
Junior

Septic Failure Risk
STATSGO




Nitrogen Deposition
NADP
NitrogenDep20112013
Value
High : 24.2421
Low : 6.3011

Metric Examples

Site Biodiversity Rank

Why?

- Rare species and habitats are important conservation targets

How?

Select wetlands where:

- Rare species and habitats are documented in the Natural Heritage Database
- May have local, state, or global biodiversity significance

Relationship to field assessment

- May be modified if old growth, mature forested swamp, large bog/fen, or summit sinkhole wetland is observed

Floristic Quality

Why?

- Best proxy for wetland condition; integrates many factors

How?

Select wetlands where:

- Landscape integrity is high, especially in 50 m buffer
- Vegetation is forested (except on marl or in beaver complexes)
- Extra points for histosol or karst

Relationship to field assessment

- Overwritten

Connection to the River Continuum

Why?

- Flood interception, habitat value

Relationship to field assessment

- Overwritten

How?

Select all wetlands where:

- >50% (>10%) of wetland is in the FEMA 100-yr or Active River Area floodplain
- Complexity of the wetland/stream interface is >3.4 (>1). Ditches and drains are excluded.

Organic Soils

Why?

- Denitrification, nutrient & pollution capture, habitat value

How?

Select wetlands that intersect with:

- SSURGO soils with a surface O horizon or with organic matter >30% in the top 8 cm (3 in) of the soil profile OR
- WV vegetation plots containing peat, mucky peat, muck, or mucky modified mineral soil in the top 8 cm (3 in) of the soil profile OR
- Mapped WV peatlands OR
- NWI attribute soil modifier “g” for histosol

Relationship to field assessment

- Overwritten

Microtopography

Relationship to field assessment

- Overwritten

Why?

- Sediment capture, chemical activity, habitat value

How?

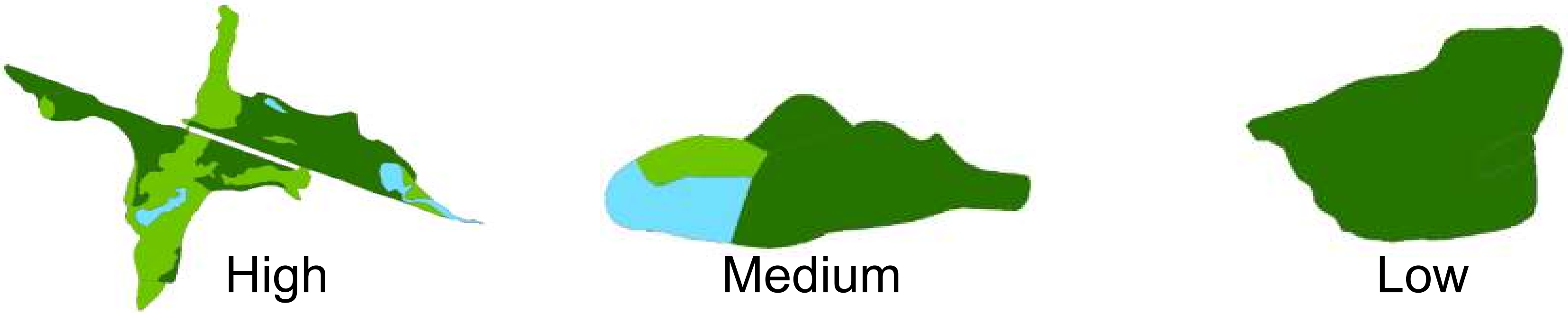
- Horizontal Interspersion (dimensionless) =

$$\frac{\text{summed perimeters of NWI communities}}{\text{sqrt (Wetland Unit area)}}$$

combined with…

- Irregularity of upland edge (dimensionless) =

$$\frac{\text{summed perimeter of Wetland Unit not bordering open water}}{\text{sqrt (Wetland Unit area)}}$$



Watershed Runoff

Why?

- Does the wetland have an opportunity to capture sediment and slow overland flow?

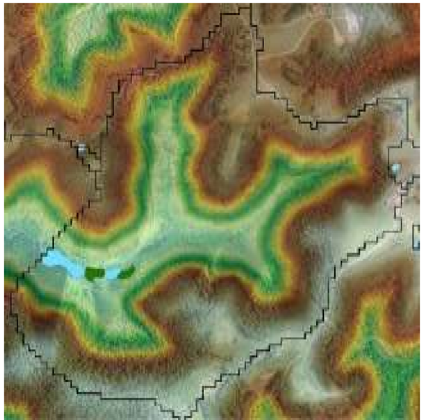
How?

- Combine median percent slope with
- Land types that produce runoff
  - NLCD classes: developed, cultivated, or barren
  - SSURGO soils with high runoff/low infiltration
  - Timber harvests within the last 5 years

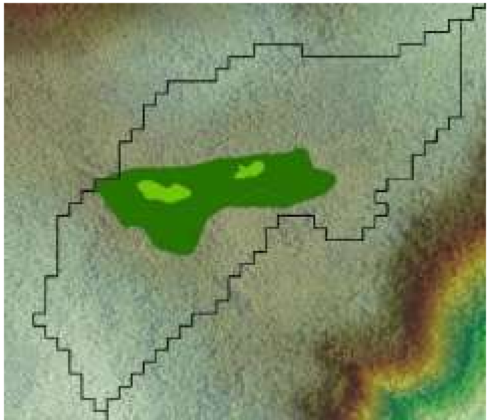
Relationship to field assessment

- GIS is final score

High



Medium

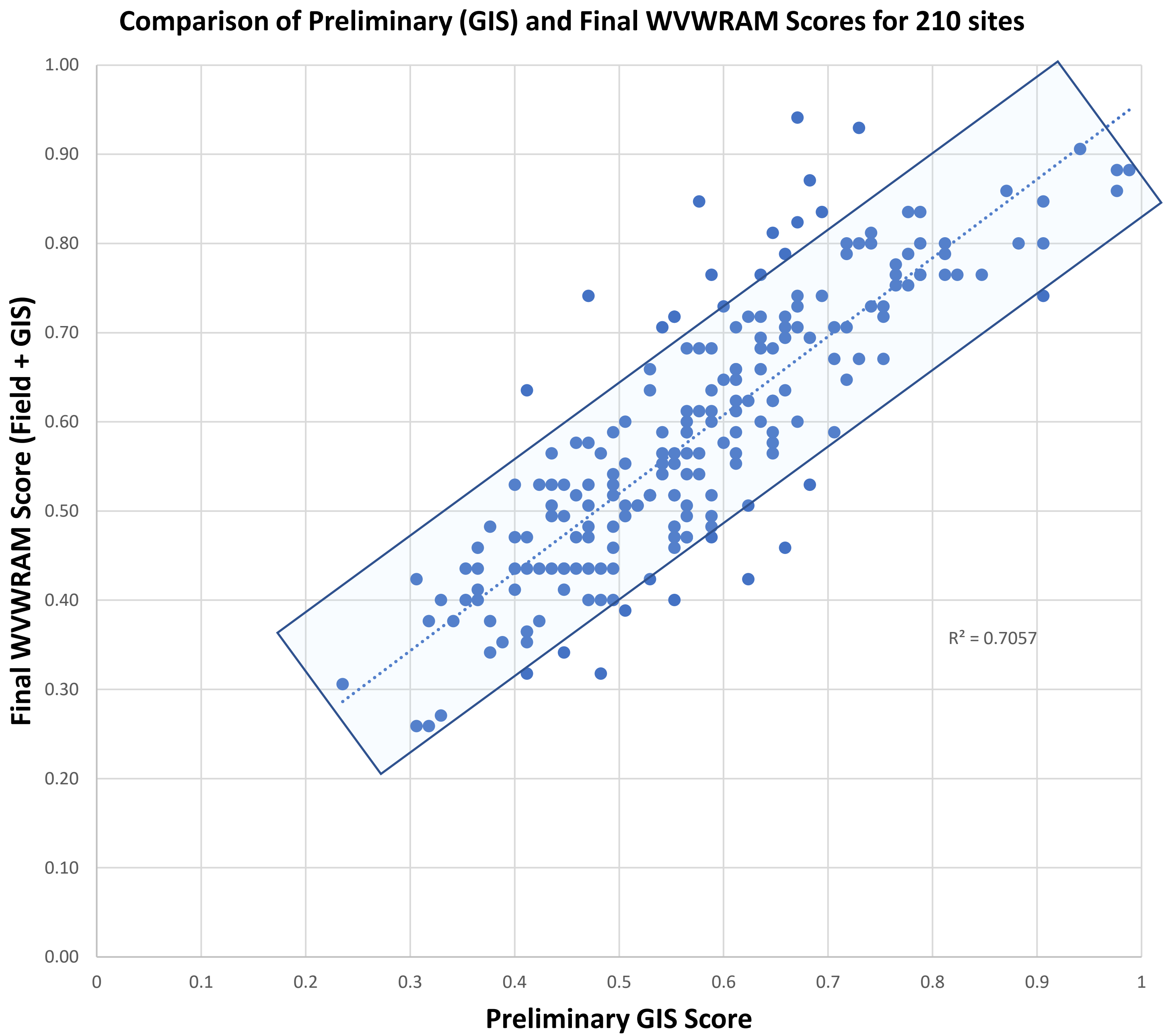


Low

GIS plus rapid field assessment:
the best of landscape-level assessment + metrics that must be obtained in the field

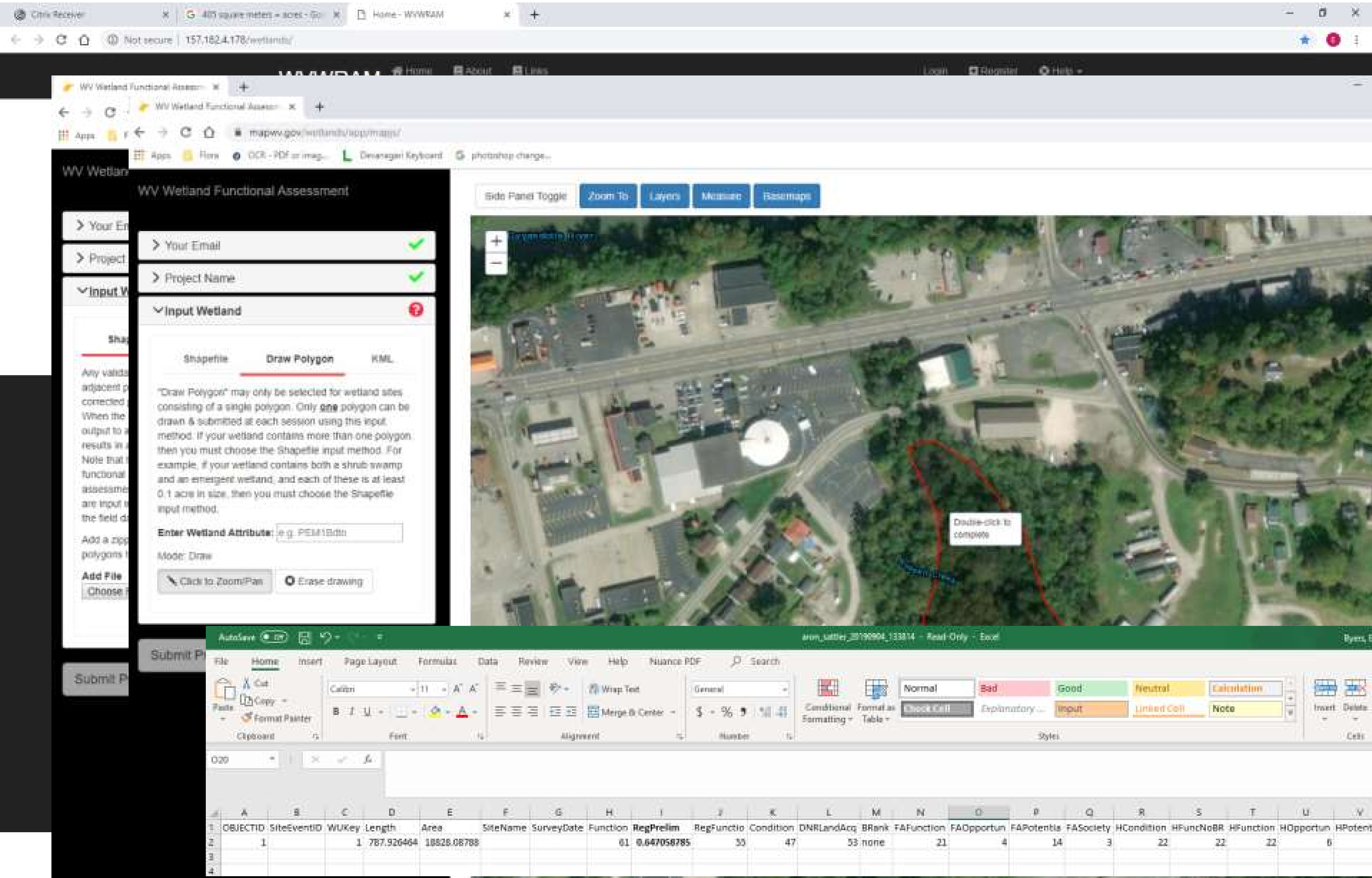
+

= Field-verified WVWRAM score



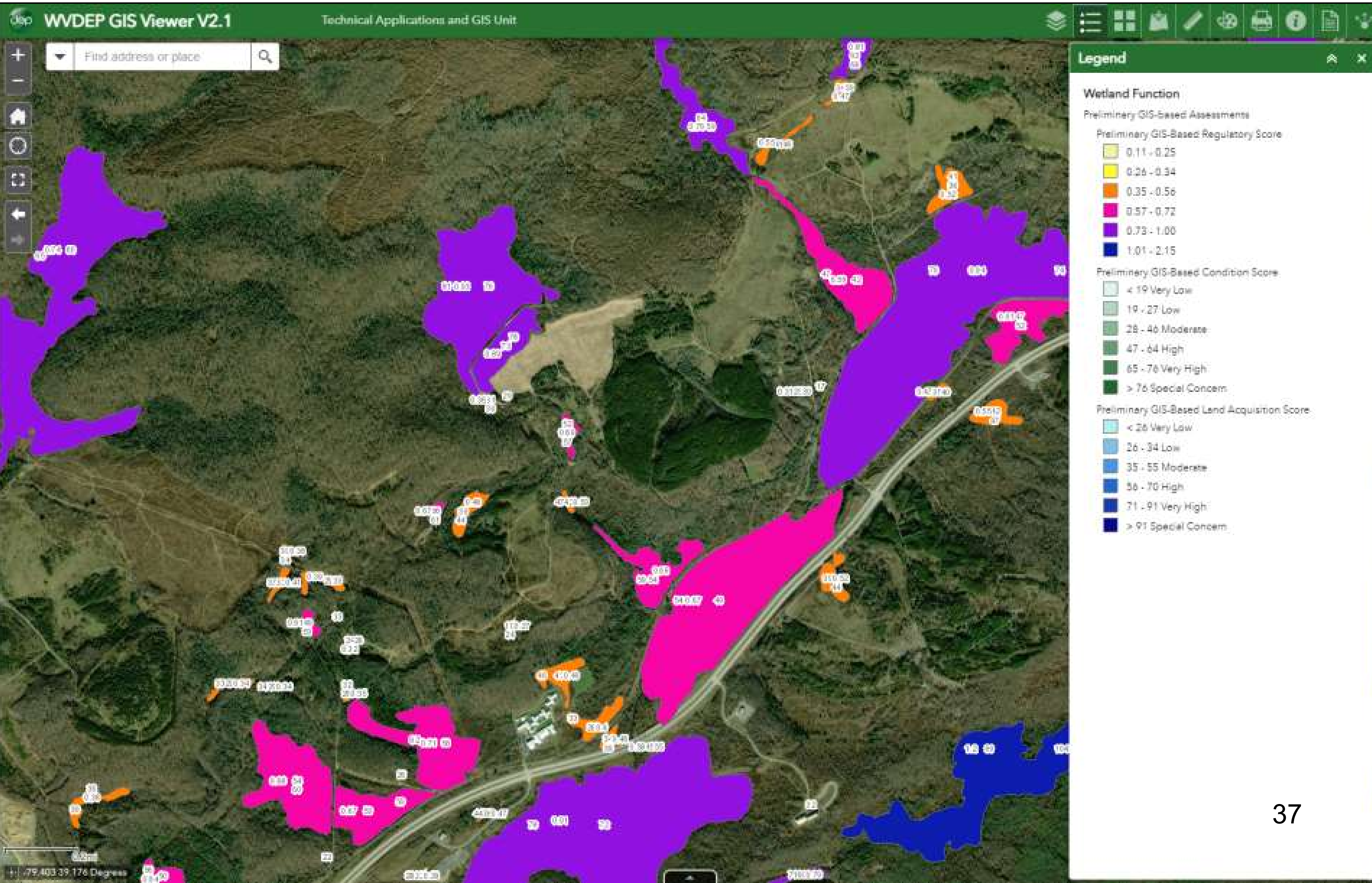
Comparison of Preliminary (GIS) and Final WVWRAM Scores for 210 sites
Final WVWRAM Score (Field + GIS)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Preliminary GIS Score
R² = 0.7057

GIS Tool: https://mapwv.gov/wetlands/



WVDEP GIS Viewer

Wetland function, condition, and land acquisition scores for all mapped wetlands



Timeline

2015: Begin development

2017: Field-testing & training with stakeholders

2020: public notice & WVDEP approval

2021: Peer review & Corps approval; begin status & trends monitoring

Jan 2024: Clean Water Act adoption

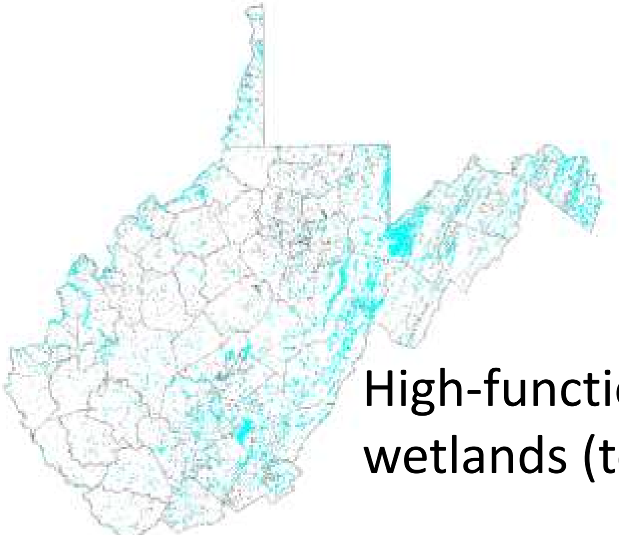
Applications

Good wetland maps & rankings promote proactive planning

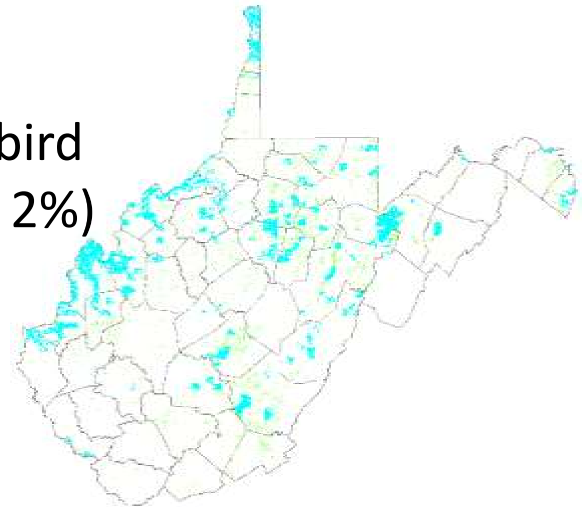
Reduce impacts to wetlands by the regulated community

- Predict mitigation costs of different sites or corridors

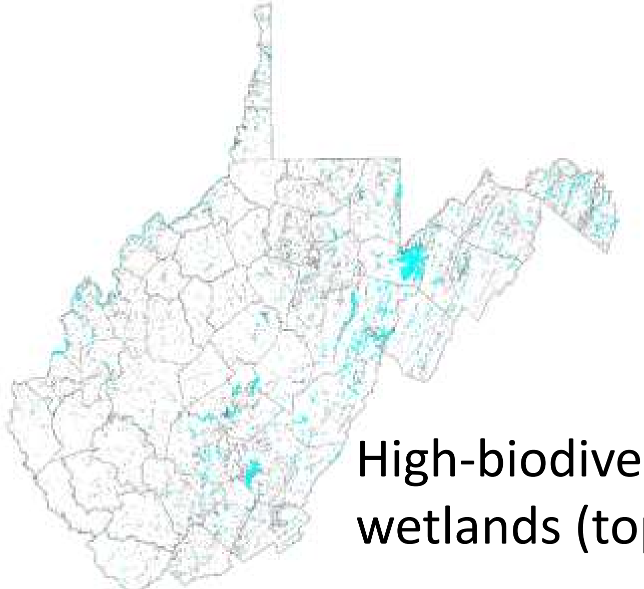
Statewide Planning



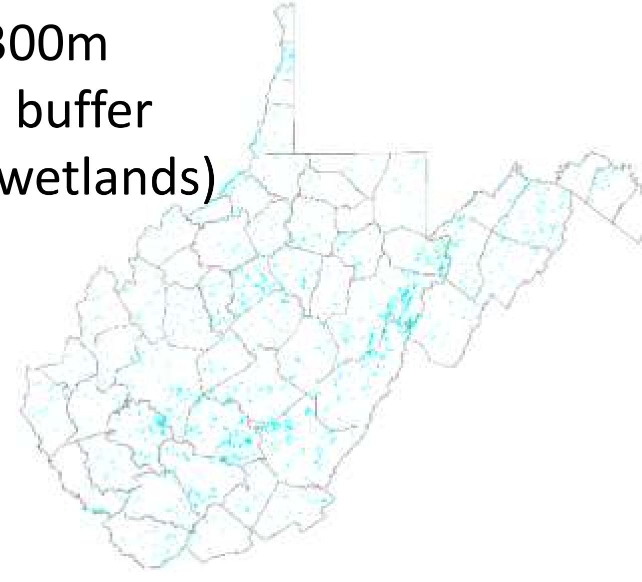
High-functioning wetlands (top 10%)



Key breeding bird wetlands (top 2%)



High-biodiversity wetlands (top 2%)



Intact 300m wildlife buffer (6% of wetlands)

Monitor Status & Trends

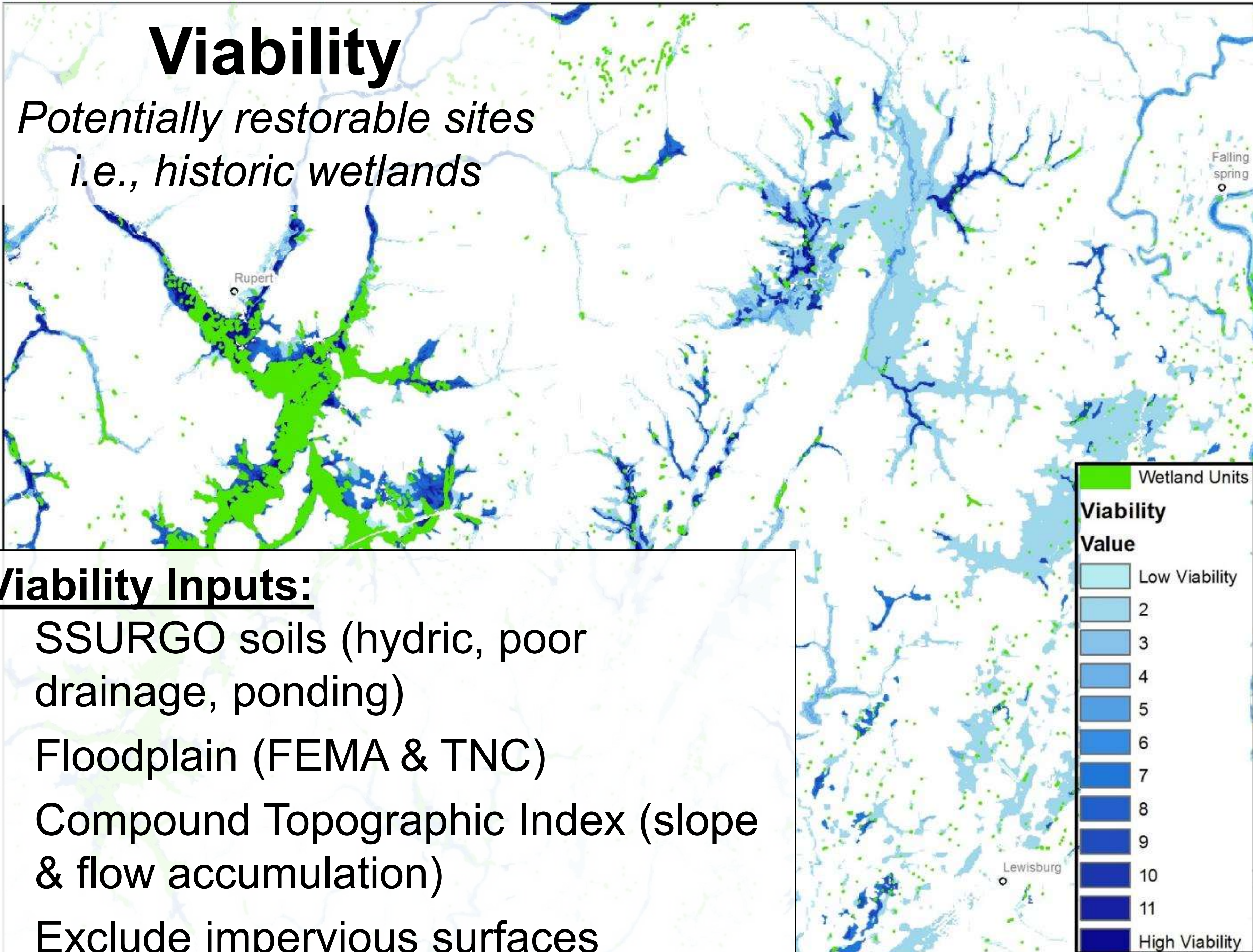
- Identify potential reference wetlands
- Combine with field assessments for probabilistic monitoring statewide

Incentivise Best Restoration Practices

- Compare potential mitigation credits at different sites prior to land acquisition; find the good neighborhoods
- Restoration Manual guides projects, showing explicit point gains for restoration actions (field assessment required)

Viability

Potentially restorable sites
i.e., historic wetlands



Viability Inputs:

- SSURGO soils (hydric, poor drainage, ponding)
- Floodplain (FEMA & TNC)
- Compound Topographic Index (slope & flow accumulation)
- Exclude impervious surfaces

Conservation Planning

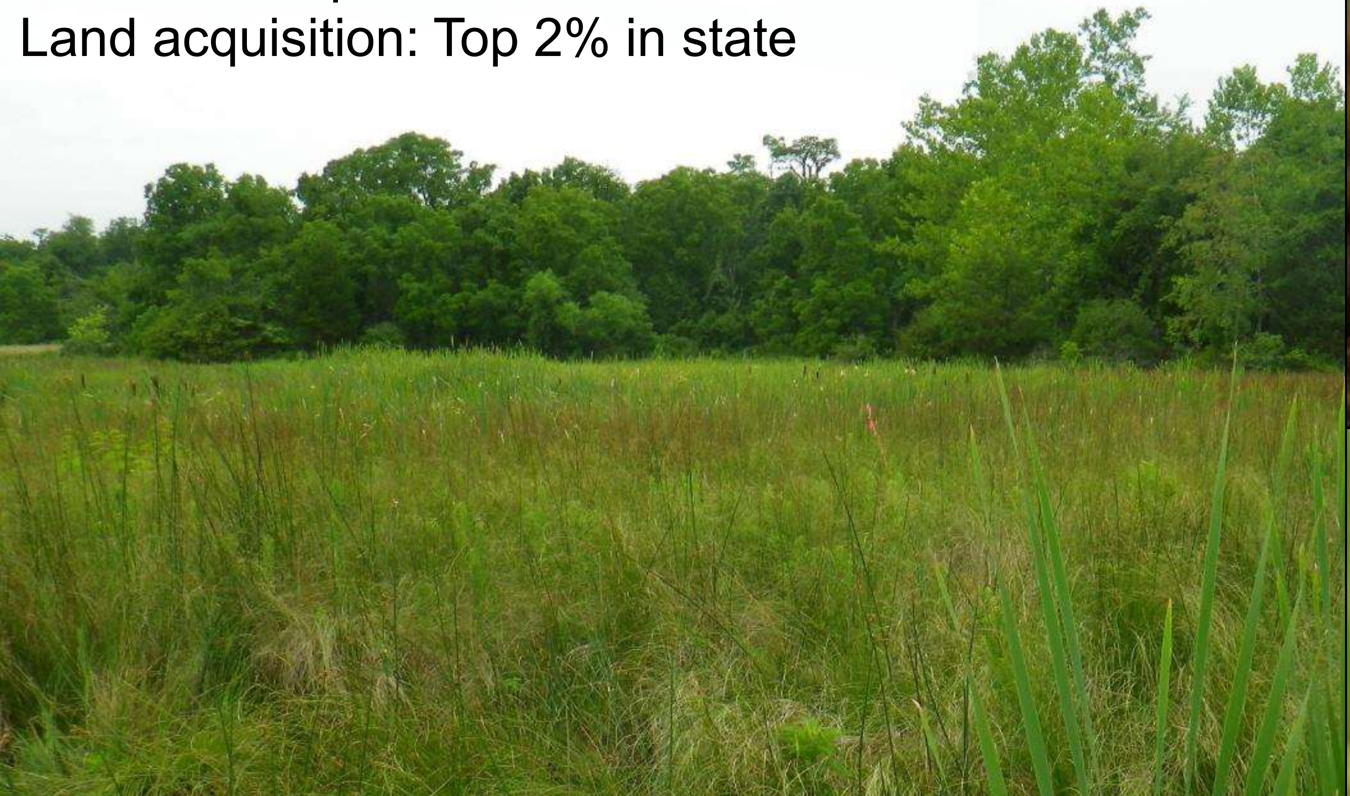
- WVDNR land acquisition decisions
- Outdoor Heritage Conservation Fund
- Municipalities and counties
- Land trusts and conservation organizations
- Engaged citizens

Degraded marsh, Hardy County
Regulatory Function: 0.39 (low)
Condition: Poor, bottom one-third in state
Land acquisition: Bottom one-third in state


Pin Oak Swamp, Greenbrier County
Regulatory Function: 0.94 (high)
Condition: Top 7% in state
Land acquisition: Top 9% in state

Shepherdstown Marl Fen

Regulatory Function: 1.00 (Exemplary)
Condition: Top 2% in state
Land acquisition: Top 2% in state



With thanks to:

EPA United States Environmental Protection Agency

WILDLIFE West Virginia Division of Natural Resources

WV GIS TC West Virginia GIS Technical Center

USDA Natural Resources Conservation Service U.S. Department of Agriculture

dep

For more information, type “WVWRAM” into your search engine, or contact Elizabeth.A.Byers@wv.gov