WV WATERSHED ASSESSMENT PILOT PROJECT

The Nature Conservancy
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Chesapeake Bay Program Meeting, Dec. 19th, 2013
Annapolis, MD

Project Background & Methodology

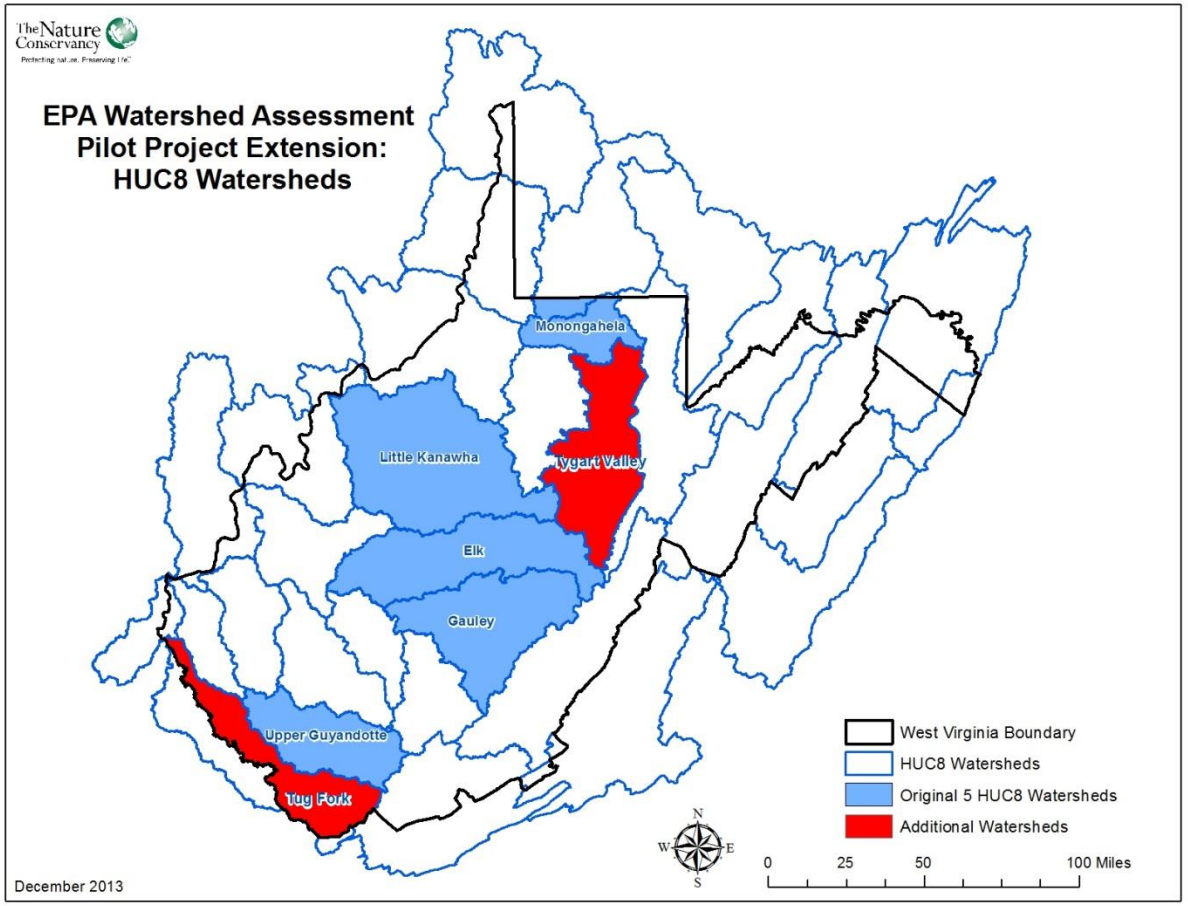
Project Objectives

- Design and test a watershed assessment process that can be replicated in WV's remaining watersheds
- Find datasets & develop metrics to measure Current Condition/Function & Future Threats
- Rank planning units in terms of Restoration & Protection Priorities
- Provide a decision support tool to assist partners, stakeholders, and regulatory staff with decisions affecting aquatic resources
- Identify data gaps & data needs

Project Study Area

7 HUC8 Watersheds:

- YEAR 1:
  - Monongahela
  - Elk
- YEAR 2:
  - Gauley
  - Little Kanawha
  - Upper Guyandotte
- Extension:
  - Tug Fork
  - Tygart Valley



Project Process & Timeline

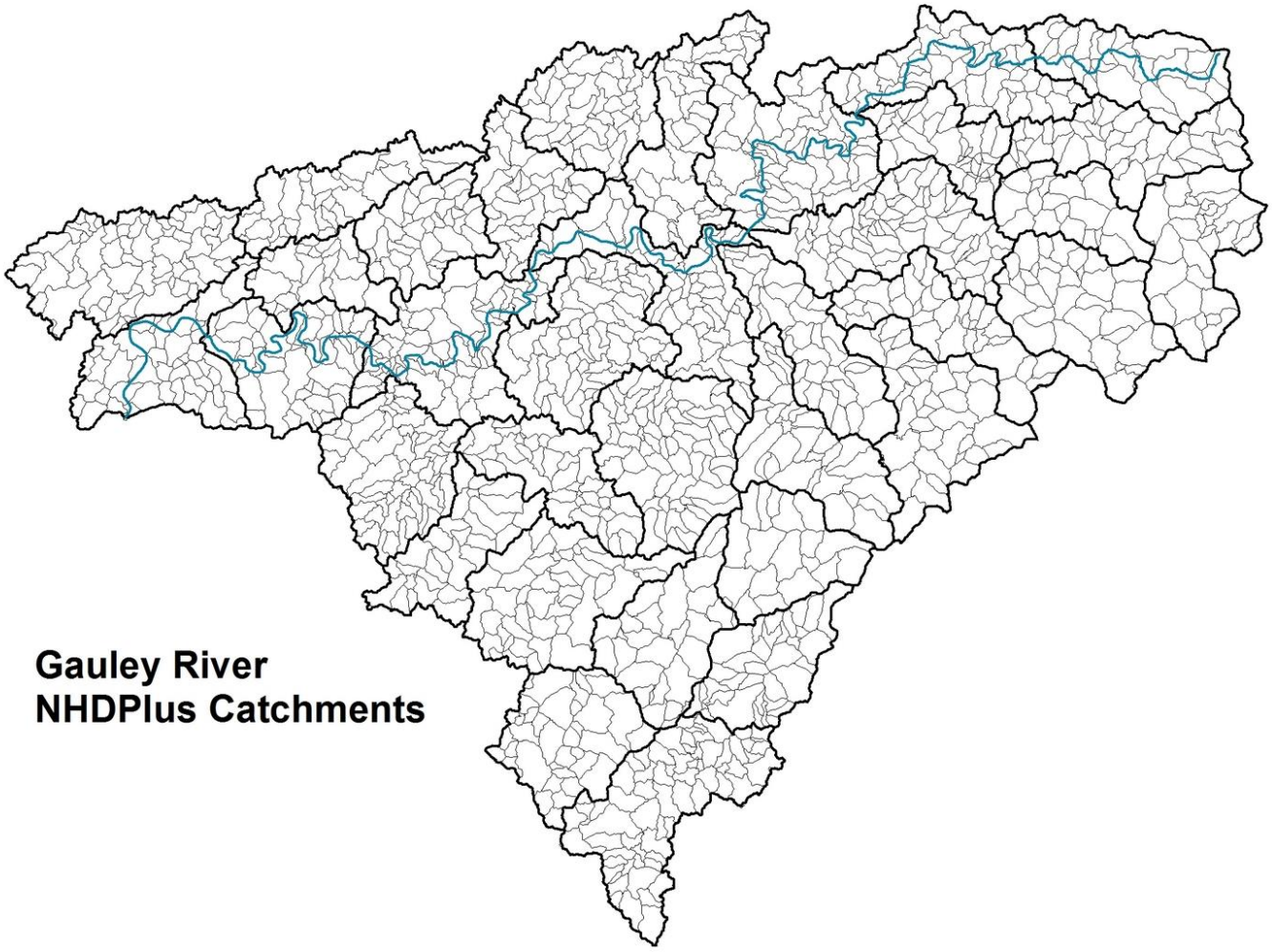
- First 2 Watersheds:
  - April 2011 – Project Start: Data Compilation
  - June 2011 – Technical Advisory Team Meeting
  - October 2011 – Expert Workshop #1
  - January 2012 – Expert Workshop #2
  - April 2012 – Stakeholder/Partner Workshop
  - June 2012 – Draft Watershed Reports completed
- Next 3 Watersheds:
  - June 2012 – Start Data Compilation
  - October 2012 - Expert Workshop #1
  - January 2013 – Expert Workshop #2
  - May 2013 - Stakeholder/Partner Workshop
  - June 2013 – Draft Watershed Reports completed
- Final 2 Watersheds (extended timeline)
  - November 2013 – Stakeholder/Partner Workshop
  - December 2013 – Final reports & interactive web tool completed

Watershed Characterization

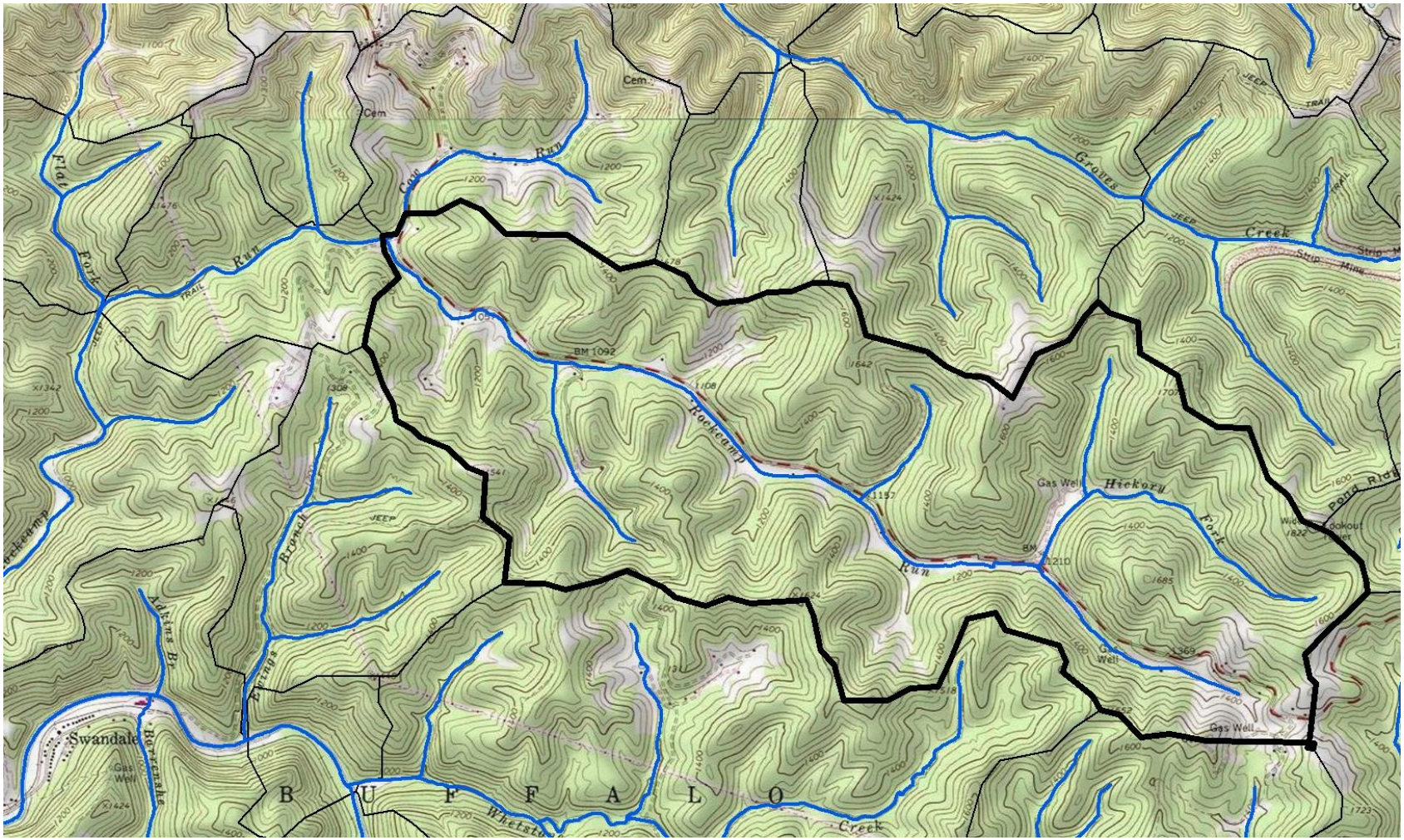
- Two Scales of Planning Units:
  - HUC-12 watersheds
  - Catchments

Planning Units 1: HUC12s

Planning Units 2: Catchments

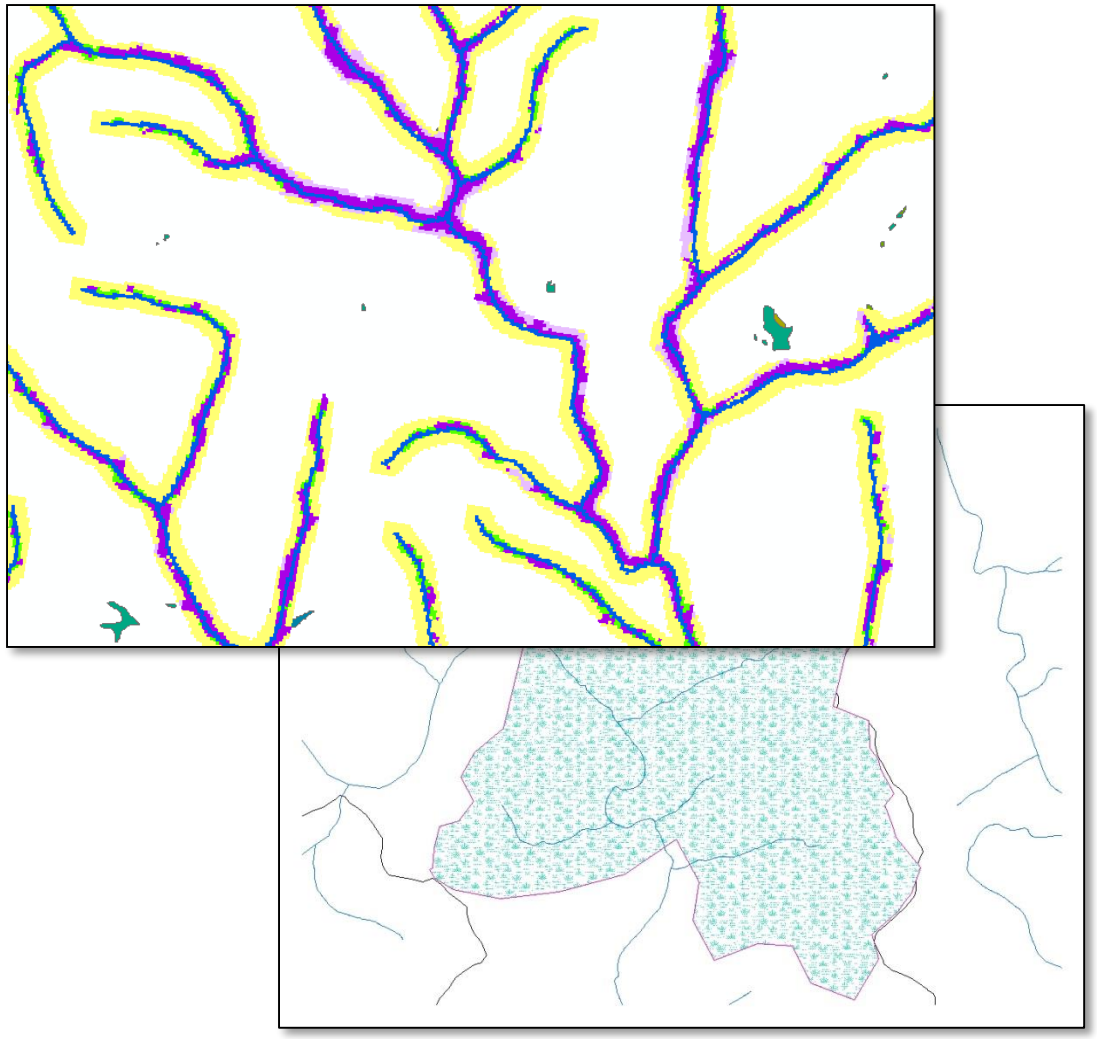


NHDPlus Catchments (modified)



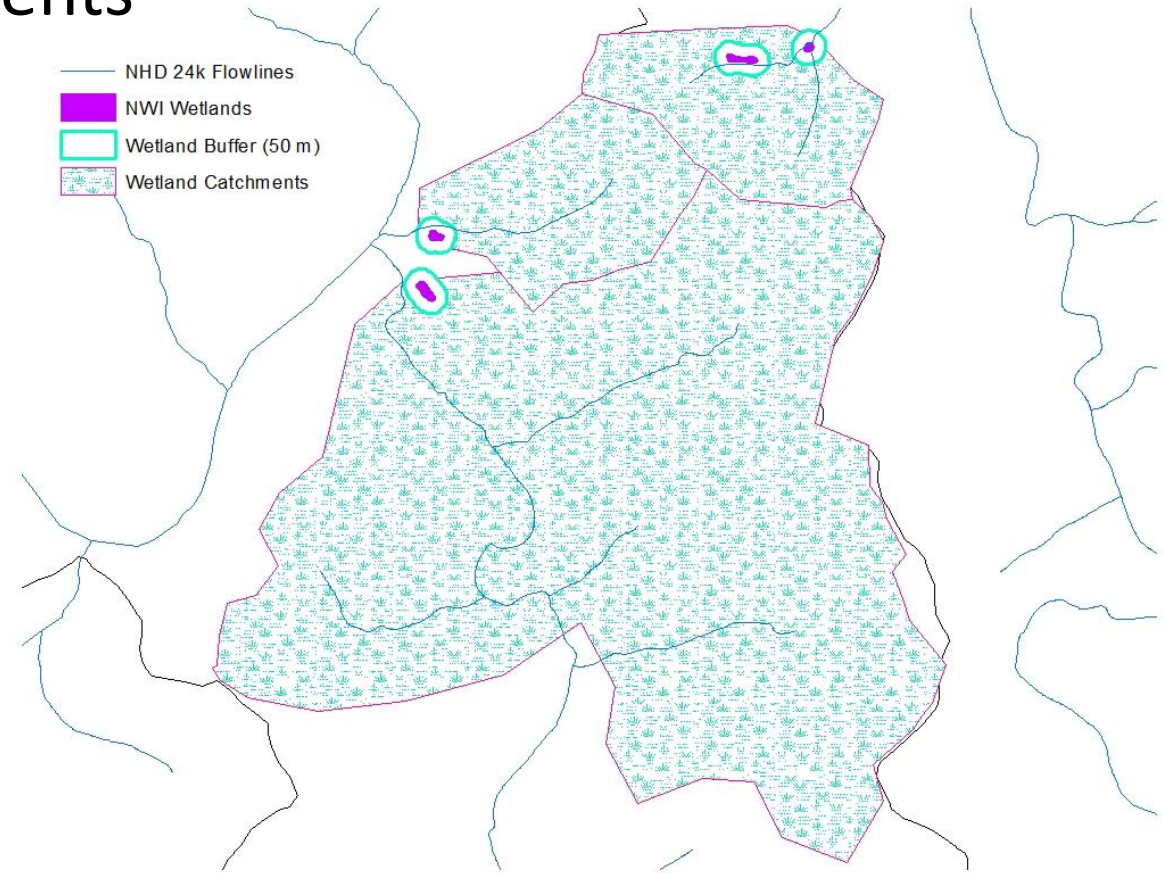
3 Models: Landscape Types

- Stream/Riparian Areas
- Wetlands
- Uplands



Wetland Buffer vs. Catchment

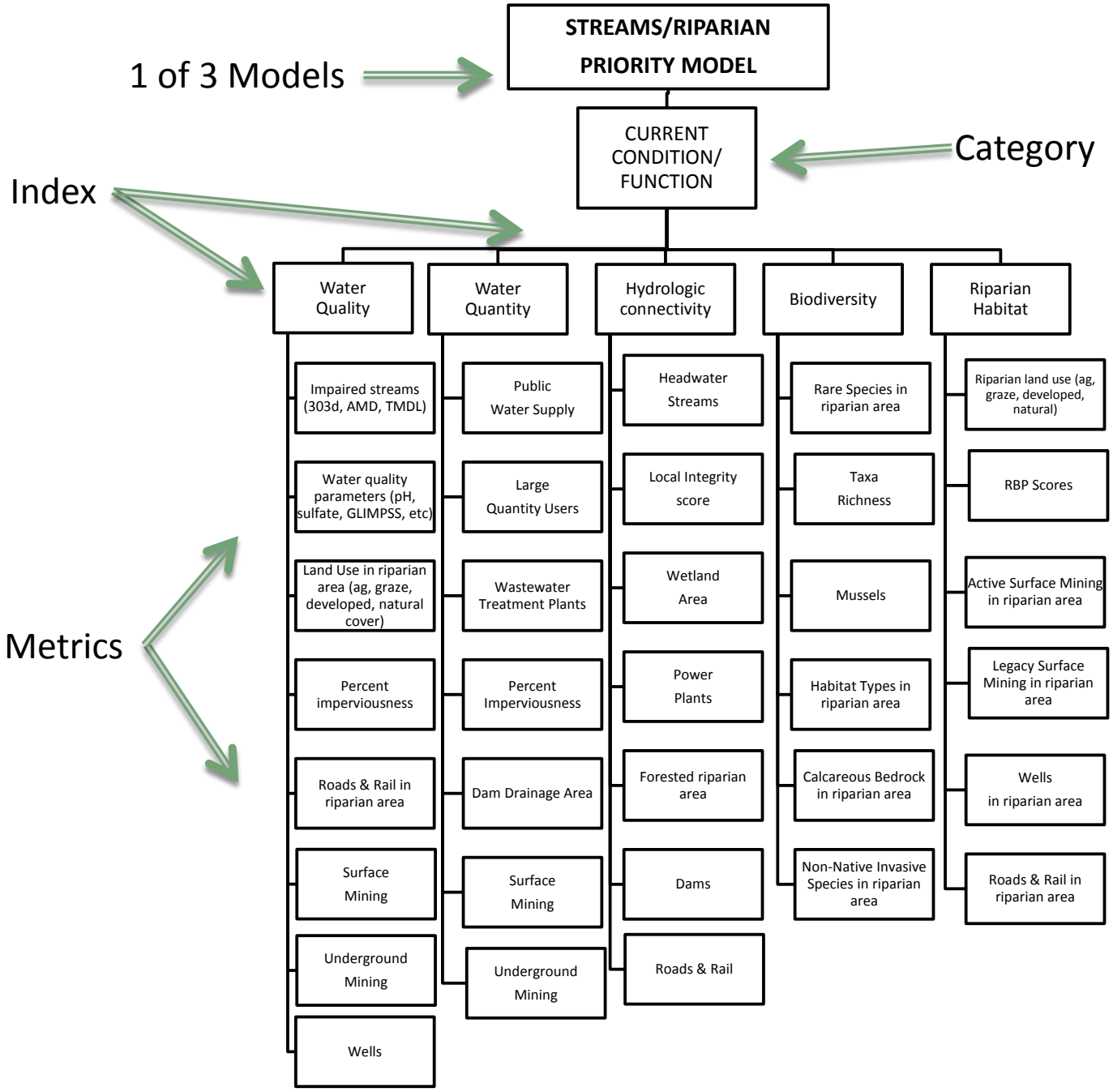
- Wetland buffer (50 m)
- Wetland catchments (delineated using contributing NHDPlus catchments)



Model Structure

Hierarchical Structure:

- 3 Categories:
  - Current Condition/Function
    - Streams
    - Wetlands
    - Uplands
  - Future Threats
  - Opportunities
- Several Indices per Category
- Multiple Metrics to define each index


1 of 3 Models
STREAMS/RIPARIAN PRIORITY MODEL
CURRENT CONDITION/ FUNCTION
Category
Index
Metrics
Water Quality
Water Quantity
Hydrologic connectivity
Biodiversity
Riparian Habitat
Impaired streams (303d, AMD, TMDL)
Water quality parameters (pH, sulfate, GLIMPSS, etc)
Land Use in riparian area (ag, graze, developed, natural cover)
Percent imperviousness
Roads & Rail in riparian area
Surface Mining
Underground Mining
Wells
Public Water Supply
Large Quantity Users
Wastewater Treatment Plants
Percent Imperviousness
Dam Drainage Area
Surface Mining
Underground Mining
Headwater Streams
Local Integrity score
Wetland Area
Power Plants
Forested riparian area
Dams
Roads & Rail
Rare Species in riparian area
Taxa Richness
Mussels
Habitat Types in riparian area
Calcareous Bedrock in riparian area
Non-Native Invasive Species in riparian area
Riparian land use (ag, graze, developed, natural)
RBP Scores
Active Surface Mining in riparian area
Legacy Surface Mining in riparian area
Wells in riparian area
Roads & Rail in riparian area

Redundant Metrics

- Perform Correlation Analysis to find highly correlated metrics
- Performed on HUC12 analysis
- PCA: to find metrics with greatest impact on water quality
- Eliminated several metrics

Metrics in Multiple Indices

- Some metrics appropriate in multiple indices:
  - Percent impervious cover
  - Surface mining
  - Oil and Gas wells
  - Road/railroad density
  - Landcover
- Indices are rated independently of each other

Weighting

- Some metrics influence condition more than others – need to weight accordingly
- Weighting based on literature review, expert opinion, workshop discussions, and “best professional judgment”
- Weighted both individual metrics and individual indices

Metrics: Condition/Function

1. Streams & Riparian Areas
2. Wetlands
3. Uplands

Indices: Streams

CONDITION/ FUNCTION

- Water quality
- Water quantity
- Hydrologic Connectivity
- Biodiversity
- Riparian Habitat

Water Quality Metrics

- Impaired Streams (303(d), TMDL, AMD)
- DEP's Water Quality Data (pH, sulfate, specific conductivity, sedimentation & embeddedness scores)
- GLIMPSS
- Surface & Underground Mining
- Impervious Surface
- Landuse/Landcover:
  - Agricultural
  - Grazed
  - Natural
  - Developed
- Oil and Gas Wells
- Road/railroad density

Water Quantity/Flow Alteration Metrics

- No good direct measurements for most streams, especially headwaters, had to find surrogates:
  - Dam drainage area
  - Impervious surface
  - Large Quantity Users
  - Public water supply intakes
  - Mining: Surface & Underground

Hydrologic Connectivity Metrics

- Percent riparian area with forested cover
- Power plants
- Roads/railroads in Riparian Area
- Percent of stream miles that are headwaters
- Wetland area

Biodiversity Metrics

- Rare and threatened species (includes DNR's SGNC species), including mussels, fish, crayfish, odonates
- Maximum number of benthic macroinvertebrate taxa
- Number of Habitat Types
- Non-native invasive species
- Mussel streams
- Calcareous bedrock

Riparian Habitat Metrics

- Riparian land use
- Active & legacy surface mining
- Oil and gas wells
- Road/railroad density
- Pipelines, transmission lines, buildings
- RBP score

Indices: Wetlands

CONDITION/ FUNCTION

- Water quality: Pollutant filtration/sediment retention
- Hydrology: Flood storage/connectivity
- Biodiversity
- Wetland Habitat

Planning Units without Wetlands

- Several planning units did not have mapped NWI wetlands, but did have hydric soils
- No scores for metrics/indices dependent on presence of wetlands
- Planning units without hydric soils or mapped NWI wetlands did not receive a wetlands score
- Planning units without mapped wetlands but with hydric soils considered restoration priorities

Water Quality Metrics (by catchment)

- Forested headwater wetlands
- Landcover in wetland catchments (% ag, grazing, urban, forested, natural)
- % imperviousness
- Roads/railroads
- Surface mining
- Oil & gas wells

Wetland Hydrology Metrics (by buffer)

- Wetland area
- Hydric soils (potential for wetland restoration)
- Forested headwater wetlands
- Forested wetlands in floodplain
- Floodplain area

Indices: Uplands

CONDITION/ FUNCTION

- Habitat Connectivity
- Upland Habitat
- Biodiversity

Habitat Connectivity metrics

- Forest Block Sizes
- Local integrity score
- Active surface mining
- Oil & gas wells
- Road/railroad density
- Development
- Transmission lines, pipelines, wind turbines
- Timber harvests

Consolidated Analysis

- Future Threats
- Opportunities

Future Threats

- Energy
  - Oil and Gas wells: well potential, proposed wells, Marcellus Shale thickness
  - Coal: unmined coal, unmined coal under permit
  - Modeled wind potential, geothermal potential
  - Proposed transmission lines, pipelines, power plants, wind turbines
- Population/Development
  - Future growth areas, population projections
  - Proposed dams, roads
- Climate Change
  - Resiliency & current density: TNC-generated datasets
  - Projected temperature & precipitation changes

Opportunities

- Protected Lands
  - Only permanently protected lands included
  - Public Lands
    - Federal
    - State
    - Local
  - Privately protected lands
    - Conservation easements
    - NGO preserves
- Priority Interest Areas
  - USFS Proclamation Boundary
  - WV Division of Forestry priority areas
  - NPS priority areas
  - TNC portfolio (aquatic and terrestrial)

Objective Analysis

Objective Analysis Categories

- Very Good: Ecologically desirable status; requires little intervention for maintenance
- Good: Indicator within acceptable range of variation; some intervention required for maintenance

Restoration Threshold

- Fair: Outside acceptable range of variation; requires human intervention
- Poor: Restoration increasingly difficult; may result in extirpation of target

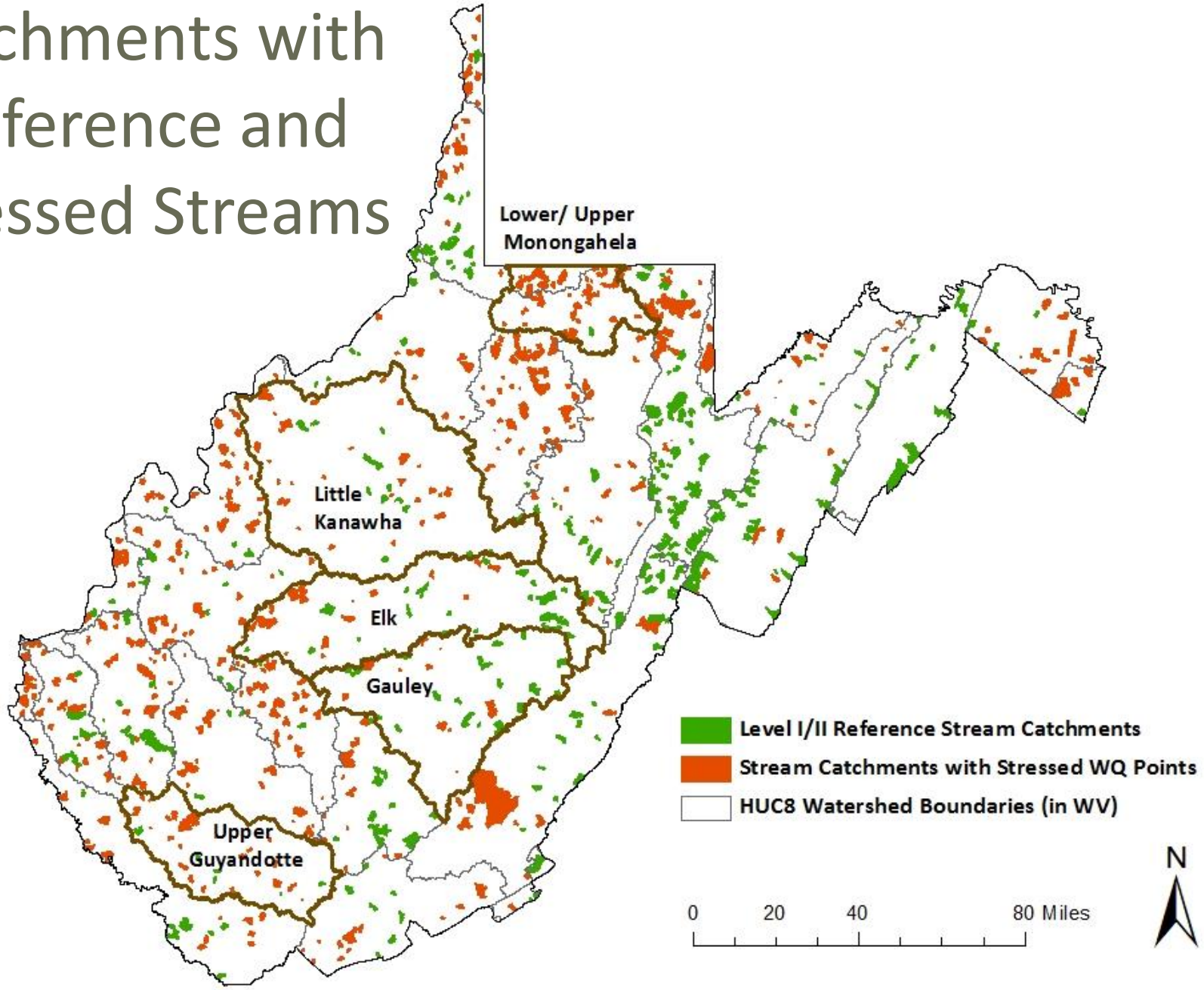
Objective Classification

- Defined thresholds for each metric and assigned each planning unit to one of four categories:
  - Very good
  - Good
  - Fair
  - Poor
- Used the DEP's reference streams and stressed points to define thresholds – represent the "best" and "worst" catchments

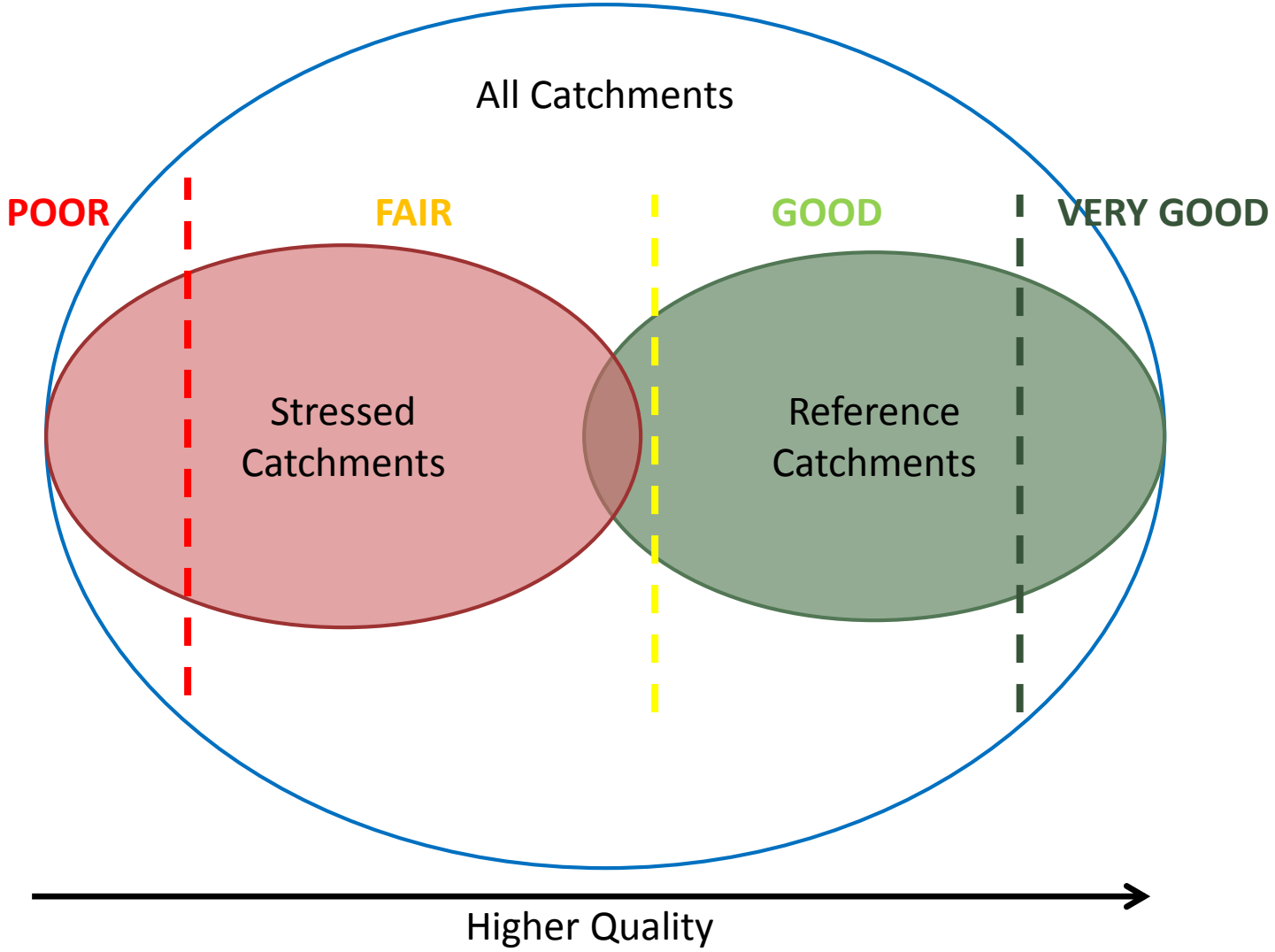
Objective Ranking Methodology

- Calculated metrics for stressed and reference catchments separately
  - Reference catchments defined thresholds for very good/good categories
  - Stressed catchments defined thresholds for fair/poor categories
- Each metric received an objective score
- Averaged metric scores (by weight) for index scores

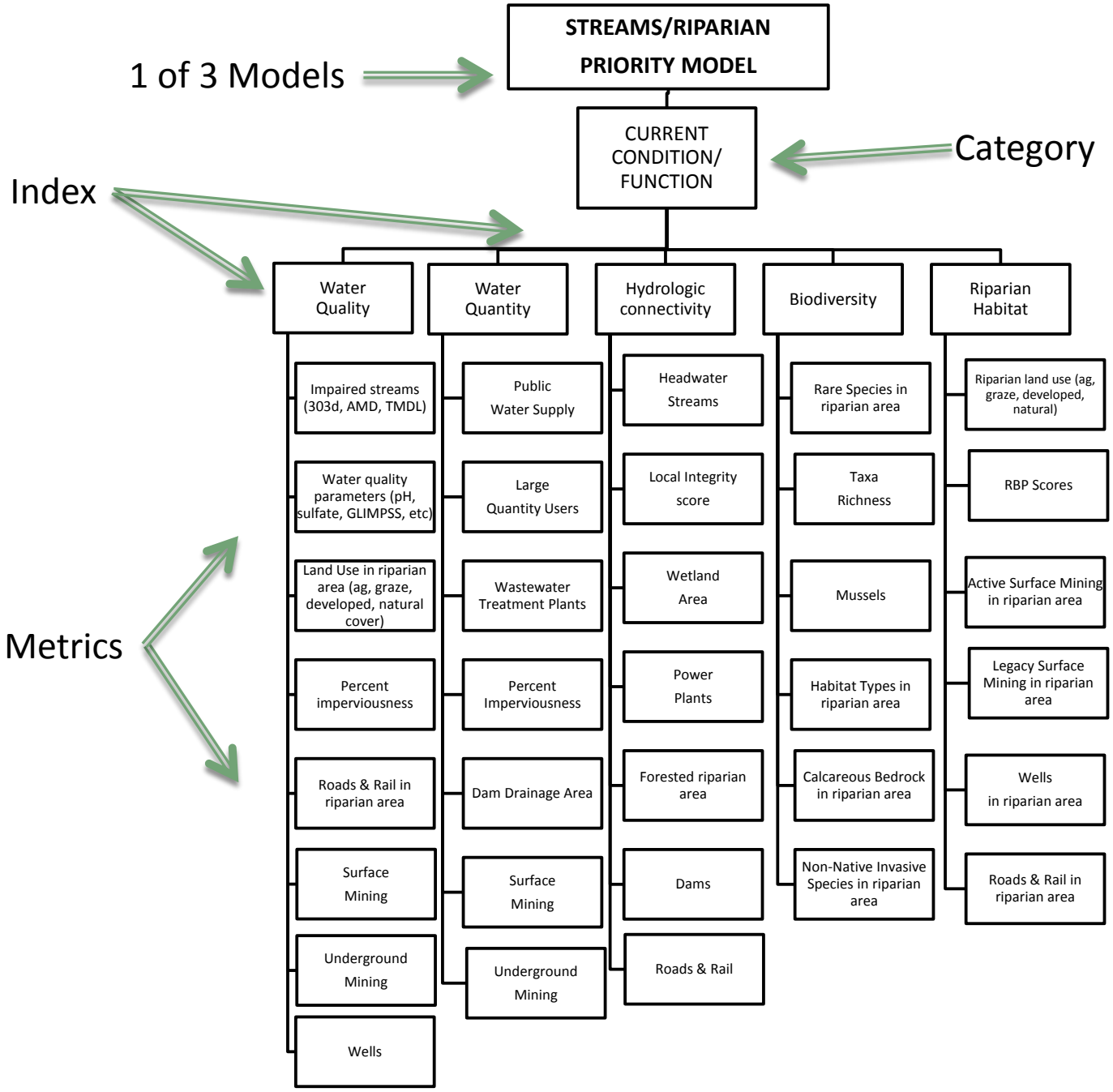
Catchments with Reference and Stressed Streams



Objective Ranking Methodology



Index and Model Results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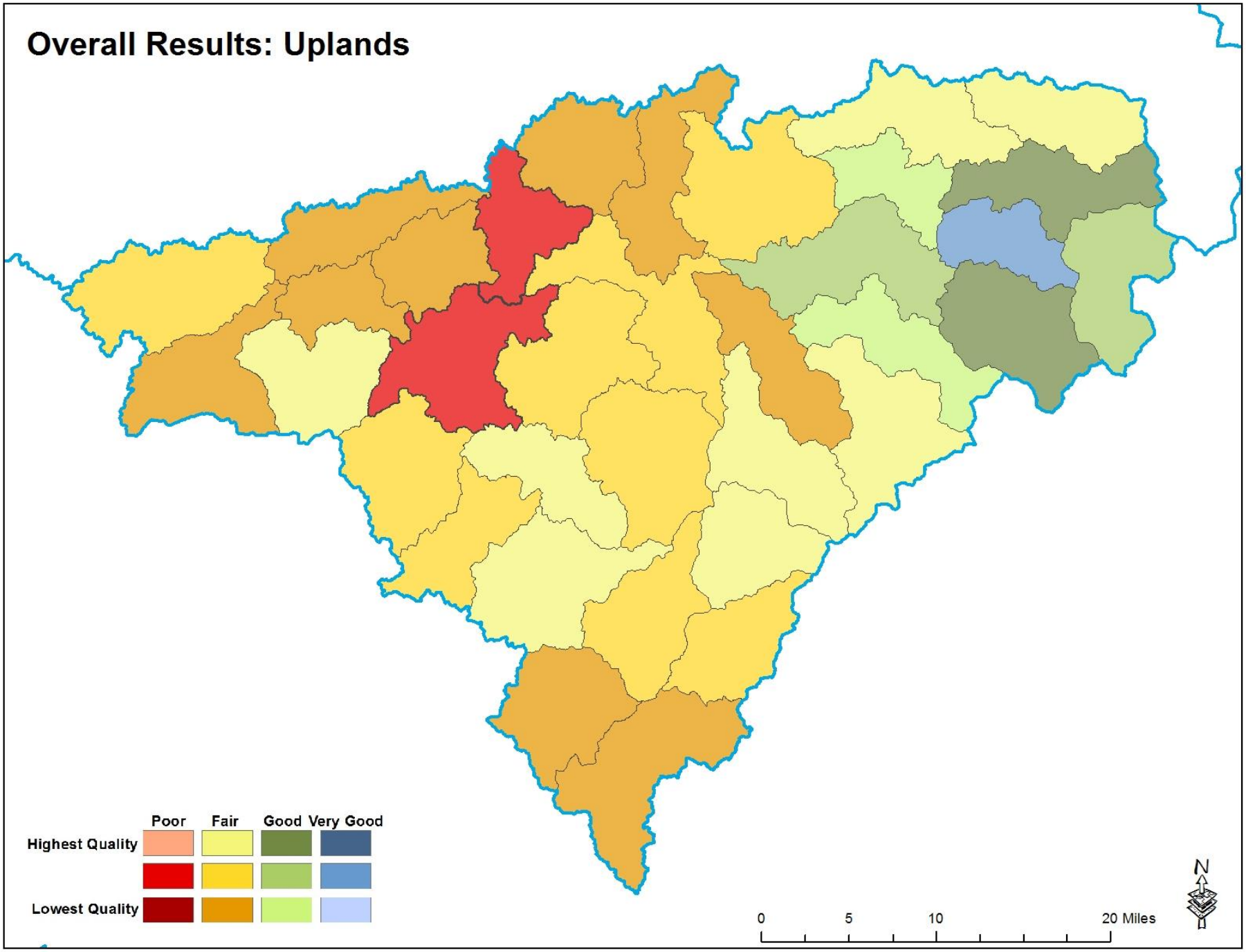
Overall Results: Uplands



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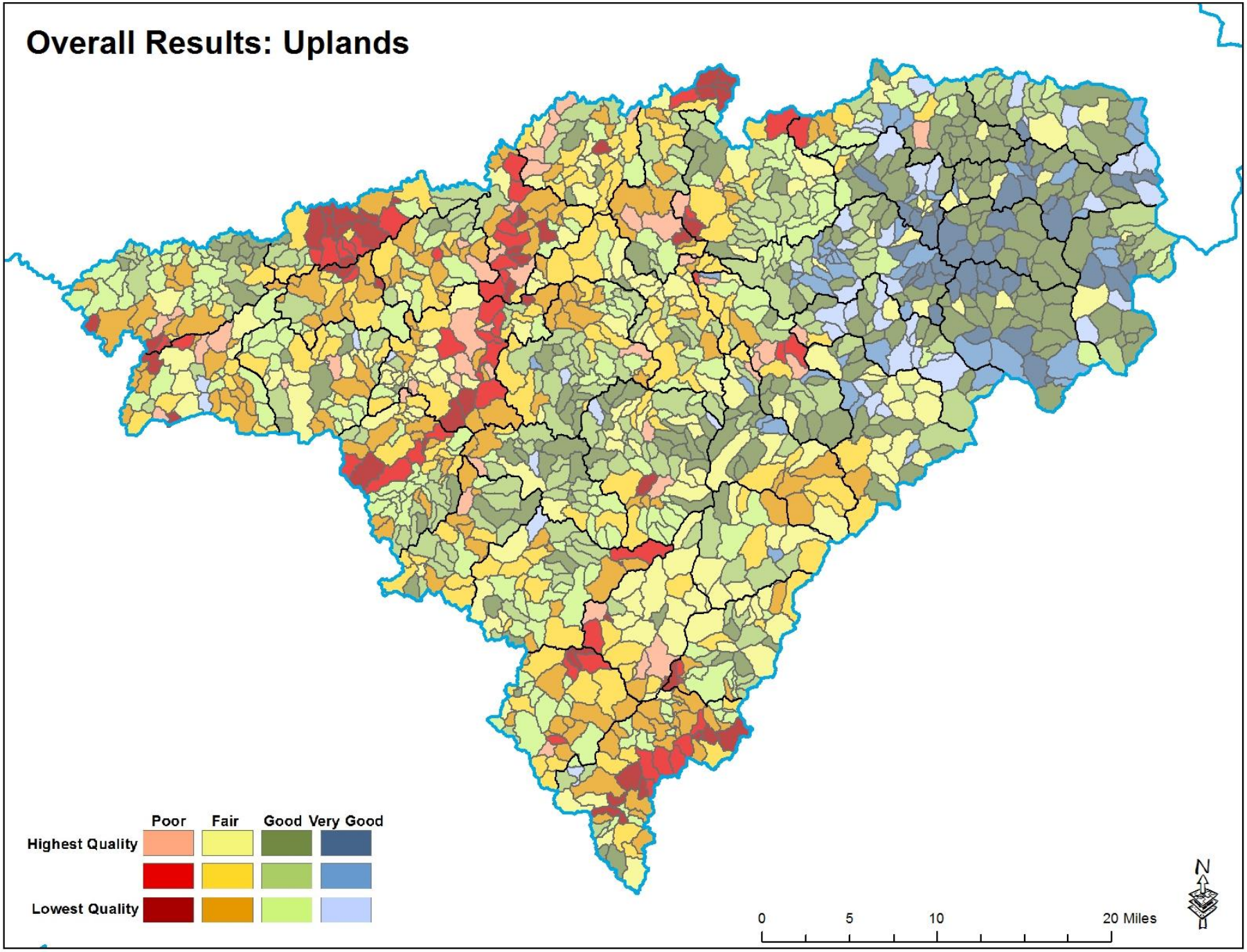
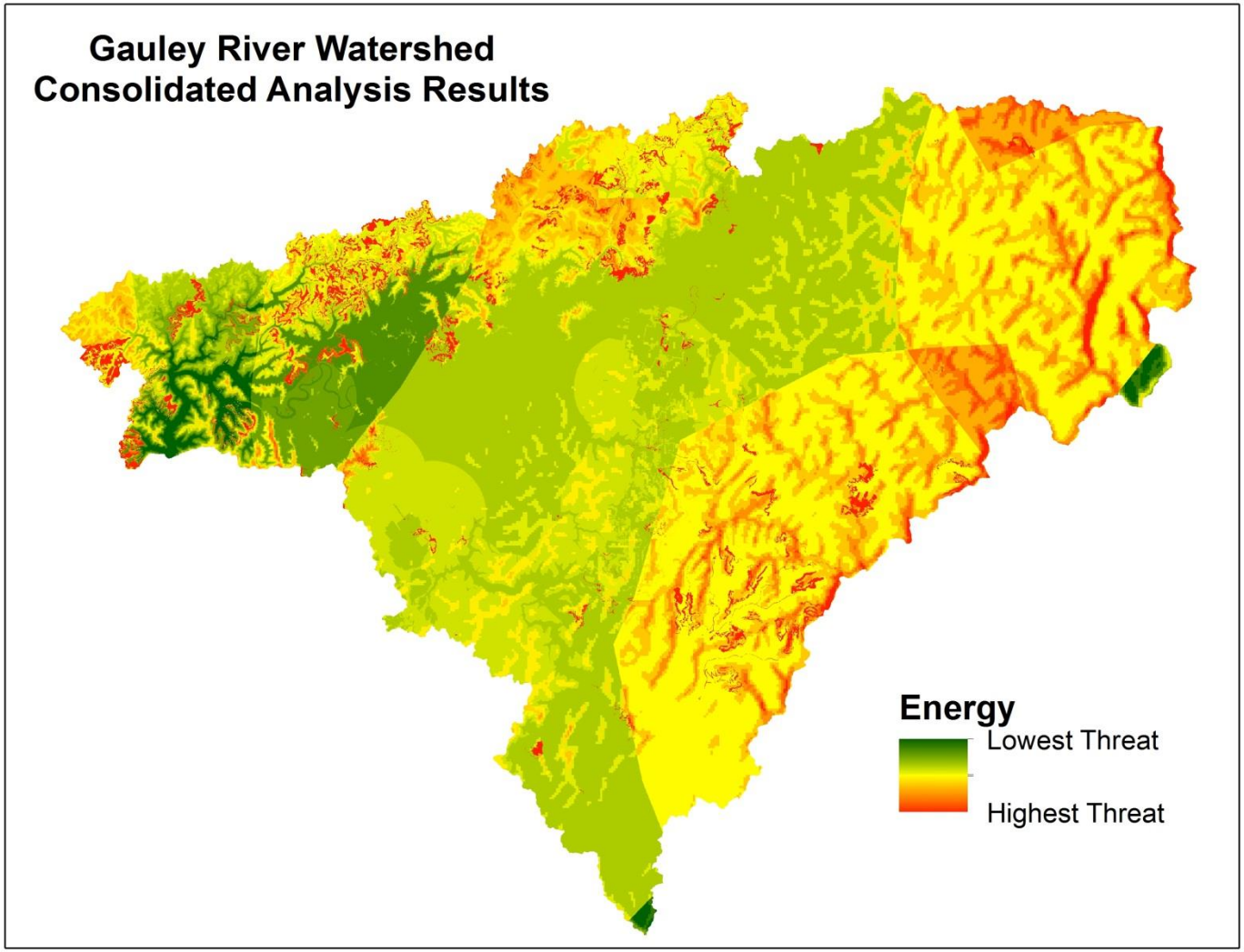


Consolidated Analysis Results



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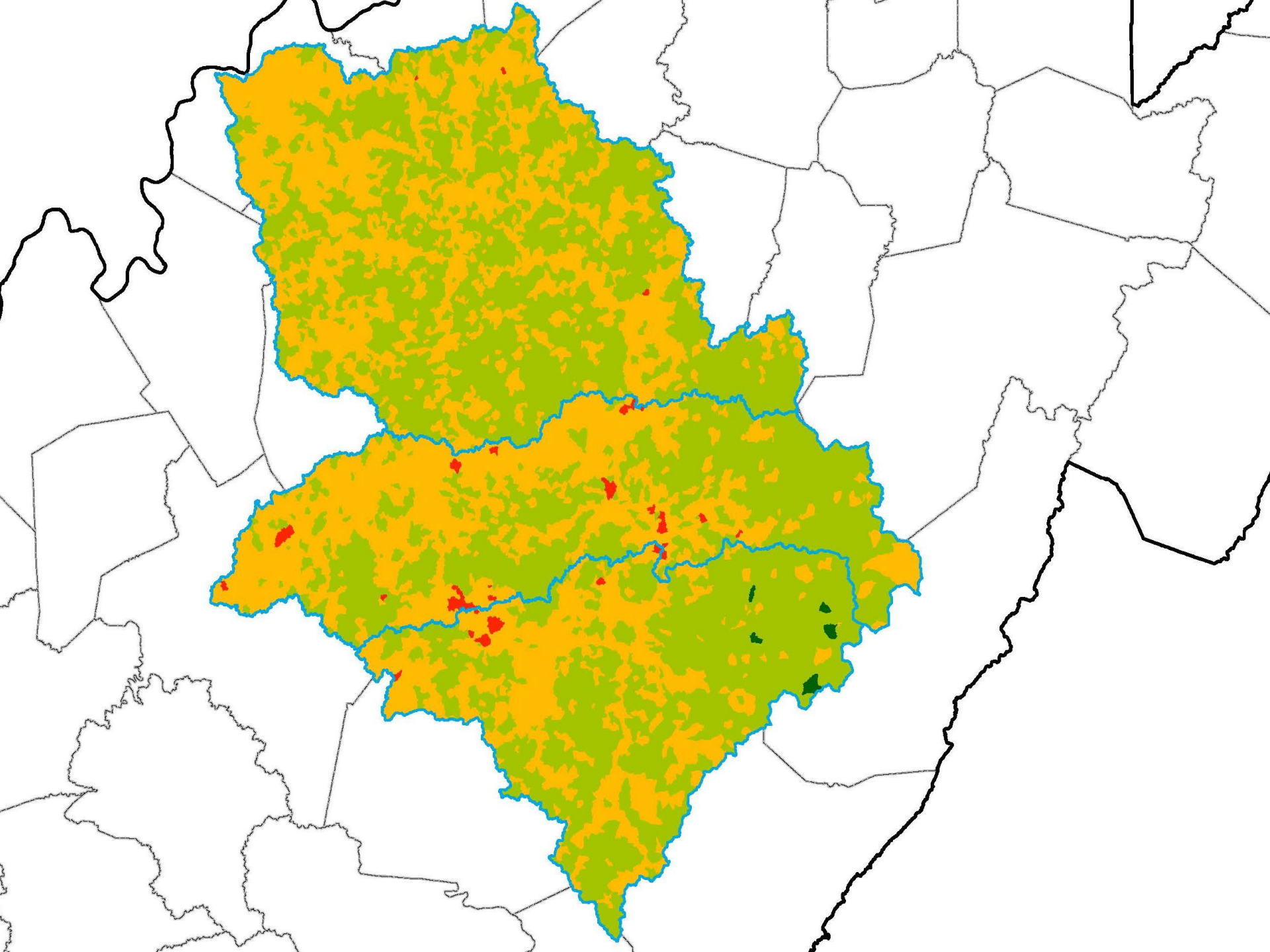
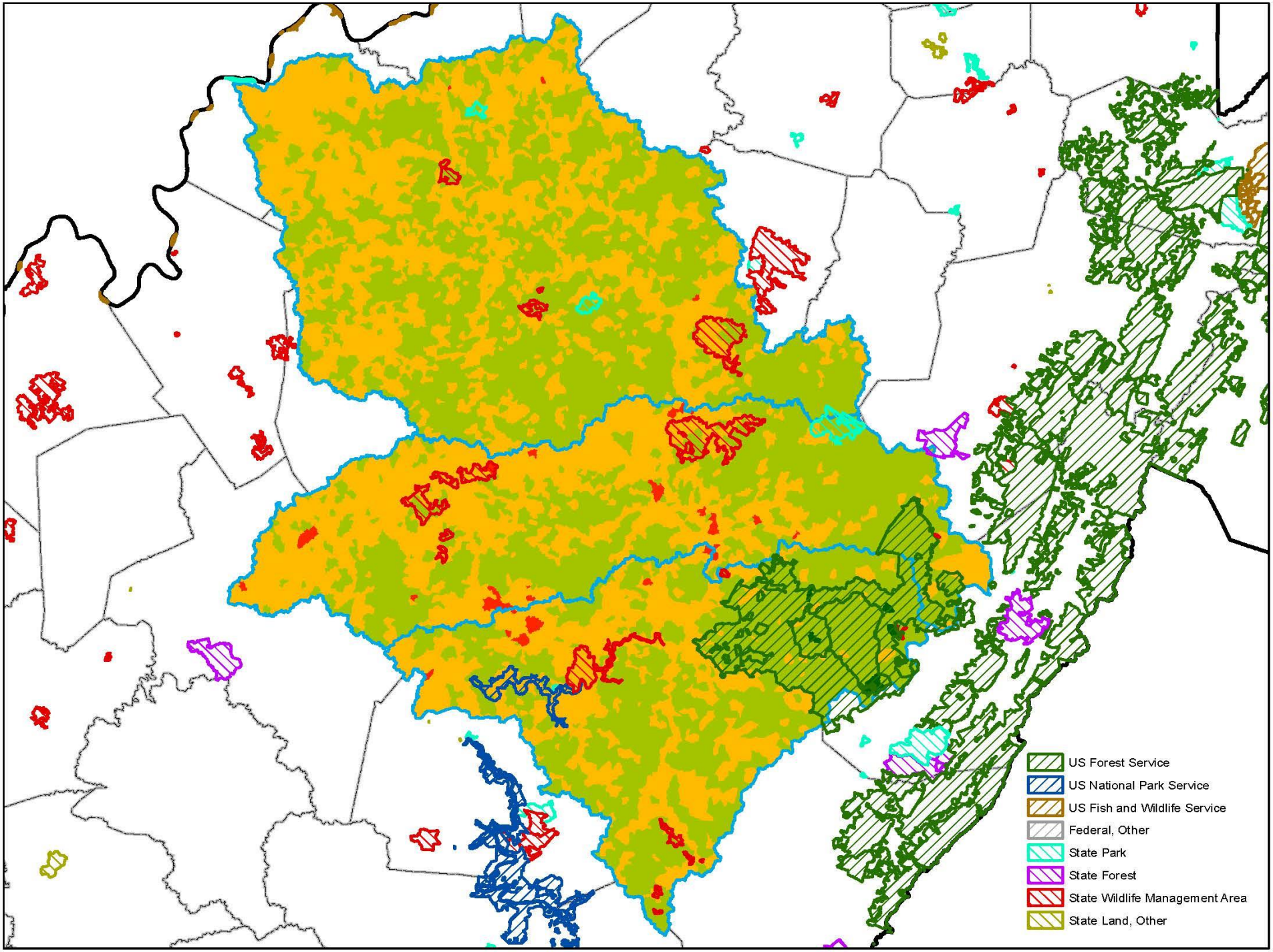
Additional Uses & Application

- Beyond Restoration and Protection Priorities
  - Identify healthy watersheds & hot spots of high quality areas across the state
  - Identify impacted and highly threatened areas
  - Compare ecological quality of aquatic and terrestrial features
  - Inform projects that may impact the natural resources in an area
  - Green Infrastructure planning




US Forest Service
US National Park Service
US Fish and Wildlife Service
Federal, Other
State Park
State Forest
State Wildlife Management Area
State Land, Other

Interactive Web Mapping Application

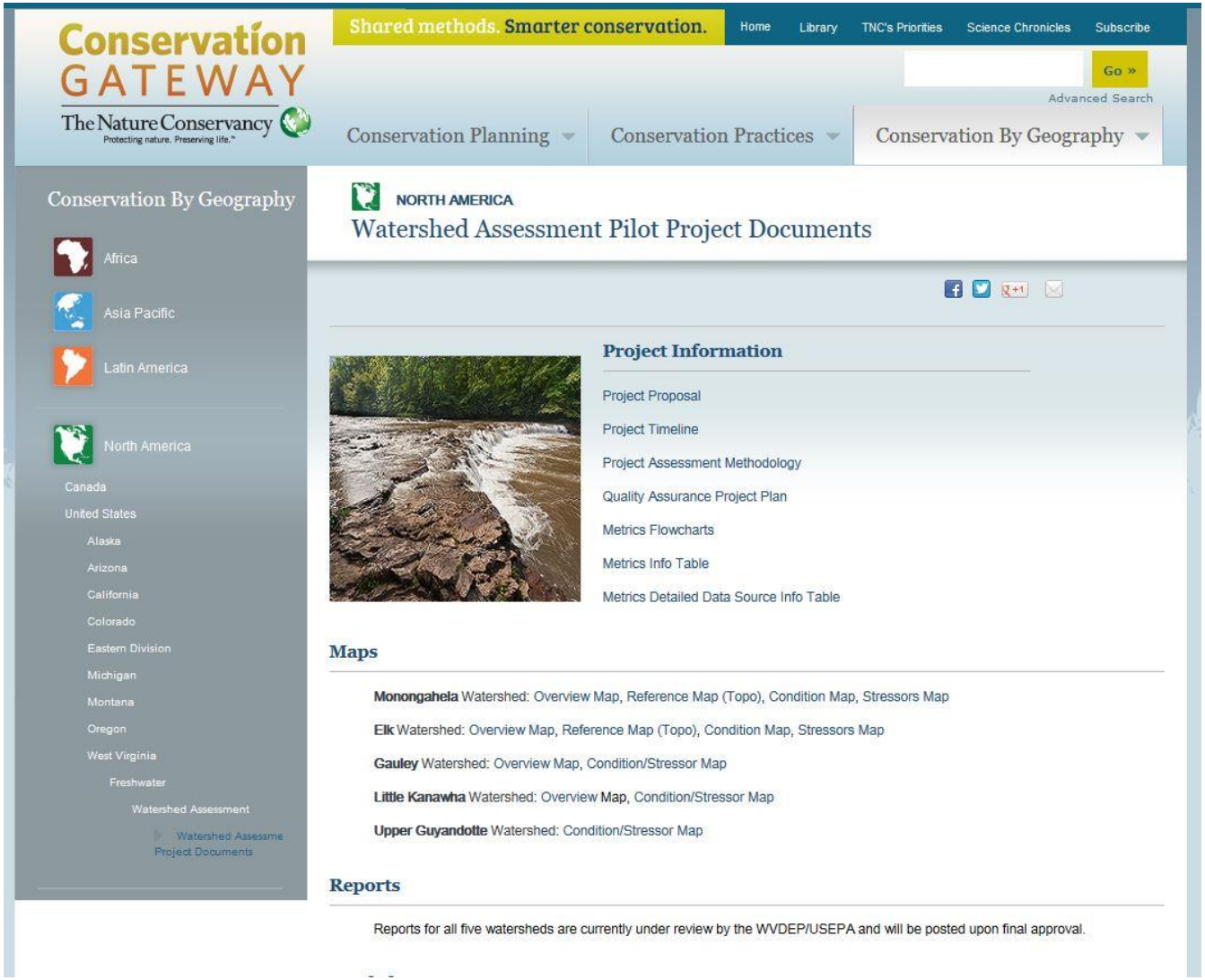
Desktop tool that will allow users to:

- View results of all scores and rankings (results for models, indices, metrics, as well as metric values)
- View additional datasets, including attribute information
- Anticipated audience: regulatory agencies, watershed associations, non-profit organizations

Word of Caution for Users

- This is purely a GIS-based analysis with no field verification
- Suggested Strategy for selecting potential protection/restoration sites:
  - Select several candidate planning units using the GIS tool
  - Conduct site visits to evaluate current conditions on the ground
  - Make final decision based on results from GIS analysis and site visits

Documents on Conservation Gateway



Partners

- US Environmental Protection Agency
- WV Department of Environmental Protection
- Many individuals from several agencies, organizations, watershed associations:
  - US Geological Survey
  - US Army Corps of Engineers
  - US Office of Surface Mining
  - US Department of Agriculture - NRCS
  - WV Division of Natural Resources
  - WV Geological and Economic Survey
  - Region 3 Intergovernmental Council
  - The Conservation Agency
  - Trout Unlimited
  - West Virginia University
  - Marshall University
  - WV Rivers Coalition
  - WV Land Trust
  - Canaan Valley Institute
  - Potesta & Associates
  - Triad Engineering
  - Morgantown Utility Board
  - Several Watershed Organizations

COMMENTS/QUESTIONS?

WV WAPP Links

- Conservation Gateway
- Interactive Web Tool