

# WV WATERSHED ASSESSMENT PILOT PROJECT



Gauley River ©Kent Mason

Stakeholder & Partner Workshop, Nov. 13<sup>th</sup>, 2013  
Flatwoods Days Inn, WV

# Workshop Outline

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- Project Background
- Results presentations
- Web Tool demonstration

# Project Background & Methodology

# Project Objectives

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- 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

## 5 HUC8 Watersheds:

### □ YEAR 1:

■ Monongahela

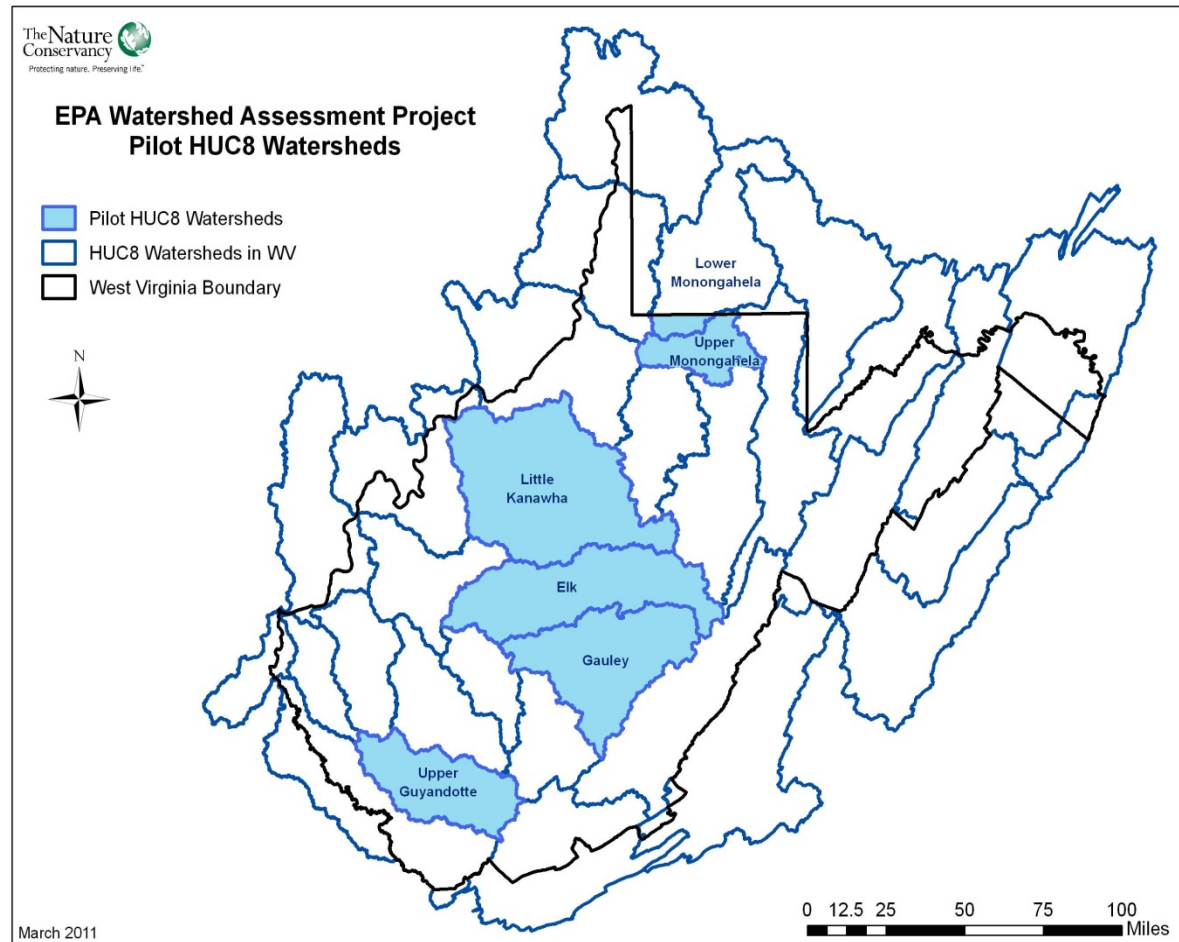
■ Elk

### □ YEAR 2:

■ Gauley

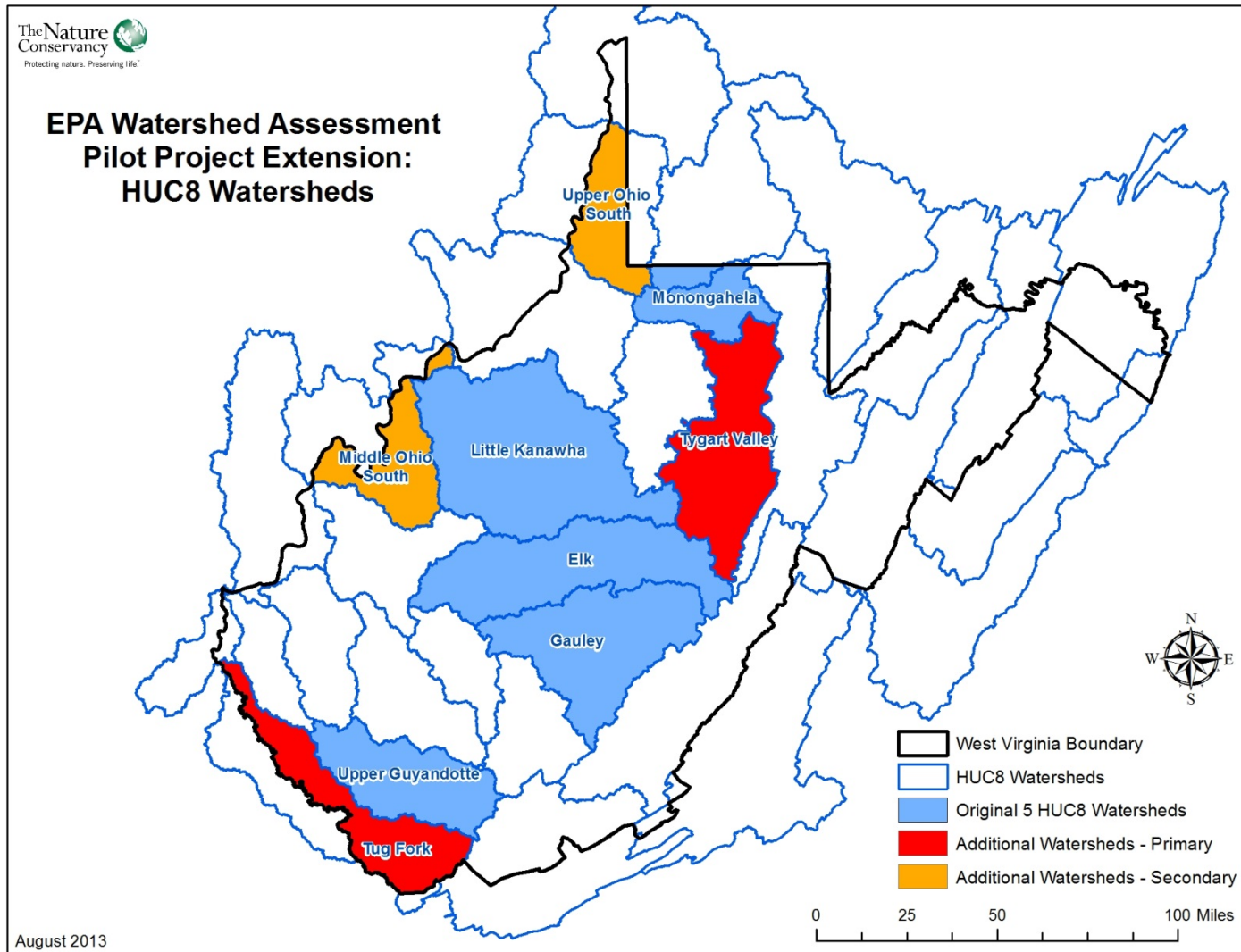
■ Little Kanawha

■ Upper Guyandotte





# Expanded Study Area



# 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

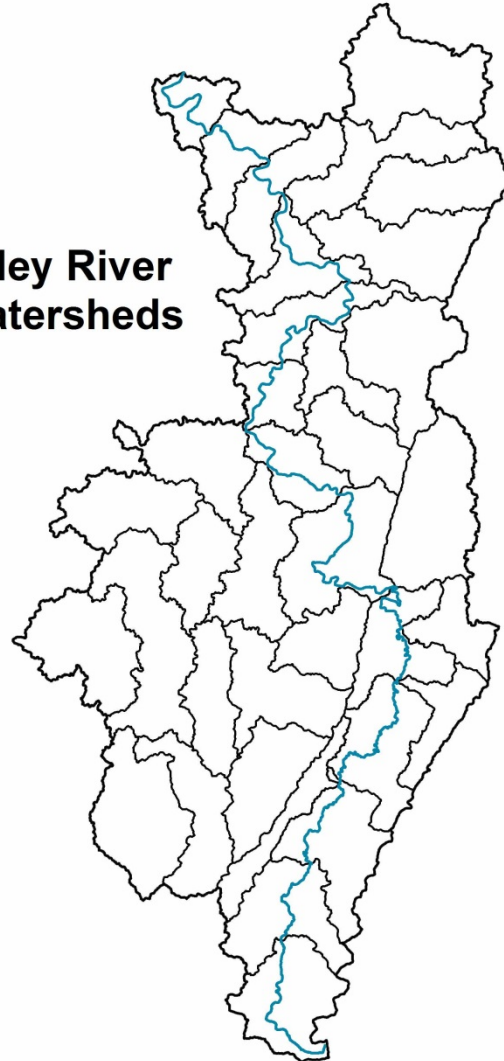
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- Two Scales of Planning Units:
  - HUC-12 watersheds
  - Catchments



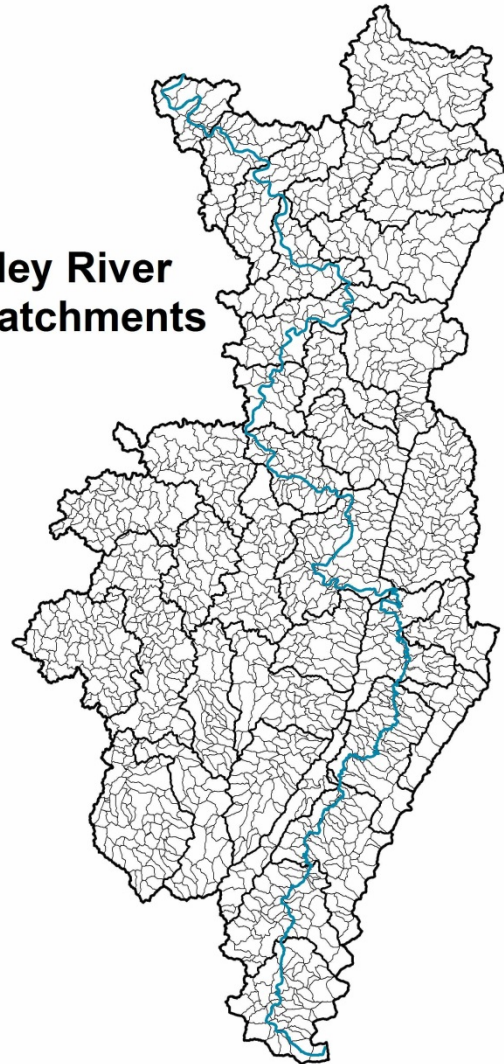
# Planning Units 1: HUC12s

**Tygart Valley River  
HUC12 Watersheds**



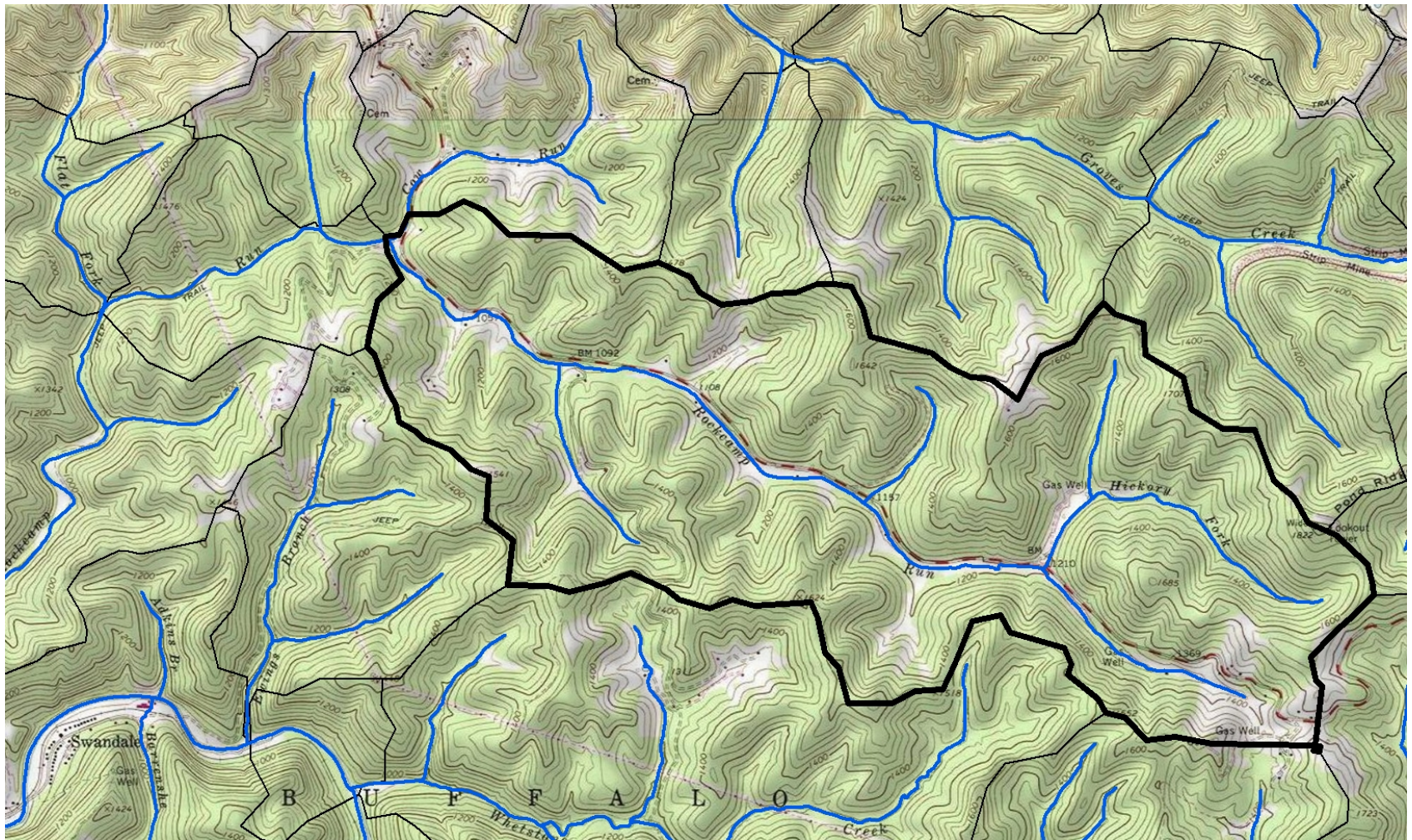
# Planning Units 2: Catchments

**Tygart Valley River  
NHDPlus Catchments**



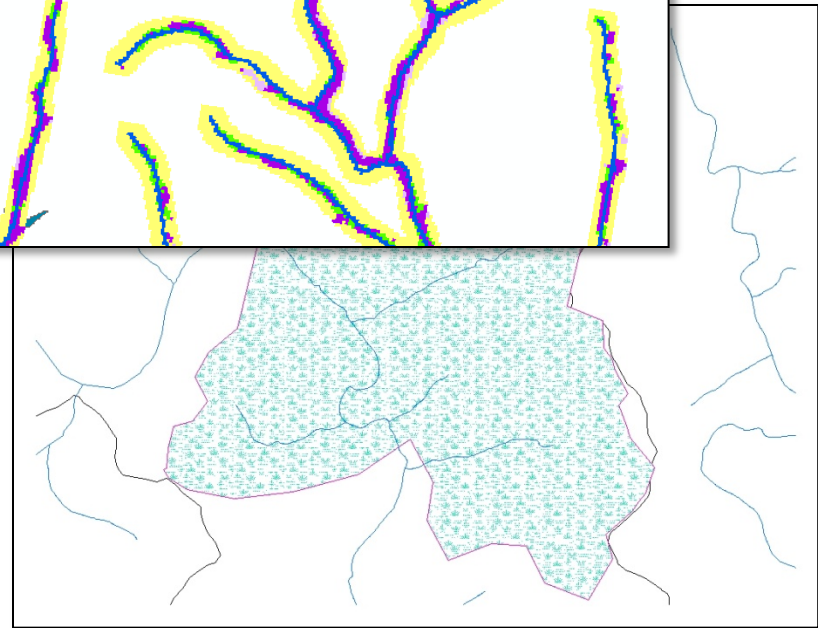
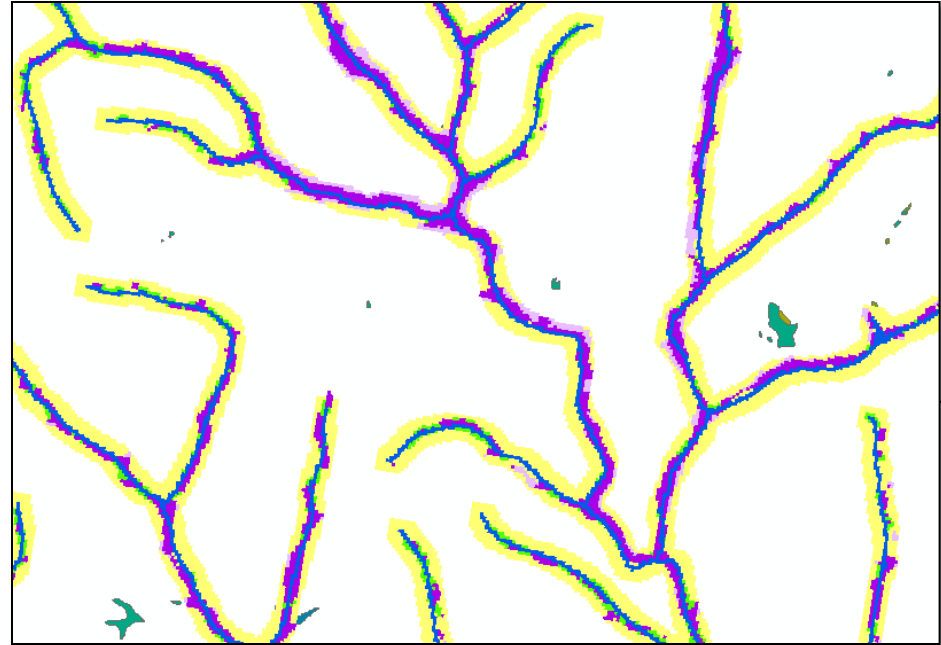


# NHDPlus Catchments (modified)



# 3 Models: Landscape Types

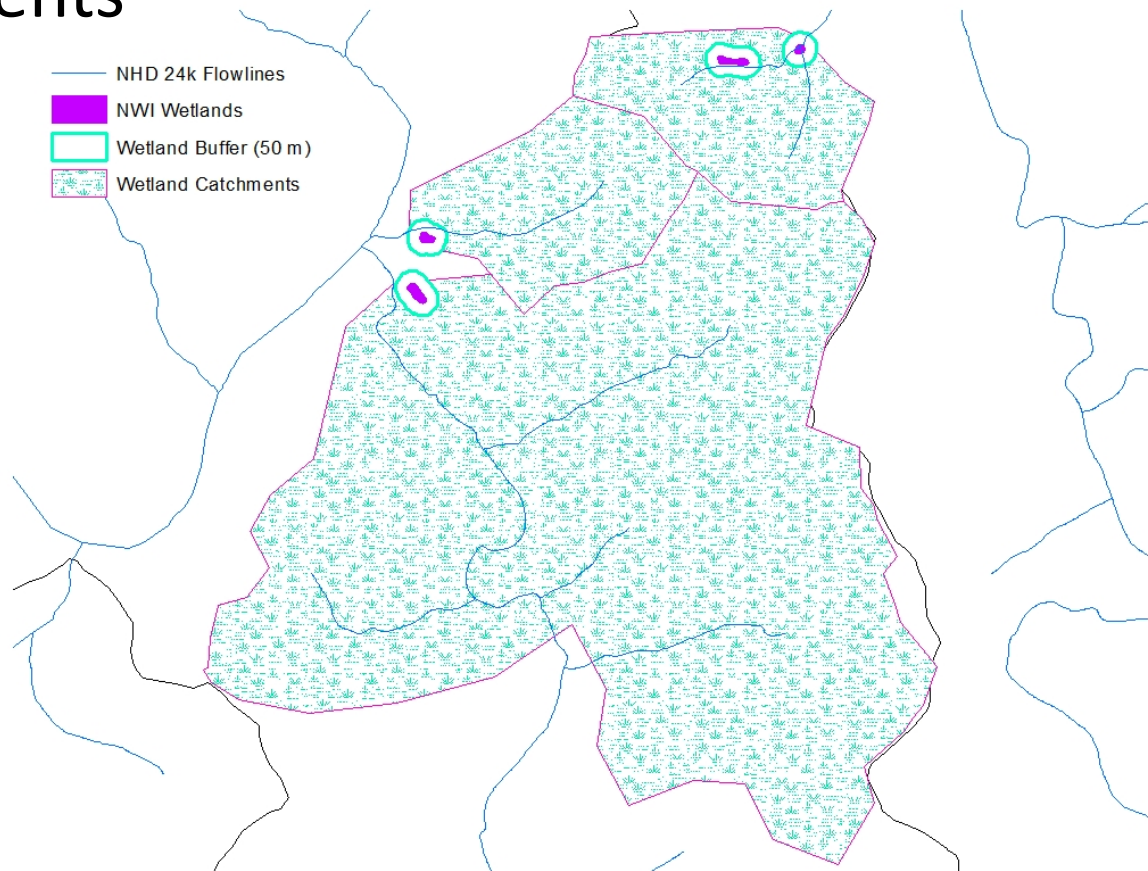
- Stream/Riparian Areas
- Wetlands
- Uplands





# 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



**STREAMS/RIPARIAN  
PRIORITY MODEL**

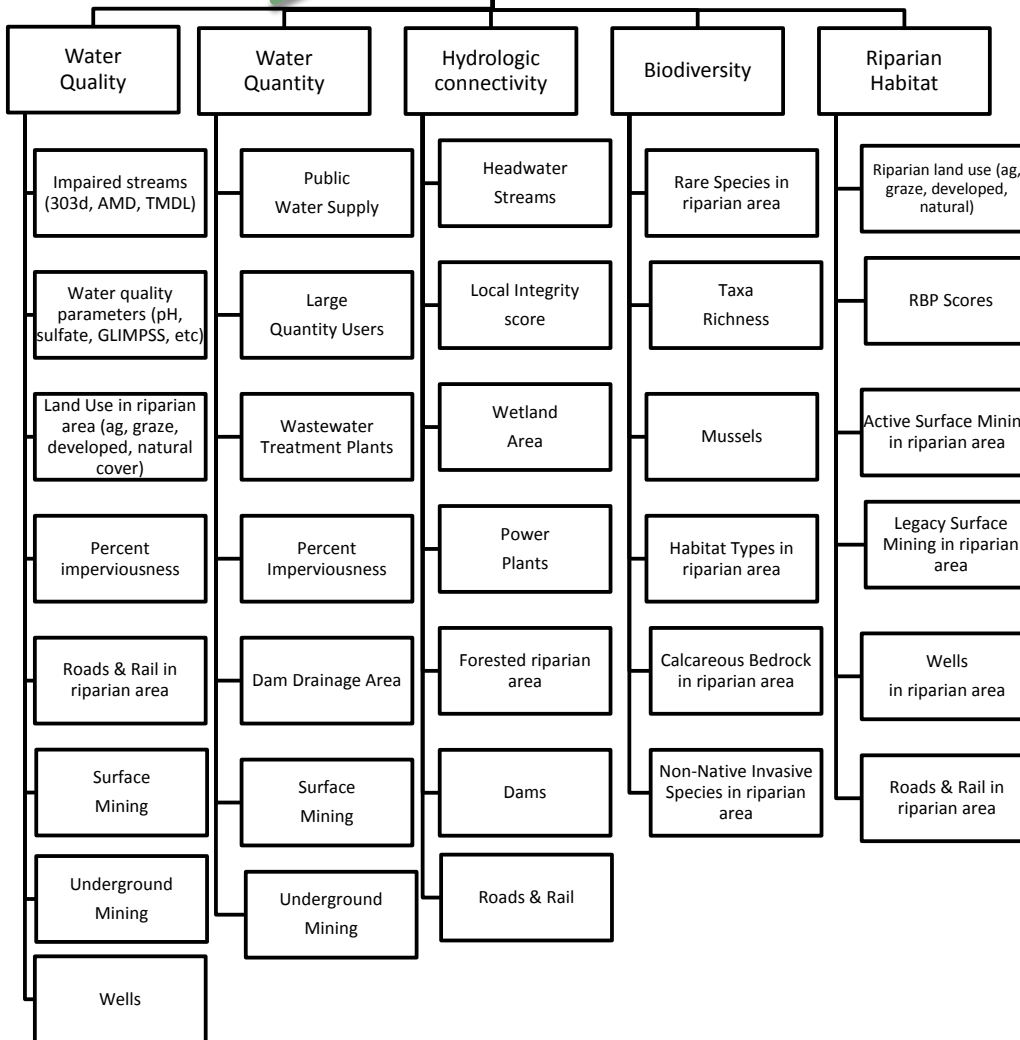
1 of 3 Models

CURRENT  
CONDITION/  
FUNCTION

Category

Index

Metrics



# Redundant Metrics

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- 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

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- 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

# Critical Metrics

- Several metrics were identified that should “cap” the ranking for the entire index:
  - Streams Water Quality
    - Imperviousness, pH, Specific Conductance, Surface Mining
  - Streams Water Quantity
    - Imperviousness
  - Streams Riparian Habitat
    - Developed Area, Surface Mining
  - Wetlands Habitat
    - Developed Area, Surface Mining
  - Uplands Habitat Connectivity
    - Developed Area, Surface Mining
  - Uplands Habitat Quality
    - Developed Area, Surface Mining

# 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

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- 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

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- 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
- Null values for metrics dependent on presence of wetlands
- Only 1 index had values for all planning units:
  - Wetland Hydrology (presence of hydric soils)
- Any planning units without hydric soils or mapped NWI wetlands were taken out of wetlands analysis

# Water Quality Metrics (by catchment)

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- 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)

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- 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

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



# Biodiversity Metrics

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- Rare and threatened species (includes DNR's SGNC species)
- Non-native invasive species
- Number of habitat types
- Calcareous bedrock
- Pests and Pathogens: Percent loss (basal area)

# Metrics: Future Threats

- ❑ Energy
- ❑ Population/Development
- ❑ Climate Change

# Energy Metrics

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- 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 Metrics

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- Future growth areas
- Development potential
- Proposed dams
- Future roads
- Population projections
- Proposed wastewater treatment plants

# Climate Change Metrics

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- Resiliency and Current Density: TNC-generated datasets
- Projected Temperature Change
- Projected Precipitation Change

# Metrics: Opportunities

1. Protected Lands
2. Priority Interest Areas

# 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

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

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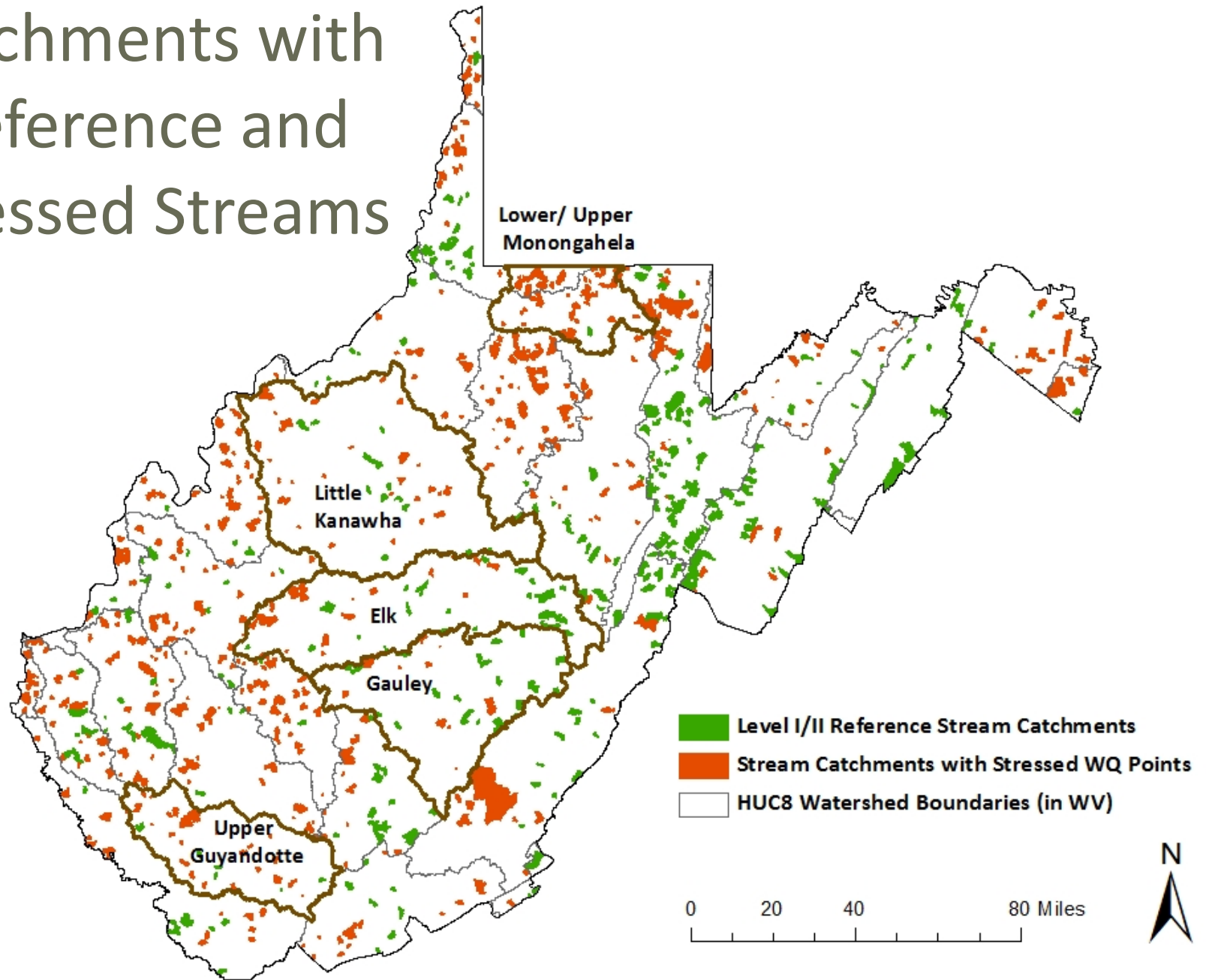
## Restoration Threshold

- **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

# Catchments with Reference and Stressed Streams

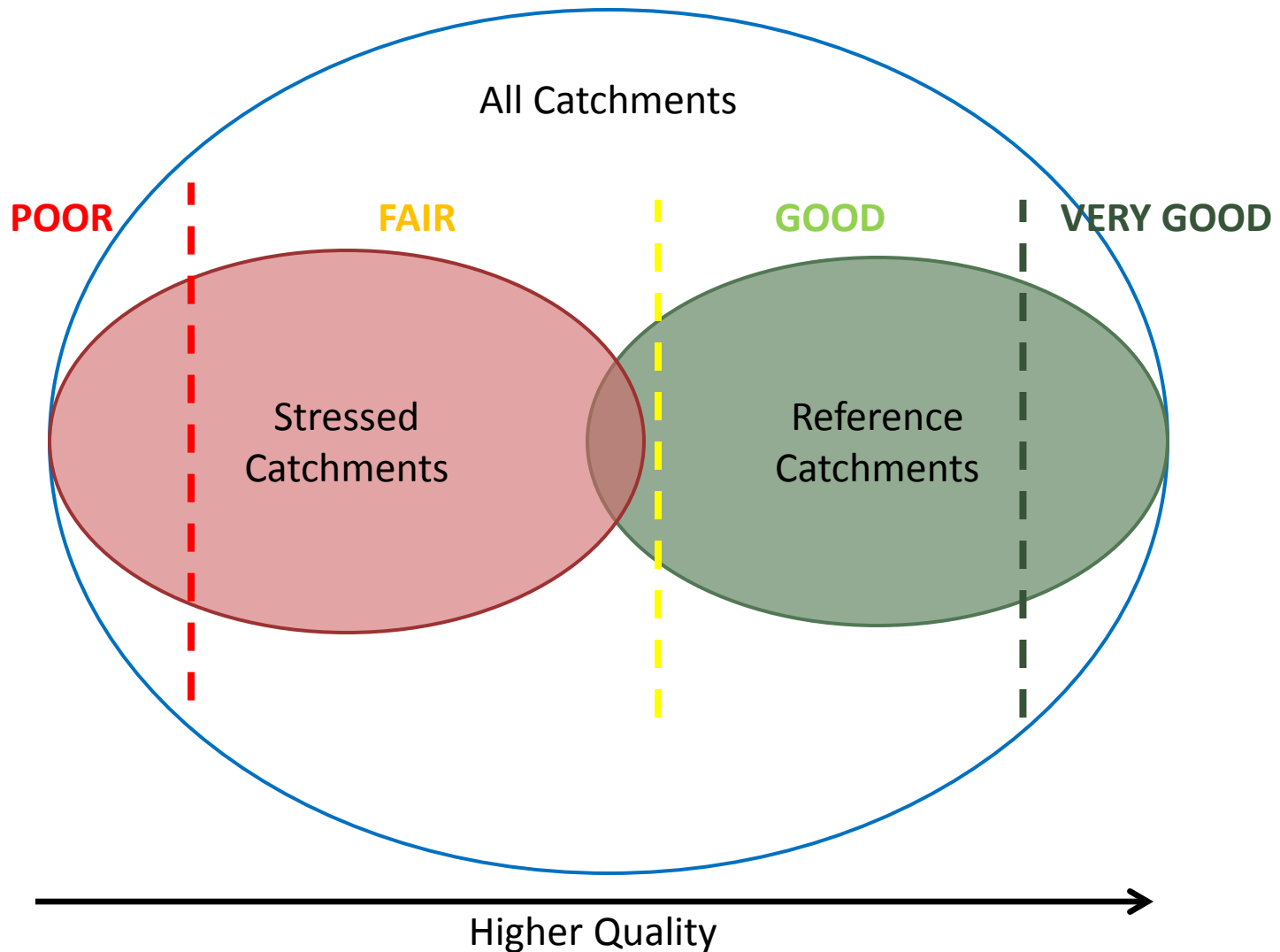


# Objective Ranking Methodology

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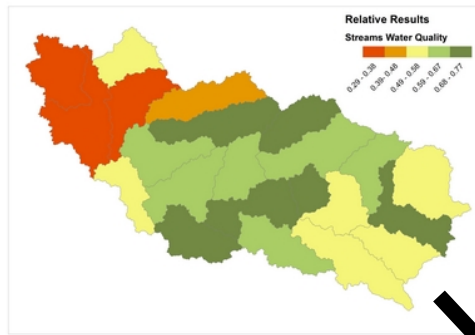
- Calculated metrics for stressed and reference catchments separately
  - Reference catchments defined thresholds for very good/good categories
  - Stressed catchments defined thresholds for fair/poor categories
- Each metric received an objective score
- Averaged metric scores (by weight) for index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

# Objective Ranking Methodology

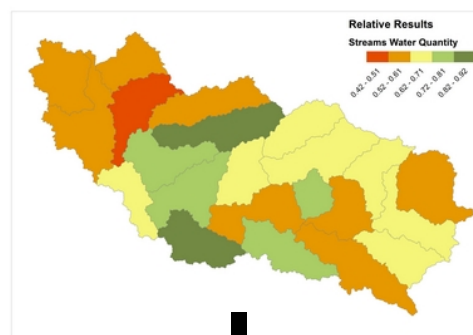


# Index and Model Results

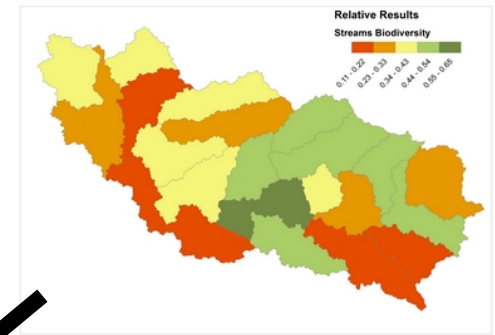
Water Quality



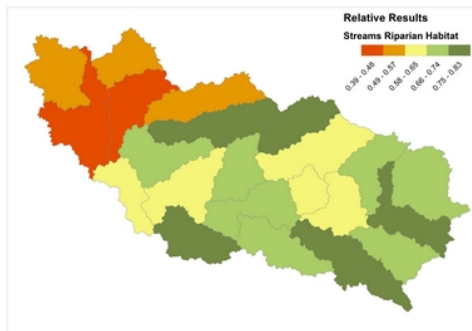
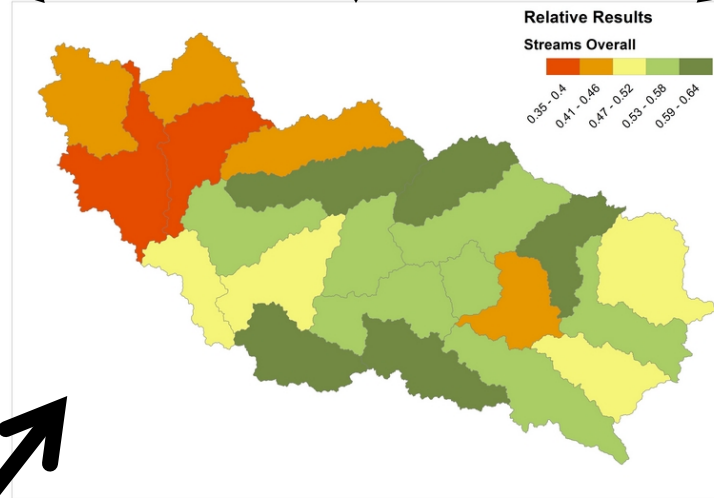
Water Quantity



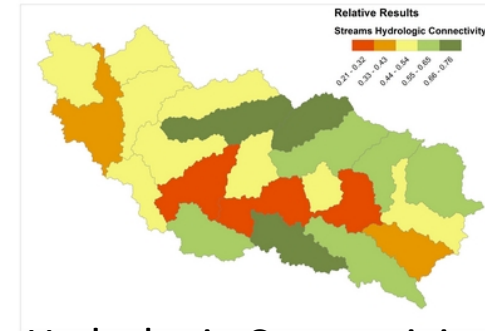
Biodiversity



**Stream Index  
Rollup to Model  
Ranking**



Riparian Habitat



Hydrologic Connectivity

**STREAMS/RIPARIAN  
PRIORITY MODEL**

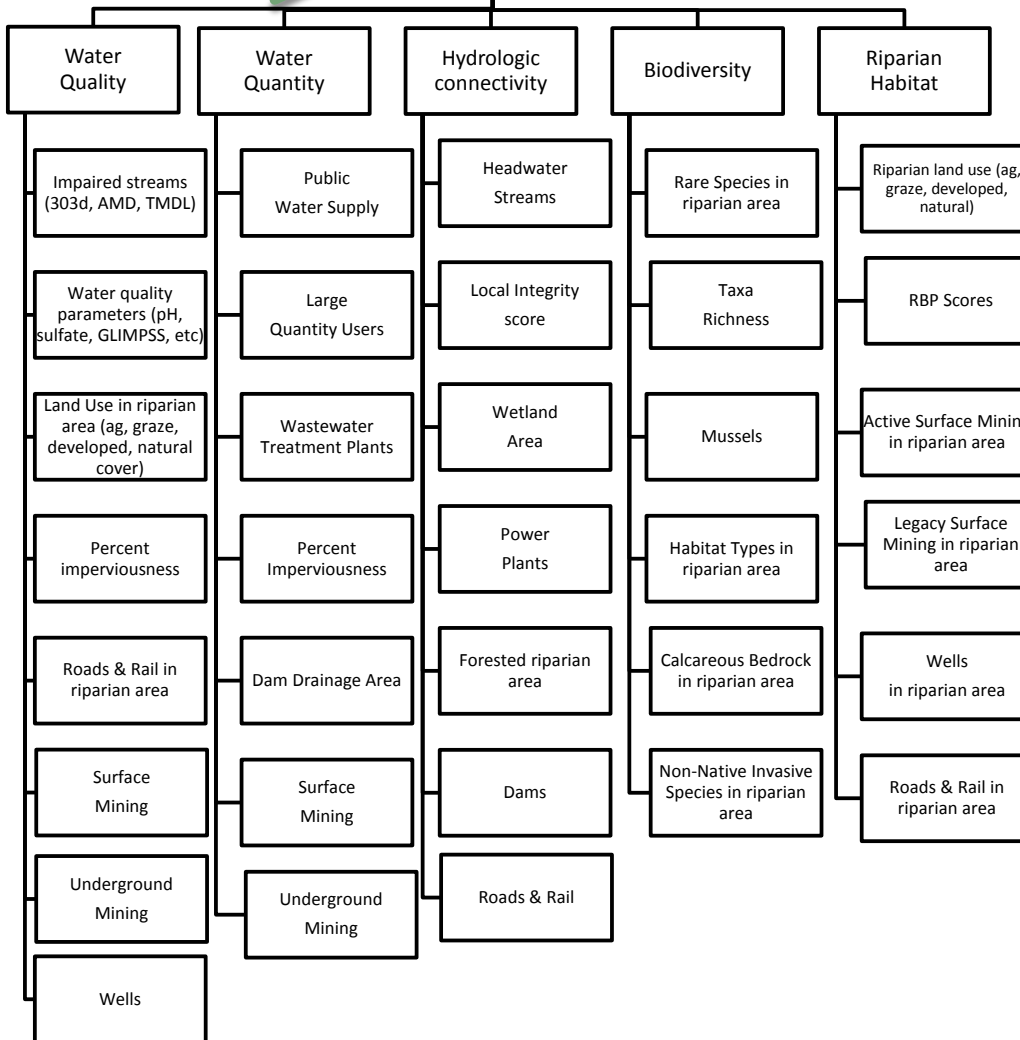
1 of 3 Models

CURRENT  
CONDITION/  
FUNCTION

Category

Index

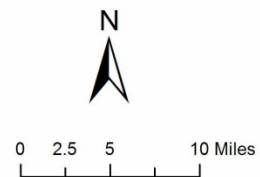
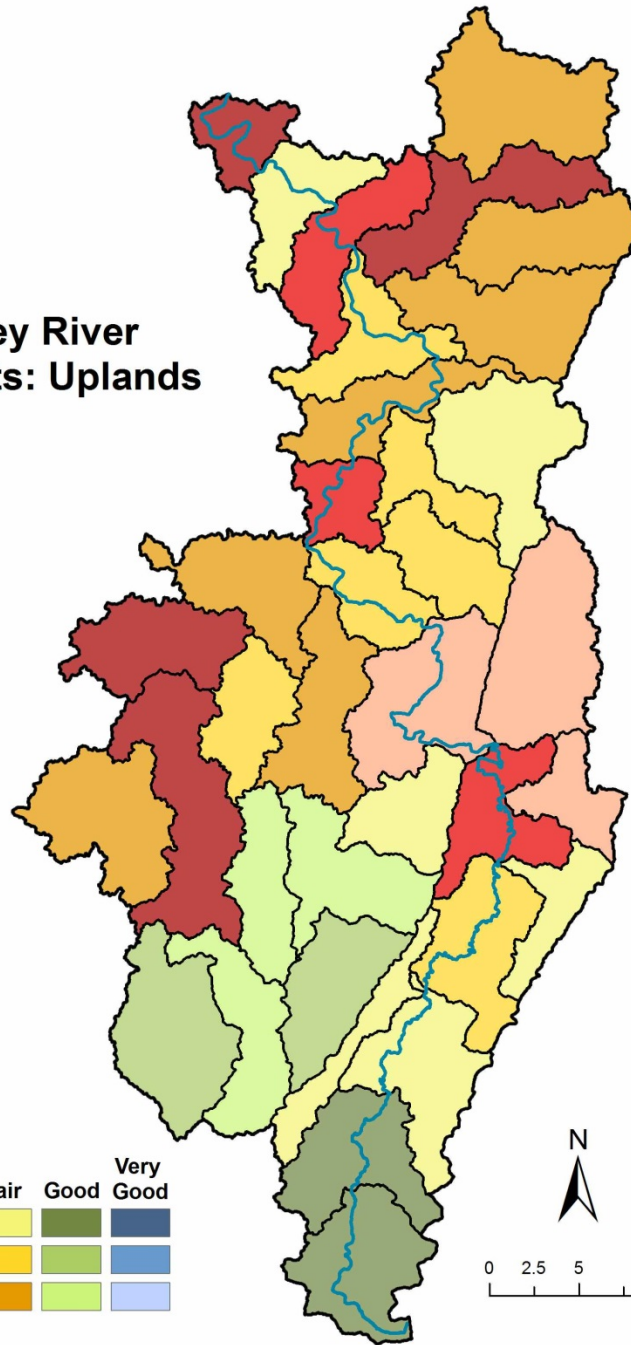
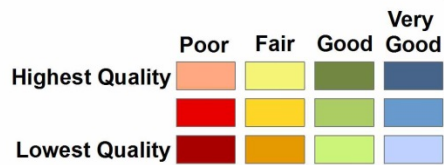
Metrics



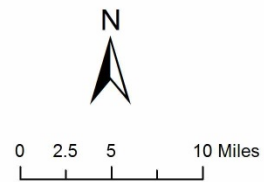
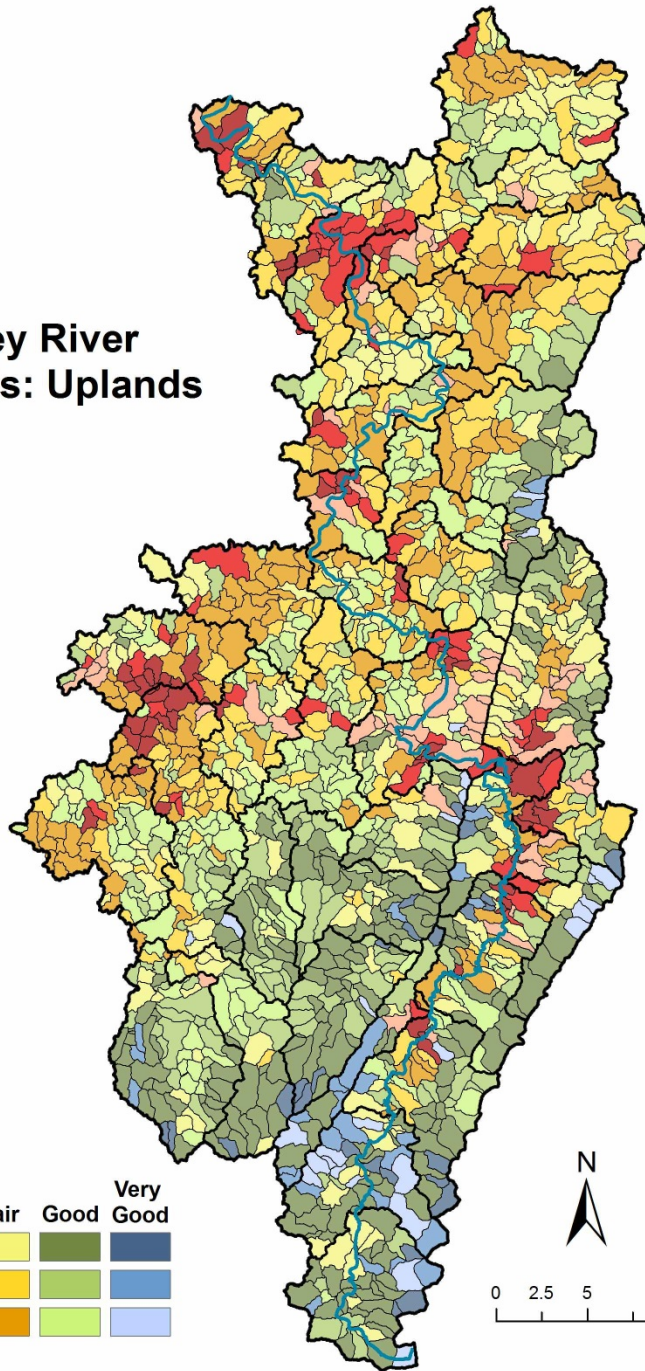
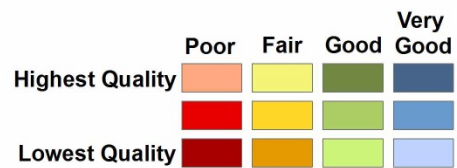


# Tygart Valley River

## Overall Results: Uplands



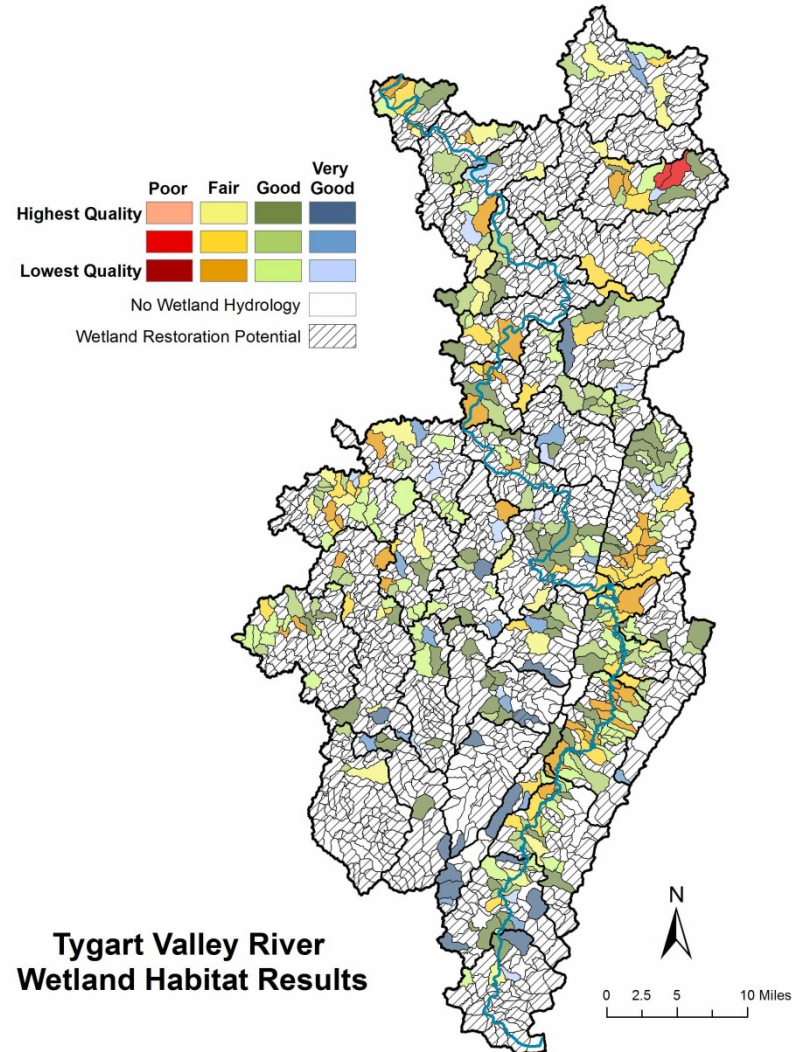
# Tygart Valley River Overall Results: Uplands



# Wetlands Index Results

White hatched: no NWI wetlands  
but wetland hydrology present:  
candidates for restoration

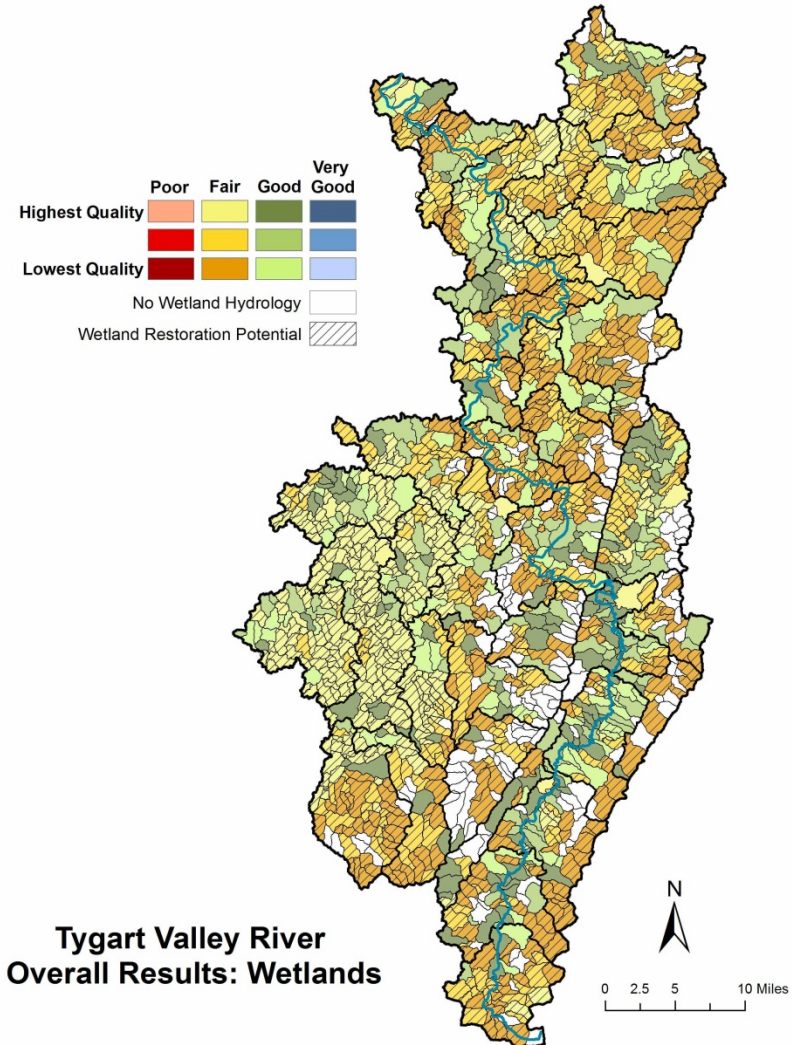
White: No wetlands or wetland  
hydrology present: not considered  
in wetland model



# Wetlands Overall Model Results

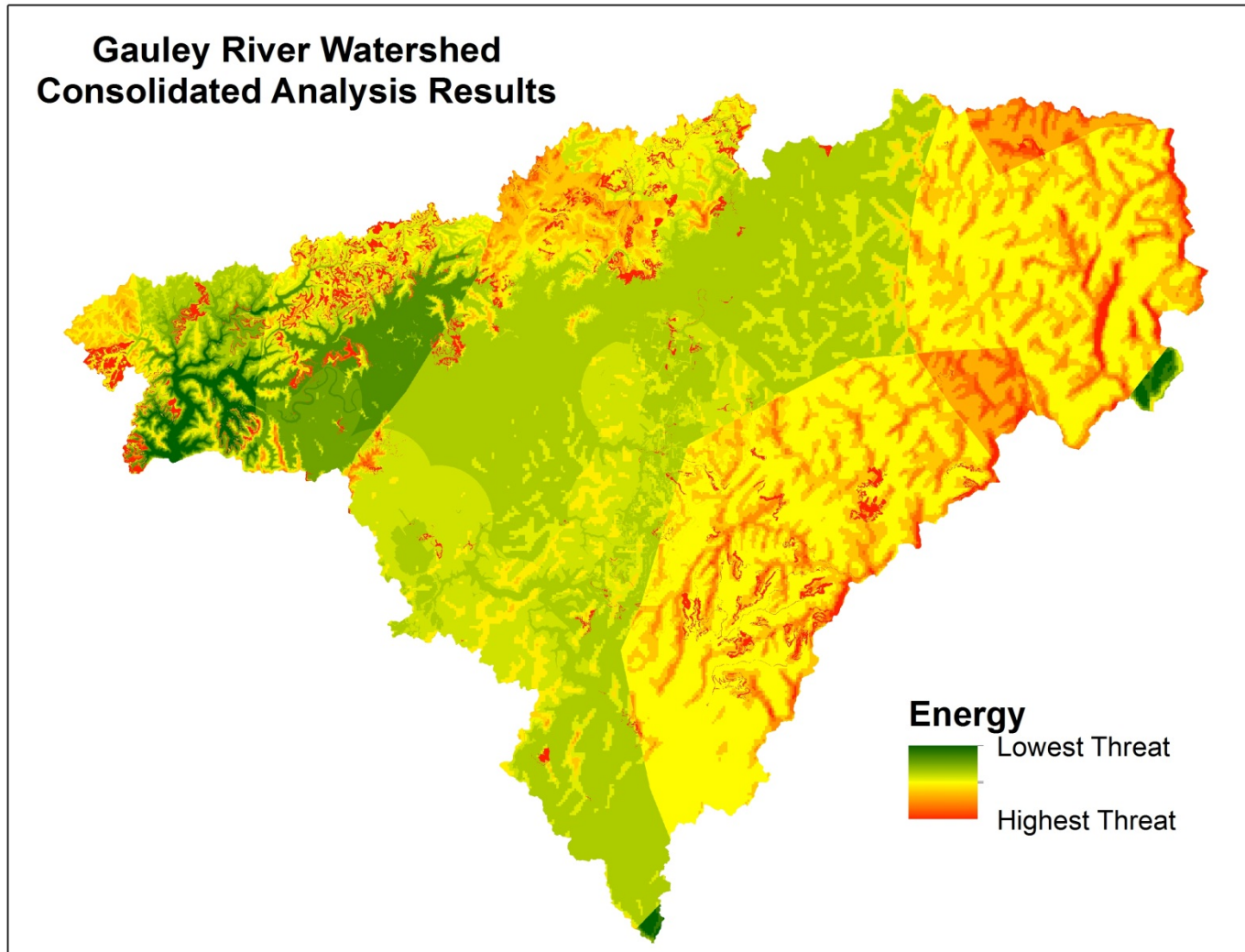
Hatched: no NWI wetlands but wetland hydrology present: candidates for restoration

Gray: No wetlands or wetland hydrology present: not considered in wetland model





# Consolidated Analysis Results



# Project Outputs

- **Watershed assessment reports**

Will include specific priorities and strategies, as well as detailed methodology, references and lessons learned

- **Interactive web mapping application**

A spatial decision support tool to assist stakeholders in identifying target areas, strategies and actions

# 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

# Interactive Web Mapping Application

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Desktop tool that will allow users to:

- View the various datasets in one application
- View results of all scores and rankings
- Develop customized scenarios to rank target areas for restoration and/or protection projects according to users' priorities
- Anticipated audience: regulatory agencies, watershed associations, non-profit organizations



# Documents on Conservation Gateway

The screenshot displays the Conservation Gateway website interface. At the top left is the logo for The Nature Conservancy, with the tagline "Protecting nature. Preserving life." and the word "GATEWAY" in large orange letters. To the right of the logo is a yellow banner with the text "Shared methods. Smarter conservation." and a navigation menu with links for Home, Library, TNC's Priorities, Science Chronicles, and Subscribe. Below the banner is a search bar with a "Go »" button and the text "Advanced Search".

The main navigation area includes three dropdown menus: "Conservation Planning", "Conservation Practices", and "Conservation By Geography". The "Conservation By Geography" menu is currently selected, showing a sidebar on the left with icons and labels for Africa, Asia Pacific, Latin America, and North America. Under "North America", there is a list of states: Canada, United States (Alaska, Arizona, California, Colorado, Eastern Division, Michigan, Montana, Oregon, West Virginia), Freshwater, and Watershed Assessment. The "Watershed Assessment" option is highlighted, leading to the "Watershed Assessment Pilot Project Documents" page.

The page title is "Watershed Assessment Pilot Project Documents" under the "NORTH AMERICA" heading. Below the title are social media sharing icons for Facebook, Twitter, and Print. The page is divided into two main sections: "Project Information" and "Maps".

**Project Information**

- Project Proposal
- Project Timeline
- Project Assessment Methodology
- Quality Assurance Project Plan
- Metrics Flowcharts
- Metrics Info Table
- Metrics Detailed Data Source Info Table

**Maps**

- Monongahela** Watershed: Overview Map, Reference Map (Topo), Condition Map, Stressors Map
- Elk** Watershed: Overview Map, Reference Map (Topo), Condition Map, Stressors Map
- Gauley** Watershed: Overview Map, Condition/Stressor Map
- Little Kanawha** Watershed: Overview Map, Condition/Stressor Map
- Upper Guyandotte** Watershed: Condition/Stressor Map

**Reports**

Reports for all five watersheds are currently under review by the WVDEP/USEPA and will be posted upon final approval.

# 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



Elk River at Birch Run, WV ©www.over-land.com

THOUGHTS/SUGGESTIONS?