

WV WATERSHED ASSESSMENT PILOT PROJECT



Gauley River ©Kent Mason

Expert Workshop #2, Round 2
Capitol Conference Center, Charleston. January 8 & 9, 2013

Workshop Outline

Day 1

- Project Background & Methodology Review
- Current Condition Results: Relative and Objective
- *Lunch*
- Strategies Discussion

Day 2

- Consolidated Analysis Preliminary Results

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
- Develop Strategies to address issues within the Watersheds

Project Study Area

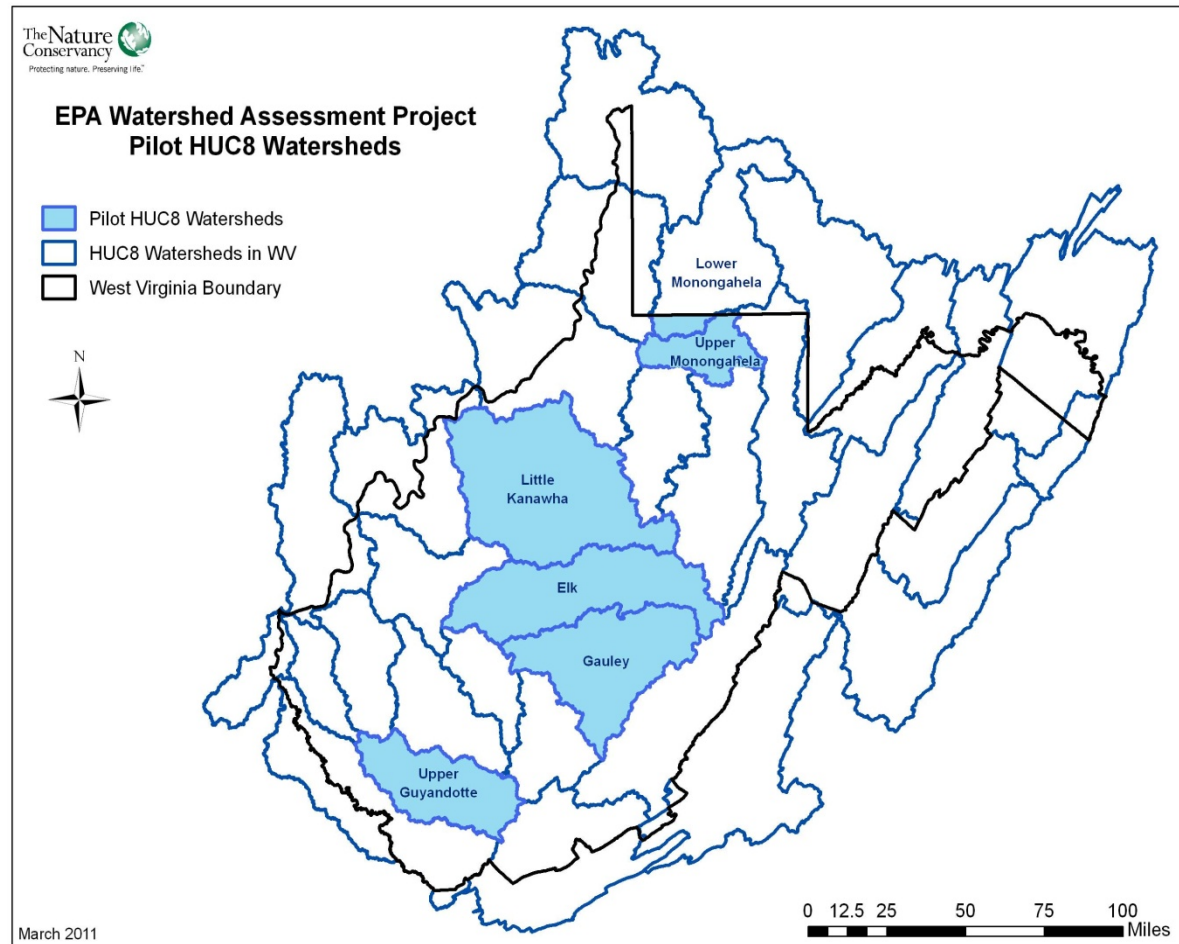
5 HUC8 Watersheds:

□ YEAR 1:

- Monongahela
- Elk

□ YEAR 2:

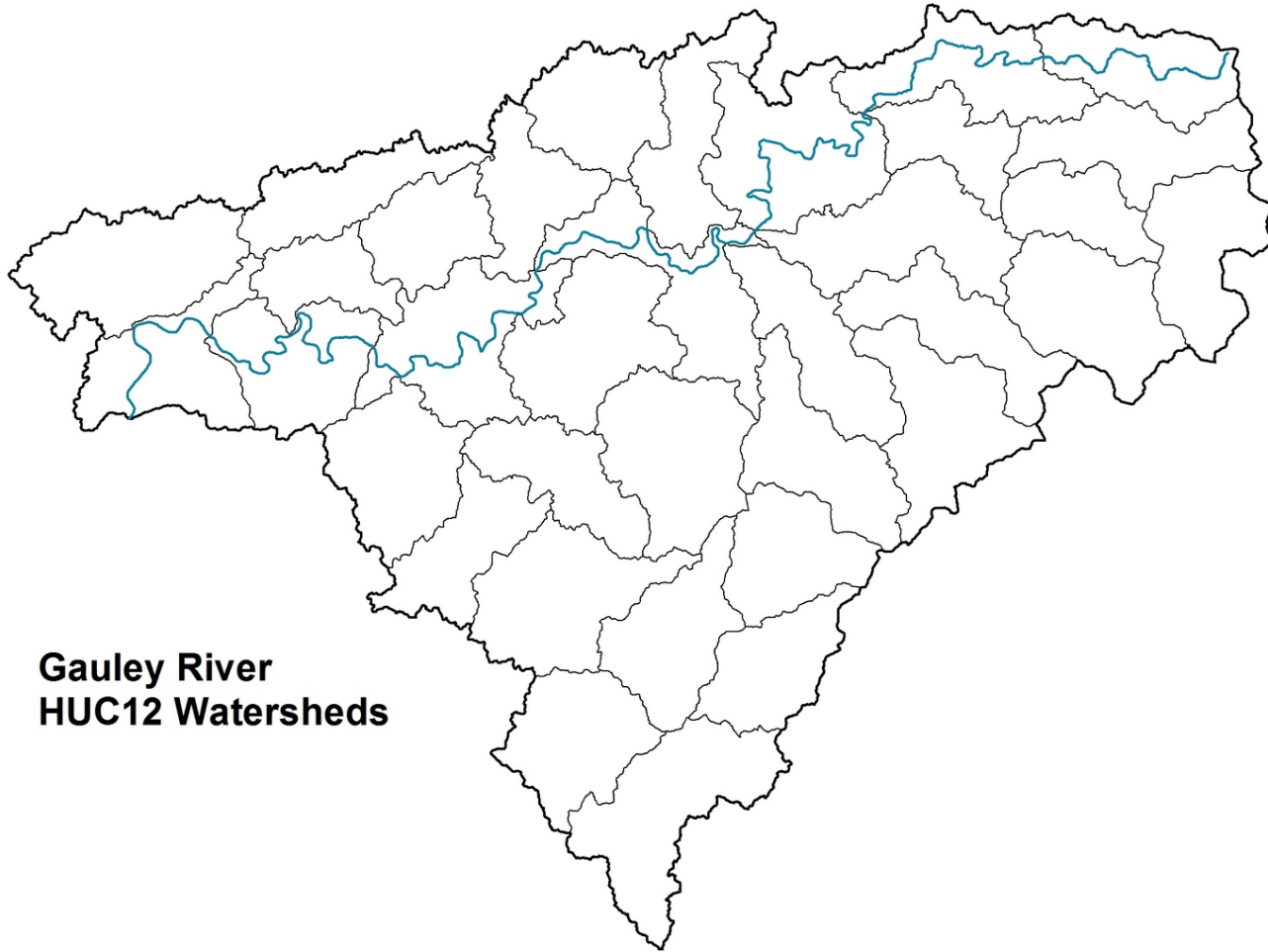
- Gauley
- Little Kanawha
- Upper Guyandotte



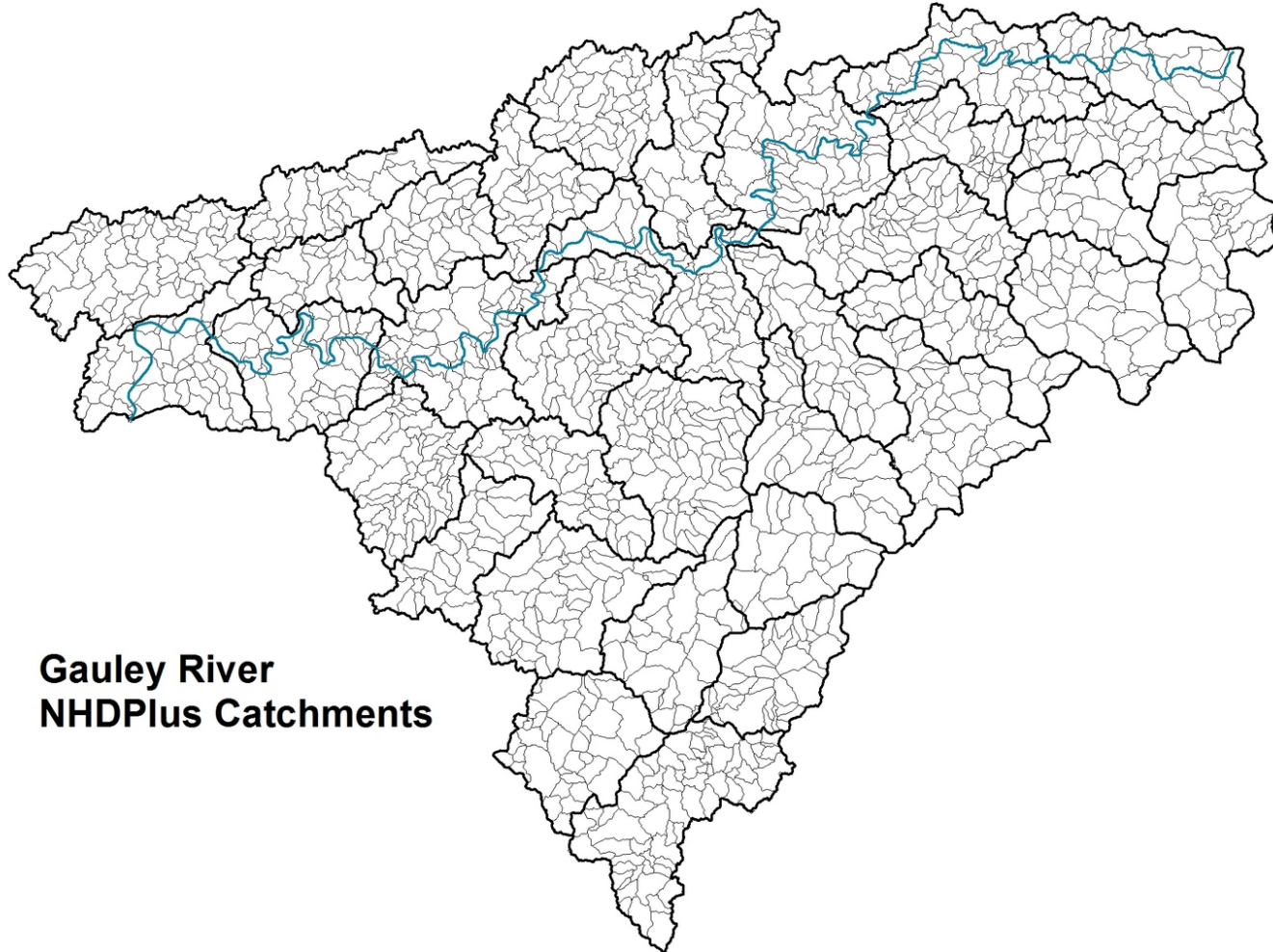
Project Process & Timeline

- 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 Workshops
 - June 2012 – Draft Watershed Reports completed
- Final 3 Watersheds:
 - June 2012 – Start Data Compilation
 - October 2012 - Expert Workshop #1
 - **January 2013 – Expert Workshop #2**
 - March 2013 - Stakeholder/Partner Workshops
 - June 2013 – Final reports & interactive web application completed

Planning Units 1: HUC12s



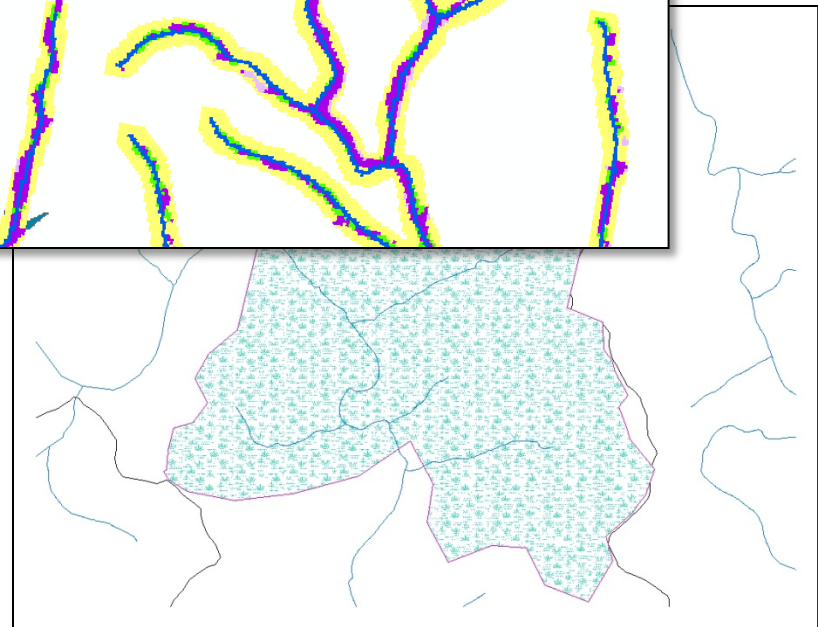
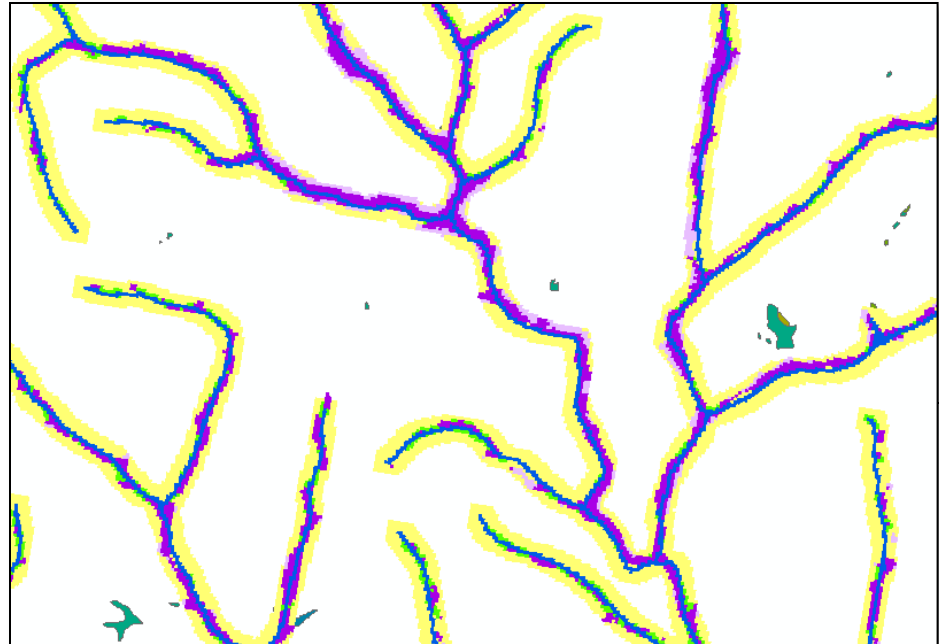
Planning Units 2: Catchments



**Gauley River
NHDPlus Catchments**

Landscape Types

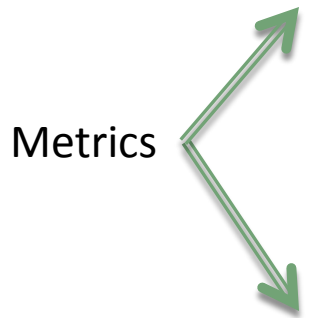
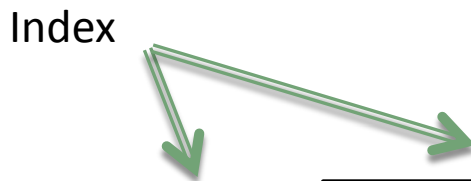
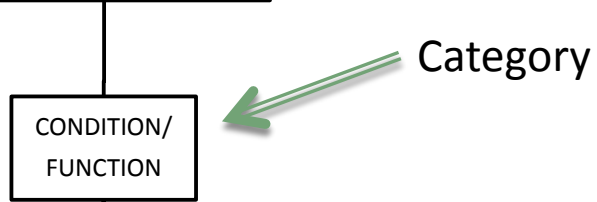
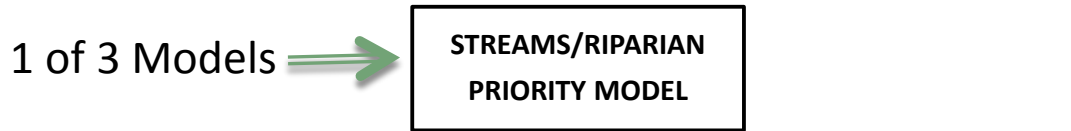
- Stream/Riparian Areas
- Wetlands
- Uplands



Model Structure

Hierarchical Structure:

- 3 Models:
 - Streams
 - Wetlands
 - Uplands
- 2 Categories:
 - Condition/Function
 - Consolidated Analysis
- Several Indices per Category
- Multiple Metrics to define each index



Water Quality	Water Quantity	Hydrologic connectivity	Biodiversity	Riparian Habitat	Protected Lands
Impaired streams (303d, AMD, TMDL)	Public water supply	Headwaters	Rare species (riparian)	Riparian land use (ag, graze, developed, natural)	Secured lands (GAP 1, 2, 3)
Water quality parameters (pH, spec cond, etc)	Large quantity users	Local integrity score	Taxa richness	RBP Score	
Land use (ag, graze, developed, natural cover)	Wastewater treatment plants	Wetland area	Mussels	Active surface mining (riparian)	
Percent imperviousness	Percent imperviousness	Power plants	Calcareous bedrock (riparian)	Legacy surface mining (riparian)	
Road/rail density	Dam drainage area	Land use (forested riparian area)	Non-native invasive species (riparian)	Wells (riparian)	
Active & legacy surface mining	Active & legacy surface mining	Dams		Road/rail density (riparian)	
Underground mining	Underground mining	Road/rail density			
Wells					

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
- Potential for double-counting of these metrics in overall model

Weighting

- Some metrics influence condition more than others – need to be weighted accordingly
- Weighting based on literature review and expert opinion
- Weighted both individual metrics and individual indices

Metrics: Condition/Function

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

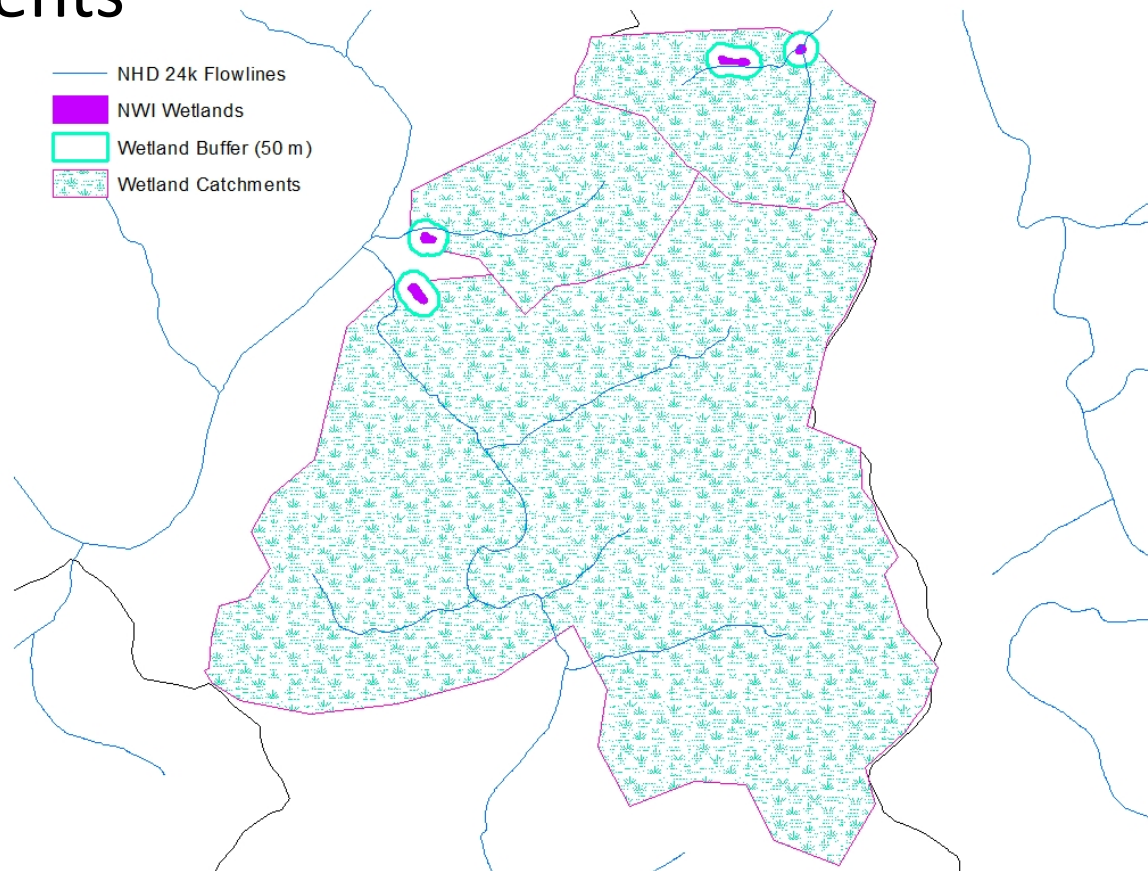
Indices: Streams

CONDITION/
FUNCTION

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

Wetland Buffer vs. Catchment

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



Indices: Wetlands

CONDITION/
FUNCTION

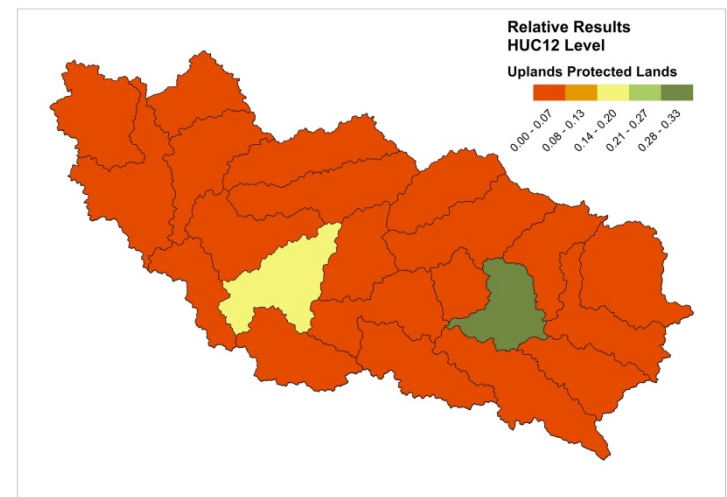
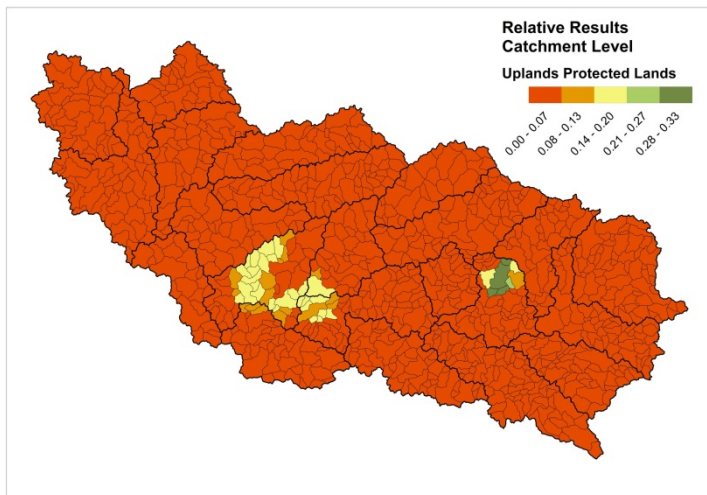
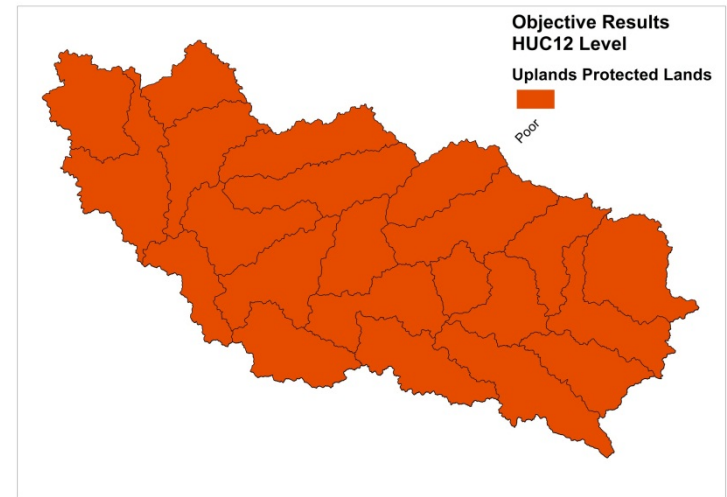
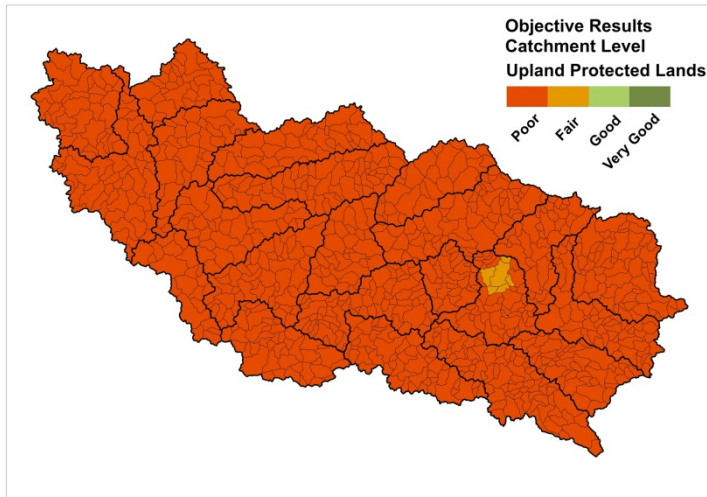
- ❑ Water quality: Pollutant filtration/sediment retention
- ❑ Hydrology: Flood storage/connectivity
- ❑ Biodiversity
- ❑ Wetland Habitat
- ❑ Protected Lands

Indices: Uplands

CONDITION/
FUNCTION

- Habitat Connectivity
- Upland Habitat
- Biodiversity
- Protected Lands

Protected Lands



Metrics: Consolidated Analysis

1. Future Threats
2. Priority Interest Areas

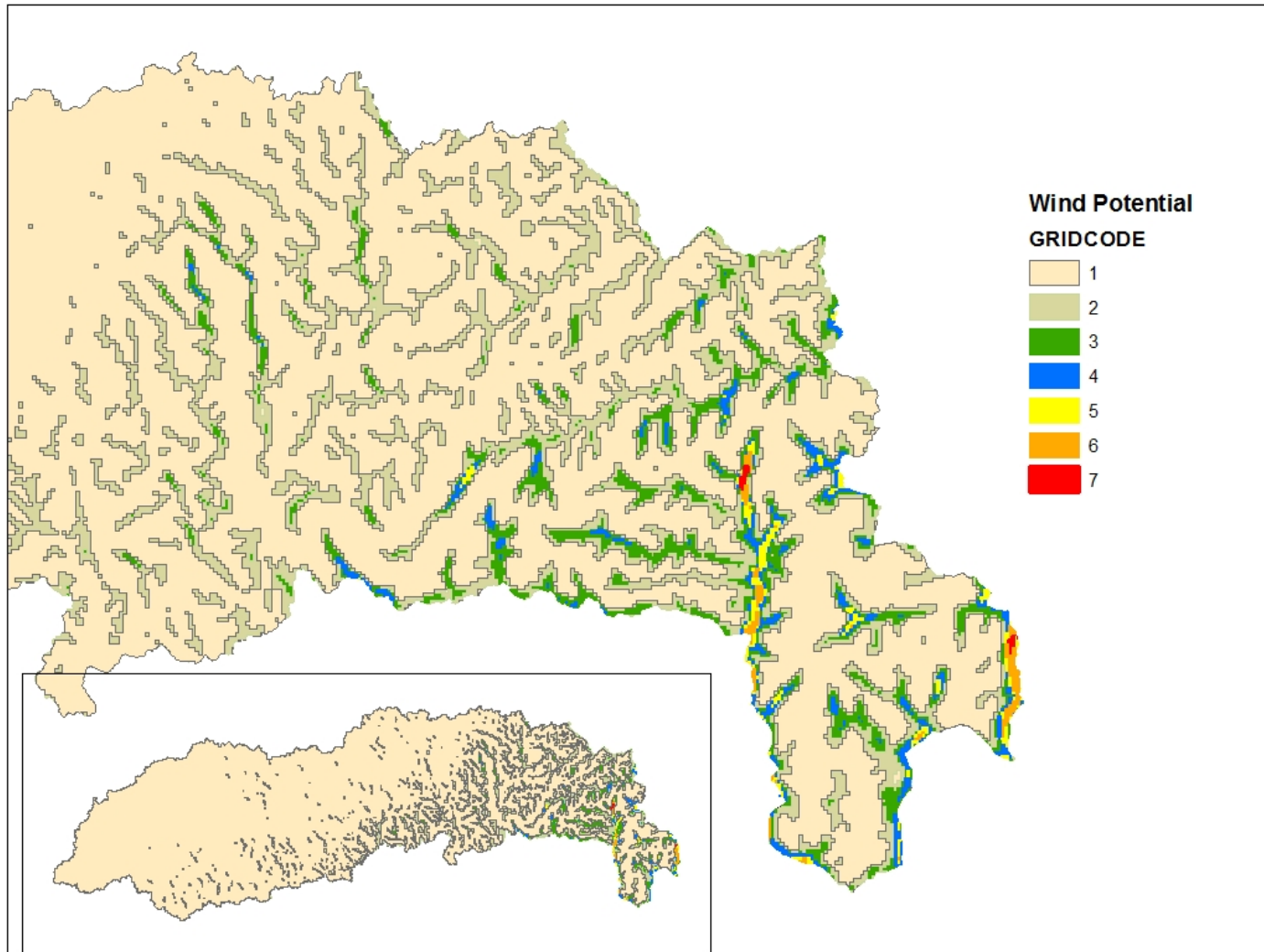
Future Threats

- Energy
 - Marcellus Shale thickness, proposed wells
 - Unmined coal, permitted mines
 - Wind potential
 - Proposed transmission lines, pipelines
- Population/Development
 - Future Growth Areas/Population projections
 - Proposed Roads
- Climate Change

Energy Metrics

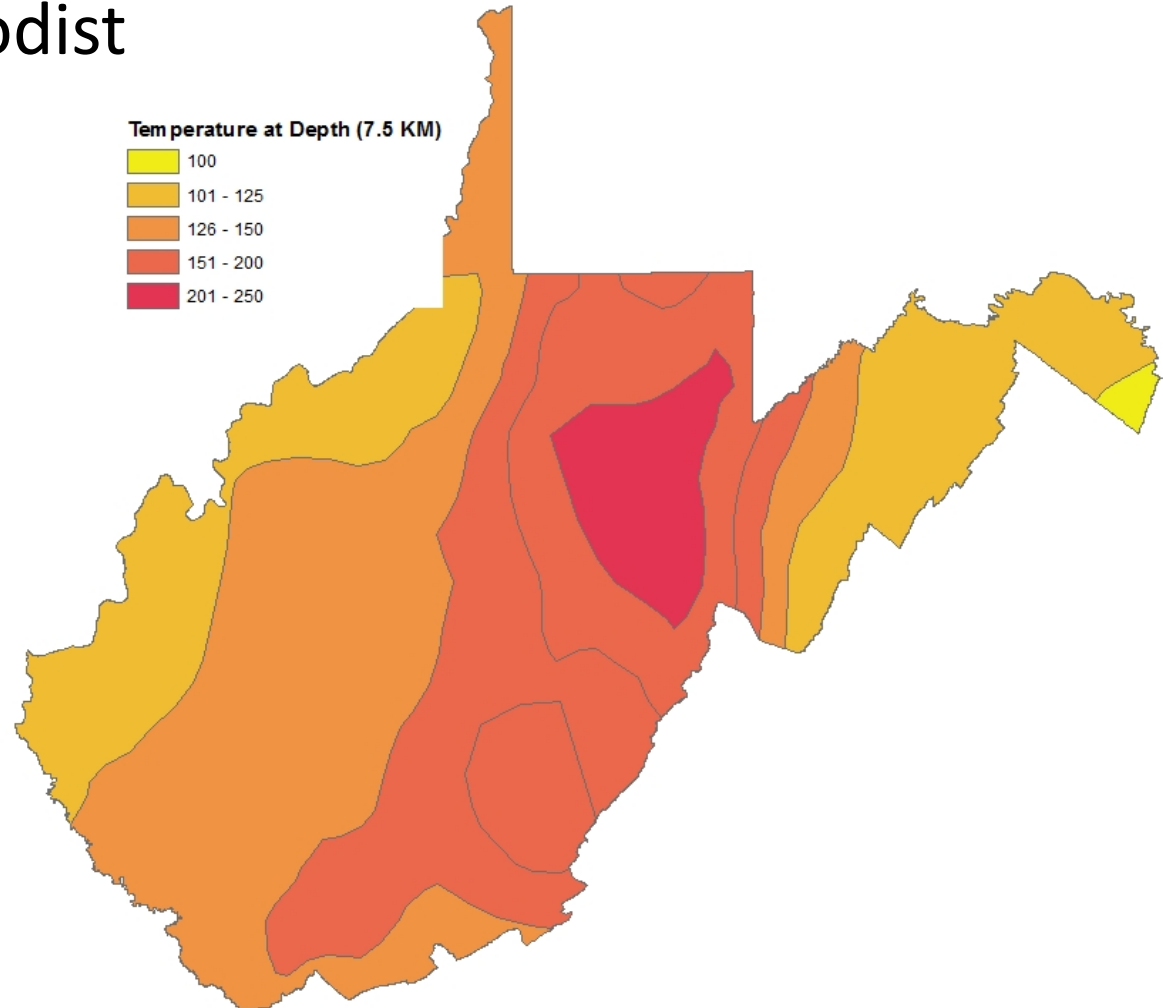
- Oil and Gas wells: well potential, proposed wells
- Coal: unmined coal, unmined coal under permit
- Proposed transmission lines, pipelines, power plants

Energy Metric: Wind Potential



Energy Metric: Geothermal

□ Southern Methodist
University (SMU)
Geothermal
Potential



Population/Development Metrics

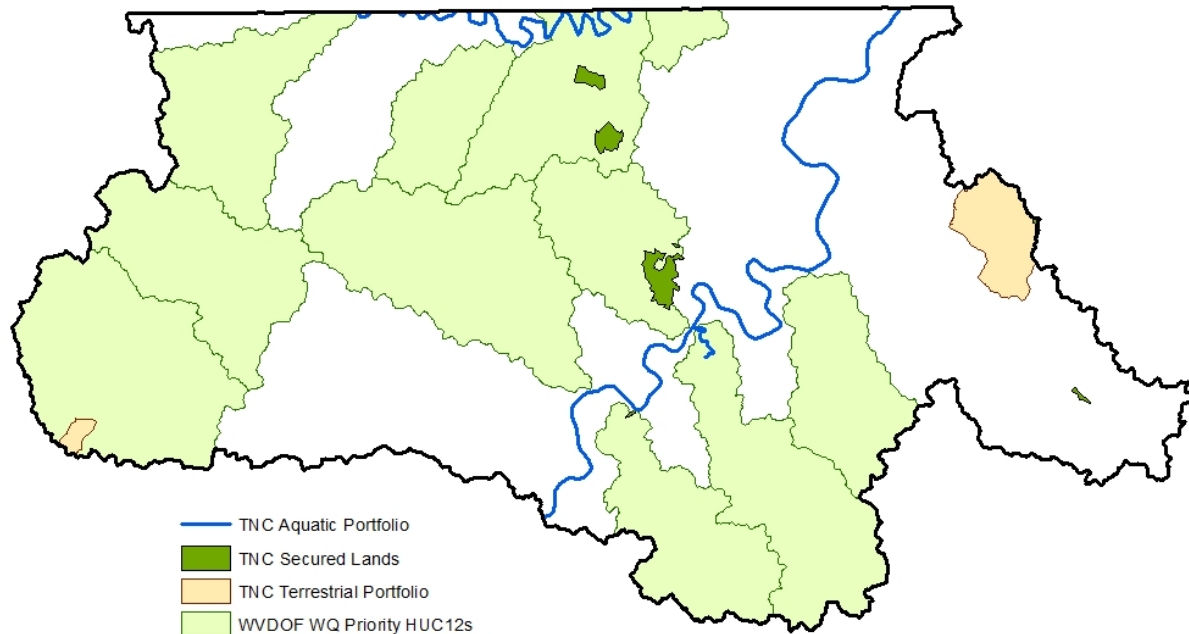
- Future growth areas
- Development potential
- Proposed dams
- Future roads
- Population projections

Climate Change Metrics

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

Priority Interest Areas

- USFS Forest Proclamation Boundary
- WV Division of Forestry priority areas
- TNC aquatic and terrestrial portfolios

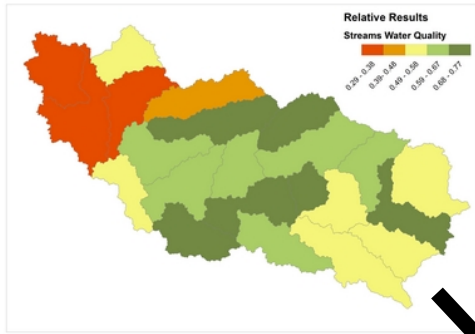


Index and Model Results

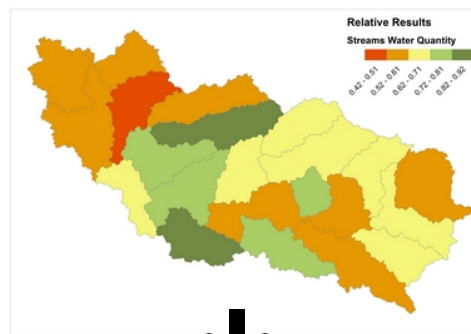
Rollup of Metrics – Relative Method

- Standardized metrics:
 - Set highest quality value to 1, lowest to 0
 - Distributed rest of values between 0 and 1
- For index scores: averaged all metrics according to metric weights
- For model scores: averaged all indices according to index weights
- Resulted in ranks for each index and model
- Grouped into equal interval categories
- Done independently at HUC12 and catchment levels

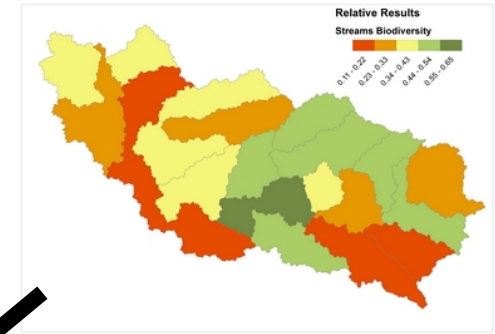
Water Quality



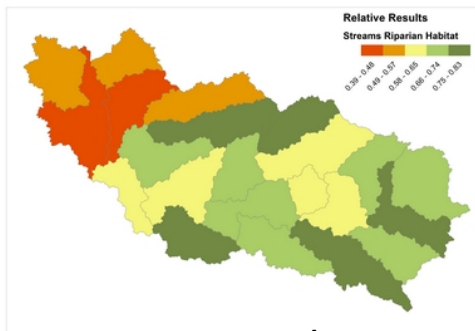
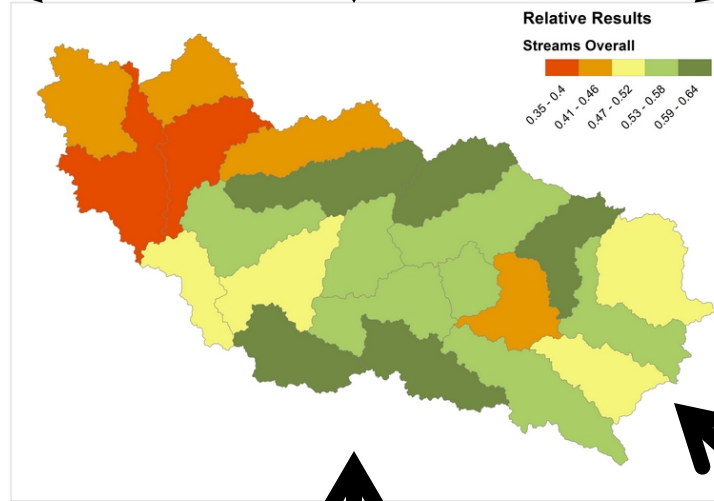
Water Quantity



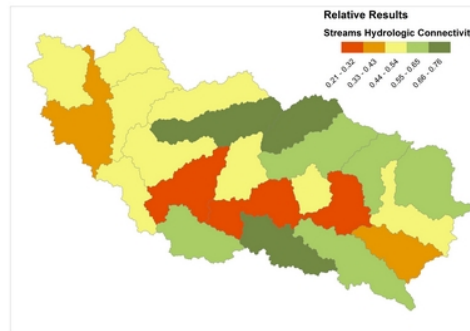
Biodiversity



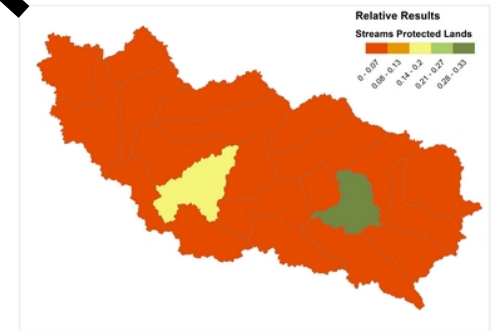
**Streams:
Upper
Guyandotte
Overall Ranking
HUC12s**



Riparian Habitat



Hydrologic Connectivity



Protected Lands

Relative vs. Objective Classification

- Relative ranking compares planning units with each other, but gives no information on which are good quality and which are not
- Need to define Thresholds for each metric to be able to assign to a category
- Literature review has only yielded a handful of objective thresholds
- Used the DEP's reference streams and stressed points to define thresholds

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

Reference Criteria

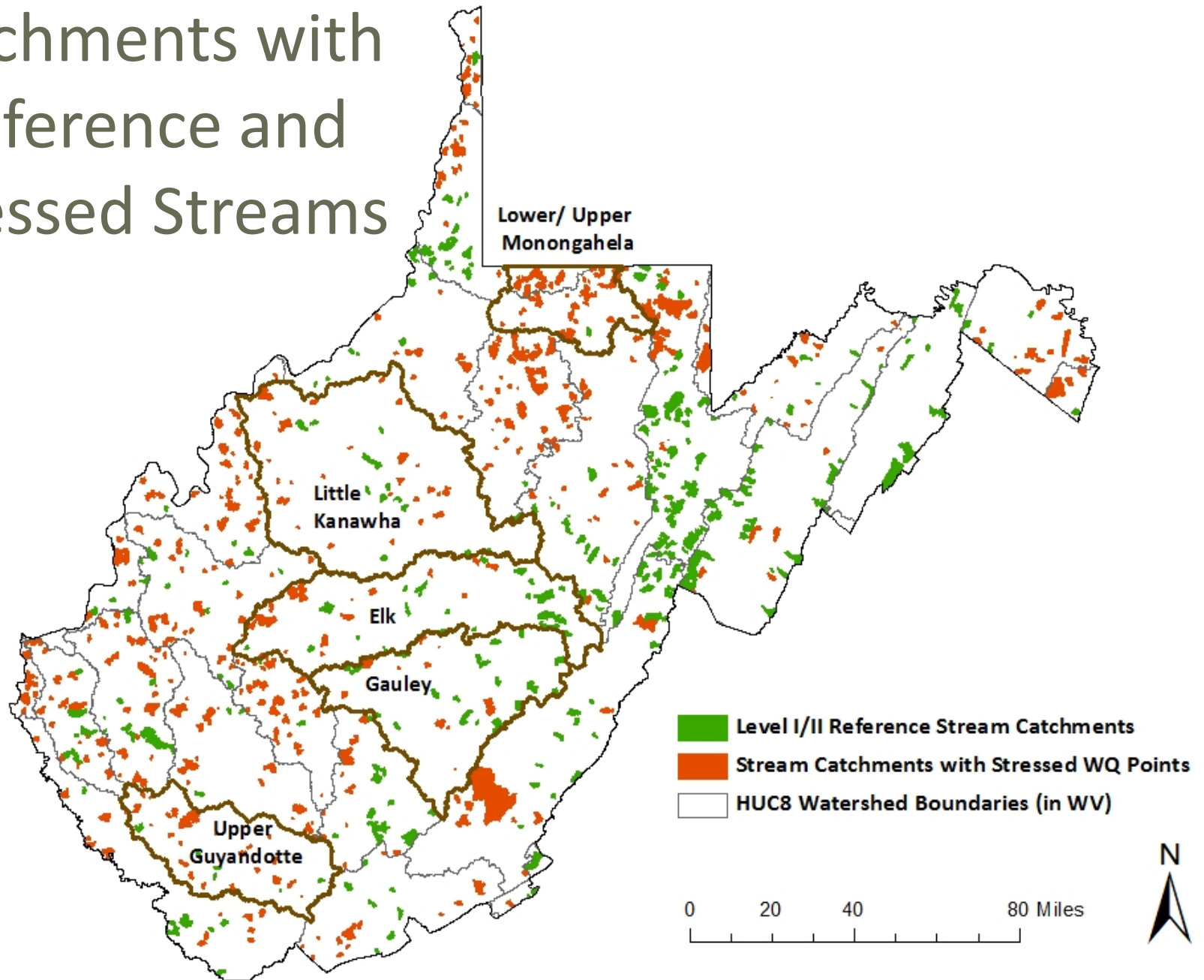
- Dissolved Oxygen: ≥ 6.0 mg/l
- pH: ≥ 6.0 and ≤ 9.0
- Conductivity: < 500 $\mu\text{mhos/cm}$
- Fecal coliform: < 800 colonies/100 ml
- No obvious sources of non-point-source pollution
- RBP Epifaunal substrate score: ≥ 11
- RBP Channel alteration score: ≥ 11
- RBP Sediment deposition score: ≥ 11
- RBP Bank disruptive score: ≥ 11
- RBP Riparian vegetation zone width score: ≥ 6
- RBP Total habitat score: 65% of maximum 240
- Evaluation of anthropogenic activities and disturbances
- No known point source discharges upstream of assessment site

Stressed Criteria

- Dissolved Oxygen: <4.0 mg/l
- pH: <4.0 or >9.0
- Conductivity: >1000 μ mhos/cm
- Fecal coliform: >5,000 colonies/100 ml
- RBP Epifaunal substrate score: <7
- RBP Channel alteration score: <7
- RBP Sediment deposition score: <7
- RBP Bank disruptive score: <7
- RBP Riparian vegetation zone width score: <4
- RBP Total habitat score: <120

Site was considered stressed if it met at least 2 of the criteria

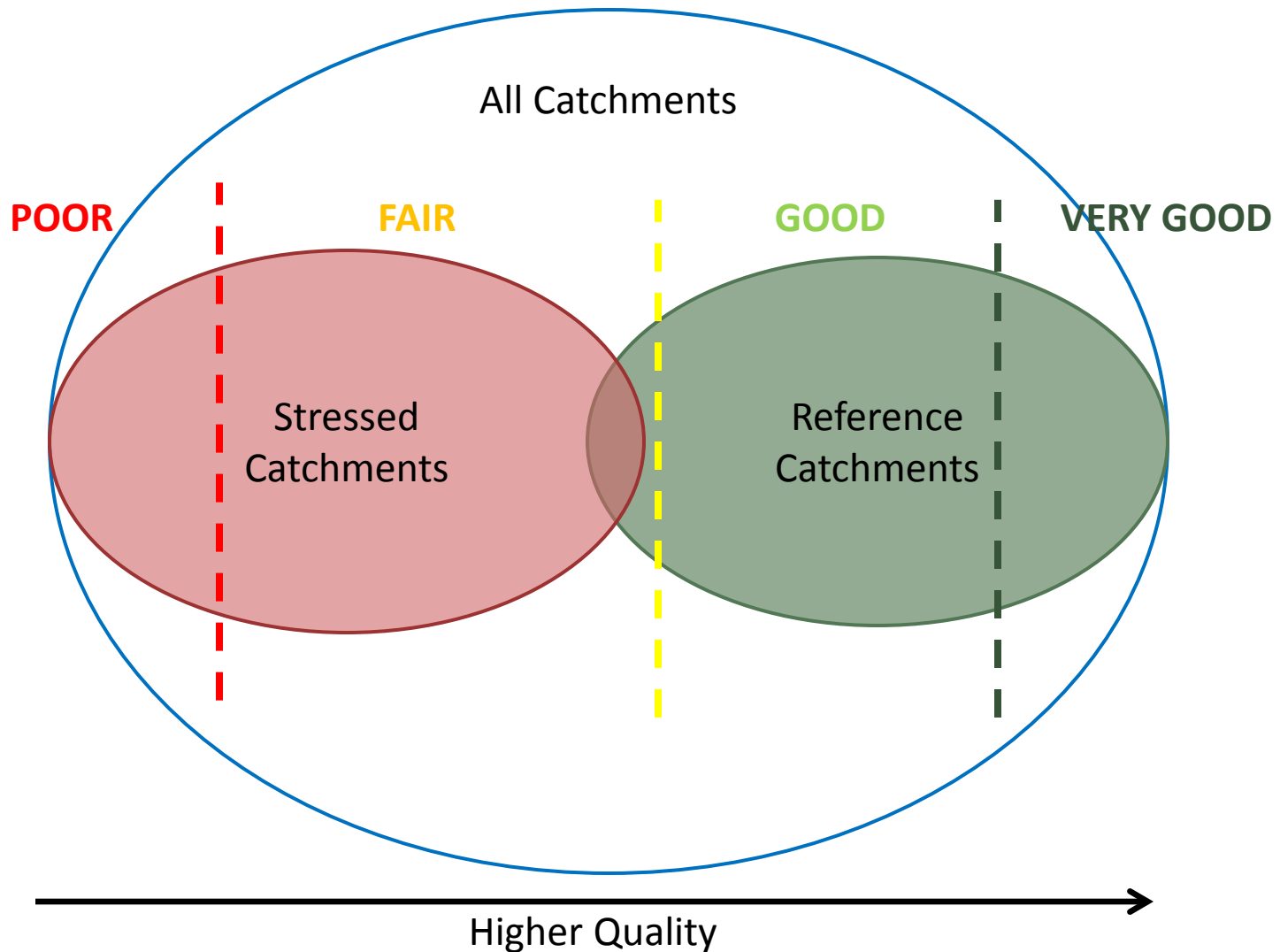
Catchments with Reference and Stressed Streams



Objective Ranking Methodology

- Calculated metrics for stressed and reference catchments separately:
 - Reference catchments to define very good/good and fair/good thresholds
 - Stressed catchments to define fair/poor threshold
- Examined the distribution of values for each metric, considered using median, 25th/75th, 90th/10th, or 95th/5th percentiles
- Results were most consistent using the 35th/65th percentiles

Objective Ranking Methodology



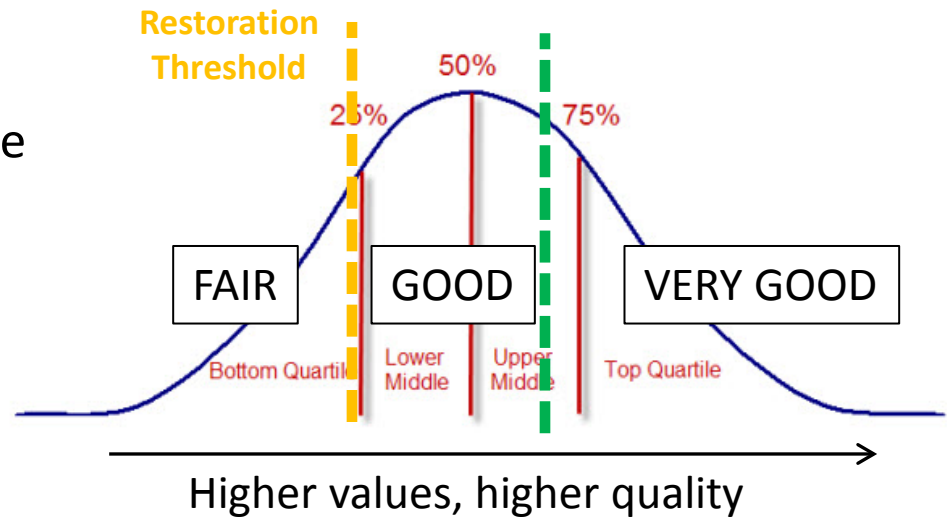
Thresholds Definition: Reference

- Top 35% of reference catchments in Very Good category (ideal ecological condition)
- Top 75% of reference catchments in Good category (acceptable ecological condition)
 - Positive metrics (higher values indicate higher quality):
 - Very good/good: 65th percentile
 - Good/fair: 25th percentile
 - Negative metrics (higher values indicate lower quality):
 - Very good/good: 35th percentile
 - Good/fair: 75th percentile

Threshold Definition: Reference

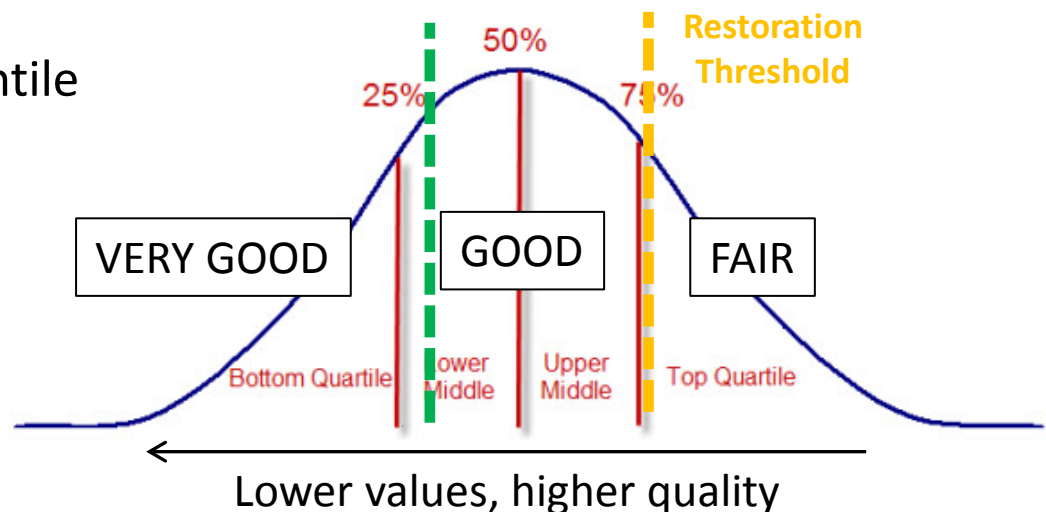
Positive Factors:

- Very good/good: 65th percentile
- Good/fair: 25th percentile



Negative Factors:

- Very good/good: 35th percentile
- Good/fair: 75th percentile



Threshold Definition: Stressed

- Worst 35% of stressed catchments in Poor category
- Majority of stressed catchments in Fair category
 - Positive metrics:
 - Fair/poor: 35th percentile
 - Negative metrics:
 - Fair/poor: 65th percentile

Killer 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

Use of Interactive Web Tool

Possible steps to define priority areas:

- 1) Start at HUC12 level:
 - a) Objective ranking:
 - i. Good/Very Good HUC12s to identify protection candidates
 - ii. Fair HUC12s to identify restoration candidates
 - iii. Poor HUC12s may be too degraded for restoration
 - b) Refine with relative ranking:
 - i. Within candidate HUC12s, find relatively better ones
- 2) Zoom in to Catchment level:
 - a) Objective ranking to identify candidate catchments
 - b) Refine with catchment relative ranking

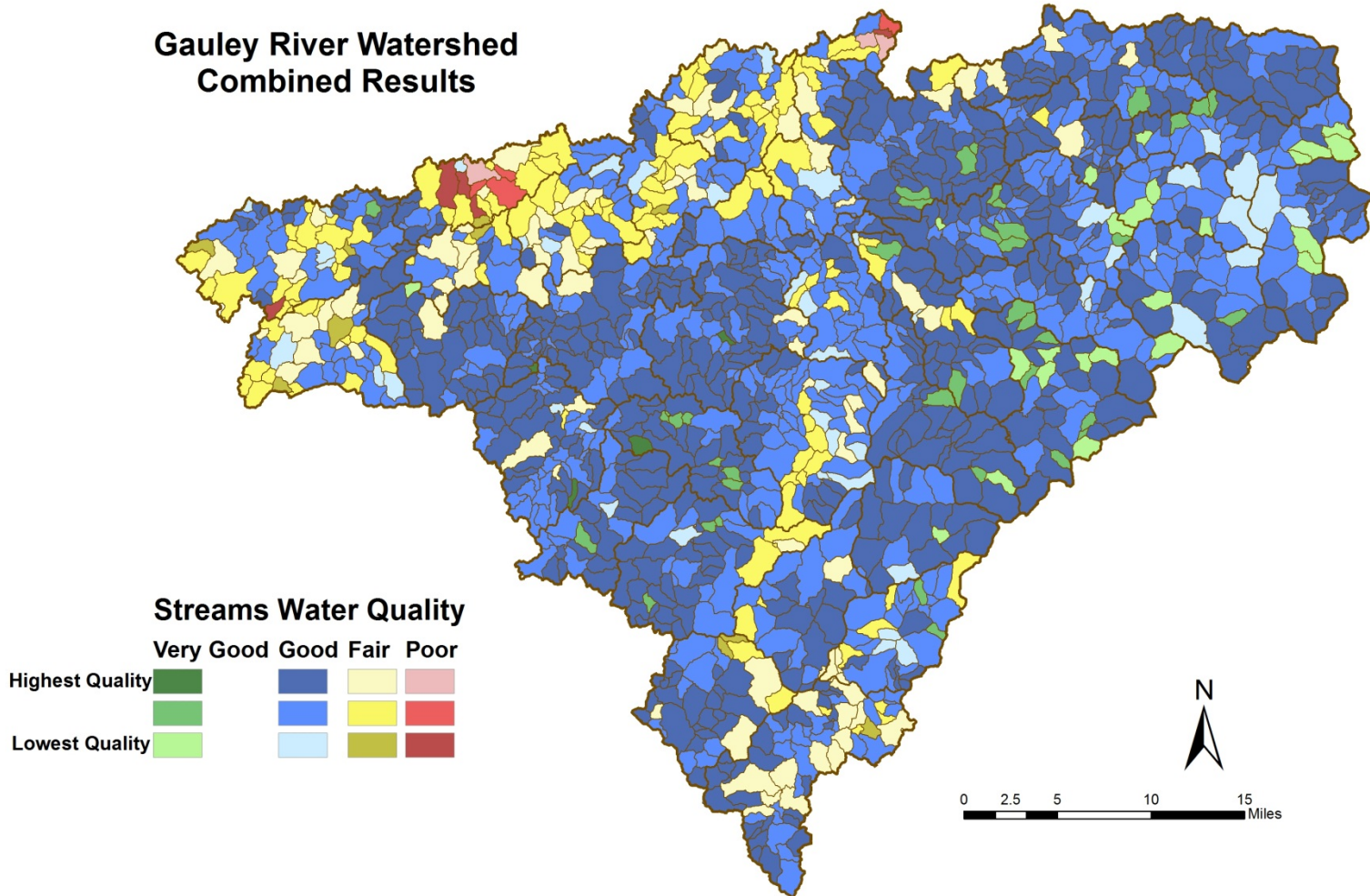
OR: Combine Objective and Relative Rankings into One Priority Index

Combined Ranking

- Start with numeric value for Objective Ranking
 - Very Good = 4
 - Good = 3
 - Fair = 2
 - Poor = 1
- Add Relative Ranking (which is on 0 – 1 scale)
- Results in one index giving relative ranking of each planning unit within each objective category
 - Very good: 4.75
 - Good: 3.56
 - Fair: 2.42
 - Poor: 1.37

Combined Ranking

Gauley River Watershed
Combined Results



Group Discussion After Results Presentations

- Are thresholds in Objective Ranking defined appropriately?
- Combined Objective/Relative Ranking
 - Is this an appropriate method to compare the two rankings?
 - Will this make presentation of analysis results easier or more confusing for end users
 - Are there alternate ways to combine the two rankings?
- How should results be presented in interactive web tool?
 - Combined ranking vs. objective and relative separately
 - Alternate work flow for end users?



THANK YOU!

Strategies

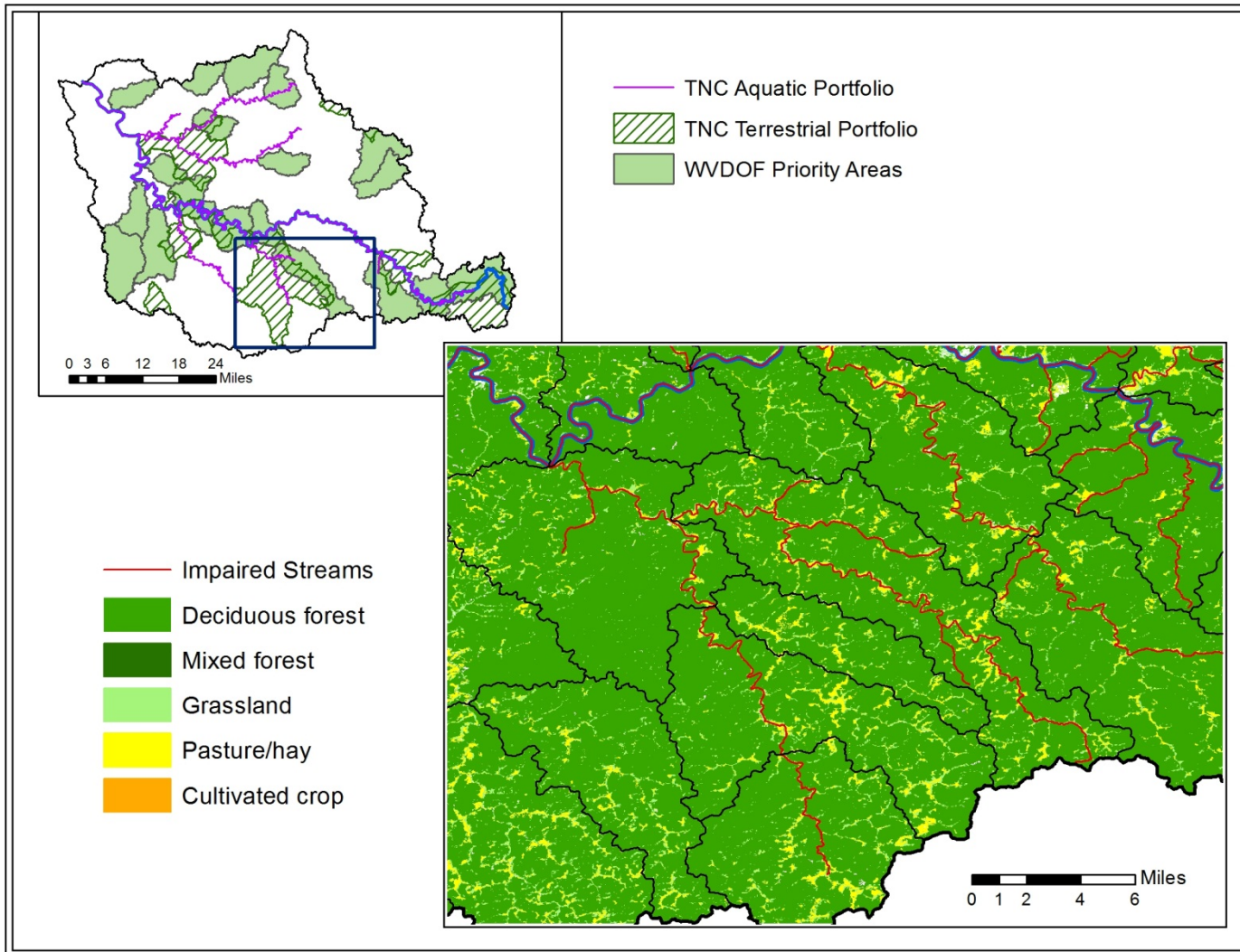
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- Identify data gaps & data needs
- **Develop Strategies to address issues within the Watersheds**

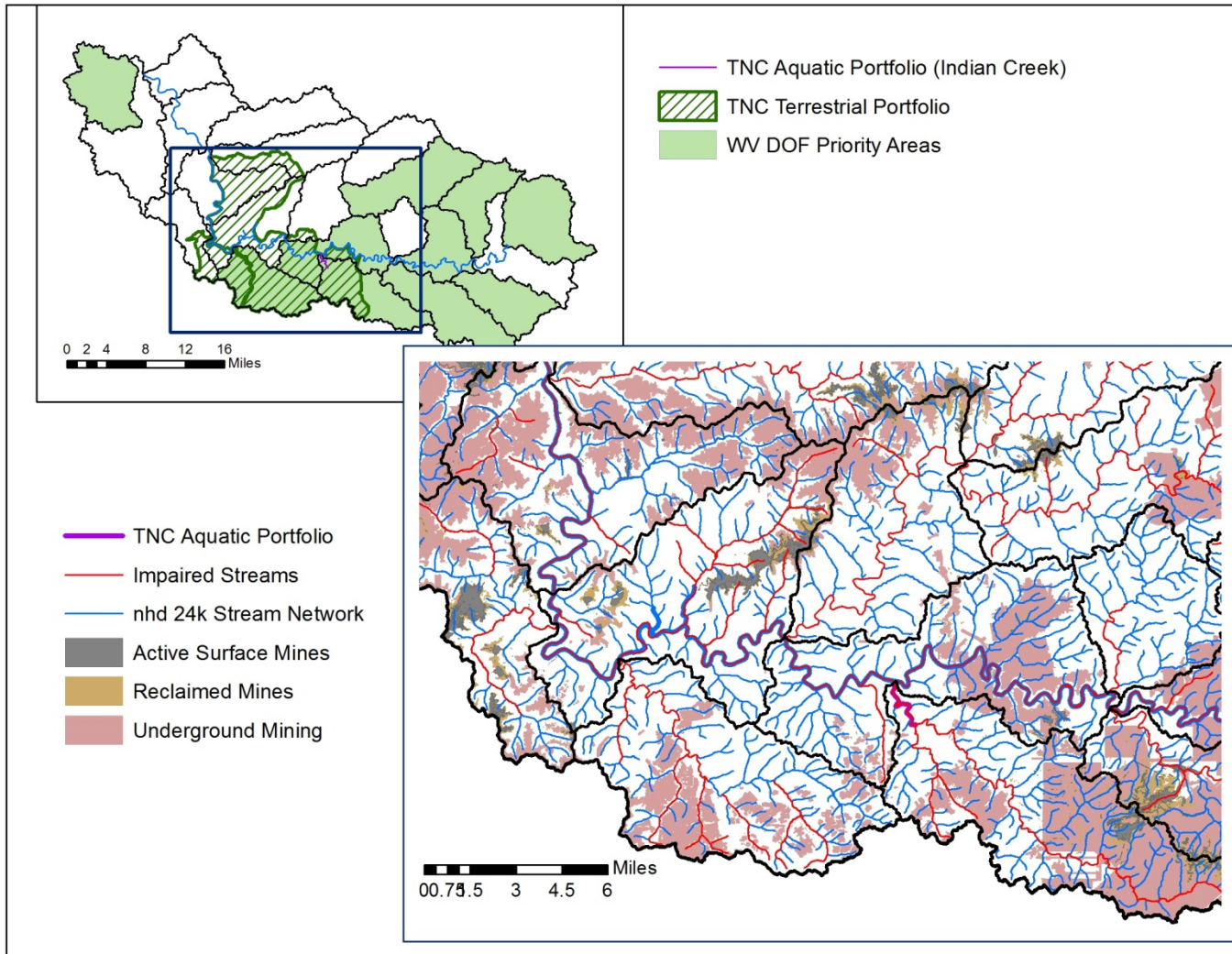
Strategy Development

- Watershed Assessment, not Watershed Plan
 - Goal is to make this tool useful to wide variety of users and strategies
 - While main purpose of project is to identify protection and restoration priorities, many identified stressors would respond primarily to other strategies, including regulation, adherence to BMPs, etc.
 - Design strategies that:
 - Don't prescribe where specifically in a watershed to work
 - Do identify trends of stresses in a watershed and potential strategies to abate them

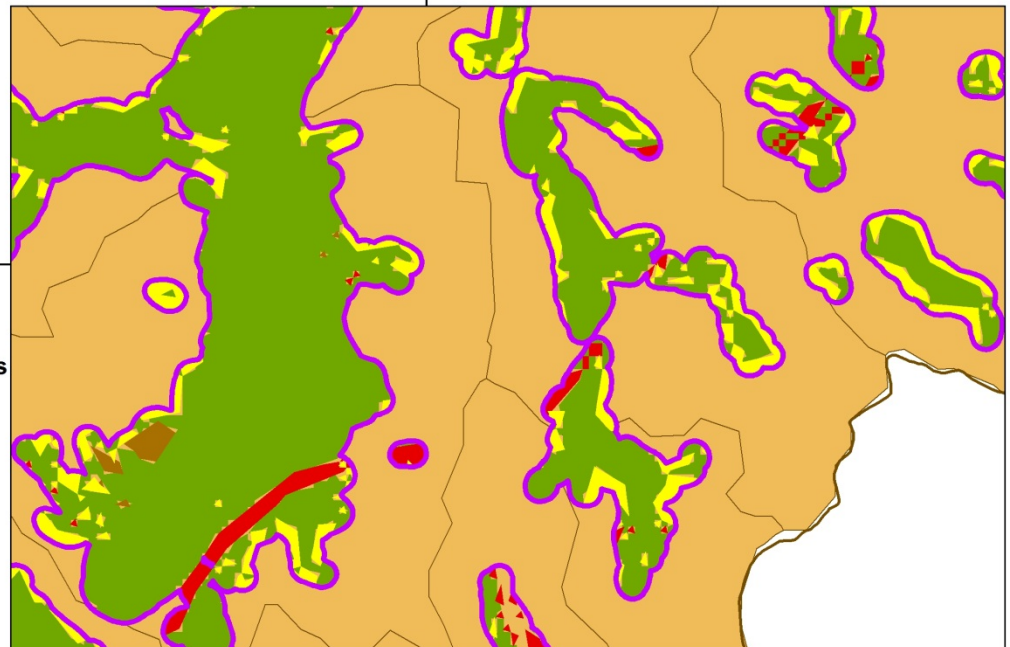
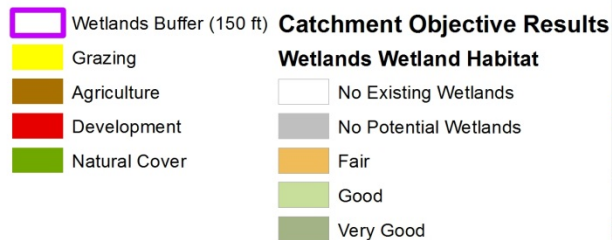
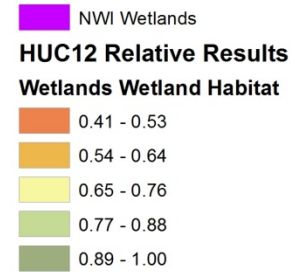
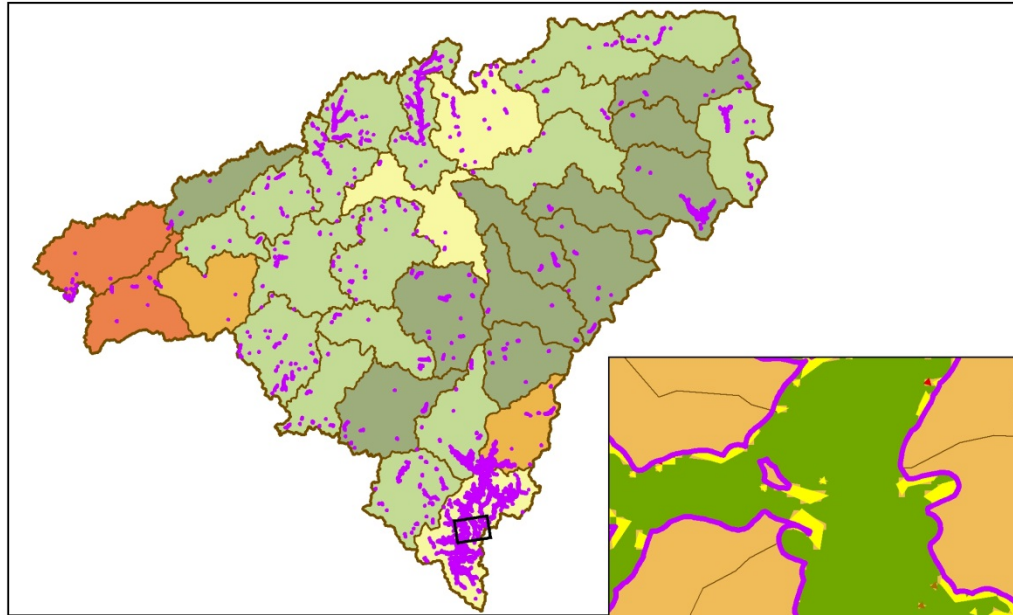
Grazing



Mining



Wetland Restoration



Streams Water Quality

- Mining-related water quality impairments
 - AMD, pH, heavy metals impairments, high specific conductance
 - Strategies:
 - treating and disposing of contaminated water before leaving mine site
 - Controlling runoff and sedimentation from mine sites
 - Installing settling ponds
 - Installing lime treatment stations
- Development
 - Inadequate sewage treatment, high impervious surface, etc.
 - Strategies:
 - Encourage installation/appropriate maintenance of functioning septic systems
 - Expansion of sewage treatment service areas
 - Education on how to minimize effects of impervious surfaces
- Riparian habitat stresses
 - Grazing, high road densities, etc.
 - Strategies:
 - Installing buffer areas along streams with limited grazing, timbering, road construction
 - Adherence to BMPs

Streams – Other Indices

- Water Quantity:
 - Underground and Surface Mining
 - High Imperviousness
- Hydrologic Connectivity:
 - Lack of forested riparian area
 - Direct flow impediments (bridges, culverts)
- Riparian Habitat:
 - Lack of natural cover in riparian area
 - Fragmenting features (roads, pipelines, wells, active surface mining)
 - Low bank stability and overall RBP scores

Biodiversity & Public Lands

- Biodiversity:
 - Invasive species
 - Lack of known rare species locations
 - Lack of mussel streams

- Protected Lands:
 - Lack of adequate protected lands

Wetlands

- Water Quality
 - Lack of forested headwater wetlands
 - Stressors in wetland catchment area (high imperviousness, low natural cover)
 - Incompatible land uses in wetland buffer
- Hydrology
 - Small or no wetlands in planning units
 - Lack of floodplain areas and hydric soils
- Wetland Habitat
 - Small forest patch sizes
 - Low natural cover
 - Roads in wetland buffers

Uplands

- Habitat Connectivity
 - Fragmentation
- Habitat Quality
 - Low natural cover in upland areas
 - Low heterogeneity scores
 - Incompatible land uses (timber harvesting, grazing)

Group Exercise

Please work through the trends for each index, developing potential strategies

Keep in mind:

- Is this level of detail a useful part of the watershed assessment?
- What can we do to improve usefulness of strategies section for the end user?



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

THOUGHTS/SUGGESTIONS?

Group Discussion After Consolidated Analysis

- Comfort Level with this Category given Data Quality/Availability
- How do we best integrate it with the webtool?
 - First selection of candidate conservation sites using Condition Analysis results
 - Then use Consolidated Analysis results to provide more information and make final selection of sites to explore
- Should Protected Lands be moved to this Category instead of Current Condition?
 - Though Protected Lands are a current state, inform feasibility more than ecological issues



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THANK YOU FOR YOUR HELP!