WV WATERSHED ASSESSMENT PILOT PROJECT

Gauley River ©Kent Mason

Stakeholder & Partner Workshop, May 8th, 2013

Flatwoods Days Inn, WV

Workshop Outline

- Project Background
- Results presentations
- Break for lunch
- Web Tool demonstration
- Strategies

Project Background & Methodology

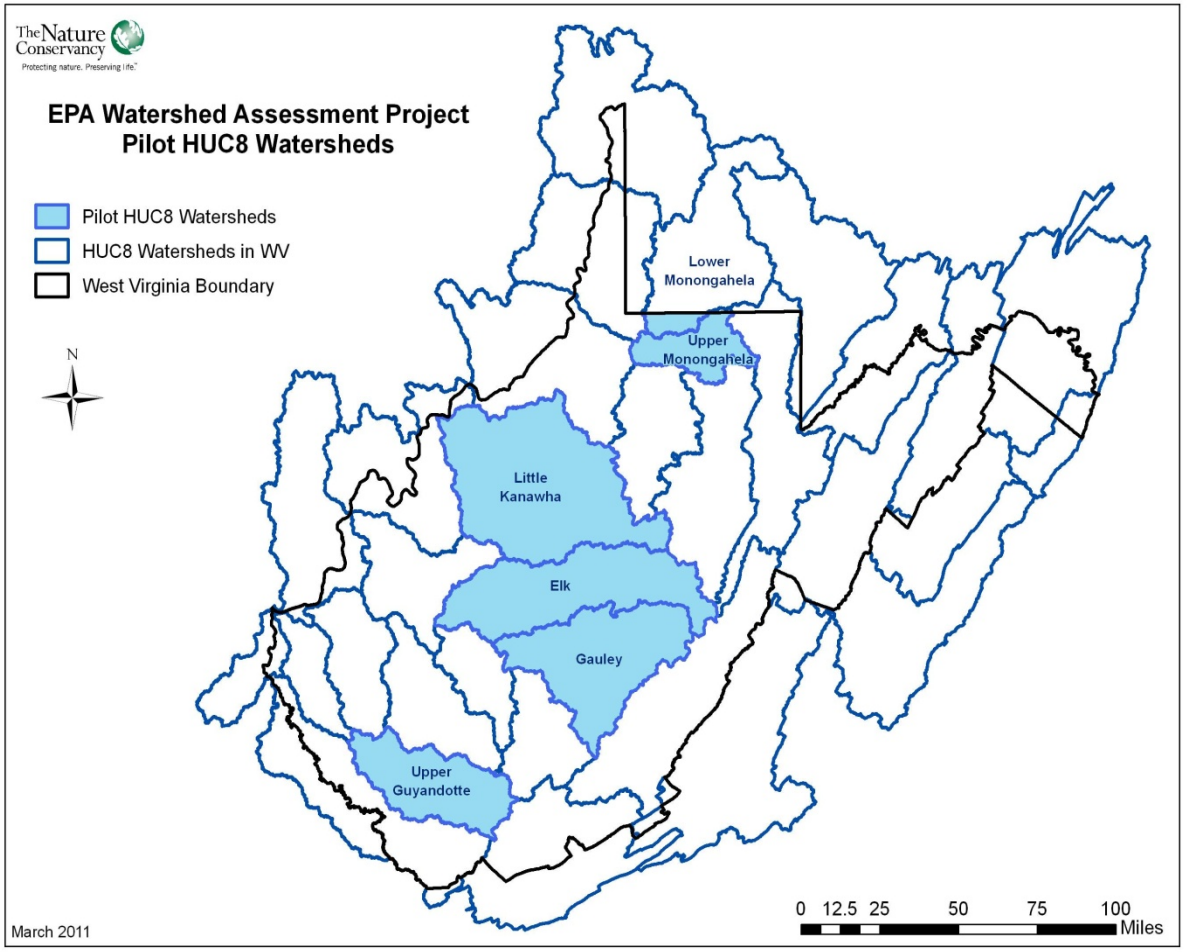
Project Objectives

- 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

5 HUC8 Watersheds:

- YEAR 1:
  - Monongahela
  - Elk
- YEAR 2:
  - Gauley
  - Little Kanawha
  - Upper Guyandotte



Project Process & Timeline

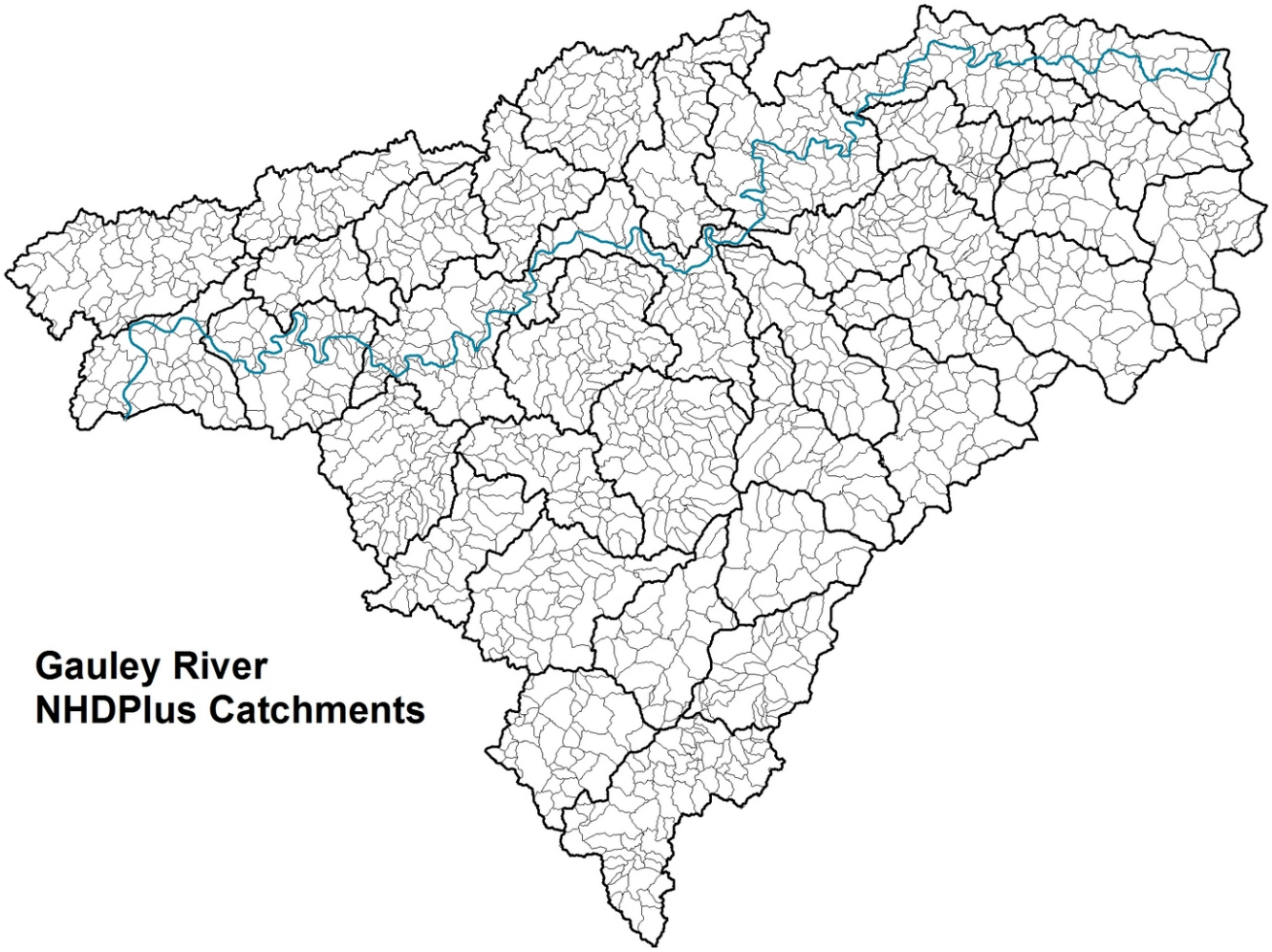
- First 2 Watersheds:
  - April 2011 – Project Start: Data Compilation
  - June 2011 – Technical Advisory Team Meeting
  - October 2011 – Expert Workshop #1
  - January 2012 – Expert Workshop #2
  - April 2012 – Stakeholder/Partner Workshop
  - June 2012 – Draft Watershed Reports completed
- Final 3 Watersheds:
  - June 2012 – Start Data Compilation
  - October 2012 - Expert Workshop #1
  - January 2013 – Expert Workshop #2
  - **May 2013 - Stakeholder/Partner Workshop**
  - June 2013 – Final reports & interactive web application completed

Watershed Characterization

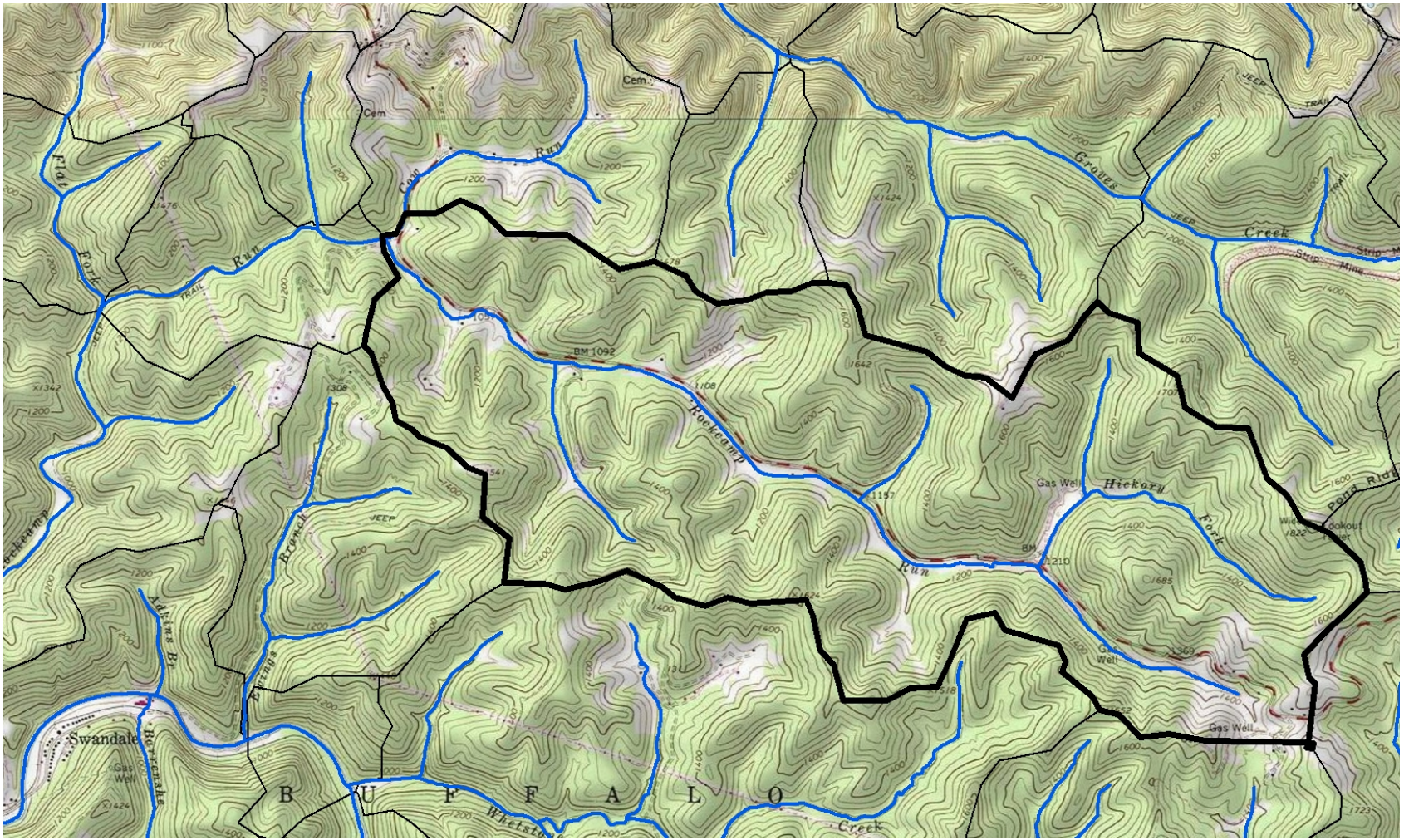
- Two Scales of Planning Units:
  - HUC-12 watersheds
  - Catchments

Planning Units 1: HUC12s

Planning Units 2: Catchments

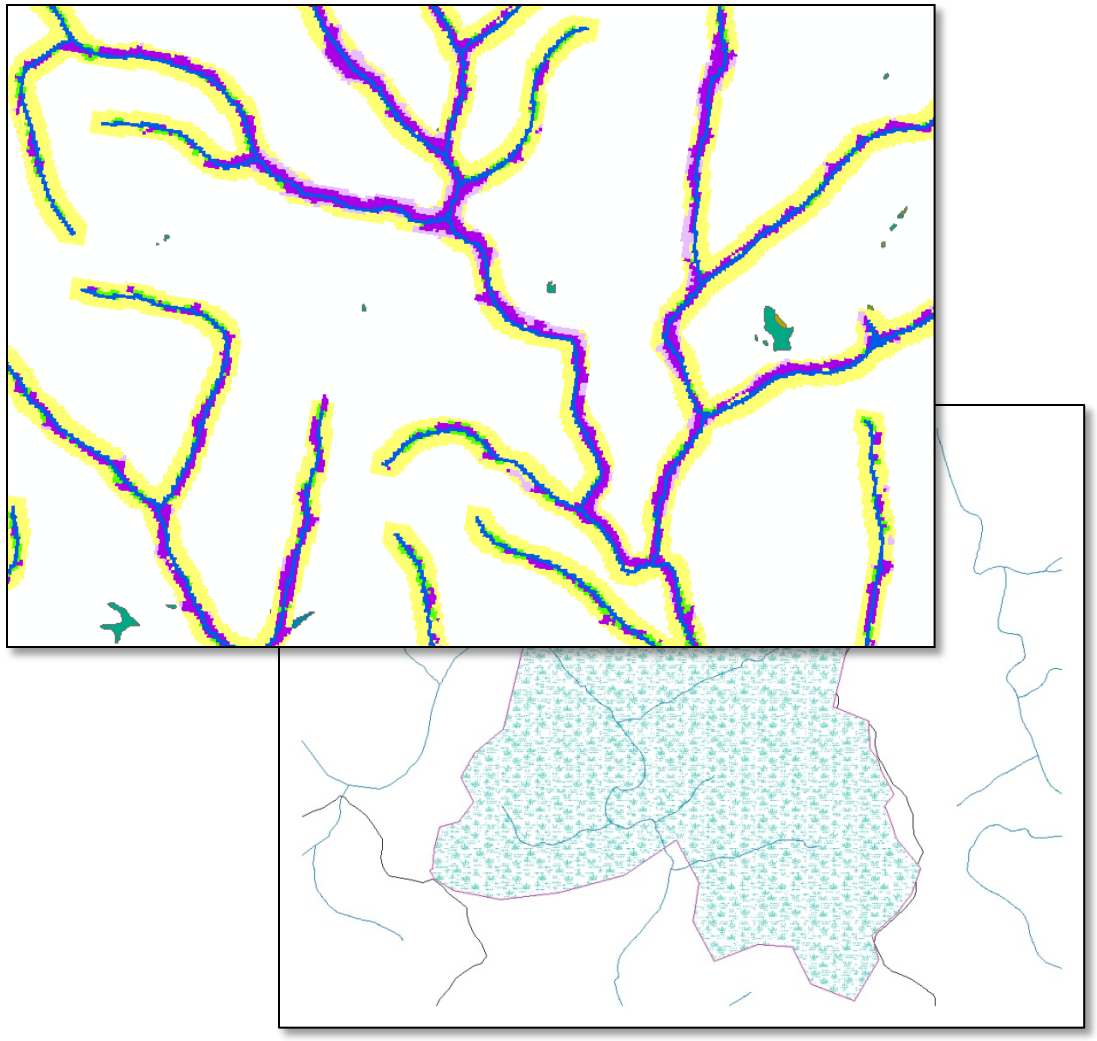


NHDPlus Catchments (modified)



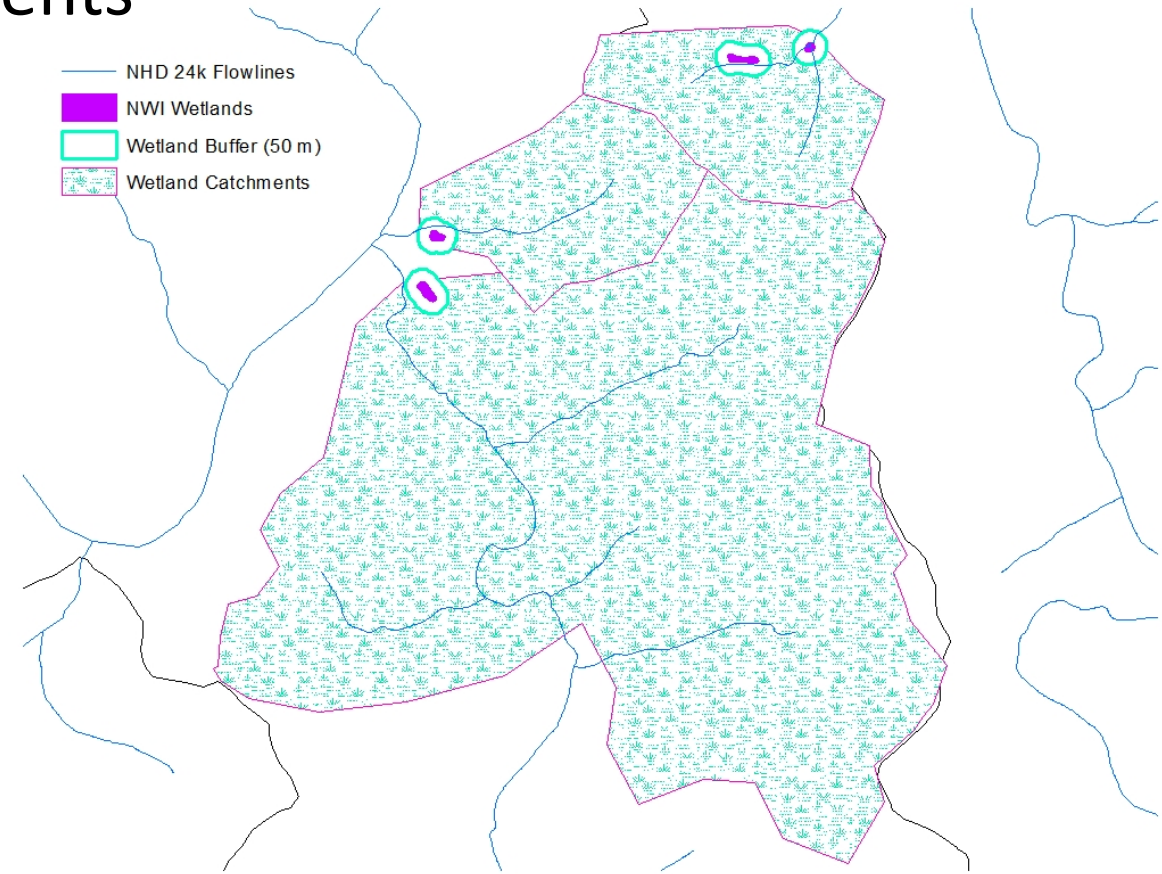
3 Models: Landscape Types

- Stream/Riparian Areas
- Wetlands
- Uplands



Wetland Buffer vs. Catchment

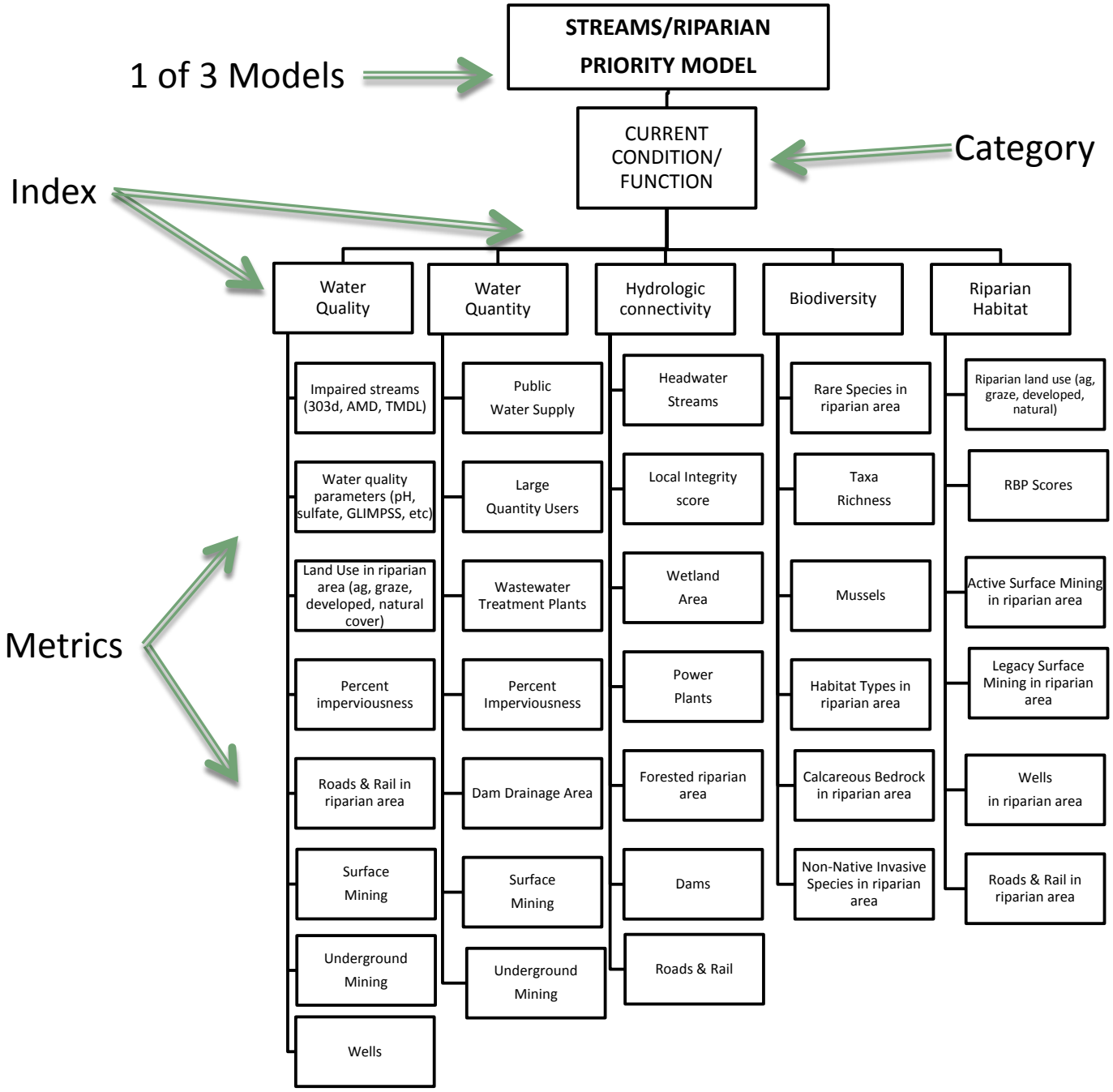
- Wetland buffer (50 m)
- Wetland catchments (delineated using contributing NHDPlus catchments)



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
Water Quality
Water Quantity
Hydrologic connectivity
Biodiversity
Riparian Habitat
Metrics
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

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

- 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
- 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)

- 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

Biodiversity Metrics

- 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

- 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

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

Climate Change Metrics

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

Metrics: Opportunities

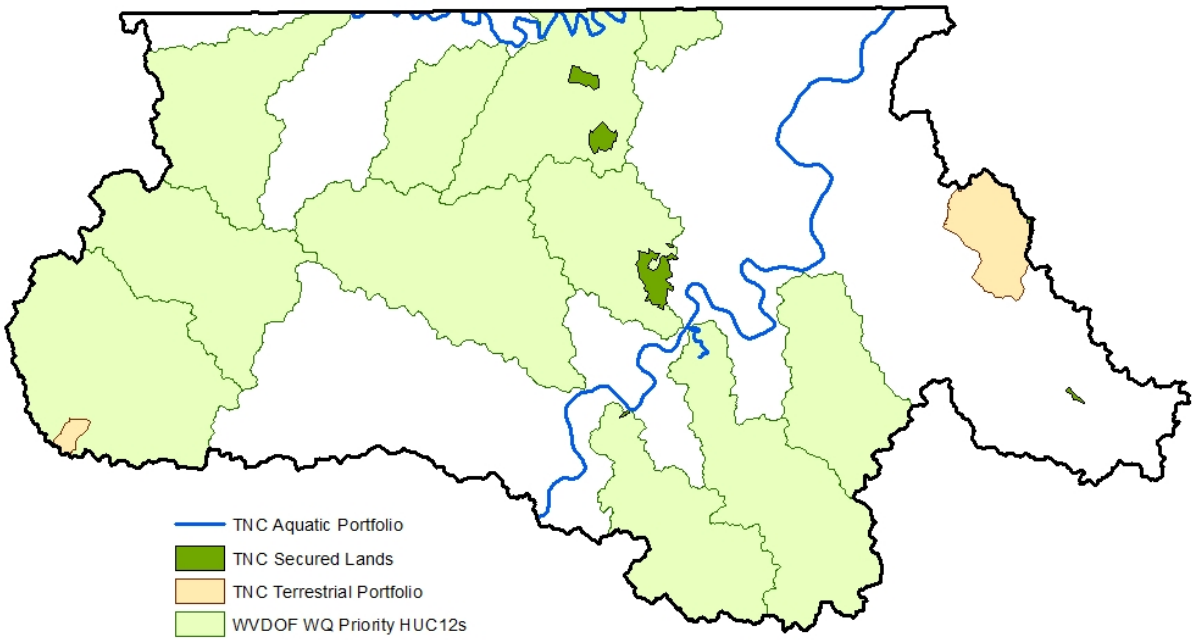
1. Protected Lands
2. Priority Interest Areas

Protected Lands

- Only permanently protected lands included
- Public Lands
  - Federal
  - State
  - Local
- Privately protected lands
  - Conservation easements
  - NGO preserves

Priority Interest Areas

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



Index and Model Results

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

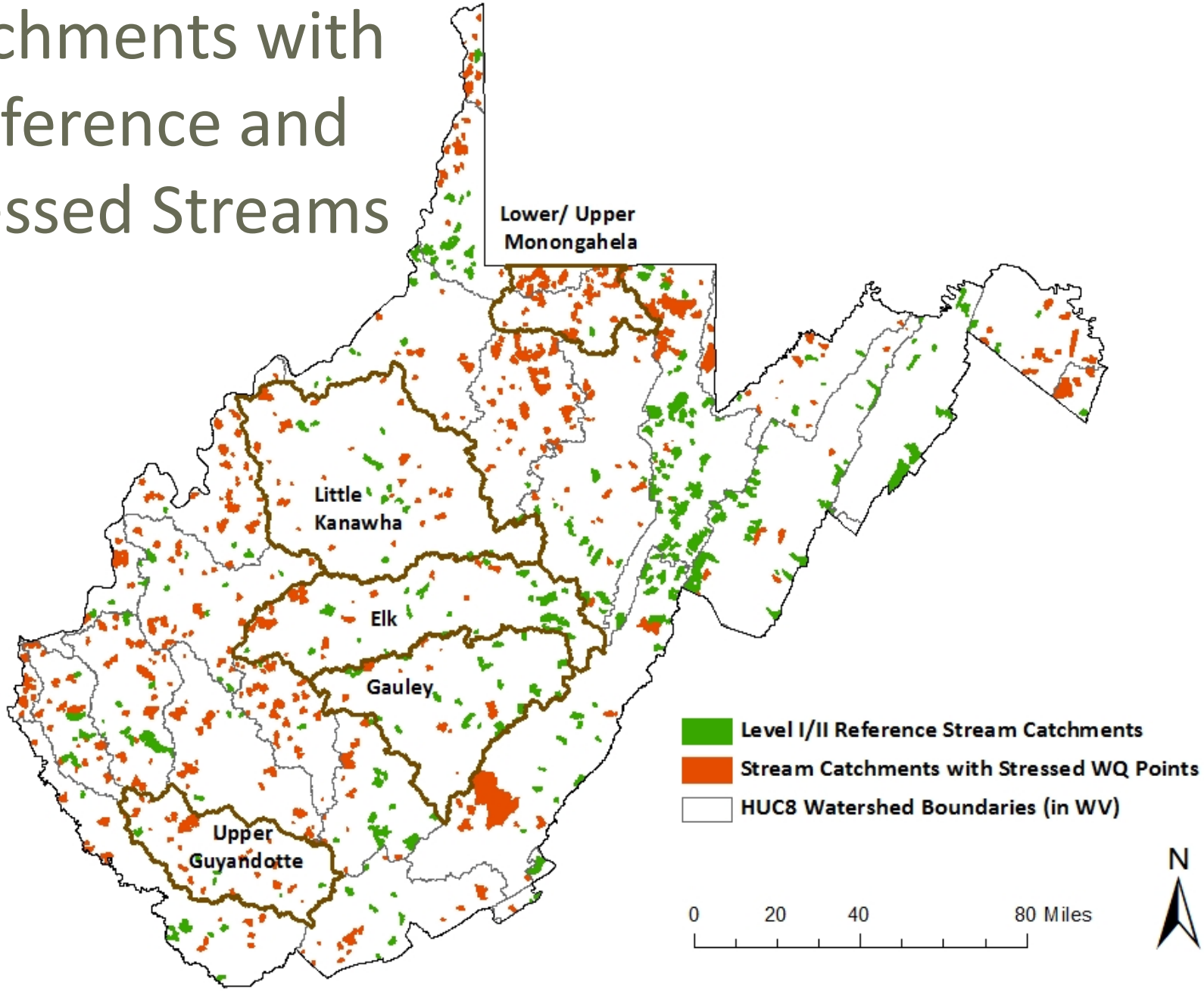
Restoration Threshold

- 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

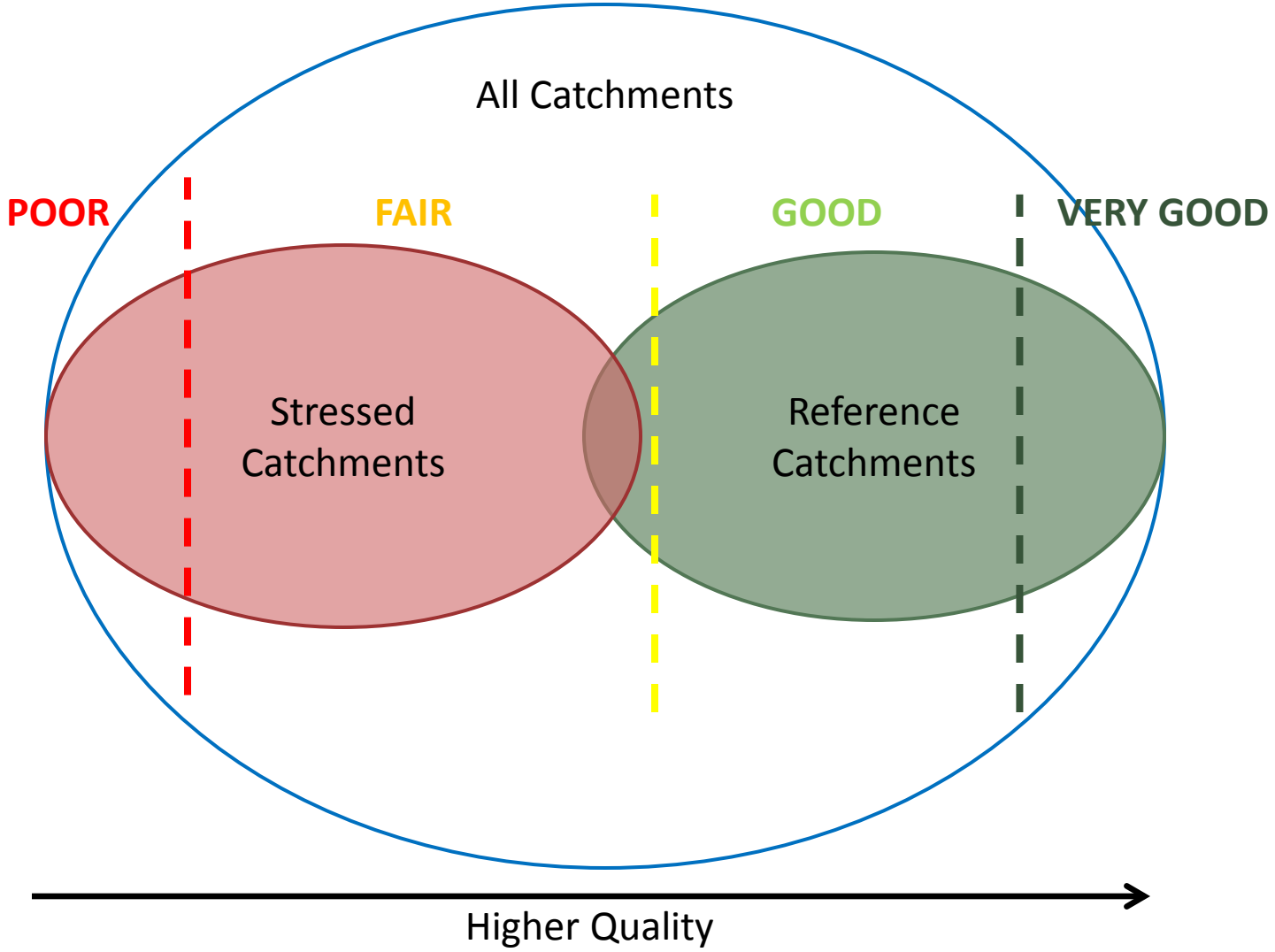
Catchments with Reference and Stressed Streams



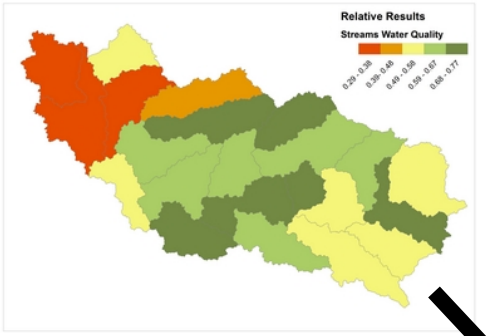
Objective Ranking Methodology

- 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

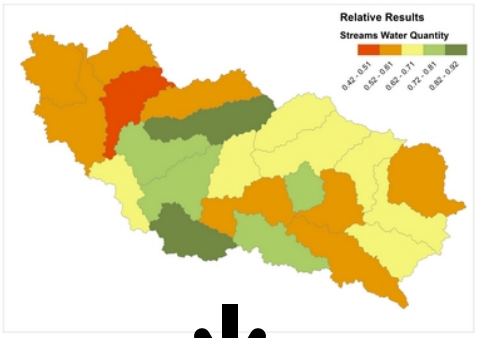
Objective Ranking Methodology



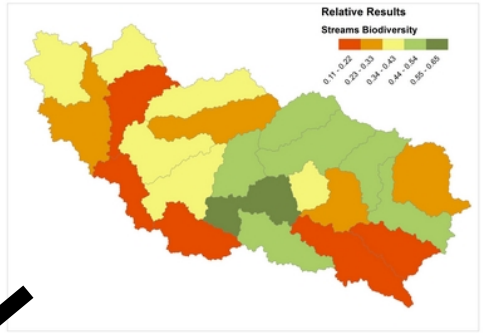
Water Quality



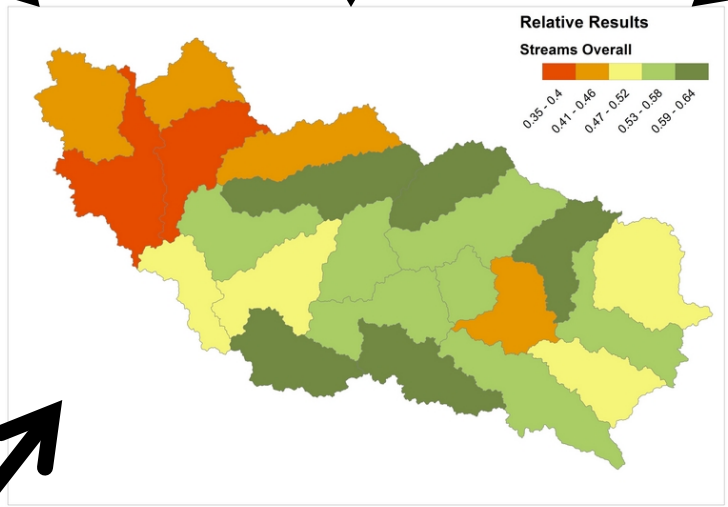
Water Quantity

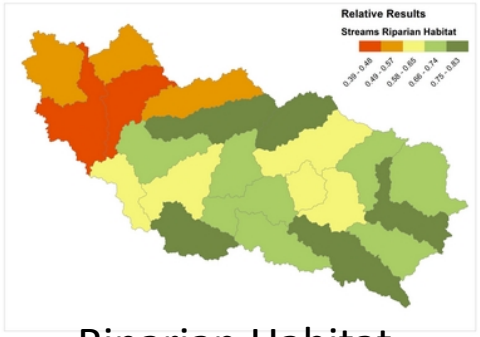


Biodiversity

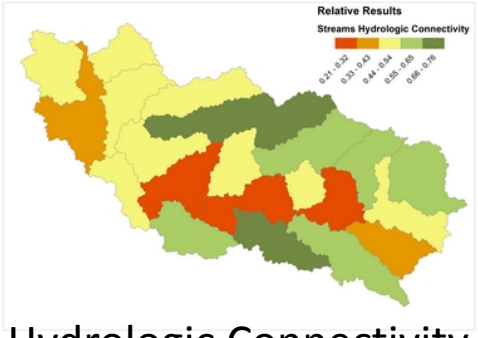


Stream Index Rollup to Model Ranking

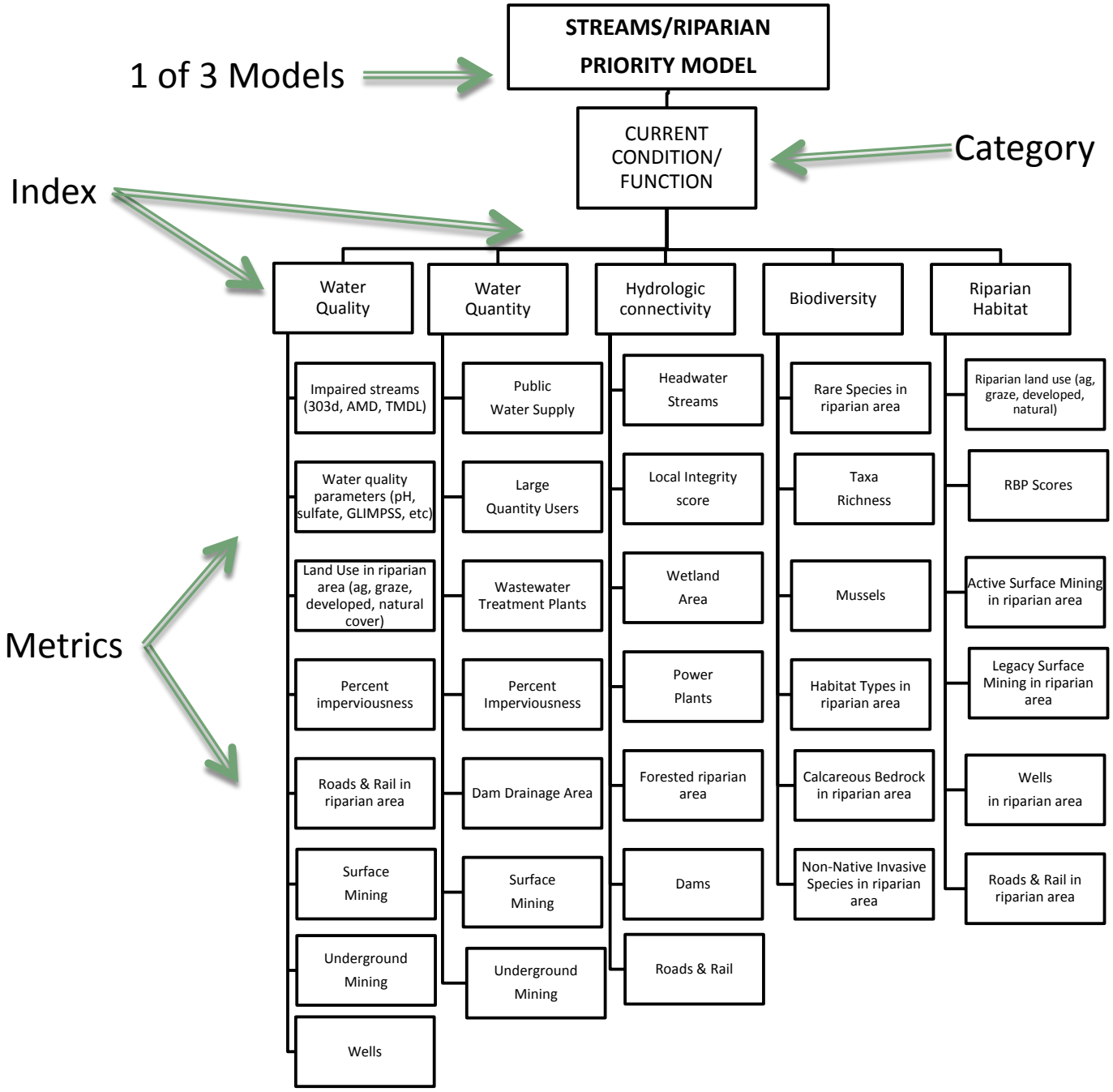




Riparian Habitat



Hydrologic Connectivity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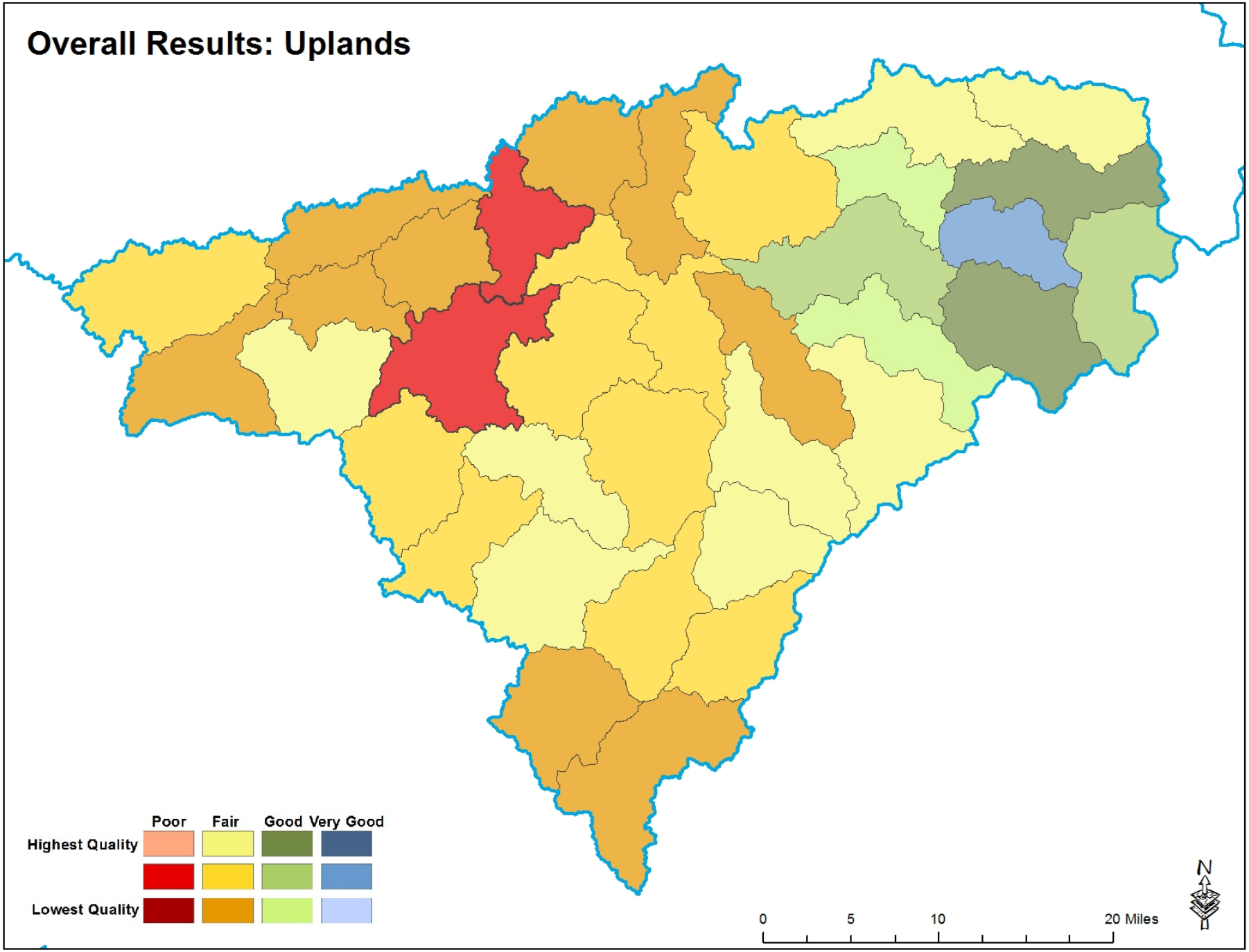
Overall Results: Uplands



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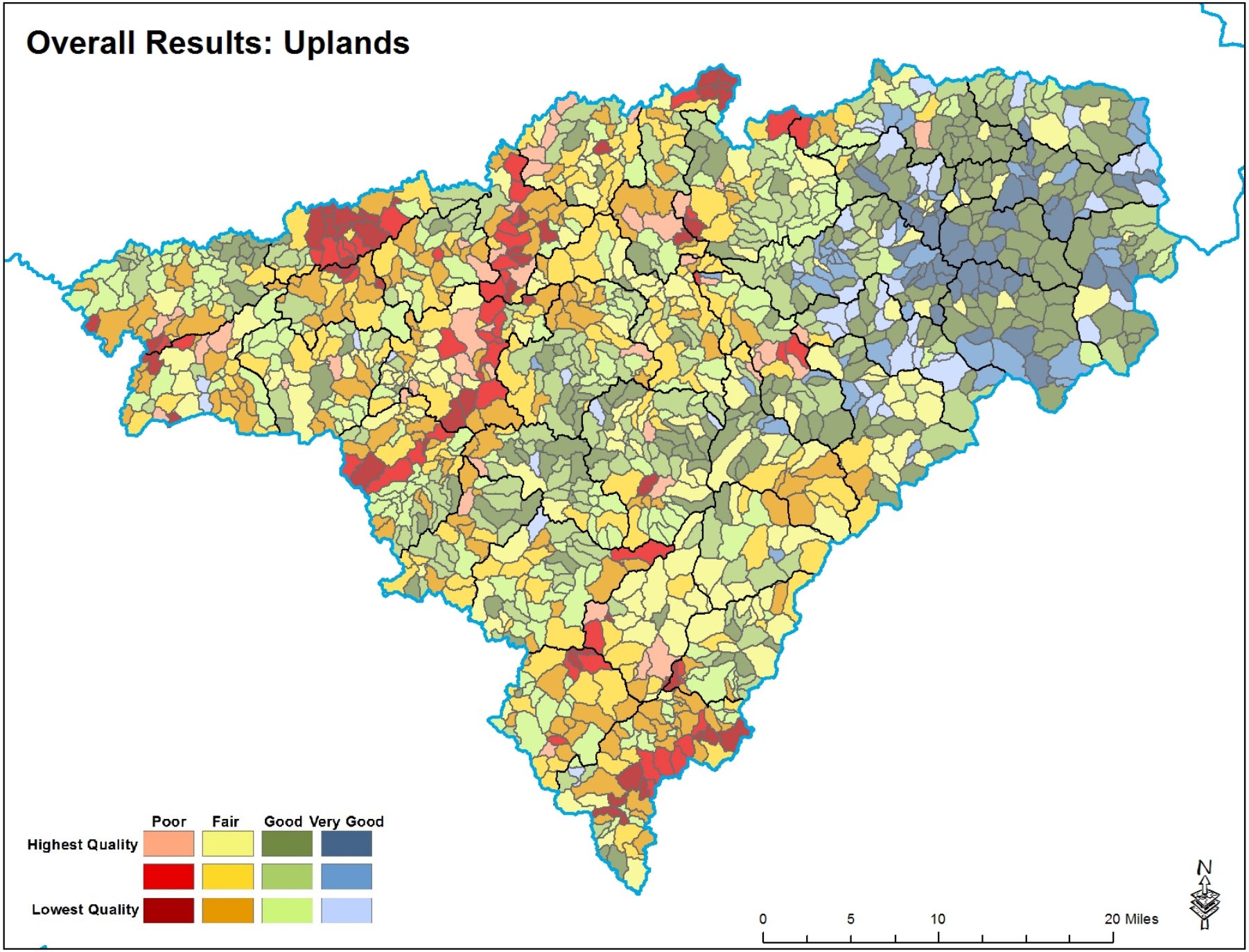
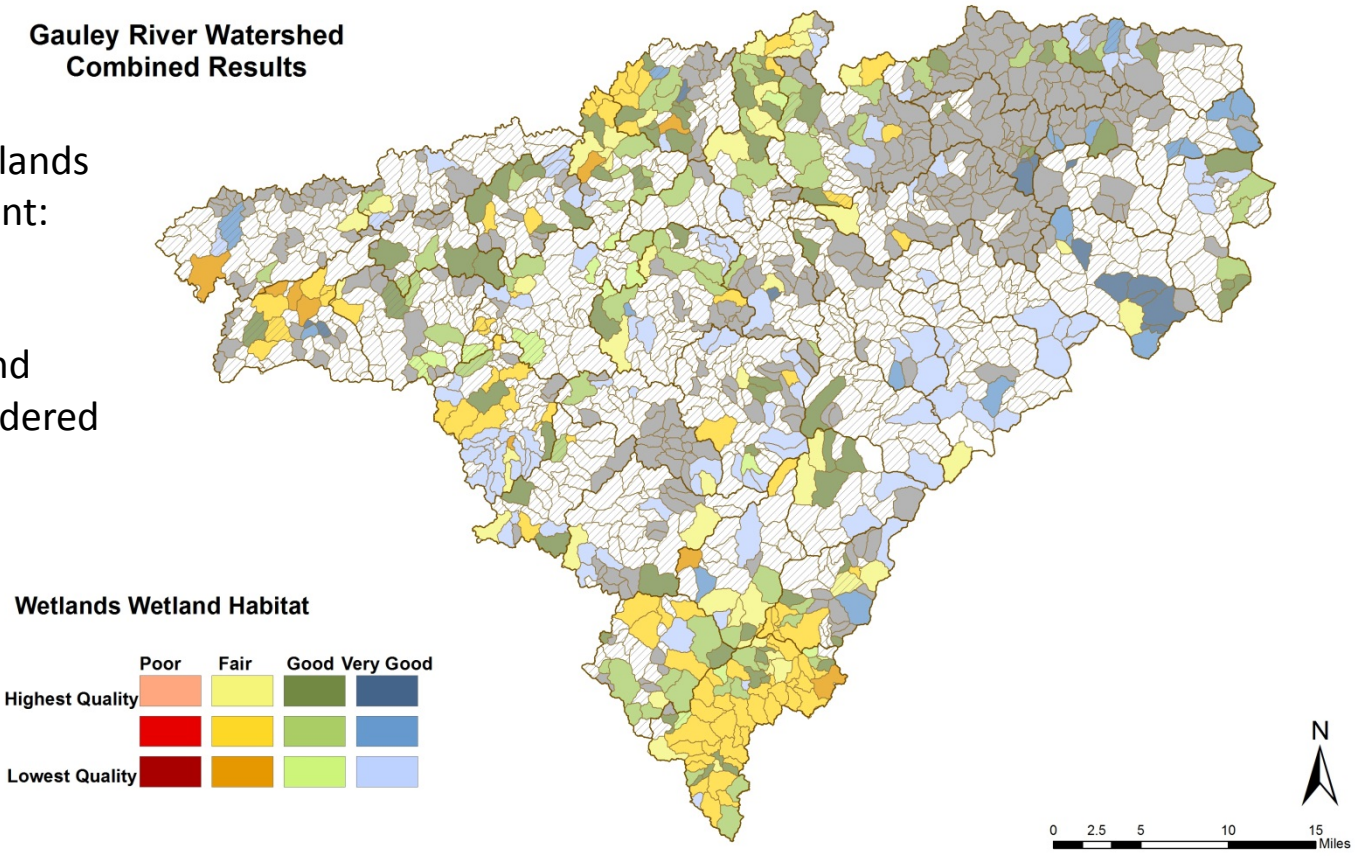


Wetlands Index Results

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

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



Wetlands Overall Model Results

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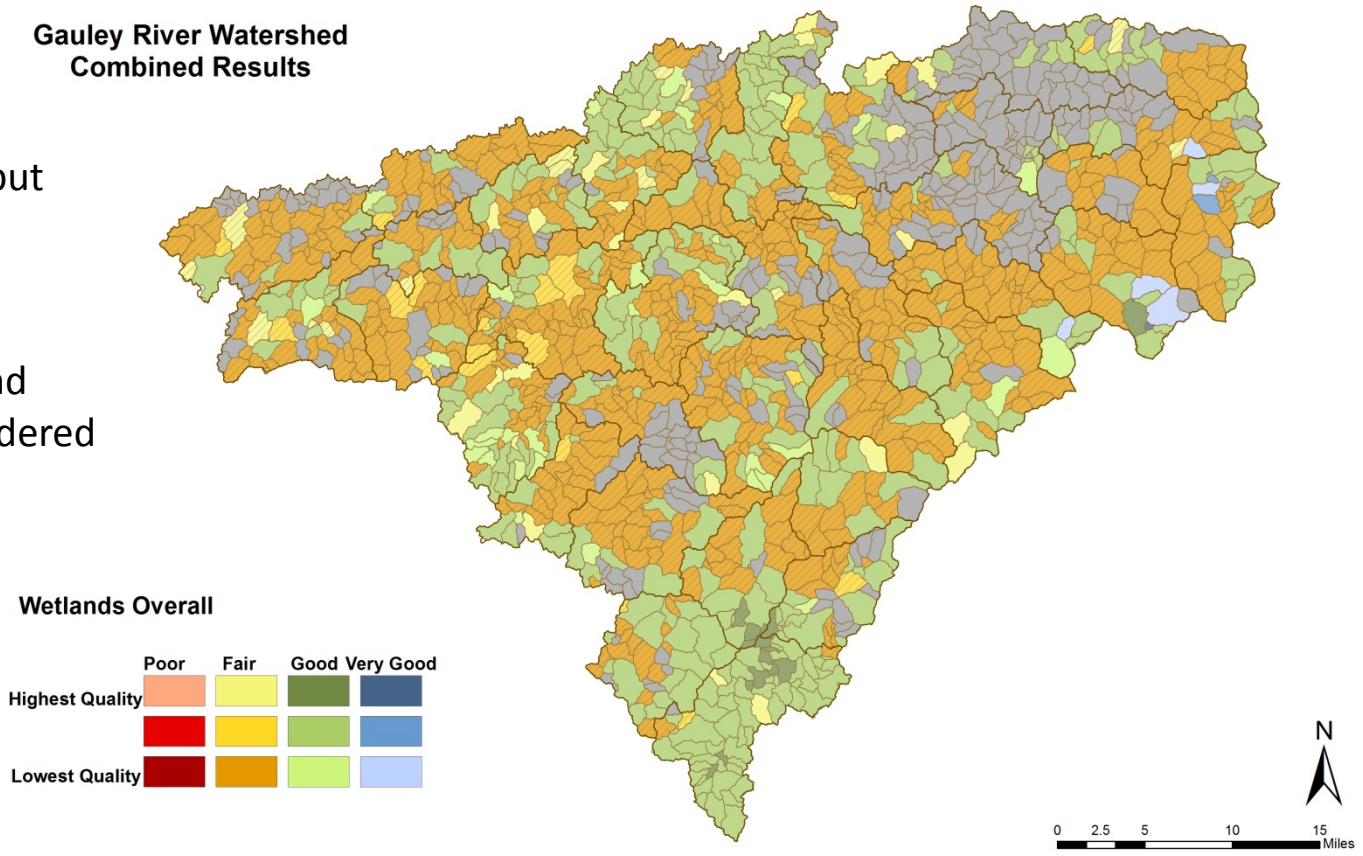
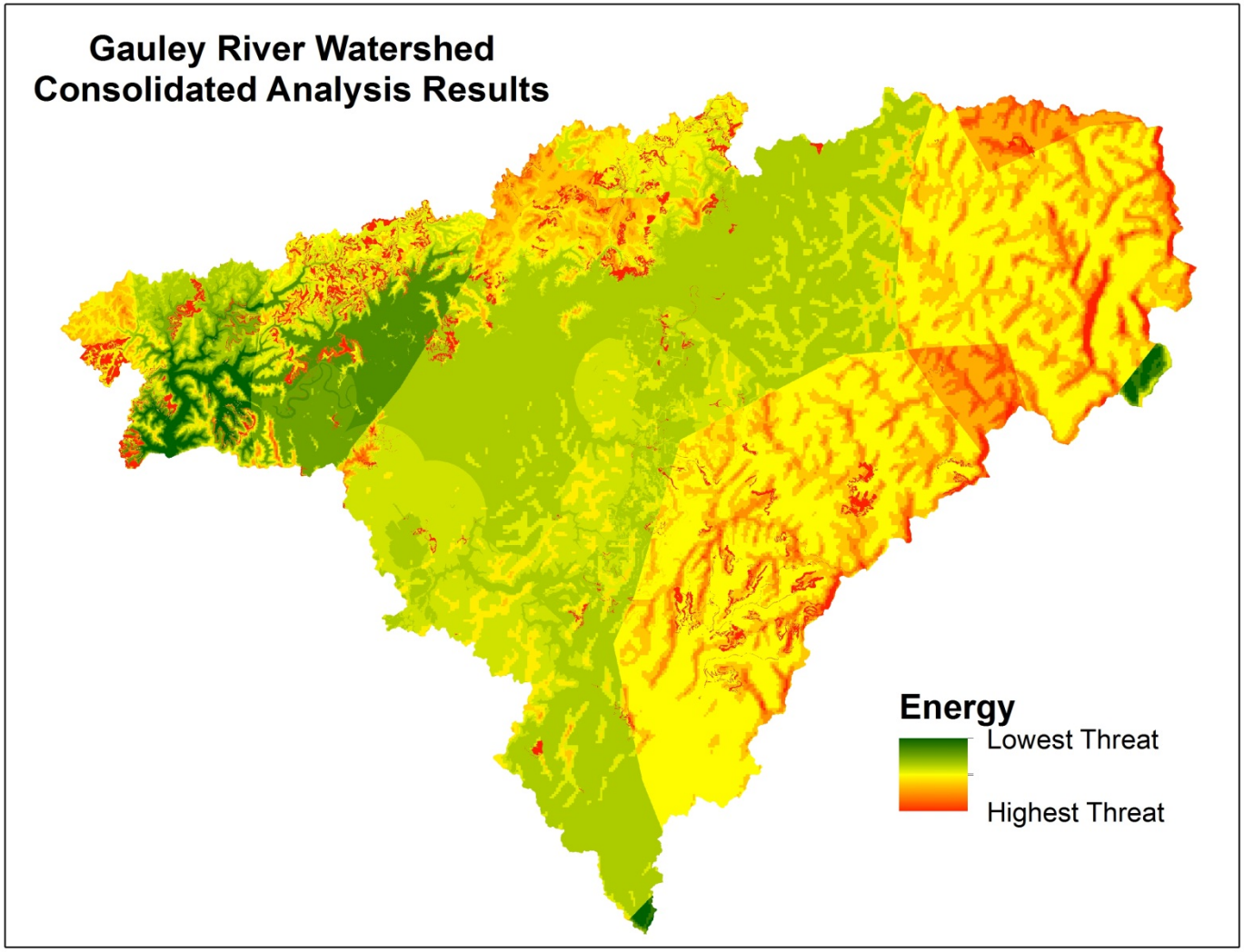


Consolidated Analysis Results



Project Outputs

- **Five 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

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

COMMENTS/QUESTIONS?

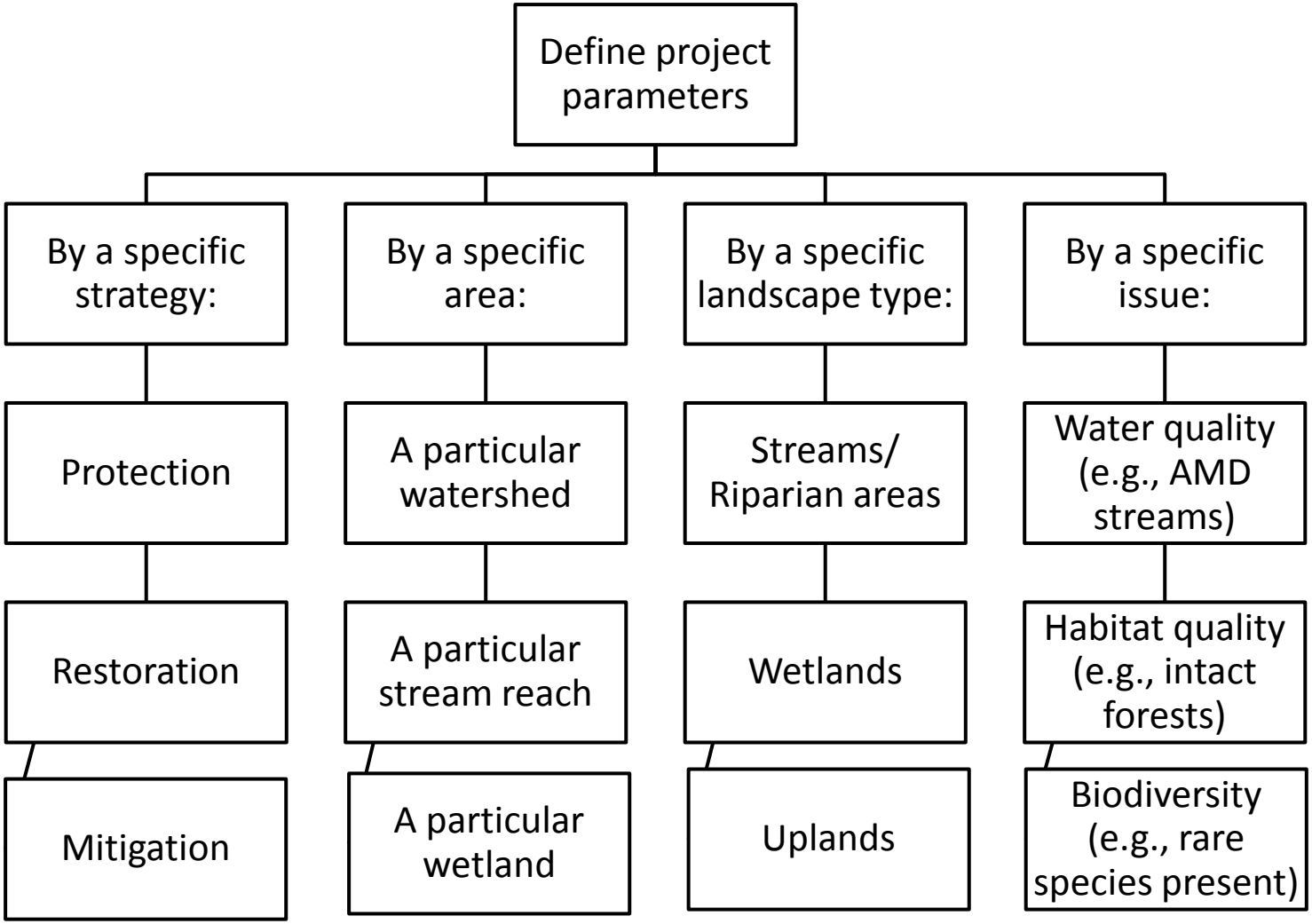
Results

Web Tool

Questions to Keep in Mind

- How do you anticipate using this tool?
  - Start with a project (restoration or protection), then use the web tool to select the best site?
    - If yes: within a HUC8 or within a larger area (region-wide or state-wide)? OR:
  - Start with a location (HUC12 or smaller?), then use the web tool to select the best type of project?
- What is your anticipated work flow?
- Which datasets would be the most useful for your project planning?

Define Project Goals and Objectives



Strategies

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

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

Strategies Group Exercise

Please work through the trends for each index, developing potential strategies, and answer the following questions:

- How useful are potential strategies to you?
- How do you anticipate using the web tool and supplied strategies?
- What can we do to improve the usefulness of the strategies section for the end user?
- What datasets would help you develop useful strategies?

Observed Trends Summary

STREAMS

- Water Quality
  - Mining-related water quality impairments (AMD, pH, heavy metals impairments, high specific conductance)
  - Development (Inadequate sewage treatment, high impervious surface, etc.)
  - Riparian habitat stresses (Grazing, high road densities, etc.)
- 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:
  - Invasive species, lack of known rare species locations, lack of mussel streams

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)

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?