

# Integrating Maryland's Tidal and Nontidal Ecological Assessments

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# Outline

- Need for integrated assessments
- MBSS and LTB as long-term monitoring programs
- Comparability of current assessments
- Gaps in assessing Maryland's waters
- Future of integrated assessments

# Need for Integrated Assessments

- Clean Water Act requires assessment of all waters
- Chesapeake Bay restoration is based on Tributary Strategies
- Water resource managers must look upstream
- Setting priorities requires comparable assessments

# MBSS and LTB

- Maryland Biological Stream Survey
  - Nontidal stream sampling since 1994
  - Probability-based with 84 watershed primary sampling units (PSUs)
  - 300 sites per year in 3- and 5-year snapshots
  - Reference-based indicators for fish, benthic macroinvertebrates, stream salamanders
    - Good
    - Fair
    - Poor
    - Very Poor

# MBSS and LTB

- Maryland Biological Stream Survey
  - Synoptic reports every 5 years at scale of
    - 8-digit watersheds (average of 90 mi<sup>2</sup>)
    - Trib basins
    - Counties
  - 305b biennial reports with pass-fail (10% of reference) by watershed
  - 303d listings of impaired waters using watershed means and confidence limits (proposed use of probability that number of stream miles degraded > 10% given confidence limit)

# MBSS and LTB

- Long-Term Benthic Monitoring Program
  - Tidal sampling since 1994
  - Probability-based with 6 strata
  - 150 sites per year within a moving average
  - Reference-based indicators for infaunal invertebrates
    - Meets goal
    - Marginally degraded
    - Degraded
    - Severely degraded

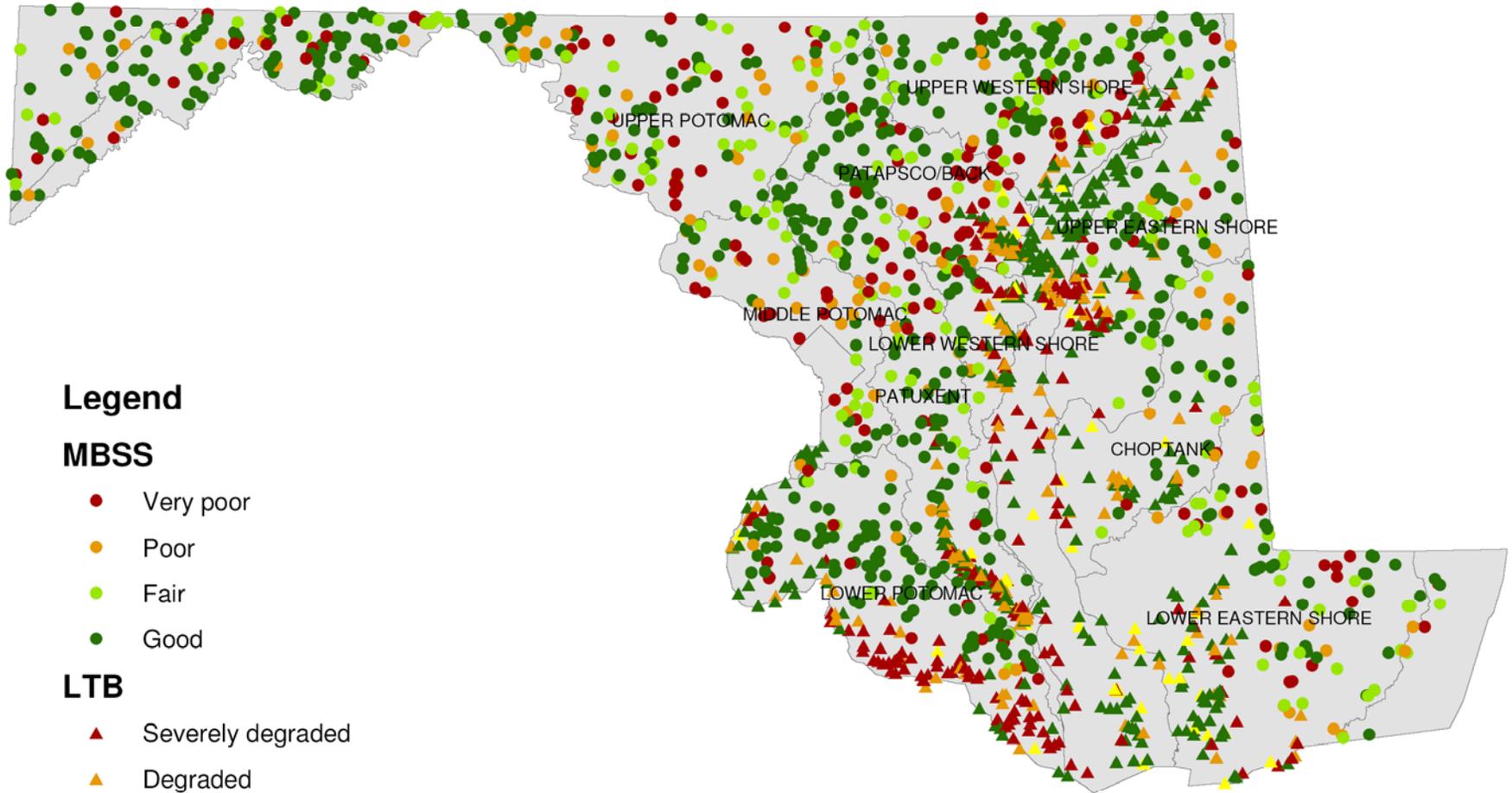
# MBSS and LTB

- Long-Term Benthic Monitoring Program
  - Annual report
  - State of Bay using 1 year of data with % pass-fail by 10 Trib Basins
  - 305b biennial report post-stratified by segment (MD half of 85) for % passing (failing  $\leq$  5% reference)
  - 303d listing uses a statistical test considering uncertainty that compares the % of area degraded with % expected in reference conditions

# Other Programs

- Maryland Coastal Bays
  - 1990s synoptic assessment
  - 2000-2006 fixed site sampling with limited random sites
- Maryland's Eyes on the Bay
  - Fixed station monthly monitoring data
  - Continuous monitoring data
  - Water quality mapping data
- UMCES Integration & Application (IAN) Network
- NOAA integrated health assessment
- VA INSTAR and PA nontidal monitoring programs

2000-2004



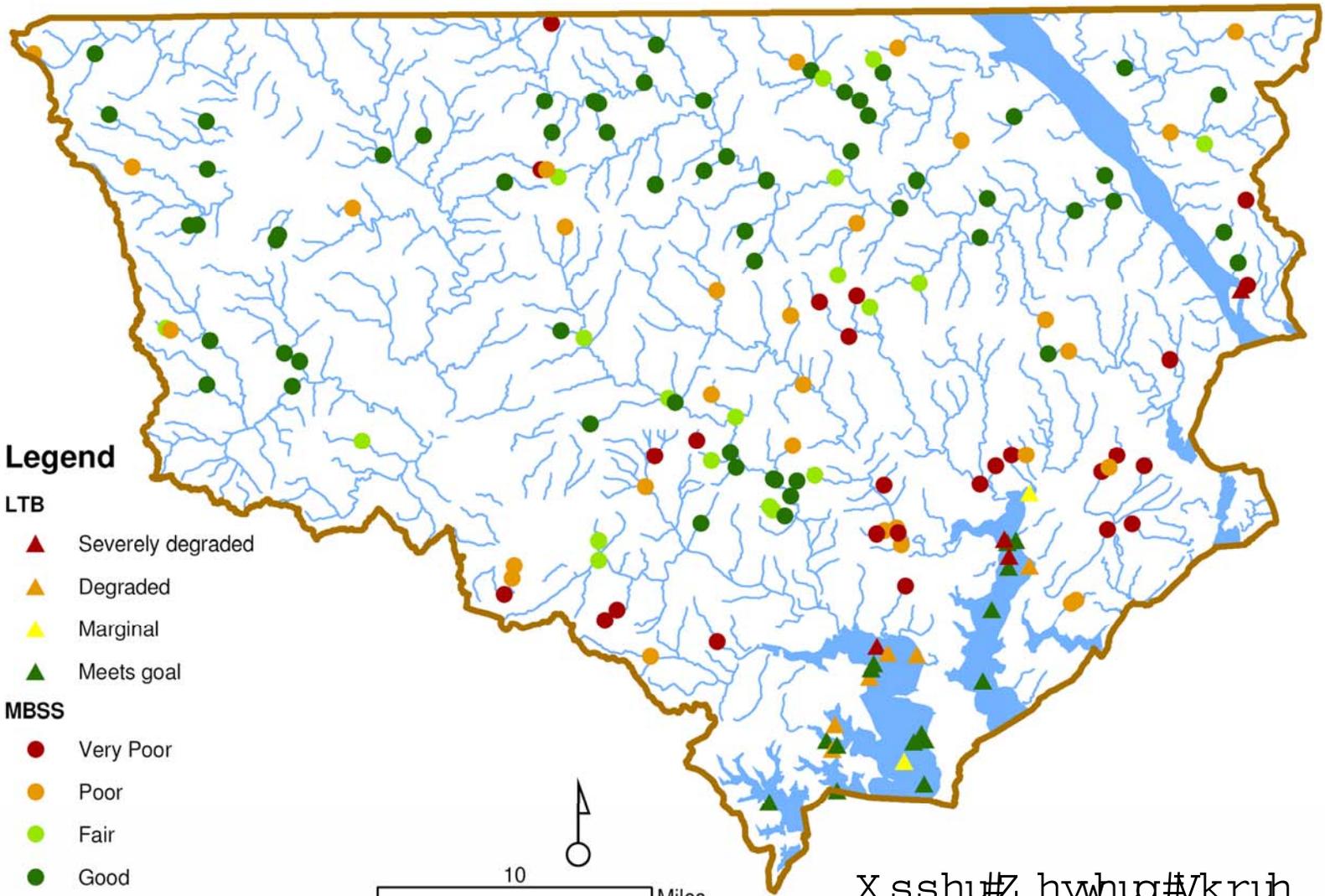
**Legend**

**MBSS**

- Very poor
- Poor
- Fair
- Good

**LTB**

- ▲ Severely degraded
- ▲ Degraded
- ▲ Marginal
- ▲ Meets goal



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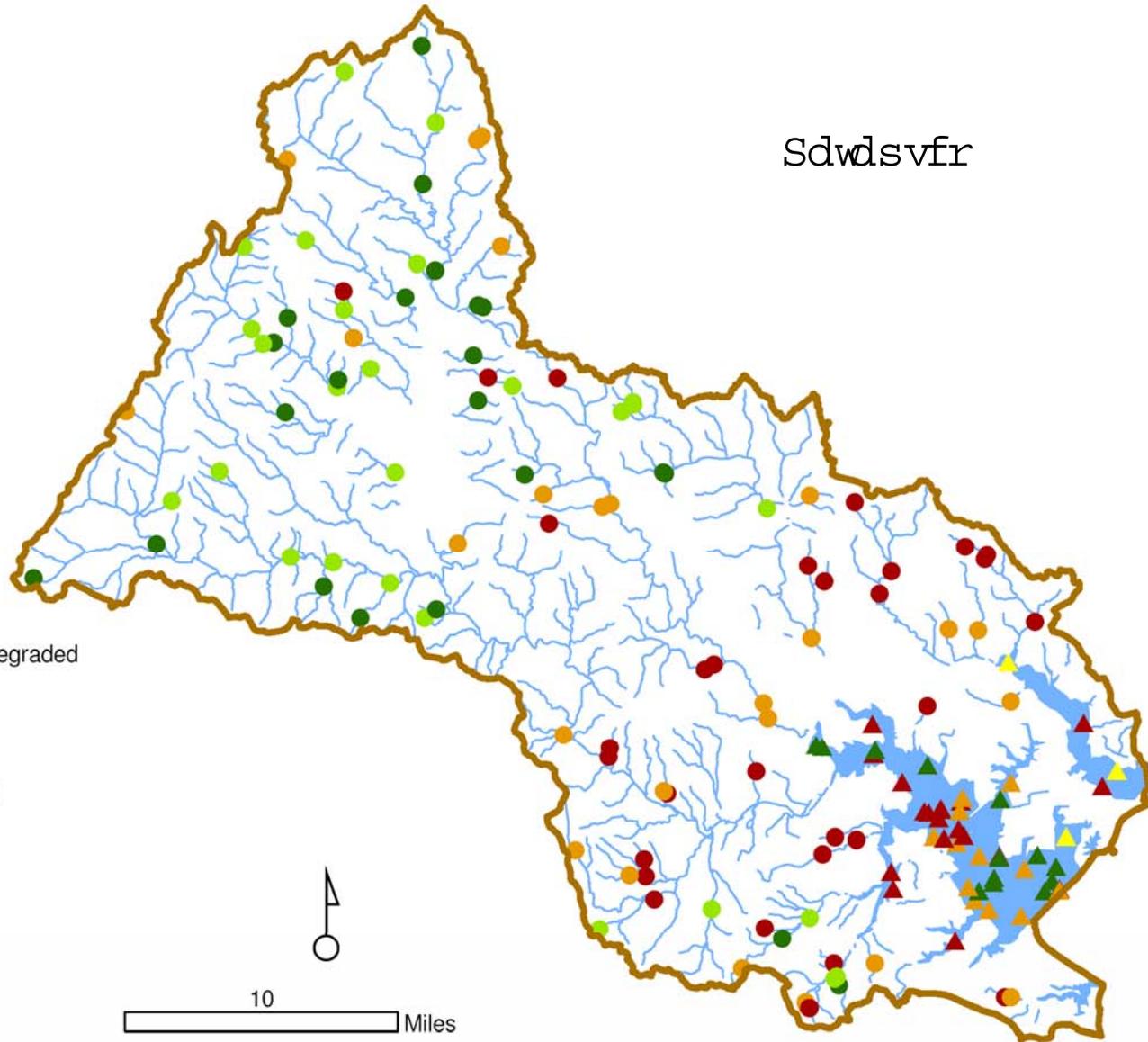
### Legend

#### LTB

- ▲ Severely degraded
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- ▲ Meets goal

#### MBSS

- Very Poor
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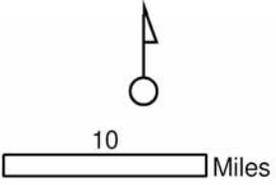
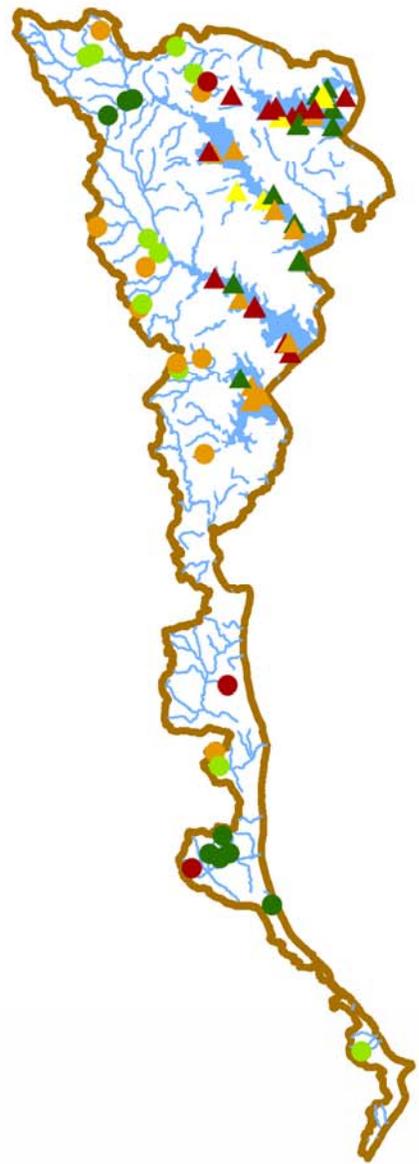
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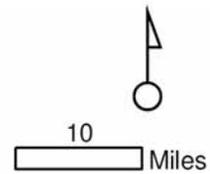
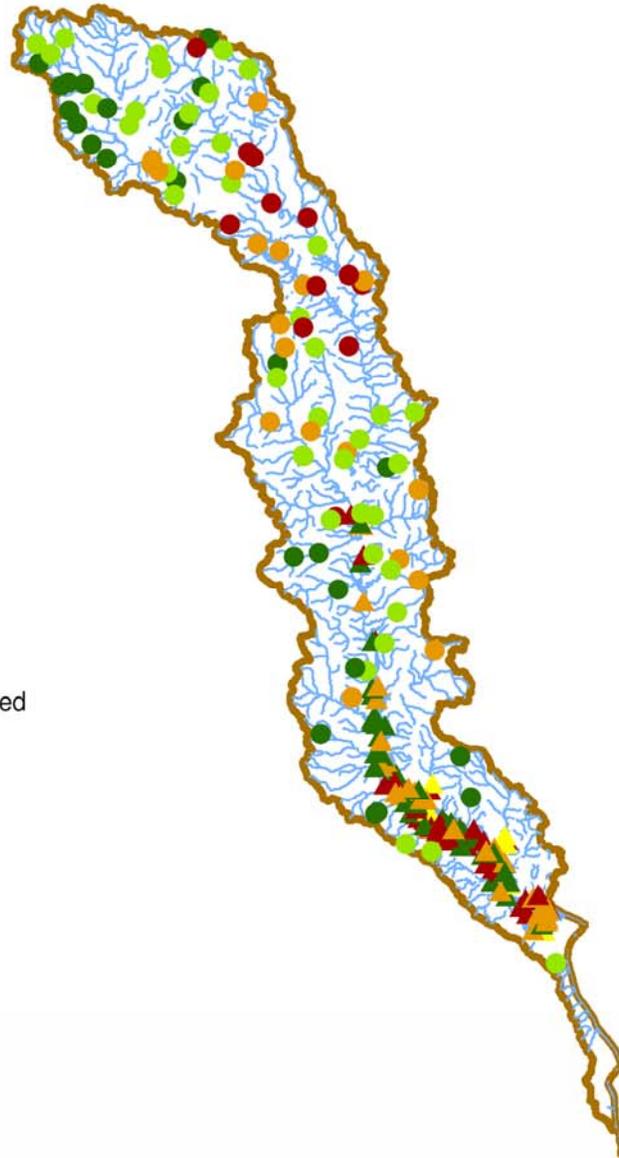
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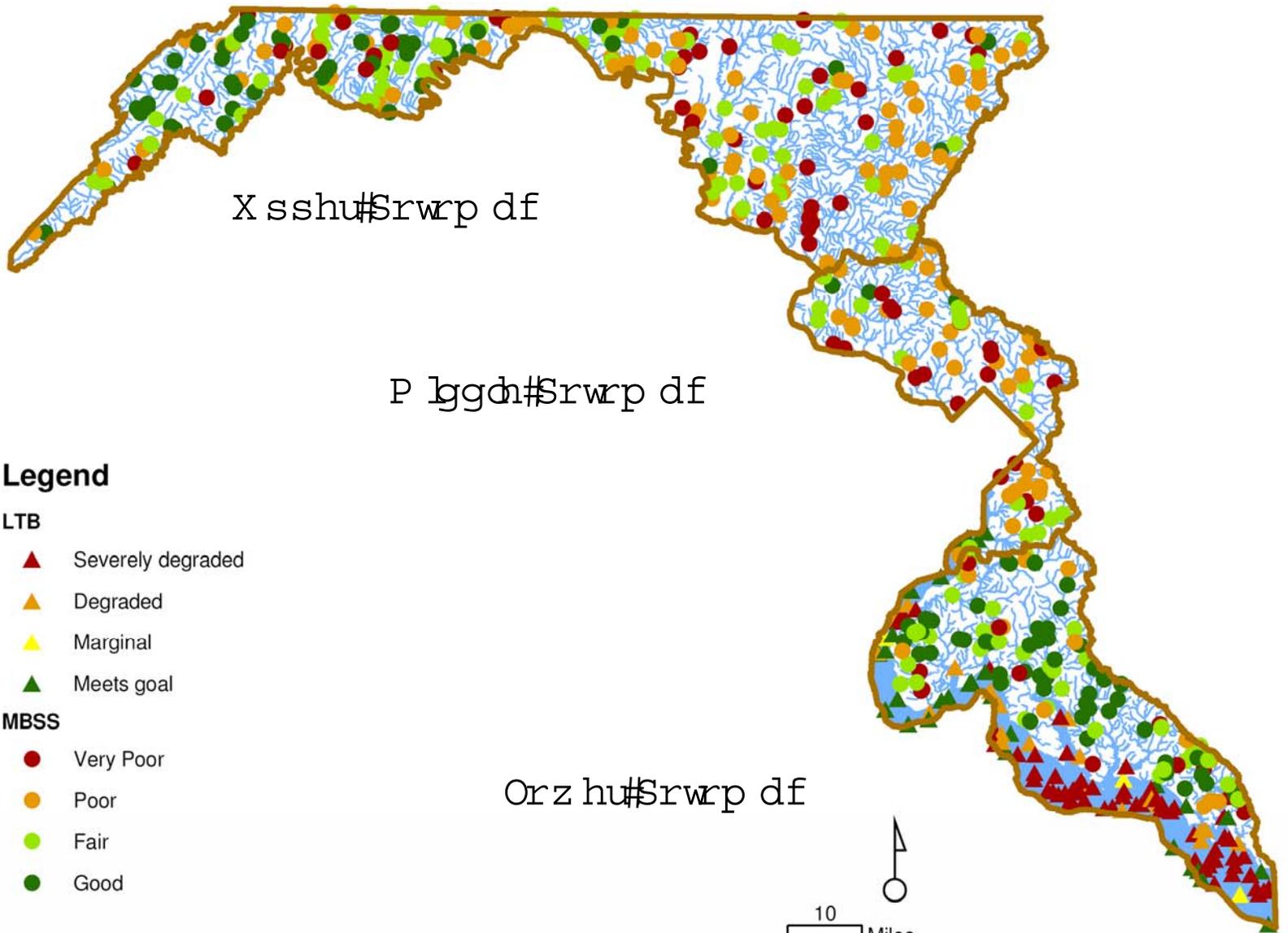
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#### MBSS

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Pingdi Watershed

Orzhu Watershed

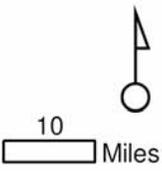
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**MBSS**

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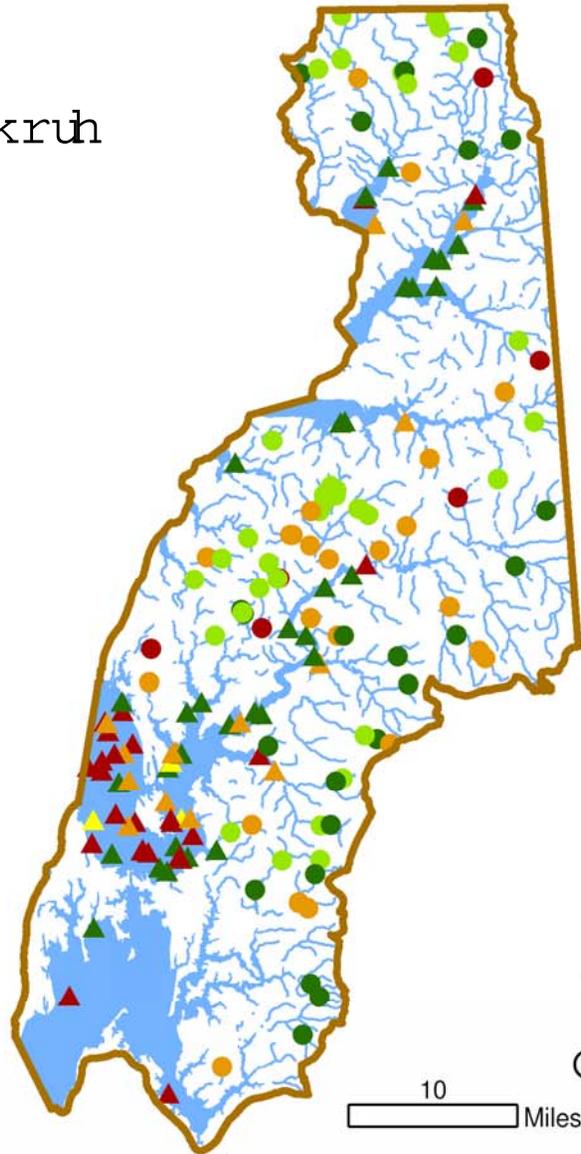
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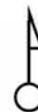
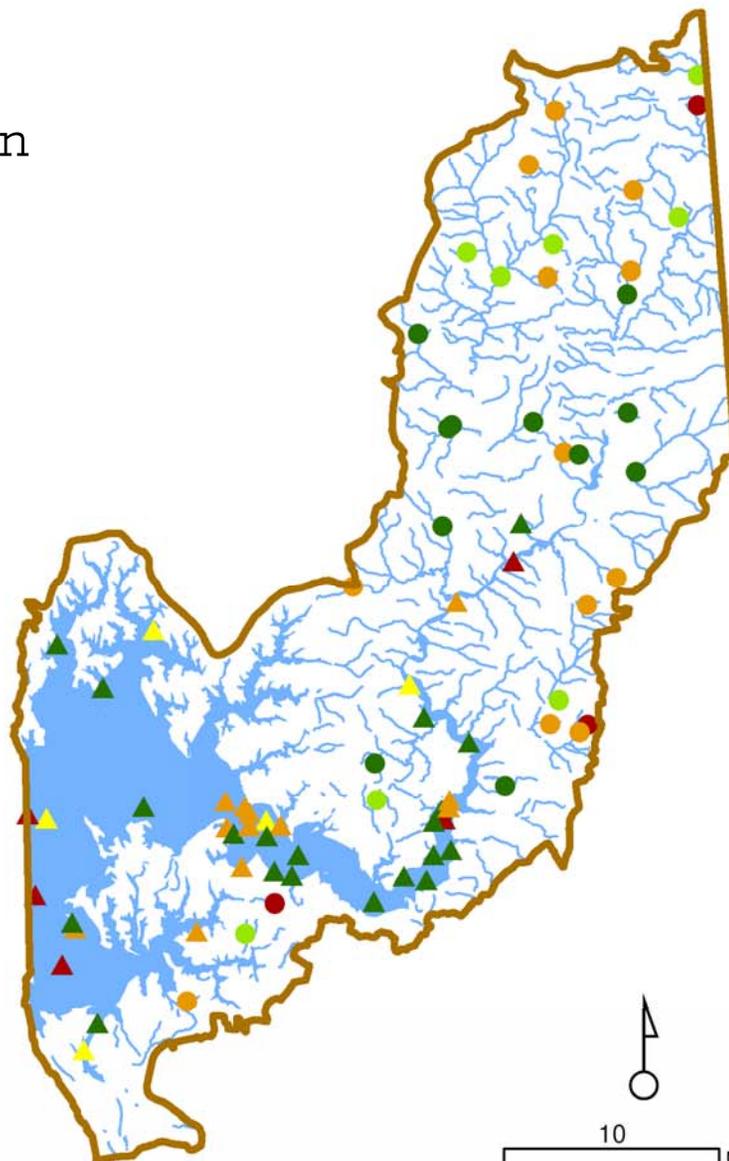
## Legend

### LTB

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10

Miles

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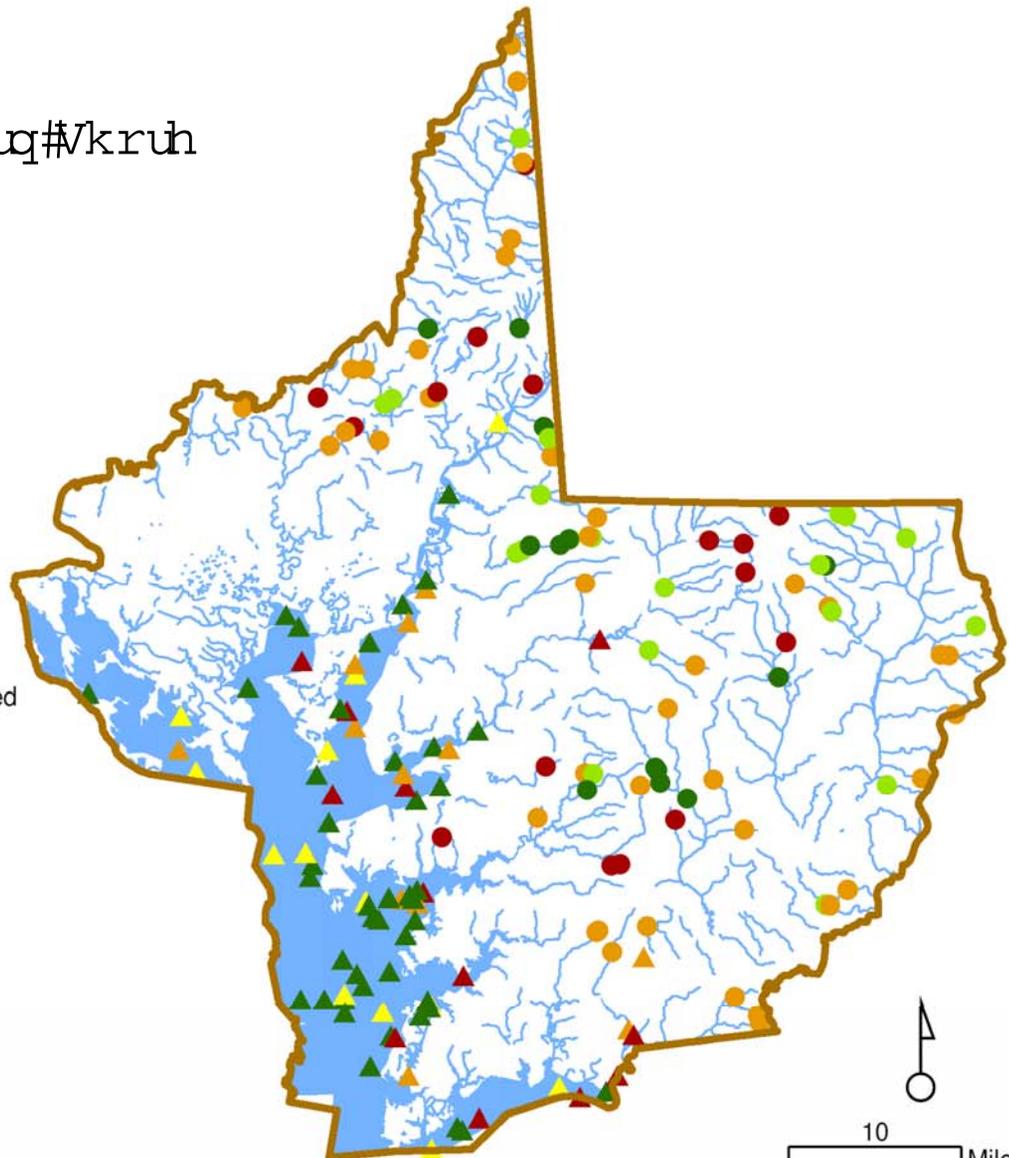
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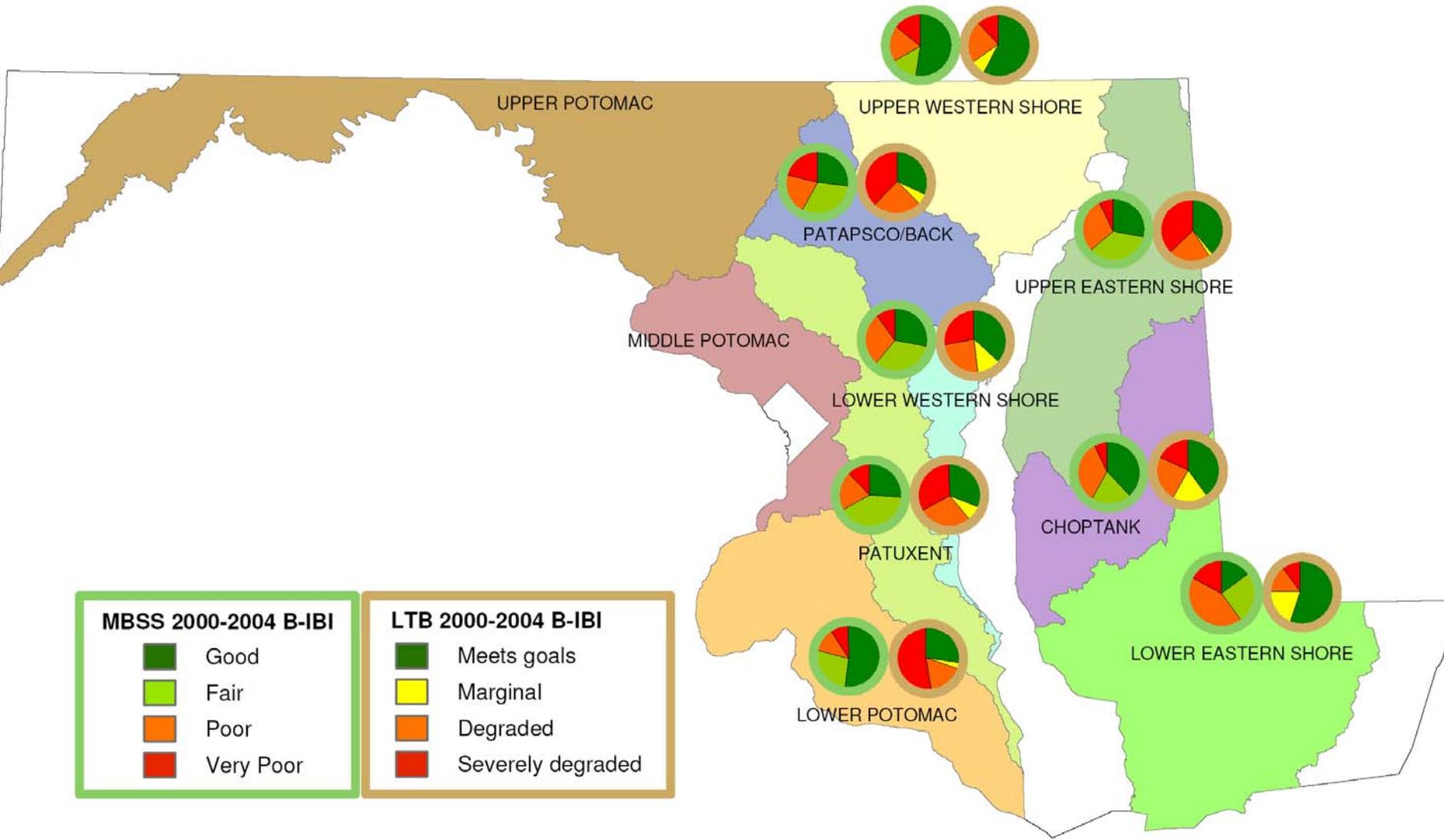
#### LTB

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- ▲ Meets goal

#### MBSS

- Very Poor
- Poor
- Fair
- Good





**MBSS 2000-2004 B-IBI**

- Good
- Fair
- Poor
- Very Poor

**LTB 2000-2004 B-IBI**

- Meets goals
- Marginal
- Degraded
- Severely degraded

LOWER POTOMAC

LOWER EASTERN SHORE

CHOPTANK

PATUXENT

LOWER WESTERN SHORE

UPPER EASTERN SHORE

PATAPSCO/BACK

UPPER WESTERN SHORE

UPPER POTOMAC

MIDDLE POTOMAC

# Comparability of Assessments

## Percent Degraded 2000-2004

Tributary Strategy Basin	MBSS	LTB	Difference
CHOPTANK RIVER	42%	60%	-18%
LOWER EASTERN SHORE	60%	45%	15%
LOWER POTOMAC RIVER	21%	72%	-51%
LOWER WESTERN SHORE	39%	63%	-24%
MIDDLE POTOMAC*			
OCEAN COASTAL**			
PATAPSCO/BACK	42%	69%	-27%
PATUXENT RIVER	33%	69%	-36%
UPPER EASTERN SHORE	36%	61%	-25%
UPPER POTOMAC*			
UPPER WESTERN SHORE	33%	43%	-10%
YOUGHIOGHENY RIVER**			

\*Partially included in LTB Lower Potomac

\*\*Basins not sampled by LTB

# Reasons Assessments May Differ

- The assessment methods are not the same
  - Degradation threshold
  - Time period (2000-2004 in this analysis)
  - Spatial scale (Trib basin in this analysis)
- Gaps in waters are not sampled
- Unique situations in each watershed, such as
  - Extensive development in coastal zone
  - Well-protected coastal zone
  - Heavy upstream loading
  - Unique natural conditions (e.g., deep waters)

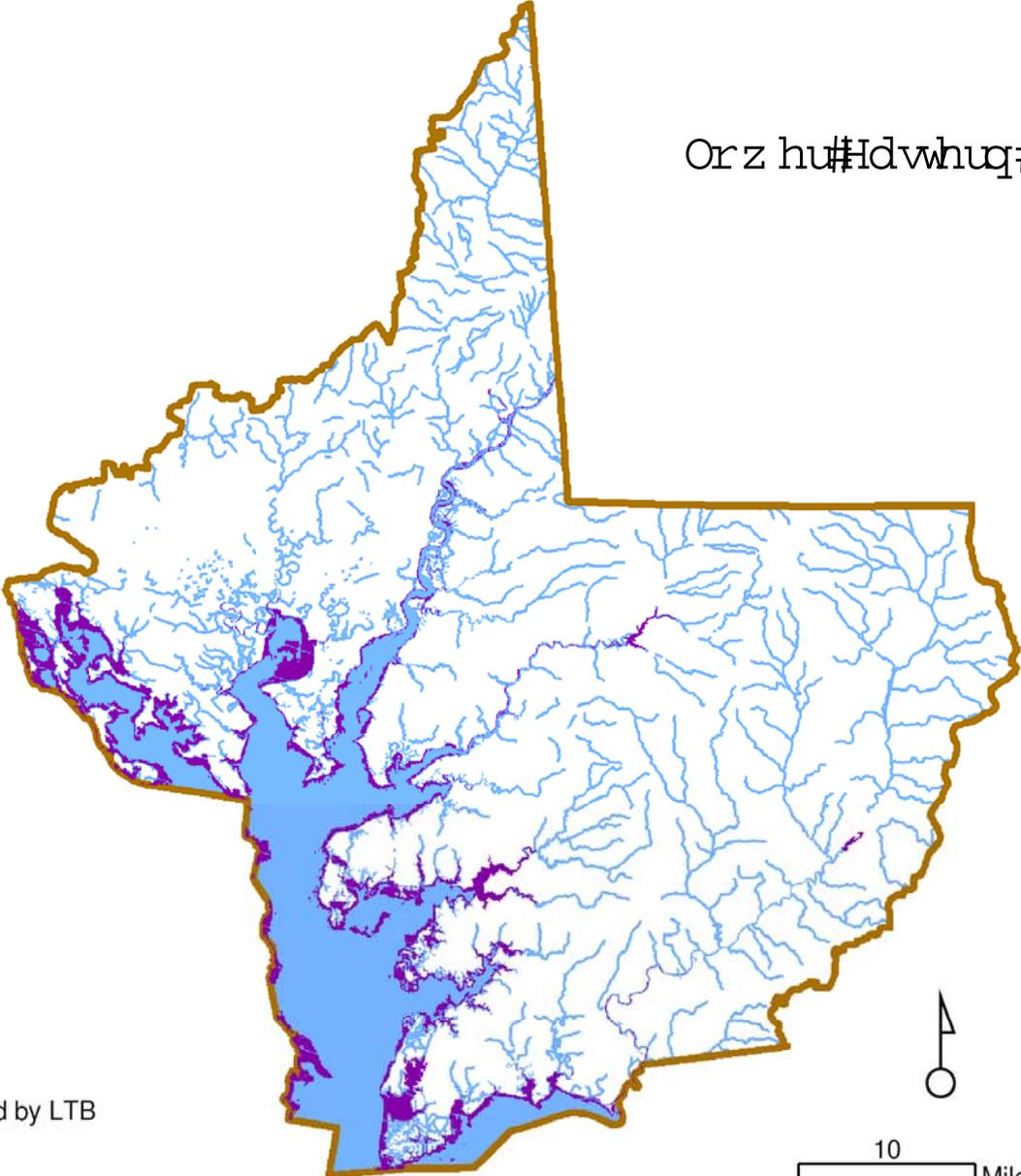
# Comparable Methods

- Both MBSS and LTB use invertebrate reference-based indicators of condition
- Thresholds of degradation are reference based, so that different condition classes that can be standardized
  - **MBSS**
    - PASS = ( $\geq$  10% of reference)
      - » Good (4.0-5.0)
      - » Fair (3.0-3.9)
    - FAIL =
      - » Poor (2.0-2.9)
      - » Very poor (1.0-1.9)
  - **LTB:**
    - PASS = Meets goal ( $\geq$  5% of reference)
    - FAIL =
      - » Marginally degraded (2.7-2.9)
      - » Degraded (2.1-2.6)
      - » Severely degraded (1.0-2.0)

# Gaps in Maryland's Waters

- LTB does not sample
  - Above head of tide (MLLW)
  - Shallows < 1 m depth
  - Mainstem deep trough > 12 m depth (but assumed to be azoic)
- MBSS does not sample
  - Below head of tide
  - Large rivers > 4<sup>th</sup> order
  - Small streams < 1<sup>st</sup> order (on 1:100,000-scale map)

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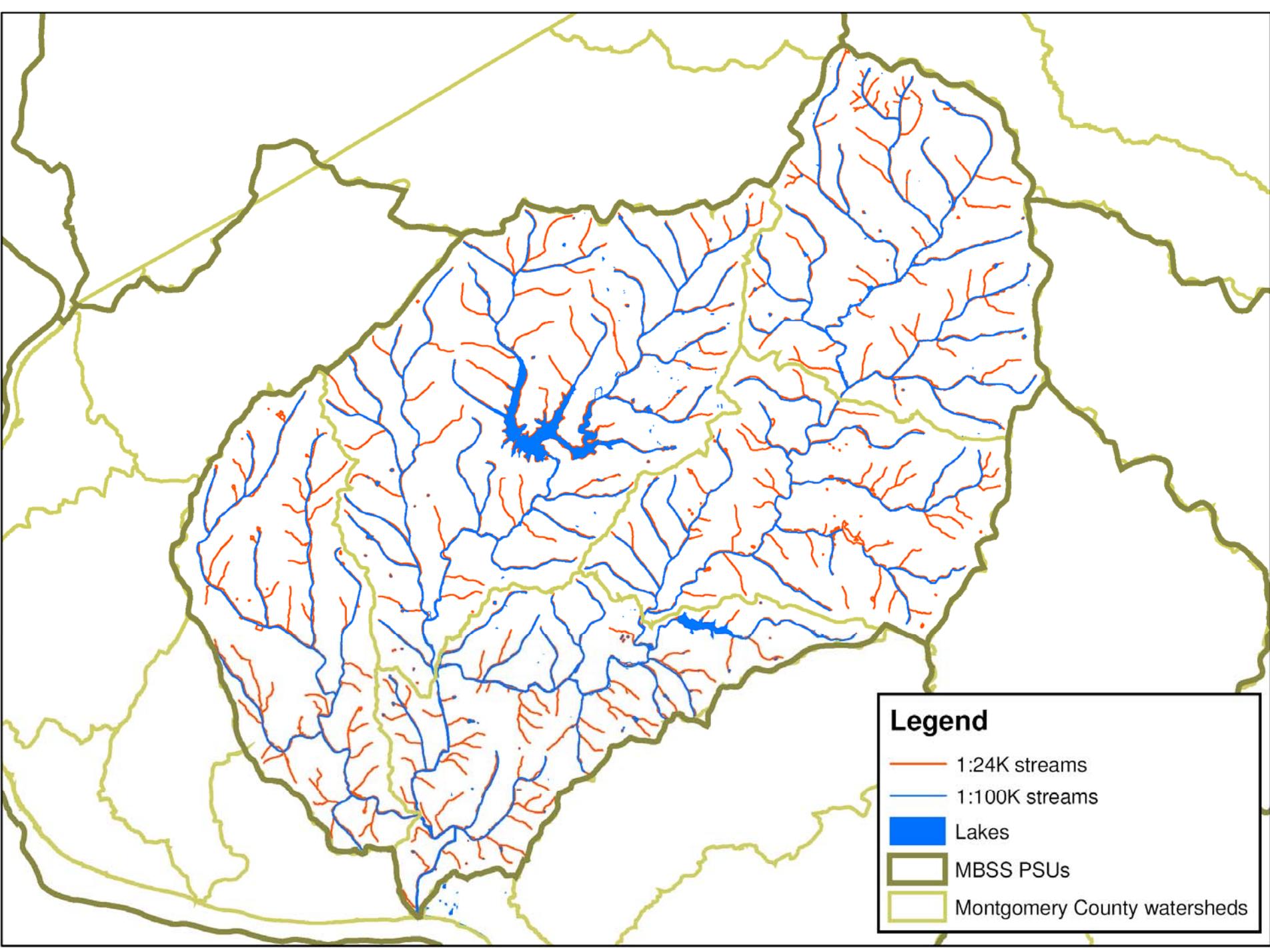


**Legend**

 Areas not sampled by LTB



10 Miles



**Legend**

- 1:24K streams
- 1:100K streams
- Lakes
- MBSS PSUs
- Montgomery County watersheds

# Gaps in Maryland's Waters

- Tidal waters are assessed by LTB (including Deep Trough)
  - Gap of up to 15% not assessed are nearshore shallows (based on NOAA data)
- Nontidal streams covered by MBSS
  - Gap of 6.8% are freshwater tidal
  - Gap of 1.5% are large rivers
  - Gap of up to 40% of miles missed are smallest streams (based on 1:24,000-scale map overlay in Montgomery County)

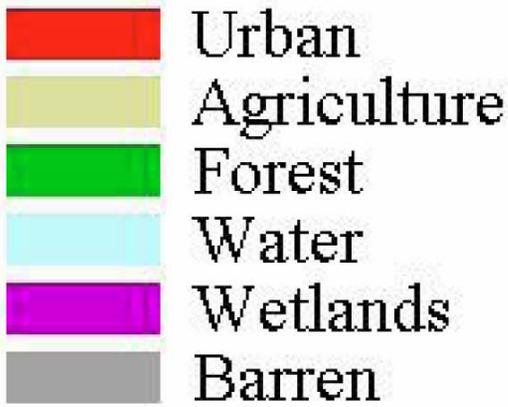
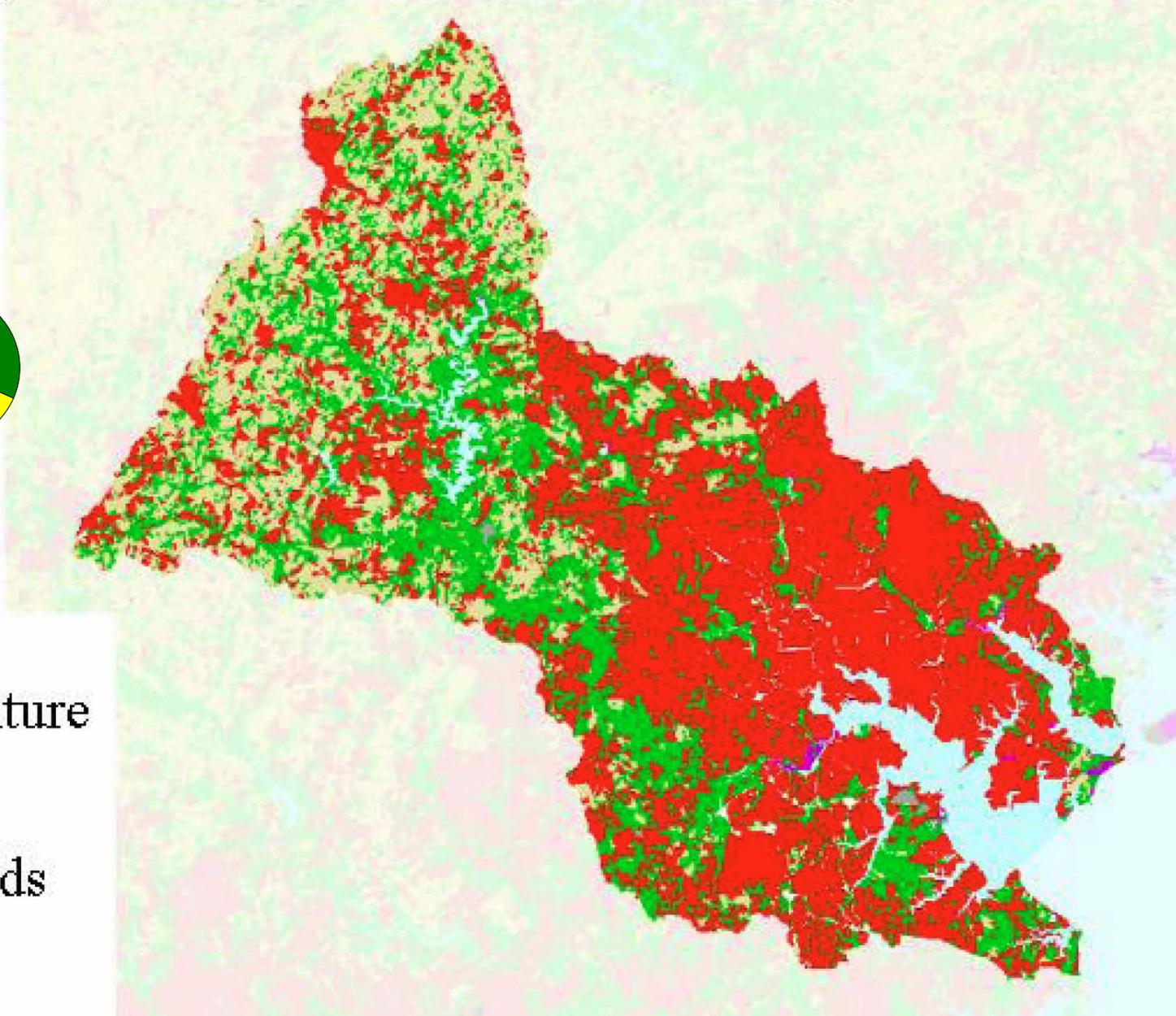
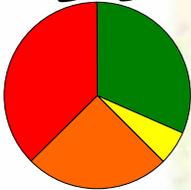
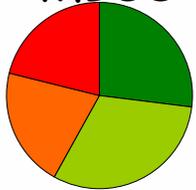
# Unique Watersheds

- Extensive development in coastal zone
- Well-protected coastal zone
- Heavy upstream loading
- Unique natural conditions (e.g., deep waters)

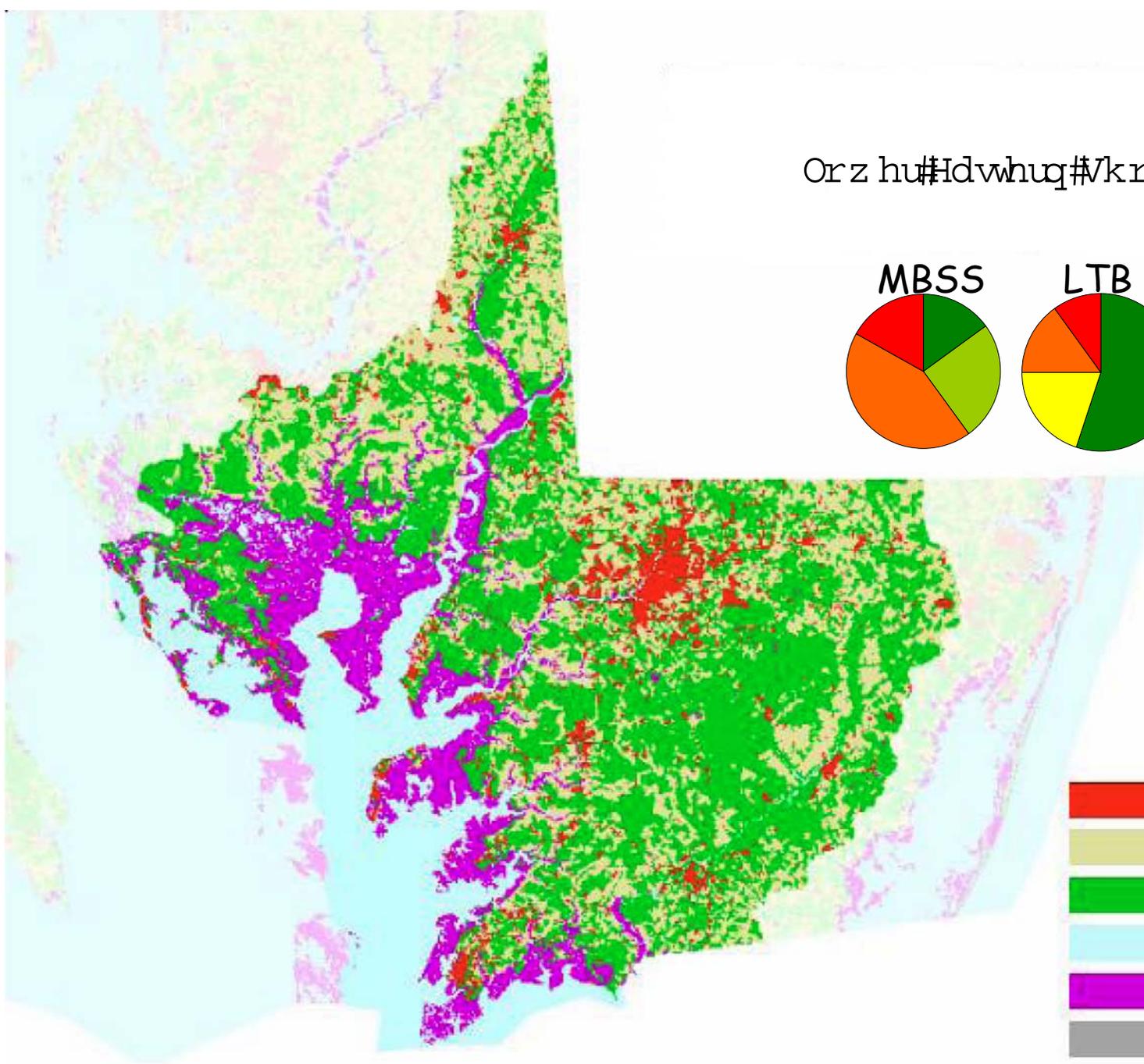
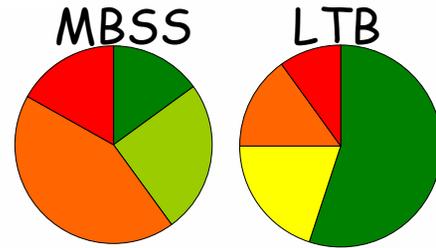
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MBSS

LTB



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# What Do We Want From Integration?

1. Integrated reporting (with consistent condition classes)
  - Eyes on the Bay
  - Chesapeake Bay EcoCheck
2. Monitoring and assessment of gaps
  - Nearshore shallows
  - Freshwater tidal
  - Small streams
  - Large rivers
3. Better understanding of upstream influences
4. Incorporation of trends information

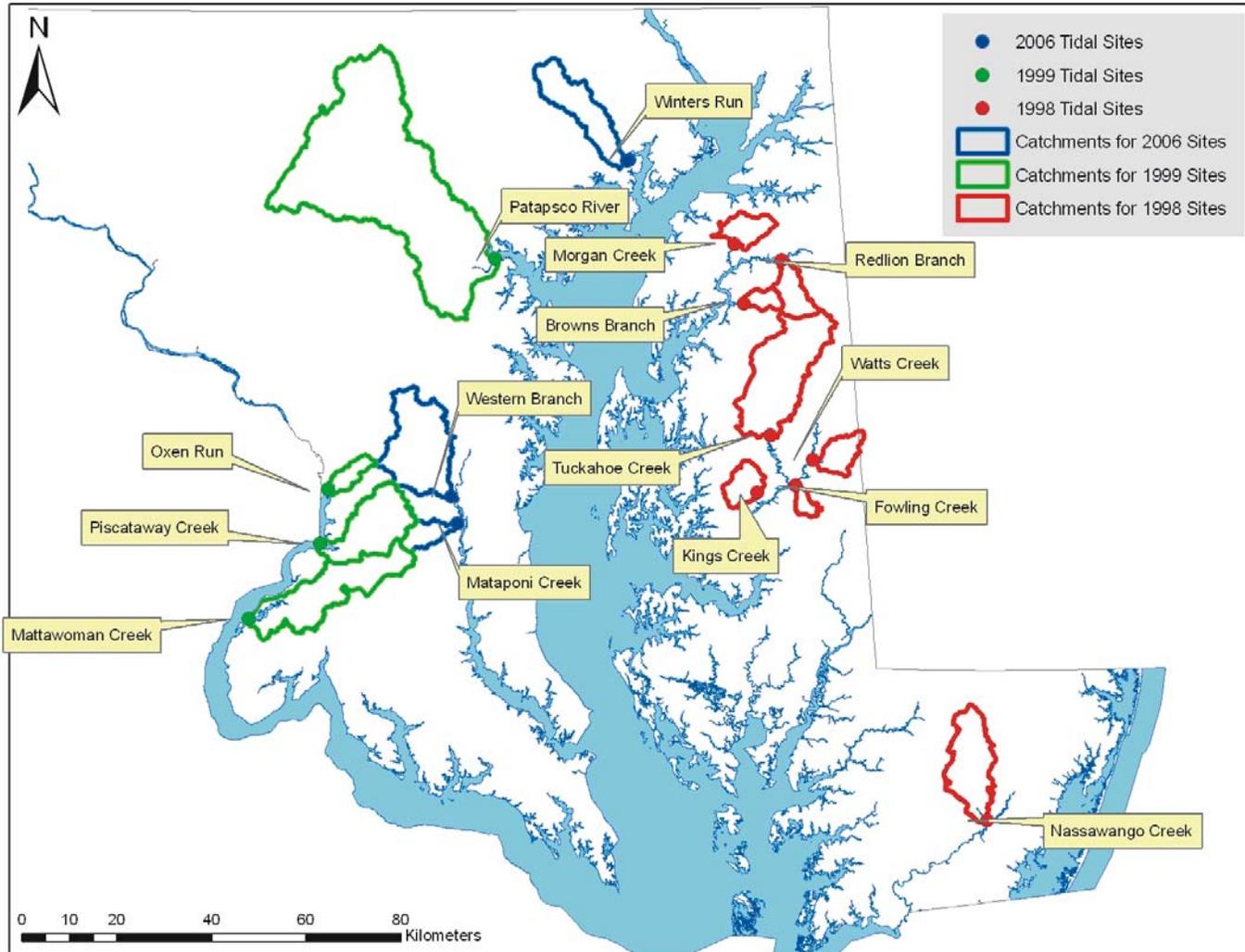
# Monitoring and Assessment of Gaps

- Feasibility of monitoring the gaps
  - Need appropriate fish and invertebrate sampling methods for tidal freshwaters (demonstrated in 1998 MBSS study)
- Who should monitor these gaps?
  - EPA national survey
  - MBSS (1999 survey design for tidal freshwaters)
  - Counties
  - Other organizations

# Better Understanding of Upstream Influences

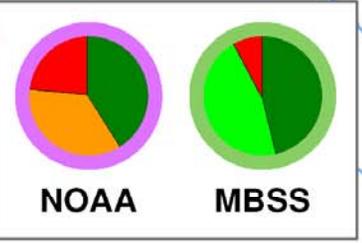
- Potential for learning from assessment mismatches
- Partition MBSS-LTB data by land use (as a predictor of coastal development influence)
- Link assessment to SPARROW model results
- Smaller scale studies to better understand downstream effects
  - MBSS 1998-1999 and 2006 fish study
  - NOAA 2007 benthic study

# 2006 MBSS Fish Study

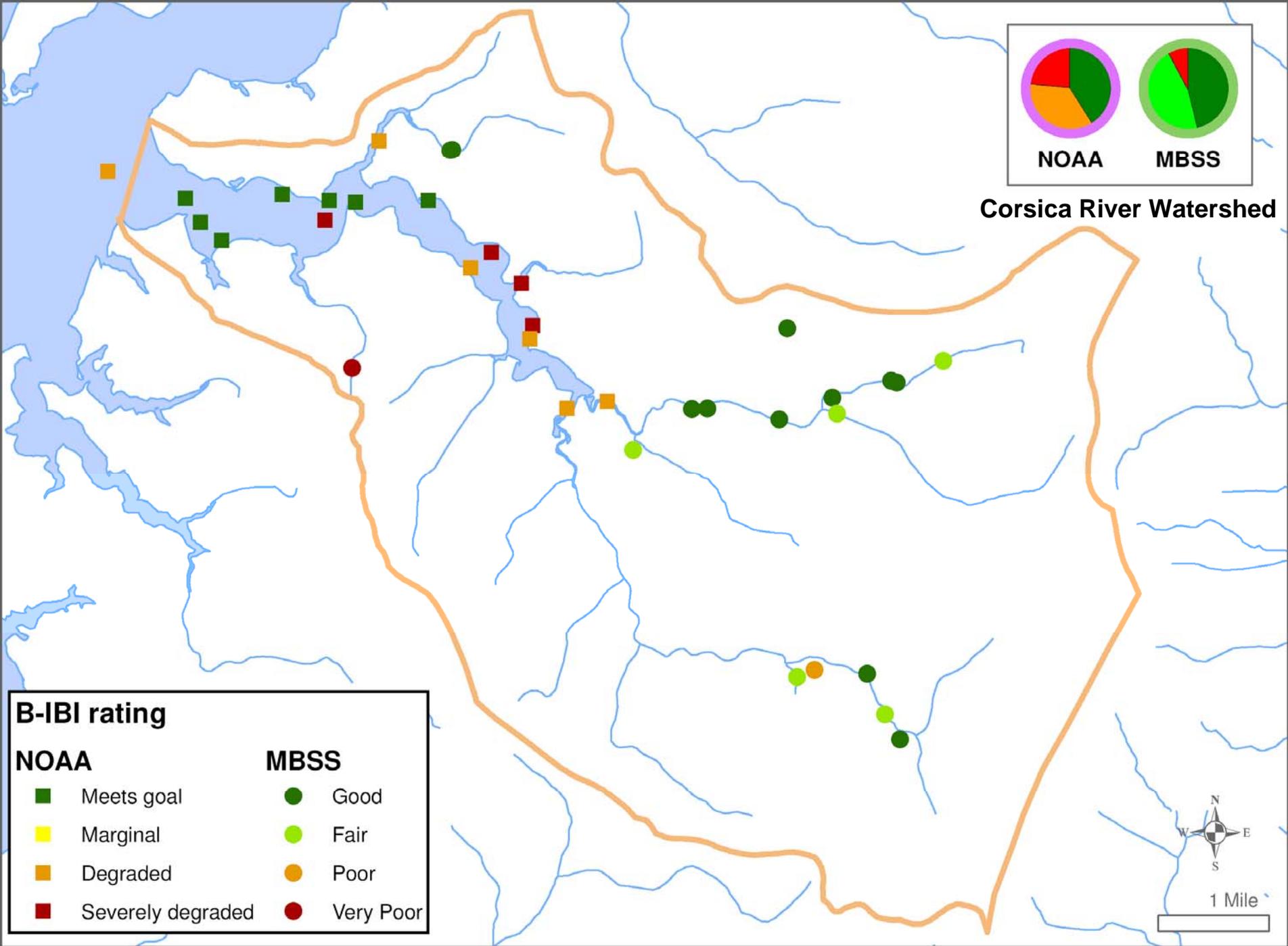


# 2007 NOAA Benthic Study

- Corsica River Watershed
- Magothy River Watershed
- Rhode/West River Watershed



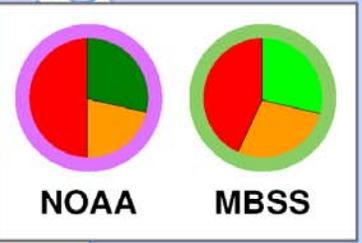
**Corsica River Watershed**



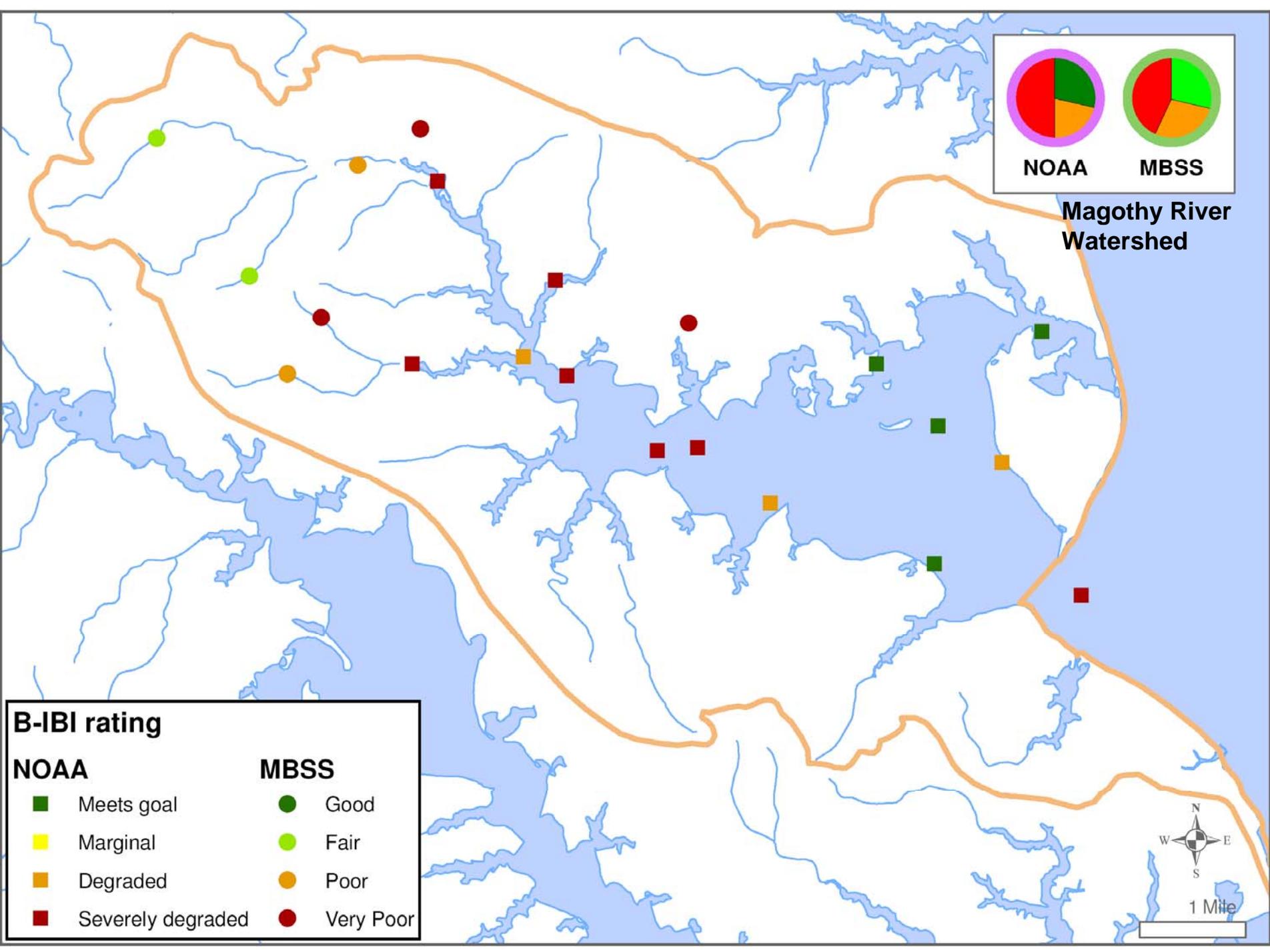
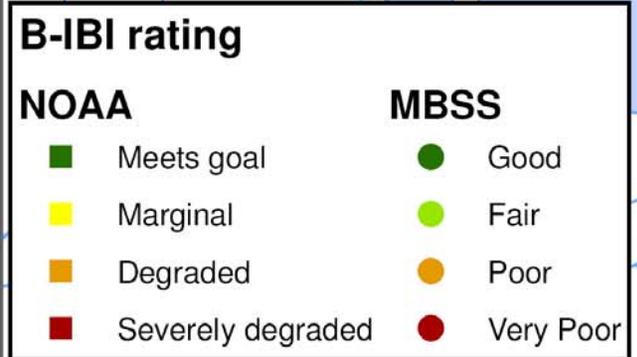
**B-IBI rating**

NOAA		MBSS	
■	Meets goal	●	Good
■	Marginal	●	Fair
■	Degraded	●	Poor
■	Severely degraded	●	Very Poor

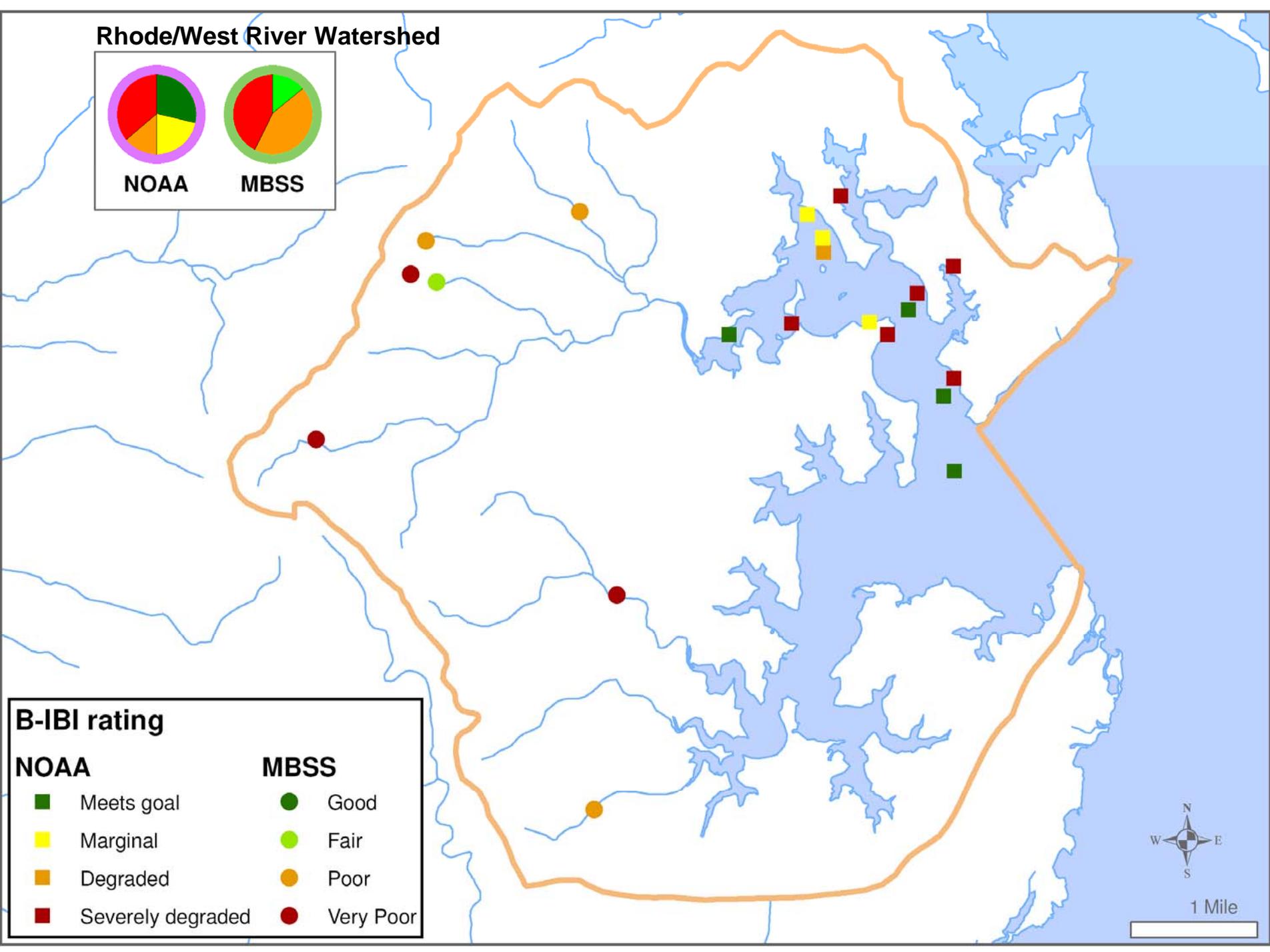
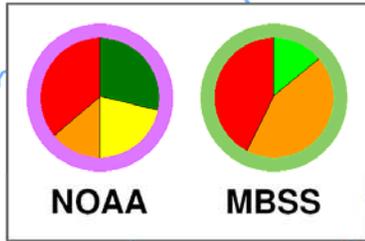




**Magothy River Watershed**



# Rhode/West River Watershed



## B-IBI rating

### NOAA

- Meets goal
- Marginal
- Degraded
- Severely degraded

### MBSS

- Good
- Fair
- Poor
- Very Poor

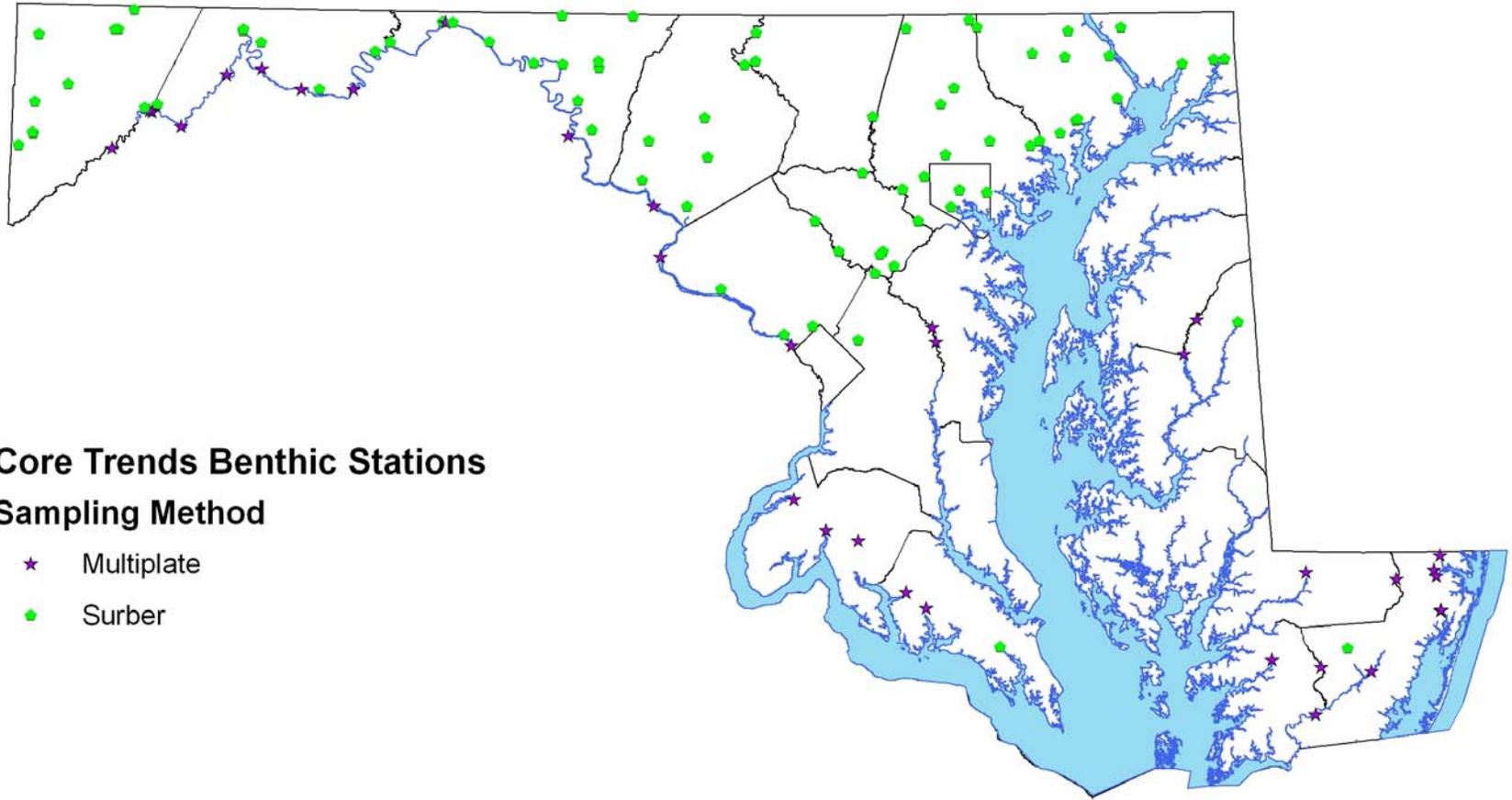


1 Mile



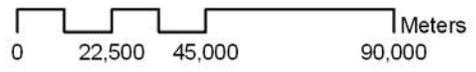
# Incorporating Trends Information

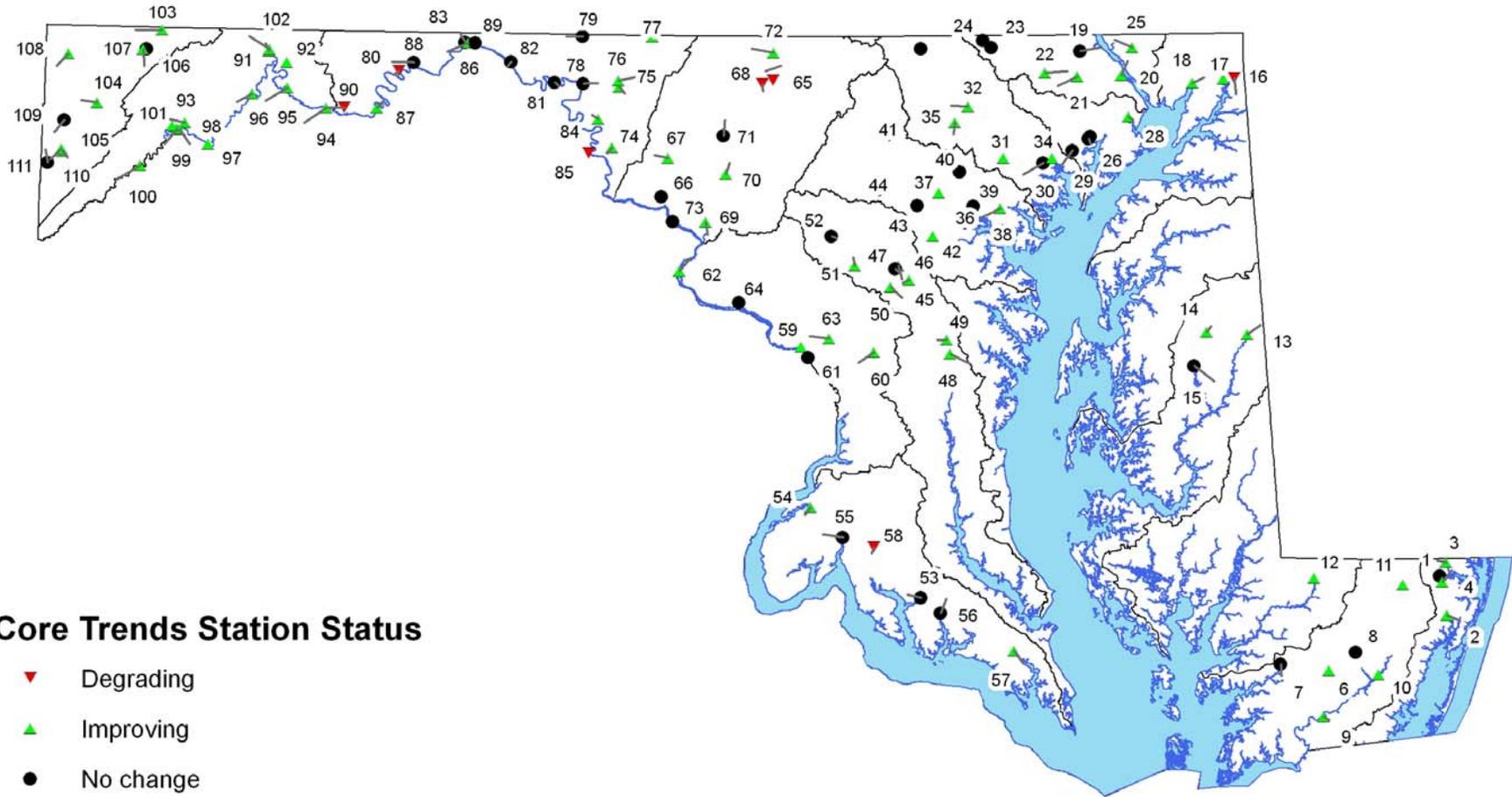
- 10-year MBSS and LTB trends analysis
- Maryland DNR CORE/TREND program
  - 111 sites, 84 TREND and 27 CORE
  - First sites sampled in 1976
  - Current sampling at annual to 5-year intervals
  - Surber in riffles and modified Hester-Dendy
  - EPT and other metrics of stream health
  - Could be tied to areawide assessments to extrapolate trends and possible downstream time lags



### Core Trends Benthic Stations Sampling Method

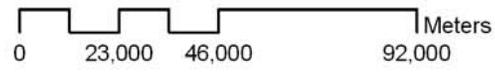
- ★ Multiplate
- Surber





### Core Trends Station Status

- ▼ Degrading
- ▲ Improving
- No change



# Future of Integrated Assessments

1. *Integrated reporting* (with consistent condition classes) is feasible
2. *Monitoring and assessment of gaps* requires some method development and funding
3. *Better understanding of upstream influences* can be obtained from studies at smaller scales
4. *Potential for incorporation of trends information* from fixed site programs