

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 mi²)
 - 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

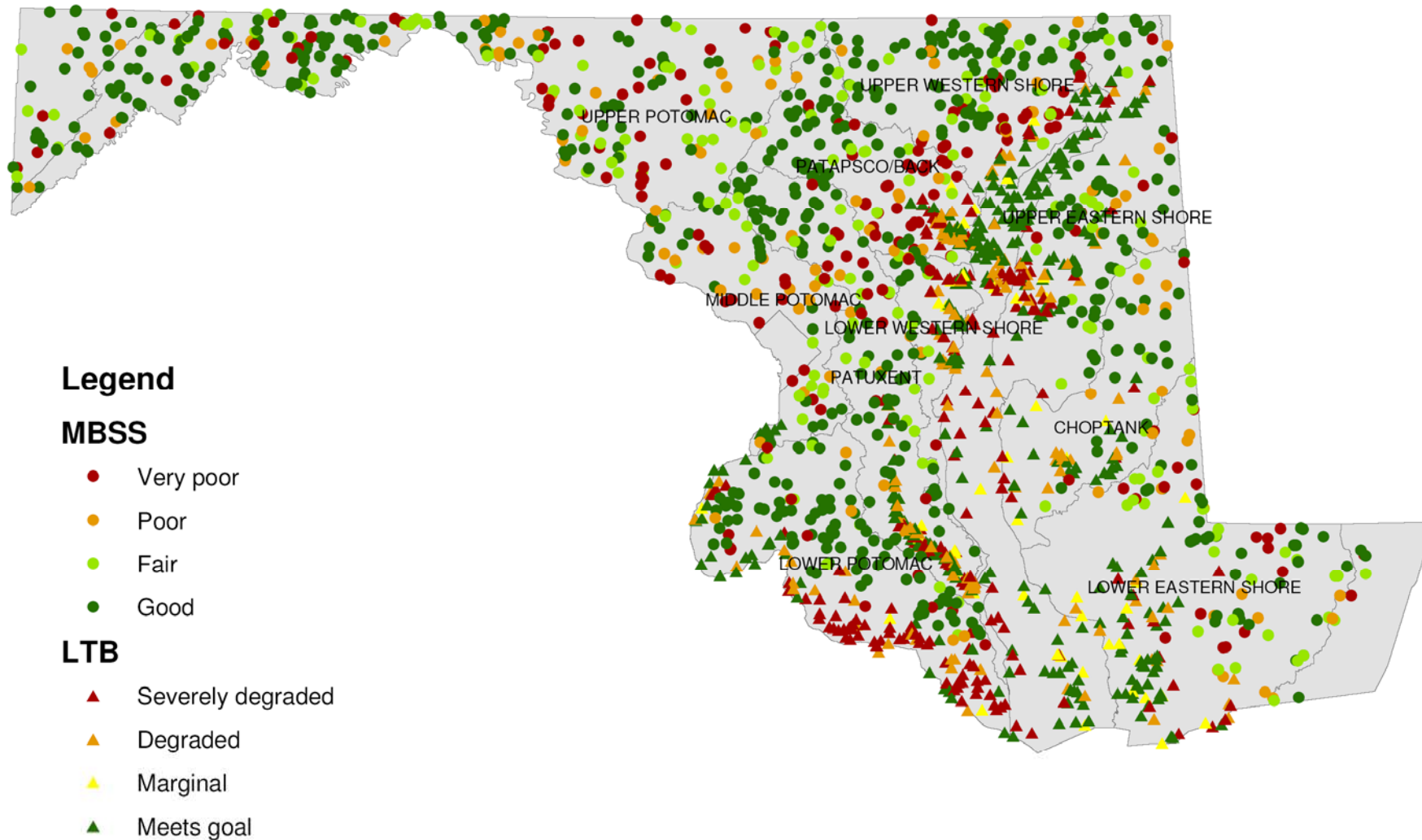
MBSS and LTB

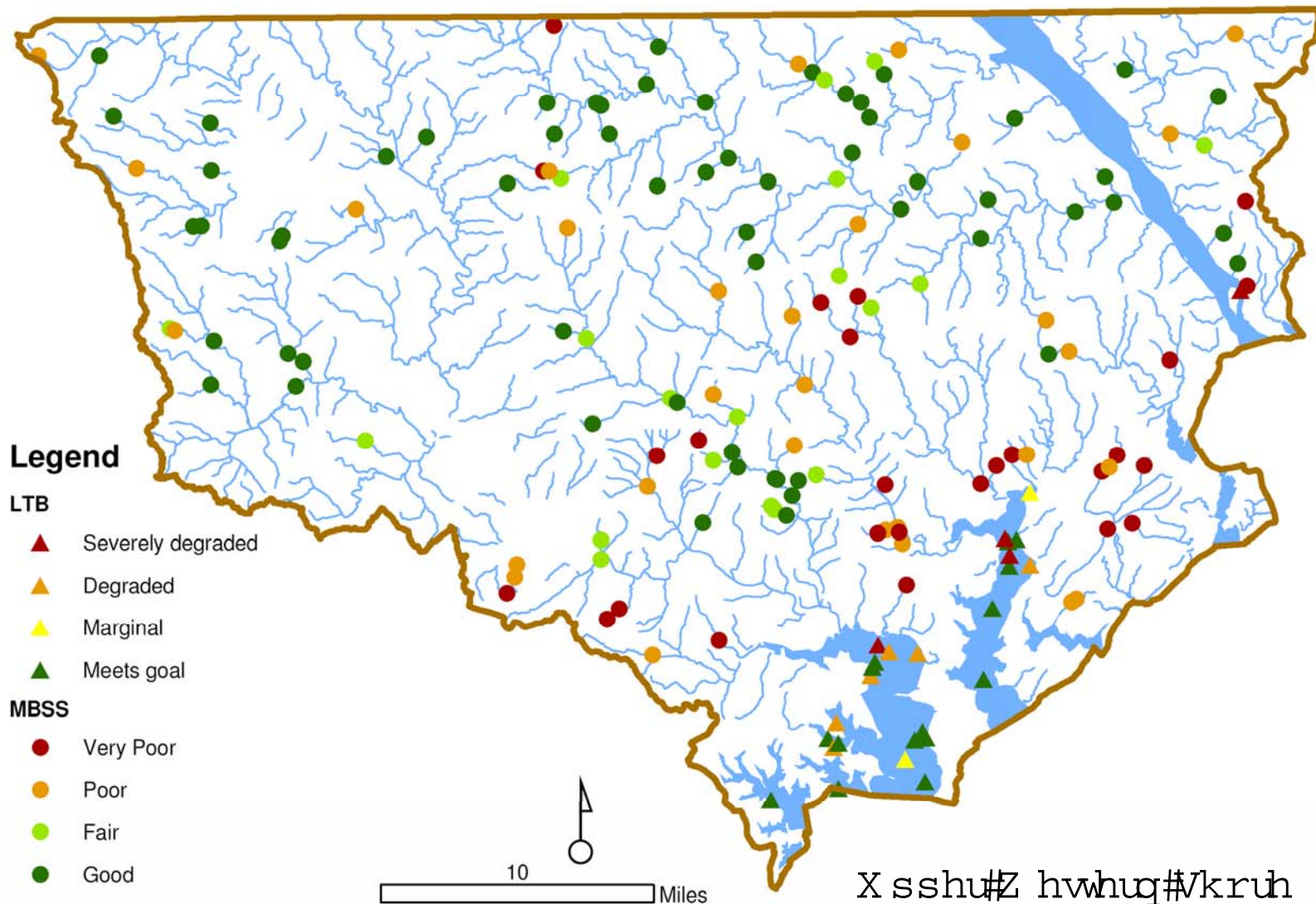
- Long-Term Benthic Monitoring Program
 - Annual report
 - State of Bay using 1 year of data with % pass-fail by 10 Trib Basins
 - 305b biennial report post-stratified by segment (MD half of 85) for % passing (failing $\leq 5\%$ reference)
 - 303d listing uses a statistical test considering uncertainty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





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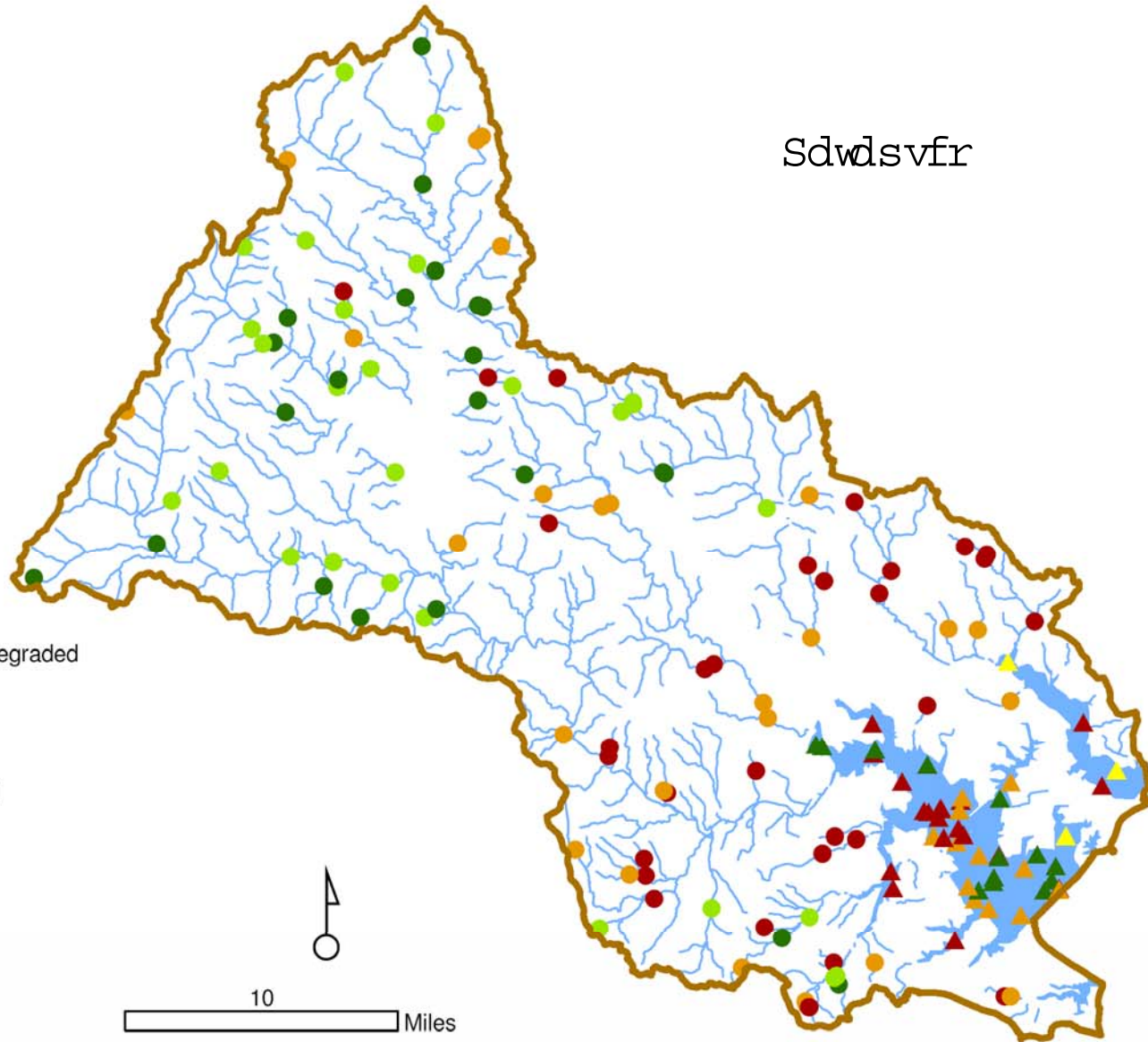
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LTB

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

MBSS

- Very Poor
- Poor
- Fair
- Good



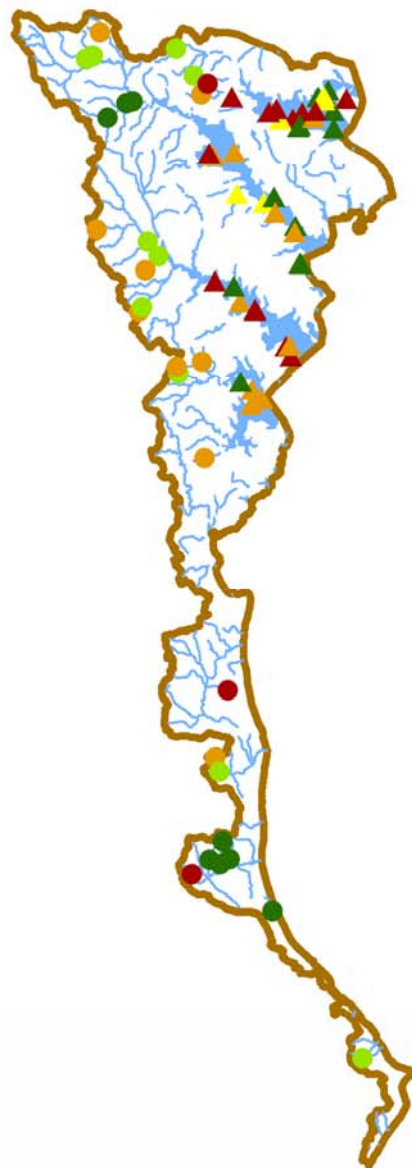
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Orizaba watershed



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Miles

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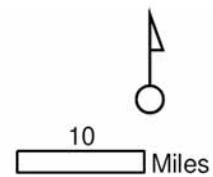
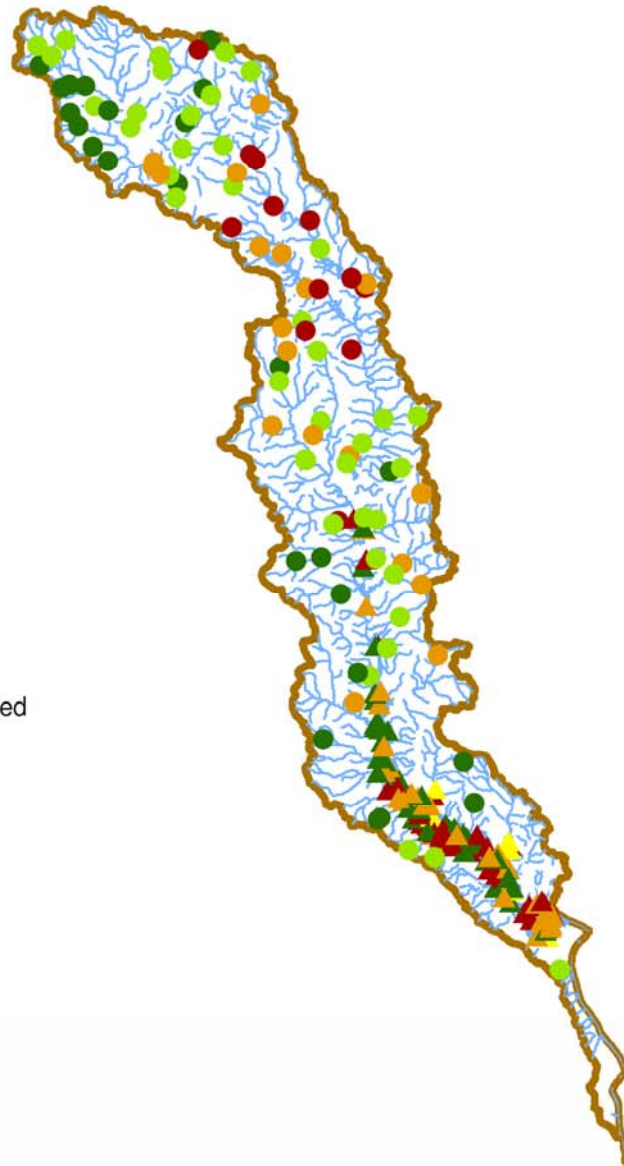
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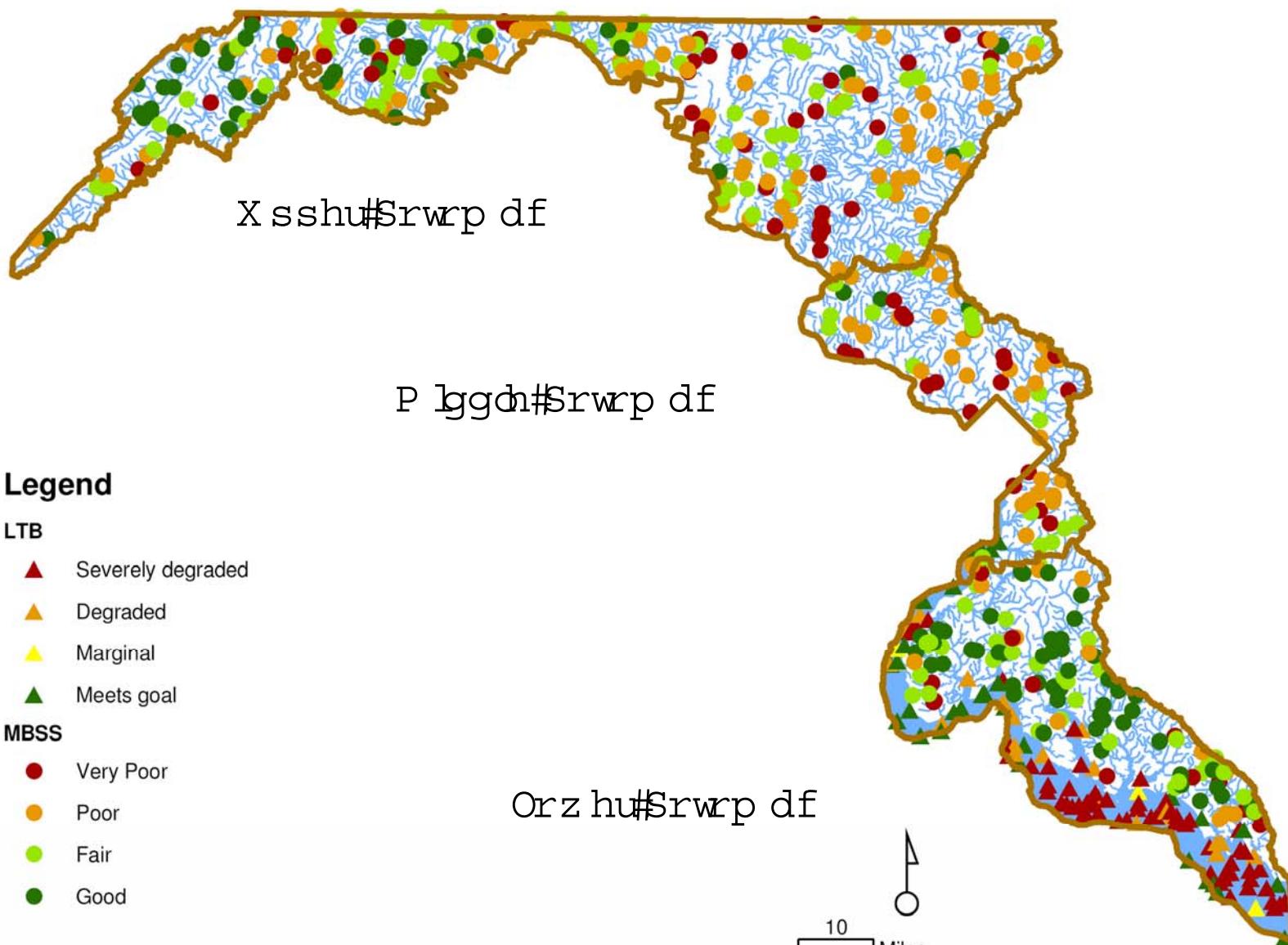
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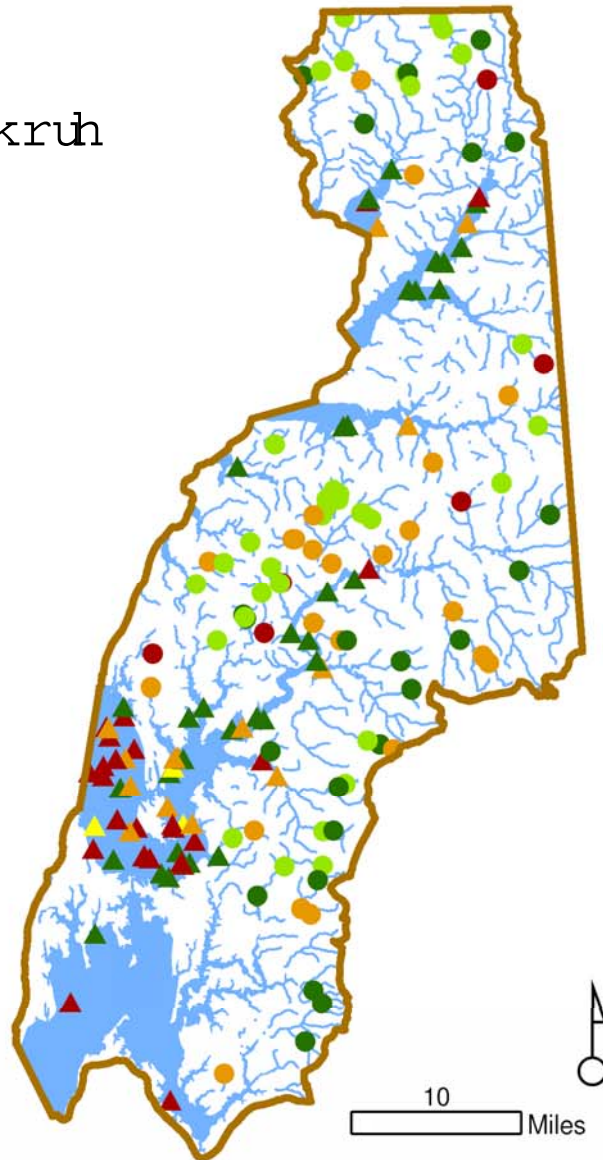
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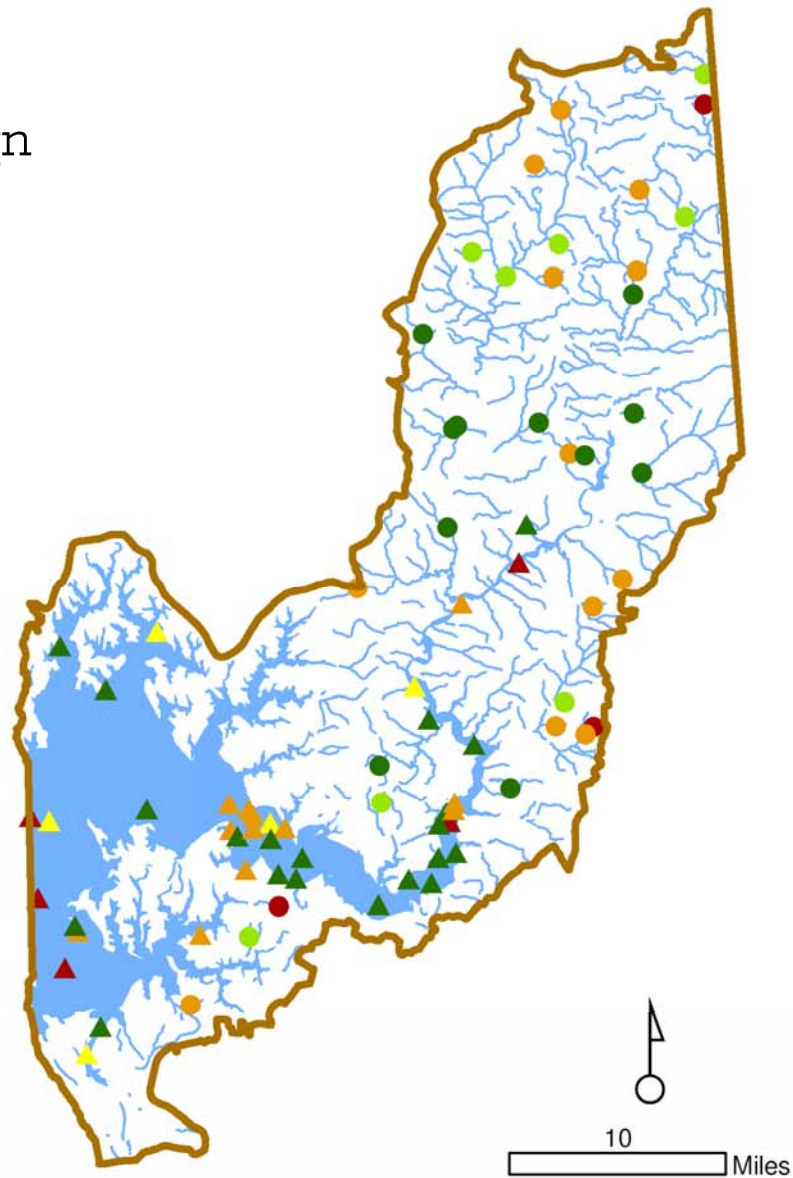
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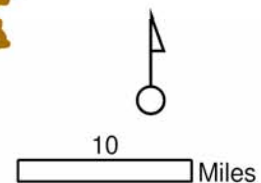
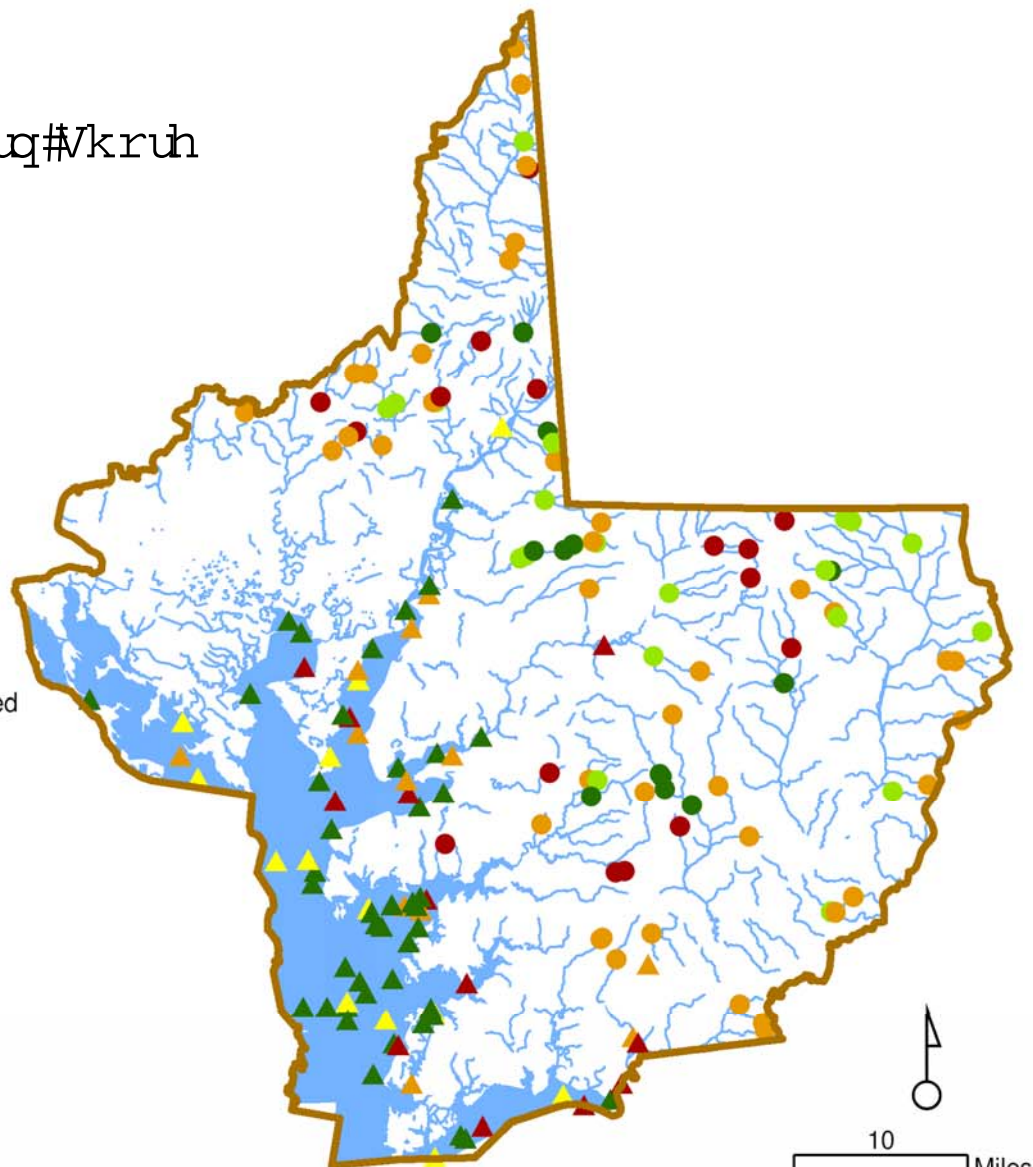
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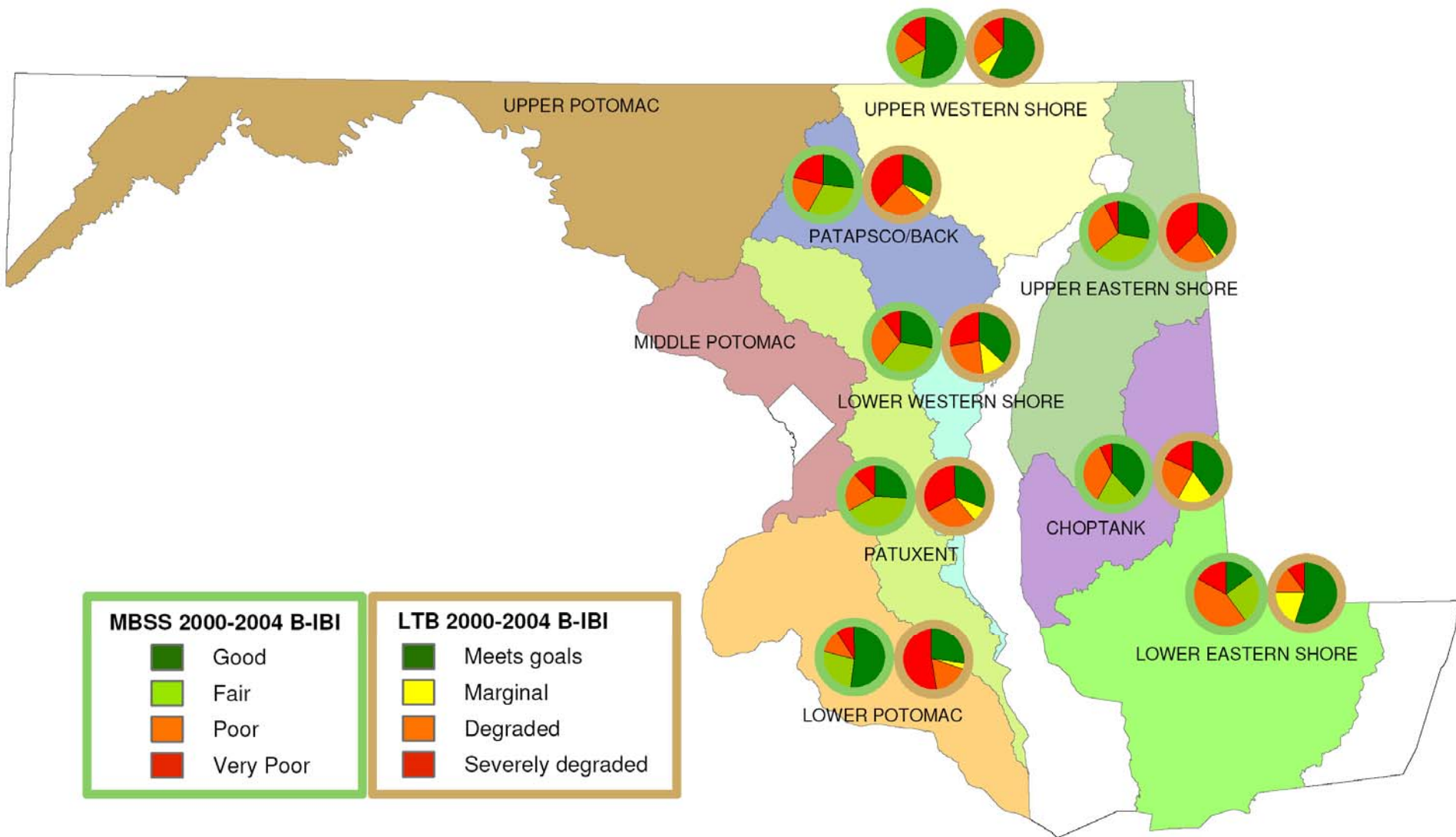
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Comparability of Assessments

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)

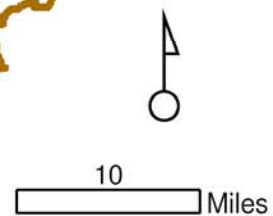
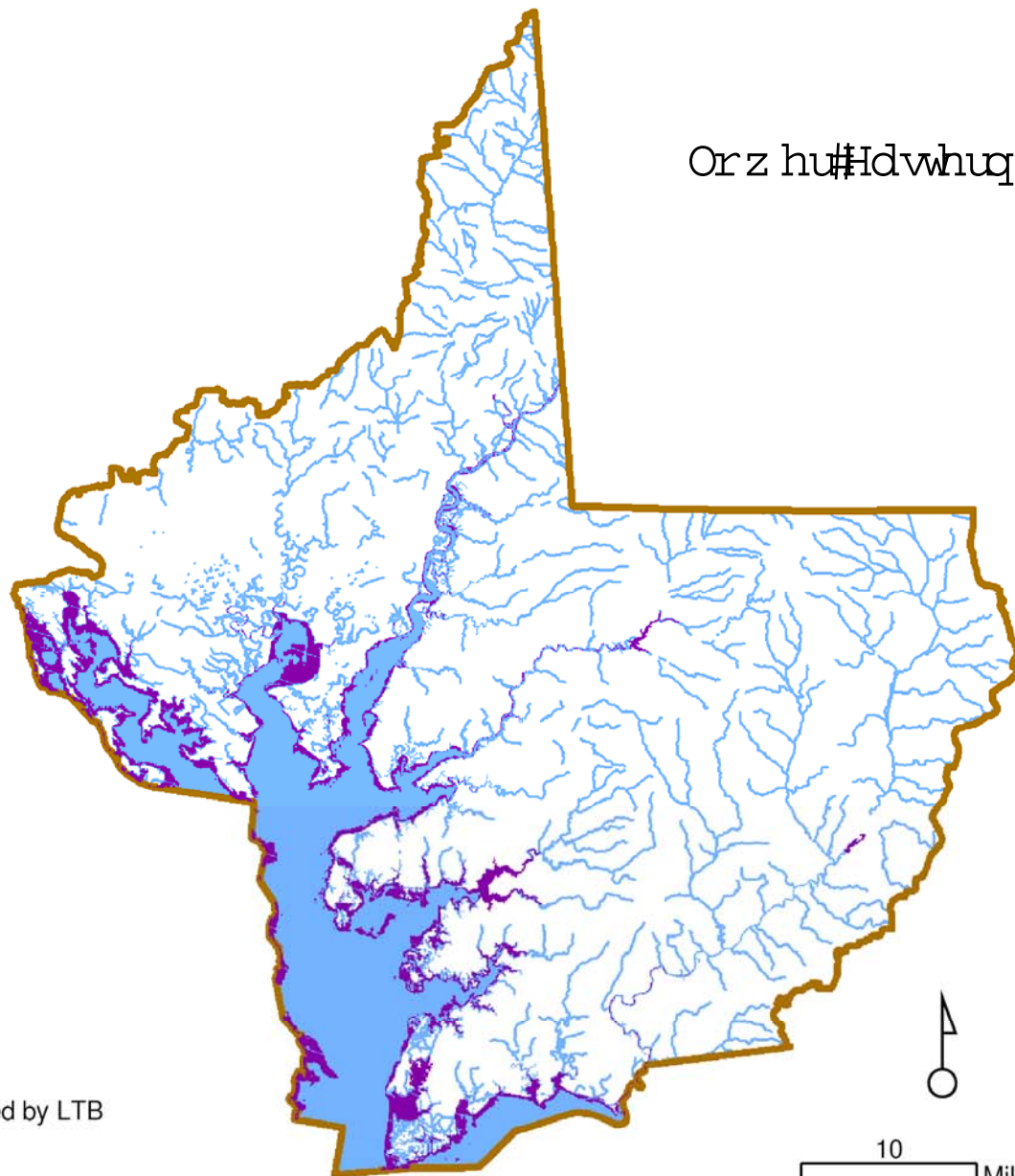
Gaps in Maryland's Waters

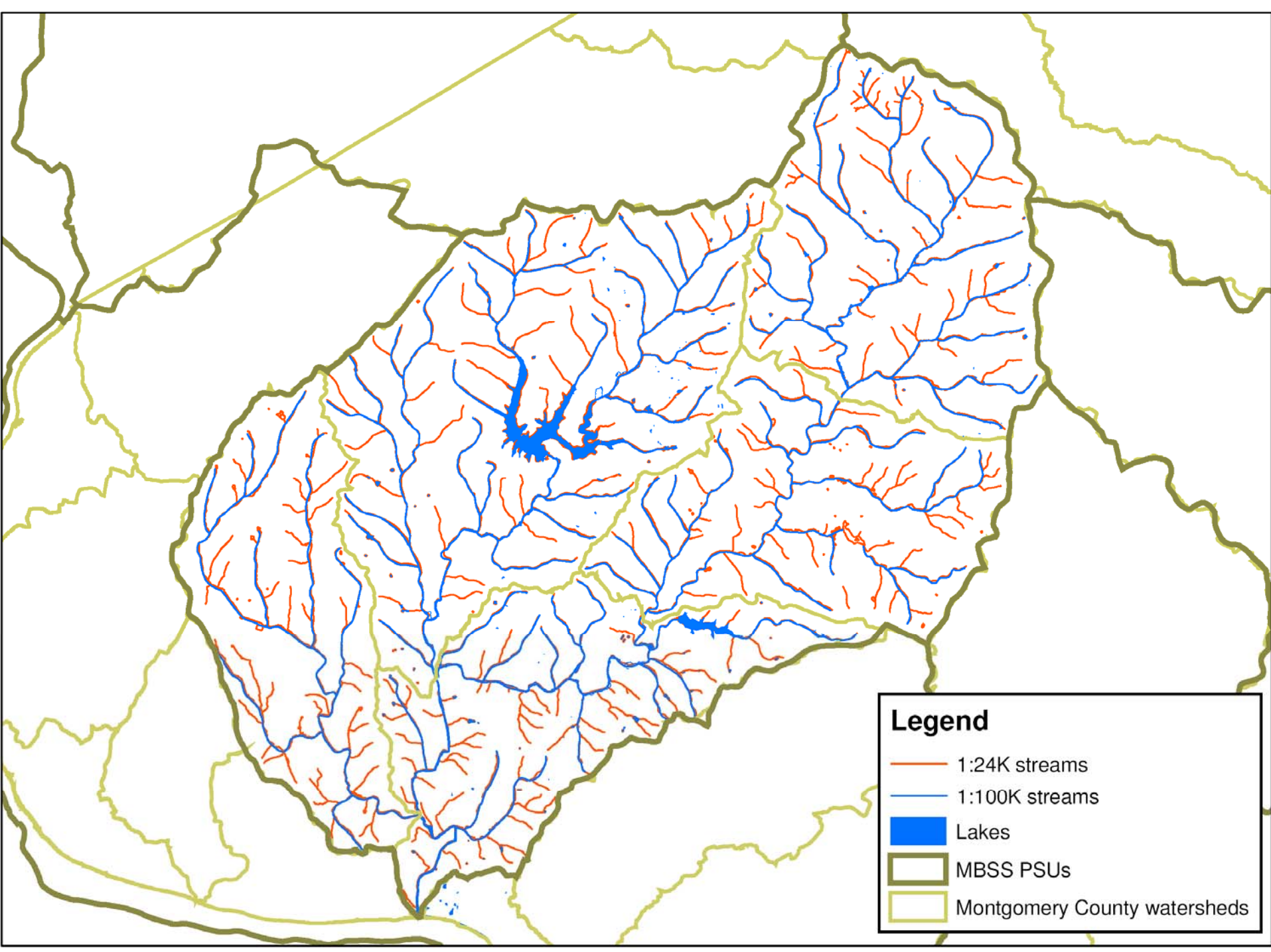
- LTB does not sample
 - Above head of tide (MLLW)
 - Shallows < 1 m depth
 - Mainstem deep trough > 12 m depth (but assumed to be azoic)
- MBSS does not sample
 - Below head of tide
 - Large rivers > 4th order
 - Small streams < 1st order (on 1:100,000-scale map)

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Legend

 Areas not sampled by LTB





Gaps in Maryland's Waters

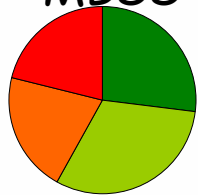
- Tidal waters are assessed by LTB (including Deep Trough)
 - Gap of up to 15% not assessed are nearshore shallows (based on NOAA data)
- Nontidal streams covered by MBSS
 - Gap of 6.8% are freshwater tidal
 - Gap of 1.5% are large rivers
 - Gap of up to 40% of miles missed are smallest streams (based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

Unique Watersheds

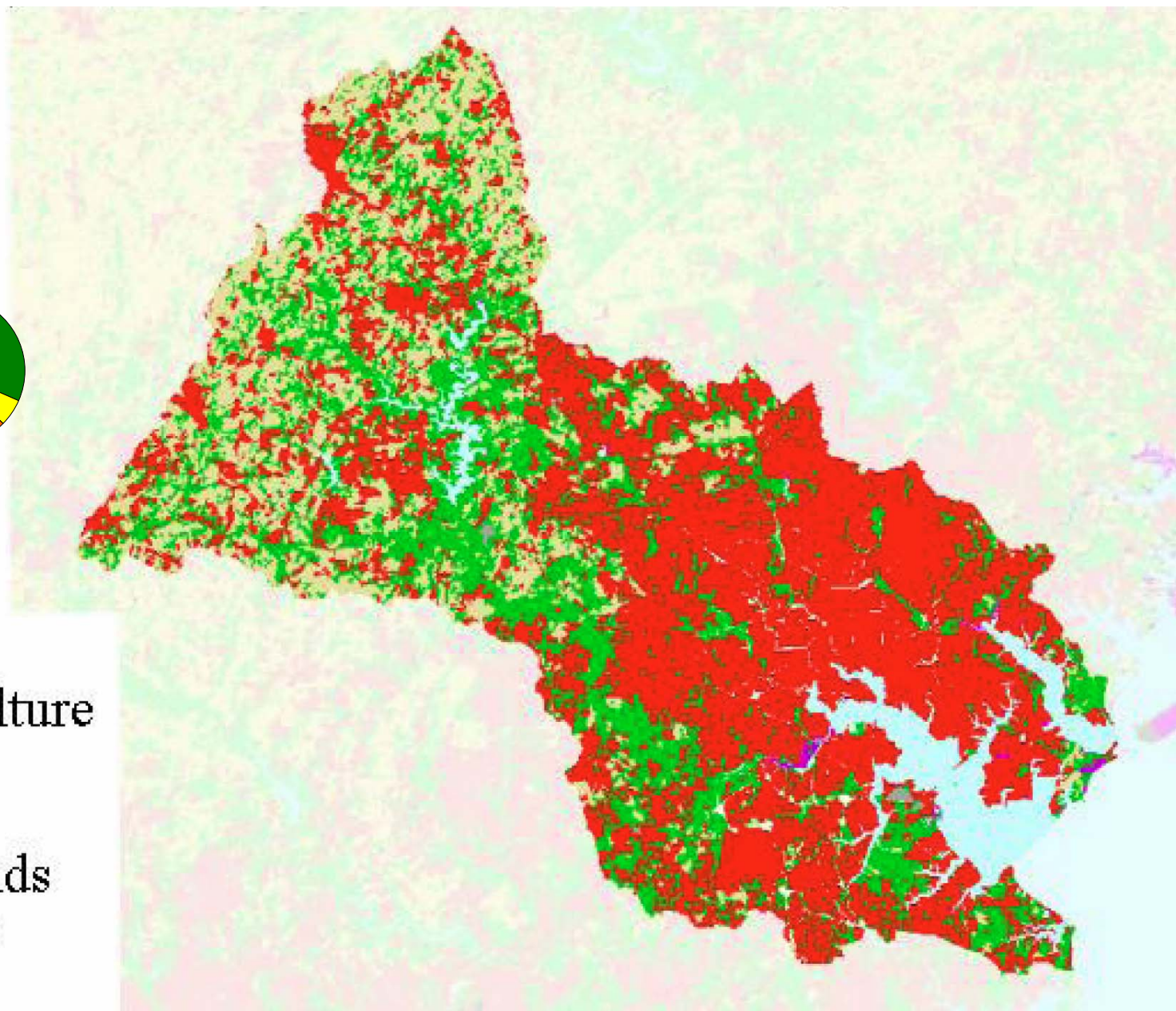
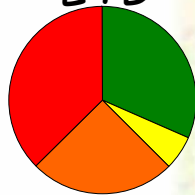
- Extensive development in coastal zone
- Well-protected coastal zone
- Heavy upstream loading
- Unique natural conditions (e.g., deep waters)

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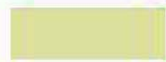
MBSS



LTB



Urban



Agriculture



Forest



Water

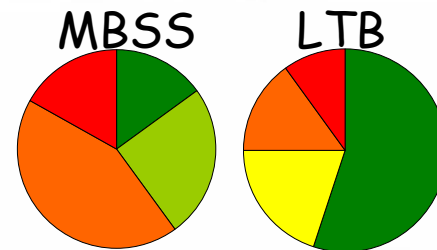


Wetlands



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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

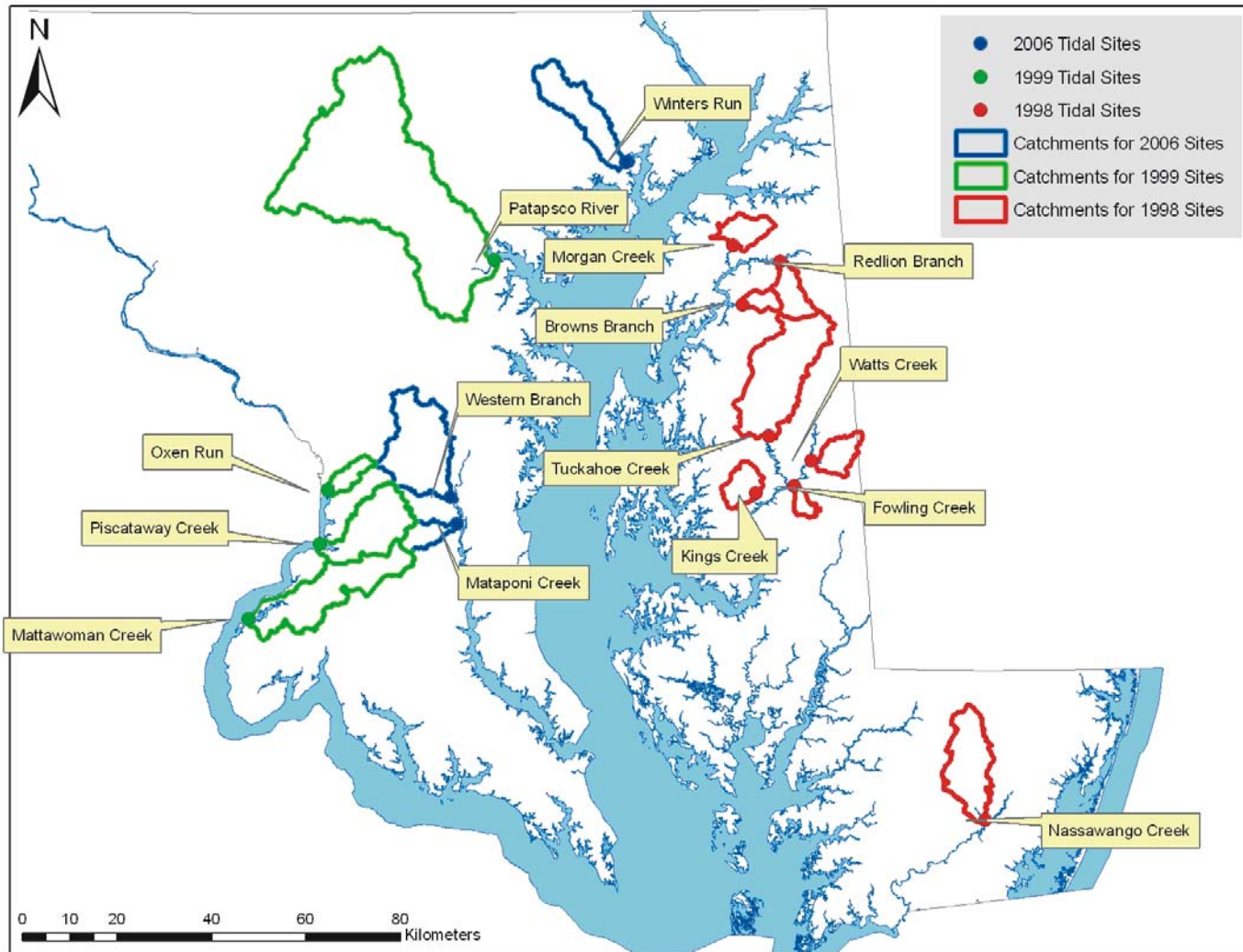
Monitoring and Assessment of Gaps

- 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

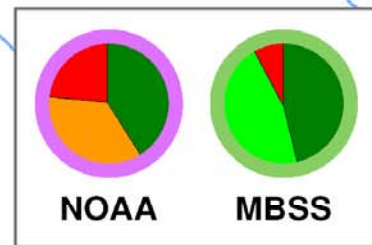
- Potential for learning from assessment mismatches
- Partition MBSS-LTB data by land use (as a predictor of coastal development influence)
- Link assessment to SPARROW model results
- Smaller scale studies to better understand downstream effects
 - MBSS 1998-1999 and 2006 fish study
 - NOAA 2007 benthic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

2006 MBSS Fish Study

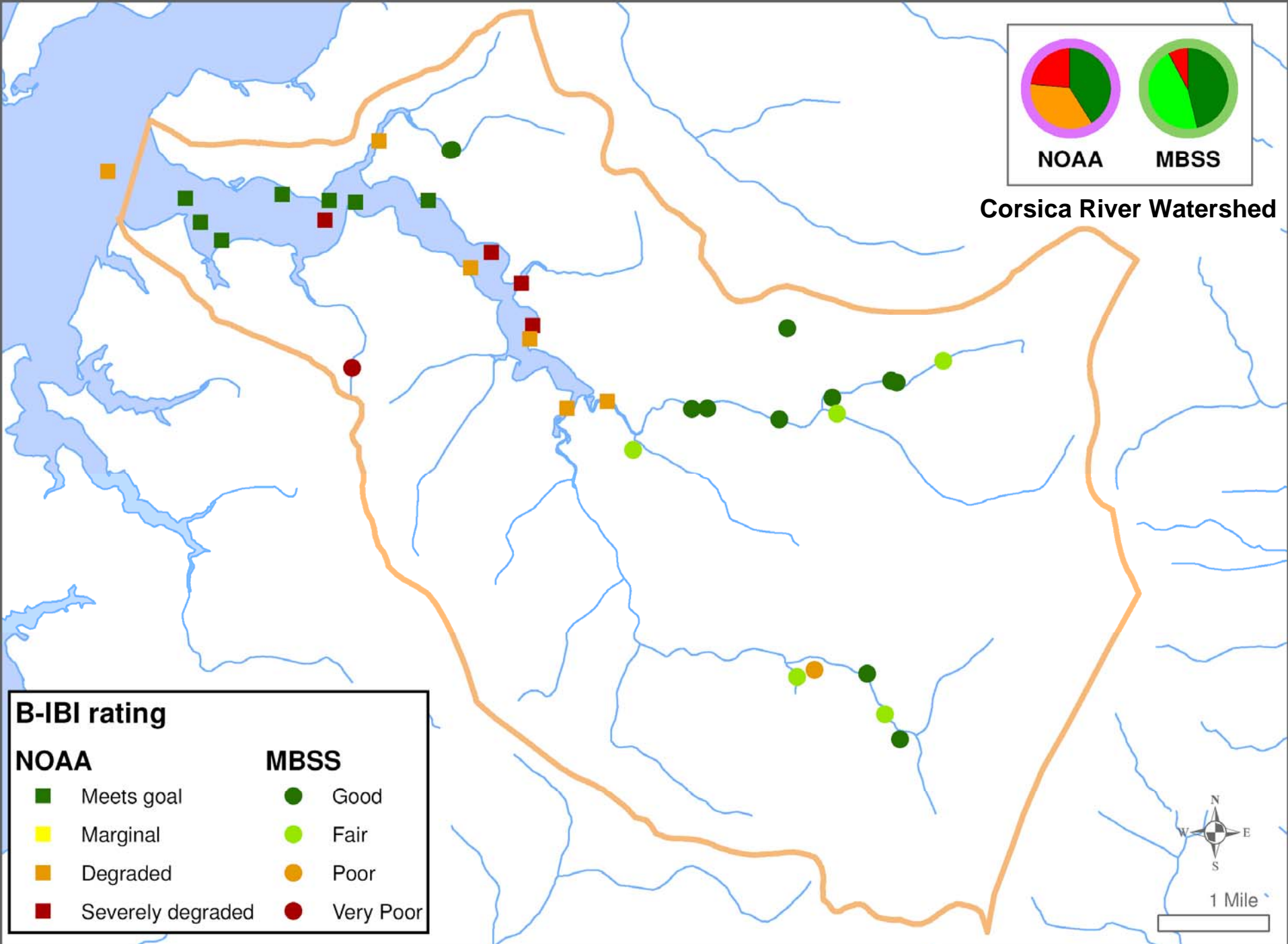
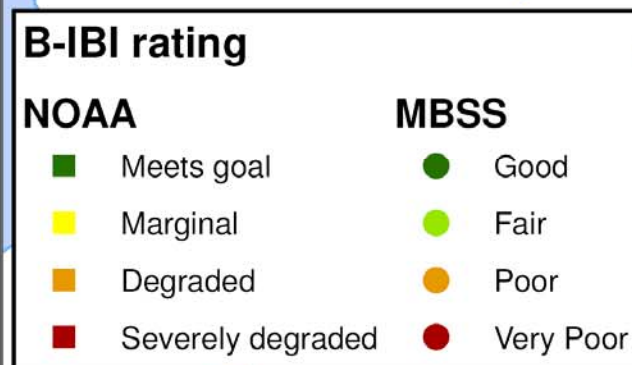


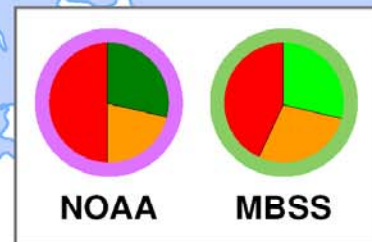
2007 NOAA Benthic Study

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

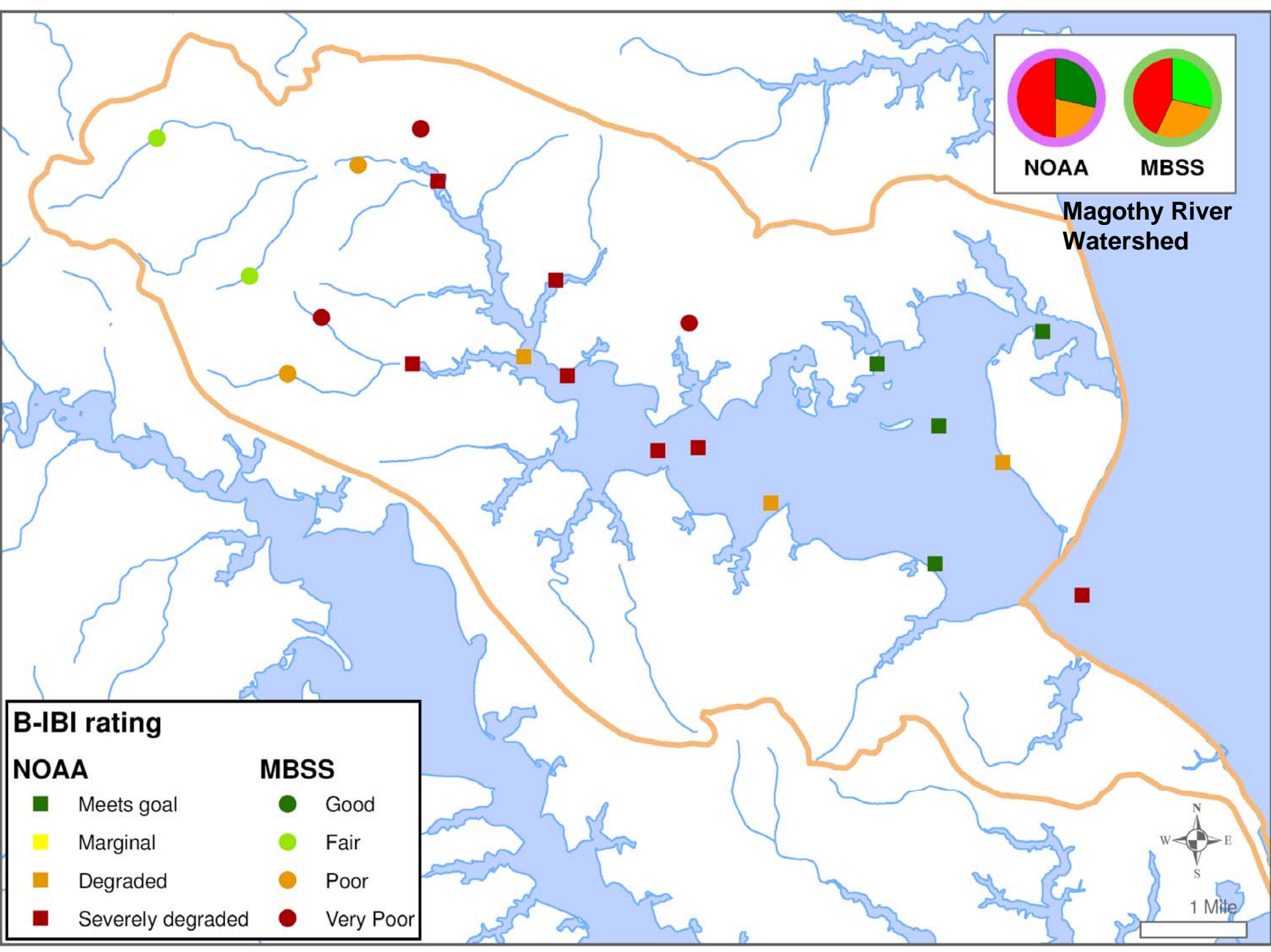
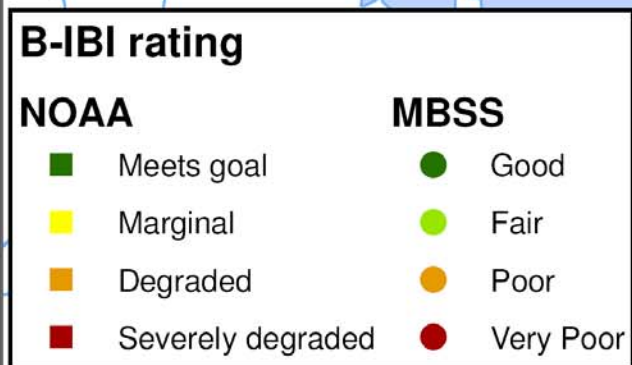


Corsica River Watershed

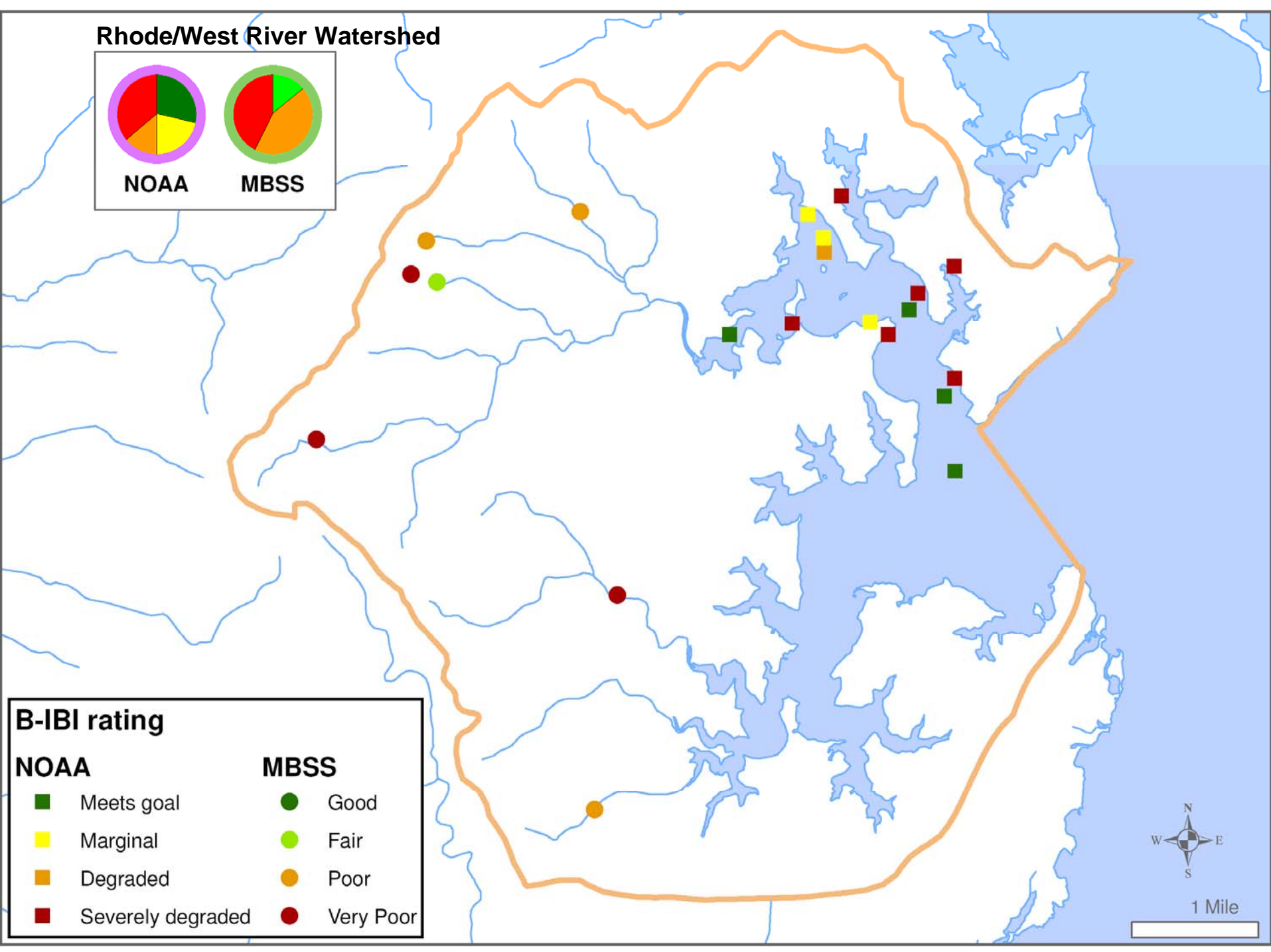
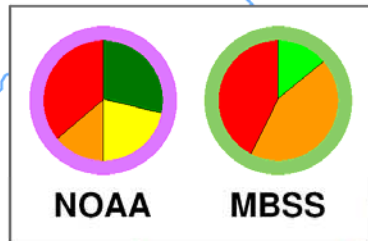




Magothy River Watershed

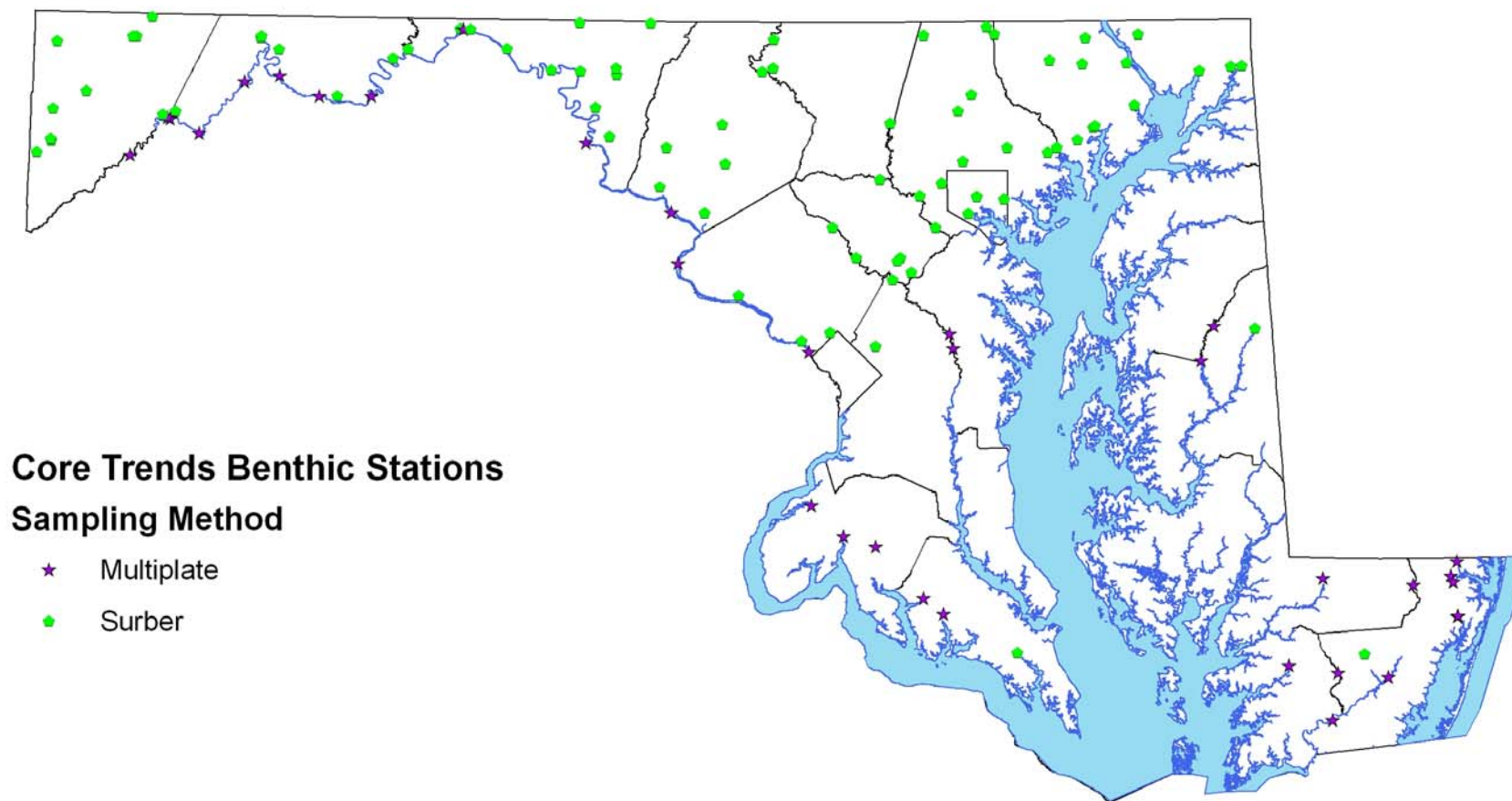


Rhode/West River Watershed



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



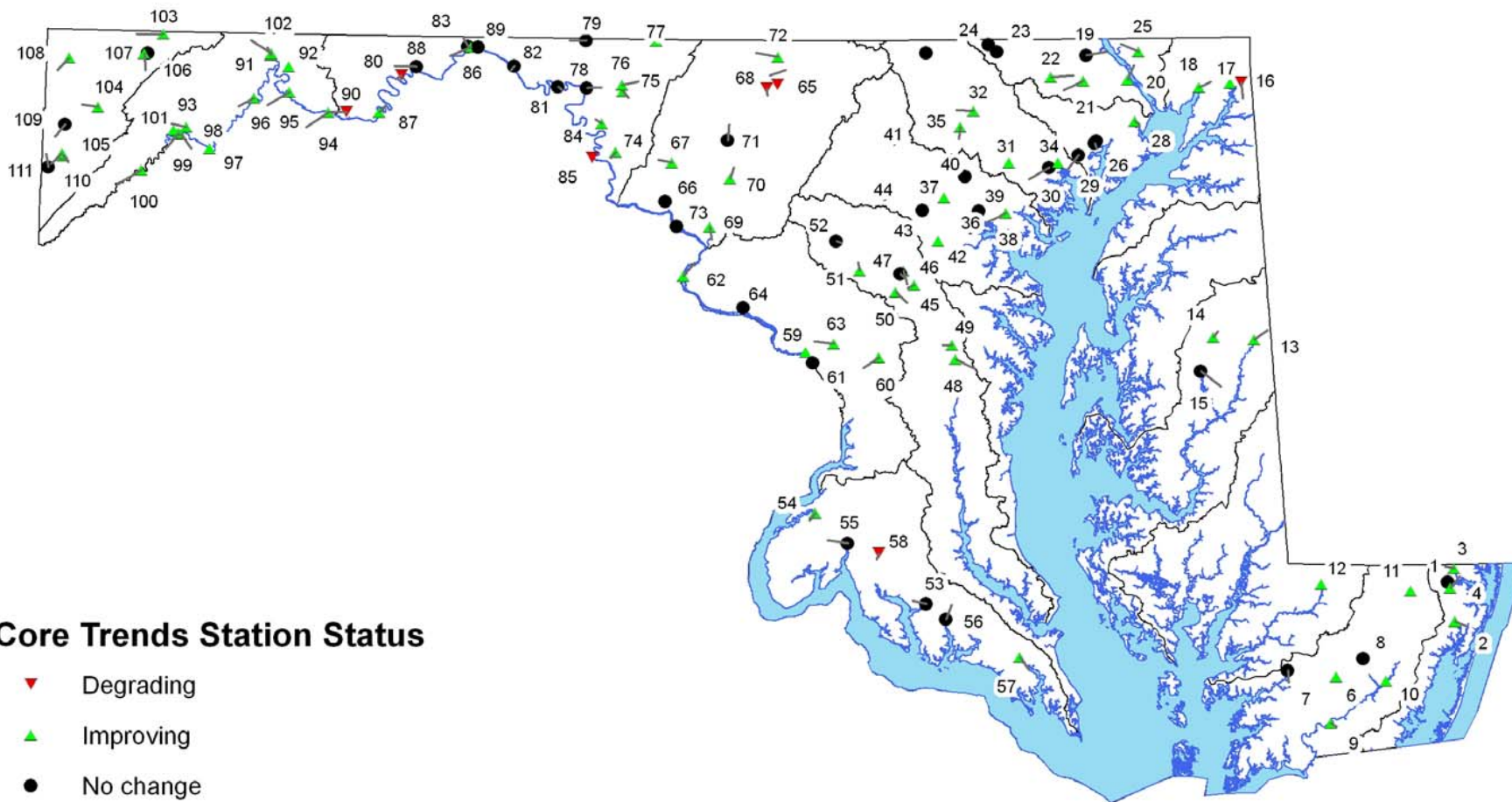
Core Trends Benthic Stations

Sampling Method

- ★ Multiplate
- Surber



0 22,500 45,000 90,000 Meters



Core Trends Station Status

- ▼ Degrading
- ▲ Improving
- No change



0 23,000 46,000 92,000 Meters

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