MARYLAND DEPARTMENT OF NATURAL RESOURCES

The Maryland Biological Stream Survey: Evolution of a Probability-Based Monitoring Program

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KerryWixted
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Maryland
Biological
Stream
Survey

Where is Maryland?

"America in Miniature"

Maryland Facts

"Old Line State"

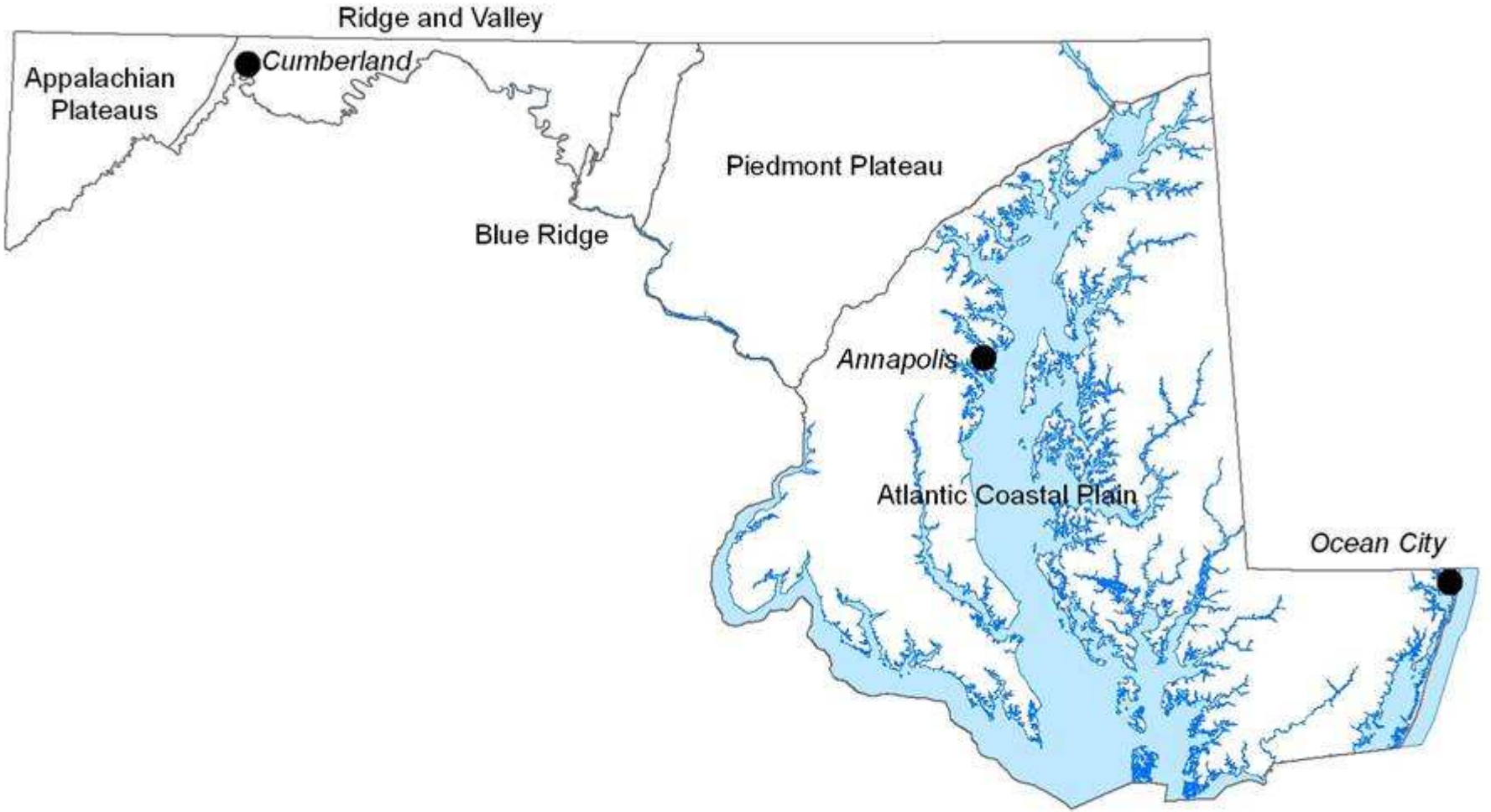
- Area = 12,407 mi^2 (42nd)
- 32% Agriculture
- 31% Forest
- 20% Open Water
- 10% Urban
- 6% Wetlands
- 1% Other
- Atlantic Ocean = 0 ft elevation
- Backbone Mountain = 3,360 ft elevation
- <15% Public Land
- Population = 5,699,478 (19th)
- Density = 541.9/mi^2 (5th)
- Median Income = $68,080 ($1^{st}$)

Annapolis

Ocean City

Cumberland

Maryland's Physiographic Provinces



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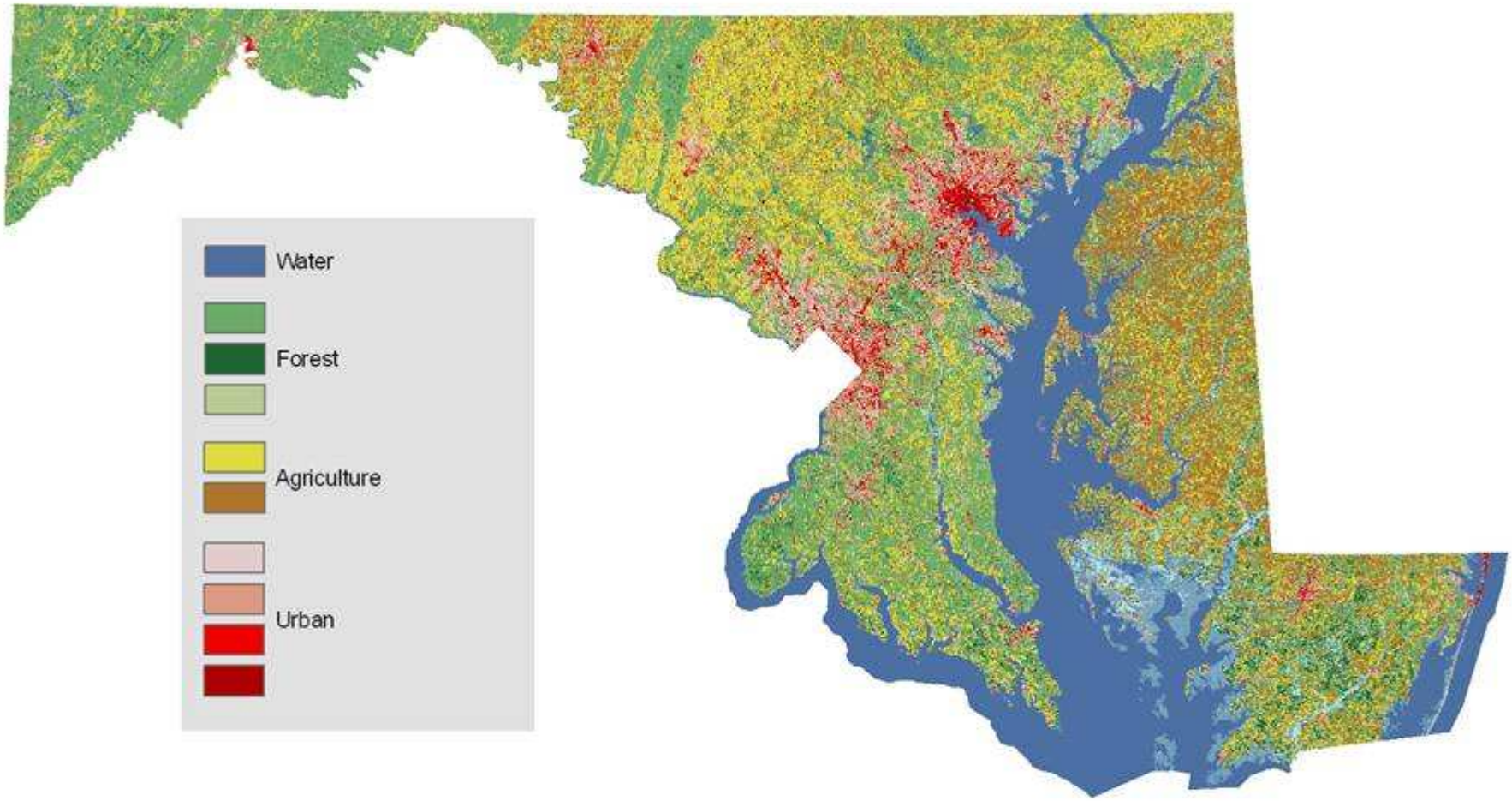
Monitoring and Non-Tidal Assessment Division
April 13, 2010

0 10 20 40 60 80 Kilometers

N

Maryland's Land Cover



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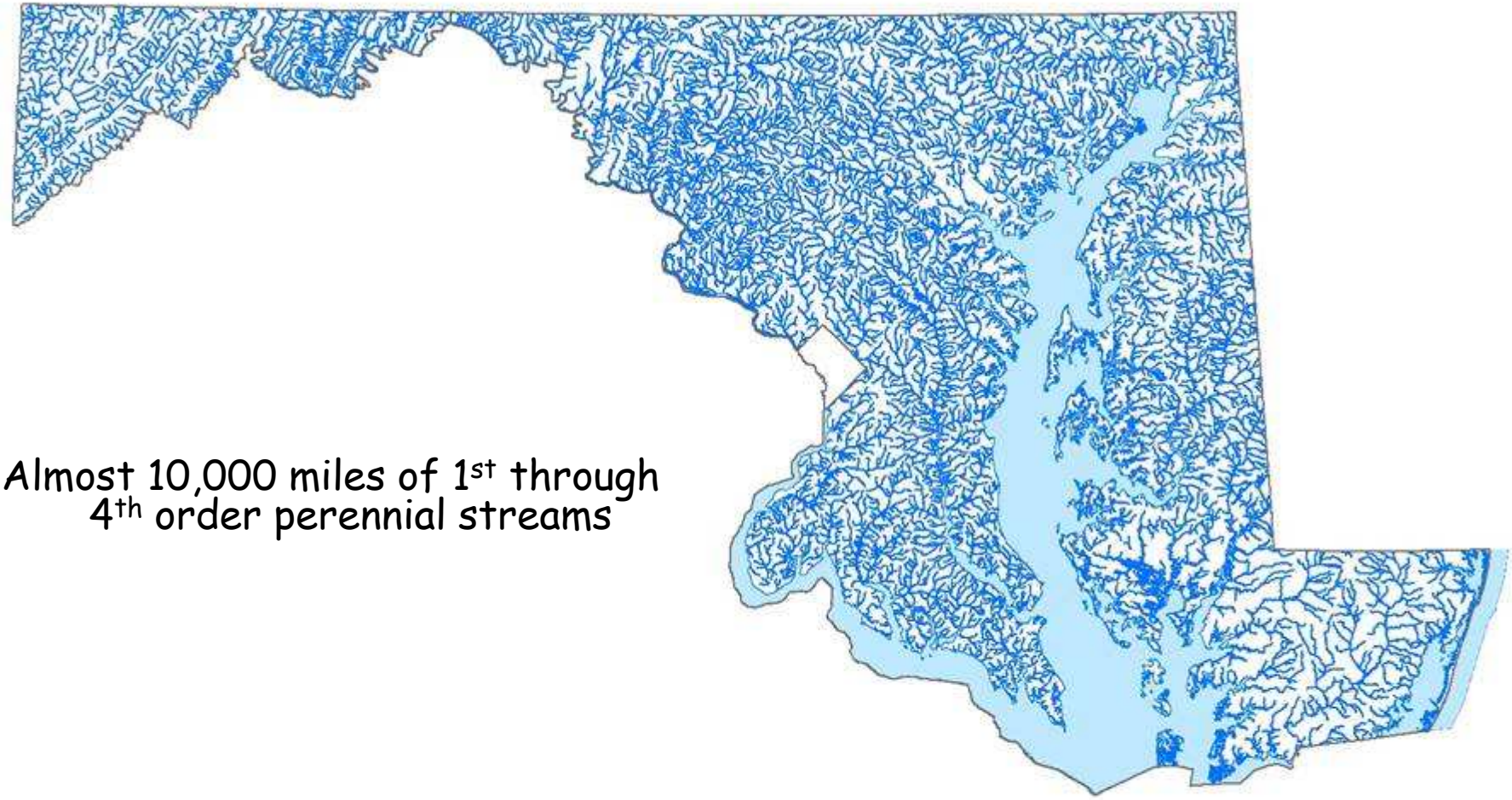
Maryland's Non-Tidal Streams*



*Almost 10,000 miles of 1st through 4th order perennial streams

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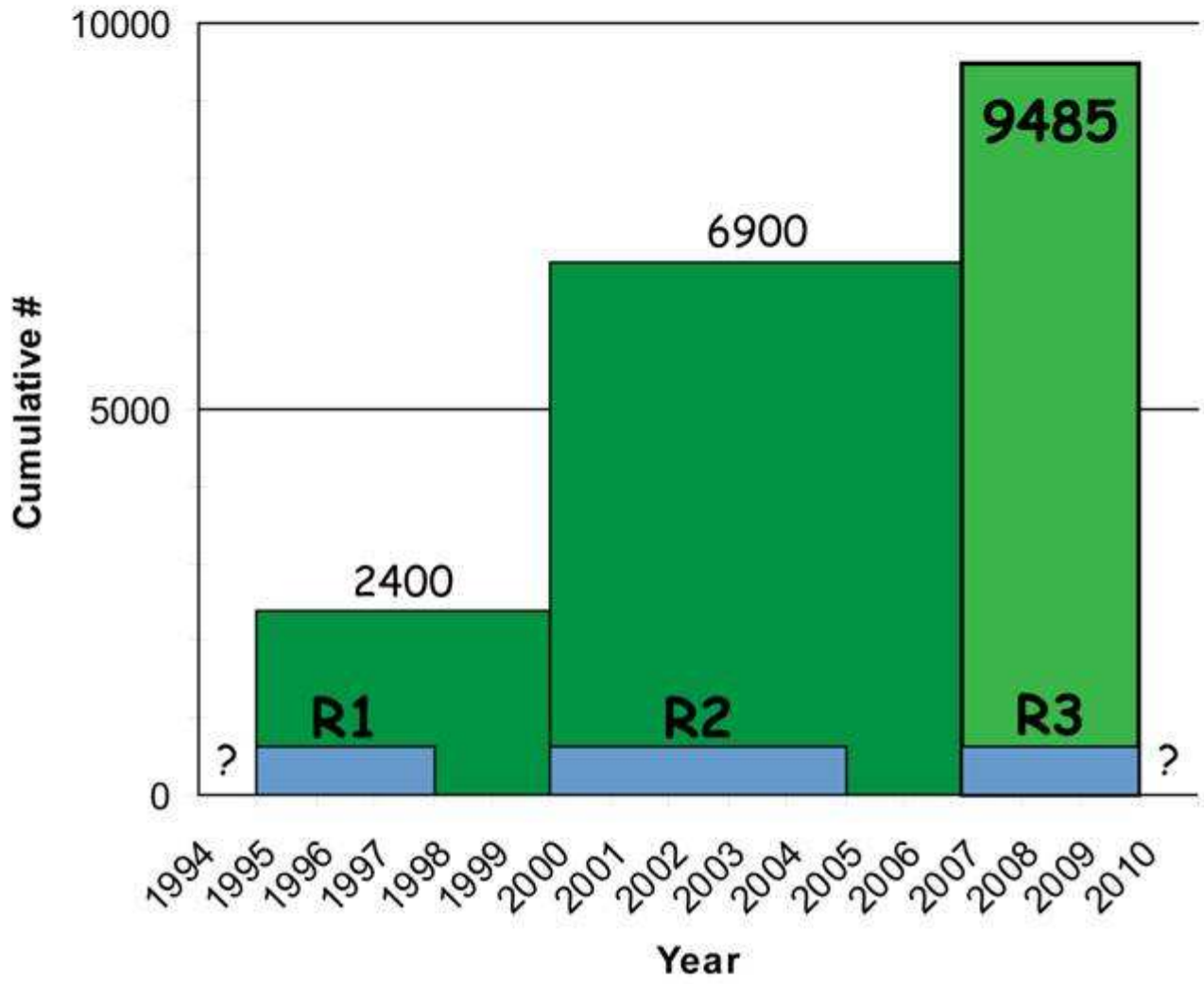
What is the MBSS?

- Statewide survey to assess stream conditions
- 1st through 3rd (now 1st through 4th) order wadeable, non-tidal streams
- 1:250,000 (now 1:100,000) scale streams map
- Probability-based sampling design stratified on geographical region and stream order
- Many private land owners – permissions
- Unbiased estimates of stream conditions with known precision at statewide, basin, and medium-size watershed scales

MBSS
Landowners Contacted



What is the MBSS?

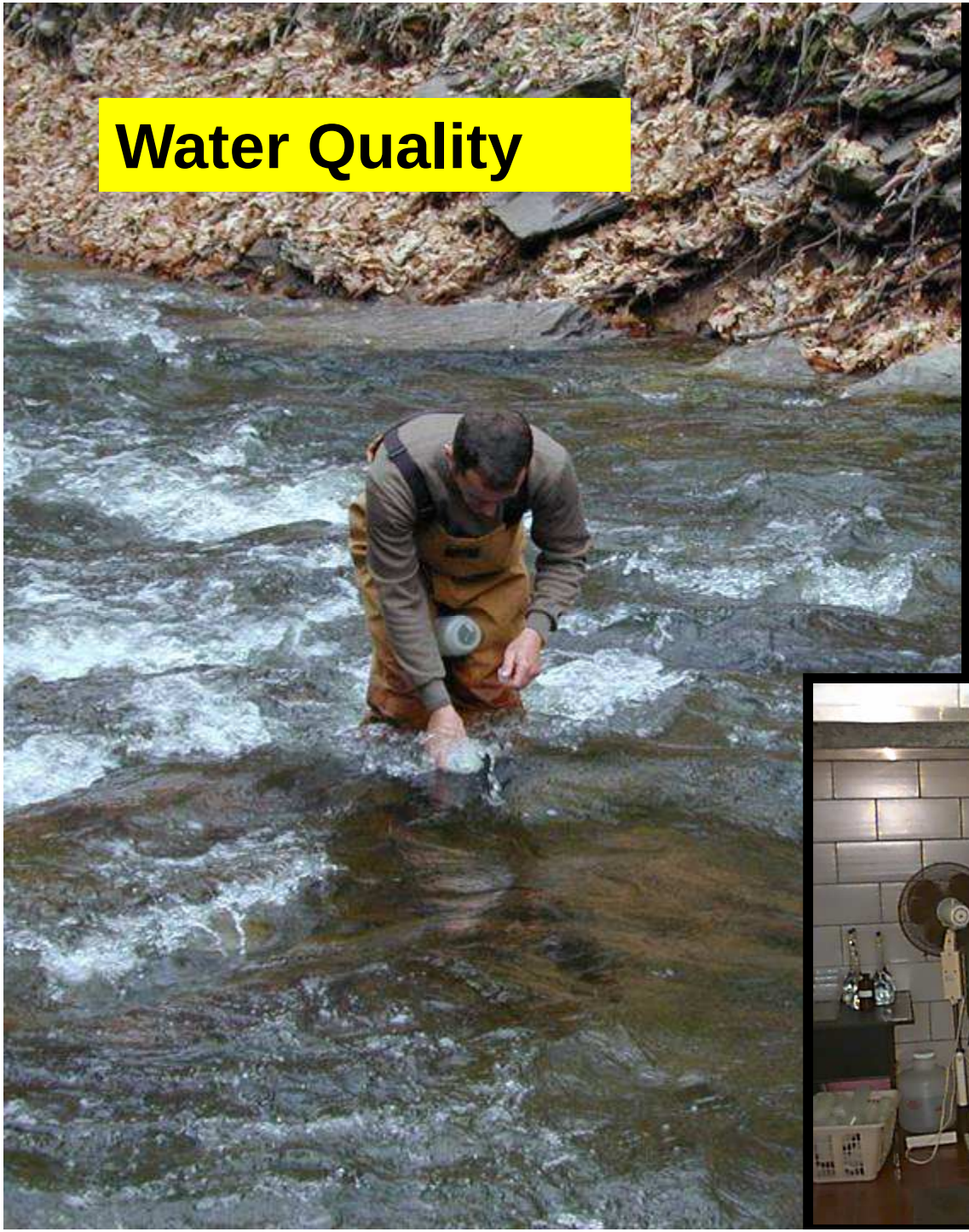
- Standard protocols for water chemistry, physical habitat, and biota
- Region-specific and reference-based benthic macroinvertebrate and fish indicators
- Salamander indicator being developed
- Multi-metric Physical Habitat Indicator
- Spring and Summer sampling periods
- Sentinel Site Network – annual sampling
- Catchment land use estimates

Benthos

Fish

Physical Habitat

Water Quality



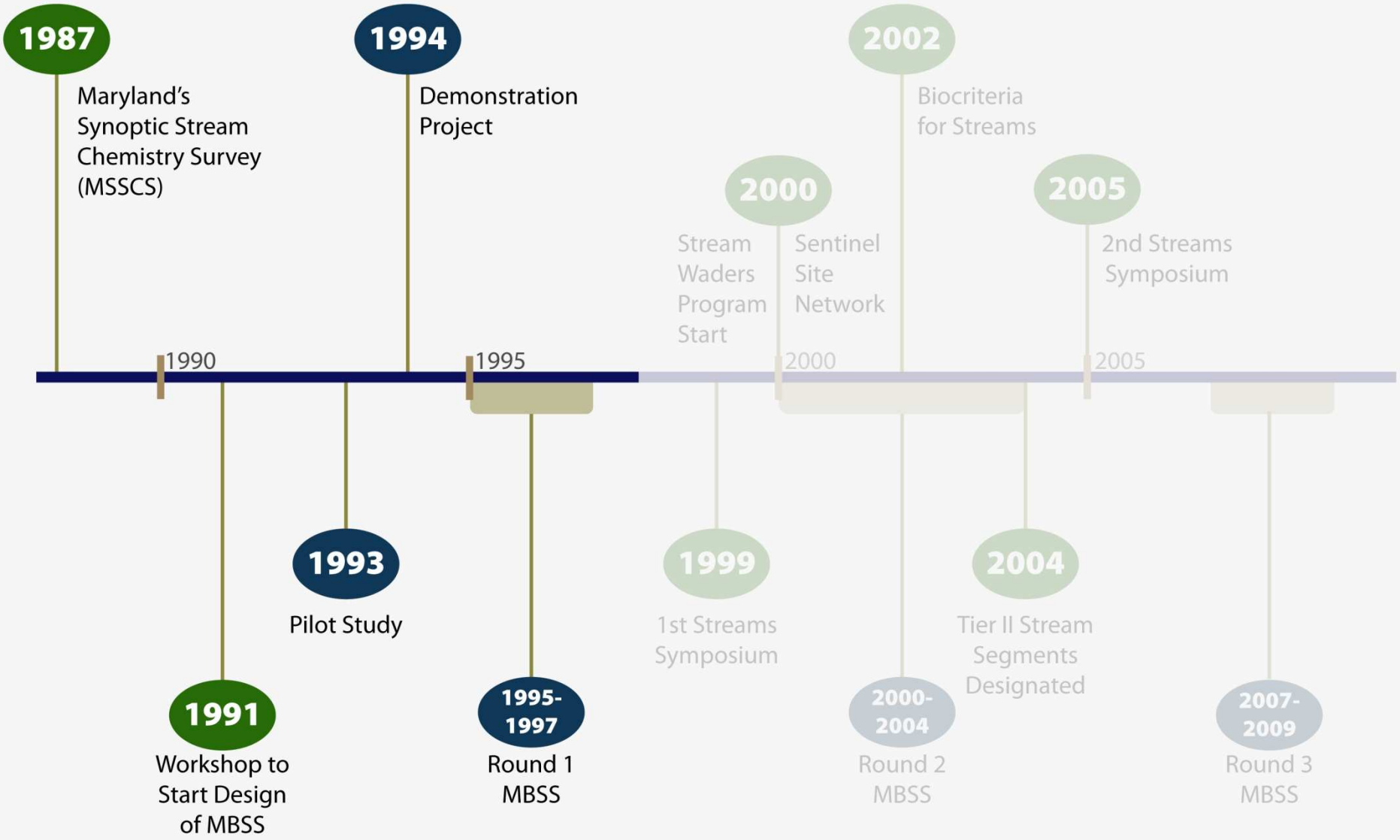
IT ALL STARTED

WITH ACID RAIN

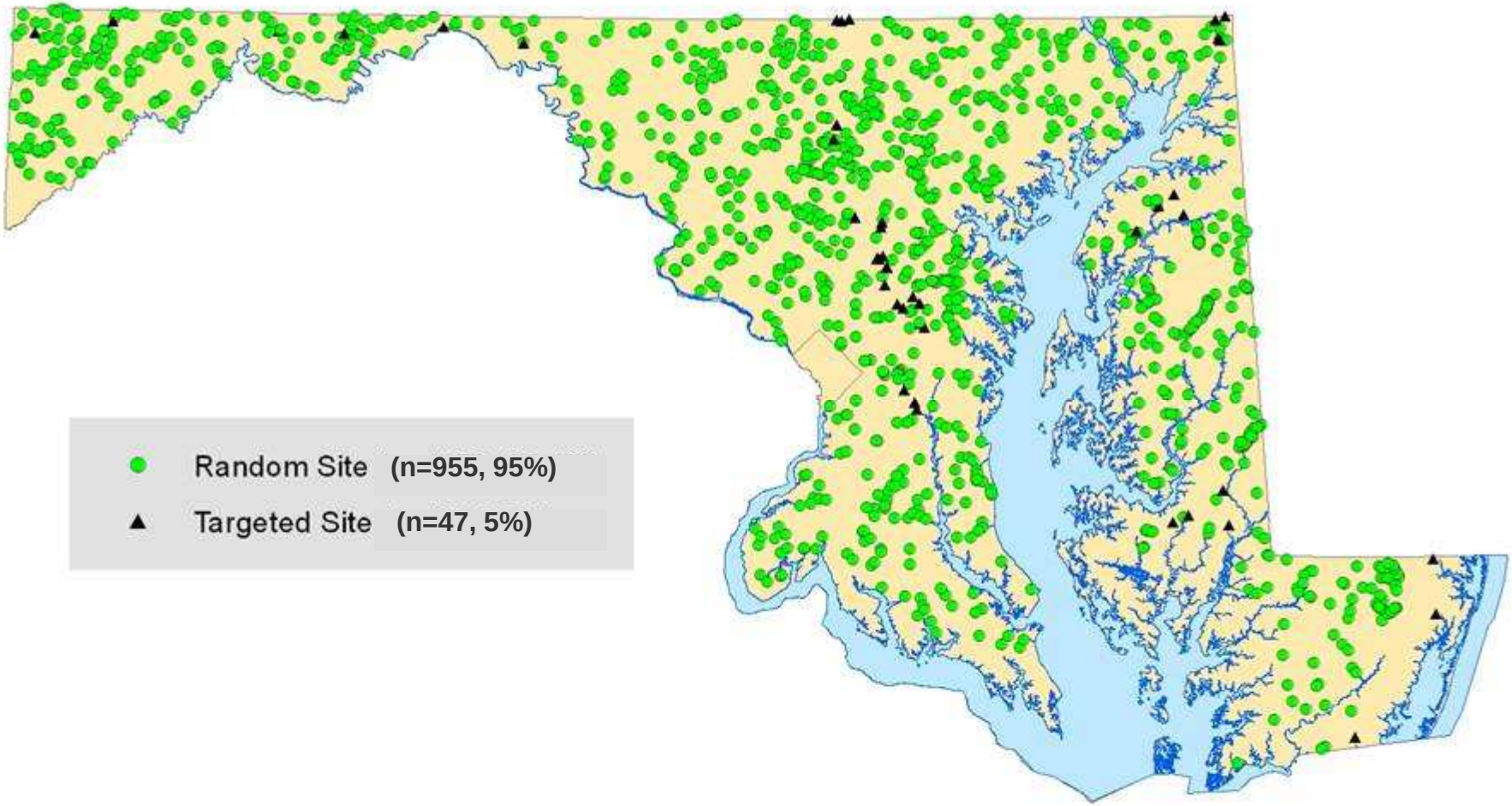
STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES

Primary Funding Source: Maryland Environmental Trust Fund

MBSS TIMELINE



MBSS Round One (1995 - 1997)



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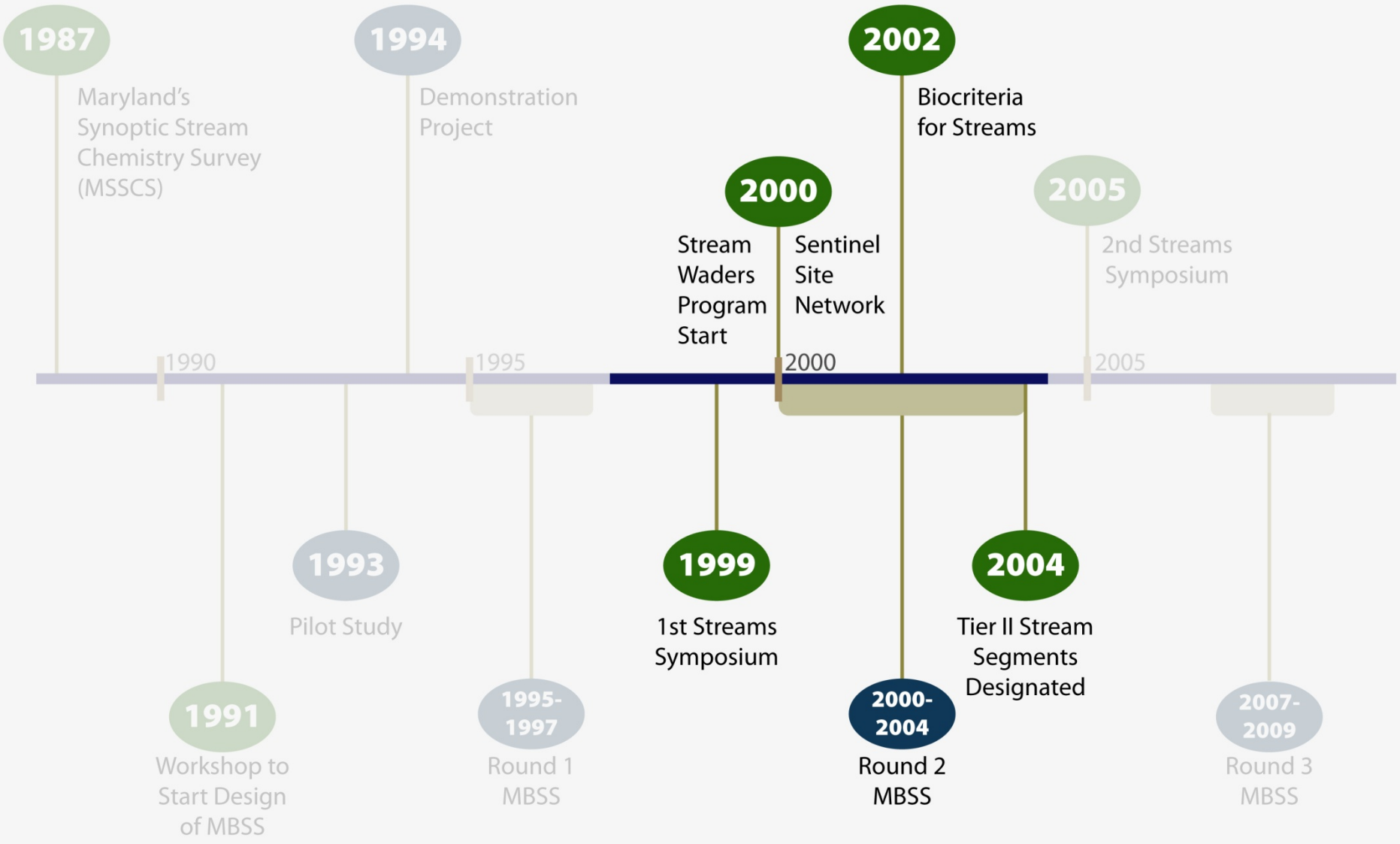
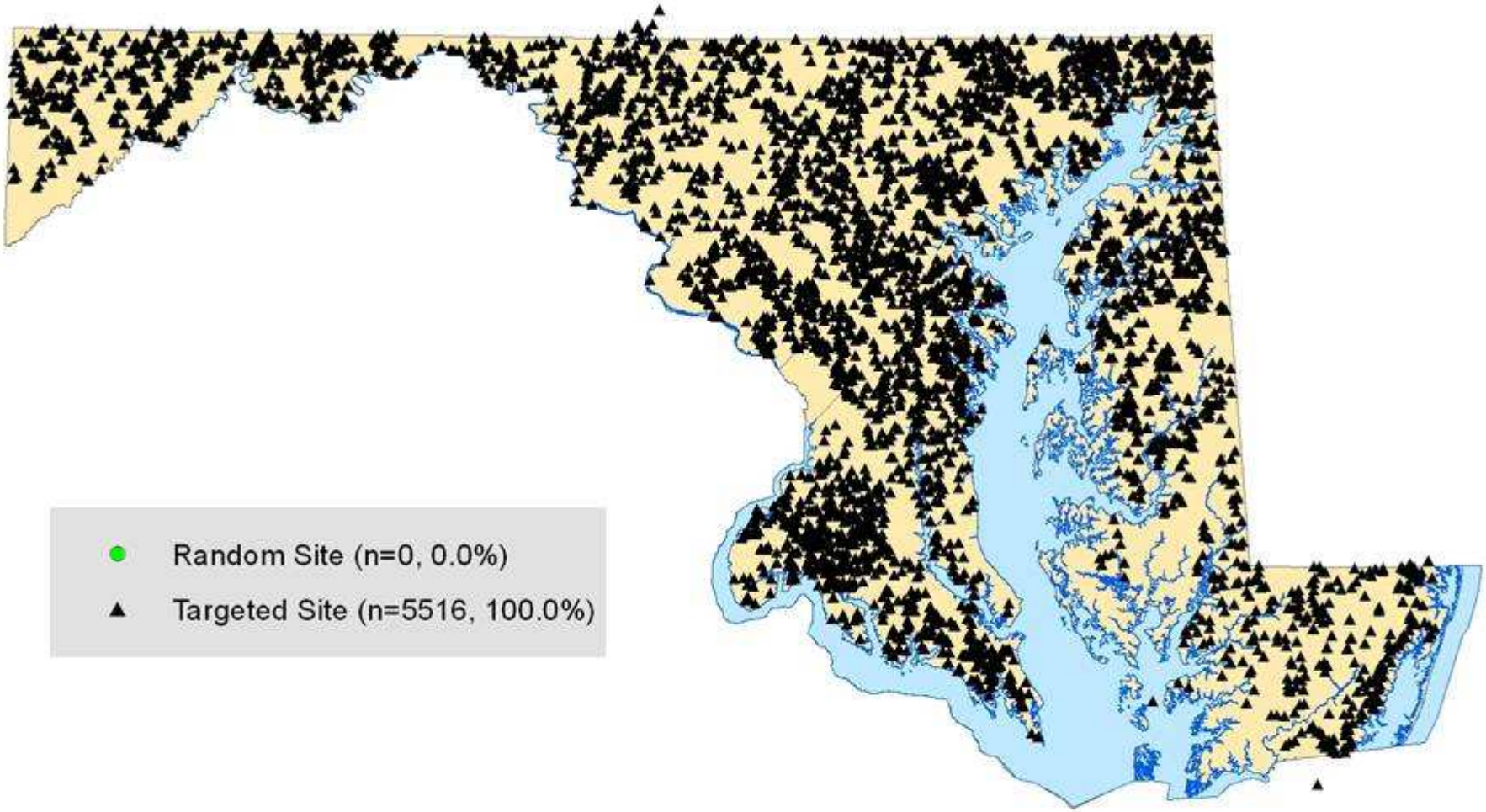
MBSS TIMELINE



Stream Waders

- MANTA's all volunteer monitoring program
- 1785 trained volunteers sampled 5516 sites since 2000
- Primary goals are education and enhanced environmental stewardship
- Secondary goal is stream health assessment

Stream Waders Sites 2000 - 2009



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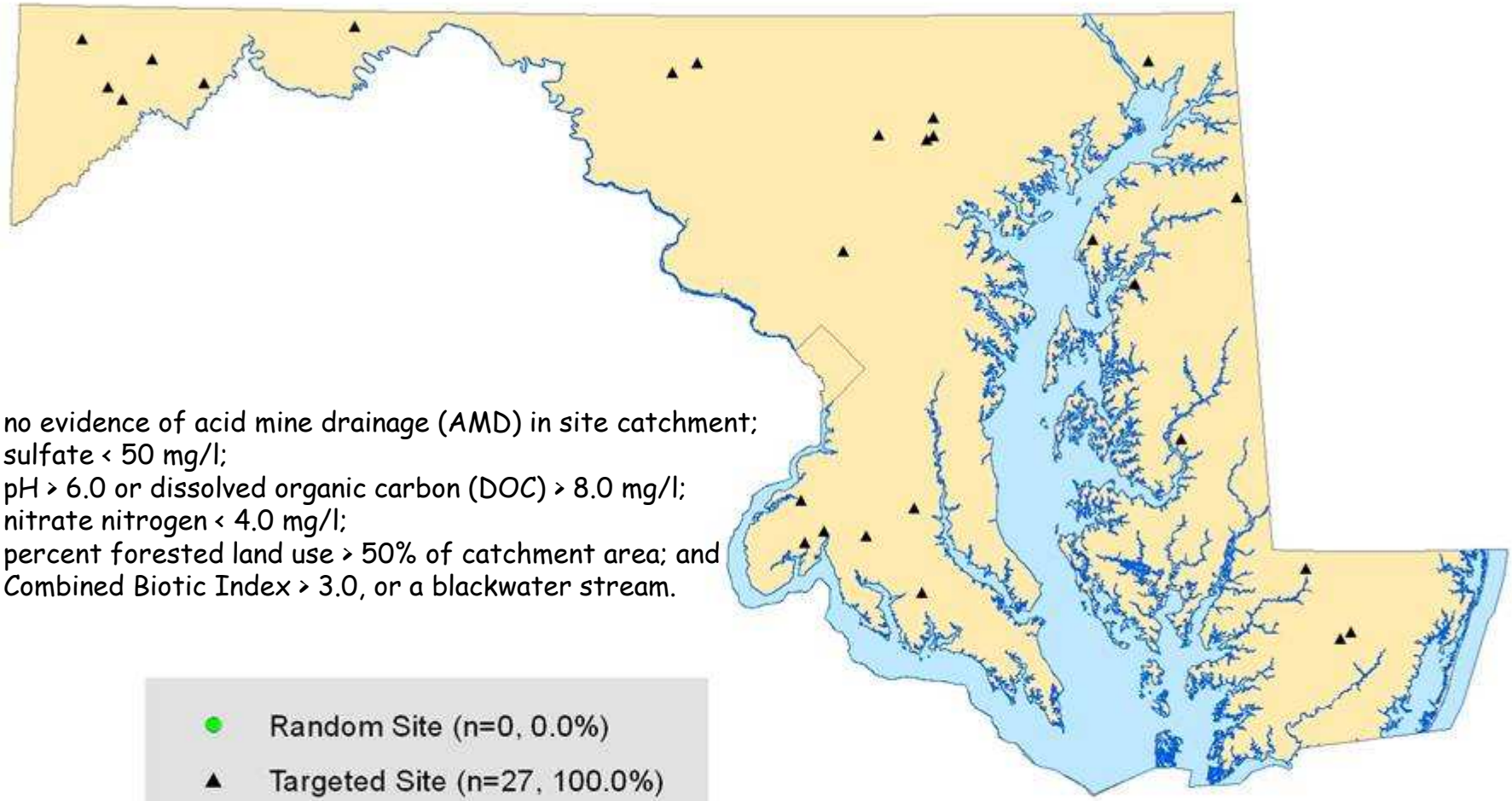
MBSS Sentinel Sites



- no evidence of acid mine drainage (AMD) in site catchment;
- sulfate < 50 mg/l;
- pH > 6.0 or dissolved organic carbon (DOC) > 8.0 mg/l;
- nitrate nitrogen < 4.0 mg/l;
- percent forested land use > 50% of catchment area; and
- Combined Biotic Index > 3.0, or a blackwater stream.

● Random Site (n=0, 0.0%)

▲ Targeted Site (n=27, 100.0%)

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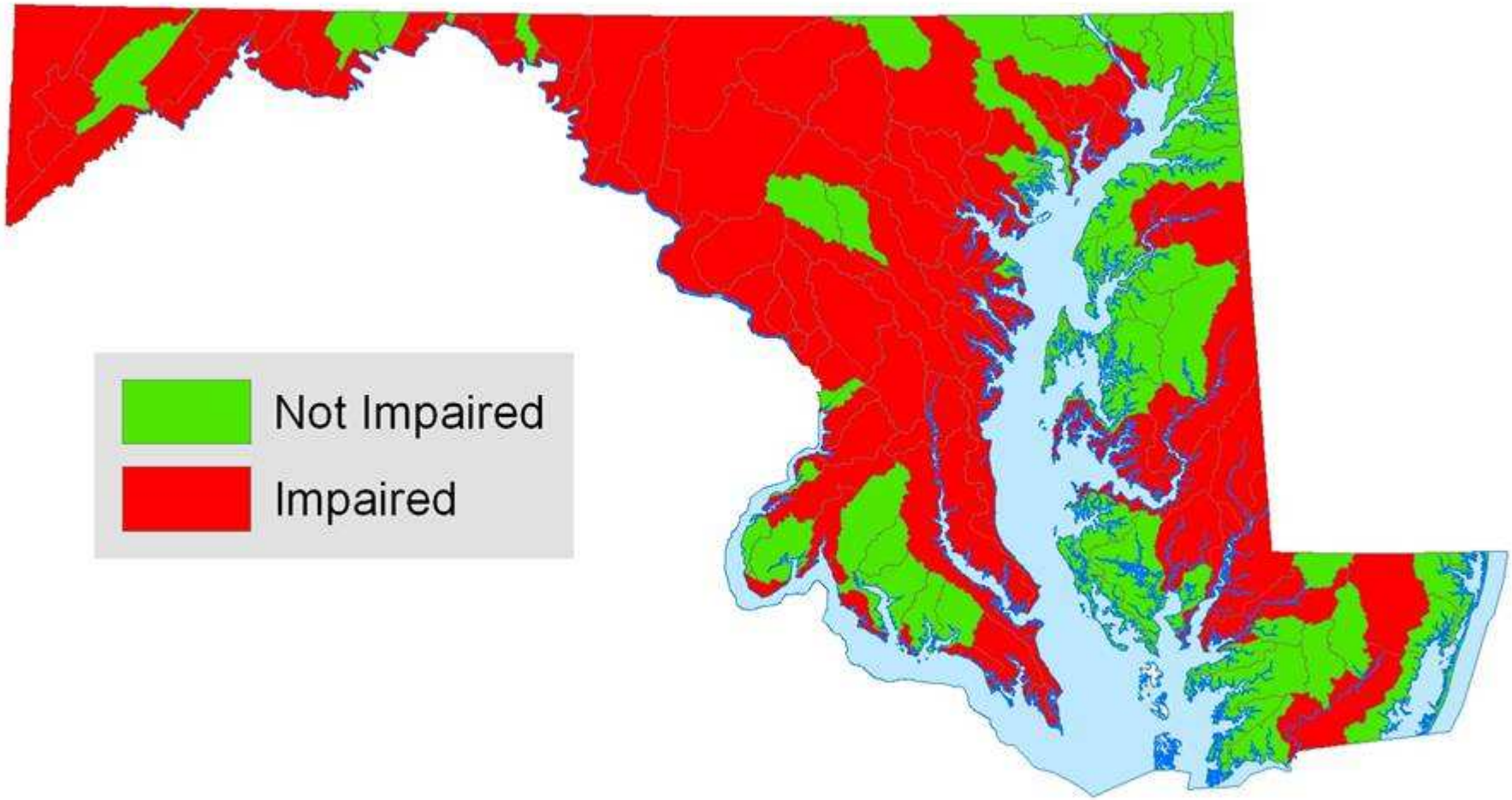
Maryland's Impaired Watersheds*



*based on MBSS-related biocriteria

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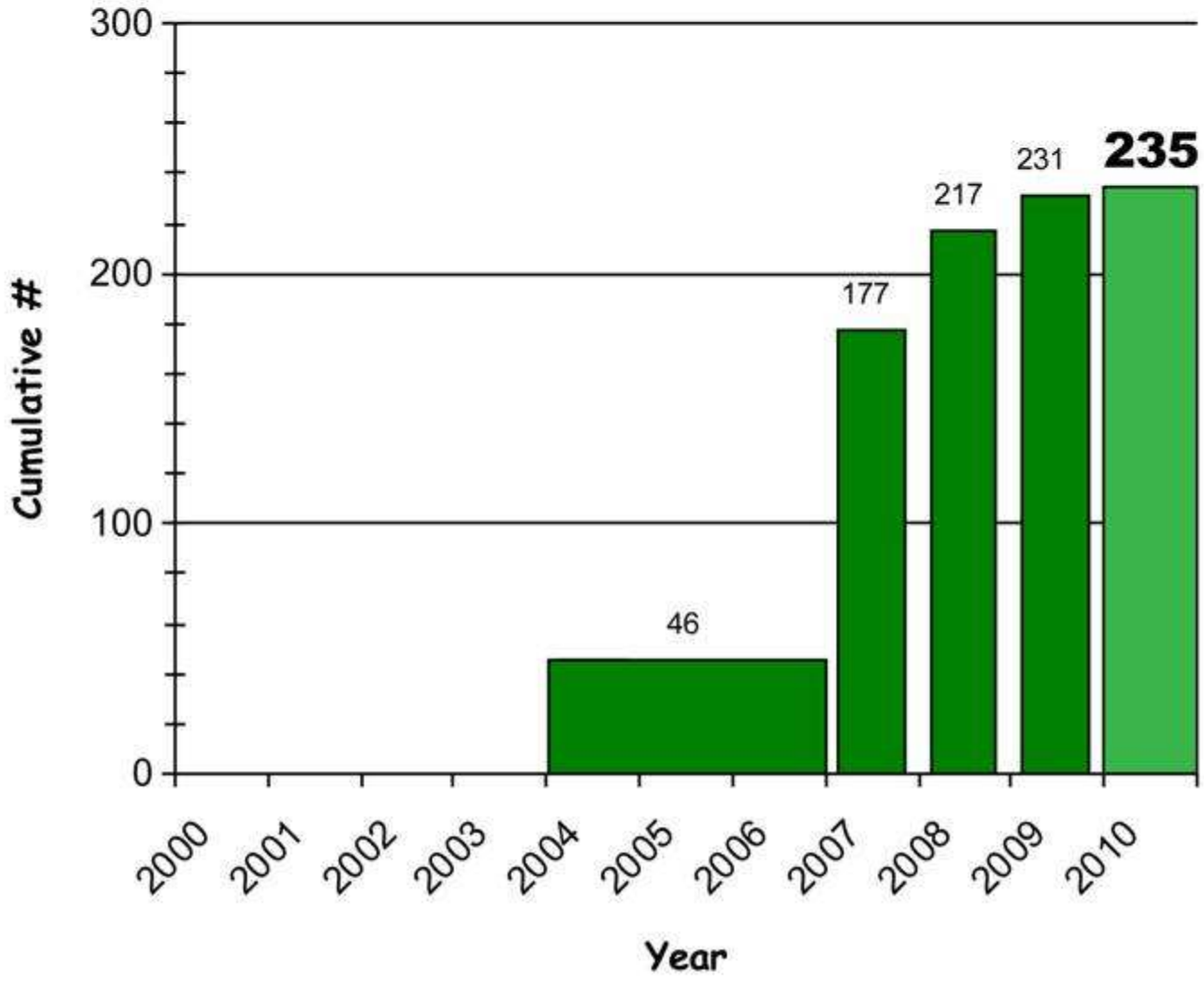
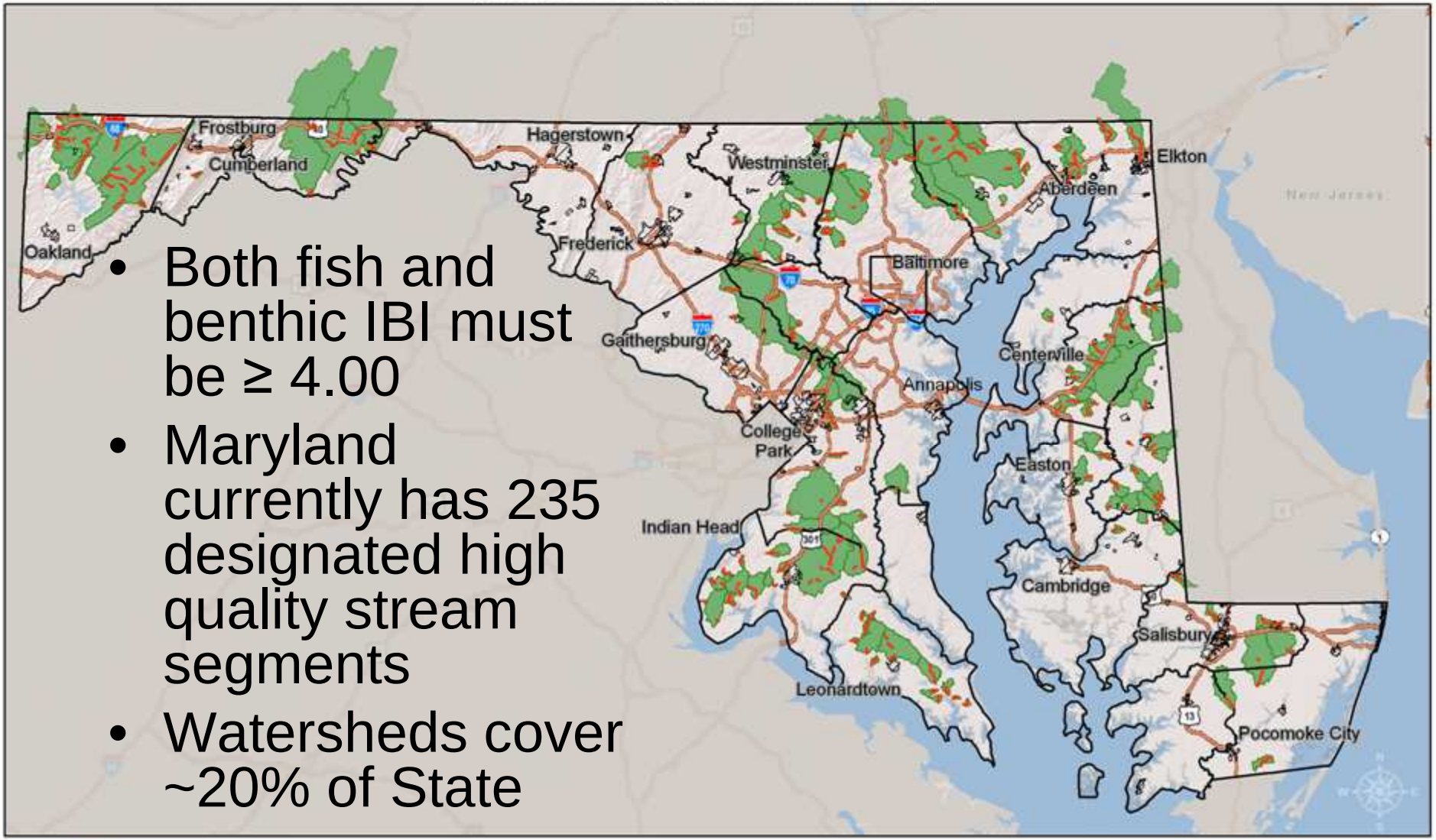
Tier II (High Quality) Waters

Stream Segments Designated



High Quality (Tier II) Waters in Maryland

[Code of MD Regulations 26.08.02.04-1]



- Both fish and benthic IBI must be ≥ 4.00
- Maryland currently has 235 designated high quality stream segments
- Watersheds cover ~20% of State

MARYLAND

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor
Shari T. Wilson, Secretary
Robert M. Summers, Deputy Secretary

Tier II Stream Segments
Tier II Catchments
Municipal Boundary
County Boundary

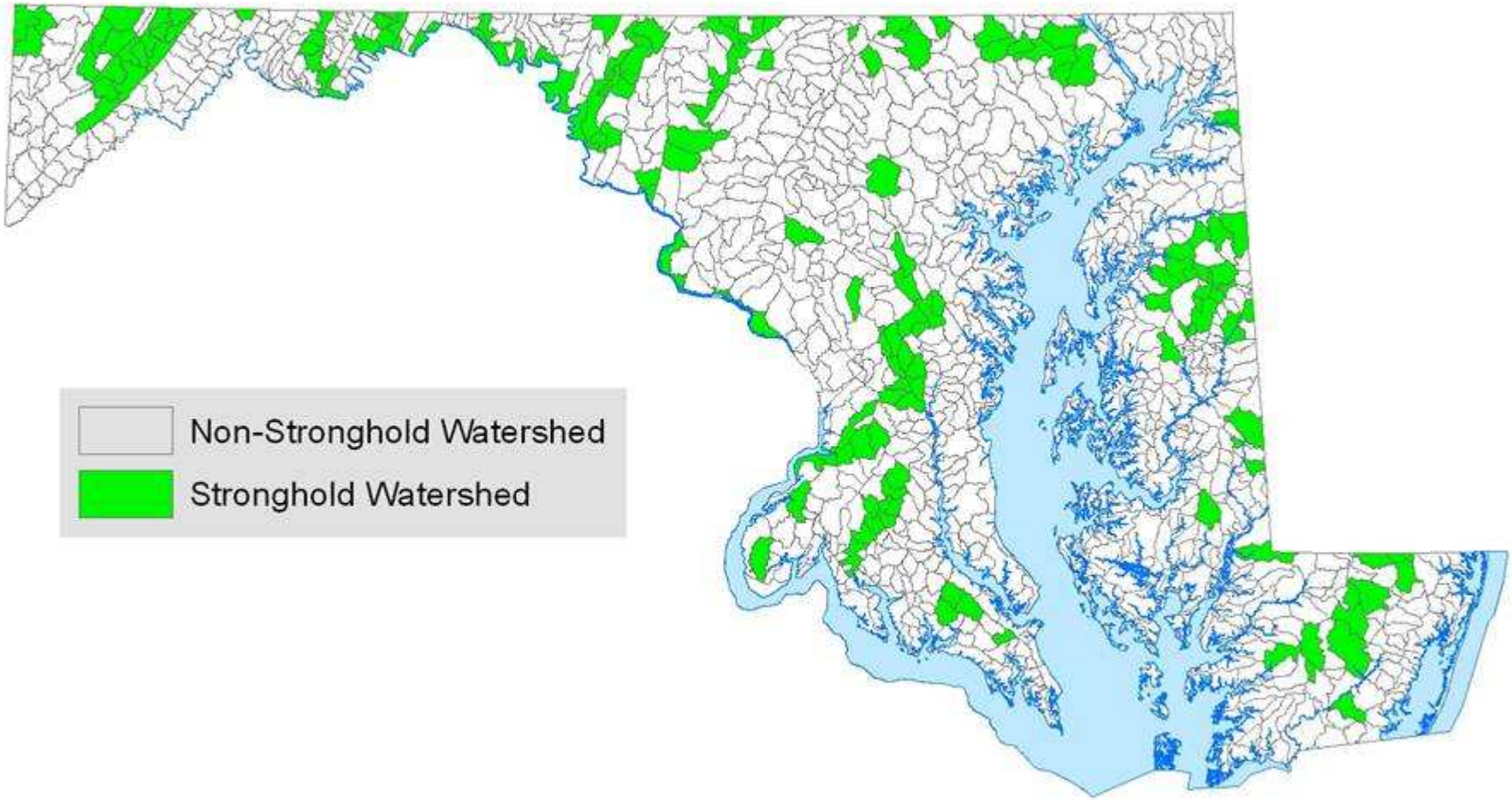
0 10 20 40 Miles

MDE

Maryland Department of the Environment
Science Services Administration
Montgomery Park Business Center
1800 Washington Boulevard
Baltimore, Maryland 21230-1718

Date Map Prepared: Mar 1, 2010

Maryland's Stronghold Watersheds



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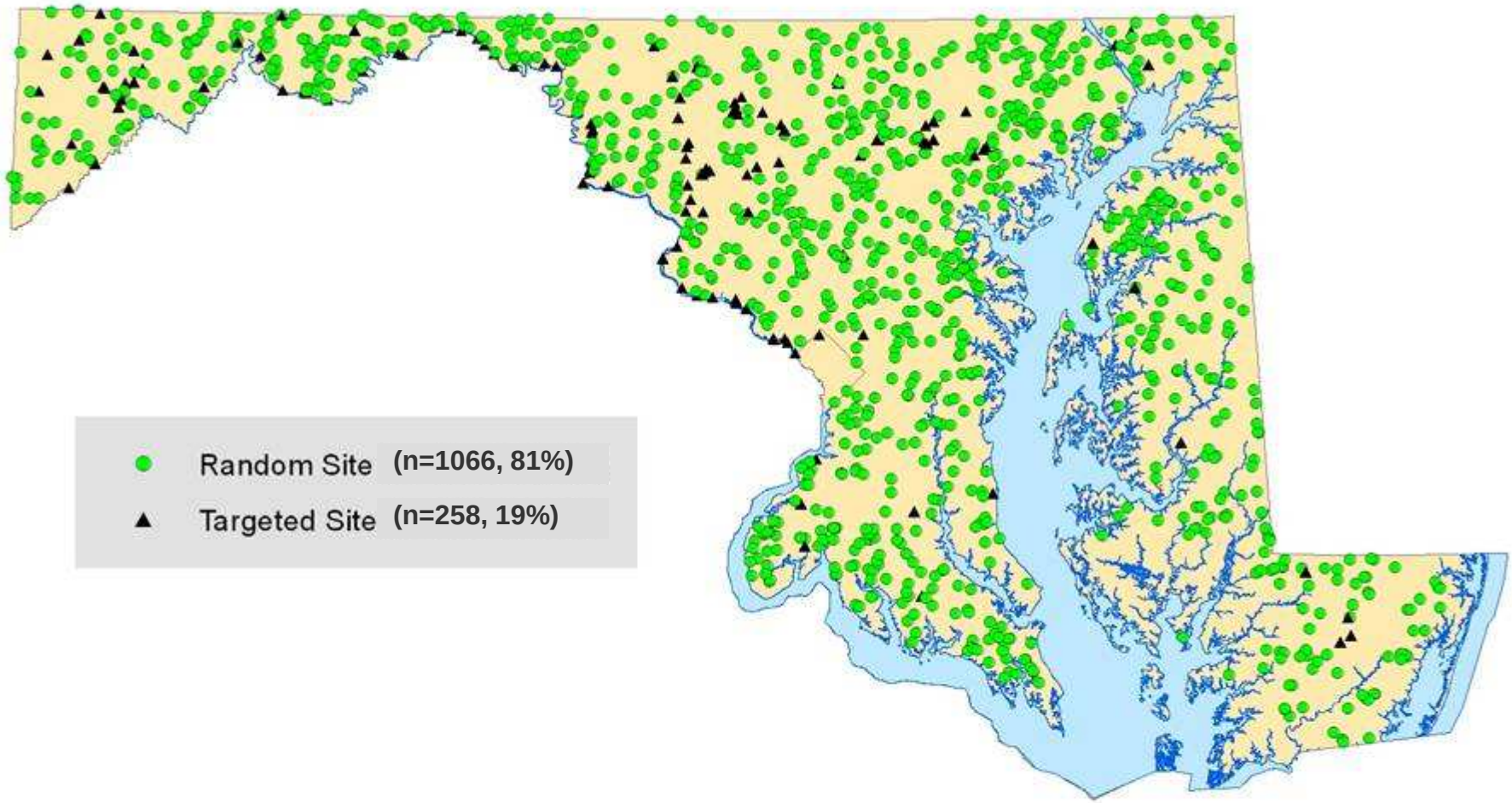
MBSS Round Two (2000 - 2004)



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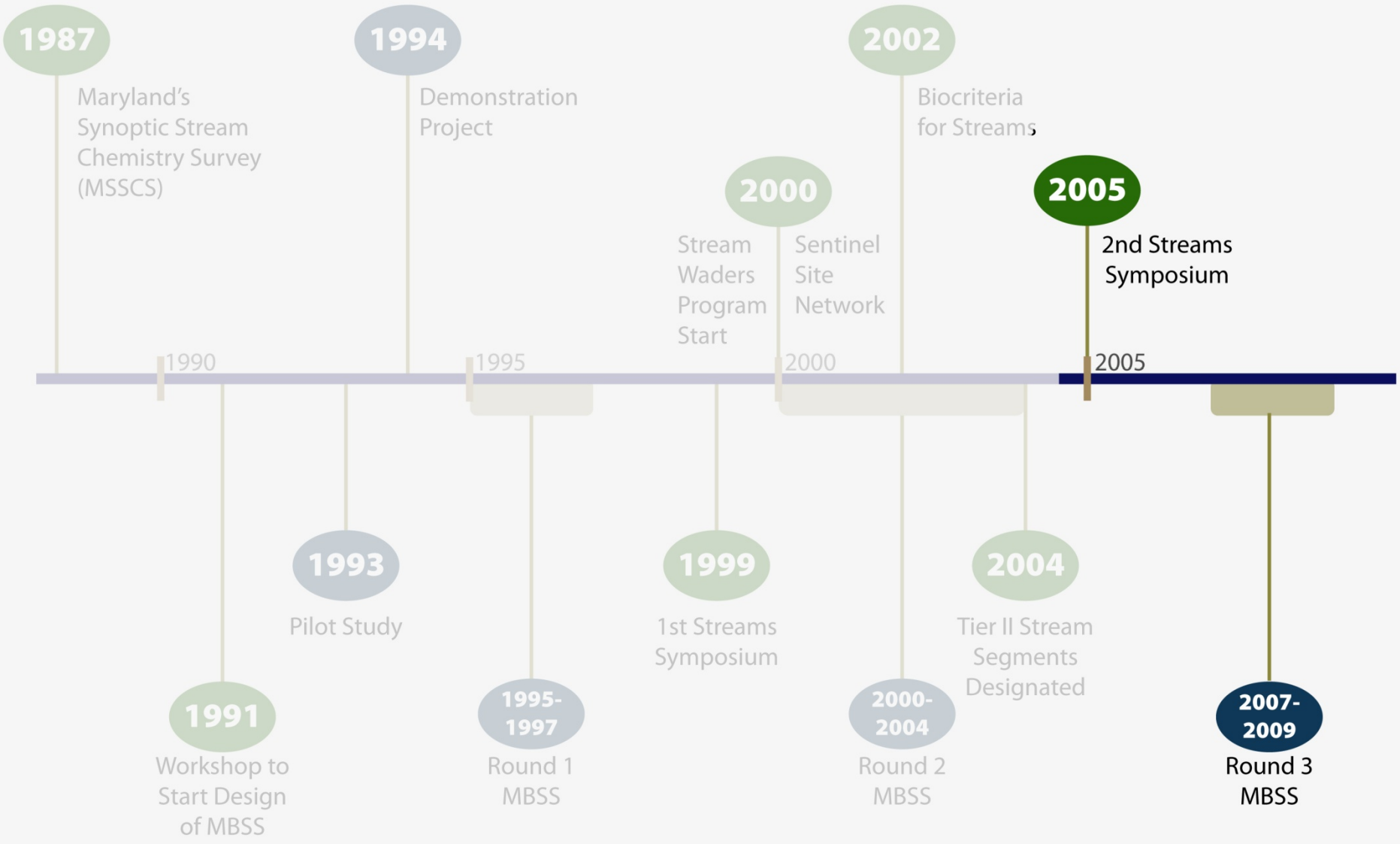
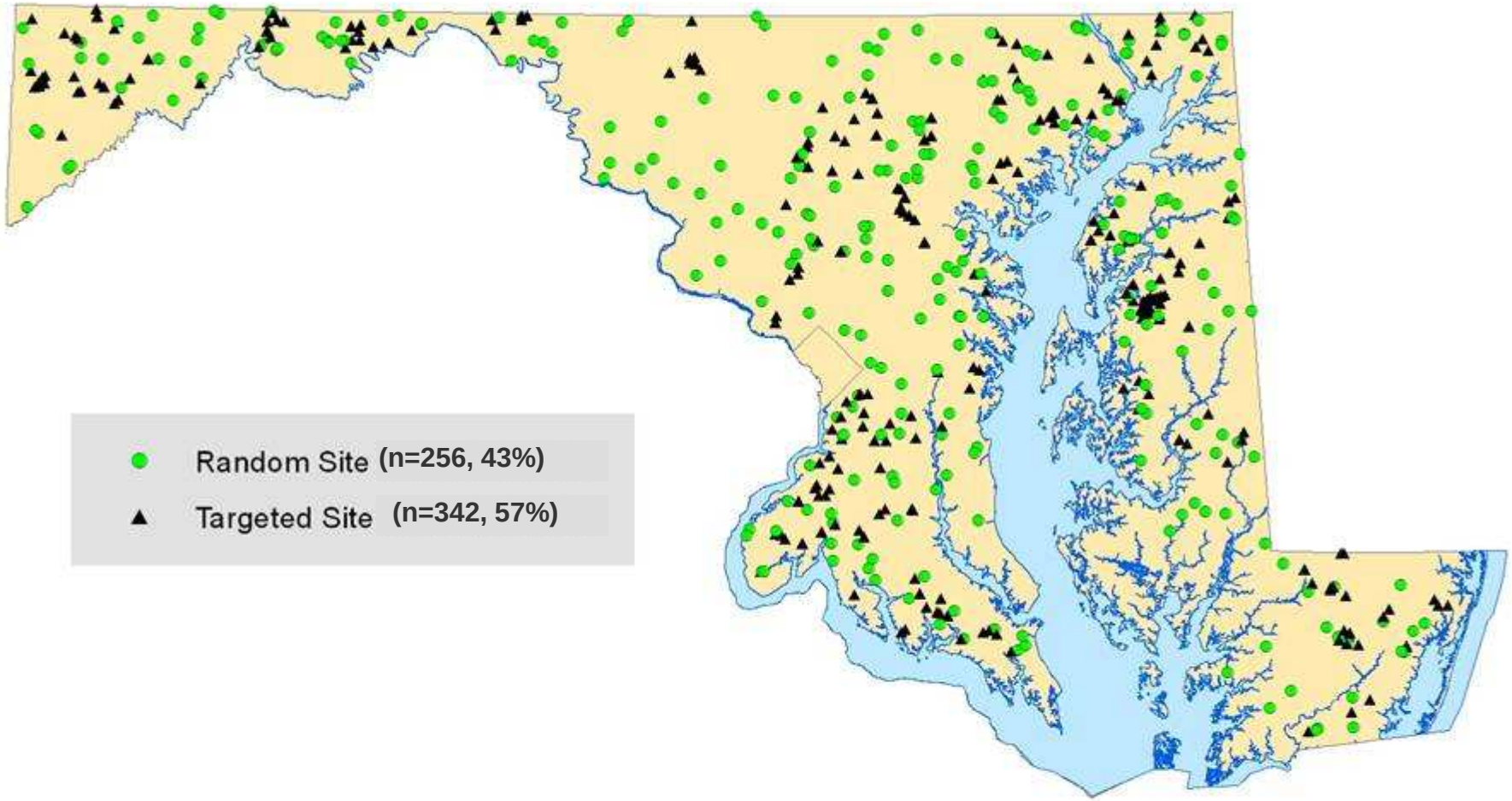
MBSS TIMELINE



MBSS Round Three (2007 - 2009)



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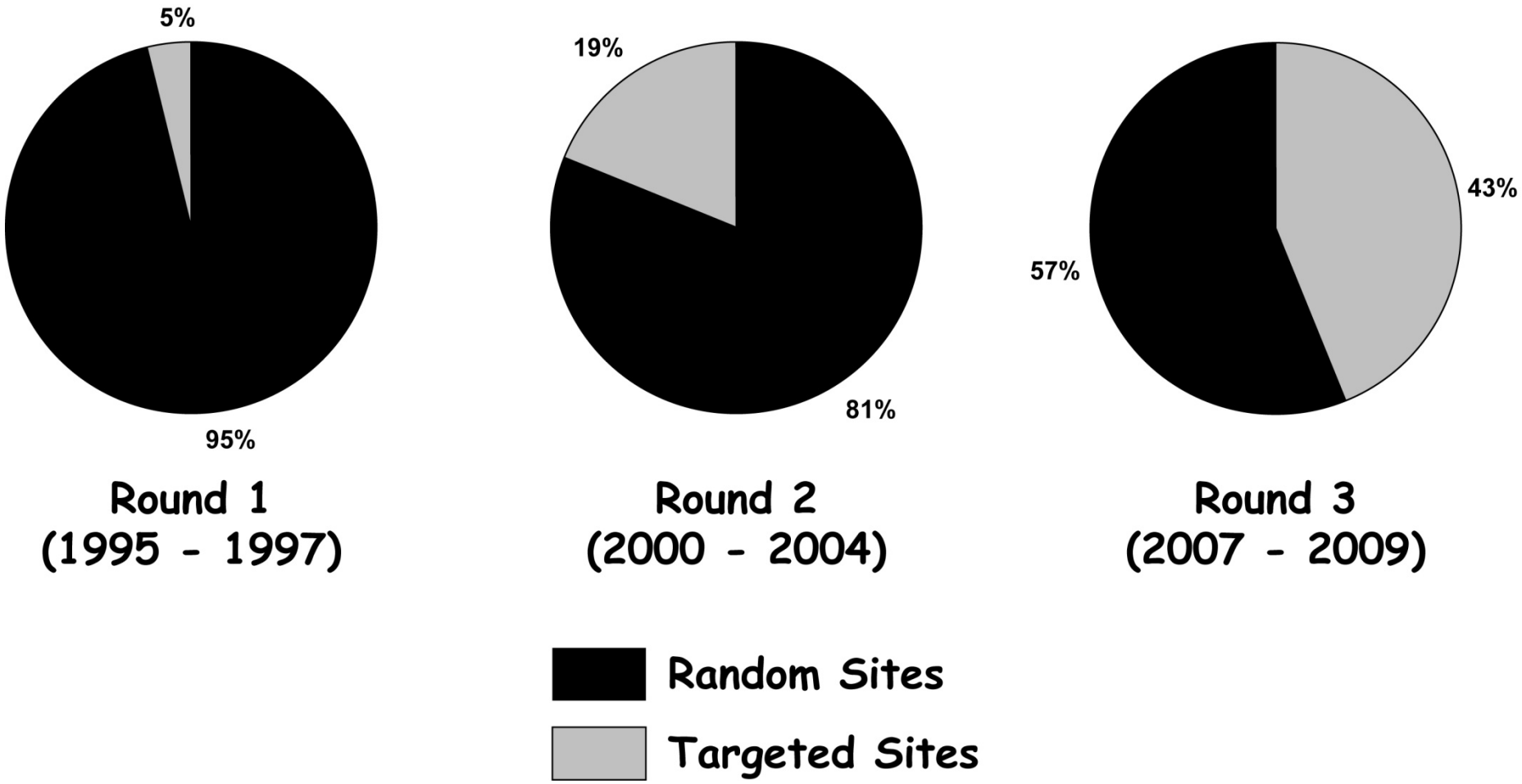
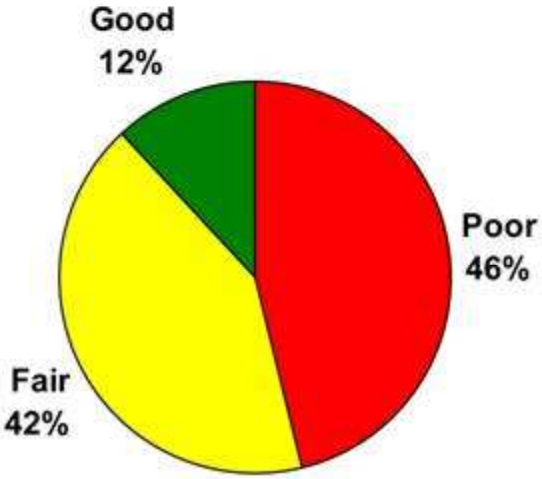
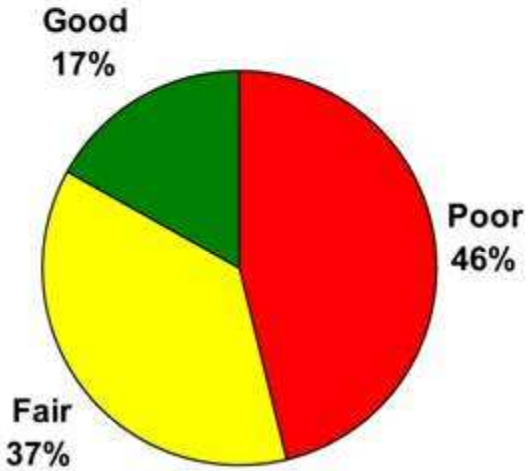
MBSS:
Evolution Overview



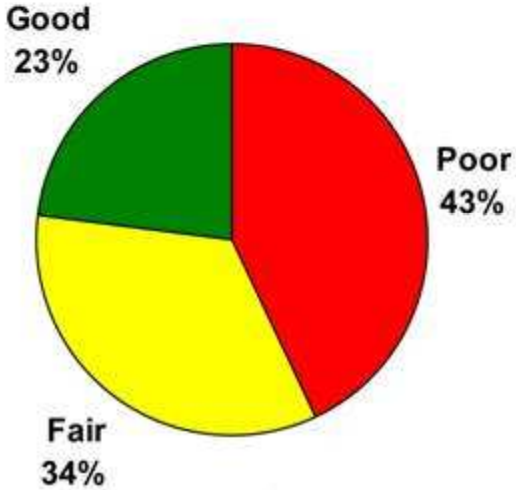
Maryland Stream Conditions



Round 1
(1995 - 1997)



Round 2
(2000 - 2004)



Round 3
(2007 - 2009)

Based on MBSS Biological Indicators

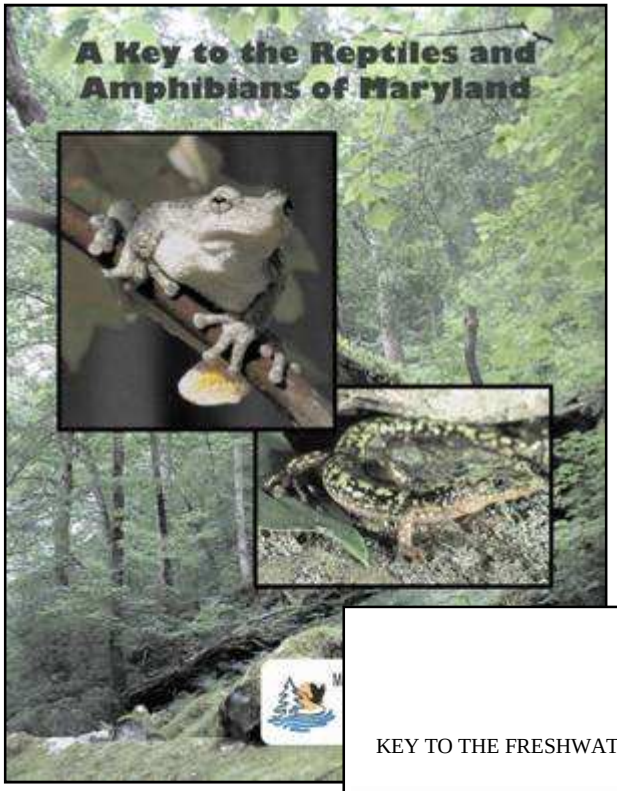
More Uses of MBSS Data

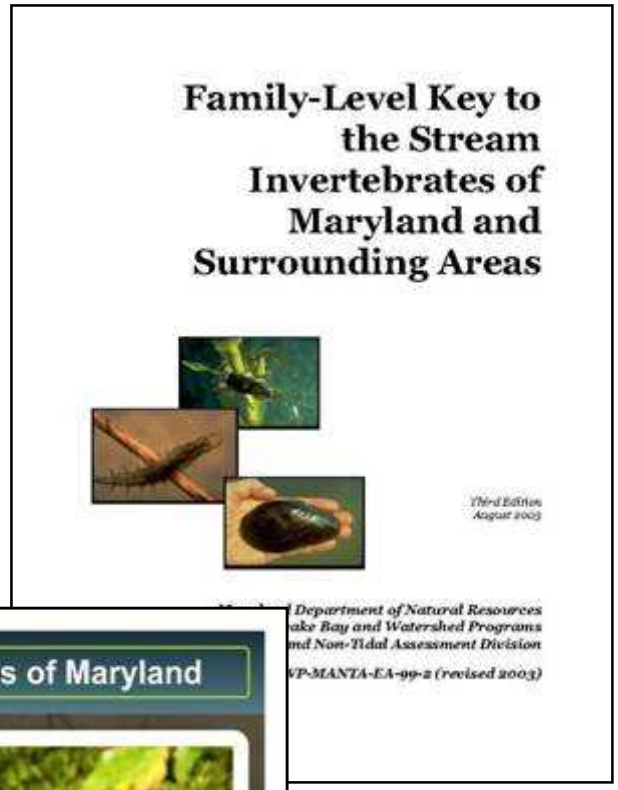
- Acid Deposition Reports to MD State Legislature
- 305(b) Report to US EPA
- Watershed Restoration Action Strategy/2010 Trust Fund Projects
- **Environmental Review**
- Imperiled Species Management
- Brook Trout Management Plan
- **Dam Removal Monitoring**
- Surface Water Use Class Refinement
- Green Infrastructure/GreenPrint/Priority Conservation Areas
- Land Acquisition and Easements/Program Open Space
- Wildlife Diversity Conservation Plan
- **Maryland Stream Atlas**
- Invasive Species Tracking/Response
- **Climate Change Monitoring**

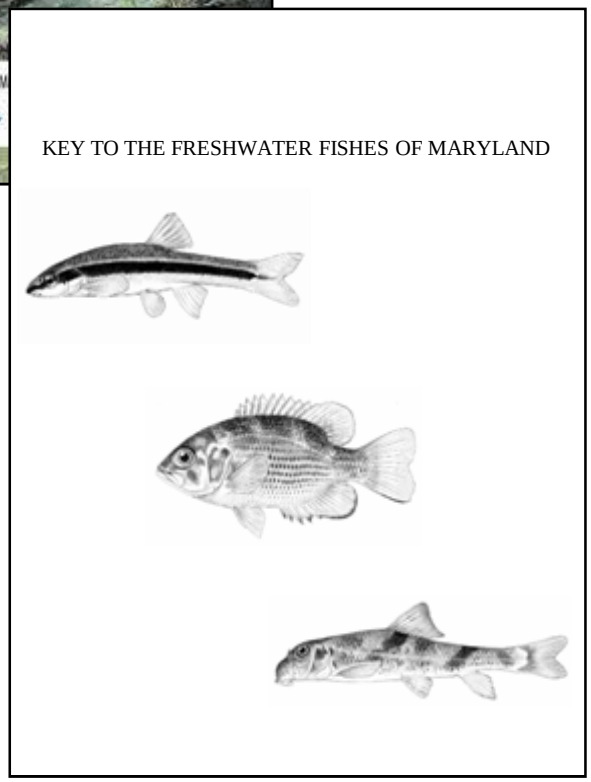
Plus…

Critter Posters

Critter Keys

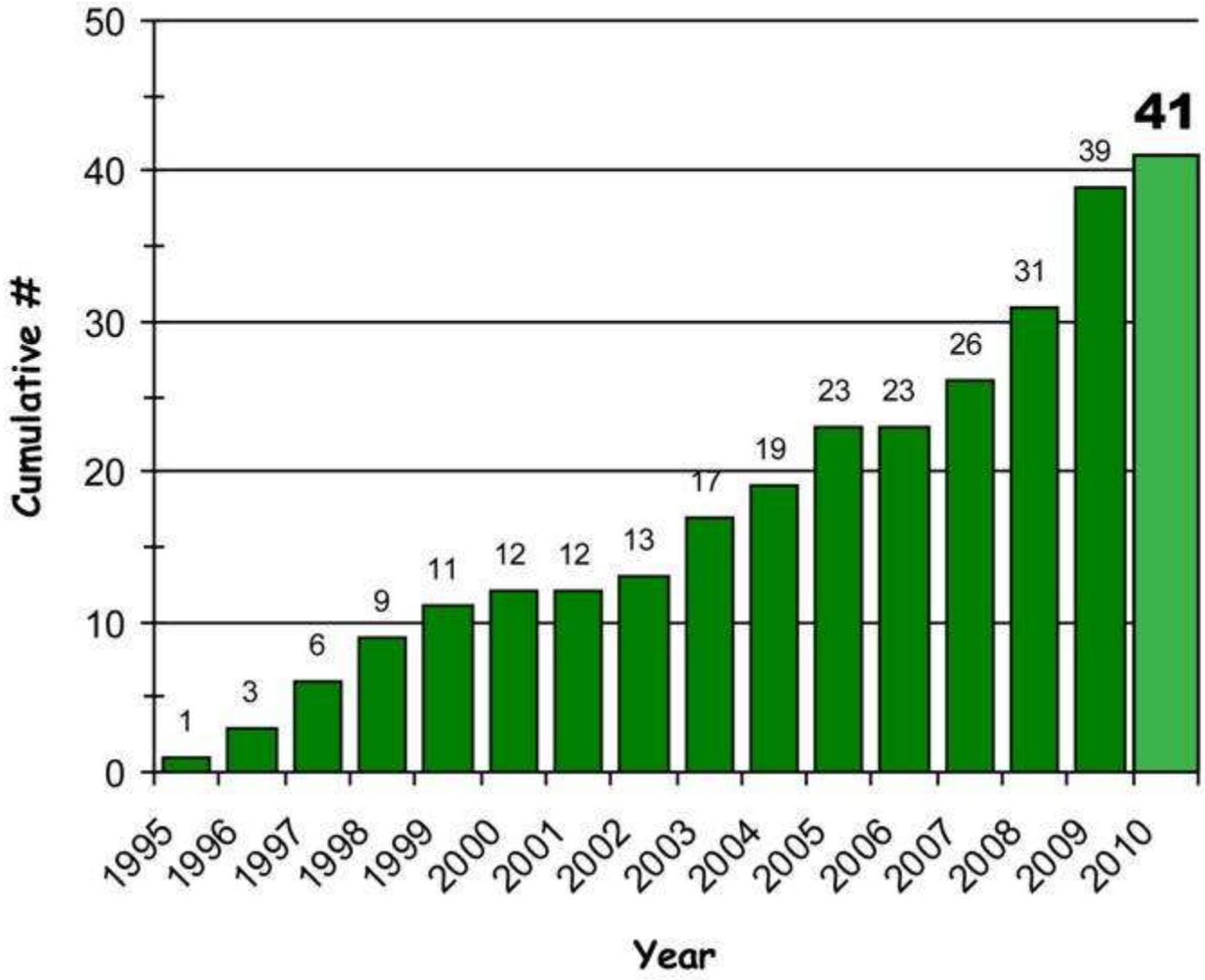






Maryland Biological Stream Survey

Published Papers



The MBSS:
"By the Numbers"

- **3** Statewide Survey & Assessments

2,529
Random MBSS Sites

966 Targeted MBSS Sites

- **10** Years of Sentinel Site Data

Actual Miles of Streams Sampled (MBSS + SW) **271** 3% of total

5,516
Targeted Stream Waders Sites