Establishing Biological Potential to Support Restoration Goals and Connecticut's Anti-degradation Policy

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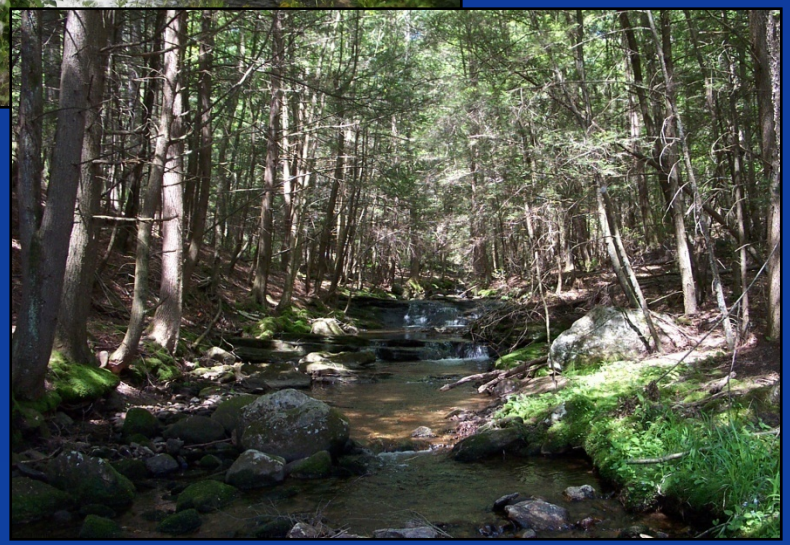
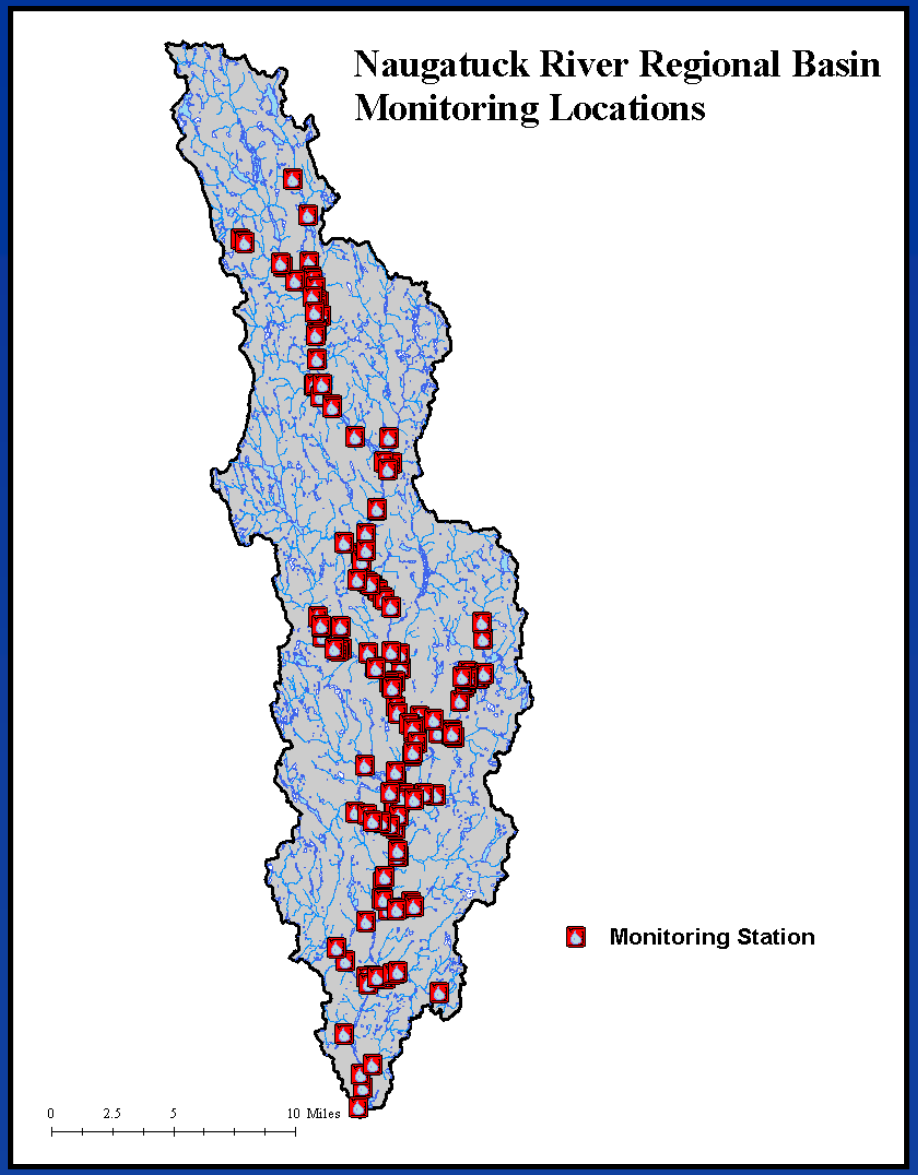


Tools to Support Water Quality Management

Targeted Monitoring

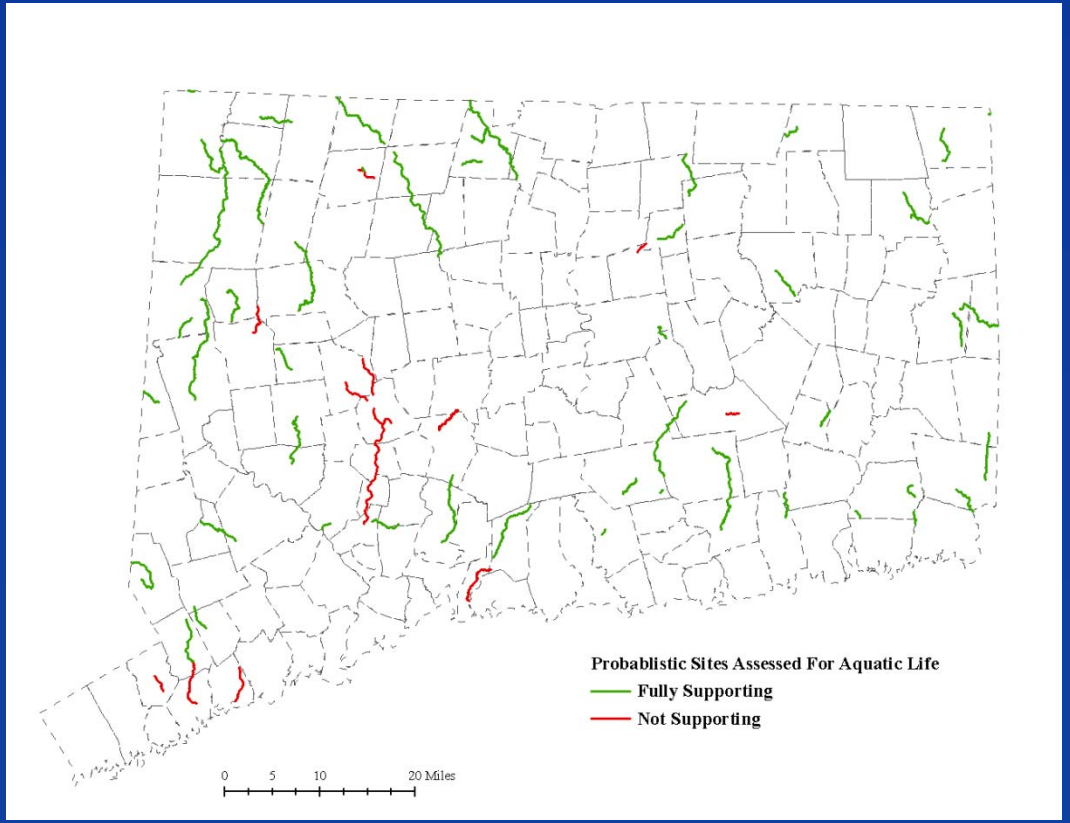
- Assess WQS Attainment
- Measure localized trends
- Identify sources of pollutants specific to waters
- Support development of local management measures (TMDLs, NPDES permits, NPS BMPs)



Tools to Support Water Quality Management

Statistical Monitoring

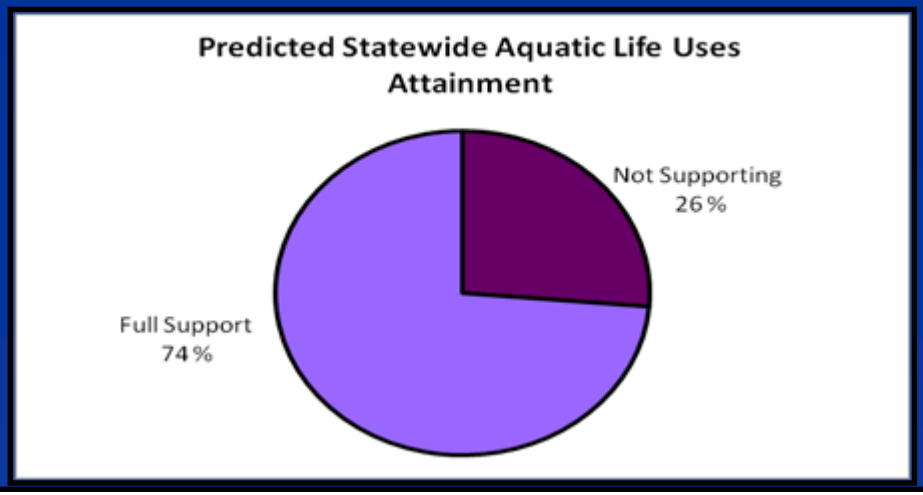
- Estimate proportion of all waters supporting water quality goals
- Measure overall State-wide water quality trends
- Support development of new water quality standards
- Prioritize targeted monitoring

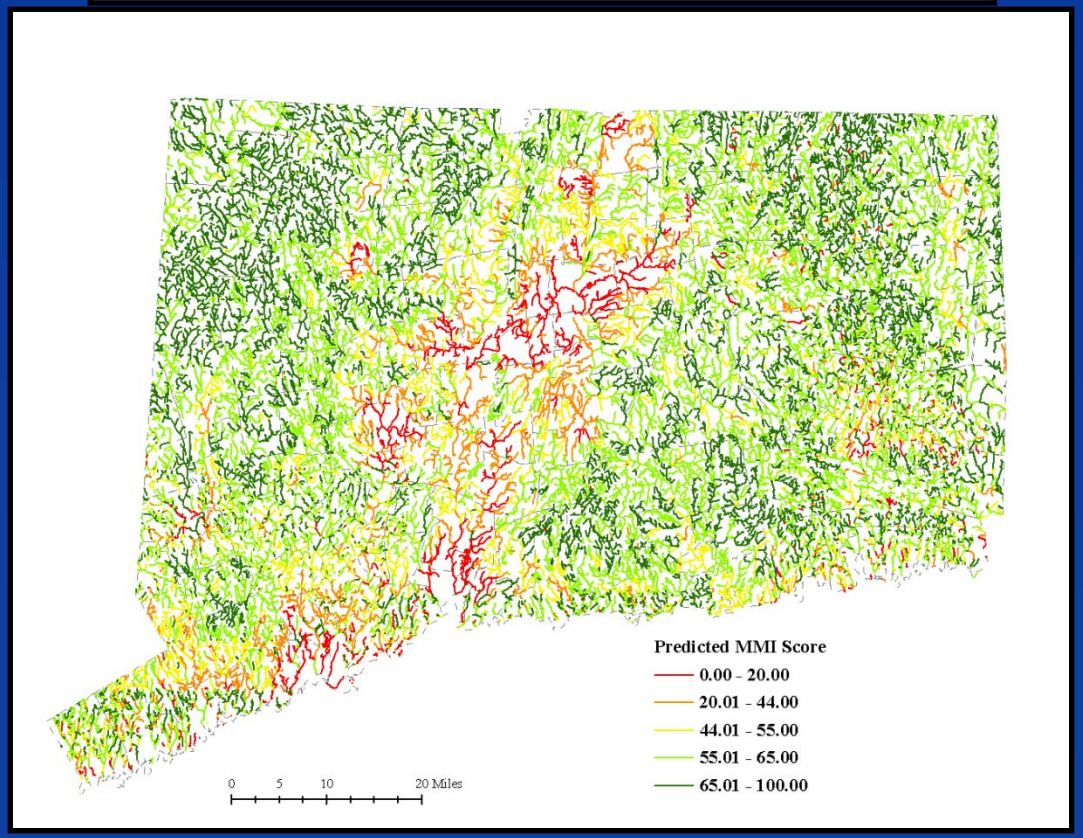


Tools to Support Water Quality Management

Modeling and landscape analysis

- Predict localized expected water quality condition
- Predict localized water quality trends
- Support development of local management measures (TMDLs, NPDES permits, NPS BMPs)
- Prioritize targeted monitoring

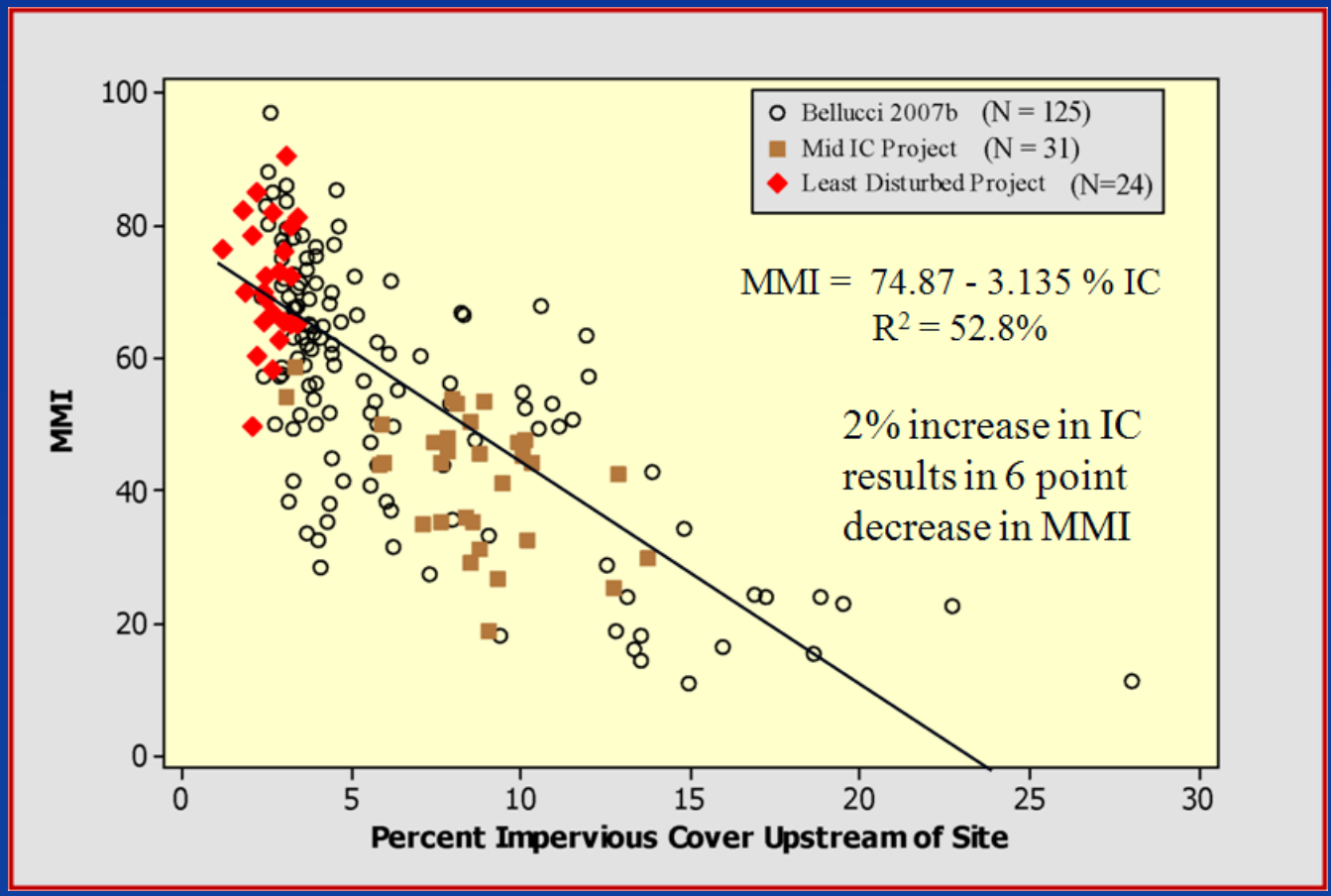




Prior Research

Modeling and landscape analysis: Impervious Cover

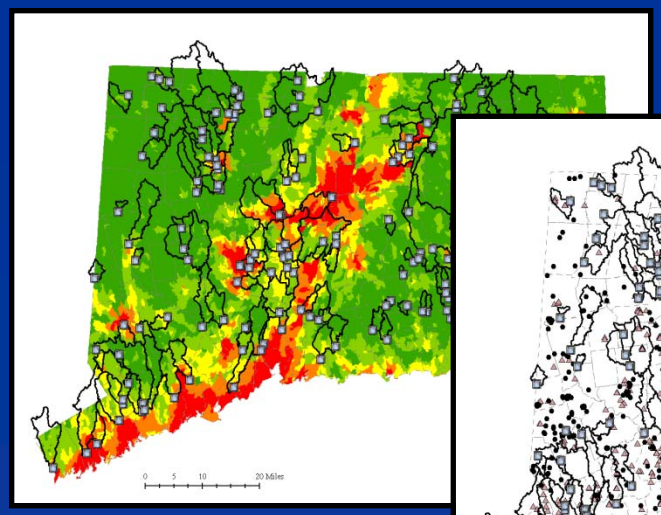
- Negative relationship between MMI and increasing total percent impervious cover
- Support development of local management measures (TMDLs, NPS BMPs)
- Prioritize targeted monitoring for TMDLs

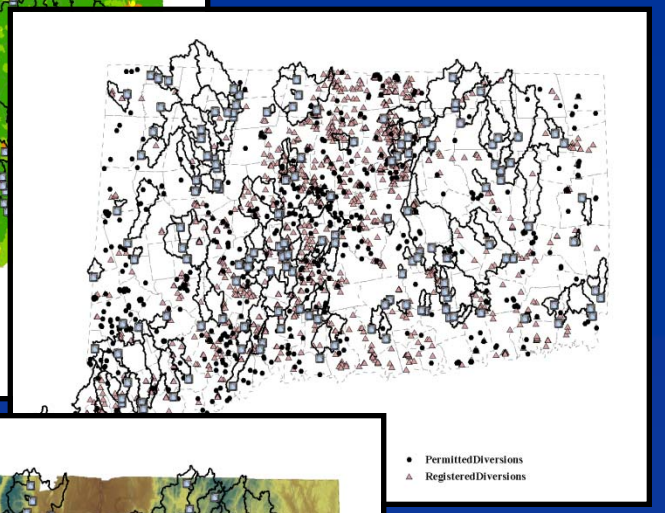


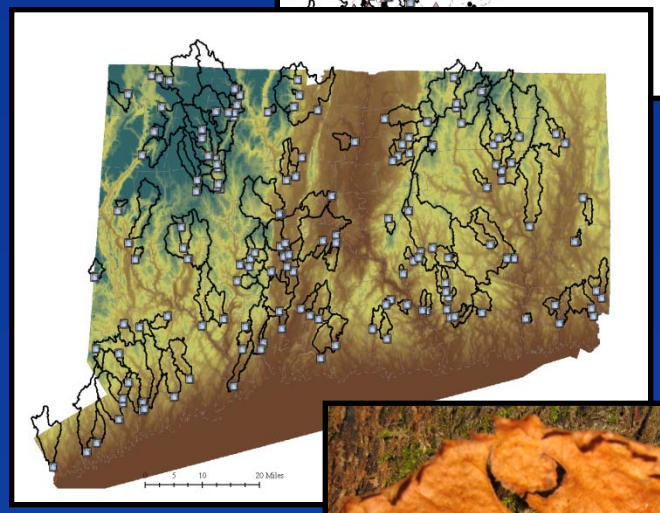
Project Plan

Modeling and landscape analysis: Expected Biological Condition

- Expand impervious cover work by including other factors that potentially effect the biological condition
- Establish a methodology to predict the expected biological condition at an unmonitored site utilizing geospatial analysis of readily available drainage basin data



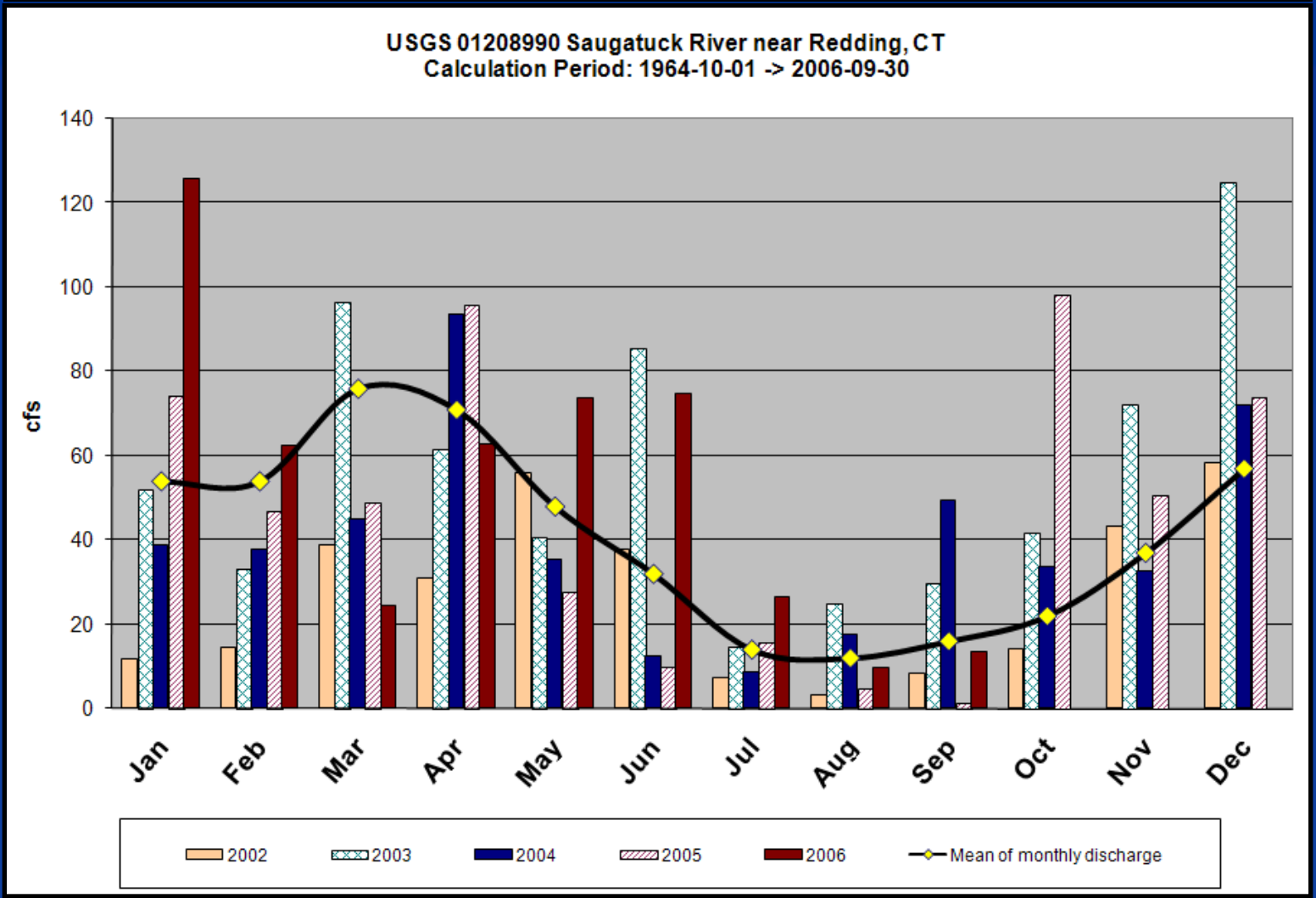




Methodology

Site Selection

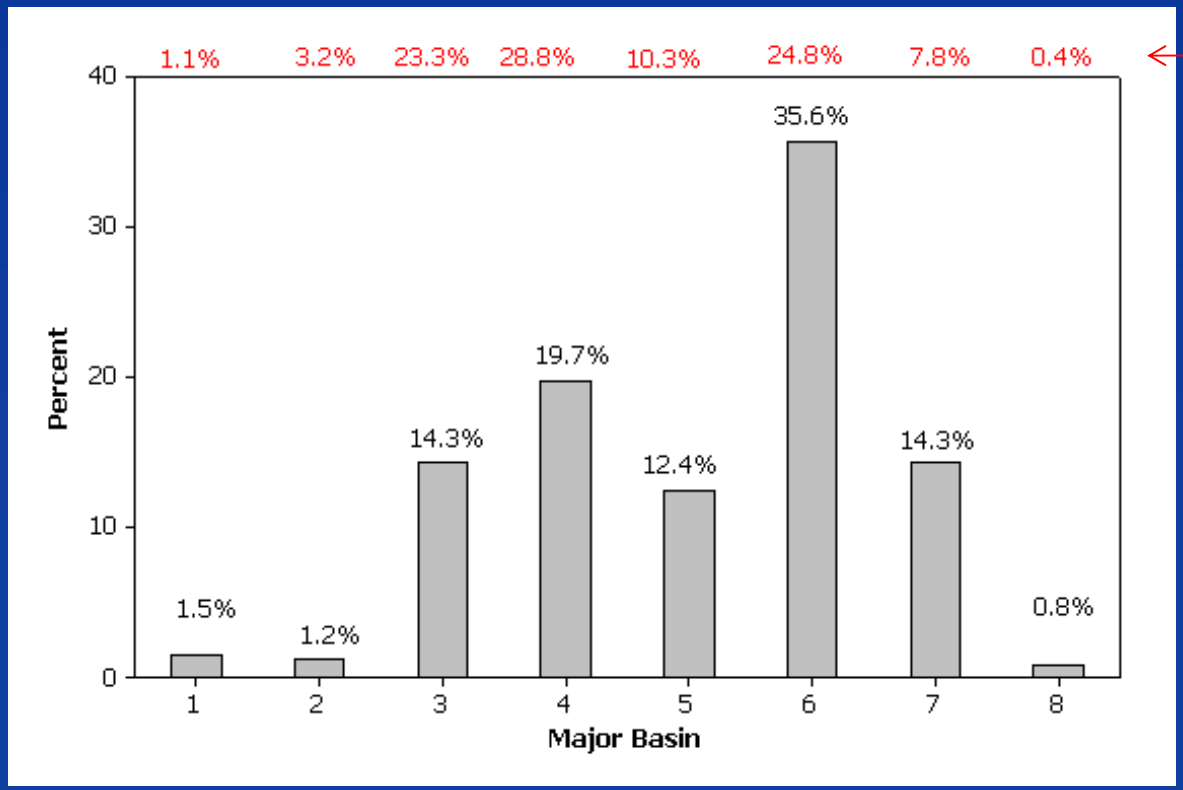
- Initial list of 266 sites from 2002 – 2007 (excluding 2005)
- 2002 – 2007 captured the range of flow conditions



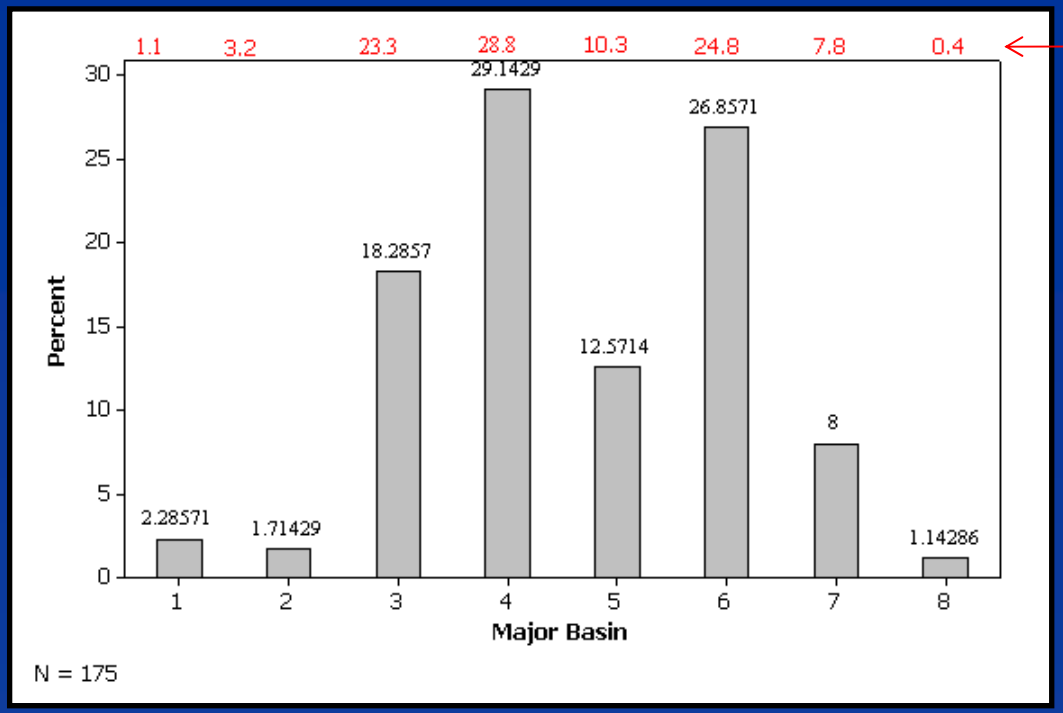
Methodology

Site Selection

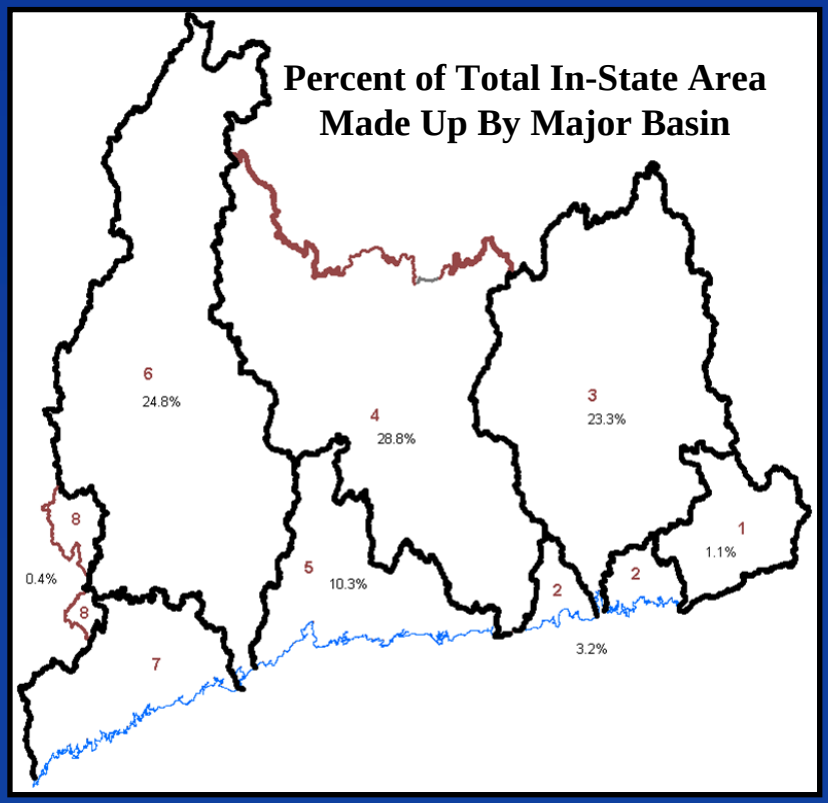
- Included probabilistic, rotating basin and targeted monitoring sites
- Noted skew of sites by major basin



Methodology



Site Selection



- Matched the sample size of each 8 major basins by the proportion of surface area each basin makes up in the State
- Randomly selected sites in each major basin based on targeted percentages so that selection of sites were weighted by In-State basin area.

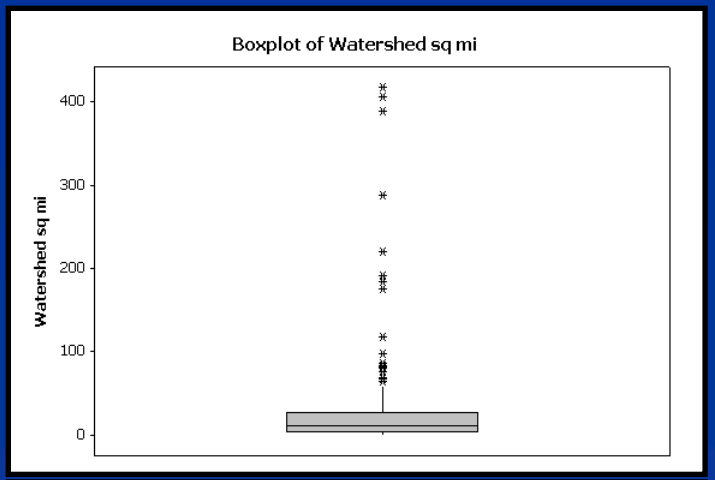
Methodology

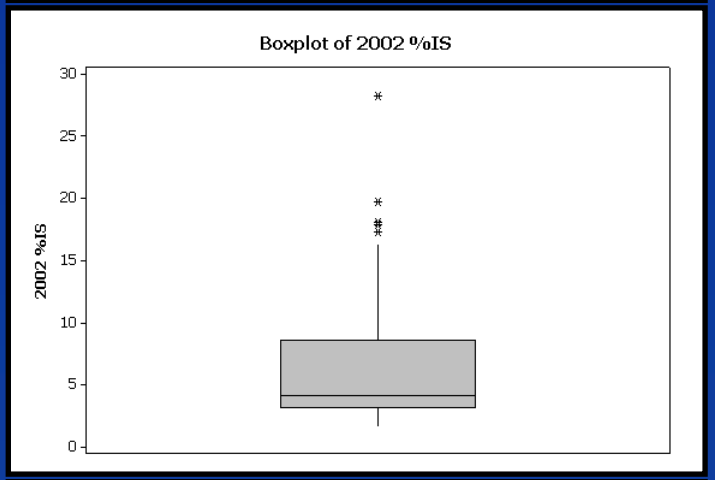
Site Selection

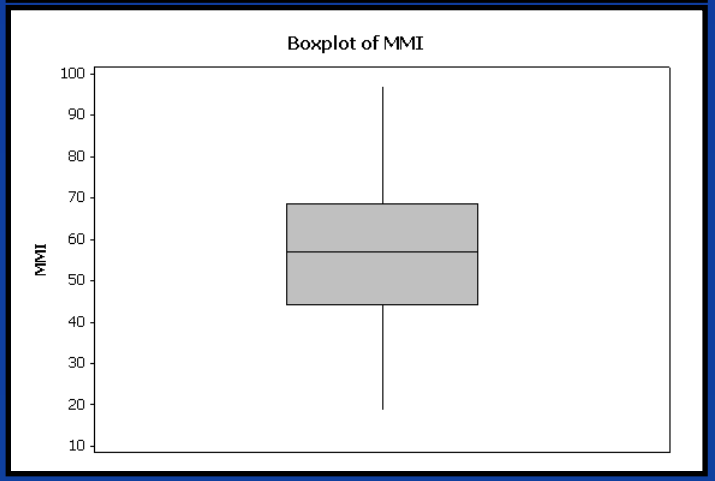
- Refined selection to exclude some outliers
- Removed ‘outlier’ large streams from dataset
- Removed streams with large majority of drainage basin outside State borders from dataset

Descriptive Statistics: MMI, 2002 %IS, Watershed sq mi

Variable	Total Count	Mean	StDev	Minimum	Median	Maximum
MMI	175	56.05	17.65	18.71	57.13	97.09
2002 %IS	175	6.018	4.195	1.616	4.099	28.248
Watershed sq mi	175	30.55	63.14	0.47	11.74	416.93



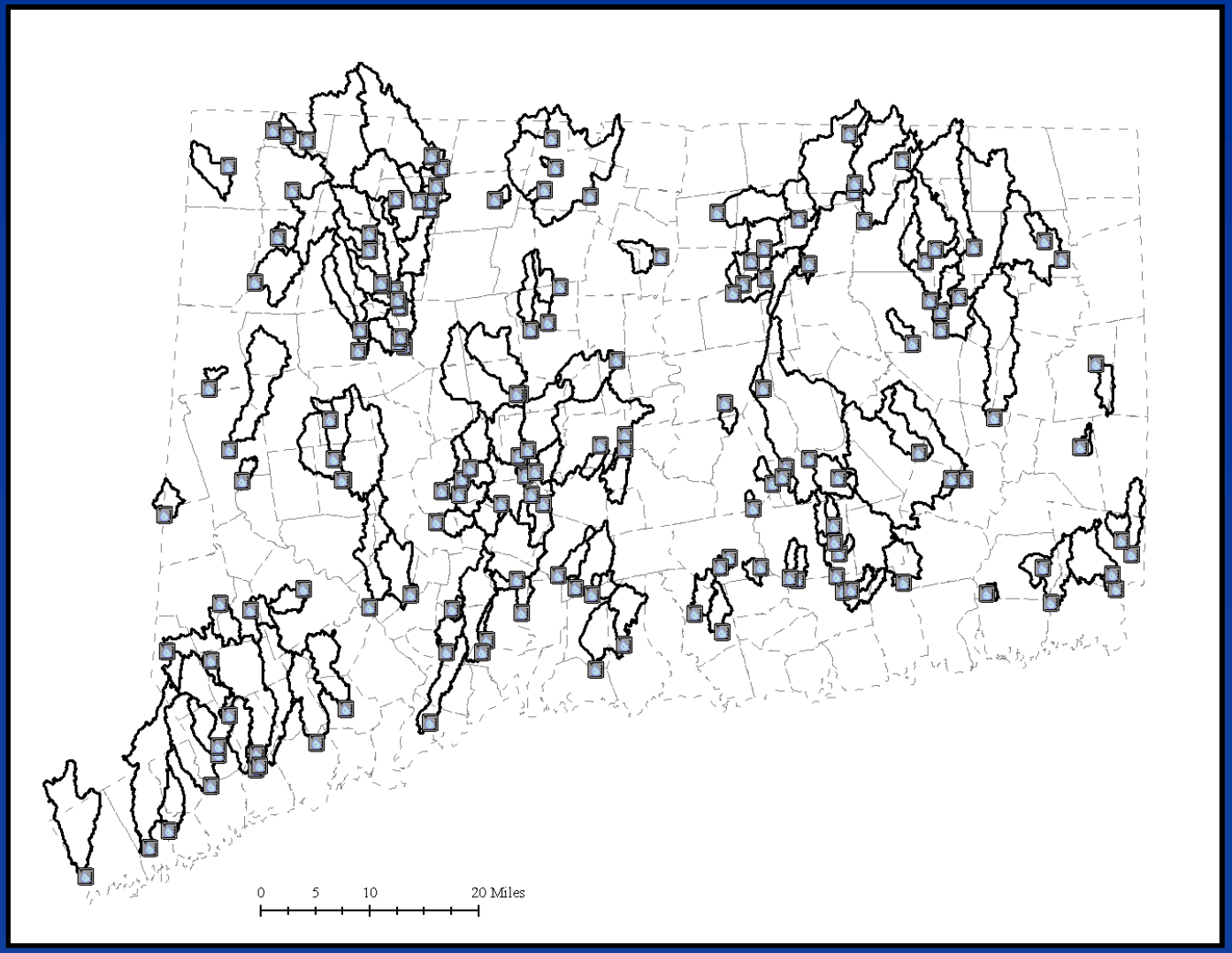




Methodology

Landscape Variable Selection

- Delineated drainage basin from stream site
- Assembled best available and relevant geospatial datasets
- Calculated landscape variables for each site drainage basin

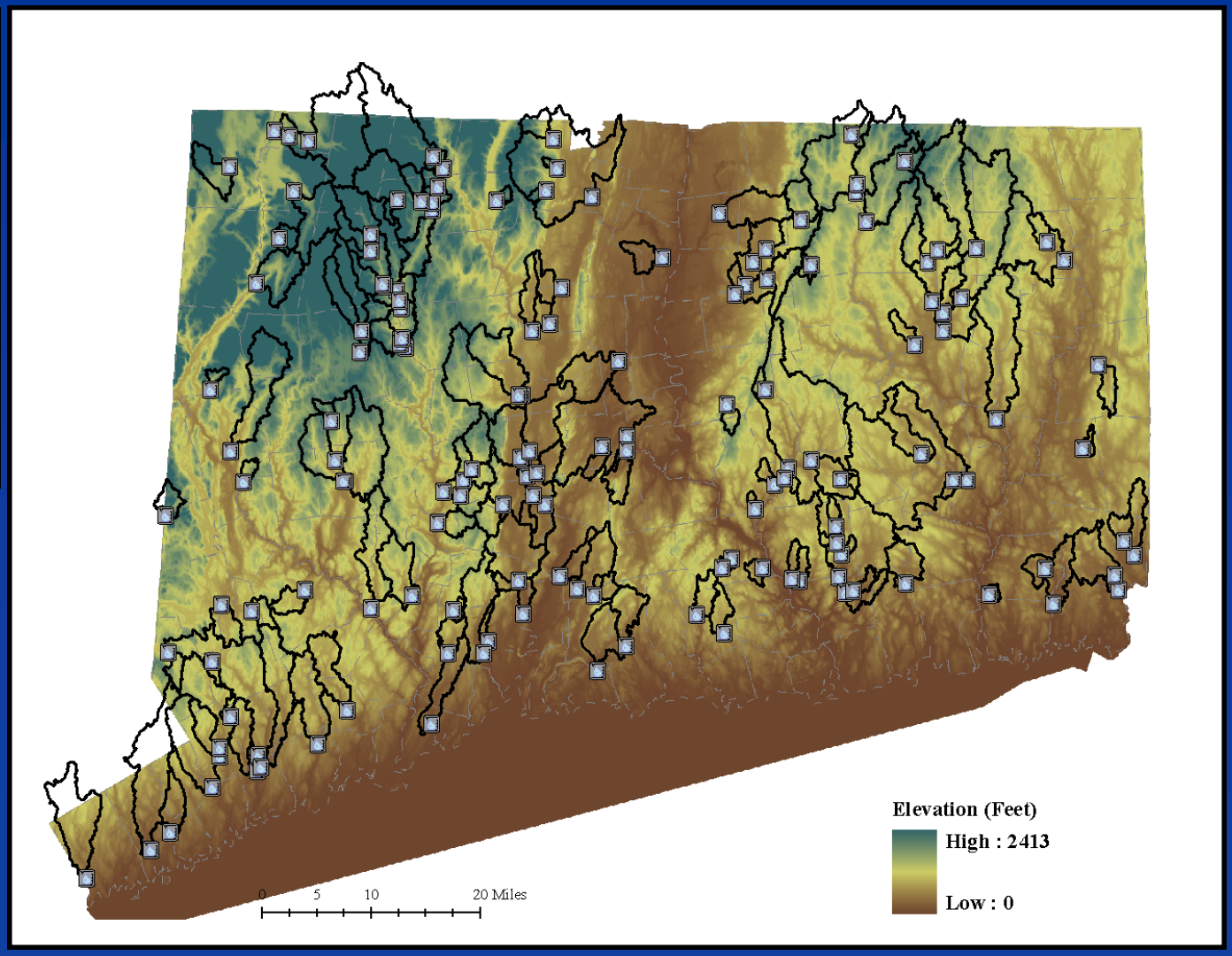


Methodology

Landscape Variable Selection

Natural Variables

- Drainage Area
- Stream Density
- Stream Order
- Elevation (At Site, Max, Min)
- Soil Type

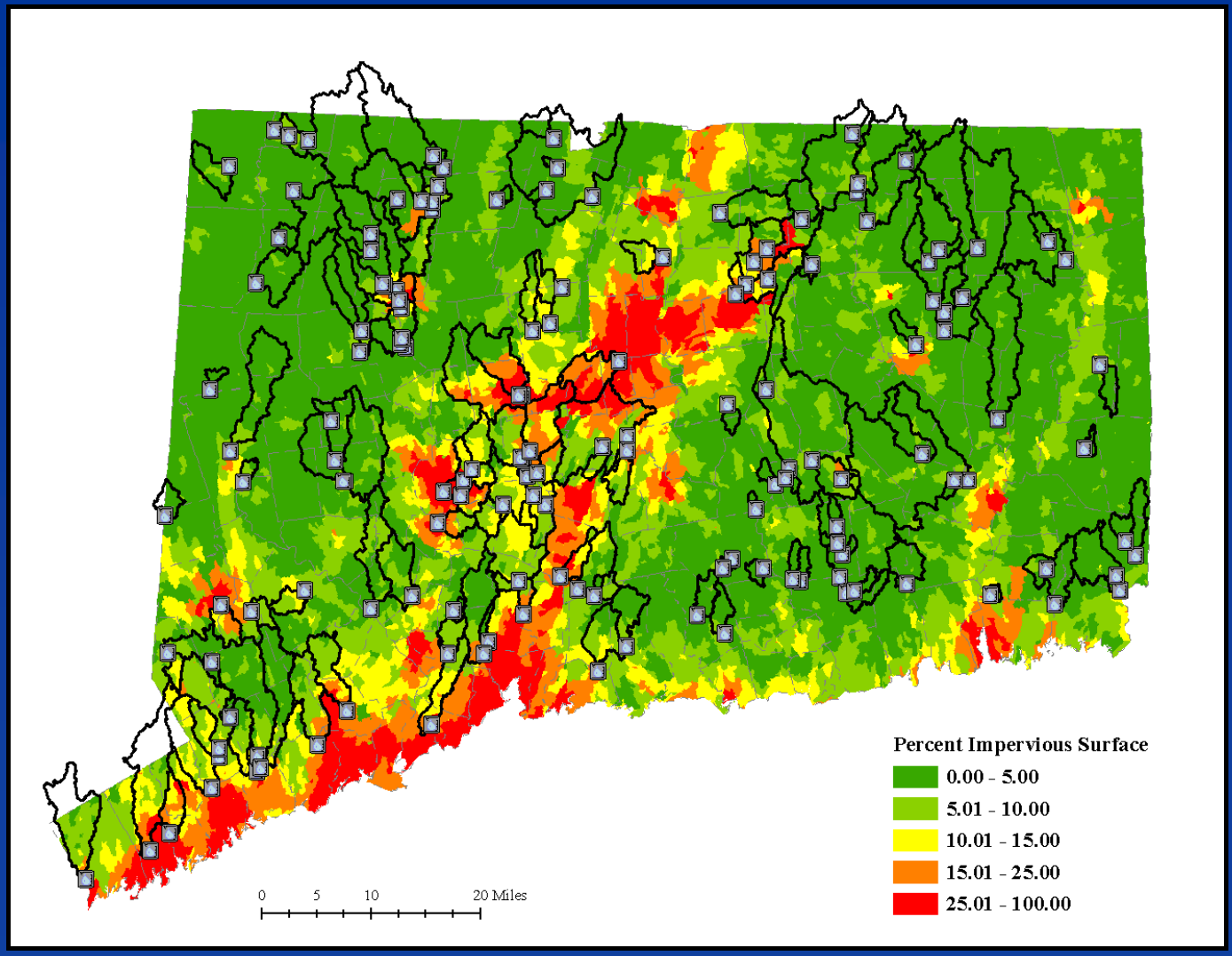


Methodology

Landscape Variable Selection

Land Cover Variables

- Percent Land Cover
- Forest Fragmentation
- Impervious Cover

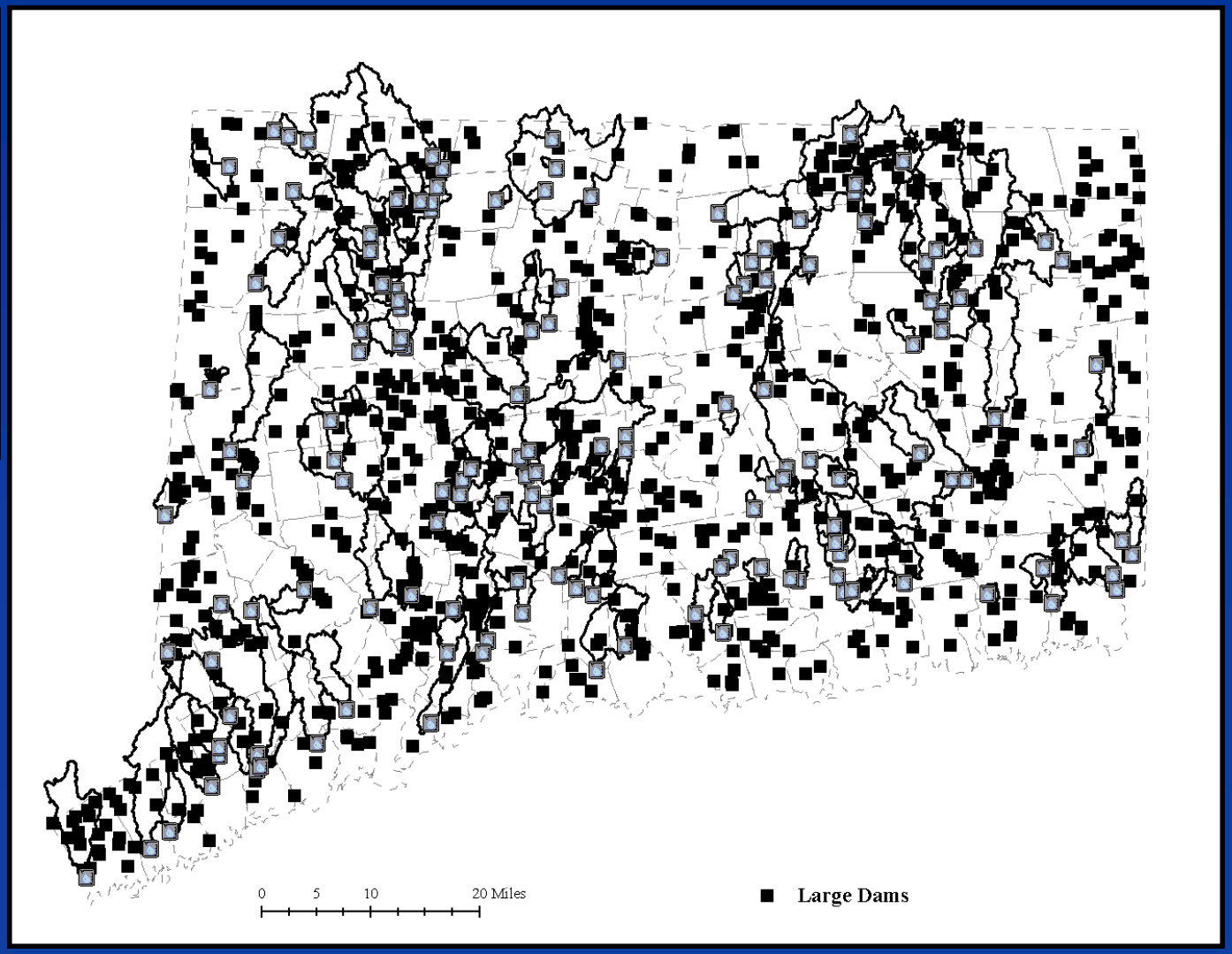


Methodology

Landscape Variable Selection

Flow Regime Variables

- Water Withdrawal Diversions
- WWTP Flow
- Large Dams
- Lake Area

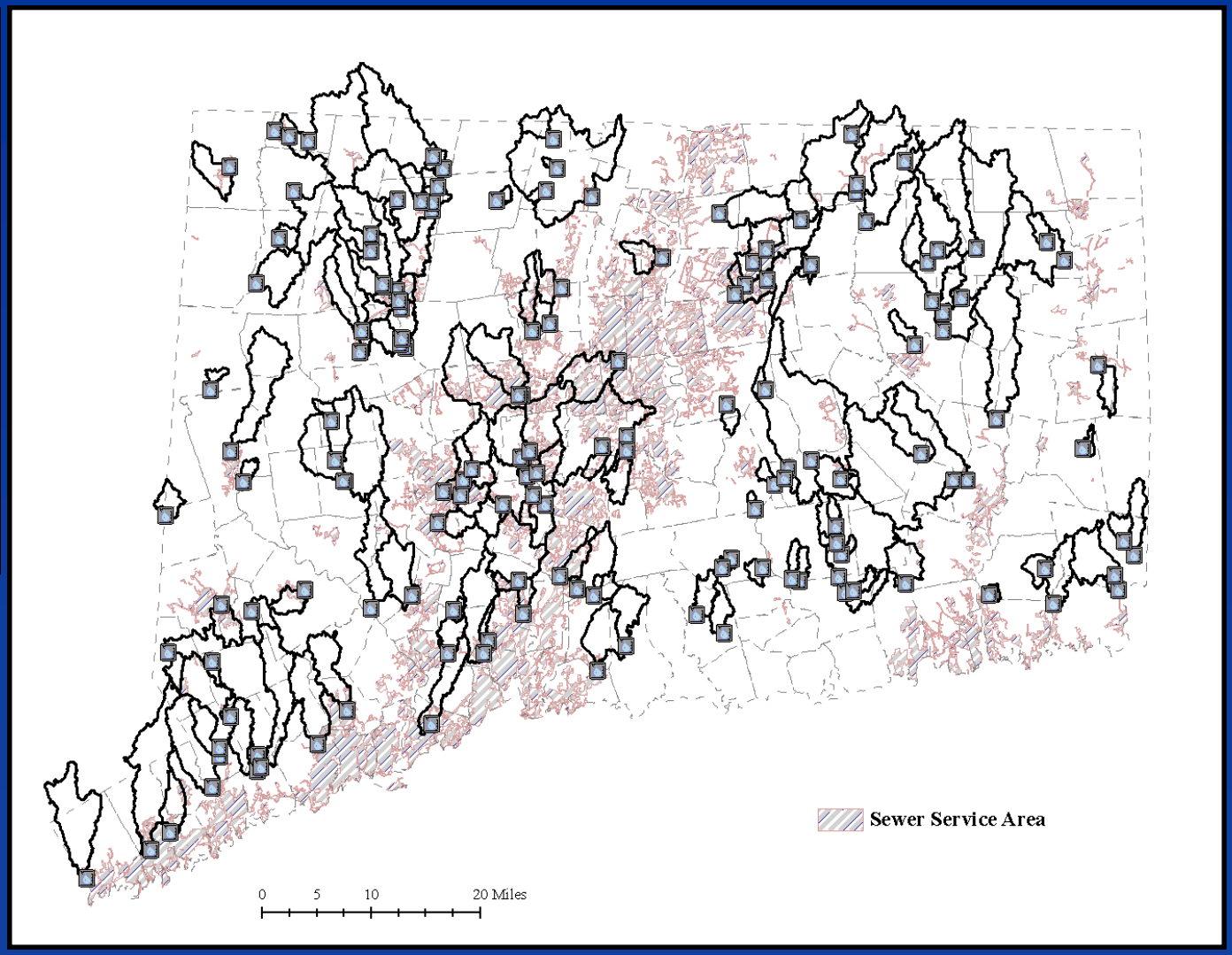


Methodology

Landscape Variable Selection

Other Stress Variables

- Road Crossings / Density
- Sewer Service Area
- Number of Farms
- Number of Remediation Sites



Methodology

Reduce Landscape Variables By Eliminating Redundant Variables

- Identify Redundant Variables Using Principle Components Analysis
- Identify Highly Correlated Variables
- Best Professional Judgment

Preliminary PCA Analysis

Non-Redundant Significant Variables
Percent IC
Outlet Elevation
Drainage Basin Area
Max diversion / 7Q10
Low flow diversion / 7Q10
7Q10 (cfsm)
Percent Water
Percent Agriculture
WWTP Flow / 7Q10
Stream Density
Percent Edge Forest
Percent Tidal Wetland

Methodology

Predict Biological Indicator Scores Based on Landscape Variables

- Develop a predictive equation using multiple regression analysis
- Predict macroinvertebrate community indicators, such as MMI Score and BCG Tier
- Predict fish community indicators, such as IBI score

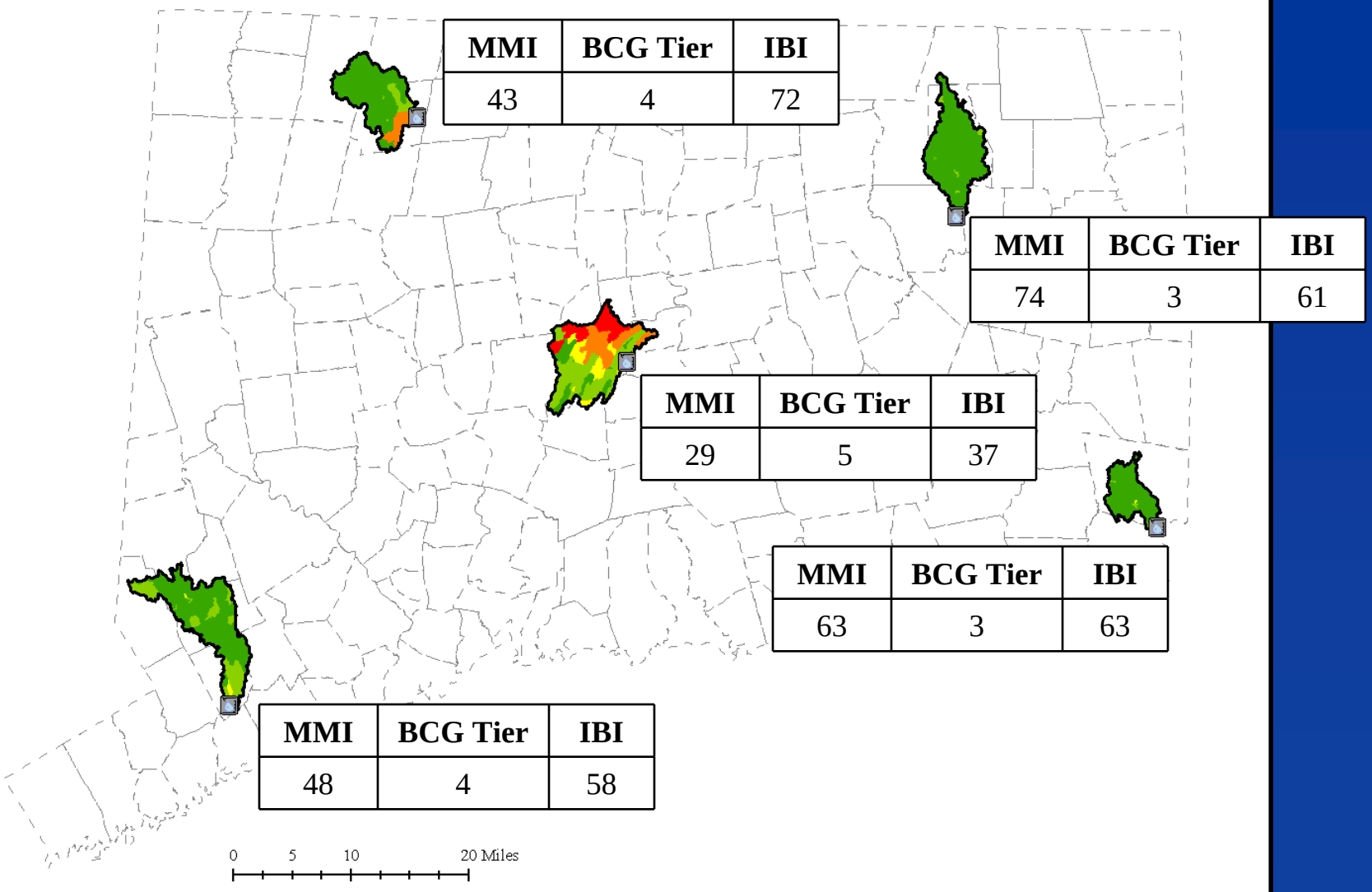
Preliminary Multiple Regression Analysis to Predict MMI

Model	Variables
1	Percent IC
2	Percent IC; Basin Area
3	Percent IC; Basin Area; Max Diversion/7Q10
4	Percent IC; Basin Area; Max Diversion/7Q10; WWTP Flow/7Q10
5	Percent IC; Basin Area; Max Diversion/7Q10; WWTP Flow/7Q10; Percent Water

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.678(a)	.459	.456	13.093767106025160	
2	.741(b)	.550	.544	11.988968480580990	
3	.766(c)	.586	.578	11.527896447964840	
4	.777(d)	.603	.592	11.328771628066970	
5	.784(e)	.615	.602	11.193354354138740	1.276

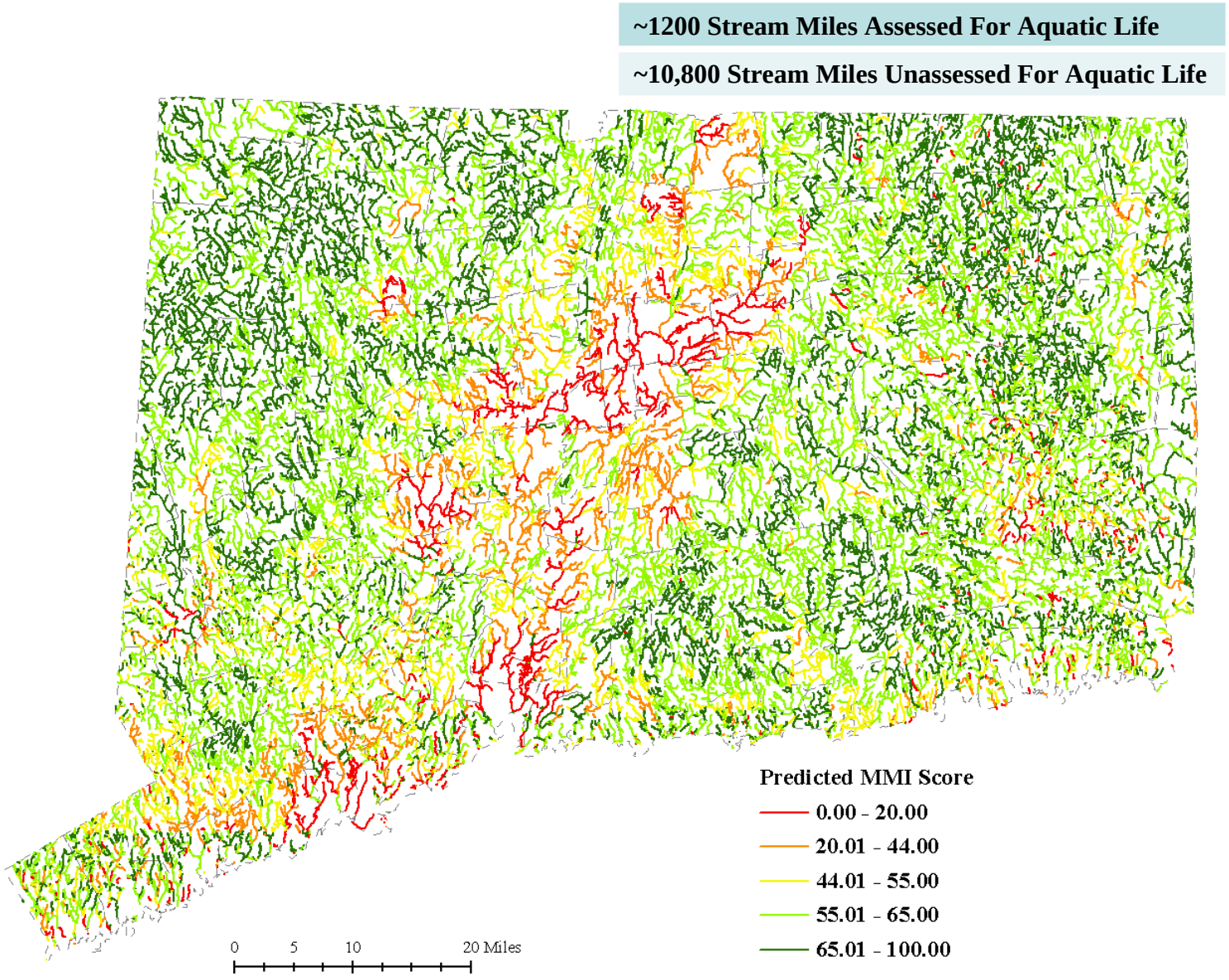
Methodology

Predict Biological Indicator Scores Based on Landscape Variables



Methodology

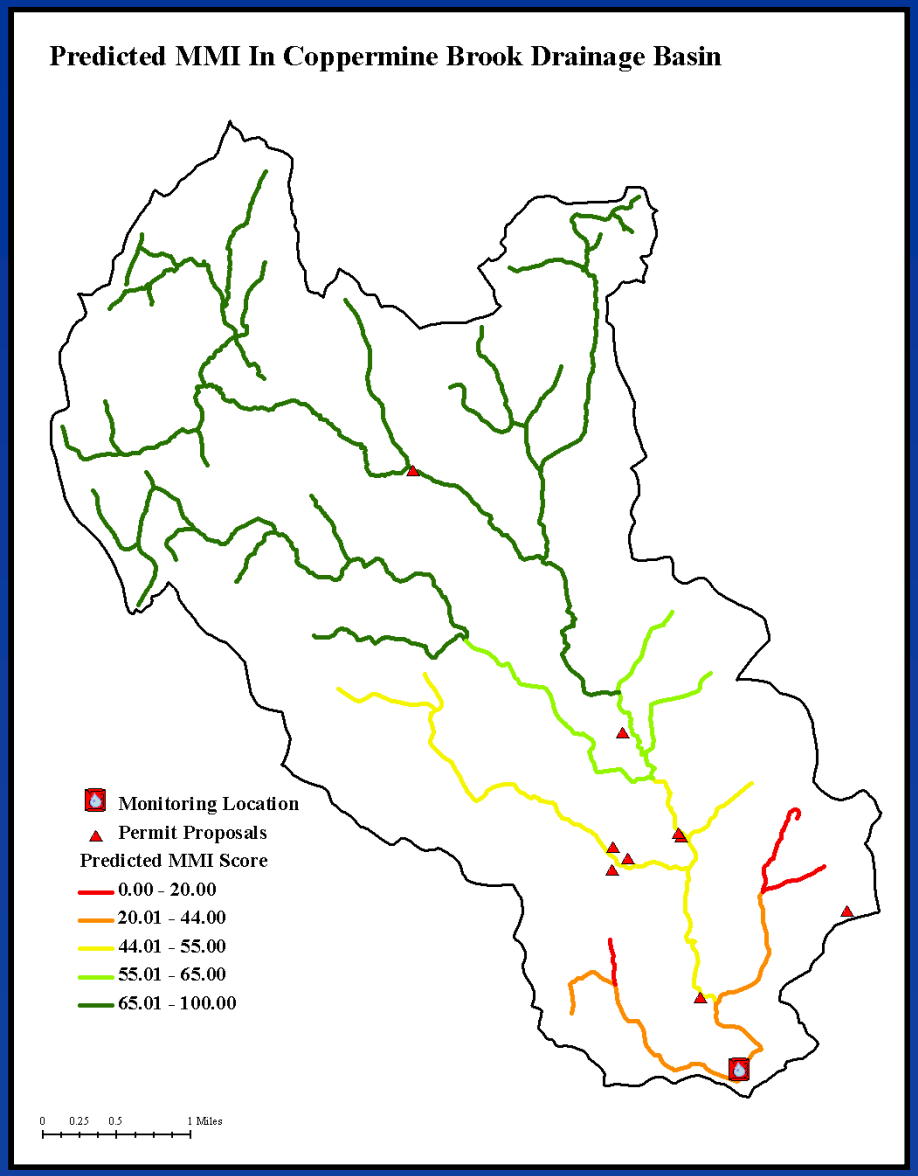
Predict Biological Indicator Scores Based on Landscape Variables



Tools to Support Water Quality Management

Predict Biological Condition To Enhance Water Quality Management

- Predict localized expected water quality condition
- Predict localized water quality trends
- Support development of local management measures (TMDLs, NPDES permits, NPS BMPs)
- Prioritize targeted monitoring

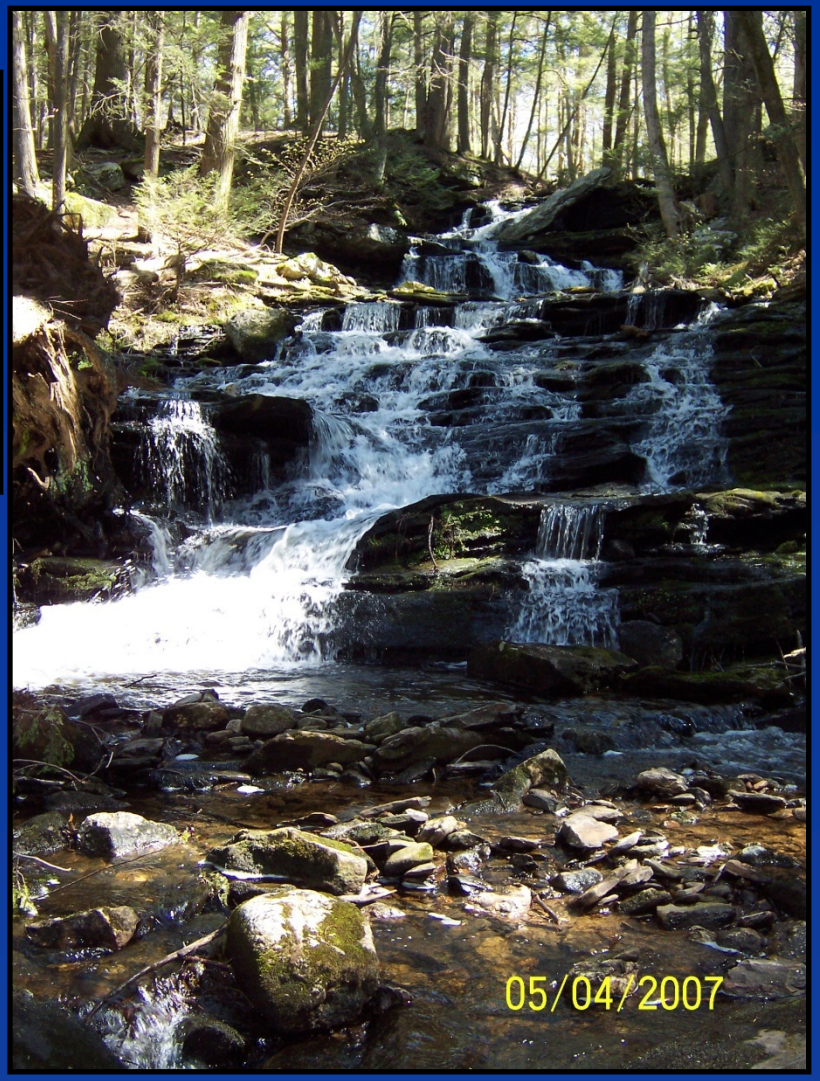


Biopotential and Implementing Antidegradation Policy

Situation	Policy Choices
No Monitoring Data	Biopotential used as guidance for decisions until monitoring confirms
Monitoring Data > Biopotential	Find out Why? Change Goal to Higher Tier or Meets ALUS
Monitoring Data = Biopotential	Meets ALUS
Monitoring Data < Biopotential	Find Out Why? Impaired Waters Listing

- **Afford better protection to high quality waters**
- **Provides intermediate goals for mixed landuse waters**
- **Provide recovery potential goals for urban rivers**

Questions?



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