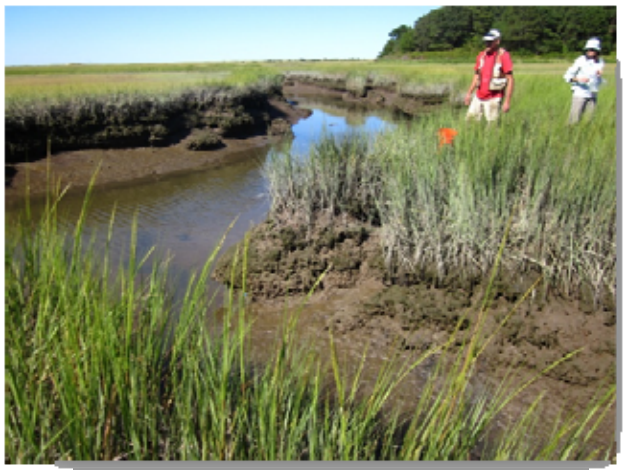
# 2015 Wetlands Monitoring & Assessment: Summary

## *Program Goals*

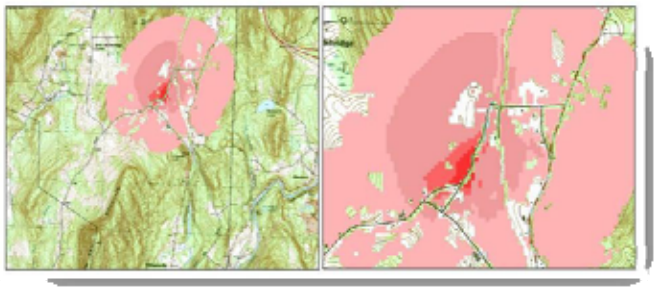
The Massachusetts Department of Environmental Protection (MassDEP) Wetlands Program has collaborated with the University of Massachusetts in Amherst ("UMass") and the Massachusetts Office of Coastal Zone Management (MCZM) since 2006, to develop a strategy to monitor and assess wetlands for purposes of reporting on the status and trends of all wetlands across the state, and for developing criteria to monitor and assess the physical, chemical and biological integrity of wetlands for reporting in the 305(b) Integrated Waters Report. Our goal is to better protect wetlands through regulation, policy & outreach.[1]

Forested wetlands in the Chicopee Watershed, Sampled Summer 2014



Sampling invertebrates in a salt marsh

## *Wetland Monitoring & Assessment Strategy*

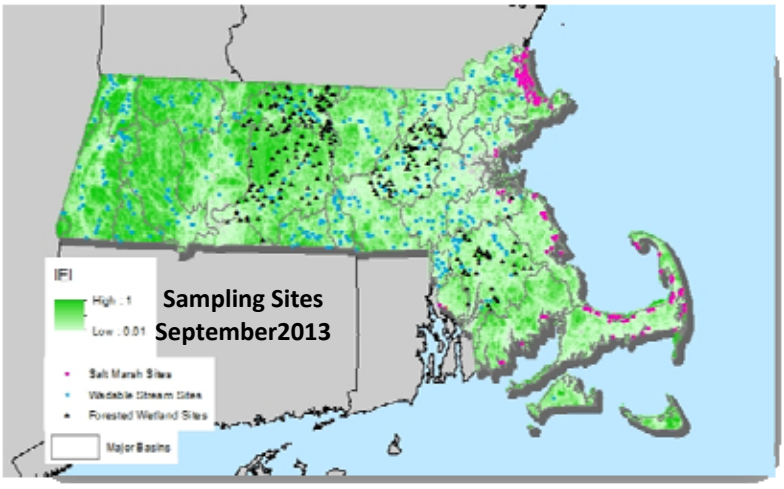


CAPS IEI depicted on USGS map

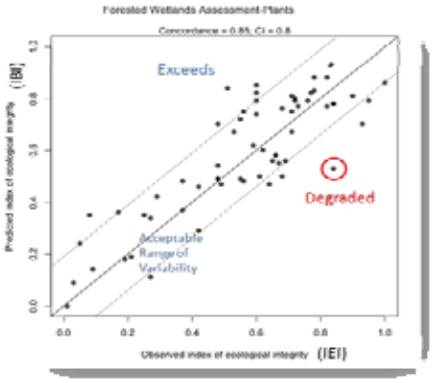
The central feature of the Massachusetts strategy is the Conservation Assessment and Prioritization System (CAPS), a landscape-level assessment model that has been under development by UMass since2000. Key components of CAPS are GIS and aerial photo based land cover mapping; and 26 inland and coastal stressor or resiliency metrics. The CAPS model combines this data and calculates a value between

[1] For detailed information on MassDEP's Wetland Monitoring and Assessment Program, please go to the following web sites: www.umasscaps.org; http://www.mass.gov/eea/agencies/massdep/water/watersheds/wetlands-protection.html#2

0 and 1 for every 30 $m^2$ point in the landscape. The CAPS value represents the index of ecological integrity (IEI) or prediction about the degree of wetland stress and suitability as biological habitat and the ability of the wetland to sustain its ecological condition in the long term and to recover from stress. CAPS does not assess wetland condition on the ground so additional tools have been developed to assess wetland condition.




Site-level assessment methods (SLAMs) for forested wetlands and salt marshes have also been developed. Using these SLAMs we have sampled forested wetland and salt marsh sites that were randomly selected along a gradient of IEI values. This data, plus data from 490 wadable streams collected by MassDEP's Division of Watershed Planning has been used for the purposes of testing and validating the CAPS predictions and modifying (as needed) the CAPS models; and for the development of Indices of Biological Integrity (IBI) for use in assessing site specific wetland condition. In 2014 a SLAM was developed for shrub swamps and site sampling was initiated for the development of IBI's. This effort is ongoing.




Assessing wetland condition using the IBI's, includes the Continuous Aquatic Life Use (CALU) assessment approach that is based on the relationship between IEI (i.e. CAPS value representing constraints on biological condition from the surrounding landscape) and IBI (i.e. actual condition of a site based on field assessments). In this approach, IEIs and the IBI's yield scores that are continuous throughout their range and on the same scale

so that a site's biological condition compared to its landscape context can be assessed (i.e. degraded, meets, exceed).

### *Indices of Biotic Integrity*

On September 15, 2013, IBI development was documented in a report entitled: *Empirically Derived Indices of Biotic Integrity for Forested Wetlands, Coastal Salt Marshes and Wadable Freshwater Streams in Massachusetts.* This report describes the effort to develop IBI's and the results. In summary, 60 of 164 separate IBI's created for single taxonomic groups (and sampling methods) across stressor metrics (i.e. measure of adverse impact of anthropogenic alterations) and ecological systems (i.e. forested wetlands, salt marsh etc.) were deemed statistically and ecologically reliable with cross-validated coefficient of concordance ranging from 0.5 to 0.84. [2] For forested wetlands, additional data was collected in the Taunton Watershed in 2013. The process of comparing results from the use of forested wetland IBIs in the Taunton resulted in a revisitation of the statistical methodology. UMass ran many additional IBI runs to explore possibilities and choose the most credible approach going forward. IBI's are now being updated and software for calculating IBI and CALU values is being finalized.

### *Project Indicators*

| **Metric** | Forested Wetland Sites Sampled through June 2015 [Development] | Forested Wetland Sites Sampled through June 2015 [Pilot Assessment] | Salt Marsh Sites Sampled through June 2015 [Development] | Salt Marsh Sites Sampled through June 2015 [Pilot Assessment] | Shrub Swamp Sites Sampled through June 2015 [Development] | Wadable Stream Data from DWP |
|---|---|---|---|---|---|---|
| # Sites Sampled | 317 | 48[3] | 190 | 1 (NWCA); 14 restoration sites[4] | 33 | 490[5] |
| # Taxa Collected | 885 | 269 (plants) | 223 (150 invertebrates (does not include | 15(NWCA plants); 21 (restoration | TBD | 294 |

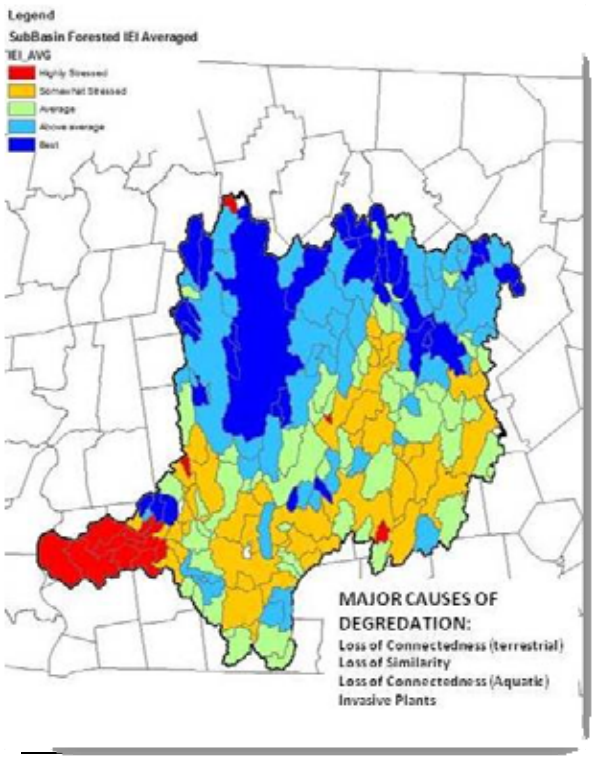
[2] The coefficient of concordance (COC) is a measure of agreement among several quantitative variables (i.e. taxonomic groups such as plants or invertebrates) and a set of objects of interest (i.e. stressor metrics). A higher COC means better agreement Cross-validation is the process of using only a portion of the available data (e.g 80%) to create a model and then use the remaining data (20%) to test the model. For the IBIs, multiple cross-validations were done and the average of these cross-validated COC values were used in the tables and reports.
The report is available at **http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/ibifin.pdf**
[3] Includes resampling of 3 National Wetland Condition Assessment sites
[4] Restoration sites were conducted using different sampling protocol called Wetlands Health Assessment Toolbar (WHAT), which involves three invertebrate stations instead of two. This was done to duplicate the historical sampling protocol
[5] Data Collected by MassDEP's Division of Watershed Planning and used by the Wetland Program for statistical analysis to calibrate CAPS and develop stream based IBI's.

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 2014 inverts); 73 plants) | plants) | | |
| Indices of Biological Integrity (IBI) Developed | 120[6] | NA | 35 | NA | TBD | 9 |
| IBI's deemed statistically and ecologically reliable[7] | 48/120 | NA | 4/35 | NA | TBD | 8/9 |

### *CAPS Model Improvements*

There are currently 23 metrics in the CAPS model that represent stressors or resiliency. Current CAPS work includes 3 new metrics nearly completed including hydrological alteration, boat traffic and nutrient loading for rivers and streams. Efforts to develop the water temperature alteration and fluvial geomorphic alteration metrics have been discontinued. [8]

### 2015 Pilot Chicopee Watershed Wetland Assessment Report




In 2013 the MassDEP Wetland Program was awarded a Wetland Program Development Grant (WPDG) by EPA to use the monitoring and assessment tools developed to date to sample 40 forested wetlands in the Chicopee River Watershed in the summer of 2014 and use CAPS, IBI's and CALU to assess those sites. This watershed was selected in accordance with the MassDEP 5-year basin cycle for water sampling. The sampling was conducted in accordance with the approved Quality Assurance Project Plan (QAPP) for Forested Wetland Monitoring and Assessment: Chicopee Watershed (Chicopee Forested Wetland QAPP). The first part of the report is a landscape analysis of the Chicopee Watershed using CAPS. In this analysis we found that the forested

[6] Incorporation of the most recent data from the Taunton River Watershed required a reassessment of the statistical methodology used to develop IBI's. Additional IBI runs will be available by the fall of 2015.
[7] This determination is based on cross-validated coefficient of cc Chicopee Watershed Index of Ecological Integrity
[8] A complete list is at the following link: http://www.umasscaps.org/about/metrics.html

wetlands in the Chicopee Watershed overall have a slightly higher average IEI than most other watersheds in Massachusetts. This is believed to be due to the presence of the Quabbin Reservoir, and a large area of undeveloped protected land associated with the reservoir in this watershed which raises the average IEI. However, like all watersheds, the presence of stressors has resulted in some degradation of forested wetlands. The primary stressor that affects the ecological integrity of forested wetlands in the Chicopee Watershed is fragmentation of the ecosystem by long linear development such as roads and railroads. This stressor is represented in the CAPS model by three metrics: connectedness, aquatic connectedness, and similarity. Invasive Plants were also found to be a top stressor contributing to degraded condition. Sampling data will be used to assess wetlands at all 40 sites by plotting their location on the CALU graph. The CALU assessments for specific sites sampled, and the CAPs IEI values for all wetlands will be used to identify degraded and pristine areas. Details will be provided in the next 305(b) report. A full report on the Chicopee assessment will be posted on the MassDEP website by the end of 2015. In the summer of 2015 sampling is being conducted in the Shawsheen, Ipswich and Parker River Watersheds of the North Coastal region, and the assessment will be completed in 2016.

### *EPA WPDG Demonstration Project: Assessment of Wetland Mitigation Success*

The UMass Research Bulletin 746/December 1998 entitled *Compensatory Wetland Mitigation in Massachusetts* ("the Brown and Veneman Report")[9] found that the majority of wetland replication projects (54.4%) undertaken in MA were not in compliance with the Wetland Protection Act (WPA) regulations. The study notes that "*The state's goal of no net loss of wetlands cannot be met unless the regulatory program succeeds in compensating for all authorized wetland impacts*." In 2002 MassDEP developed guidance to improve wetland replication success but it is unclear to what degree mitigation success has improved in MA since the Brown and Veneman report. [10] In 2011 MassDEP obtained funding through an EPA funded Wetland Program Development Grant (WPDG) to conduct a study to determine how well we are doing more than a decade later. Similar to the Brown and Veneman Report, we randomly selected 44 municipalities to study how successful wetland replication was during the 2004-2008 timeframe. In this study we also are testing the SLAM, CAPS, IBI and CALU tools on a select sample of sites. [11]

[9] http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/cwm.pdf
[10] http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/replicat.pdf
[11] See the Quality Assurance Project Plan for more detail: http://www.mass.gov/eea/agencies/massdep/water/watersheds/summary-of-2012-wetland-field-projects.html#QualityAssuranceProjectPlans

Study of wetland replication, summer 2013

Wetland replacement area in need of improvement

In the study of 44 municipalities, of the 91 sites where permission to access was obtained, 56% were built and created a wetland; 13% were never built and 31% were constructed but failed to produce wetlands. When evaluating whether the wetland replacement areas met all performance criteria of the Massachusetts wetland regulations we found that only 36% of replacement areas were built and created wetlands that were fully compliant with the regulations. While a slight improvement over the Brown and Veneman estimates, these numbers are not where we hoped they would be, and recommendations are being developed. The CALU analysis is currently being finalized. The full report is expected to be published during the fall of 2015.

## WPDG Demonstration Project: Prioritizing Stream Crossing Improvements using CAPS

In October of 2011, MassDEP received an EPA WPDG for this project to promote improved river and stream continuity. This demonstration project is another example of how CAPS can be used to make effective decisions – this time in association with the *River and Stream Continuity Project* ((The Continuity Project). A Quality Assurance Project Plan (QAPP) was developed to standardize protocols and quality control procedures. [12]

Stream Assessment in Progress

This study was conducted to examine the extent of field assessments that are needed to obtain reliable results from the Conservation Assessment and Prioritization System (CAPS) Critical Linkages model[13] in prioritizing stream crossings for improvement. A second goal is to increase the number of assessments in the North

[12] http://www.mass.gov/eea/agencies/massdep/water/watersheds/quality-assurance-project-plans-qapps.html
[13] http://www.umasscaps.org/docs_reports/index.html

Atlantic Aquatic Connectivity Collaborative Crossings Database ("NAACC Crossings Database")[14] to improve the accuracy of assessing and prioritizing stream crossing improvements. Field assessments were conducted for over six hundred stream crossing structures primarily located in three watersheds in Massachusetts: the Buzzards Bay, Chicopee, and Ipswich watersheds. A scenario analysis was conducted by comparing 1) Comprehensive: near comprehensive assessment (69-80% field assessed), all others run in comparison with these results; 2) All modeled by Critical Linkages, none field assessed; 3) Null: This is a control where all aquatic passability scores are randomly generated. The results of CAPS model test suggest that it is not necessary to field assess every crossing in a watershed in order to use the Critical Linkages methodology to evaluate the ecological restoration potential for culvert replacements and crossing upgrades. Results suggest that assessing only 30% of crossings in a sub-watershed may be acceptable as long as the 30% are selected strategically (i.e. using best case 'impact' scores when all are modeled).

[14] www.streamcontinuity.org/cdb2