

Elise Leduc, M.E.M., P.W.S.

Coastal Scientist

EXPERTISE

More than 5 years of experience in coastal environmental management, wetland delineation and restoration, shellfish and eelgrass surveys, coastal planning, geospatial analysis, shoreline change analysis, ecological risk assessments, conservation prioritizations, field sampling, and Massachusetts environmental regulations.

QUALIFICATION SUMMARY

- Experience with wetland delineation, shellfish and eelgrass surveys, and field data collection of sediments, water, and invertebrates for environmental studies.
- Experience with salt marsh restoration planning and ecological monitoring.
- Adept at spatial data acquisition and geospatial analysis using ESRI's ArcGIS to analyze and display data for coastal and marine projects.
- Experience conducting shoreline change analyses.
- Experience with local, state, and federal permitting of coastal and environmental projects.
- Experience developing beach management plans, multi-hazard mitigation plans, and other coastal management and conservation planning documents.
- Strong written and verbal communication skills, and the ability to engage diverse groups of stakeholders through presentations and meeting facilitation.
- ESRI ArcGIS; ETGeowizards; MATLAB; Microsoft Office; Adobe Photoshop and Illustrator.

WORK EXPERIENCE

2012-Present	Coastal Scientist, Woods Hole Group, Inc.
2011-2012	Watershed Management Fellow, Charles River Watershed Association
2011	Coastal Conservation Planner, North Carolina Division of Coastal Management
2010	Conservation GIS Analyst, Great Land Trust
2009-2010	Wetland Laboratory Technician, Duke University Wetland Center
2006-2008	Rural Aquaculture Extension Agent, Peace Corps Zambia



Education

2011 – M.E.M.
Coastal Environmental
Management
Duke University
2006 – B.A.
Biology
Williams College

Licenses and Registrations

- MA EOEEA Municipal
Vulnerability Preparedness
(MVP) Program Provider
- Professional Wetland
Scientist (PWS)
- Wetland Delineator
Certification
- OSHA 40-Hour HAZWOPER

Professional Affiliations

-Society of Wetland Scientists

Publications & Presentations

12

KEY PROJECTS

Falmouth Climate Change Vulnerability Assessment and Adaptation Planning, Falmouth, MA, Project Manager

A highly resolved, numerical model was developed to assess the combined impact of sea level rise, storm events, winds, tides, and waves to coastal Towns throughout Massachusetts. Results from this model were used to assess risk to all municipally-owned assets in the Town of Falmouth, including buildings, roads, parking lots, recreational facilities, and coastal infrastructure. The results of the vulnerability assessment were used to inform short- and long-term adaptation and resiliency planning for the Town based on the projected flood risk and overall consequence of flooding to each asset. Results maps were developed for the probability of flooding for present day, 2030 and 2070, as well as for the depth of flooding for two return period events.

MVP Community Resiliency Building Process & Multi-Hazard Mitigation Plan, Orleans, MA, Project Manager

Worked cooperatively with Town officials to complete the Municipal Vulnerability Preparedness (MVP) certification process, while simultaneously updating the Town's Multi-Hazard Mitigation Plan (MHMP). Completing the MHMP update in tandem with participation in the Municipal Vulnerability Preparedness (MVP) program allowed the Town to utilize funding and resources as efficiently as possible, since the major components of both processes have a great deal of overlap. Compiled updated data on flood zones, wind hazard areas, shoreline change, high fire risk areas, shoaling, erosion and sea-level rise. Information was provided about the location, extent, frequency, past occurrences and likely impacts of all hazards. As an MVP Certified Provider, served as lead facilitator for the MVP Community Resiliency Building workshop, and facilitated small group discussions to guide workshop participants in the development of resiliency actions. Results of the MVP workshop, as well as the MHMP vulnerability assessment were used to guide municipal officials through the development of targeted mitigation actions to reduce the Town's vulnerabilities to natural hazards. The results of the MVP workshop process were compiled into a Final Summary and Findings Report, in addition to the update and completion of a MEMA/FEMA approvable MHMP.

Cow Yard Marsh Restoration Study, Dartmouth, MA, Project Manager

Cow Yard Marsh is a 16-acre salt marsh bisected by an elevated private gravel access roadway. Two culverts pass underneath the gravel road, but disrepair of these structures has caused significant degradation of the eastern cell of the marsh in recent years, resulting in large areas of non-vegetated pools and pannes. We are currently developing an existing conditions plant community cover type map through aerial photo interpretation that will be ground truthed in the field, and planning the deployment of 5 tide gages at key locations along the creek channel and throughout the marsh system, that will provide detailed site-specific tidal information necessary to accurately model the hydrology of the system. Woods Hole Group will then use this data to run a two-dimensional (2-D) hydrodynamic salinity model, which will be used to evaluate various alternatives for restoring the culverts, and ultimately restoring tidal flow to the upper reaches of the Cow Yard marsh system.

Watson Park Erosion Mitigation and Coastal Resiliency Improvement Project, Braintree, MA, Project Manager

Compiled existing conditions data, performed a wetland delineation and site topographic survey, and performed targeted coastal processes analyses as part of a feasibility study for natural storm-damage protection along an eroding coastal bank at Watson Park located on the Fore River in Braintree. Conducted an alternatives analysis and developed preliminary design plans for a living shoreline stabilization project along the portion of the

KEY PROJECTS (CONTINUED)

shoreline that has experienced significant erosion. The study also included an analysis of the potential for salt marsh migration to occur in and around Watson Park as a result of sea level rise.

MVP Community Resiliency Building Process, Towns of Falmouth and Wareham, MA, Project Manager

As an MVP Certified Provider, served as lead facilitator for the Falmouth and Wareham MVP Community Resiliency Building workshops. Compiled relevant Town data on critical town infrastructural, societal and environmental features. Developed figures, maps and presentation materials to convey areas vulnerable to specific natural hazards (e.g., flood risks, sea-level rise, high risk dams, etc.). Facilitated small group discussions to guide workshop participants in the development of resiliency actions. Presented the results of the workshop at public listening sessions. Compiled results of the MVP workshops into Final Summary and Findings Reports.

Wareham Climate Change Vulnerability Assessment & Adaptation Planning, Wareham, MA, Project Manager

Conducted a climate change vulnerability assessment of municipal infrastructural, societal and environmental features to develop targeted strategies aimed at reducing risks from flooding, increased storm intensity, sea level rise and storm surge as part of an MVP Action Grant award. Results from a highly resolved, numerical model were used to assess risk for municipally-owned assets throughout the Town of Wareham, as well as impacts residential neighborhoods and sensitive coastal habitats throughout Town. The results of the vulnerability assessment were used to inform short- and long-term adaptation and resiliency planning for the Town based on the projected flood risk and overall consequence of flooding to each asset, as well as to quantify the number of households in each neighborhood at risk. Results maps were developed for the probability of flooding for present day, 2030 and 2070, as well as for the depth of flooding for two return period events.

Town of Marshfield Multi-Hazard Mitigation Plan, Marshfield, MA, Project Manager

Worked cooperatively with Town officials to update existing Hazard Mitigation Plan in compliance with MEMA/FEMA guidance and to meet CRS Program requirements. Compiled updated data on flood zones, wind hazard areas, shoreline change, and high fire risk areas, as well as documented natural hazards that have occurred in the past 5 years. Information was provided about the location, extent, frequency, past occurrences and likely impacts of all hazards. Conducted a vulnerability assessment for Town-identified critical facilities, as well as Town-wide property and assets. Conducted multiple public outreach meetings, as well as administered an online public survey to engage residents in the plan development process. Worked with key stakeholders to develop mitigation actions. Plan was approved by MEMA/FEMA within 2 months with no requested changes.

Herring River Estuary Restoration Project, Wellfleet & Truro, MA, Coastal Scientist

The Herring River Estuary restoration project aims to restore up to 1,000 acres of wetland area. Incorporated high-resolution hydrodynamic numerical model output into the Sea Level Affecting Marshes Model (SLAMM) in a unique way to predict wetland change associated with proposed tidal restoration scenarios, rather than the traditional sea-level rise input. Analyzed and repackaged ecological model outputs to provide a useful set of information for restoration managers. Results of the SLAMM model were also used as inputs to a multi-parameter decision tool to guide the adaptive management process associated with restoring the Herring River Estuary. The results of the ecological modeling, as well as the adaptive management decision tool with help determine the appropriate new engineering tide gate openings and water control structures.

KEY PROJECTS (CONTINUED)

Living Shorelines – State of the Science, New England States, Coastal Scientist

Compiled a report on the State of the Science of Living Shorelines in New England. Developed a comprehensive questionnaire for use in interviewing New England living shorelines experts including regulators, academic researchers, practitioners, and non-profit coastal organizations. Designed concise profile pages for featured living shoreline types highlighting design features, siting considerations, permitting considerations and providing insights for the unique challenges of facing these projects in cold climates. Developed an applicability index tool that can help users identify the living shoreline types that are best suited for their specific site conditions.

Flood Mitigation and Ecological Resilience Project, Weymouth, MA, Coastal Scientist

Conducted a site evaluation and wetland delineation of a salt marsh wetland, which is currently tidally restricted due to an improperly sized and poorly maintained culvert. Performed vegetative community assessments, an evaluation of hydrology, and a hydric soils assessment. Reconnaissance level assessments were also conducted at two reference wetlands to identify opportunities for function improvement and restoration design. Based on the wetland survey and evaluation of the site, the results of the hydrodynamic modeling, and the information obtained from the two reference areas, a permit level restoration plan was developed. The plan combines technical ecological engineering components with adaptive management activities to meet the comprehensive goals of restoring the salt marsh vegetative community, controlling invasive species, and improving the hydrological connectivity and habitat quality, and includes a culvert replacement, daylighting of a 150-foot section of creek, slope stabilization and Phragmites management.

Town of Marshfield Beach Management Plan, Marshfield, MA, Project Manager

Compiled existing conditions data including shoreline change, FEMA flood zones, budgets and dredge records, as well as mapped wetland resource areas, coastal structures and beach amenities for Marshfield public beaches. Developed an online survey, which received over 1,000 responses, to gather public opinion about current management actions. This information will be used to identify new management activities to improve the recreational or conservation functions of the public beaches, and all data and recommendations will be compiled into a final Beach Management Plan document, and presented at multiple public meetings.

Modeling the Effects of Sea Level Rise on Coastal Wetlands, MA, Coastal Scientist

Worked for the Massachusetts Office of Coastal Zone Management to model the effects of sea level rise on coastal wetlands statewide. Data inputs required by SLAMM, such as topographic data, mapped wetlands, accretion and erosion rates, salinity, tide levels and ranges, percent imperviousness, and freshwater inputs, were identified, compiled and processed in order to run the model. The North Shore's Great Marsh was chosen as a sub-site for pilot testing and sensitivity analysis due to the amount of data available for the system. Final model simulations were run for both the sub-site, as well as state-wide simulations involving 18 regional panels, for three out-year scenarios and four projected sea level rise rates based on IPCC predictions. These results will aid CZM in identifying areas along the Massachusetts coast where wetlands can and cannot migrate and adapt to sea level rise, given current elevations and development.

KEY PROJECTS (CONTINUED)

Environmental Permitting for Beach Nourishment at Ashumet Pond, Falmouth, MA, Project Manager

Conducted a site evaluation and wetland delineation of a pond and bordering vegetated wetland. Developed a beach nourishment design and plan suitable for the topography, which avoided sensitive wetland resources and rare species habitat. Coordinated closely with NHESP and local Conservation Commission staff to effectively avoid adverse impacts to numerous rare and endangered species present at the site. Compiled and submitted all permits associated with the project, including the local Notice of Intent and Board of Selectman permits, the state level Chapter 91 license, and the federal U.S. Army Corps of Engineers permit.

Falmouth Multi-Hazard Mitigation Plan Update, Falmouth, MA, Project Manager

Updated the Multi-Hazard Mitigation Plan for the Town of Falmouth in compliance with MEMA/FEMA guidance and to meet CRS Program requirements. Engaged stakeholders and the public, and fully documented the plan development process. Acquired additional and updated data on all natural hazards addressed in the plan, and added additional hazards to match those highlighted by the State. Information was provided about the location, extent, frequency, past occurrences and likely impacts of all hazards. Conducted a vulnerability assessment for Town-identified critical facilities, as well as Town-wide property and assets. Facilitated stakeholder meetings to refine goals, assess results of the hazard and vulnerability assessment and develop mitigation actions. Presented results of the Plan to the Local Emergency Planning Committee and the Board of Selectman, and assisted the Town with Plan submittal and adoption.

Ninigret Pond Salt Marsh Restoration, Charlestown, RI, Coastal Scientist

Conducted a wetland evaluation and provided restoration planning guidance for a large scale (~40 acre) salt marsh restoration project using thin layer sediment deposition. Selected targeted restoration areas based on level of existing vegetation degradation and elevation. Compiled and analyzed tidal, salinity, vegetation, soil core, and elevation data to develop a restoration plan and target marsh platform elevations. Developed adaptive management guidelines for maintenance and monitoring of the project in the future.

Sears Point Salt Marsh Restoration Monitoring, Chatham, MA, Coastal Scientist

Worked closely with the wetland restoration firm, surveyor, regulators and client to develop a multi-year restoration monitoring program for a 4,500 sf salt marsh restoration project. Monitoring involved assessment of area of coverage, quantifying percent coverage, and stem counts. Prepared a summary report, documenting the findings through maps, tables, photos, and written descriptions following the completion of the first year's monitoring efforts. The report was submitted to state regulators per requirements of the restoration program, and monitoring and reporting will continue until restoration goals have been met.

Dredge Disposal Analysis, Chatham, MA, Coastal Scientist

Developed selection criteria to choose areas that are best suited for disposal of dredge material. Calculated fill capacity and designed potential nourishment templates for 14 potential disposal sites. Potential dredge disposal site rankings were based on physical logistics (i.e. location, volume, equipment access, etc.), as well as each site's potential benefits (i.e. erosion protection, habitat restoration, coastal resiliency, etc.) and potential permitting and regulatory constraints (i.e. shellfish resources, presence of salt marsh or eelgrass, etc.). Compiled final rankings, analyses, maps, and fill cross-sections into a final report for the Town.

KEY PROJECTS (CONTINUED)

Eastward Ho! Annual Wetland Resource Area Monitoring, Chatham, MA, Coastal Scientist

Conducted annual surveys of wetland resource areas along a 2-mile coastline in Pleasant Bay. Delineated the area and extent of salt marsh resources. Performed an eelgrass survey by boat, using view boxes, to identify and delineate areas of eelgrass offshore. Conducted a shellfish survey consisting of 22 transects. Areas of each wetland resource area were tabulated and compared to corresponding areas from previous years to document changes. Any erosion control activities along the property or natural events (i.e. storms) that may have influenced any of the area changes are also noted.

Town of Sandwich Beach Management Plan, Coastal Scientist

Conducted a review of historical documents, maps, and existing data for Sandwich public beaches. Reviewed, mapped and described existing conditions and historical shoreline change through site visits and geospatial analysis. Performed historical shoreline change analysis for Sandwich public beaches. Documented existing activities being undertaken by the Town as on-going management of the public beaches. Identified and proposed new management activities that could improve the recreational or conservation functions of the public beaches. Compiled all existing management practices and new recommendations into a final Beach Management Plan document.

Evaluation and Restoration Plan for Whidah Road Salt Pond, Chatham, MA, Project Manager

Served as project manager for a salt pond evaluation to determine the best course of management for the pond, which was experiencing frequent inlet closures. Conducted an elevation survey of the salt pond, salt marsh, inlet, coastal beach and nearshore area, collected water quality measurements, and performed a vegetation and habitat assessment for the pond and marsh. Combined an analysis of historical aerial photos to determine the frequency of inlet closure, with an assessment of the hydraulics at the site to determine at what tidal elevations and for how long during the daily tidal cycle water would flow between the pond and the bay, to evaluate the need and the feasibility of opening the inlet. Prepared a summary report and graphics detailing the findings of our study.

Newtown Creek CERCLA Environmental Risk Assessment, New York City, NY, Coastal Scientist

Review and comment on ecological risk documents, such as the RI/FS Work Plan, Screening Level Ecological Risk Assessment (SLERA), Baseline Ecological Risk Assessment (BERA), Risk Analysis Plan (RAP), etc. Conduct data synthesis and analysis, calculations and research to support CERCLA comments and recommendations. Provide technical review and recommendations on toxicity tests, site selection, benthic community analysis, weight-of-evidence method, and technical documents. Create presentations, figures, maps and comments to submit to EPA on behalf of the City.

Technical Evaluation of FEMA FIRMs for the Towns of Scituate, Marshfield, and Duxbury, MA, Coastal Scientist

Evaluated draft FEMA maps, and identified errors and inconsistencies in FEMA's analyses, such as oversights along a particular transect or flawed assumptions. Reanalyzed flood area delineations along FEMA's existing transects, and created additional transects to document and accurately map the flooding potential around location-specific topography. Adjusted and reclassified mapped flood zones and Base Flood Elevations (BFEs) to reflect updated modeling. Produced updated flood maps.

KEY PROJECTS (CONTINUED)

Green Infrastructure for Coastal Resilience on Barges Beach, Cuttyhunk, Town of Gosnold, Coastal Scientist

Over the past twenty years, severe winter storms have caused significant overwashing of Barges Beach, causing the barrier to become extremely low and vulnerable and allowing sand, cobble, and rocks to frequently wash into Cuttyhunk Channel making navigation hazardous. Woods Hole Group conducted a thorough alternatives analysis, taking various coastal processes into consideration. The preferred alternative consisted of a beach nourishment and dune restoration using a combination of sand, gravel and cobble. Completed key components of the submitted Environmental Notification Form, including the project narrative, Massachusetts Office of Coastal Zone Management (CZM) consistency review, and mitigation measures, in support of a coastal resiliency project along Barges Beach on Cuttyhunk Island.

Chilmark Pond Property Evaluation, Chilmark, MA, Project Manager

Served as project manager for a coastal property evaluation along the southern coast of Martha's Vineyard. Researched and investigated the historic and potential future shoreline changes, and how they might impact a new house to be built on site. Conducted a site visit to evaluate the existing conditions at the site. Acquired and georeferenced historical aerial photographs and charts from the 1800s to the present, and utilized these to document the location of mean high water over time along 2 miles of the southern Martha's Vineyard coastline. Performed a shoreline change analysis using the digitized shorelines to compute a historical shoreline change rate, and help inform projections of future shoreline change rates. Compiled data and wrote a summary report of findings to provide guidance for future planning and construction on the property.

Status and Resilience of the Westport Harbor Barrier Beach, Westport, MA, Coastal Scientist

Compiled and georeferenced aerial photography and historical charts to perform a shoreline change analysis for the Westport Harbor Barrier Beach system. Utilized the shoreline change results to project future shoreline change with and without sea level rise. To incorporate sea level rise into future estimates, LiDAR elevation data in conjunction with the predicted sea level rise scenarios in Global Sea Level Rise Scenarios for the United States National Climate Assessment were used. Developed projections for 25, 50 and 100 years into the future.

Coastal Pond Management Plan, Chilmark, MA, Project Manager

Developed a comprehensive pond management plan for a coastal salt pond on Martha's Vineyard. Conducted a site visit to evaluate existing conditions, investigate pond depth and sediment type, and make observations about the stability of the nearby barrier beach. Performed a shoreline change analysis for the southern barrier beach, a critical component to the future management of the pond and the rest of the property. Gathered background information on past and current practices for Phragmites control and pond management activities, as well as on general geology and soil conditions in the area, flood zone designations, and ecology of the pond to accurately identify and understand the problems facing the pond, and to develop alternatives for managing the pond. The Pond Management Plan addressed preserving and/or restoring the open water pond habitat, and minimizing erosion on the barrier beach, which is necessary for the longevity of the pond. The plan provided background and reasoning, estimated effectiveness, estimated cost, and projected time frame for each proposed alternative.

PUBLICATIONS AND PRESENTATIONS

Leduc, E. 2018. "Innovative Use of SLAMM to Guide Wetland Restoration Planning and Adaptive Management Decisions for the Herring River Estuary." Presentation at the 6th Annual Cape Coastal Conference, Barnstable, MA, December 2018.

Leduc, E., K. Bosma, T. Smith. 2018. "Innovative Use of SLAMM to Project Wetland Changes Due to Tidal Restoration." Presentation at the Society of Wetland Scientists Annual Conference, Denver, CO, May 2018.

Leduc, E., T. Wickwire, S. Kirk, and J. Torgan. 2018. "Building Resilience with Nature-Based Solutions: New Tools for Siting Living Shoreline Projects in New England." Presentation at the Annual New England Association of Environmental Biologists Conference, Devens, MA, March 2018.

Leduc, E. T. Wickwire, and S. Kirk. 2017. "Can We Protect New England Coasts with Living Shorelines? Part II: Profile Pages, Applicability Index and Case Studies." Presentation at the 5th Annual Cape Coastal Conference, Barnstable, MA, December 2017.

Leduc, E. 2017. "Field Survey Technology Innovations and Lessons Learned: Using an Underwater Camera for Benthic Habitat Surveys." Presentation at the 41st Presentation at the Annual New England Association of Environmental Biologists Conference, Hartford, CT, March 2017.

Leduc, E., J.J. Cura, E. Mahoney, C. Prabhu. 2017. "Sediment Toxicity Testing in Oily Sediments: Strategies from the Newtown Creek Case Study." Poster Presentation at the Ninth International Conference on Remediation and Management of Contaminated Sediments, New Orleans, LA, January 2017.

Leduc, E., K. Bosma, and M. Carullo. 2016. "Using SLAMM to Identify Coastal Wetland Areas Vulnerable to Sea Level Rise in Massachusetts." Presentation at the Society of Wetland Scientists (SWS) Annual Conference, Corpus Christi, TX, June 2016.

Cura, J.J., E. Leduc, C. Prabhu, and E. Mahoney. 2015. "Sediment Toxicity in Different Classes of Reference Area and in the Newtown Creek Superfund Site." Poster Presentation at the Society of Environmental Toxicology and Chemistry (SETAC), Salt Lake City, UT, November 2015.

Leduc, E. 2011. "An Evaluation of GIS Prioritizations for Selecting Wetland Mitigation Sites: Cook Inlet Case Study" Master's Project, Duke University's Nicholas School of the Environment, Durham, NC.

Leduc, E., K. Price, and T. Miller. 2011. "State of North Carolina 2011 Coastal and Estuarine Land Conservation Program (CELCP) Plan" NC Department of Environment and Natural Resources, Division of Coastal Management.

"A Prioritization of Land Parcels for Wetland Mitigation around Knik Arm" prepared for Great Land Trust, Anchorage, AK. 2011.

"A Prioritization of Land Parcels for Conservation in the Matanuska-Susitna Borough" prepared for Great Land Trust, Anchorage, AK. 2010.