

Title: Fish, Wildlife & Biodiversity Conservation

Project Leader: Scott Jackson

Project Overview

Massachusetts is the third most densely populated state in the nation. The rate of land consumption for residential development is steadily increasing far out of proportion to its population growth. Haphazard growth has impacted water resources, natural resource-based enterprises, open space, wildlife habitat, and community character. Climate Change is already impacting natural resources and the way that people interact with natural systems. Nearly half the state's communities lack professional planning staff, while volunteer boards struggle with increasing levels of responsibility, liability, time demands and public mistrust.

The Fish, Wildlife & Biodiversity Conservation Project addresses these concerns through related initiatives that focus on habitat loss and fragmentation, establishing priorities for ecological restoration, mitigating development impacts on wildlife and ecosystems and climate change adaptation. Major initiatives include:

- **The Conservation Assessment and Prioritization System (CAPS)** - CAPS is a computer software program and an approach to prioritizing land for conservation that provides an objective, dynamic, and flexible tool to support decision-making for land conservation, land management, project review and permitting to protect habitat and biodiversity.
- **The River & Stream Continuity Project** - focuses on the impact of road-stream crossings (culverts, bridges, fords) on fish and other aquatic organism passage by providing technical guidance and standards, field surveys, and other tools and approaches for setting priorities for culvert upgrade or replacement
- **Wildlife Conservation** - engages in applied research and provides information, educational materials and programs based on current research to promote wildlife conservation including efforts to better understand the impacts of roads and highways on wildlife and ecosystems and to develop and evaluate techniques for mitigating those impacts.
- **Wetlands Regulations and Protection** - part of a broader effort to provide training and information to municipal officials, this initiative provides workshops and materials for conservation commissions in the implementation of the Massachusetts Wetlands Protection Act.
- **Climate Change Adaptation** – conducting research, outreach education and facilitating a coordinated response to climate change that includes vulnerability assessments, climate adaptation planning, and coordinated action to protect natural resources/systems and strengthen their contributions to the resiliency of human communities in MA.

Activity Summary – 2019

- Meetings and other engagements with businesses and organizations (88)
- Meetings and other engagements with MA Municipalities (58)
- Technical Assistance to Municipalities for Designation Applications and Annual Reporting (15)

Total Educational contacts

	Adults	Youth
Direct Contacts	1534	
Indirect Contacts (Print, Web, etc...)	71696	

Narrative Summary and Impact

I serve as a general resource on fish, wildlife and biodiversity conservation with a particular emphasis on reptiles and amphibians, and the impact of roads and highways on wildlife and ecosystems.

Because of my involvement in the UMass Air program and my role in using drones and sensors to conduct research in salt marshes, I was contacted by Carolyn Mostello, a coastal waterbird biologist from the MA Division of Fisheries and Wildlife (MassWildlife), about the potential for using Unmanned Aerial Systems (UAS) to monitor wildlife and assess habitat. Carolyn and another MassWildlife biologist came to UMass Amherst to meet with me and others in ECo who were involved in drone data collection and research. Following this meeting, I was asked if I would be willing to participate in a meeting at the MassWildlife Headquarters in Westborough, to discuss applications of UAS technology. I organized a group of UMass scientists to travel to Westborough and present on our work, and UAS technologies more generally. I was expecting to meet with 6-8 MassWildlife biologists. Instead, we were led to a large meeting room where 32 biologists and administrators were in attendance for the meeting/presentations. The meeting and discussion went on for four hours. There was a lot of interest among the biologists and administrators in developing cooperative research and monitoring project with UMass.

Over the past year my fish, wildlife and biodiversity activities included:

- I organized and facilitated a meeting and series of presentations on the potential for using Unmanned Aerial Systems (UAS) to monitor wildlife and assess habitat for the MA Division of Fisheries and Wildlife.
- I serve on the Steering Committee for the Staying Connected Initiative (SCI), a partnership working to restore and enhance landscape connections for the benefit of people and wildlife across the Northern Appalachian/Acadian region of the eastern U.S. and Canada.
- I served on the abstract review committee for the International Conference on Ecology and Transportation, reviewing 15 abstracts.
- I maintain the MA Herp Atlas web site.
- I maintain the MA Snakes web site.
- Over the course of the past year, I conducted a field trip and a facilitated meeting on the topic of fish, wildlife and biodiversity conservation reaching 272 participants for a total of 308 contact hours.

A new focus of my work over the past couple of years has been climate change adaptation, especially with regard to ecosystem integrity and conservation. In cooperation with the MA Division of Fisheries and Wildlife and the Northeast Climate Science Center, I lead a team that developed a web-based MA Wildlife Climate Action Tool. Our goal in creating this tool was to provide information to municipalities, landowners, land trusts and other local conservation organizations on the science of climate change and actions that can be taken to protect natural resources in the face of that change. The tool includes detailed information about how climate change is likely to affect Massachusetts, climate related stressors likely to affect wildlife and other natural resources, vulnerability assessments for over 60 wildlife species, and specific actions that can be taken to protect natural resources in the face of climate change. The tool also includes a spatial data viewer that allows users to view GIS data relevant to whatever stressor, assessment or adaptation page they are viewing.

Developing content for the Climate Action Tool, I realized how little conservation effort is explicitly directed at climate-related threats. Little is being done to identify ecosystems that are most vulnerable to climate change and the particular climate-related stressors that need to be addressed. In response I, along with Melissa Ocana, created an informal partnership to focus on ecosystem-based climate adaptation, with representation from the Northeast Climate Adaptation Science Center, MA Division of Fisheries and Wildlife, MA Division of Ecological Restoration, MA Coastal Zone Management, The Nature Conservancy, EcoAdapt, Harvard Forest, and the Executive Office of Environmental Affairs. The implementation elements of this work are 1) ecosystem or issue-based work groups intended to identify research and information needs, and opportunities to collaborate on adaptation based conservation action, and 2) a community of practice called the Massachusetts Ecosystem Climate Adaptation Network (Mass ECAN) to create a network of climate adaptation practitioners to promote collaboration and share information, ideas, and success stories. Over the past year activities included:

- In 2017, Melissa Ocana and I created the Massachusetts Ecosystem Climate Adaptation Network (Mass ECAN), a community of practice for people interested in climate adaptation to protect ecosystems. The second annual Mass ECAN conference was held on October 18, 2018 and was attended by over 100 people from across Massachusetts and across disciplines.
- Maintain and update the Massachusetts Wildlife Climate Action Tool (www.climateactiontool.org).
- I wrote an article on the MA Wildlife Climate Action Tool that was published in the newsletter of the Association of Massachusetts Wetland Scientists.
- I serve as convener for the MA Climate Adaptation Partnership. This partnership includes the MA Office of Coastal Zone Management, MA Division of Ecological Restoration, MA Division of Fisheries and Wildlife, Harvard Forest, EcoAdapt, The Nature Conservancy, the DOI Northeast Climate Adaptation Science Center, and UMass Amherst. This is an action-oriented partnership to share and support best practices, conduct research, facilitate engagement, provide technical assistance, and implement projects across Massachusetts for climate change adaptation. This past year, the Partnership oversaw the work of six work groups, focusing on: cold-water streams, salt marshes, Southern New England forests, rivers and streams (“slowing the flow”), climate change communication, and main-streaming nature-based solutions.
- A new work group focused on climate adaptation to protect Southern New England forests was created that is co-lead by Maria Janowiak (USFS) and John Scanlon (MassWildlife).
- A new work group focused on “slowing the flow” will address the need to store more water, especially in upper portions of watersheds, to address flooding and drought concerns associated with climate change. This work group is being led by Rosalie Starvish (GZA).
- I participate as a member of the Cold-water Streams, Salt Marsh, Southern New England Forests, and Slow the Flow work groups.

- Melissa and I were successful at getting a Center for Agriculture, Food and the Environment (CAFE) Summer Scholars internship to fund an undergraduate student to work on Mass ECAN and other climate change adaptation projects. Ian Kennedy was our intern for the summer.
- Melissa and I were successful at getting a Center for Agriculture, Food and the Environment (CAFE) Policy Scholars internship to fund a graduate student to work on Mass ECAN and other climate change adaptation projects. Max Ditley served as our Policy Scholar intern.
- This past year Melissa Ocana and I initiated a McIntire-Stennis project that will, in part, be investigating the degree to which people engaged in forest stewardship and conservation are using various tools and information sources to implement climate adaptation strategies and actions.
- Over the course of the past year, I conducted three workshops and presentations on the topic of climate change adaptation reaching 195 participants for a total of 103.5 contact hours.

I created the River and Stream Continuity Project in 2000 and have served as project leader ever since. I convened a group of people from a variety of agencies and organizations who were concerned about the impact of road-stream crossings on fish and other aquatic organism passage. In 2005, three of the organizations/agencies that were key players in initiating and implementing the project joined to create the River and Stream Continuity Partnership. In 2015, the project expanded significantly and is now called the North Atlantic Aquatic Connectivity Collaborative (NAACC) and covers 13 states in the northeastern U.S. I have served as project leader for the NAACC since its beginning.

Creation of the NAACC required coordinating with various agencies and organization that were already involved in road-stream crossing assessment using a variety of methodologies (CT, VT, NH, ME and USFS) and developing a unified crossing assessment protocol that could be used throughout the 13 state, North Atlantic region. I oversaw the development of a web-based GIS mapping tool to assist cooperators in the prioritization of stream crossings for assessment, creation of field data forms and instructions, creation of electronic data forms and mapping utilities for digital data collection using tablet computers, algorithms for scoring crossing data, and an elaborate online database for housing, scoring and distributing data from NAACC field assessments. Under my leadership, the NAACC is expanding rapidly, both in terms of the number of people involved and crossings assessed, but also in the development of new assessment modules to complement the aquatic passability module that was implemented in 2016.

In addition to expanding efforts to assess road-stream crossings geographically I've continue to work with Paula Rees (WRRC) and Steve Mabee (Geosciences) to deepen the culvert-related work to include culver condition assessments, structural, hydraulic and geomorphic risk of failure, and potential disruption of services due to storm-related culvert failures. These projects will allow us to make common cause between environmental agencies/organizations interested in protecting and enhancing aquatic connectivity and highway and emergency management agencies that seek to create more resilient transportation infrastructure. Work over the past year has included:

- I co-authored with Paula Rees and Steve Mabee a final report for a MassDOT-funded project to develop and test methodologies to evaluate risk, vulnerability and criticality related to road-stream crossings, using the Deerfield River watershed as a pilot project. I presented the results of this project at the Northeast Transportation and Wildlife Conference in the fall of 2018.
- I serve as project leader for the NAACC and convener of the NAACC Steering Committee. I oversee development of all new NAACC assessment modules and scoring systems, and am responsible for data quality and management for NAACC data collected across the 13-state region. This past year, two new members joined the NAACC Steering Committee.

- Ongoing revisions and improvements to the online Road-Stream Crossings Database so that it can better serve cooperators throughout the 13-state region.
- Maintenance and technical support for an electronic crossing assessment form for laptop computers, tablets and smart phones, along with utilities to facilitate navigation to field sites and collection of photographic data that would be automatically associated with electronic field forms.
- Maintenance of an online training and certification program for observers and coordinators participating in the NAACC.
- Two new assessment modules were added to the NAACC this year: 1) Aquatic Connectivity for Road-Stream Crossings on Tidal Streams and 2) Terrestrial Wildlife Connectivity of Road-Stream Crossings.
- The NAACC Data Center was transfer to a new hosting company. The streamcontinuity.org web site was revamped so that now the landing page serves a portal to aquatic connectivity web resources including collaboratives and data and decision support tools.
- The Aquatic Connectivity Scenario Analysis Tool (<http://ecosheds.org/aq-connectivity-tool/#/>) was finalized and launched. This is an online tool that uses road-stream crossing data from the North Atlantic Aquatic Connectivity Collaborative (NAACC) and the UMass Critical Linkages assessment to allow users to create scenarios that involve combinations of crossing replacements and/or dam removals, and evaluate them for gains in aquatic connectivity and ecological restoration potential. I used the tool to assess 89 scenarios for the Housatonic Valley Association.
- Served as convener of the MA River and Stream Continuity Partnership (one meeting).
- Over the course of the past year, I conducted twelve workshops and presentations, including a conference presentation, on the topic of river and stream continuity reaching 462 participants for a total of 467 contact hours.

I continue to play a leadership role in Massachusetts and the region for wetlands assessment and wetlands protection. I serve as a project leader working with the MA Department of Environmental Protection (MassDEP), MA Office of Coastal Zone Management (CZM) and the U.S. Environmental Protection Agency (EPA) to develop cost-effective tools and techniques for assessment and monitoring of wetland and aquatic ecosystems. An important aspect of our work involves the development of new metrics for use in CAPS to better assess the ecological integrity of wetlands across Massachusetts. A new aspect of my wetlands work is focusing on salt marshes. These coastal wetlands are being degraded across the northeast by a variety of stressors, including sea level rise, changing sediment dynamics, nutrient enrichment, crab herbivory, erosion, and general marsh dieback. Charlie Schweik and I now lead a research project investigating the use of Unmanned Aerial Systems (UAS) to map salt marshes and assess their condition and vulnerabilities. I frequently provide advice and technical assistance to MassDEP's wetlands program. The close collaboration with MassDEP, MA CZM and EPA ensures the relevance of this work for policy and regulations related to wetlands assessment and protection. I continued my long-standing collaboration with the MA Association of Conservation Commissions (MAACC) to provide training to conservation commissioners. This past year my wetland related work has included:

- This year, in collaboration with Charlie Schweik, I continued an EPA-funded project to use Unmanned Aerial Systems (UAS) to assess wetland condition in salt marshes. For this second year of data collection, the research plan and Quality Assurance Project Plan (QAPP) were modified based on experience during the 2018 field season. Additional UAS equipment and sensors were purchased, and field data collection was continued at five sites and initiated at four new sites on the Massachusetts coast. We received notice in August 2019 that our project was selected for a Wetlands Program Development grant that will extend our salt marsh UAS work for another two years (2020-2021).

- I was successful at getting a Center for Agriculture, Food and the Environment (CAFE) Summer Scholars internship to fund an undergraduate student to work as a field technician for our EPA-funded salt marsh UAS project. Josh Ward was our intern for the summer.
- I was successful at getting a Center for Agriculture, Food and the Environment (CAFE) Policy Scholars internship to fund a graduate student to work as field crew manager for our EPA-funded salt marsh UAS project. Amanda Davis served as our Policy Scholar and field crew manager during the 2019 field season.
- I continued a new collaboration with Jon Woodruff (GeoSciences Department) on salt marsh research. His focus is on sediment dynamics in salt marshes; this is a subject of relevance to my interests in assessing wetland condition and viability. Jon supported our successful grant proposal to EPA; we supported his successful proposal to the Northeast Climate Adaptation Science Center. Our respective research projects will focus on the same field sites so that we can both utilize UAS and other data collected in these salt marshes.
- I organized, moderated and presented at a full-day salt marsh symposium for UMass-Amherst faculty and graduate students engaged in salt marsh research. The goal was to provide an opportunity for each of us to learn what other related research was being conducted at UMass Amherst and facilitate collaboration in project development and grant writing. A number of people from GeoScience and ECo participated. Collaborators from the MA Office of Coastal Zone Management and U.S. EPA listened in on the presentations using Zoom.
- As a follow up to a report I completed (with MassDEP) in 2018 on the success of wetland mitigation projects in Massachusetts, I have been providing technical assistance to MassDEP to improve the success of wetlands replacement projects including identification of potential regulatory changes and the drafting of a revised version of their mitigation guidance document.
- I served on a Wetlands Expert Panel for the Chesapeake Bay Program to develop recommendations for a credit system for wetland restoration projects based on their potential for removing nitrogen, phosphorus, and suspended solids from water enter the Bay. Over the past year, I participated in eight remote meetings via videoconference, reviewed a number of documents, and provided feedback on a draft report.
- Along with Deb Henson, I submitted to MassDEP a draft revision of the state's wetland delineation manual. This involved numerous phone calls and email exchanges with MassDEP personnel to resolve outstanding issues about the approach to delineation that will be recommended by the state.
- I again offered Wetlands Assessment and Field Techniques (NRC 581) as a blended course with 15 people participating via a non-credit option offered through UMass Extension. Eleven of these non-credit students participated in the full course (8 lectures and 5 field labs); four participated in a lectures-only version of the course. Participants included state and municipal agency staff, environmental consultants, conservation commissions, and members of conservation organizations. The format of this course was designed to allow natural resource professionals and conservation commissioners to participate in the lecture portion of the course either in person or via web-casting (webinar). Eight lecture sessions met once a week in the evenings. Five field sessions scheduled later in the semester met once a week on Wednesday afternoons.
- Students in the Wetlands Assessment and Field Techniques course field tested portions of a new wetlands functional assessment methodology being developed by the U.S. Army Corps of Engineers and U.S. EPA. Feedback from students was communicated back to the agency personnel involved in the development of the methodology.
- Over the course of the past year, I conducted three workshops and presentations on wetlands topics reaching 149 participants for a total of 128.77 contact hours.

Since 1999, I have led, in collaboration with Kevin McGarigal a major integrated research and extension project centered around the Conservation Assessment and Prioritization System (CAPS). CAPS combines principles of landscape ecology and conservation biology with the capacity of modern computers to compile spatial data and characterize landscape patterns. It is an ecosystem-based (coarse-filter) approach for assessing the ecological integrity of lands and waters and subsequently identifying and prioritizing land for habitat and biodiversity conservation. CAPS, or elements of CAPS, have been incorporated into other landscape-based analyses, including MassWildlife's Biomap 2, The Nature Conservancy's Resilient and Connected Landscapes, and Designing Sustainable Landscapes (Connect the Connecticut and Nature's Network). Critical Linkages is an extension of CAPS that involves scenario analysis to identify land that is most critical for maintaining landscape-scale connectivity as well as the best opportunities to restore connectivity through culvert replacement, dam removal and the use of wildlife passage structures on roads and highways. Critical Linkages also conducted an assessment of regional-scale landscape connectivity and produced the Conductance Index for use in identifying and prioritizing land of greatest importance for regional connectivity. The Conductance Index has been incorporated into the Massachusetts Audubon Society's MAPPR tool for parcel-based prioritization and conservation.

The CAPS statewide assessment for Massachusetts, originally completed in 2011, was rerun in July 2015 with updated models and four newly developed integrity metrics. A version of CAPS and the Critical Linkages analysis was applied across the 13-state North Atlantic region of the U.S. As these assessments in other states were completed, I was more involved in providing outreach and training throughout the region on the use of CAPS for conservation decision-making.

CAPS is integrated into two other projects that I organized and continue to lead: 1) the River and Stream Continuity Project and 2) the MA Wetlands Assessment and Monitoring Project (see below for details). Following are specific CAPS-related activities that I engaged in during the 2018-2019 year.

- The Aquatic Connectivity Scenario Analysis Tool (<http://ecosheds.org/aq-connectivity-tool/#/>) was finalized and launched. This is an online tool that uses road-stream crossing data from the North Atlantic Aquatic Connectivity Collaborative (NAACC) and the UMass Critical Linkages assessment to allow users to create scenarios that involve combinations of crossing replacements and/or dam removals, and evaluate them for gains in aquatic connectivity and ecological restoration potential. It allows users to create scenarios to assess the synergistic effects of multiple barrier removal projects on connectivity restoration and allows for flexible cost-benefit analyses that can be used to target restoration funds to the most impactful projects.
- This past year Melissa Ocana and I initiated a McIntire-Stennis project that will, in part, be investigating the degree to which CAPS and other data sources and tools are being used as part of strategic forest conservation in the Northeastern U.S.
- This past summer I initiated a project, funded by the Trustees (formerly The Trustees of Reservations) that will use CAPS to identify high-quality areas of coastal wetlands and evaluate the degree to which these areas are likely to be degraded by future development in the surrounding landscape. This involves the use of CAPS to assess ecological integrity of coastal wetland under current conditions and a future scenario that includes conversions of land for development.
- I maintained the CAPS web site (www.umasscaps.org) which provides information about CAPS and its various applications. Data from CAPS assessments are available for download as GIS layers or as PDF maps.

- Over the course of the past year, I conducted six workshops and presentations on CAPS and related applications reaching 334 participants for a total of 265.32 contact hours (# participants x program length).

Collaborating Organizations

- **MA Division of Fisheries and Wildlife**
- **MA Division of Fisheries and Wildlife**
- **MA Office of Coastal Zone Management**
- **MA Department of Environmental Protection**
- **Northeast Climate Science Center**
- **North Atlantic Aquatic Connectivity Collaborative**
- **Massachusetts Audubon Society**
- **Massachusetts Department of Agriculture**