2 Progress Since 2005

The Massachusetts conservation community, which includes federal, state, regional, and local groups, agencies, and tribes, has been working for well over a century to conserve and restore the biodiversity of the Commonwealth, including what we now call the Species of Greatest Conservation Need and their habitats. This chapter summarizes some of the highlights from the past decade, since the first Massachusetts State Wildlife Action Plan in 2005, but also touches on some of the longer-term efforts towards conservation. While this Plan is written by the Massachusetts Division of Fisheries and Wildlife, the accomplishments described here are not those of the Division alone, but those of the entire conservation community. Without the cooperation and pooling of resources among all the conservation partners, without the dedication and vision of organizations large and small, we cannot hope to conserve these species, their habitats, and the ecological processes that sustain them.

A: Land Protection

Since 1891, when The Trustees of Reservations was founded, Massachusetts has had many conservation groups targeting land for protection. Currently, there are over 150 private land trusts across the state, ranging from large, state-wide organizations such as Mass Audubon and The Trustees of Reservations, to small, single-town land trusts such as the Paxton and Grafton Land Trusts. Three state agencies are major landowners or hold conservation easements: the Department of Conservation and Recreation, the Division of Fisheries and Wildlife in the Department of Fish and Game, and the Department of Agricultural Resources. In addition, the Executive Office of Energy and Environmental Affairs coordinates and supports all three agencies as well as private and municipal conservation groups. The federal government, through its U.S. Fish and Wildlife Service, National Park Service, and Army Corps of Engineers, owns nine National Wildlife Refuges, several large flood control sites, the Cape Cod National Seashore, and the Appalachian Trail Corridor, among other properties. Many cities and towns hold large and small conservation areas, parks, and watershed lands.

Together, these organizations and agencies have protected about one quarter of Massachusetts acreage from development (Executive Office of Energy and Environmental Affairs, et al. 2015). Let us say that again, because it is so important:

One quarter of the land in Massachusetts, a long-settled, densely populated state, is protected from development.

In fact, about half of the acres of the most important areas for biodiversity (the Key Sites; see Chapter 4, section D) are protected.

In the past decade, since the first SWAP, approximately 132,339 acres have been permanently protected from development by all the conservation groups working in the state. Of those acres, a minimum of about 48,059 acres, or 36.3%, are currently considered to be habitat for Species of Greatest Conservation Need. An additional 46,755 acres, or 35.3%, are mapped in *BioMap2*, which is a map of the most important fine- and coarse-filter biological resources in Massachusetts (see Chapter 4, section D, for more detail on *BioMap2*).

Funding for land protection comes from many sources, from federal grants down to municipal budgets and donations by private citizens and businesses. A few of the major sources of funding on the state level recently have been:

- Open Space Bond. Since 1996, the Massachusetts legislature has passed four Open Space Bond Bills, totaling over $4.7 billion dollars, almost $1 billion of which has been specifically set aside for land protection.
- The Community Preservation Act. Signed into law in 2000, this legislation allows municipalities to create a local Community Preservation Fund to support three purposes: open space protection, historic preservation, and affordable housing. Funding comes from a local surcharge of not more than 3% on real estate transfers and from annual state disbursements. Since 2000, more than 21,800 acres has been protected as open space through Community Preservation Act funding.
- The Commonwealth Conservation Land Tax Credit. If a landowner donates, either outright or via a conservation restriction, land with important natural resources, the owner can receive a state tax credit of up to 50% of the donation value, up to $75,000. Lands that qualify include those with wildlife habitat and biological diversity, agricultural and forestry operations, drinking water suppy watersheds, recreational opportunities, or with scenic and cultural values. This program began in 2011, and to date has been instrumental in protecting 7,712 acres on 173 properties across the state.
- LAND and PARC grants. The Massachusetts Division of Conservation Services offers grants to municipalities under the Local Acquisitions for Natural Diversity (LAND) and Parkland Acquisitions and Renovations for Communities (PARC) Programs, which first began in 1961. Funds for the grants come from the Open Space Bond.
- Massachusetts Wildlands Fund. Also known as the Land Stamp, this is a $5 fee added to the cost of each Massachusetts hunting, fishing, and trapping license. These funds are used by the Massachusetts Division of Fisheries and Wildlife to acquire land for wildlife habitat. Lands acquired in this way are open for hunting, fishing, trapping, and other passive wildlife-related recreation. In the

past decade, about $10.8 million of Wildlife Funds has been used to protect about 10,800 acres.

Protectedness Analysis

As part of updating the SWAP, the Division of Fisheries and Wildlife has undertaken a protectedness analysis of biological resources state-wide. Land protection is a significant action often used to conserve Species of Greatest Conservation Need; analyzing the degree to which specific biological resources are protected allows monitoring of the effectiveness of this action.

Three levels of resources were analyzed:

- Fine-filter: species and natural communities.
- Coarse-filter: several types of landscape-scale resources, as mapped in *BioMap2* (see section E, below), including Forest Cores, Landscape Blocks, Wetland Cores and Buffers, Aquatic Buffers, Vernal Pool Cores, and Coastal Adaptation Areas.
- Subwatersheds.

The first draft of the results of these analyses was available for the current SWAP (further refinements are expected within the next year or so). Some of the relevant findings are listed below.

Species of Greatest Conservation Need: Overall, 341,950 acres (44%) of the 773,132 acres of mapped habitat (not open water) of SGCN are protected. However, note that protectedness ranges for 0% to 100% protected, depending on the species. A few highlights from this analysis:

- Orchids: About 60% of the habitat of SWAP orchids is protected.
- Pitch Pine/Scrub Oak moths and butterflies: About 61% of the habitat of SWAP moths and butterflies of Pitch Pine/Scrub Oak habitats is protected.
- Ambystomid salamanders (Marbled, Blue-spotted, Jefferson's): 40% to 53% of non-open-water habitat is protected.
- Freshwater turtles (N. Red-bellied Cooter, Bog, Blanding's, Wood): 27% to 35% of non-open-water habitat is protected
- Apparently 100% protected: 9 species (Small-footed Myotis, Blackpoll Warbler, Crested Fringed Orchis, Annual Peanutgrass, Black-fruited Woodrush, Mountain Cranberry, Smooth Woodsia, Sessile Water-speedwell, Fogg's Goosefoot)
- Apparently 0% protected: 12 species (Threespine Stickleback, Taconic Cave Amphipod, Piedmont Groundwater Amphipod, Ogden's Pondweed, Ram's-head Lady's-slipper, Southern Twayblade, Creeping Sedge, Glaucous Sedge, Midland Sedge, Rich Woods Sedge, Sea Lyme-grass, Arborvitae) (This category points up the difficulties of existing data sets; one Ram's head Lady's-slipper population is protected by The Nature Conservancy, but that property was shown as unprotected in GIS data at the time of this analysis.)

Natural communities: Only Priority Natural Communities were analyzed. Priority Natural Communities are those considered to be rare or uncommon in Massachusetts (Swain and Kearsley 2015). Overall, 45,348 acres (64%) of the 70,568 acres (not including open water) of documented Priority Natural Communities are protected. This relatively high degree of protectedness may result from targeted protection of the rarest natural communities and/or, more likely, from surveys for natural communities being conducted mostly on already protected land. Nonetheless, this degree of protectedness is encouraging.

Coarse-filter resources: Overall and considered on a state-wide basis, 49.9% of the coarse-filter resource acreage is permanently protected. Considered individually, these resources range from 42.1% protected (Aquatic Buffer) to 64.4% protected (Forest Core), on a state-wide basis.

- Forest Cores and Landscape Blocks were also analyzed by ecoregion. The least protected Forest Cores are in the Western New England Marble Valleys/ Berkshire Valleys ecoregion, at 40.9%.
  - The most protected Forest Cores are in the Cape Cod and Islands ecoregion, at 73.8%. The least protected Landscape Blocks are in the Western New England Marble Valleys/Berkshire Valleys ecoregion, at 25.1%.
  - The most protected Landscape Blocks are in the Cape Cod and Islands, Taconic Mountains, and Worcester Plateau ecoregions, at 56.8% to 57.9%.
- Wetland Cores, Wetland Buffers, Vernal Pool Cores, and Aquatic Buffers were also analyzed by major watershed.
  - The degree of protectedness of Wetland Core by watershed (where there is any Wetland

Core at all) ranges widely, from 6% to 91%. For the watersheds with more than 1,000 acres of Wetland Core, the percent protected ranges from 8% to 80%, still a very wide range.

- The degree of protectedness of Wetland Buffer by watershed (where there is any Wetland Buffer at all) ranges widely, from 6% to 90%. For the watersheds with more than 1,000 acres of Wetland Buffer, the percent protected ranges from 9% to 76%, also a very wide range.
- As for Wetland Cores and Buffers, protection of Vernal Pool Cores by watershed varies as widely as mathematically possible, from 0% to 100%.
- Protection of Aquatic Buffers by watershed also varies widely, from 1% to 68%.

Subwatersheds: Of the 27 major watersheds in Massachusetts, the percent of protectedness ranges from 6.6% for the Blackstone to 35.4% for the Westfield. Note, however, that even within the overall Blackstone watershed, eight of the subwatersheds are over 50% protected. Conversely, within the overall Westfield watershed, 20 of the subwatersheds are completely unprotected. Further analysis of subwatersheds will incorporate percent of impervious surface within each subwatershed.

What these protectedness analyses indicate is that, overall, Massachusetts has done a remarkable job protecting its biodiversity from development, which is the primary threat in one way or another to most of the SWAP species and habitats. The conclusion we draw from these analyses is that, going forward, the conservation community in Massachusetts must be ever more focused and targeted in its land protection efforts, to ensure that the breadth of biodiversity is adequately represented in our protected lands.

B: Habitat Management

As the acreage of protected land in Massachusetts has grown, the need to manage the habitats on these protected lands – and on private lands as well – has become ever more evident. Chapter 4 in this Plan will cover the threats to our landscape in more detail, but in addition to outright destruction of natural lands by all forms of human development, even undeveloped, protected lands are threatened by the lack of natural disturbance regimes (especially wildfire and flooding) and by invasion by exotic species that crowd out native plants and animals. This section highlights some of the efforts over the past decade towards managing and restoring habitats to benefit Species of Greatest Conservation Need.

Maintaining Early Seral Habitats

The Division of Fishery and Wildlife's Biodiversity Initiative (BDI), which predates the 2005 SWAP, seeks to maintain and restore the native diversity of flora and fauna in the Commonwealth through active land management. The BDI works to reestablish open grassland, shrubland, and young-forest habitats that benefit rare and declining species of conservation need.

The Habitat Program focuses on creating a distribution of open habitats that were formerly provided through natural processes, like flooding and fire, across more than 200,000 acres of state wildlife lands. Human land-use change has substantially limited beaver impacts across the landscape, for example, and has greatly reduced the natural occurrence of fire in the coastal regions and major river valleys of the state. The extensive open habitats that formerly resulted from these natural disturbances can be emulated through management of abandoned-field sites, which typically involves some tree clearing, extensive brush mowing, invasive plant control, and limited use of prescribed fire. The BDI Key Sites effort specifically identifies the highest priority sites for management of open habitats, and these critical open areas complement existing DFW Forest Reserve lands to help conserve the biological diversity of species and communities across the landscape.

The Division's landscape composition goals for the state's Wildlife Management Areas (Figure 2-1) are science-based, have received broad public support (including endorsement by the DFW Board), and call for about 20-25% open habitats (including grassland, shrubland, and young forest sites), and 75-80% full-canopy forest (including 10-15% forest reserves) across approximately 190,000 acres of state wildlife lands. DFW staff conducts tree clearing, brush mowing,

invasive plant control, and biological monitoring statewide through a public, competitive bidding process to help move from current to desired conditions.

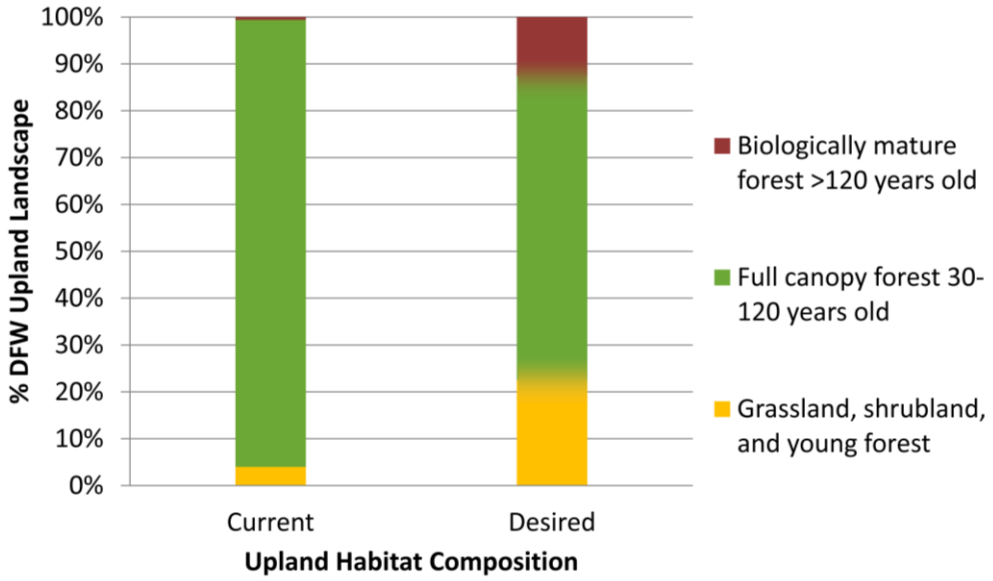

Figure 2-1. Current and desired habitat-composition goals for upland sites on DFW Lands.

From 2005 to mid-2015, DFW carried out 78 habitat management projects (timber harvests of various types, brush-hogging, burning, etc.) on 25 Division Wildlife Management Areas and Wildlife Conservation Easements, totaling about 3800 acres. More than 1500 of those acres have been treated in the past 18 months, as the Division has implemented the BDI Key Sites effort.

Massachusetts Natural Resources Conservation Service (NRCS) Partnership with MassWildlife

To improve efforts towards managing and restoring habitats to benefit Species of Greatest Conservation need on private land, the DFW Private Lands Habitat Biologist has worked under Cooperative Agreement with the Massachusetts Natural Resources Conservation Service (NRCS) since 2008 (see Box 2-1). The Private Lands Habitat Biologist (PLHB) provides NRCS with technical assistance for developing habitat management components of Farm Bill Funding Program applications; Wildlife Habitat Incentive Program (WHIP), Environmental Quality Incentives Program (EQIP), Wetlands Reserve Program (WRP), and Working Lands for Wildlife (WLFW). The PLHB also contributes to developing MA NRCS ranking criteria for funding programs, modifying habitat management practices, and establishing new practices. The PLHB also serves as liaison between NRCS and the DFW with respect to *The Conservation Strategy for the New England Cottontail*.

The Massachusetts office of NRCS aligned their State WHIP Plan with DFW's State Wildlife Action Plan and set priorities including working as part of a coordinated effort to help accomplish the goals of the Massachusetts SWAP, focusing restoration and/or management efforts on native aquatic, upland, and wetland habitats that are important for at-risk wildlife species, emphasizing restoration and/or management that will benefit at-risk wildlife species, and reducing the impacts of invasive plants species on at-risk wildlife species and/or their habitats. Priority habitat types consistent with the SWAP were also identified for the Massachusetts WHIP Plan: marshes & wet meadows,

shrub dominated wetlands, grasslands, pitch pine-scrub oak systems, upland oak forest, and young forest/shrubland.

With passage of the 2014 Farm Bill, the WHIP was eliminated and under EQIP a minimum of 5% of funding is to be used for managing wildlife habitat. The 2014 Farm Bill also established WLFW as a funding pool under the EQIP. WLFW directs funding assistance to seven species nationwide, two of which occur in Massachusetts: New England Cottontail and Bog Turtle. EQIP specifies wildlife habitat development as a program purpose; the practices required to manage disturbance-dependent habitats such as mechanical tree clearing, brush hogging, delayed mowing, and prescribed burning were and continue to be offered under EQIP. In addition, EQIP offers such practices as invasive species control, pollinator habitat planting, turtle nest site creation, and nesting structures for birds. Therefore, under the 2014 Farm Bill, the PLHB continues to prepare habitat management proposals to benefit SGCN, which will be used by NRCS in developing EQIP funding applications for eligible landowners.

Since 2009, under partnership with NRCS, the PLHB has participated in developing 109 habitat management projects funded by Farm Bill programs. Property ownership includes 87 farm or forest landowners, 14 land trusts, 3 conservation organizations, and 5 hunting/fishing clubs. Management of approximately 2,300 acres of habitat (including 124 acres of Pitch Pine Scrub Oak, 604 acres of young forest/shrubland, 127 acres of grassland) has taken place. The total amount of NRCS funding reimbursed to these landowners has been nearly $2.5 million from federal fiscal year 2009 through 2014.

Box 2-1: A NRCS-DFW Partnership
…..written by NRCS

Technical assistance activities in support of farmers and their working lands has been a key priority for the United States Department of Agriculture's Natural Resources Conservation Service (NRCS) throughout the agency's history. More recently, with the passage of recent Farm Bills (i.e., Food, Conservation and Energy Act of 2008, and the Agricultural Act of 2014), NRCS opportunities to address fish and wildlife conservation were significantly increased and identified as an agency priority. To ensure that Massachusetts NRCS activities and resources result in maximum benefits to wildlife, NRCS has developed a strong partnership with the Massachusetts Division of Fisheries and Wildlife (DFW). Following are a few examples:

Habitat Management Biologist

Under the conservation provisions of recent Farm Bills, NRCS provides technical and financial assistance to private landowners and land managers who voluntarily agree to apply conservation practices on their land for the conservation and improvement of natural resources, including habitat for wildlife and fisheries resources. Every year since 2009, NRCS and the DFW have partnered to enhance NRCS's delivery of wildlife and fisheries technical assistance to private landowners within the Commonwealth. DFW provides NRCS with the services of a Habitat Management Biologist who is responsible for providing site specific wildlife habitat recommendations to NRCS staff for the development of conservation plans targeting fisheries and wildlife. Because the DFW is the state agency responsible for the restoration, conservation, and management of fish and wildlife resources in Massachusetts, and NRCS has financial assistance programs that can enhance wildlife habitat, both agencies benefit.

Natural Heritage Review Biologist

As a federal agency, NRCS has responsibilities under Section 7 of the U.S. Endangered Species Act of 1973; which requires federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their habitat. Additionally, NRCS policy requires consideration of impacts to species protected by state or tribal laws or regulations. Since 2009, NRCS has entered into an annual agreement with the DFW, through its Natural Heritage and Endangered Species Program (NHESP), for the services of a NHESP Review Biologist. The Review Biologist evaluates draft conservation plans related to any NRCS activities that are located within NHESP delineated Priority Habitat in order to determine potential impacts (both positive and negative) to State listed species. Additionally, when necessary, the Review Biologist will provide NRCS with recommendations to mitigate any potential negative impacts from NRCS funded activities. This enables both agencies to more effectively meet their individual and collective obligations for conserving listed species and their habitats.

NRCS CONSERVATION PROGRAMS

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers to address natural resource concerns such as water and air quality, soil erosion, and wildlife habitat. In recent years, private forest landowners have increasingly participated in EQIP, providing an opportunity to combine healthy forest management with wildlife habitat restoration and enhancement.

In the past, the Wildlife Habitat Incentive Program (WHIP), authorized under the 2008 Farm Bill and administered by NRCS, was a voluntary program that offered technical and financial assistance for restoring, developing and enhancing wildlife habitat on eligible land. The 2014 Farm Bill repealed WHIP; habitat management and enhancement is now emphasized under EQIP. NRCS foresees a seamless transition from WHIP to EQIP for assistance to landowners regarding wildlife habitat.

Continued on the next page….

Box 1, continued

WHIP program provisions required that the NRCS State Conservationist develop a plan outlining the NRCS objectives and priorities. Additionally, the plan would serve as the basis for allocation of funds within the state. To ensure that NRCS focused assistance on habitats and species in greatest conservation need, one of our first steps in developing the plan was to review the Massachusetts Comprehensive Wildlife Conservation Strategy (CWCS) and identify the priority habitat types and priority conservation actions that could be implemented under WHIP, and now EQIP, in order to further the goals of the CWCS.

> *The Comprehensive Wildlife Conservation Strategy (CWCS) identifies the species that the DFW deems "in greatest need of conservation," with the goal of conserving the wildlife biodiversity of Massachusetts. Wildlife species in greatest need of conservation were identified and assigned to one or more habitat types essential to their survival. Additionally, the CWCS identifies primary strategies that could be utilized by DFW and partners in order to achieve the goal of conserving the Commonwealth's biodiversity.*

Three of the four primary objectives identified in the Massachusetts NRCS plan entailed focusing on the restoration and management of habitats for at-risk species in order to maintain the biodiversity of the Commonwealth. The remaining primary objective in the plan was *"work as part of a coordinated effort to help accomplish the goals of the Massachusetts Comprehensive Wildlife Conservation Strategy."* Ultimately, the plan identified 11 habitat types as a focus.

Wetlands Reserve Program (WRP) & Agricultural Conservation Easement Program – Wetlands Reserve Easements (ACEP-WRE)
Under the former WRP and current ACEP-WRE, NRCS provides financial and technical assistance to landowners to restore, enhance and protect wetlands through the purchase of conservation easements. The wetland reserve conservation easements provide many benefits, including habitat for fish and wildlife and the protection of biological diversity. Through our partnership with DFW, the Habitat Management Biologist visits the proposed conservation easement sites with NRCS in order to provide wildlife habitat recommendations that will be incorporated into the restoration plans.

Program Ranking Criteria
The financial assistance programs enacted by the recent Farm Bills use a ranking process to select applications for funding that will optimize environmental benefits and achieve national, state and local priorities. For example, a national priority of the Environmental Quality Incentives Program (EQIP) is the *"promotion of at-risk species habitat conservation."* Under various Farm Bill programs that include wildlife as a priority, Massachusetts NRCS has developed state and local ranking questions that use the work of DFW's BioMap2. Since the purpose of BioMap2 is to guide strategic biodiversity conservation in Massachusetts by focusing stewardship efforts on those areas that are most critical for ensuring the long term persistence of rare species and their habitats, NRCS is better able to focus our technical and financial assistance on projects that will produce optimal benefits.

New England Cottontail

The Massachusetts Division of Fisheries and Wildlife is working with many partners to conserve the New England Cottontail, a regionally endemic rabbit which inhabits early successional uplands with high shrub densities. Partners in this effort include federal and other state agencies, universities, wildlife organizations, private companies, municipalities, land trusts, and Native American tribes. The Wildlife Management Institute coordinates this collaboration that has lead to pooling of resources, efficiently using funds, and devising new and innovative approaches to conservation.

In 2012, a *Conservation Strategy for the New England Cottontail* (NEC) was adopted (Fuller and Tur, 2012). The Strategy identified actions to address threats to the cottontail, along with goals to be met by 2030. The Strategy is based on the adaptive management concept; it can and will be changed as scientists learn new facts about this rare cottontail and as new threats emerge or as old threats diminish. The key to carrying out the Strategy lies in ensuring that the right conservation actions are applied in the right places to successfully recover the species.

The Strategy employs an administrative structure that includes a New England Cottontail Executive Committee consisting of the Wildlife Management Institute, U.S. Fish and Wildlife Service (USFWS), state wildlife agency directors, and the USDA Natural Resources Conservation Service (NRCS). It is responsible for overseeing the adaptive decision-making process and charging an NEC Technical Committee with developing and carrying out objectives of the Strategy and tracking accomplishments. The Executive Committee also plays an important role in obtaining funds to accomplish conservation tasks. The Executive Committee has established bylaws that outline procedures for communication among its members. The New England Cottontail Technical Committee, a group of biologists from all six states within the species' range, as well as professionals with the USFWS and NRCS are responsible for identifying habitat and population goals for the species. Work Groups, under guidance of the Technical Committee, address all aspects of the Strategy and include Outreach/Education, Habitat Management/ Landowner Recruitment, Captive Breeding, Research/Monitoring, Land Protection, and Information Management. MassWildlife staff serves as representatives on the Executive Committee, Technical Committee, and all of the work groups.

As part of the Habitat Management/Landowner Recruitment work group, each state formed a Land Management Team (LMT). The Massachusetts Land Management Team convened in June 2011 and is comprised of the MassWildlife Upland Game Biologist and the Private Lands Habitat Biologist, as well as staff from the USFWS's Eastern MA Refuge Complex, Partners for Fish and Wildlife Program, and Southern New England-NY Bight Coastal Program, in addition to Massachusetts NRCS staff. The team has responsibility for establishing demonstration areas, developing site-specific management plans, coordinating with National Wildlife Refuges and Estuarine Research Reserves, contacting landowners, creating habitat on private land through Farm Bill funding, creating habitat on municipal, state, and federal land, managing contracts and vendors, and refining Habitat Best Management Practices.

Land Management Team coordination has allowed for habitat management to take place on adjacent lands under multiple ownerships with various funding sources. For example, approximately 230 acres of adjacent state, municipal, and tribal lands within the Mashpee National Wildlife Refuge are being managed in coordination with funding and/or resources from a State Wildlife Grant, the USFWS Partners for Fish and Wildlife Program, the USFWS Eastern MA Refuge Complex, NRCS, and the Town of Mashpee. In total for Massachusetts, approximately 2,312 acres of habitat management for New England Cottontail has been planned or completed since 2010 (300 on federal lands, 918 on military bases, 537 on state lands, 209 on municipal lands, 310 on private lands, and 38 on tribal lands). Habitats being managed include Pitch Pine-Scrub Oak systems in southeastern Massachusetts, where prescribed fire is being implemented, and creation of young forest habitat in southwestern Massachusetts, where clear-cutting is taking place.

The habitat goal for Massachusetts to benefit New England Cottontail is 6,800 acres. This may be met by 2030 via creating new habitat, enhancing or managing existing habitat, documenting NEC use of self-sustaining natural habitat, and documenting NEC use of formerly unoccupied habitat.

As a result of coordinated, regional conservation efforts and review of the best available scientific information,

the USFWS announced on September 11, 2015, that Endangered Species Act listing of New England Cottontail is not warranted.

C: Environmental Regulation on the State Level

The Commonwealth of Massachusetts is a national leader in its environmental laws and regulations. This section summarizes the most important of the current laws and provides links for more information.

The Executive Office of Energy and Environmental Affairs and "its appropriate departments" are appointed the authority to promulgate the duties of the "state environmental policy" (MGL ch. 21A, § 2). Under Section 2(1)-(30), specific duties are laid out that the office and its appropriate departments are required to fulfill, such as the management and protection of the state's natural resources like air, water, and land and all the wildlife those resources inhabit.

The **Massachusetts Environmental Policy Act**, known as MEPA, requires that all state agencies and their constituents evaluate any action taken to determine the "impact on the natural environment," including impacts on climate change, by using "all practicable means and measures to minimize damage done to the environment" (MGL ch. 30, § 61). The review process consists of the governing constituency deciding whether an environmental impact report is required or not, public and agency review period, and the issuance of the final determination by the governing agency's secretary. For more details on the regulatory process under MEPA, see the MEPA website.

The **Massachusetts Endangered Species Act**, also known as MESA, is administered by the director of the Division of Fisheries and Wildlife within the Department of Fish and Game, under Massachusetts General Laws Chapter 131A, enacted December, 1990, and its implementing regulations, 321 CMR 10.00, last revised October 15, 2010. With the exception of certain permissible activities found in Section 3 of Chapter 131A, no person may take, possess, transport, export, process, sell or offer for sale, buy or offer to buy, nor shall a common or contract carrier knowingly transport or receive for shipment, any plant or animal species listed as endangered, threatened or of special concern or listed under the Federal Endangered Species Act. To determine whether any species of plant or animal constitutes an endangered, threatened, or species of special concern, the director must base his/her determination on biological criteria by using the best available scientific evidence (see more on the process and criteria for listing here and in Appendix A). For more details on the regulatory process under MESA, see the MESA website.

The **Massachusetts Clean Air Act** authorizes the Department of Environmental Protection (DEP) to adopt regulations ". . . to prevent pollution or contamination of the atmosphere" by monitoring ambient air quality within the state (MGL ch. 111, § 142A). The Department establishes ambient air quality standards, periodically reviews and amends "such standards and implementation plan so as to minimize the economic cost . . . ., provided, however, that such standards shall not be less than the minimum federal standards."

The **Climate Protection and Green Economy Act** mandates that the Executive Office of Energy and Environmental Affairs set 2020 statewide greenhouse gas (GHG) emission limits that are between "10 percent and 25 percent" lower than the emission levels in 1990 and a plan to achieve those levels (MGL ch. 21N). The plan is updated every five years to achieve "the maximum technologically feasible reductions" of GHG emissions. The DEP regulates and monitors emissions, in accordance with the adopted limits, to reduce levels and energy use, "increase efficiency and encourage renewable sources of energy." Established regulations "require the reporting and verification of statewide greenhouse gas emissions" to the regional GHG registry and reporting system. This system enables the DEP "to monitor and enforce compliance." For more details, see the Clean Energy and Climate Plan website.

The **Wetlands Protection Act**, enacted in 1963, grants the DEP the authority to adopt regulations and policies to ensure the protection of the state's wetlands and interests of the public (MGL chapter 131, section 40). Massachusetts was the first state to enact a law protecting wetlands. There are eight interests established by the Act: the protection of public and private water supply; the protection of ground water supply; flood control; storm damage prevention; the prevention of pollution; the protection of land

containing shellfish; the protection of fisheries; and the protection of wildlife habitat. In order to meet these interests, the statute states that: "No person shall remove, fill, dredge or alter any bank, riverfront area, fresh water wetland, coastal wetland, beach, dune, flat, marsh, meadow or swamp bordering on the ocean or on any estuary, creek, river, stream, pond, or lake, or any land under said waters or any land subject to tidal action, coastal storm flowage, or flooding" The local conservation commission has the duty to assure that the law is enforced. Any proposed activity that may alter wetlands and resource areas must go through a review process, which entails public review and the conservation commission's determination as to whether the activity will significantly change the resource and affect the interests set out in the Act. For more details, see the Wetlands Protection Act regulations website.

The **Massachusetts River Protection Act** was a 1996 amendment to the Wetland Protection Act to include the protection of rivers and riverfront areas. The Act shares the same eight interests as the Wetland Protection Act. The Act also "encourage[s] and support[s] the establishment of a system of open space lands along the rivers." The DEP develops regulations to administer the law, which the conservation commission follows in order to carry out the purposes of the Act. Any proposed projects must go through a review process to make sure that there is "no significant adverse impact on riverfront areas" and no practicable alternative exists. For more details, see the Massachusetts Rivers Protection Act website.

The **Public Waterfront Act** was enacted to protect the state's tidelands, great ponds, and nontidal rivers and streams (MGL chapter 91, section 2). The Act preserves, protects, and promotes public rights to use the tidelands exclusively for water-dependent activities. The Waterways Regulation Program within the DEP is the primary authority in protecting these waterways and the public's right to use them. Furthermore, the program is in charge of authorizing activities that may impede on those rights and cause damage to the tidelands. For more details, see the Massachusetts Public Waterfront Act website.

A more recently enacted law, **An Act Protecting Lakes and Ponds from Aquatic Nuisances**, amends Mass General Law Chapter 21 by adding Section 37B. This Section states that "no person shall knowingly or intentionally place, or cause to be placed, an aquatic nuisance in or upon inland waters" (MGL chapter 21, section 37B). The Department of Conservation and Recreation is mandated to develop an aquatic nuisance control program that will manage and protect lakes and ponds from nuisance species. In the fall of 2000, representatives from the Massachusetts Office of Coastal Zone Management (CZM), the Massachusetts Bays Program, the Department of Conservation and Recreation, and many other partners convened to form the Aquatic Invasive Species Working Group and write the *Massachusetts Aquatic Invasive Species Management Plan*. The plan, available for download here, was completed in 2002.

In the early 2000s, the Massachusetts Invasive Plants Advisory Group (MIPAG), a voluntary collaborative of research institutions, nonprofit organizations, the landscape, nursery, and agricultural industry, and state and federal agencies, convened and began to develop a list of plants considered to be invasive by this definition: "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems." In 2006, the Massachusetts Department of Agriculture began a two-step ban on species determined to be invasive by MIPAG. By 2009, all species on the Massachusetts Prohibited Plant List were banned from importation, sale, and trade in the state.

The **Massachusetts Oceans Act**, enacted in 2008, requires the Executive Office of Energy and Environmental Affairs, in consultation with an ocean advisory committee, to develop an ocean management plan (MGL chapter 21A, section 4C). The law lays out objectives that must be included and considered when developing the management plan. A few of the objectives are to "preserve and protect the public trust," consider the importance of the waters to the people who use it for their livelihood, and to value biodiversity and ecosystem health, including protecting particular marine habitats. Released in 2009 and amended in 2015, the resulting Massachusetts Ocean Management Plan is the blueprint for the protection and sustainable use of the ocean under state jurisdiction; see this link for more details and to download the plan.

The **Massachusetts Ocean Sanctuaries Act** designates the Office of Coastal Zone Management to implement

regulations that are imperative to protect from "any exploitation, development, or activity that would significantly alter" the ecology or appearance of the ocean (MGL chapter 132A, section 14). Five sanctuaries have been established as seen under Section 13 of the Act. The Department of Conservation and Recreation is entrusted with the protection of the sanctuaries.

The **Massachusetts Clean Water Act**: Although the Federal Environmental Protection Agency issues National Pollutant Discharge Elimination System permits, Massachusetts has its own set of water pollution laws. The duty to "enhance the quality and value of water resources and to establish a program for prevention, control, and abatement of water pollution" is appointed to the Division of Water Pollution Control within the DEP (MGL chapter 21, section 27). The division must adopt minimum water quality standards, "prescribe effluent limitations," and "require dischargers to establish monitoring, sampling, record keeping and reporting procedures," among other stipulations stated in the Act.

The **Forest Cutting Practices Act** was created to provide protection of forests for public use and benefit. The statute recognizes the importance of forestlands, ecologically and economically. It states that "public welfare requires the rehabilitation, maintenance, and protection of forest lands for the purpose of conserving water, preventing floods and soil erosion, improving the conditions for wildlife and recreation, protecting and improving air and water quality, and providing a continuing and increasing supply of forest products for public consumption, farm use, and for the woodusing industries of the commonwealth" (MGL chapter 132, section 40). The state forestry committee must, after a public hearing, adopt and implement forest cutting practices and guidelines (MGL chapter 132, section 41). If harvesting does not fall under the five exemptions, one must send a notice of intent with a proposed cutting plan, which then goes through a permitting process in order to obtain a license to cut. For more details, see the Forest Cutting Practices Act website.

D: Partnerships

Biodiversity conservation in Massachusetts is often a cooperative effort. Depending on the scale of the project, these efforts may involve local groups – for example, a small land trust pairing with a municipal Conservation Commission to protect a piece of land – up to multiple groups on the state-wide level working on new state laws and implementing regulations. This section highlights three such partnerships that started in the past decade and continue on today.

Sustainable Water Management Initiative (SWMI)

One threat to Massachusetts' rivers and streams is the withdrawal of water for human uses such as drinking water and irrigation. Particularly in eastern Massachusetts, stream flows in late summer, traditionally the lowest flows of the year, have been insufficient in some places in recent years to support fluvial fish and other aquatic life (Armstrong et al. 2011). In response concern about these alterations of natural stream flows, the state Executive Office of Energy and Environmental Affairs (EEA) began the Sustainable Water Management Initiative (SWMI) in 2010.

EEA convened a stakeholder advisory committee with staff support from several state agencies (the Department of Environmental Protection, the Department of Fish and Game, and the Department of Conservation and Recreation) to develop. These stakeholders include:

- The Massachusetts Rivers Alliance
- Staff from private engineering firms
- An environmental law expert
- Mass Audubon
- Municipal public works managers
- The Massachusetts Water Resources Authority
- The Environmental League of Massachusetts
- The Cape Cod Cranberry Growers' Association
- The Massachusetts Water Works Association
- Regional planning agency staff
- The Conservation Law Foundation
- An expert in sustainable business
- The Nature Conservancy
- The Charles River Watershed Association
- A USGS hydrologist

In 2012, after two years of stakeholder input, public outreach, and research, the Executive Office of Energy and Environmental Affairs released the SWMI framework. This defines a methodology for determining safe yield of water for human uses from each of the state's watersheds, as well as developing how stream flow criteria will be used by the Massachusetts Department of Environmental Protection in issuing permits under the state's Water Management Act. The SWMI framework is expected to balance the water needs of people and fish, maintaining sufficient flows in streams previously stressed by excessive withdrawals.

Linking Landscapes

In 2008, the Massachusetts Division of Fisheries and Wildlife (MassWildlife) and its Natural Heritage and Endangered Species Program (MA NHESP) entered into an interagency service agreement with the Massachusetts Department of Transportation (MassDOT), Highway Division, to improve the efficiency of state-level environmental project review. This nationally recognized model of cooperation between state agencies has resulted in faster reviews, cost savings, and protection of endangered species and their habitats. As part of the agreement, both agencies agreed to pursue proactive projects to reduce wildlife-vehicle collisions and improve public safety where feasible. Transportation infrastructure affects wildlife through direct mortality due to vehicle collisions and by fragmenting and degrading habitats. In addition, vehicle collisions with wildlife often result in property damage and sometimes personal injury or death. The Commonwealth contains 11,918 miles of highways and major roads and 24,471 miles of local roads. Road densities are greatest in the eastern region and in areas of high population densities within portions of the Connecticut River Valley in Franklin, Hampshire, and Hampden counties.

In conjunction with the University of Massachusetts, Amherst, the agencies launched Linking Landscapes for Massachusetts Wildlife (LLMW), a long-term and multifaceted volunteer-based monitoring program and planning collaboration to be implemented throughout the state. Utilizing expertise from various state departments along with collaboration with the public, LLMW's objectives are to: 1) reduce wildlife-vehicle collisions and improve public safety; 2) enhance, protect, and restore habitats impacted by roads; 3) control invasive species; 4) incorporate conservation priorities into transportation planning; and 5) implement wildlife transportation and research.

In 2010, four research projects were developed to collect information through volunteer participation on wildlife roadway mortality sightings. Three separate databases available on the LLMW website serve as a central location for compiling observations of vernal pool amphibians during spring migration, turtles, and all other wildlife. LLMW has also coordinated a monitoring program for freshwater turtle mortality associated with the nesting season. Online data forms available on the LLMW website use a Google Map interface allowing for the identification of the exact location of an observation and all of its associated data, including species and numbers of animals observed, date of the observation, observer name, contact information, and additional comments. More recently, LLMW has been incorporated into the MA NHESP's Vernal Pool and Rare Species Information System. This program uses citizen scientists to conduct repeated surveys each spring to further inform site prioritization. Program participants have included state and independent biologists, members of conservation and watershed organizations, and other citizen scientists. From 2010 to 2014, over 350 volunteers participated in these projects. They documented over 3,500 mortalities (representing 49 species) at 1,161 locations throughout the state, including mortality for nine currently and formerly state-listed salamander and turtle species. Wildlife crossing hotspots are mapped and highlighted based on the number of observed mortalities, if mortalities were observed in multiple years, and if rare species were present. MassDOT has installed barrier fencing at the highest ranking site identified by the Turtle Road Mortality Monitoring Program, and surveys in subsequent years indicated a 90 percent reduction in mortality.

In addition to community engagement through citizen science, LLMW has installed improved crossing structures and wildlife barriers to enhance public safety and protect endangered species; implemented over 50 acres of invasive species control and habitat restoration of scenic uplands and calcareous wetlands that are hotspots for biodiversity; engaged with community organizations to build and install nesting boxes for American Kestrels, a SWAP species; and installed and monitored Peregrine Falcon nesting boxes on bridges.

Climate Change

Since the 2005 SWAP, response to climate change by the Commonwealth of Massachusetts has centered on developing a better understanding of how climate change is likely to impact SGCN and their habitats, including the adaptive capacity of these species and how they might respond to climate changes. See Chapter 5 for more detail on climate change in Massachusetts.

At the state level, the Massachusetts Division of Fisheries and Wildlife (DFW) participated in the development of the State Climate Change Adaptation Report, Massachusetts Climate Change Adaptation Report , which was released in September of 2011. DFW staff served on both the Steering Committee for the Climate Change Advisory Committee and on the Natural Resources and Habitat Subcommittee.

In 2010, the Manomet Center for Conservation Sciences, in Plymouth, MA, worked with the DFW to conduct a Climate Change Vulnerability Assessment of many of the habitats identified in the 2005 SWAP. This project was conducted under the leadership of Dr. Hector Galbraith, who used an expert elicitation approach to conduct the assessment. Staff members from the DFW were asked a series of questions regarding their expert opinions regarding how the SGCN species may react to various climate conditions. Climate change projections were derived using two emission scenarios. Dr. Galbraith summarized the results from these question and answer sessions. These results were edited through an iterative process until the staff felt like the reports had correctly captured the results from the expert elicitation sessions. Results of the project were presented in three reports:

- Volume 1 - Introduction and Background. This report provides background to the project by describing how biodiversity conservation is currently carried out by the Division of Fisheries and Wildlife; the history, objectives, and methods of the SWAP; and how the climate in Massachusetts has been changing and is expected to change over the remainder of this century.
- Volume 2 - Habitat and Species Vulnerability. This volume reports the results of the work assessing the likely vulnerabilities of fish and wildlife and their habitats to climate change. The report addresses the following questions: How do the SWAP-targeted fish and wildlife habitats rank in terms of their likely comparative vulnerabilities to climate change? How will the representation of these habitats in Massachusetts be altered by a changing climate? Which vertebrate Species in Greatest Need of Conservation are likely to be most vulnerable to climate change?
- Volume 3 - Habitat Management. This report provides at least partial answers to the second question: how valued ecological resources might be effectively managed as climatic conditions continue to change. What degree of confidence can be assigned to the above predictions?

In addition to producing the reports, Manomet and DFW hosted a daylong public workshop at Bryant College where the report results were shared, which was attended by over one hundred participants.

Once the Climate Change Vulnerability Assessment effort was completed, it became apparent that this information regarding the relative vulnerability of SGCN to projected climate change conditions needed to be put into a range-wide context if it was going to be of the most use to Massachusetts and the other Northeast States where these species occur. The Northeast Association of Fish and Wildlife Agencies provided funding through the Regional Conservation Needs Grant Program for Manomet Center for Conservation Sciences and the National Wildlife Federation to conduct a Regional Climate Change Vulnerability Assessment.

E: Outreach

A major outreach effort in the past decade was the production of *BioMap2* by the Massachusetts Natural Heritage and Endangered Species Program and the Massachusetts Chapter of The Nature Conservancy.

In 2001 and 2003, the Natural Heritage and Endangered Species Program produced the original BioMap and Living Waters biodiversity conservation plans. *BioMap2*, developed in partnership with The Nature Conservancy in 2010, replaces these earlier plans. *BioMap2* was designed to guide strategic

biodiversity conservation in Massachusetts over the next decade by focusing land protection and stewardship on the areas that are most critical for ensuring the long-term persistence of rare and other native species and their habitats, exemplary natural communities, and a diversity of ecosystems. *BioMap2* was also designed to include the habitats and species of conservation concern identified in the State Wildlife Action Plan.

To capture all the elements of biodiversity, the *BioMap2* project approached the conservation of Massachusetts' biological resources at multiple scales and combined hundreds of individual pieces of geospatial data about the state's species, ecosystems, and landscapes. These elements of biodiversity fell into one of two complementary categories, **Core Habitat** and **Critical Natural Landscape**. *Core Habitat* identifies key areas to ensure the long-term persistence of species of conservation concern, exemplary natural communities, and intact ecosystems across the Commonwealth. *Critical Natural Landscape* identifies larger landscape areas that are better able to support ecological processes, disturbances, and wide-ranging species. *BioMap2* Core Habitat and Critical Natural Landscape overlap in many locations. Together, Core Habitat and Critical Natural Landscape identify 2.1 million acres that are key to the protection of the state's biodiversity. See more detail, see the website here: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/land-protection-and-management/biomap2/biomap2-town-reports.html

Outreach products of the *BioMap2* project include the following:

- 13 GIS layers, available for public download through the MassGIS website. These include layers for Core Habitat, the six Core Habitat subcomponents, Critical Natural Landscape, and the five Critical Natural Landscape subcomponents.
- An on-line interactive map, which allows anyone to look at *BioMap2* components at the local level state-wide.
- A summary report, which explains what *BioMap2* is and how to use it. This summary is included in Appendix E as part of this SWAP.
- A technical report, which explains how BioMap2 was produced. This summary is included in Appendix E as part of this SWAP.
- A poster, showing Core Habitats and Critical Natural Landscapes across the state.
- A report for each municipality in the state which had *BioMap2* components. Each report explains the *BioMap2* project and describes the important biodiversity elements known from the city or town.

Two years after *BioMap2* came out, The Nature Conservancy conducted a survey of *BioMap2* users. Of the 161 respondents to the survey, 97% recommended *BioMap2* to their peers. The most common users of *BioMap2* were land trusts (40% of respondents), followed by municipalities (19%), state agencies (18%), and non-governmental organizations (17%). For more details of the survey responses, see the summary here.

F: Inventory, Research, and Data Maintenance

Conservation groups across Massachusetts have continued to monitor and research the status, life histories, and threats to SGCN in the past decade. A few of these efforts are summarized below.

Natural Heritage and Endangered Species Program Database

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) maintains a GIS-based database for rare species occurrences (including all MESA-listed and almost all SWAP species), natural communities, vernal pools, and other landscape features of biological interest such as bat hibernacula. Since 2004, more than 11,600 records of these elements of biodiversity have been added to the NHESP database. These data were used in development of the Regional SGCN list.

Vernal Pool & Rare Species Information System

The Vernal Pool & Rare Species Information System, or VPRS, was launched in 2012 by NHESP. Created using funds from the Environmental Protection Agency's (EPA) Wetland Program Development Grant, VPRS is a web-based mapping and data submittal application for rare species observation reports and vernal pool certifications. The VPRS system provides:

- the ability to complete on-line NHESP Plant and Animal Observation forms and Vernal Pool Certification forms, thus simplifying data submittal for biologists and citizen scientists;
- the ability to bulk-upload data from a spreadsheet;
- a more efficient method for NHESP staff to review and process submitted data;
- a direct communication method between data submitters and NHESP staff; and
- timely updates to the publically available Certified Vernal Pool data and town-by-town rare species lists.

Mass Audubon's Breeding Bird Atlas 2

From 2007 through 2011, more than 650 volunteers coordinated by Mass Audubon worked to update the first-ever Breeding Bird Atlas in North America, which covered the years 1974 to 1979. An extraordinary amount of data was collected in the more than 43,000 hours of field work of this update: 149,470 reports of 222 species, covering 98% of the atlas blocks. These data were collated and analyzed by Mass Audubon, resulting in the release of their State of the Birds reports in 2011 and 2013. Their reports noted that about 60% of the best-surveyed bird species had increasing or stable populations, leaving about 40% that were decreasing strongly or moderately. For more information, see the Breeding Bird Atlas 2 website, here: http://www.massaudubon.org/our-conservation-work/wildlife-research-conservation/statewide-bird-monitoring/breeding-bird-atlases/bba2