

**COMMONWEALTH OF MASSACHUSETTS
SUPREME JUDICIAL COURT**

Suffolk, ss.

SJC-11432

NEW ENGLAND FORESTRY FOUNDATION, INC.

Appellant

v.

BOARD OF ASSESSORS OF THE TOWN OF HAWLEY

Appellee

**On Appeal from a Final Decision of the Appellate Tax Board
No. F306063**

**BRIEF OF *AMICUS CURIAE*
THE NATURE CONSERVANCY and
THE MASSACHUSETTS AUDUBON SOCIETY
In Support of
THE NEW ENGLAND FORESTRY FOUNDATION, INC.**

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**Statement of Interest and
Identity of the Amici Curiae**

The Nature Conservancy ("The Conservancy") is a leading nonprofit conservation organization working around the world to protect ecologically important lands and waters for nature and people. The Conservancy's mission is to conserve the lands and waters on which all life depends. Based on the best available science, The Conservancy has pioneered on-the-ground and in-the-water approaches to protect and sustainably manage natural systems, and it has applied proven solutions at scale through regional and global networks of conservation specialists. It has more than one million members globally. Since 1951, The Conservancy worldwide has protected more than 119 million acres of land and 5,000 miles of rivers. It works in all 50 states and more than 30 countries protecting habitats from grasslands to coral reefs.

In Massachusetts, The Conservancy represents the ideals of 26,000 members. Since extending its work to Massachusetts in 1962, The Conservancy has protected thousands of acres containing natural resources, and it leads science-based projects that help to keep nature healthy throughout the state. Since acquiring

its first protected land in this state, the 100-acre Black Pond Bog in Norwell, The Conservancy has protected lands in the Berkshire-Taconic range; on Cape Cod and the Islands; among the ponds of Plymouth; and in the watersheds of the Westfield, Taunton and Connecticut Rivers.



Figure 1: Sundew blossoms in the Hawley Bog, an example of a low-management, low-public-use habitat with rare species and important educational and scientific value managed by The Conservancy. Photo ©Dorothy Keper Monnelly on The Conservancy web site.¹

The Conservancy partners with other non-profits as well as state land-management agencies to identify and protect the state's rich biodiversity. In 2010, The Conservancy and the Massachusetts Department of Fish & Game produced BioMap2, a science-based

¹ The website addresses referenced in this Brief are set forth in the Addendum. They begin at the first page of the Addendum.

comprehensive biodiversity conservation plan for Massachusetts. See the BioMap2 address at Addendum. The Conservancy's work lessens the burdens of government by providing scientific, financial, and staffing resources to identify habitats in need of conservation, and by taking action to achieve these objectives. BioMap2 at page 3 contains a joint invitation from Fish & Game and The Conservancy: "Please join us in helping to protect the full breadth of the Commonwealth's natural heritage." Elsewhere, this public/private conservation tool states: "Protection and stewardship of **BioMap2's Core Habitat and Critical Natural Landscape** is essential to safeguard the diversity of species and their habitats, intact ecosystems, and resilient natural landscapes across Massachusetts." Id. at page 4 (boldface in the original).

The Conservancy secures habitat through land purchases, conservation restrictions, and other forms of stewardship. The Conservancy has a significant stake in protecting the tax-exempt status of its protected preserves so that funds may be applied to new conservation efforts. The Conservancy petitions assessors throughout the Commonwealth for tax-exempt

status under G.L. c.59, §5, Third, when the organization purchases land or receives it by gift. The loss of tax-exempt status for The Conservancy's lands would drain its resources, limit the scope of its work, and injure its ability to lessen the burdens of government.

The Massachusetts Audubon Society ("Mass Audubon") was founded in 1896 by a group of Boston women working to halt the worldwide slaughter of birds killed to supply plumage to the hat-making and garment industries. In four years, the growing society secured passage of The Lacey Act of 1900, 16 U.S.C. §§3371-3378, to prohibit trade in wildlife, fish, and plants illegally taken, transported or sold. In 1911, the organization secured passage of a statute outlawing the sale of native bird plumes. The 1913 Tariff Act banned the import of wild bird plumes, and the Migratory Bird Treaty Act of 1918, 16 U.S.C. §§703-712, protected more than 800 species of birds. See Jennifer Price, "Hats Off to Audubon," web address in the Addendum.

Mass Audubon is one of the largest and most prominent conservation organizations in New England. Its original goals focused only on birds, but the

organization's aperture has broadened with the needs of nature in this state. Since acquiring Moose Hill in Sharon in 1922, Mass Audubon has protected more than 35,000 acres of conservation land. It conducts nature education programs for 225,000 children and adults annually, and advocates for sound environmental laws and policies at the local, state and federal levels.



Figure 2: The migratory Red Knot is studied at Mass Audubon's shoreline sanctuaries. See "Red knots elusive as U.S. considers threatened status," *The Boston Globe*, May 29, 2013 (joint government and Mass Audubon effort to band these birds)(Picture by S. Winter and B. Jerrey, *The National Geographic*.)

Balancing its desire to engage people with an equally strong sense of responsibility to protect nature, Mass Audubon operates 41 wildlife sanctuaries prepared for public visitation, and a larger number that provide important habitat for both rare and common species of animals and plants. Each sanctuary

generates valuable natural goods and services that include clean drinking water, fresh air, carbon storage, and greenhouse gas absorption. As one of the largest landowners in the state, and the largest landowning charity, Mass Audubon is well positioned to demonstrate how a non-profit charitable conservation organization lessens the burdens of government by owning, occupying and operating conservation land.

Mass Audubon has been expressly identified as a "partner" of Commonwealth agencies in the 2005 State Wildlife Action Plan. See the Plan's web address in the Addendum. The organization also contributed valuable staff and other resources to the creation of BioMap2. Mass Audubon has also performed the research and invested the resources for such studies as Losing Ground Beyond the Footprint: Patterns of Development and their Impact on the Nature of Massachusetts (Mass Audubon 4th ed. May 18, 2009), and State of the Birds: Documenting Changes in Massachusetts' Birdlife (Mass Audubon 2011). See web addresses in the Addendum.

Like other charitable conservation organizations, Mass Audubon petitions assessors for exemptions, and devotes substantial time and energy to complying with the requirements and obligations of tax-exempt status.

Audubon is respected and relied upon by the state's environmental-protection and open-space agencies for its reliance on applied science in advancing its land conservation and stewardship work. Audubon's land conservation and stewardship activities lessen the burdens of government, and the loss of its tax-exempt property status would severely and permanently reduce the resources that can be applied to those efforts.

I. ISSUE PRESENTED

The Court's solicitation of *amicus* briefs, SJC-11432, invited submissions as follows:

Whether certain forest land owned by the plaintiff, a land conservation organization, qualifies for charitable tax exemption pursuant to G.L. c.59, §5, Clause Third; whether the Appellate Tax Board erred in ruling, among other things, that the plaintiff's purposes and activities do "not fit into the established realm of traditional charities according to Massachusetts case law," that the property was not sufficiently open to and accessible to the public to qualify for tax exemption, and that the plaintiff "failed to demonstrate a sufficiently active appropriation of the subject property to achieve a public benefit."

II. STATEMENT OF THE CASE AND FACTS

Amici Curiae adopt the Statement of the Case and Statement of the Facts as presented in the New England Forestry Foundation, Inc.'s ("NEFF") brief.

III. SUMMARY OF ARGUMENT

The Conservancy and Mass Audubon believe that anything less than a complete reversal of the Appellate Tax Board's ("ATB") decision will send a harmful and highly visible message that charitable, non-profit conservation organizations no longer lessen the burdens of government by preserving and protecting the land, air, water, and wildlife of Massachusetts. In addition to NEFF's arguments, The Conservancy and Mass Audubon urge the Court to consider the following points made in this amicus brief:

Public Access for Recreation Is Not the Sole Litmus Test for Property Tax Exemptions. Private, Non-Profit Stewardship of Conservation Land Achieves Many Important Public Goals: Public access, in particular providing land for recreation, is not the sole means by which charitable land conservation organizations can provide public benefits consistent with their charitable purpose. The ATB mistakenly adopted a one-dimensional litmus test for the property tax exemption. In reality, there are numerous other public benefits that charitable land conservation organizations help government achieve. These include the protection of wildlife and plant habitat; the

production of clean water and air; sequestering of carbon from the atmosphere; and the understanding and maintenance of intact natural ecosystems.

Occupancy, including the Stewardship of Conservation Land, Is Determined by the Reasonable, Good Faith Application of the Land to the Organization's Charitable Purposes: The "occupancy" of land for charitable purposes should, as this Court has repeatedly held, be determined by the officers of the charitable corporation acting reasonably and in good faith to use the land in a way that achieves the charitable purposes of the organization. Charitable land conservation organizations occupy land in many different ways: when they conserve the land's animals, plants, soils and water; when they study and understand the land's biological, geological and hydrological systems; when they analyze how the land and its systems play a role in surrounding ecologies; when they make land available for public access; and when they make some land available primarily for wildlife habitat and scientific inquiry, with appropriate public access as a secondary goal.

The Protection and Preservation of Land and Wildlife Habitat is a Burden of Government that

Charities Help Lessen Significantly: The Legislature has mandated the preservation of habitat for the purpose, among other things, of promoting the state's rich biological diversity. Numerous agencies help implement this goal. These agencies' efforts are significantly augmented by the work of nonprofit, charitable land conservation organizations. With global climate change, preserving biological diversity has become more important and more challenging. In short, these non-governmental organizations (NGO's) unmistakably lessen the burdens of government.

IV. ARGUMENT

A. Introduction: This State's Land Ethic

The ATB erred by endorsing Hawley's narrow test for charitable exemption. By failing to apply correctly the Court's binding precedents, including Carroll v. Commissioner of Corporations and Taxation, 343 Mass. 409 (1961) (holding that NEFF's teaching of sound forestry serves the public interest and is therefore charitable), the ATB imposed a "public access" requirement that obstructs implementation of the state's land-preservation and habitat-protection policies. The ATB's approach, if affirmed, will harm the ability of private conservation organizations to

lessen the burdens of government in achieving important public good.

The ATB's rejection of "the preservation of a habitat for diverse species," and its insistence that "active appropriation" means advertised public access, NEFF v. Hawley, 2013 WL 360527 at 11 (ATB January 28, 2013), ignores the statutes, regulations, and guidance policies implemented by the state's environmental and conservation agencies. The ATB's tunnel vision also ignores profound advances in our understanding of the environment. The ATB's view that only active human recreation makes wilderness land eligible for a tax exemption smacks of what the fabled forester Aldo Leopold called the "conqueror" view of humanity's relationship to planet Earth: "we see repeated the same basic paradoxes: man the conqueror versus man the biotic citizen; science the sharpener of his sword versus science the searchlight on his universe; land the slave and servant versus land the collective organism." "The Land Ethic," A Sand County Almanac, 186-187 (The Library of America, 2013 ed.).

What we have learned beginning with Darwin's insights into the survival of the species, is that sometimes the interests of mankind are best served by

leaving the birds and the bees, the fish of the sea, the trees on the mountains, and the flowers of the meadows well enough alone. Humanity is a part of, not the master of, nature. "We know now what was unknown to all the preceding caravan of generations: that men are only fellow-voyagers with other creatures in the odyssey of evolution. This new knowledge should have given us . . . a sense of kinship with fellow-creatures; a wish to live and let live" Leopold, *supra*, "On a Monument to the Pigeon" at 97.

Contrary to the ATB's outlook, Leopold's land ethic has become firmly embedded in the public policy of the Commonwealth. Private, charitable conservation organizations should not pay property taxes on the lands that they acquire and manage in furtherance of the government's conservation and habitat protection goals.

B. Environmental Protection, Preservation of Wildlife Habitat, and Conservation of Land Are All Burdens of Government.

Carroll v. Commissioner of Corporations and Taxation, *supra*, determined that a testamentary gift to NEFF was exempt from the inheritance tax because NEFF's teaching of sound forestry practices was charitable work that lessened the burdens of

government. "Teaching the private owners of a public resource [sound forestry] . . . is education which serves a constitutionally and statutorily declared public interest and it is thus, in the significant general sense, charitable." Id. at 413-414.

Since Carroll was decided in 1961, the Legislature and the voters have made government's environmental protection and land conservation burdens significantly broader and deeper. In 1972, in a constitutional amendment promulgated by popular vote, "the protection of the people in their right to the conservation, development, and utilization of agricultural, mineral, forest, water, air and other natural resources . . . [was] declared to be a public purpose." Article 97 of the Amendments to the Massachusetts Constitution (approved and ratified Nov. 7, 1972) (emphasis added). The government's acquisition of land for such purposes is so important that a two-thirds vote of the legislature is required to re-purpose the property. See Mahajan v. Dept. of Environmental Protection, 464 Mass. 604 (2013).

Legislative acts to preserve, conserve and protect the environment have been numerous and far-reaching. In 1974, the Legislature created the

Executive Office of Environmental Affairs (now the Executive Office of Energy and Environmental Affairs or "EEA") and included within state environmental policy "the management of air, water and land resources to assure the protection and balanced utilization of such resources within the commonwealth, realizing that providing safe water to drink and clean air to breath is a basic mandate." St.1974, c.806, §2. Recreation falls within that mandate, but so too does "the perpetuation, extension, and proper management of the public and private forest lands of the commonwealth." NEFF and organizations like The Conservancy and Mass Audubon lessen the burdens of government by participating in and supporting that mandate.

EEA and its Departments have acquired responsibility for the implementation and enforcement of several laws protecting habitat. The Wetlands Protection Act ("WPA"), G.L. c.131, §40, recognizes wildlife habitat as a protected interest. See St.1986, c.262, §1. The Rivers Protection Act, St.1996, c.258, §§17-19, added more provisions protecting habitat. The Legislature's mandates are more fully explained in "Massachusetts Wildlife Habitat Protection Guidance

for Inland Wetlands," (Department of Environmental Protection, March 1, 2006)(web address in the Addendum).

In addition to habitat protection, state laws exist for the purpose of preserving biological diversity in the ecological regions that comprise the Commonwealth. For example, the Massachusetts Endangered Species Act, G.L. c.131A, §§1 to 7, protects species that are endangered, threatened, or of special concern. The alteration of habitat can also constitute an illegal taking of a protected species. Massachusetts follows the federal government's lead by defining the taking of species "as including the disruption of an animal's 'nesting, breeding, feeding, or migratory activity.'" A separate section of the statute explicitly prohibits the alteration of significant habitat. See Susan George, et al., "State Endangered Species Acts," Endangered Species Act: Law, Policies and Perspective, page 349 (ABA Section ed. 2010), citing G.L. c.131, §§ 1 and 2. The Commonwealth's Natural Heritage & Endangered Species Program ("NHESP"), part of the Division of Fisheries & Wildlife, has as its "overall goal . . . the protection of the state's wide range of native

biological diversity." See NHESP web address in Addendum.

The cited statutes are but a small snapshot of the state's environmental and conservation mandates. EEA's "2013-2015 Strategic Plan" identifies "Resource Protection" as one of its three broad themes. See web address in Addendum. Within that theme the EEA identifies the conservation of "open space and working landscapes for current and future generations to provide clean air, clean water, and wildlife habitat" as one of the Executive Office's "measureable goals."

The Department of Environmental Protection ("DEP") carries a broad mandate to protect air, water and land. So too does the Department of Conservation and Recreation ("DCR"). DCR shoulders a major part of the conservation mandates imposed by the Legislature and the state's citizens in the last 50 years. The DCR executes an open-space mandate, but makes public recreation just one item on a large menu of land-conservation and open-space goals. DCR has established a "Landscape Designation Process" that categorizes DCR properties "into three different landscape designations: Reserves, Parklands, and Woodlands." DCR Annual Report FY12 at page 5. See also Landscape

Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines at 3-4 (DCR March 2012). Although passive recreation is allowed in Reserves, they are to be held as "large contiguous blocks . . . where the dominant ecosystem service objectives will be biodiversity maintenance, nutrient cycling and soil formation, and long-term carbon sequestration." Id. The primary zone for recreation will be Parklands. In turn, Woodlands will combine a mixed focus on sustainable forestry, recreation, and provision of "ecosystem services, including: production of high-quality, local, renewable wood products, protection of water quality, carbon sequestration, and both late forest successional structures, and in focused areas, early forest successional states to promote habitat diversity." Id. at 4 (footnotes omitted).

In sum, the environmental-protection and land-conservation burden of state government is broad and deep. That burden includes more than the provision of public recreation areas. While EEA, DEP, DCR, Fisheries and Wildlife, and NHESP have a legal obligation to implement the conservation mandate, it is also evident that those agencies fulfill their

obligations through a strong alliance with nonprofit, charitable, land-conservation organizations.

C. Stewardship of Conservation Land by Charitable Organizations Lessens the Burdens of Government and is "Occupancy" Within the Meaning of the Property Tax Exemption.

When charitable organizations like The Conservancy, Mass Audubon, or NEFF manage land for conservation purposes, or when they manage land subject to a conservation restriction, they are occupying the land in order to achieve their charitable goals. Although occupancy sometimes includes recreation, it does not always. Sometimes management and occupancy of the land consists of inspections by scientists and stewards; sometimes it involves visits by small groups limited in size because of the fragile nature of the ecosystem; sometimes it involves unrestricted use by humans during part of the year and prohibited use during other seasons. In many instances, even if limited public use is appropriate, advertising, significant signage, and hardscape parking can be contrary to the property's conservation values. When conserved land is managed as a wildland, appropriate stewardship may

consist of purposely minimizing all human impact. These conservation approaches are all means by which NGOs occupy land to fulfill their charitable purpose.

G.L. c.59, §5, Third, does not require constant or even frequent use of conservation land by humans for recreational use. Land is "occupied" when possession is obtained and control is maintained. See The American Heritage Dictionary of the English Language at 1218 (5th ed. 2011). As has been held repeatedly, when lands are reasonably required to pursue charitable purposes, the scope of occupancy should be determined by the officers of the organization. Courts do not interfere so long as those officers act reasonably and in good faith. See Assessors of Dover v. Dominican Fathers Province of St. Joseph, 334 Mass. 530, 540-541 (1956).

In 1869, the Massachusetts General Hospital acquired 110 acres and kept them empty "to prevent too near proximity of buildings and use which might be deleterious to the hospital." The court ruled that the empty buffer zone was "sufficient occupation" and the land was properly tax-exempt. Massachusetts General Hospital v. Inhabitants of Somerville, 101 Mass. 319 (1869). Similarly, Smith College acquired 86 acres as

an empty buffer zone for the college's observatory. This was sufficient occupancy to merit tax-exempt status. The ATB held that with respect to using the land in harmony with the college's purpose, "the determination of [Smith College] is controlling." Trustees of Smith College v. Board of Assessors of the Town of Whately, 1981 WL 11702 (ATB July 21, 1981), *aff'd*, 385 Mass. 767, 769 (1982). Today's ATB has forgotten what it once held.

The ATB's insistence in NEFF v. Hawley that conservation land be widely available and broadly advertised for recreational use ignores the different kinds of habitat protection and other ecology-preserving uses that are a fundamental part of our state government's conservation mission. The ATB's decision is silent about the state's far-reaching conservation policies, and it ignores the partnership principle between state agencies and charitable NGOs that has become a fundamental component of habitat protection and wildlife preservation in Massachusetts. See *infra* at 35-40. Stewardship of the land is occupancy within the meaning of G.L. c.59, §5, Third.

1. Low-Maintenance Stewardship and Limited Public Access is Occupancy that Both Lessens the Burdens of Government and Fulfills the Goals of Charitable Land Conservation Organizations.

Sometimes, species preservation and biological diversity require human activity to be greatly reduced or even eliminated. A fragile bog, forest wildlands, and the dens of endangered snakes are stewardship examples involving minimal human impacts.

a. The Hawley Bog

The Hawley Bog is "a cold, northern sphagnum-heath² bog [that] occupies an old and shallow glacial lake basin. All major vegetation zones that demonstrate bog succession are present, from the central open water pond to the surrounding spruce-fir forest." National Registry of Natural Landmarks ("NNL") June 2009 at 46. See web address in Addendum.

The Secretary of the Interior established the NNL Program in 1962 under the Historic Sites Act of 1935, 16 U.S.C. §461. Its purpose is "to identify and encourage the preservation of the full range of geological and biological features that are determined

²"Sphagnum" refers to "[a]ny of various mosses . . . of wet acidic areas, having long fibrous leafy stems, the decomposed remains of which form a type of peat." The American Heritage Dictionary at 1685.

to represent nationally significant examples of the Nation's natural heritage." See NNL Introduction. Potential sites are evaluated by qualified scientists, and listing "does not change ownership of a site, and does not dictate use or activity." *Id.*



Figure 3: Visits to the Hawley Bog are limited in size to small groups no greater than ten. ©Eric Aldrich on The Conservancy's web site.

The eleven NNL sites in Massachusetts include the Hawley Bog, and they "range in size from just over 20 acres to nearly 5,000 acres and are stewarded by a variety of landowners including the Massachusetts Department of Conservation and Recreation, The Nature Conservancy, Wampanoag Tribe of Gay Head, municipalities, and other private conservation organizations and individuals." See web address for state list in Addendum. Many NNL sites are another

example of private land conservation and stewardship in support of a public policy.

Hawley Bog occupies four acres within a 40-acre parcel owned by Five Colleges, Inc. See web site in Addendum. A mat of peat 30-feet thick floats on the water of a deep glacial depression, sustaining a complex community of plants. The bog's low oxygen and acidic water limit decomposition of organic matter. This low-nutrient environment supports pitcher plants and members of the sundew family, which are carnivorous plants consuming insects to obtain nutrients missing from the peat. Polly Ryan-Lane, "Hawley Bog: Pitcher Perfect," The Botanic Garden News, 13-14 (Spring 2010). See web address at Addendum.

Five Colleges acquired the site in 1978 for ecological research and teaching. In 1993, to assure protection for the bog community and its rare species, The Conservancy purchased 25 abutting acres. Id. at 13. The Conservancy manages the bog pursuant to the "Hawley Bog Preserve Management Plan 2013." See copy in Addendum. While the Bog is open to the public, the greatest threat to its habitat is overuse and humans walking on the fragile bog mat.

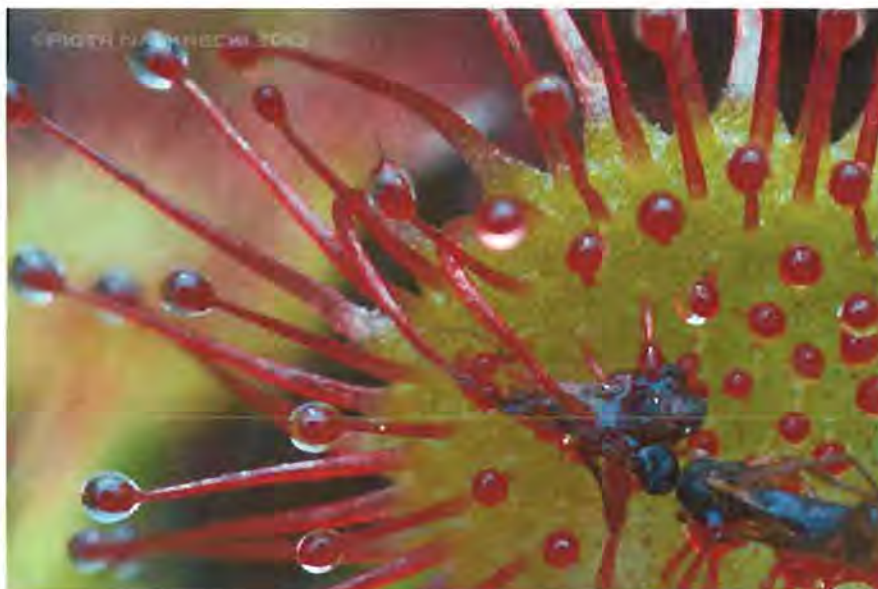


Figure 4: Insects in a sundew in the Ponkapoag Bog, a sphagnum bog similar to the Hawley Bog, but owned and managed by the Commonwealth as part of the Blue Hill Reservation near Boston.³

To limit impacts, groups of ten or more need permission to visit. See Ryan-Lane, supra, at 14. A narrow boardwalk reduces the risk of trampling on the bog mat, but poaching of rare plants is an ongoing threat that is difficult to control. See Management Plan supra, at 7 and 11. In sum, the Hawley Bog is an excellent example of private habitat protection with limited public access. The Bog's stewards also shoulder the work needed to accomplish important public goals: the protection of rare species; public

³ Photograph by Dr. Piotr Naskrecki, Harvard University. See "Bog Killers," October 22, 2013 blog entry at thesmallmajority.com (visited November 2, 2013). Used by permission of Dr. Naskrecki.

education about such species' habitat needs; and the promotion of scientific inquiry and research to shape the ongoing evolution of public policies to conserve land and wildlife. Simply put, the private owners and managers of the Hawley Bog lessen the burdens of government.

b. Forest Wildlands

Another low-management, low-public-access niche in the broad spectrum of conservation stewardship is the "forest wildland," or "forest reserve." Wildland reserves are another forceful example of the public-private partnership at work in land conservation. DCR has created forest "Reserves" (along with "Woodlands" and recreational "Parklands") as one of three land-designation categories for its properties. See "Landscape Designations for DCR Parks & Forest: Selection Criteria and Management Guidelines" (web address in the Addendum).

DCR manages its Reserves with three "ecosystem service objectives" in mind: biodiversity expansion, including complex forest systems; carbon sequestration; and provision of wilderness recreation opportunities. Id. at 17, n.10. DCR "occupies" its Reserves by "allow[ing] natural processes to determine

the long-term structure, composition, function and dynamics of the forest to the maximum extent possible." Id. DCR gives equal importance to "monitoring and studying these conditions, then applying this knowledge to low impact forest management techniques within Parklands and Woodlands, and on privately-managed forests." Id.



Figure 5 Some old-growth forest in DCR's Mohawk/Monroe/Savoy Forest Reserve in the northern Berkshires.

Many conservation organizations occupy their own forests exactly the way that DCR occupies its Reserves. The NGOs implement the same management principles articulated by DCR. The compatibility of private forest stewardship with DCR's approach is

evident in Wildlands and Woodlands: A Vision for the Forests of Massachusetts (2005), a stewardship proposal published by the Harvard Forest of Harvard University. See web address in Addendum. For Wildlands, this strategy proposes a prohibition on forest harvesting with a "humble and hands-off approach." Id. at 11. "Passive recreation, educational activities and non-destructive scientific inquiry should be allowed in most, although not necessarily all, reserves." Id. Woodlands, in contrast, would be actively managed to include habitat improvement (encouraging certain species and combatting others through targeted cutting, prescribed burning and control of invasive species) and sustainable forestry to supply a steady stream of quality wood products. Id. at 17.

Since the publication of the 2005 recommendation for Massachusetts, a large number of non-profit, charitable conservation organizations – including NEFF and the amici – have joined with Harvard Forest to form The Wildlands and Woodlands Partnership. See Wildlands and Woodlands: A Vision for the New England Landscape (May 2010) (web address in the Addendum). These non-profits are occupying their forest wildlands

in accordance with management principles endorsed and promoted by DCR for its Reserves. They are lessening the burdens of government and occupying their property in accordance with their own charitable goals as well.

NGOs have also teamed with DCR to acquire abutting lands that will help achieve Reserves large enough for the wildland forest ecology to survive. In fact, DCR's Landscape Designation Guidelines have made the recruitment of non-government partners an express component of the strategy to achieve adequate sizes for forest Reserves and to manage them successfully over the long term. With respect to size, the Landscape Designation Guidelines state that "Reserves are . . . intended to be several thousand acres in size to provide adequate protection of resources, with the potential to be increased over time (either via state or local land conservation efforts or by co-management of non-state protected forests) to reach sizes of 10,000 to 15,000 acres." Id. at 16. The recruitment of private land conservation organizations is critical to the successful implementation of DCR's forest reserve goals. The Land Designation Guidelines state that "it will be critical to work toward the protection of forested lands adjacent to Reserves to

help retain the large forest blocks envisioned for Reserves. DCR will seek partnerships with statewide and regional conservation organizations to help accomplish this." Id. at 20 (emphasis added).



Figure 6 The Conservancy's Stacy Mountain Preserve near French King's Bridge on the Connecticut River.

Mass Audubon's Whetstone Wood Wildlife Sanctuary serves as a solid land bridge between patches of state-owned reserves. Whetstone is "Mass Audubon's largest wildlife sanctuary, and the only one managed explicitly as a wildland - where human impact is minimized and the extent and function of natural communities are of paramount importance." Bob Wilber, "This Sanctuary Has Never Met a State Forest It Didn't Like!" (June 26, 2013) See web address in the Addendum. The Whetstone Sanctuary consists of 2,500 acres. In

addition to linking state-owned forest reserves, it is situated in an area designated by EEA as the North Quabbin Bioreserve. Id. In the context of DCR's landscape designations and the protection of the Quabbin Reservoir watershed, there is no doubt that Mass Audubon's stewardship of this Sanctuary is lessening the burdens of government.

The Conservancy owns the 101-acre Reed Brook Preserve in Florida, MA, which abuts the DCR's Mohawk/Monroe/Savoy Forest Reserve overlooking the Deerfield River. See Massachusetts Forest Reserves Long Term Ecological Monitoring Program: Mohawk/Monroe/Savoy Forest Reserve (June 2009) (web address in Addendum). Page four of that report shows the location of The Conservancy's parcel in the midst of the 6,800-acre DCR Reserve. The eastern portions of this Reserve are in Hawley, a short distance from NEFF's parcel. The Reed Brook Preserve is occupied in accordance with DCR's Reserve management principles, and accordingly lessens the burdens of government by linking the parcels that form the state-owned Reserve.

c. Protecting the Dens of Endangered Snakes

Snakes, a reptile family containing many endangered species, require protection from humans.

This may surprise people raised to kill snakes on sight because of their reputation for poisonous bites.⁴ At the other extreme, poachers capture snakes for the illegal pet trade or for use in religious ceremonies. See "Asserting a God-Given Right to Snakes," The New York Times at A10 (November 16, 2013).



Figure 7 Timber Rattlesnake basking on granite outcropping. ©Tom Tynning, www.westernmassnaturalist.org

Snakes are also the subject of medical research and a resource for a surprising number of medical applications. Snake venom has produced "better treatments for . . . high blood pressure, heart disease, stroke, Alzheimer's disease and cancer." See *"Story of Discovery: Making Medicines from Poisonous*

⁴ A recent paper analyzing our need to detect and avoid snakes as a factor in the evolution of our visual acuity is Quan Van Le, et al., "Pulvinar neurons reveal neurobiological evidence of past selection for rapid detection of snakes," *Proceedings of the National Academy of Sciences* (October 2013) at www.pnas.org (visited Nov. 3, 2013).

Snakes," National Institute of Health (web address in Addendum). The characteristics of venom that affect the circulatory and nervous systems can be harnessed to dissolve blood clots and treat strokes and heart attacks. Eptifibatide, a drug used to prevent heart attacks, is a modified rattlesnake venom protein used to treat people since 1998. Id.

Both the Timber Rattlesnake and the Copperhead are endangered in Massachusetts. Their greatest risks are from loss of habitat and human interference. The Timber Rattlesnake historically lived throughout Massachusetts, but in the past 25 years these snakes have been documented only in Berkshire County, the Connecticut River Valley, and in the Blue Hills Reservation. "Timber Rattlesnakes are imperiled by destruction of rocky and woodland habitats, excessive removal by collectors, and mortality and persecution at the hands of snake hunters and the general public." NHESP's "Timber Rattlesnake Fact Sheet" (web address in Addendum and copy in the Addendum).

Timber Rattlesnakes eat mice, chipmunks, moles and other rodents. In the deciduous forests, they are "top predators" keeping the overall wildlife ecology in balance. Their vulnerability to humans, however,

makes secrecy about their den locations a high preservation priority. Id. at 3. Poaching from dens is of such concern with Timber Rattlesnakes that a consultant hired by The Conservancy to survey potential den locations in Berkshire County has posted a website warning about the importance of keeping locations secret. R. Stechert, Hudson Highlands Environmental (web address at Addendum).⁵



Figure 8: Endangered Copperhead basking in Western Massachusetts.
©Tom Tynning, www.westernmassnaturalist.org

Endangered Copperheads face the same threats. The Division of Fisheries and Wildlife's Assistant Director for NHESP, Tom French, has estimated that

⁵ See also Tom Tynning web address in the Addendum (visited December 4, 2013) "[T]he Timber Rattlesnake . . . is one of the most endangered terrestrial vertebrates . . . in all the Northeast. . . . Increased development, road mortality, poaching, purposeful killing, climate change, emerging disease, off-road vehicle abuse, genetic bottlenecking, and other affronts are ongoing problems."

there are only 150 to 200 copperheads left in the state, "with about 50 of the snakes living in the Blue Hills." See Don Lyman, "Endangered copperheads make home in Blue Hills," The Boston Globe (July 1, 2012). Educating the public is a double-edged sword: "'On the one hand we don't want to tell people about them,' said French, 'but on the other hand we want people to realize they're here because they're unique and endangered.'" Id. See NHESP Copperhead Fact Sheet in Addendum.

2. The ATB Ignores How Charitable Conservation Organizations and Government Agencies "Occupy" Land and Protect Habitat in Identical Ways.

Under the ATB's analysis in NEFF v. Hawley, organizations like The Conservancy and Mass Audubon that own preserves containing endangered species requiring minimal interaction with humans would fail the ATB's test for the G.L. c.59, §5, Third, charitable exemption. The ATB emphasized public advertising of conservation land, in particular advertising to raise its profile for recreational use. The ATB also faulted NEFF for failing to have parking areas, signage and other hard infrastructure to support recreation. The ATB's recreation litmus test,

however, ignores the burdens of conservation and habitat protection that the government has taken on in Massachusetts (and elsewhere). The ATB also imposes physical occupation requirements that conservation organizations and even state agencies would find harmful rather than helpful in meeting their conservation and habitat-protection goals. Land conservation organizations which pursue such goals as part of their charitable mission should be allowed to rely on science and fieldwork to determine how best to "occupy" their various preserves. In some cases, conservation preserves are best left primarily to the snakes, the bogs, and the complex, old-growth forest with reduced or even limited visits by humans. That type of stewardship constitutes occupancy of charitable property that lessens the burdens of government.

D. The Commonwealth Counts Upon Land Conservation Charities as "Mission Critical" Partners in the Preservation of Biological Diversity and Habitat.

In 2001, President Bush signed the Department of the Interior and Related Agencies Appropriations Act, 2002, 115 Stat. 414, 422, P.L. 107-63 (Nov. 5, 2001), to create the State Wildlife Grants program. These

grants fund "the development and implementation of programs for the benefit of wildlife and their habitat, including species that are not hunted or fished" 115 Stat. at 422. Congress stipulated that each State wishing to participate had to develop a Comprehensive Wildlife Conservation Strategy ("CWCS") by October 1, 2005. CWCS's - or, as they are often called, "State Wildlife Action Plans" (SWAP) - were required to contain "a comprehensive wildlife conservation plan . . . that considers the broad range of the . . . jurisdiction's wildlife and associated habitats, with appropriate priority placed on those species with the greatest conservation need." 115 Stat. at 422.

A SWAP must contain eight elements, including descriptions of locations and relative conditions of key habitat and community types essential to the conservation of those species in greatest need. See 2005 Massachusetts Comprehensive Wildlife Conservation Strategy explaining "Where the Eight Required Elements can be Found." See web address at Addendum. Each state completed a SWAP by 2005. See State Wildlife Grants: Five-Year Accomplishment Report at page 18 (web address in Addendum). The Five-Year report describes

how SWAP grants are "now an essential funding source for state fish and wildlife agencies, allowing them to engage conservation partners in restoring and actively managing our nation's declining wildlife and the places they live." Id. at page 2 (emphasis added).

The EEA, the Division of Fisheries and Wildlife, and the Department of Fish and Game completed the Massachusetts SWAP in October 2005 and revised it in September 2006. The first sentence of the "Executive Summary" states: "The goal of the Comprehensive Wildlife Conservation Strategy . . . is to conserve the wildlife biodiversity of Massachusetts." In Chapter Three, "Issues Affecting Biodiversity," the agencies state that "[b]y far the greatest contributor to the loss of species and habitat diversity in Massachusetts has been the destruction and fragmentation of habitat by residential, commercial, and industrial development." SWAP at 11. "Given the current pace of development — 46 acres per day or an area equal to paving over the Boston Common every twelve hours — a habitat protection strategy must be developed soon or functional ecosystems and our current biodiversity will not endure." Id. at Chapter Two, page 7. One quarter of the state's land area (1.2

million acres out of a 5 million-acre land mass) is developed. By comparison, in 1971, only 17% (857,000 acres) was developed. Id. at Chapter Three, Page 11. See also James DeNormandie, Losing Ground Beyond the Footprint: Patterns of Development and their Impact on the Nature of Massachusetts (Mass Audubon 4th ed. May 18, 2009). On page 5, Losing Ground notes that from "1999-2005, Massachusetts lost an estimated 22 acres per day to all forms of development. Conversion of 22 acres per day from a natural to a developed state is like creating a development the size of the cities of New Bedford, Lawrence, and Springfield combined every 5 years." See the report's web address at Addendum.

Problematically, much remaining undeveloped land is fragmented. Often, forest that was once continuous is now broken into patches of varying sizes. This has a negative impact on species that are area-sensitive, i.e., cannot survive in small patches of habitat. It also reduces the survival chances of species that require buffered, interior forest areas. While approximately 57% of Massachusetts is forested today, less than 12% (about 600,000 acres) is buffered from fragmentation. SWAP, *supra*, at 16. Fragmentation impacts are severe on some species. "For example, some

bird species may suffer extensive mortality in small forest patches because predators that use adjacent non-forest areas destroy eggs (e.g., raccoons), kill adult birds directly (e.g., house cats), or both (e.g. fox)." Id.

The SWAP identifies seven categories of conservation strategies to be pursued in Massachusetts. It asserts unambiguously, however, that "the foremost priority among these strategies is the proactive protection of the habitats of the species in greatest need of conservation." Id. at 132. Funding to protect habitat is "dwindling rapidly," while approximately 710,000 acres of what is considered "Core Habitat" remains unprotected from development or other destructive actions. Even with substantial help and participation from non-profit, charitable land protection groups, "[i]t will be almost impossible . . . to protect all of this land." Id. 132-133. **In fact, a strong private-public partnership is a key strategy for implementing the Commonwealth's land-conservation and habitat-protection goals.** "Coordination and Partnerships" is one of the seven conservation strategies expressly set forth in the SWAP, which states that the "Division of Fisheries & Wildlife uses

partnerships and coordinates efforts in many ways to conserve, manage and restore the fish and wildlife of the Commonwealth." SWAP, Chapter 7 at 155. Praising the wide range of joint conservation efforts between government and non-profit organizations, the SWAP states that "regardless of the partner or the degree of formality, each and every one of them is critical to the mission." Id. (emphasis added).

BioMap2, mentioned earlier in this brief, is an example of the "mission critical" private-public conservation partnership. This research tool identifies 1,242,000 acres of "Core Habitat" in Massachusetts and another 1,783,000 acres of "Critical Natural Landscape." See web addresses at Addendum. Core Habitat consists of key areas "critical for the long-term persistence of rare species and other Species of Conservation Concern." Id. at 9. Critical Natural Landscape identifies blocks of land that are minimally developed and that have the capacity to "provide habitat for wide-ranging native species, support intact ecological processes, maintain connectivity among habitats, and enhance ecological resilience to natural and anthropogenic disturbances in a rapidly changing world." Id. Notably for this

case, NEFF's forest in Hawley is part of Critical Natural Landscape identified in BioMap2. See a copy of the "Hawley" report from BioMap2 in the Addendum. (The web address is also in the Addendum.)

E. The ATB Failed to Consider the Commonwealth's Conservation Burden and Consequently Ignored How Mission-Critical Partners like NEFF Lessen the Burdens of Government.

The ATB's decision in NEFF v Hawley displays nearly complete ignorance of the Commonwealth's statutory, regulatory and policy framework for preserving habitat and otherwise protecting and preserving the state's eco-regions. Massachusetts' detailed and extensive framework for the protection and preservation of habitat and biodiversity goes unrecognized by the ATB, which also seems ignorant of the partnership principle that now pervades state environmental protection policies. The ATB dismissively describes the preservation of habitat as "a laudable goal" that is not "sufficiently charitable." 2013 WL 360527 at 11.

Not only does the ATB ignore the fact that the Court found NEFF to be lessening the burdens of government in 1961, it completely ignores the fact

that state agencies have publicly declared organizations like NEFF, The Conservancy, and Audubon to be "critical to the mission" when it comes to fulfilling statutory mandates to preserve and protect the state's biological diversity. The ATB attempts to pull itself up by its own bootstraps, citing its own decisions to support its public-recreation requirement for charitable property tax exemptions. See 2013 WL 360527 at 10-11 citing Brookline Conservation Land Trust v. Assessors of Brookline, 2008 WL 2368711 (ATB June 5, 2008) and Forges Farm, Inc. v. Assessors of Plymouth, 2007 WL 3038003 (ATB October 18, 2007). The ATB ignores the test for "lessens the burdens of government" that has been repeatedly ratified by this Court.

NEFF's 134-acre forest is situated in the southwest area of Hawley in territory that has been identified as "Critical Natural Landscape" in BioMap2. See "Hawley Report" maps at pages 9, 11, and 19. See also Land Designation Guidelines, Appendix 11 at Locator Page 1 (Berkshire North). NEFF's forest is bordered on two sides by DCR's Kenneth Dubuque State Forest, and it also abuts a privately-owned open field subject to a conservation restriction. As such, NEFF's

forest plays a role in adding buffer to the state forest and in helping to maintain an unfragmented forest habitat. NEFF is, in fact, pursuing a public policy goal for the state forest.

In its DCR Annual Report FY12, DCR states that it recently "acquired 130 acres that fit perfectly into the southern boundary of the Kenneth Dubuque State Forest. This property adds to a large block of unfragmented forestland . . . , includes wetlands, interior forest, and provides opportunities for hiking and fishing." Id. at 6. NEFF's similarly sized 134-acre forest is performing the same function as DCR's recent acquisition: it reduces forest fragmentation, provides crucial buffer to the state-owned forest, provides habitat, and promotes scientific and educational opportunities. Is NEFF not lessening the burdens of government by adding to "a large block of unfragmented forestland" in Hawley?

NEFF's land is less than a mile southeast of a 25,569-acre area identified in BioMap2 as "Core Habitat Area 2975." See "Hawley Report" at 11 (Core Habitat in Hawley). That habitat "supports 29 rare and uncommon species, including three endangered bats, seriously threatened by white-nose syndrome." Id. at

17-18 (Core 2975 narrative). Only a mile to the east is the 127-acre "Core Habitat Area 2434" situated within the larger state forest. Both Area 2975 and Area 2434 provide habitat for the Twelve-spotted Tiger Beetle and for Bridle Shiners. Id. at 12-13 (listings of "Species of Conservation Concern" in Core Habitat Areas). The former is an insect species of "special concern" in Massachusetts, and the latter is a fish species of special concern. Id. See NHESP Fact Sheets for these species in the Addendum.



Figure 9: An enlarged view of the Twelve-Spotted Tiger Beetle. ©Larry de March, Bugguide.net/node/view/620243.



Figure 10: An illustration of the Bridle Shiner, a small minnow less than 3 inches long. (Ellen Edmonson and Hugh Chrisp, commons.wikimedia.org)

NEFF's forest is in the watershed of both Core Habitat Areas, and it provides a bulwark against fragmentation that helps connect these areas. NEFF's sustainable forestry practices combine habitat preservation and anti-fragmentation with the ability to derive timber resources without impairing or undermining habitat values. NEFF is lessening the burdens of government by adding to the size of the "Woodland" anchored by DCR's state forest and by managing the NEFF land in harmony with DCR's management principles. See Land Designation Guidelines at 37-53 (Woodlands).

NEFF's conservation also "provide[s] valuable natural goods and services such as water quality protection, air pollution removal, and stormwater management." See The Return on Investment in Parks and Open Space in Massachusetts, page 6 (The Trust for Public Land September 2013)(web address in the Addendum), which describes in detail the values derived from the conservation of various ecological regions. The report identifies thirteen ecosystem types protected through state funding mechanisms from 1998 to 2011, with deciduous forest being the largest category. Every dollar invested in conserving these

lands returned \$4 in economic value, id. at 22, from drinking water protection; food control; climate change mitigation; tourism; outdoor recreation; agriculture; forestry; and commercial fishing. Private, non-profit organizations like NEFF, The Conservancy and Mass Audubon also provide this kind of value on their protected lands. These charitable nonprofits own land and exercise stewardship that lessens the burdens of government. Their properties are occupied for charitable purposes within the meaning of G.L. c.59, §5, Third, and should be tax exempt.

E. CONCLUSION

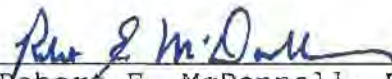
NEFF v. Hawley needs to be reversed. Aside from undermining important public policies, the ATB's *NEFF* ruling will inflict long-term harm on the close collaboration that has developed between the Commonwealth's conservation agencies on one side, and charities like NEFF, The Conservancy, and Mass Audubon on the other. As described in numerous agency guidelines and policies, these NGO's are "mission critical" partners in the long march to preserve the state's rich natural resources, rich biological

diversity, and life-sustaining lands, air and water.
The decision should be reversed.

Respectfully submitted,

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Addendum

**Brief of Amicus Curiae
The Nature Conservancy and
The Massachusetts Audubon Society
in support of
The New England Forestry Foundation**

Part I Web addresses cited in this brief

**Part II Hawley Bog Preserve
Management Plan (2013)**

Part III BioMap2: Hawley

Part IV NHESP Fact Sheets

- 1. Bridle Shiner**
- 2. Copperhead**
- 3. Timber Rattlesnake**
- 4. Twelve-spotted Tiger Beetle**

Addendum

Part I

Web Addresses Cited in Brief

ADDENDUM PART I: WEB ADDRESSES

Document	Pages of Brief	Web Address
Hawley Bog sundew blossoms (photograph)	2	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/massachusetts/ma-50-years-slideshow.xml (visited December 3, 2013)
<u>BioMap2</u>	3, 6, 40, 41, 42, 43	http://maps.massgis.state.ma.us/dfg/biomap2.htm (visited October 2, 2013) BioMap2 is also available on the web site of the Executive Office of Energy and Environmental Affairs (EEA) and The Conservancy's web site.
Jennifer Price, "Hats Off to Audubon"	4	http://archive.audubonmagazine.org/features0412/hats.html (visited October 2, 2013)
2005 Massachusetts Comprehensive Wildlife Conservation Strategy (a/ka State Wildlife Action Plan 2005 (amended 2006)	6, 18, 36, 37, 38, 39, 40	www.mass.gov/eea/agencies/dfg/dfw/wildlife-habitat-conservation/massachusetts-wildlife-conservation-strategy.html (visited October 2, 2012). <i>See</i> Chapter Seven: Overview of Conservation Strategies" at 155-156.
Losing Ground Beyond the Footprint: Patterns of Development and Their Impact on the Nature of Massachusetts	6, 38	http://www.massaudubon.org/content/download/8604/149734/file/LosingGround_web1.pdf (visited December 3, 2013) James DeNormandie, author
State of the Birds: Documenting Changes in Massachusetts' Birdlife	6	http://www.massaudubon.org/content/download/9510/156446/file/state-of-the-birds-2011-document.pdf (visited December 3, 2013)
Massachusetts Wildlife Habitat Protection Guidance for Inland Wetlands	14, 15	http://www.mass.gov/dep/water/laws/wldhab.pdf (visited October 2, 2013)

Document	Pages of Brief	Web Address
Natural Heritage & Endangered Species Program	15, 16	http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/ The NHESP web page with numerous links to programs and policies concerning habitat protection and biodiversity (visited October 2, 2013).
EEA "2013-2015 Strategic Plan"	16	www.mass.gov/eea/docs/eea/eea-2013-2015-strategic-plan-17-january-2013.pdf (visited October 26, 2013)
<i>DCR Annual Report FY12</i>	16, 24, 43	www.mass.gov/eea/docs/dcr/2012-dcr-annualreport.pdf (visited October 26, 2013)
<i>Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines</i>	16, 17, 25, 26, 28, 29, 45	www.mass.gov/eea/docs/dcr/ld/management-guidelines.pdf (visited October 26, 2013)
<i>National Registry of Natural Landmarks June 2009</i>	21, 22	www.nature.nps.gov/nnl/docs/NNLRegistry.pdf (visited November 2, 2013)
Massachusetts NNL sites	22	www.nature.nps.gov/nnl/state/cfm?State=MA (visited November 2, 2013)
Five Colleges Consortium, Inc.	23	The Five Colleges Consortium includes Amherst College, Mt. Holyoke College, Smith College, U. Mass. Amherst, and Hampshire College. See www.fivecolleges.edu/consortium (visited October 2, 2013)
Polly Ryan-Lane, "Hawley Bog: Pitcher Perfect," <i>The Botanic Garden News</i>	23, 24	www.smith.edu/garden/Newsletter/newssp10.pdf (Smith College Spring 2010) (visited November 2, 2013)

Document	Pages of Brief	Web Address
Dr. Piotr Naskrecki "Bog Killers"	24	http://www.thesmallmajority.com (visited November 2, 2013)
<i>Wildlands and Woodlands: A Vision for the Forests of Massachusetts</i>	27	www.wildlandsandwoodlands.org/vision/vision-massachusetts (visited November 3, 2013)
<i>Wildlands and Woodlands: A Vision for the New England Landscape</i>	27	www.wildlandsandwoodlands.org/vision-vision-new-england (visited November 3, 2013)
Bob Wilber, "This Sanctuary Has Never Met a State Forest it Didn't Like!"	29, 30	blogs.massaudubon.org/landprotection/this-sanctuary-has-never-met-a-state-forest-it-didn't-like/ (visited November 2, 2013)
<i>Massachusetts Forest Reserves Long Term Ecological Monitoring Program: Mohawk/Monroe/Savoy Forest Reserve</i>	30	http://www.mass.gov/eea/docs/dcr/stewardship/forestry/pdf/mohawk-monroefr.pdf (visited November 3, 2013)
Story of Discovery: Making Medicines from Poisonous Snakes	31, 32	http://archive.is/25mFc (visited December 1, 2013) <i>See also</i> "The Bite That Heals," http://ngm.nationalgeographic.com/2013/02/125-venom/holland-text (visited September 13, 2013)
Quan Van Le, et al., "Pulvinar neurons reveal neurobiological evidence"	31	www.pnas.org (visited November 3, 2013) Proceedings of the National Academy of Sciences
NHESP "Timber Rattlesnake Fact Sheet"	32	http://www.mass.gov/eea/docs/dfg/nhesp/species-and-conservation/nhfacts/crotalus-horridus.pdf (visited December 18, 2013)

Document	Pages of Brief	Web Address
R. Stechert, Hudson Highland Environmental	33	http://hudsonhighlandsenviro.com/personnel/richard-randy-stechert (visited September 29, 2013)
Tom Tying	33	http://westernmassnaturalist.org/the-snake-pages/patterned-snakes/timber-rattlesnakes-venomous.html (visited September 29, 2013)
<i>State Wildlife Grants: Five Year Accomplishment Report</i>	36, 37	http://www.teaming.com (visited Nov. 3, 2013). This report was produced through a joint effort of the Association of Fish and Wildlife Agencies and the U.S. Fish and Wildlife Service.
Town of Hawley Report in BioMap2	41, 42, 43, 44	www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/land-protection-and-management/biomap2/biomap2-town-reports.html (visited October 3, 2013)
<i>The Return on Investment in Parks and Open Space in Massachusetts</i>	45, 46	http://cloud.tpl.org/pubs/benefits-ma-roi-report.pdf (visited October 3, 2013)

Addendum

Part II

Hawley Bog Preserve Management Plan (2013)

Hawley Bog Preserve Management Plan

2013

by Karen Lombard and Angela Sirols



Photo credit: Caitlyn Snyder

I. Site Overview & Location

Hawley Bog is located in the town of Hawley, Franklin County, Massachusetts and is part of larger wooded wetland area near the old Hawley town common. (Appendix A). The 4-acre bog is a good example of a level bog. Hawley Bog is located at an elevation of 550m (1800 ft) above sea level, an elevation that was above glacial Lake Hitchcock at the end of the last glaciation. Pollen studies from the bog indicate that the current vegetation composition developed at the site only during the past few thousand years.

Protection of the site for conservation and education purposes began in 1970 when the Connecticut River Watershed Council acquired the first 40-acre parcel. Five Colleges Inc. (Five Colleges) purchased this parcel in 1978. The Nature Conservancy (TNC) purchased 25 adjacent acres in 1993 in order to further protect the bog community and the rare species found at the site. Since that time, the area has been used for education and research by the faculty and students in the Five College system (University of Massachusetts, Smith College, Amherst College, Hampshire College and Mt. Holyoke College). TNC manages the Five College tract under a management agreement.

The National Park Service designated the site as a National Natural Landmark in 1974, and as a Natural Area by the Society of American Foresters. There is a sign commemorating the Landmark designation affixed to a large boulder.



Directions and best site access:

Hawley Bog is roughly 45 minutes from either Greenfield or Northampton, MA.

Hawley Bog can be accessed from Route 2 by going south on 8A from Charlemont. Immediately after crossing the Deerfield River and railroad tracts, take left on E. Hawley St. Take E. Hawley Rd several miles to the town common parking area just past Forget Rd on the right. The trail to the bog is the left trail off the common.

Hawley Bog can also be accessed from Rt 112 in Ashfield at its N junction with Rt 116. Take the Hawley Rd (turns into Ashfield Rd) until it ends and take a right onto E. Hawley Rd. Take this road a couple of miles until you see the Town Common on the left (opposite small red house). The trail to the bog is the left trail off the common.

II. Conservation Significance

The entire preserve falls into both Biomap2 core habitat and is designated MA Natural Heritage and Endangered Species Program (MNHESP) priority habitat under the MA Endangered species act.

Additionally Hawley Bog falls into TNC's Northern Appalachian Whole System and was designated an ecoregional portfolio site in TNC's Lower New England-Northern Piedmont Ecoregional Plan because of its high quality bog.

This preserve was designated as a "flagship" preserve by TNC's MA chapter in 2013. A flagship preserve is a signature place that offers public access opportunities and can serve as a platform for engaging people while retaining significant ecological values and minimizing impacts. A flagship may also demonstrate or export land management practices. This property is the most visited of all of TNC MA preserves.

Targets

<u>Name</u>	<u>Rank</u>	<u>Target Type</u>
Northern Appalachian Whole System		
Level Bog		Ecoregional
Rare species (see link)		Site

III. Site Description

1. Land Protection history

As mentioned above most of the bog mat is owned by Five Colleges and is part of an approximately 40-acre tract that was acquired by Five Colleges from the Connecticut River Watershed Council in 1978 (Franklin County Registry of Deeds, Book 1544, Page 128). In 1991 TNC purchased approximately 25 acres of bog and forested swamp from Joseph & Judith LaChappelle in (Franklin County Registry of Deeds, Book 2575, Page 93) to further protect the site. Additional protected land in the area includes the Kenneth Dubuque Memorial State Forest and a tract of land owned by the University of Massachusetts Foundation, both of which abut the Five Colleges tract.

<u>Subunits</u>	<u>CLS IFMS ID</u>	<u>Type</u>	<u>Acreage</u>	<u>Protection Date</u>
LaChappelle	10013675	Fee	26	1991
Five Colleges, Inc. (not owned by TNC)		Fee	40	1978

2. Other legal rights

TNC has a management agreement with Five College's Inc. to manage the bog. This is renewed every 5 years and was last renewed in 2011.

TNC provided a small amount of money to the Sons & Daughters of Hawley for kiosk installation in 2009 and as a result has a small space in the kiosk to display information.

3. Land use history

The site is bisected by the 'Swamp Road' which connected the old Hawley town center to Plainfield. In 2009 the Sons and Daughters of Hawley, a group comprised of Hawley residents, initiated a project to rediscover the historic Hawley Town Common. The Common, located just east of Hawley Bog, was actively used by the town from 1798 to 1848, and it has since been abandoned. This project set out to rediscover Hawley's Old Town Common and to create an educational historic site with paths along the cellar holes and other evidence of the vanished community. In addition to a parking area and a kiosk detailing the historic site and the Hawley Bog, there are numerous interpretative signs which invite the visitors to discover the particular history of Hawley's town common and its adjacent environs, including Hawley Bog. The project has greatly improved the visibility and access to the preserve, and it is a wonderful example of collaboration among the Sons and Daughters of Hawley, The Highland Communities Initiative of the Trustees of Reservation, Mass Humanities, the Nature Conservancy, and the Five Colleges.

4. Hydrology

The bog lies in a depression surrounded by a wooded swamp. Potash Brook originates in this wetland complex and eventually runs into the Mill Brook, a tributary to the Connecticut River. Beaver activity has created several channels connecting the bog pond with the brook. Beavers have been influencing the hydrology of this area for many years; however impacts of beavers on the fragile bog mat community could be potentially detrimental. Although beavers were extirpated from Massachusetts by the late 1700s, they were reintroduced to the state in the early part of this century and have since become well established. In the mid-1970s the state Division of Fisheries and Wildlife (DFW) trapped and relocated beavers that were in the Hawley Bog area. It is estimated that 4-12 beaver were removed over a four-year time period. However, according to former DFW Western Wildlife District Manager Tom Keefe, bogs generally are not prime beaver habitat because there are not enough hardwoods and the water is too acidic. Several large beaver flowages are located in the Hawley State Forest that abuts Hawley Bog. There is also a large beaver flowage downstream from the bog.

5. Natural Processes

See hydrology section above for information on beavers. A major ice storm in December 2008 caused extensive tree damage, including limbs falling onto the boardwalk.

6. Community descriptions

Level bog - Hawley Bog is a good example of an unspoiled sphagnum heath bog occupying a shallow glacial lake basin. Level bogs are dwarf-shrub peatlands, generally with pronounced hummocks and hollows in sphagnum moss. These wetland communities are very acidic and nutrient-poor because the peat isolates them from nutrients in groundwater and streams. Depth studies have shown that an accumulation of 30 feet of consolidated peat underlies the middle of the bog with 22 feet of peat at the edge of the forest. Dominant plants of the bog mat include *Sphagnum* sp., *Vaccinium oxycoccos*, *Chamaedaphne calyculata*, *Myrica gale*, *Ledum groenlandica*, *Kalmia angustifolia*, *Kalmia polifolia*, *Sarracenia purpurea*, *Drosera rotundifolia*, *Utricularia cornuta*, and a variety of sedges.

Open pond - At the center of the bog is a small, elongate pond about 300 feet long and varying from 20 to 60 feet wide. It is somewhat atypical in that it has an outlet, although this outlet is not much more than a trickle most of the year.

Coniferous forest/Wooded swamp - The land surrounding the bog is a wooded swamp dominated by *Tsuga canadensis*, *Acer rubrum*, *Fraxinus nigra*, *Abies balsamea*, & *Picea mariana*.

Hemlock-northern hardwood forest - On the drier slopes surrounding the bog and swamp are large stands of *Tsuga canadensis* and *Kalmia latifolia* as well as hardwoods such as *Fagus grandifolia*, *Acer saccharinum*, and *Betula lenta*.

7. **Rare Species** - see [here](#)

8. **Other wildlife**
None noted

IV. Preserve Management

1. Threats

Threats (to individual tracts, as well as cross subunit or preserve)

Threat	Scope	Severity	Time Frame
Overuse (trampling)	low	medium	ongoing
Invasive Species	low	low	ongoing
Boundary encroachment	low	low	ongoing
Beaver flooding	low	low	low
Illegal plant collection	low	med	ongoing

See management section for details on each threat

2. Governing laws specific to this property, compatible human use, prohibited activities

Any restoration work within 100 feet of a wetland requires a permit obtained from the local Conservation Commission under the MA Wetlands protection act. All restoration work requires the approval of a management plan by MNHESP as all of the preserve is mapped as priority habitat under the MA Endangered Species Act.

Activities on this preserve are also governed by guidelines in the TNC MA chapter's "Stewardship Policies and Minimum Standards" document. Activities which may cause damage to species, natural communities, or other natural features need to be controlled or eliminated. Such activities include but are not limited to trampling of vegetation, cutting of vegetation, altering of hydrologic conditions, digging, dredging, and the application of pesticides or herbicides (except for approved invasive species control measures). Natural processes will be allowed to occur, except when it is determined that rare species or communities are being negatively impacted. Potential alteration of rare species habitat is a priority concern.

ADA Assessment: to be completed

3. Management Goals

Management of the site (including lands owned by TNC and Five Colleges) will be conducted by TNC under the terms of the 2011-2016 Hawley Bog Management Agreement.

TNC will focus management efforts to protect occurrences of rare species and natural communities. This area has been used extensively for education and research in the past and these uses should continue as long as the ecological integrity of the area is not threatened. Passive education is encouraged at this preserve and an interpretive sign has been installed along the path into the bog for this purpose. This sign informs visitors about the characteristics and ownership of the bog. Currently a volunteer steward at the preserve is important in monitoring and threat assessment at this site.

4. Management Information and History

A boardwalk across the bog mat was built in 1997 in an effort to reduce the impact of trampling on the bog mat, replacing an older, less substantial boardwalk. A significant portion of the boardwalk was replaced or repaired in 2012 using locally harvested wood and a local AmeriCorps crew.

A patch of the invasive *Phragmites australis* was treated each year, from 2006 to 2008, to reduce the extent of its growth and negative impacts on native vegetation. By the last year of treatment the patch had been greatly reduced. A major ice storm in December 2008 caused tree damage, including limbs falling onto the boardwalk. A volunteer cleared the majority of the down trees during the summer of 2009. Also in 2008, another volunteer assisted with the installation of a registry box, where visitors can sign in and therefore help determine amount of use of the preserve. A more detailed description of the recent management activities can be found in Appendix C.

5. Management Actions and Timeline

Timeline for general management activities

Activity	When	Who
Inspect and maintain tracts with visitor use including trails, signage, and boardwalks and respond to violations promptly	Yearly	TNC staff and volunteers
Inspect tracts with limited/no visitor use and respond to violations promptly	Every 3 years	TNC staff or volunteer
Walk high risk boundaries (near developed areas) and check signage	Yearly	TNC staff or volunteer
Walk low risk boundaries	Every 3-5 years	TNC staff or volunteer
Vegetation Management/Invasives Control	As prioritized (staff or restoration review process)	TNC staff
Monitor and report on rare species or target populations	As needed or time allows	TNC staff with USFWS/Heritage/NEWFS as appropriate
Check nature.org preserve descriptions to make sure everything is up to date	Yearly	TNC staff
Update management plan	Upon renewal of management agreement	TNC staff

a. Details on Annual Preserve Stewardship Activities

The Nature Conservancy will conduct annual preserve stewardship activities that will include:

- 1) at least one visit to the preserve to assess infrastructure (i.e., parking area, kiosk, signage, trail, boardwalk) and habitat;

- 2) removing vegetation that may be obstructing the safe use of the boardwalk and trails, and visual access to signs, kiosk, and the registry box; and
- 3) maintenance and/or repairs which are necessary for safety reasons or as deemed important by TNC staff.

b. Other Management Recommendations to Address Threats

1. Use of Bog for Research and Education

The greatest threat to rare species and communities at this site is degradation of the bog and wetland communities from overuse. This example of a level bog is well-known and much-visited. Although moderate levels of disturbances from trampling are affecting the peat layer, this bog remains a high-quality example of this natural community (MNHESP 2012). Further degradation could result from inappropriate use of the bog such as excessive walking on the fragile bog mat by visitors or researchers.

Recommendations:

- Require that researchers follow the protocol listed below.
- Limit the approval of research projects that are concentrated in one or several areas of the bog for multiple years, particularly if they are extensive research projects.
- Maintain relationships with volunteer stewards to maintain the boardwalk and signs and to monitor threats and inappropriate use.
- Coordinate any large group visits to the bog.
- Maintain all signs stating that the bog mat should not be walked on.
- Maintain the boardwalk and trail for safe and enjoyable use by visitors.
- Monitored the area for illegal motorized access or other inappropriate uses (such as off road or all terrain vehicles, snowmobiles, dirt-bikes, horses, mountain bikes).

Guidance for Approving Research Requests

The research and educational opportunities that this site provides are very valuable to both the Five College consortium and the scientific community. Research conducted in a manner not harmful to the community or the species should continue. Potential research projects include assessing the impacts of beaver activity on the bog, the successional vegetation changes of an abandoned beaver pond, hydrological studies, and status reports on the species found within the bog ecosystem – as well as a study to investigate the effects of the research activities on the bog community.

Potential research projects should be reviewed by the Field Reserves Committee of Five Colleges and TNC for approval. Approval for a project will be based on the need for the research, potential damage to species populations or natural communities, the specific area requested for research use, and potential conflict with other activities at the site. Researchers should follow the protocol listed at the end of this paragraph and evaluate any impacts on the bog during the research project. As mentioned above, successive intensive research projects in the same area of the bog should be avoided so that the bog can recover between projects. The results of impact analyses should be incorporated into the decision-making regarding proposed research projects.

Investigators should adhere to the following:

- Limit time spent on the bog mat.
- Use portable boardwalks at all times to distribute weight.
- Attempt to use the same main trails to access the bog, but adjust access if significant damage to the bog mat is occurring.
- Report back to TNC regarding the time spent on the mat.
- Supply TNC with final reports or published articles involving data collection and studies at Hawley Bog.

2. Invasive species

At present the threat of the invasive grass, *Phragmites australis*, has largely been removed from the preserve. Successive herbicide treatments from 2006 to 2008 greatly reduced the presence of this invasive plant. Currently *Phragmites* is not considered to be a significant threat to the site. However the plant is still present and therefore resurgence of the threat is possible.

Recommendations:

- Monitor each year for changes in known population or for new invasions.
- Implement appropriate herbicide treatment if past population appears to be increasing in size or density, or if new populations are established.

3. Boundary encroachment

To date boundary encroachment has not been a problem at the Hawley Bog. However, boundaries along the road frontage and adjacent to developed lots are vulnerable to dumping and

encroachment. Posting these boundaries is a priority. Boundaries that occur in the wetland are of lesser priority as they are difficult to access and less likely to suffer encroachment.

Recommendation:

- Post and monitor boundary markers along road frontage.

4. Beaver activity

Beaver activity in the area could change the water level of the bog more quickly than the bog could respond. In the past ten years there have been no observed negative effects of beavers. However casual visual monitoring of the bog should be maintained to assess if this becomes a serious threat to the community.

Recommendations:

- Monitor annually to assess and determine if beaver activity is a threat to any resources of concern.
- Identify and implement appropriate beaver management actions if beaver activity is determined to be a threat to the bog and associated natural resources.

5. Illegal Plant Collection

Pitcher plants have been taken from near the boardwalk in the past. It is difficult to stop this type of activity, however, any mention of this species has been removed from the website.

c. Rare Species Monitoring

The rare species and natural communities at this site should be monitored or censused on a regular schedule. Monitoring may not be needed annually, but undertaken frequently enough to give an indication of the status of the populations. The monitoring of rare species can be done by qualified and authorized volunteer groups and Massachusetts Natural Heritage and Endangered Species Program (MNHESP) staff, with potential assistance from TNC staff. Any research and management activities should not threaten the integrity of the populations. Monitoring should include assessing the status of the bog mat for potential threats from natural or human impacts.

Recommendations:

- Regularly meet with NHESP to discuss status and potential threats to rare species and

- determine if management actions are required.
- Locate and map current locations of rare species populations and communities, if sufficient resources are available.

V. Research and Inventory

This site has been the focus for several studies over the years. Research projects have included a red maple study, a vegetation history, and research on pitcher plants. Students from the colleges and universities in the Five College system have done class projects and independent research on the bog, species, and various aspects of the natural communities.

From 1996-2002 Dr. Aaron Ellison (Harvard University; Five College Graduate faculty member), Dr. Leszek Bledzki (Mount Holyoke College) and Dr. Nicholas Gotelli (University of Vermont) studied pitcher-plants at Hawley Bog (with assistance from students at these two institutions). The focus of their research was the responses of plants to nutrient loading, such as that caused by acid rain and snow. Based on four years of data collection, Ellison and Gotelli found that these plants can use the nitrogen in acid rain as an additional nutrient source, and that too much nitrogen causes these plants to give up the carnivorous habit and produce flat leaves that are more efficient at photosynthesizing. This additional nitrogen may also lead to increased flowering, such as that seen at Hawley during the summer of 2000. Ellison has also completed an impact analysis for use in evaluating research use of the bog.

In addition, Ellison and Gotelli documented the biodiversity of ants at Hawley and other bogs in Massachusetts, Connecticut and Vermont. Ants are the primary prey of pitcher-plants. At Hawley, they discovered a species of ant, *Myrmica lobifrons*, which previously had not been recorded in Massachusetts, but is now considered the most common ant species in New England bogs.

Publication List

- Bledzki, L.A. and A. M. Ellison. 2003. Diversity of rotifers from northeastern U.S.A. bogs with new species records for North America and New England. *Hydrobiologia* 497: 53-62.
- Bledzki, L.A. and A.M. Ellison. 1998. Population growth and production of *Habrotracha rosa* Donner (Rotifera: Bdelloidea) and its contribution to the nutrient supply of its host, the northern pitcher plant, *Sarracenia purpurea* L. (Sarraceniaceae). *Hydrobiologia* 385: 193-200.

- Ellison, A. M., H. L. Buckley, T. E. Miller, & N. J. Gotelli. 2004. Morphological variation in *Sarracenia purpurea* (Sarraceniaceae): geographic, environmental, and taxonomic correlates. *American Journal of Botany* 91: 1930-1935.
- Ellison, A. M. & N. J. Gotelli. 2002. A fine-scale indicator of nitrogen saturation in northern ecosystems. *Proceedings of the National Academy of Sciences, USA* 99: 4409-4412.
- Ellison, A.M., E.J. Farnsworth, and N.J. Gotelli. 2002. Ant diversity in pitcher-plant bogs of Massachusetts. *Northeastern Naturalist* 9(3):267-284.
- Ellison, A.M. 2001. Interspecific and intraspecific variation in seed size and germination requirements of *Sarracenia* (Sarraceniaceae). *American Journal of Botany* 88(3): 429-437.
- Gotelli, N.J. and A.M. Ellison, 2002. Nitrogen deposition and extinction risk in the northern pitcher plant, *Sarracenia purpurea*. *Ecology* 83(10): 2758-2765.
- Gotsch, S.G. and A.M. Ellison. 1998. Seed germination of the northern pitcher plant, *Sarracenia purpurea*. *Northeastern Naturalist* 5(2): 175-182.
- Moziuk, G.A. and R.B. Livingston. 1966. Ecology of red maple (*Acer rubrum* L.) in a Massachusetts upland bog. *Ecology* 47(6): 942-950.
- Patterson, W.A. III 1986. Vegetation history of Hawley Bog. Hawley, Massachusetts University of Massachusetts.
- Richardson, Bob. 2011. Hawley Bog Wildflowers. Gone Beyond Press, Charlemont, MA.

VI. References

Massachusetts Natural Heritage & Endangered Species Program (rare species data from 2012)

VII. Plan Review and Revision

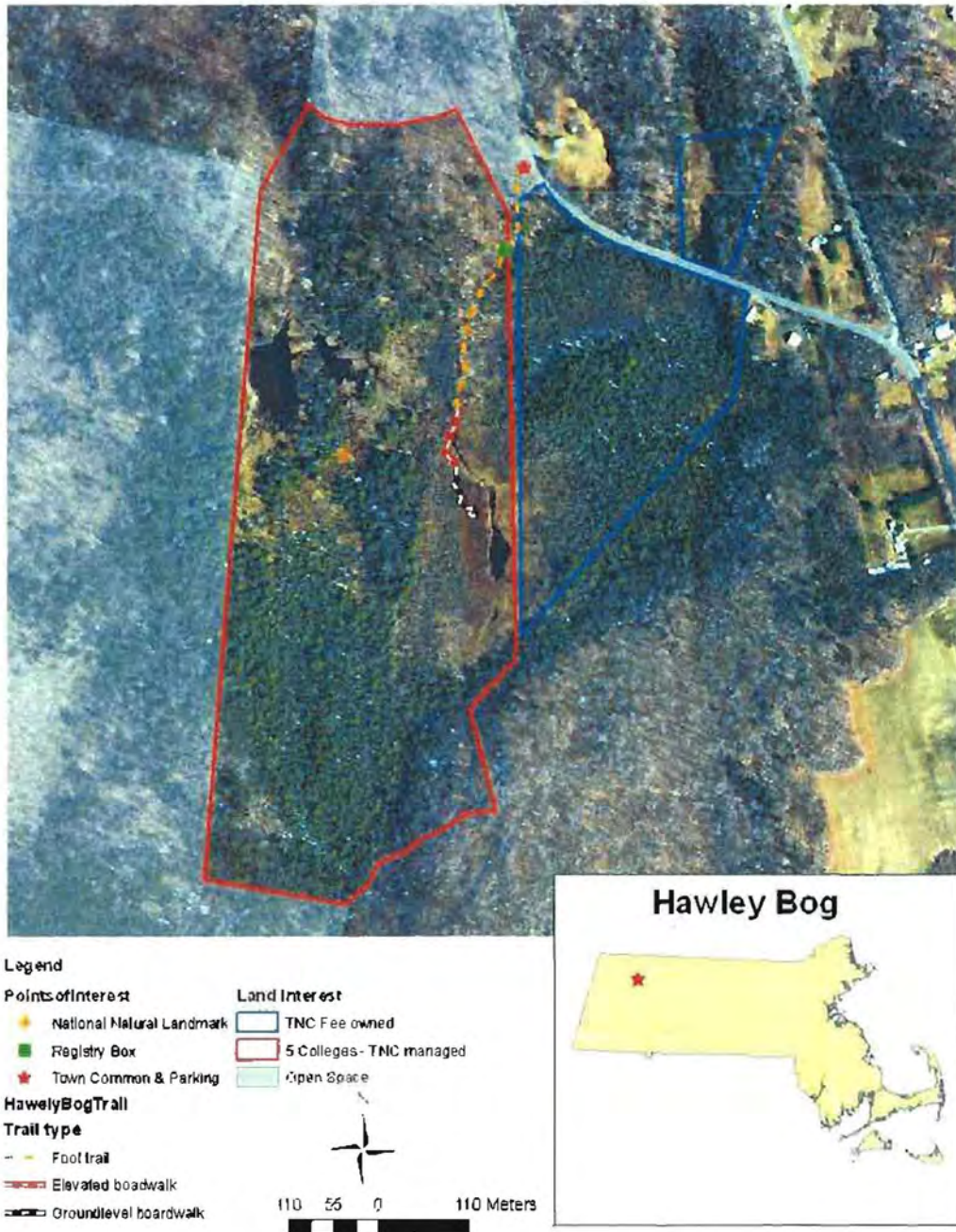
This management plan will be reviewed and updated by TNC and the Field Reserves Committee of Five Colleges every five years, coinciding with the term of the Management Agreement.



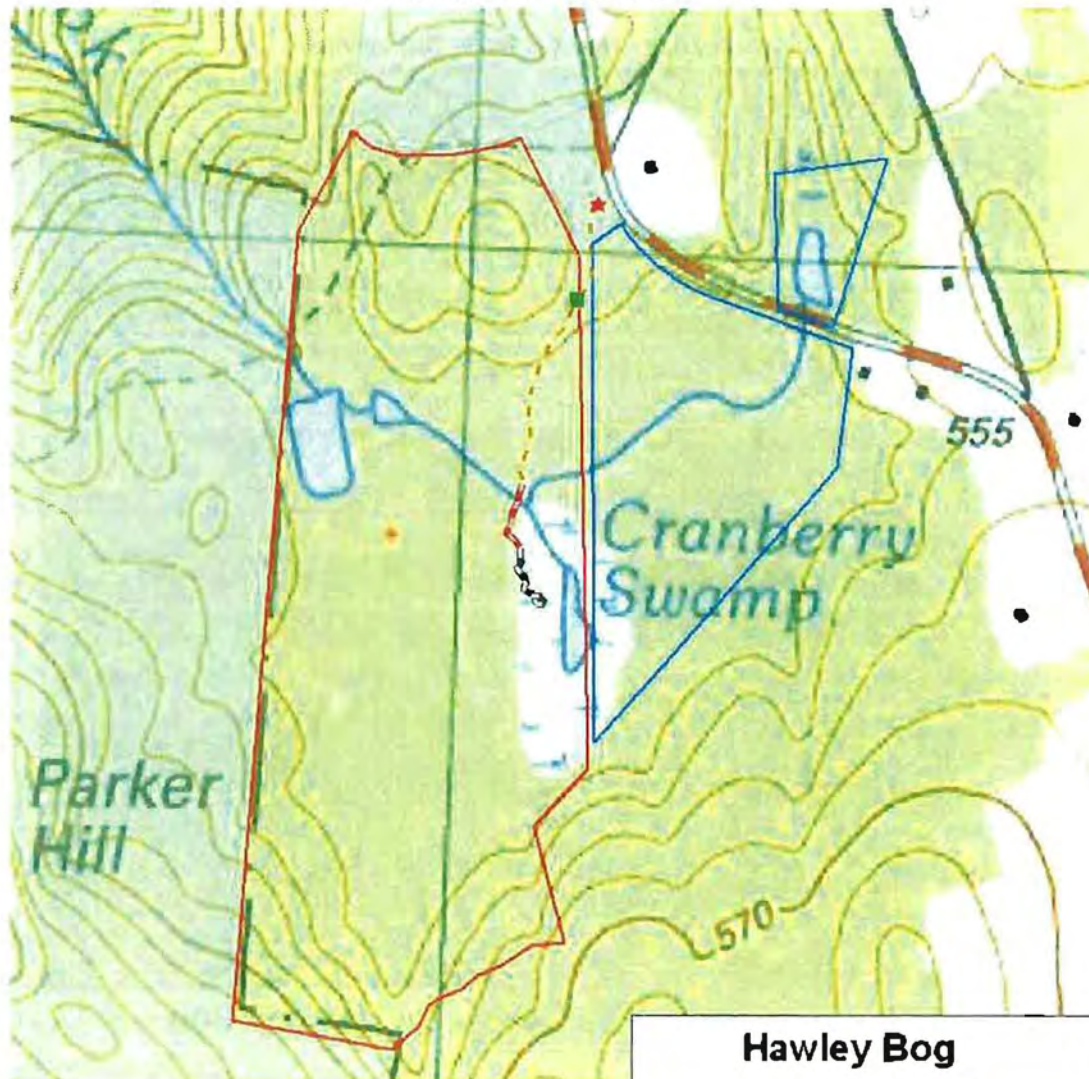
Looking east from the end of the boardwalk out onto the bog mat. 2011. A.Sirois

Appendix A: Maps of Site

Hawley Bog – MassGis 2005 - Orthophoto



Hawley Bog – USGS Topographic Map



Legend

Points of Interest

- ★ National Natural Landmark
- Registry Box
- ★ Town Common & Parking

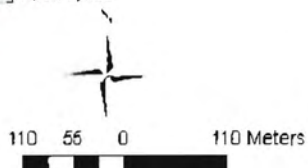
Land Interest

- TNC Fee owned
- 5 Colleges - TNC managed
- Open Space

Hawley Bog Trail

Trail type

- Foot trail
- Elevated boardwalk
- Groundlevel boardwalk



Appendix B

Global and State Ranks

This information is adapted from NatureServe at <http://www.natureserve.org/explorer/ranking.htm>

Global Conservation Status Definitions

Listed below are definitions for interpreting NatureServe global conservation status ranks (G-ranks). These ranks reflect an assessment of the condition of the species or ecological community across its entire range. Where indicated, definitions differ for species and ecological communities.

Rank	Definition
G1	Critically Imperiled—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	Imperiled—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	Secure—Common; widespread and abundant.

State Conservation Status Definitions

Listed below are definitions for interpreting NatureServe conservation status ranks at the state (S-rank) levels. Assigning state conservation status ranks for species and ecological communities follows the same general principles as used in assigning global status ranks. A state rank, however, cannot imply that the species or community is more secure at the state/province level than it is nationally or globally (i.e., a rank of G1S3 cannot occur). State ranks are assigned and maintained by state or provincial natural heritage programs and conservation data centers.

Rank	Definition
S1	Critically Imperiled—Critically imperiled in the state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2	Imperiled—Imperiled in the state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state/province.
S3	Vulnerable—Vulnerable in the state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	Secure—Common, widespread, and abundant in the state/province.

Appendix C

Management Activities Log, 2006-2009

2006

Phragmites management – On August 28th, a Student Conservation Association crew (3 people), lead by TNC staff, treated the entire patch of Phragmites. They used the clip and drip method of herbicide application (12 oz), and removed the cut vegetation (2 bags). The patch was sparse and treatment took 1.5 hours.

2007

Phragmites management – On August 7th, two TNC staff treated the patch of Phragmites using the same method as 2006. The treatment took 1 hour and required 8 oz. of herbicide.

Rare species survey – New England Wildflower Society's (NEWFS) Plant Conservation Program (NEPCoP) volunteers searched for *Cypripedium reginae* but did not find it. They plan to keep searching.

2008

Ice Storm – December 11, 2008 a large freezing rain and ice storm moved through New England and New York. Damage from the ice was extensive. Volunteer steward Richard Warner provided photo documentation of the event (Fig.1).



Registry Box – In May, volunteer installed a preserve registry box at the entrance to the preserve. The volunteer checks the box regularly and sends the completed forms to TNC. The objective of the registry box was to determine the use of the preserve. Thus far, results show that the preserve is being used more than originally thought.



Fig. 2 Registry box

Phragmites management – On August 12th, on TNC staff treated the patch of Phragmites using the same method as 2006. The treatment took 15min and required 2 oz. of herbicide.

2009

Ice Storm Repairs - Volunteer steward Richard Warner responded to the damage from the December 2008 ice storm. He reported that two trees had fallen across the boardwalk with minor damage and one tree fell away from the boardwalk, lifting one of the supports that was sitting high on the root-ball and badly wrenching the boardwalk. He cut both trees that fell across the boardwalk and mended some damaged parts of the boardwalk.

Addendum

Part III

BioMap2: Hawley



BioMap2

CONSERVING THE BIODIVERSITY OF
MASSACHUSETTS IN A CHANGING WORLD

Hawley

Produced in 2012

This report and associated map provide information about
important sites for biodiversity conservation in your area.

**This information is intended for conservation planning, and is
not intended for use in state regulations.**



Natural Heritage
& Endangered Species
Program
Massachusetts Division of Fisheries & Wildlife

The Nature
Conservancy 
Protecting nature. Preserving life.



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Elements of *BioMap2* Cores

Core Habitat Summaries

Elements of *BioMap2* Critical Natural Landscapes

Critical Natural Landscape Summaries





Introduction

The Massachusetts Department of Fish & Game, through the Division of Fisheries and Wildlife's Natural Heritage & Endangered Species Program (NHESP), and The Nature Conservancy's Massachusetts Program developed *BioMap2* to protect the state's biodiversity in the context of climate change.

BioMap2 combines NHESP's 30 years of rigorously documented rare species and natural community data with spatial data identifying wildlife species and habitats that were the focus of the Division of Fisheries and Wildlife's 2005 State Wildlife Action Plan (SWAP). *BioMap2* also integrates The Nature Conservancy's assessment of large, well-connected, and intact ecosystems and landscapes across the Commonwealth, incorporating concepts of ecosystem resilience to address anticipated climate change impacts.

Protection and stewardship of *BioMap2* Core Habitat and Critical Natural Landscape is essential to safeguard the diversity of species and their habitats, intact ecosystems, and resilient natural landscapes across Massachusetts.

What Does Status Mean?

The Division of Fisheries and Wildlife determines a status category for each rare species listed under the Massachusetts Endangered Species Act (MESA), M.G.L. c.131A, and its implementing regulations 321 CMR 10.00. Rare species are categorized as Endangered, Threatened or of Special Concern according to the following:

- Endangered species are in danger of extinction throughout all or a significant portion of their range or are in danger of extirpation from Massachusetts.

BioMap2



Get your copy of the *BioMap2* report! Download from www.nhesp.org or contact Natural Heritage at 508-389-6360 or natural.heritage@state.ma.us.

- Threatened species are likely to become Endangered in Massachusetts in the foreseeable future throughout all or a significant portion of their range.
- Special Concern species have suffered a decline that could threaten the species if allowed to continue unchecked or occur in such small numbers or with such restricted distribution or specialized habitat requirements that they could easily become Threatened in Massachusetts.

In addition NHESP maintains an unofficial watch list of plants that are tracked due to potential conservation interest or concern, but are not regulated under the Massachusetts Endangered Species Act or other laws or regulations. Likewise, described natural communities are not regulated by any law or regulations, but they can help to identify



Natural Heritage
& Endangered
Species Program

Massachusetts Division of Fisheries and Wildlife
100 Hartwell Street, Suite 230, West Boylston, MA 01583
phone: 508-389-6360 fax: 508-389-7890



ecologically important areas that are worthy of protection. The status of natural communities reflects the documented number and acreages of each community type in the state:

- Critically Imperiled communities typically have 5 or fewer documented good sites or have very few remaining acres in the state.
- Imperiled communities typically have 6-20 good sites or few remaining acres in the state.
- Vulnerable communities typically have 21-100 good sites or limited acreage across the state.
- Secure communities typically have over 100 sites or abundant acreage across the state; however, excellent examples are identified as Core Habitats to ensure continued protection.

In 2005 the Massachusetts Division of Fisheries and Wildlife completed a comprehensive State Wildlife Action Plan (SWAP) documenting the status of Massachusetts wildlife and providing recommendations to help guide wildlife conservation decision-making. SWAP includes all the wildlife species listed under the Massachusetts Endangered Species Act (MESA), as well as more than 80 species that need conservation attention but do not meet the requirements for inclusion under MESA. The SWAP document is organized around habitat types in need of conservation within the Commonwealth. While the original BioMap focused primarily on rare species protected under MESA, *BioMap2* also addresses other Species of Conservation Concern, their habitats, and the ecosystems that support them to create a spatial representation of most of the elements of SWAP.

BioMap2: One Plan, Two Components

BioMap2 identifies two complementary spatial layers, Core Habitat and Critical Natural Landscape.

Core Habitat identifies key areas that are critical for the long-term persistence of rare species and other Species of Conservation Concern, as well as a wide diversity of natural communities and intact ecosystems across the Commonwealth. Protection of Core Habitats will contribute to the conservation of specific elements of biodiversity.

Critical Natural Landscape identifies large natural Landscape Blocks that are minimally impacted by development. If protected, these areas will provide habitat for wide-ranging native species, support intact ecological processes, maintain connectivity among habitats, and enhance ecological resilience to natural and anthropogenic disturbances in a rapidly changing world. Areas delineated as Critical Natural Landscape also include buffering upland around wetland, coastal, and aquatic Core Habitats to help ensure their long-term integrity.

The long-term persistence of Massachusetts biological resources requires a determined commitment to land and water conservation. Protection and stewardship of both Critical Natural Landscapes and Core Habitats are needed to realize the biodiversity conservation vision of *BioMap2*.

Components of Core Habitat

Core Habitat identifies specific areas necessary to promote the long-term persistence of rare species, other Species of Conservation Concern, exemplary natural communities, and intact ecosystems.

Rare Species

There are 432 native plant and animal species listed as Endangered, Threatened or Special Concern under the Massachusetts Endangered Species Act (MESA) based on their rarity, population trends, and threats to survival. For





Table 1. Species of Conservation Concern described in the State Wildlife Action Plan and/or included on the MESA List and for which habitat was mapped in *BioMap2*. Note that plants are not included in SWAP, and that marine species such as whales and sea turtles are not included in *BioMap2*.

Taxonomic Group	MESA-listed Species	Non-listed Species of Conservation Concern
Mammals	4	5
Birds	27	23
Reptiles	10	5
Amphibians	4	3
Fish	10	17
Invertebrates	102	9
Plants	256	0
Total	413	62

BioMap2, NHESP staff identified the highest quality habitat sites for each non-marine species based on size, condition, and landscape context.

Other Species of Conservation Concern

In addition to species on the MESA List described previously, the State Wildlife Action Plan (SWAP) identifies 257 wildlife species and 22 natural habitats most in need of conservation within the Commonwealth. *BioMap2* includes species-specific habitat areas for 45 of these species and habitat for 17 additional species which was mapped with other coarse-filter and fine-filter approaches.

Priority Natural Communities

Natural communities are assemblages of plant and animal species that share a common environment and occur together repeatedly on the landscape. *BioMap2* gives conservation

priority to natural communities with limited distribution and to the best examples of more common types.

Vernal Pools

Vernal pools are small, seasonal wetlands that provide important wildlife habitat, especially for amphibians and invertebrate animals that use them to breed. *BioMap2* identifies the top 5 percent most interconnected clusters of Potential Vernal Pools in the state.

Forest Cores

In *BioMap2*, Core Habitat includes the best examples of large, intact forests that are least impacted by roads and development, providing critical habitat for numerous woodland species. For example, the interior forest habitat defined by Forest Cores supports many bird species sensitive to the impacts of roads and development, such as the Black-throated Green Warbler, and helps maintain ecological processes found only in unfragmented forest patches.

Wetland Cores

BioMap2 used an assessment of Ecological Integrity to identify the least disturbed wetlands in the state within undeveloped landscapes—those with intact buffers and little fragmentation or other stressors associated with development. These wetlands are most likely to support critical wetland functions (i.e., natural hydrologic conditions, diverse plant and animal habitats, etc.) and are most likely to maintain these functions into the future.

Aquatic Cores

To delineate integrated and functional ecosystems for fish species and other aquatic





Species of Conservation Concern, beyond the species and exemplary habitats described above, *BioMap2* identifies intact river corridors within which important physical and ecological processes of the river or stream occur.

Components of Critical Natural Landscape

Critical Natural Landscape identifies intact landscapes in Massachusetts that are better able to support ecological processes and disturbance regimes, and a wide array of species and habitats over long time frames.

Landscape Blocks

BioMap2 identifies the most intact large areas of predominately natural vegetation, consisting of contiguous forests, wetlands, rivers, lakes, and ponds, as well as coastal habitats such as barrier beaches and salt marshes.

Upland Buffers of Wetland and Aquatic Cores

A variety of analyses were used to identify protective upland buffers around wetlands and rivers.

Upland Habitat to Support Coastal Adaptation

BioMap2 identifies undeveloped lands adjacent to and up to one and a half meters above existing salt marshes as Critical Natural Landscapes with high potential to support inland migration of salt marsh and other coastal habitats over the coming century.

The conservation areas identified by *BioMap2* are based on breadth and depth of data, scientific expertise, and understanding of Massachusetts' biodiversity. The numerous

Legal Protection of Biodiversity

BioMap2 presents a powerful vision of what Massachusetts would look like with full protection of the land most important for supporting the Commonwealth's biodiversity. While *BioMap2* is a planning tool with *no regulatory function*, all state-listed species enjoy legal protection under the Massachusetts Endangered Species Act (M.G.L. c.131A) and its implementing regulations (321 CMR 10.00). Wetland habitat of state-listed wildlife is also protected under the Wetlands Protection Act Regulations (310 CMR 10.00). The *Natural Heritage Atlas* contains maps of Priority Habitats and Estimated Habitats, which are used, respectively, for regulation under the Massachusetts Endangered Species Act and the Wetlands Protection Act. For more information on rare species regulations, and to view Priority and Estimated Habitat maps, please see the Regulatory Review page at www.mass.gov/dfwele/dfw/nhesp/regulatory_review/reg_review_home.htm.

BioMap2 is a conservation planning tool that **does not, in any way, supplant the Estimated and Priority Habitat Maps which have regulatory significance. Unless and until the *BioMap2* vision is fully realized, we must continue to protect our most imperiled species and their habitats.**

sources of information and analyses used to create Core Habitat and Critical Natural Landscape are complementary, and outline a comprehensive conservation vision for Massachusetts, from rare species to intact landscapes. In total, these robust analyses define a suite of priority lands and waters that, if permanently protected, will support Massachusetts' natural systems for generations to come.





Understanding Core Habitat Summaries

Following the Town Overview, there is a descriptive summary of each Core Habitat and Critical Natural Landscape that occurs in your city or town. These summaries highlight some of the outstanding characteristics of each Core Habitat and Critical Natural Landscape, and will help you learn more about your city or town's biodiversity. You can find out more information about many of these species and natural communities by looking at specific fact sheets at www.nhesp.org.

Additional Information

For copies of the full *BioMap2* report, the Technical Report, and an [interactive mapping tool](#), visit the *BioMap2 website* via the Land Protection and Planning tab at www.nhesp.org. If you have any questions about this report, or if you need help protecting land for biodiversity in your community, the Natural Heritage & Endangered Species Program staff looks forward to working with you.

Contact the Natural Heritage & Endangered Species Program

By phone 508-389-6360
By fax 508-389-7890
By email natural.heritage@state.ma.us
By Mail 100 Hartwell Street, Suite 230
West Boylston, MA 01583

The GIS datalayers of *BioMap2* are available for download from MassGIS at www.mass.gov/mgis.



**Natural Heritage
& Endangered
Species Program**

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For more information on rare species and natural communities, please see our fact sheets online at www.nhesp.org.



Town Overview

Hawley lies within the Berkshire

Highlands/Southern Green Mountains Ecoregion, an area drained by the Deerfield, upper Westfield, Hoosic, and Housatonic Rivers. Lakes and ponds are relatively abundant. This ecoregion has deep soils that support northern hardwoods and spruce-fir forests.



Hawley at a Glance

- Total Area: 19,728 acres (30.8 square miles)
- Human Population in 2010: 337
- Open space protected in perpetuity: 9,742 acres, or 49.4% percent of total area*
- BioMap2 Core Habitat: 4,121 acres
- BioMap2 Core Habitat Protected: 2,494 acres or 60.5%
- BioMap2 Critical Natural Landscape: 16,002 acres
- BioMap2 Critical Natural Landscape Protected: 8,641 acres or 54.0%.

BioMap2 Components

Core Habitat

- 2 Exemplary or Priority Natural Community Cores
- 1 Forest Core
- 2 Wetland Cores
- 5 Aquatic Cores
- 1 Vernal Pool Core
- 11 Species of Conservation Concern Cores**
 - 2 amphibians, 2 fishes, 3 insects, 5 plants

Critical Natural Landscape

- 2 Landscape Blocks
- 3 Wetland Core Buffers
- 5 Aquatic Core Buffers

* Calculated using MassGIS data layer "Protected and Recreational Open Space—March, 2012".

** See next pages for complete list of species, natural communities and other biodiversity elements.

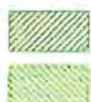
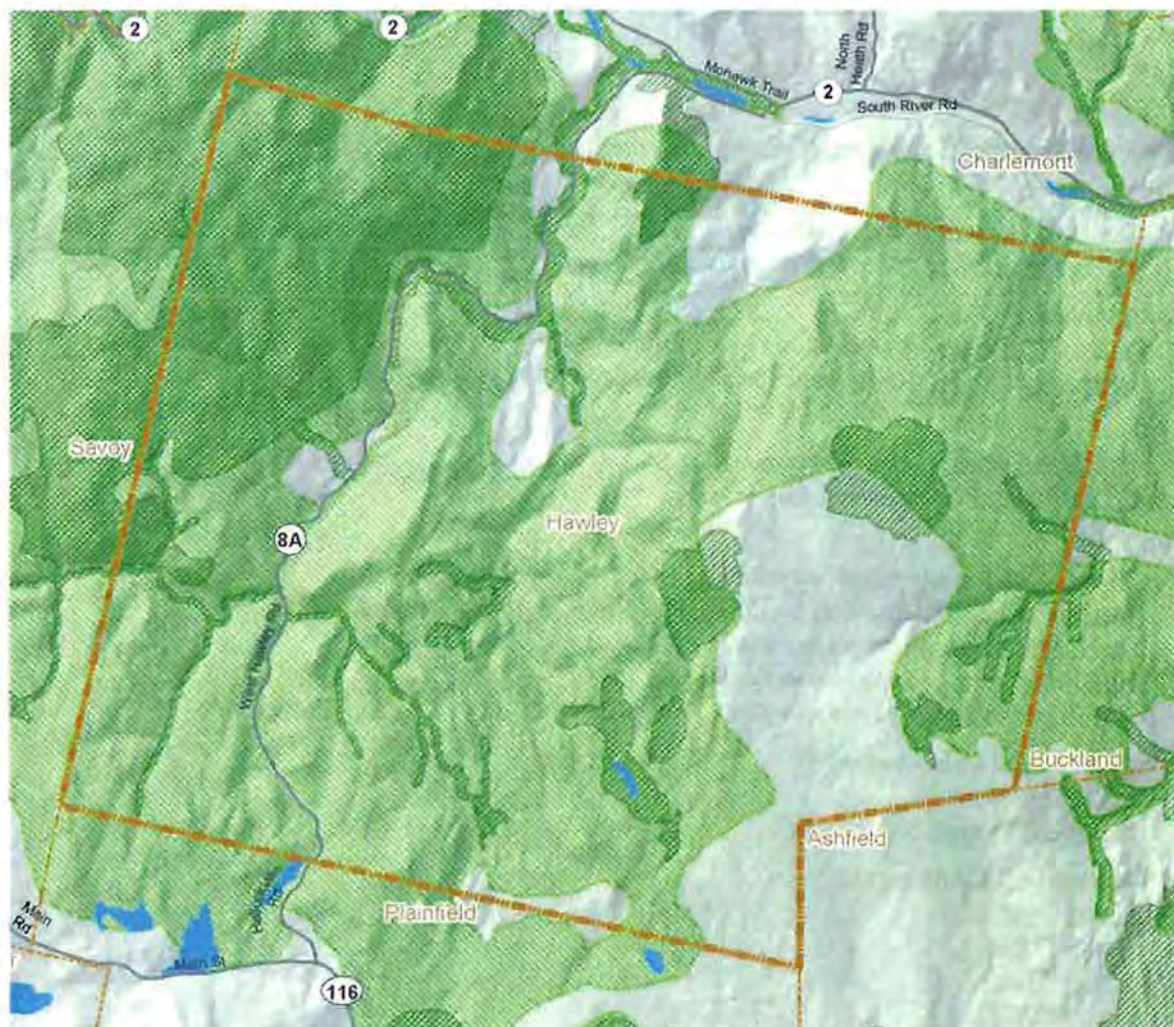




BioMap2

Conserving the Biodiversity of Massachusetts in a Changing World

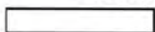
BioMap2 Core Habitat and Critical Natural Landscape in Hawley



BioMap2 Core Habitat

BioMap2 Critical Natural Landscape

1 Mile



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**Species of Conservation Concern, Priority and Exemplary Natural Communities,
and Other Elements of Biodiversity in Hawley**

Insects

Beetles

Twelve-spotted Tiger Beetle, (*Cicindela duodecimguttata*), SC

Dragonflies

Ocellated Darner, (*Boyeria grafiana*), SC

Ski-tipped Emerald, (*Somatochlora elongata*), SC

Amphibians

Jefferson Salamander, (*Ambystoma jeffersonianum*), SC

Spring Salamander, (*Gyrinophilus porphyriticus*), Non-listed SWAP

Fishes

Longnose Sucker, (*Catostomus catostomus*), SC

Bridle Shiner, (*Notropis bifrenatus*), SC

Plants

Dwarf Mistletoe, (*Arceuthobium pusillum*), SC

Long-leaved Bluet, (*Houstonia longifolia*), E

Leafy White Orchis, (*Platanthera dilatata*), T

Nodding Pogonia, (*Triphora trianthophora*), E

Few-flowered Sedge, (*Carex pauciflora*), E

Priority Natural Communities

Level Bog, S3

Spruce-Fir Swamp, S3

Other BioMap2 Components

Forest Core

Aquatic Core

Wetland Core

Vernal Pool Core

Landscape Block

Aquatic Core Buffer

Wetland Core Buffer

E = Endangered

T = Threatened

SC = Special Concern

S1 = Critically Imperiled communities, typically 5 or fewer documented sites or very few remaining acres in the state.

S2 = Imperiled communities, typically 6-20 sites or few remaining acres in the state.

S3 = Vulnerable communities, typically have 21-100 sites or limited acreage across the state.



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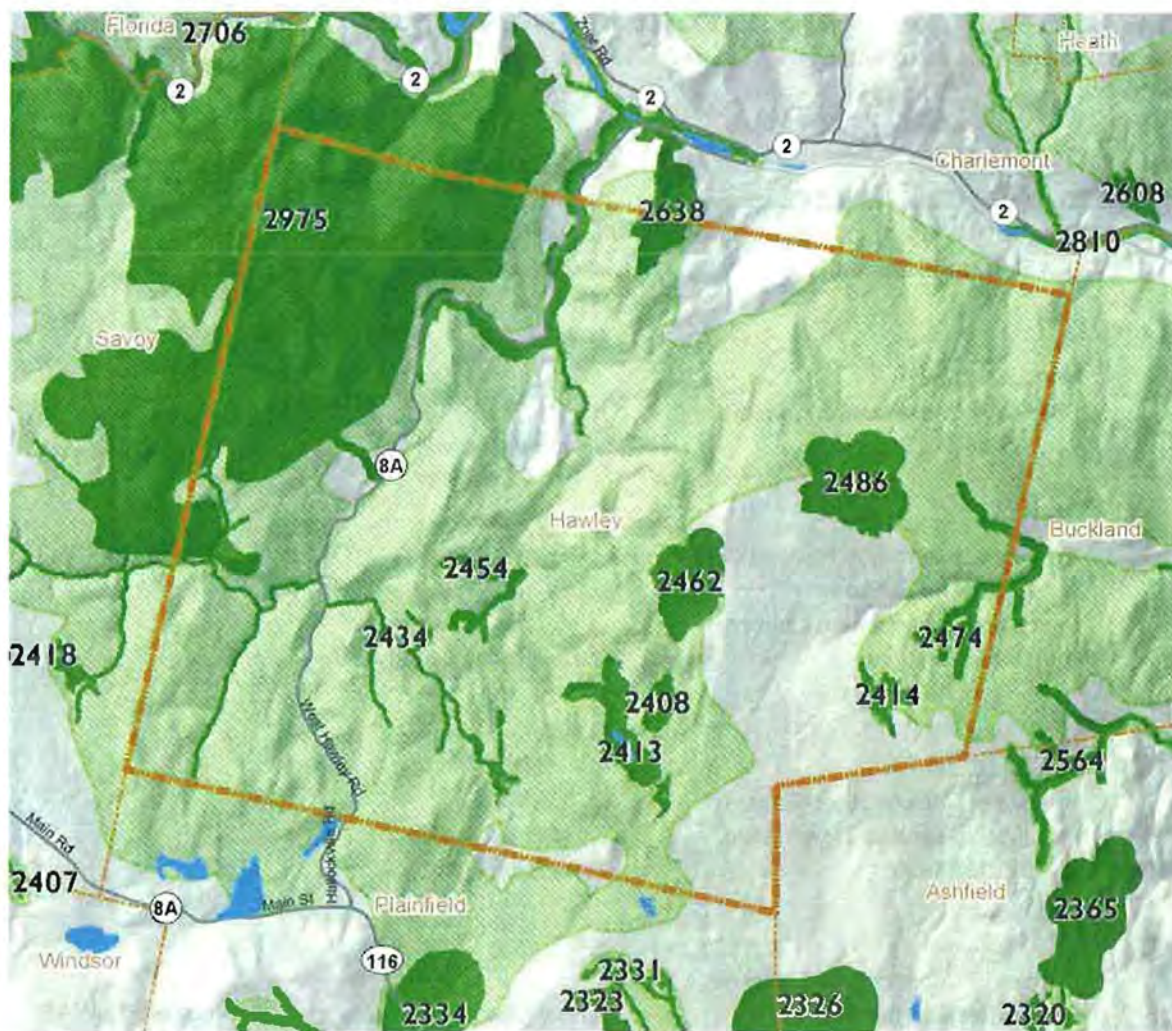




BioMap2

Conserving the Biodiversity of Massachusetts in a Changing World

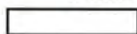
BioMap2 Core Habitat in Hawley

Core IDs correspond with the following element lists and summaries.



-  BioMap2 Core Habitat
-  BioMap2 Critical Natural Landscape

1 Mile



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Elements of BioMap2 Cores

This section lists all elements of *BioMap2* Cores that fall *entirely or partially* within Hawley. The elements listed here may not occur within the bounds of Hawley.

Core 2408

Aquatic Core

Species of Conservation Concern

Leafy White Orchis

Platanthera dilatata

T

Ski-tipped Emerald

Somatochlora elongata

SC

Core 2413

Wetland Core

Species of Conservation Concern

Ski-tipped Emerald

Somatochlora elongata

SC

Core 2414

Priority & Exemplary Natural Communities

Spruce-Fir Swamp

S3

Species of Conservation Concern

Dwarf Mistletoe

Arceuthobium pusillum

SC

Core 2434

Aquatic Core

Species of Conservation Concern

Twelve-spotted Tiger Beetle

Cicindela duodecimguttata

SC

Bridle Shiner

Notropis bifrenatus

SC

Core 2454

Species of Conservation Concern

Spring Salamander

Gyrinophilus porphyriticus

Non-listed SWAP

Core 2462

Aquatic Core

Priority & Exemplary Natural Communities

Level Bog

S3

Species of Conservation Concern

Dwarf Mistletoe

Arceuthobium pusillum

SC

Few-flowered Sedge

Carex pauciflora

E

Ski-tipped Emerald

Somatochlora elongata

SC

Jefferson Salamander

Ambystoma jeffersonianum

SC



**Core 2474**

Species of Conservation Concern
Spring Salamander

Gyrinophilus porphyriticus

Non-listed SWAP

Core 2486

Vernal Pool Core
Species of Conservation Concern
Jefferson Salamander

Ambystoma jeffersonianum

SC

Core 2638

Species of Conservation Concern
Long-leaved Bluet
Nodding Pogonia

Houstonia longifolia

E

Triphora trianthophora

E

Core 2975

Forest Core

Aquatic Core

Priority & Exemplary Natural Communities

Acidic Rocky Summit/Rock Outcrop Community

High-energy Riverbank

S3

High-Terrace Floodplain Forest

S2

Northern Hardwoods - Hemlock - White Pine Forest

Red Oak - Sugar Maple Transition Forest

Rich, Mesic Forest Community

S3

Species of Conservation Concern

Autumn Coralroot

Corallorhiza odontorhiza

SC

Bailey's Sedge

Carex baileyi

T

Bartram's Shadbush

Amelanchier bartramiana

T

Bristly Black Currant

Ribes lacustre

SC

Crooked-stem Aster

Symphotrichum prenanthoides

SC

Farwell's Water-milfoil

Myriophyllum farwellii

E

Large-leaved Goldenrod

Solidago macrophylla

T

Leafy White Orchis

Platanthera dilatata

T

Michaux's Sedge

Carex michauxiana

E

Mountain Alder

Alnus viridis ssp. *crispa*

T

Nodding Pogonia

Triphora trianthophora

E

Northern Mountain-ash

Sorbus decora

E

Shore Sedge

Carex lenticularis

T

Spiked False Oats

Trisetum spicatum

E

Thread Rush

Juncus filiformis

E

Woodland Millet

Milium effusum

T

Orange Sallow Moth

Pyrrhia aurantiago

SC



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Early Hairstreak	<i>Erora laeta</i>	T
Twelve-spotted Tiger Beetle	<i>Cicindela duodecimguttata</i>	SC
Ocellated Darner	<i>Boyeria grafiana</i>	SC
Ski-tipped Emerald	<i>Somatochlora elongata</i>	SC
Spring Salamander	<i>Gyrinophilus porphyriticus</i>	Non-listed SWAP
Bridle Shiner	<i>Notropis bifrenatus</i>	SC
Longnose Sucker	<i>Catostomus catostomus</i>	SC
American Bittern	<i>Botaurus lentiginosus</i>	E
Mourning Warbler	<i>Oporornis philadelphia</i>	SC
Sharp-shinned Hawk	<i>Accipiter striatus</i>	SC





Core Habitat Summaries

Core 2408

A 51-acre Core Habitat featuring Aquatic Core and Species of Conservation Concern.

Aquatic Cores are intact river corridors within which important physical and ecological processes of the river or stream occur. They delineate integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern.

Leafy White Orchis is a plant of sunny, wet areas, including bogs, seepage slopes, and wet woods, especially where cold water surfaces to form springs. It prefers non-acid soil conditions.

Ski-tipped Emeralds are dragonflies that inhabit small to medium-sized streams that may have a moderate or very sluggish flow and dense or little emergent vegetation.

Core 2413

A 183-acre Core Habitat featuring Wetland Core and a Species of Conservation Concern.

Wetland Cores are the least disturbed wetlands in the state within undeveloped landscapes—those with intact buffers and little fragmentation or other stressors associated with development. These wetlands are most likely to support critical wetland functions (i.e., natural hydrologic conditions, diverse plant and animal habitats, etc.) and are most likely to maintain these functions into the future.

Two Wetland Cores occur on mid elevation Mafic bedrock (rich in minerals like iron and magnesium), one of the least common ecological settings for Wetland Cores in the state.

Ski-tipped Emeralds are dragonflies that inhabit small to medium-sized streams that may have a moderate or very sluggish flow and dense or little emergent vegetation.

Core 2414

A 64-acre Core Habitat featuring a Priority Natural Community and a Species of Conservation Concern.

Spruce-Fir Boreal Swamps are forested wetlands dominated by red spruce and balsam fir. These swamps are typically found at stream headwaters or in poorly drained basins in the higher, western and north-central parts of the state. This example of Spruce-Fir Swamp is in good condition, with no invasive exotic species and well-buffered within a forested landscape.

A member of the Christmas Mistletoe family, Dwarf Mistletoe is a very small fleshy shrub, usually no more than 0.8 inch tall, that parasitizes conifer trees. In Massachusetts, Dwarf Mistletoe occurs in peatlands varying from kettlehole peat bogs to spruce-fir-birch headwater swamps, generally on the branches of black spruce (*Picea mariana*).

Core 2434

A 127-acre Core Habitat featuring Aquatic Core and Species of Conservation Concern.





Aquatic Cores are intact river corridors within which important physical and ecological processes of the river or stream occur. They delineate integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern.

Twelve-spotted Tiger Beetles are dark brown to black in color, with white markings on the elytra (wing covers). The beetle larvae dig burrows into dark clay and silt banks along river banks and pond shores. The adult beetles disperse widely and may be found far from their larval habitats, often in sand pits or along sandy roads and paths.

Bridle Shiners are small (<5 cm) minnows that are found in clear water in slack areas of streams and rivers and are also found in lakes and ponds.

Core 2454

An 80-acre Core Habitat featuring a Species of Conservation Concern.

Spring Salamander adults inhabit clean, cold, high-gradient brooks and headwater seeps in forest habitat, usually at elevation >100 m. Larvae are entirely aquatic and largely nocturnal, spending daylight hours buried below the streambed or hidden under stones. Adults are semi-aquatic and spend most of their time under cover objects along the margins of brooks, springs, and seeps; however, they will venture into upland forest during rainy weather.

Core 2462

A 218-acre Core Habitat featuring Aquatic Core, a Priority Natural Community, and Species of Conservation Concern.

Aquatic Cores are intact river corridors within which important physical and ecological processes of the river or stream occur. They delineate integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern.

Level Bogs are dwarf-shrub peatlands, generally with pronounced hummocks and hollows in sphagnum moss. These wetland communities are very acidic and nutrient-poor because the peat isolates them from nutrients in groundwater and streams. This example of a Level Bog is well-known and much-visited. Although moderate levels of disturbances from trampling are affecting the peat layer, this bog remains a high-quality example of this natural community.

A member of the Christmas Mistletoe family, Dwarf Mistletoe is a very small fleshy shrub, usually no more than 0.8 inch tall, that parasitizes conifer trees. In Massachusetts, Dwarf Mistletoe occurs in peatlands varying from kettlehole peat bogs to spruce-fir-birch headwater swamps, generally on the branches of black spruce (*Picea mariana*).

Few-flowered Sedge is a perennial deciduous sedge that usually occurs in open peat bogs, but occasionally in coniferous swamps.

Ski-tipped Emeralds are dragonflies that inhabit small to medium-sized streams that may have a moderate or very sluggish flow and dense or little emergent vegetation.

Adult and juvenile Jefferson Salamanders inhabit upland forests during most of the year, where they reside in small-mammal burrows and other subsurface retreats. Adults migrate during late winter or





early spring to breed in vernal pools and fish-free areas of swamps, marshes, or similar wetlands. Larvae metamorphose in late summer or early fall, whereupon they disperse into upland forest.

Core 2474

A 172-acre Core Habitat featuring a Species of Conservation Concern.

Spring Salamander adults inhabit clean, cold, high-gradient brooks and headwater seeps in forest habitat, usually at elevation >100 m. Larvae are entirely aquatic and largely nocturnal, spending daylight hours buried below the streambed or hidden under stones. Adults are semi-aquatic and spend most of their time under cover objects along the margins of brooks, springs, and seeps; however, they will venture into upland forest during rainy weather.

Core 2486

A 333-acre Core Habitat featuring Vernal Pool Core and a Species of Conservation Concern.

Vernal pools are small, seasonal wetlands that provide important wildlife habitat, especially for amphibians and invertebrate animals that use them to breed. *BioMap2* identifies the top 5 percent most interconnected clusters of Potential Vernal Pools in the state.

Adult and juvenile Jefferson Salamanders inhabit upland forests during most of the year, where they reside in small-mammal burrows and other subsurface retreats. Adults migrate during late winter or early spring to breed in vernal pools and fish-free areas of swamps, marshes, or similar wetlands. Larvae metamorphose in late summer or early fall, whereupon they disperse into upland forest.

Core 2638

A 214-acre Core Habitat featuring Species of Conservation Concern.

Long-leaved Bluet grows in dry, sunny or lightly shaded habitats. Rocky openings with ledges and bedrock exposures are particularly favorable; dry sterile fields, gravel banks, roadsides, quarries and similar human-influenced habitats also provide suitable habitat.

Nodding Pogonia, a delicate, colonial orchid, grows in sloping, mesic, mixed hardwood forests, usually beech-dominated, in deep pockets or hollows with accumulated leaf litter and deep humus.

Core 2975

A 25,569-acre Core Habitat featuring Forest Core, Aquatic Core, Priority Natural Communities, and Species of Conservation Concern.

The upper Deerfield River and several of its tributaries connect four Forest Cores in northwestern Massachusetts. This complex Core Habitat supports 29 rare and uncommon species, including three Endangered bats, seriously threatened by white-nose syndrome. As the river and brooks cut down through layers of ancient rocks, areas of richer bedrock were exposed. These scattered rich areas a number of rare plants, including Nodding Pogonia and Autumn Coralroot orchids.

Forest Cores are the best examples of large, intact forests that are least impacted by roads and development. Forest Cores support many bird species sensitive to the impacts of roads and development and help maintain ecological processes found only in unfragmented forest patches.





Aquatic Cores are intact river corridors within which important physical and ecological processes of the river or stream occur. They delineate integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern.

Acidic Rocky Summits are open communities of shrubs, scattered grasses, mosses, lichens and occasional trees found on exposed rocky summits. These areas are dry with little soil, and can often be found as patches within other ridgetop communities. This large example of Acidic Rocky Summit/Rock Outcrop is in good condition, with evidence of the natural disturbance regime, fire, that can perpetuate this community type.

High-Energy Riverbank communities are sparse, open graminoid communities found on cobble and sand deposits along fast-flowing rivers that experience severe flooding and ice scour. This Core has two examples of High-Energy Riverbank with high species and habitat diversity. One is in excellent condition, and a large buffer of natural forest.

High-Terrace Floodplain Forests are deciduous hardwood forests that occur along riverbanks, above the zone of annual flooding. Although they do not flood annually, they flood often enough for the soil to be moderately enriched. This example of High-Terrace Floodplain Forest is in good condition, with moderate diversity and good buffering by natural vegetation.

Northern Hardwoods-Hemlock-White Pine Forests have a mix of evergreen and deciduous trees, with a closed, full canopy, and sparse shrub and herbaceous layers. It commonly occurs on north facing slopes and ravines with moderately acidic soils. This example of Northern Hardwoods-Hemlock-White Pine forest is large and unfragmented. Large tracts of this forest type are important habitat for Massachusetts' more common species such as bear, deer, moose, and neo-tropical migrant birds.

Red Oak-Sugar Maple Transition Forests have species typical of both northern hardwood forests (maples), and central hardwood forests (oaks). This widespread forest type is moderate in moisture, pH, and nutrient availability. This relatively large example of Red Oak-Sugar Maple Transition Forest is in very good condition, with many very old trees and the structural characteristics of an old growth forest.

Rich, Mesic Forests are a variant of northern hardwood forests, dominated by sugar maple with a diverse herbaceous layer that includes many spring wild flowers, in a moist, nutrient-rich environment. This small patch of Rich, Mesic Forest is a regional variant lacking the full species diversity of this community type. However it is in very good condition, with no exotic species, and is found within a very large naturally vegetated area.



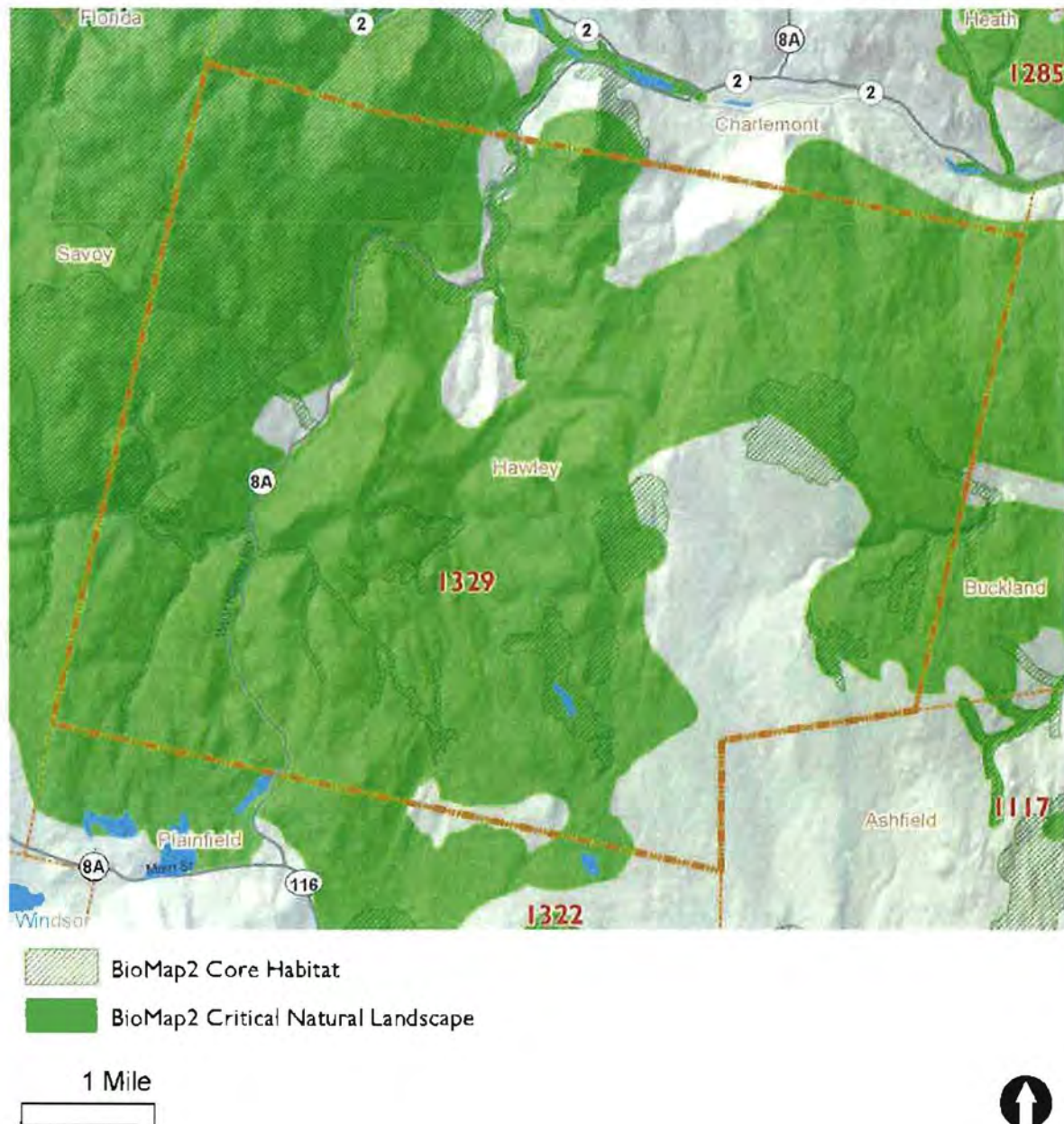


BioMap2

Conserving the Biodiversity of Massachusetts in a Changing World

BioMap2 Critical Natural Landscape in Hawley

Critical Natural Landscape IDs correspond with the following element lists and summaries.



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BioMap2

Conserving the Biodiversity of Massachusetts in a Changing World

Elements of BioMap2 Critical Natural Landscapes

This section lists all elements of *BioMap2* Critical Natural Landscapes that fall *entirely or partially* within Hawley. The elements listed here may not occur within the bounds of Hawley.

CNL 1329

Aquatic Core Buffer

Landscape Block

Wetland Core Buffer



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Critical Natural Landscape Summaries

CNL 1329

A 111,531-acre Critical Natural Landscape featuring Aquatic Core Buffer, Wetland Core Buffer and Landscape Block.

A variety of analyses were used to identify protective upland buffers around wetlands and rivers. One, the variable width buffers methodology, included the most intact areas around each wetland and river, by extending deeper into surrounding unfragmented habitats than into developed areas adjacent to each wetland. Other upland buffers were identified through the rare species habitat analysis. In this way, the conservation of wetland buffers will support the habitats and functionality of each wetland, and also include adjacent uplands that are important for many species that move between habitat types.

Landscape Blocks, the primary component of Critical Natural Landscapes, are large areas of intact predominately natural vegetation, consisting of contiguous forests, wetlands, rivers, lakes, and ponds, as well as coastal habitats such as barrier beaches and salt marshes. Pastures and power-line rights-of-way, which are less intensively altered than most developed areas, were also included since they provide habitat and connectivity for many species. Collectively, these natural cover types total 3.6 million acres across the state. An Ecological Integrity assessment was used to identify the most intact and least fragmented areas. These large Landscape Blocks are most likely to maintain dynamic ecological processes such as buffering, connectivity, natural disturbance, and hydrological regimes, all of which help to support wide-ranging wildlife species and many other elements of biodiversity.

In order to identify critical Landscape Blocks in each ecoregion, different Ecological Integrity thresholds were used to select the largest intact landscape patches in each ecoregion while avoiding altered habitat as much as possible. This ecoregional representation accomplishes a key goal of *BioMap2* to protect the ecological stages that support a broad suite of biodiversity in the context of climate change. Blocks were defined by major roads, and minimum size thresholds differed among ecoregions to ensure that *BioMap2* includes the best of the best in each ecoregion.



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Natural Heritage &
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Addendum

Part IV

Natural Heritage and Endangered Species Program

Fact Sheets

- 1. Bridle Shiner**
- 2. Copperhead**
- 3. Timber Rattlesnake**
- 4. Twelve-spotted Tiger Beetle**

Natural Heritage & Endangered Species Program

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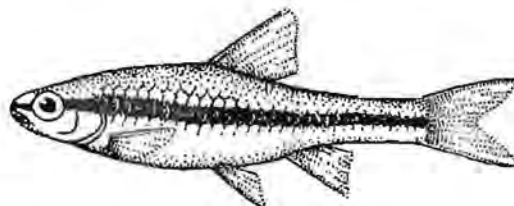
Bridle Shiner *Notropis bifrenatus*

State Status: **Special Concern**

Federal Status: **None**

Description: The Bridle Shiner is a small minnow (< 50 mm) that is straw colored with a distinct dark lateral band that starts at the tip of the snout and ends in a spot at the base of the caudal fin. This minnow has a large eye and a somewhat pointed, slightly subterminal mouth. The scales on the sides of the body have distinct dark outlines. The breast is usually 90-100% scaled and the belly is fully scaled. The lateral line is generally incomplete. Bridle Shiners have 32-36 lateral line scales. They generally have 8 dorsal rays, 7 anal rays, 8 pelvic rays, and 12 pectoral rays. They have a silvery and lightly speckled peritoneum (lining of the body cavity).

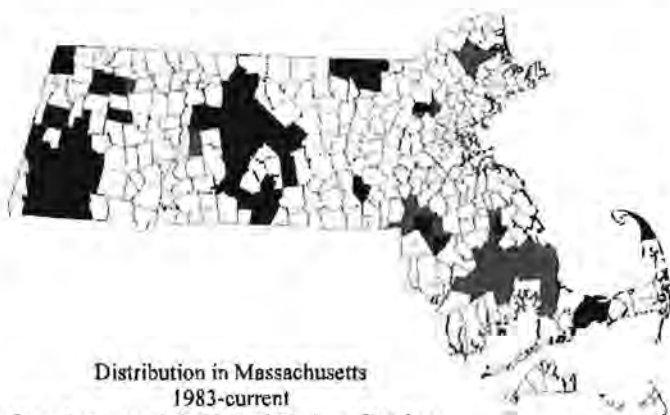
Habitat: Bridle Shiners are found in clear water in slack areas of streams and rivers and are also found in lakes and ponds. They are associated with moderate levels of submerged aquatic vegetation with open areas where they can school. Bridle Shiners seem to prefer sites with high coverage of submerge aquatic vegetation along the bottom 25 cm. In addition, sites with Bridle Shiner tend to have more aquatic vegetation with feather-like leaves such as *Ceratophyllum*.



Drawing by Laszlo Meszoly, from Hartel et al. 2002. Inland Fishes of Massachusetts.

Life History: The Bridle Shiner matures at a year and only lives for about 2 years. Spawning occurs during the day from late May to the end of July but may occur as late as August. Spawning sites are generally located in water depths of 0.6 m in clearings surrounded by dense submerged vegetation, such as *Myriophyllum* or *Chara*. Eggs sink and adhere to vegetation. Young of the year remain in vegetation until late July when they begin to school with other young of the year bridle shiners, and by August they join adult schools. Bridle Shiners are visual predators and feed only during the day. They feed in the water column or around aquatic vegetation; although before aquatic vegetation has started growing in the spring, they feed at the bottom. Their diet mainly consists of invertebrates, such as Chironomidae, Cladocera and Copepoda. Bridle Shiners are not good swimmers and are ideal prey for pickerel, bass, and perch species.

Threats: Habitat alterations due to turbidity, flow alterations, draining of ponds, and exotic species are major threats to Bridle Shiners. Bridle Shiners are visual feeders and turbidity will decrease their feeding efficiency. Bridle Shiners are also poor swimmers and as such changes in flows can negatively impact their habitats. When exotic plants dominate and form large monocultures, this changes the Bridle Shiner's preferred habitat of vegetation with open areas.



Distribution in Massachusetts
1983-current

Based on records in Natural Heritage Database

Breeding Season

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Updated August 2008

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Natural Heritage & Endangered Species Program

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Copperhead (*Agkistrodon contortrix*)

State Status: **Endangered**
Federal Status: None

DESCRIPTION: Copperheads get their name due to their solid, relatively unmarked, coppery-colored head resembling the color of an old copper coin. As with all pit vipers, Copperheads have broad, triangularly shaped heads, with a distinct narrowing just behind the head. The eyes have vertically elliptical (catlike) pupils. There is a very thin line on each side of the face that separates the richer copper color of the top of the head from the lighter color of the lip area. The iris of the eye is pale gold, and the pupil is dark. On the body there is a series of dark brown to reddish, hourglass-shaped, cross bands. These are narrow in the middle of the body and broad to the sides. The ground color ranges from beige to tan. Body markings are continuous over the entire length of the body, including the tail. Young snakes are replicas of adults, except that the body has an overtone of light grey and the tip of the tail is yellow.



DeGraaf, R. M., and Rudis, D.D. 1983
Amphibians and Reptiles of New England.
Amherst, Massachusetts: The University of
Massachusetts.

Adult Copperheads usually measure 60–90 cm (24–36 inches) in length; the newborn young are usually 18–23 cm (7–9 inches). Males usually have longer tails, but females can grow to greater total lengths (up to 4 ft.). There is no reliable external cue to differentiate the sexes. The Copperhead has weakly keeled scales (*i.e.*, a ridge protrudes from the middle of each scale), giving the snake a relatively rough-skinned appearance.

SIMILAR SPECIES IN MASSACHUSETTS: The Timber Rattlesnake (*Crotalus horridus*) is the only other pit viper in Massachusetts, but is generally yellow or brown with black, brown, or rust-colored blotches separated by crossbands rather than the hourglass pattern of the Copperhead. The Eastern Milk Snake (*Lampropeltis triangulum*) may exhibit similar coloration, but the markings are in blotches and spots rather than the distinctive hourglass pattern. Its body and head are considerably thinner than those of the Copperhead and the pupils are round, as they are in all of our non-venomous species. The Northern Water Snake (*Nerodia sipedon*) has a similar coloration and markings, but has a thinner, dark-colored head and is rarely encountered far from water.

RANGE AND HABITAT IN MASSACHUSETTS: The range of the Copperhead is from southern New England to southwest Illinois, south to central Georgia and through central North Carolina.

In Massachusetts, the Copperhead is usually associated with deciduous forest and shows a preference for traprock (basalt) ledges with extensive rock slides below. The Copperhead is a relative of the Eastern Cottonmouth and, like that species, is fond of moist, damp habitats. Many copperhead wintering dens are on the fringes of swamps, reservoirs, rivers, and streams. The entrances to the hibernacula (dens) have southern, southeastern, or southwestern exposures, allowing the Copperhead to sun itself in the spring and fall. The rock slides generally are interspersed with deciduous trees, Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron* spp.), lichens, and damp leaf litter. Stands of red cedar (*Juniperus virginiana*), pine (*Pinus* spp.), and hemlock (*Tsuga canadensis*), along with cool, damp meadows, are characteristic of Copperhead habitat in Massachusetts.



The summering grounds of the Copperhead are near wetlands, wooded swamps and marshes, or lakes and reservoirs. During this time, this species may also inhabit fields and meadows, wet woodlands, and quarries.

LIFE HISTORY AND ECOLOGY: Copperheads belong to the family of snakes known as pit vipers. Like other reptiles, they are vertebrates (they have backbones) and they are ectothermic (they cannot control their body heat by physiological means and must move to a warmer or cooler environment to control their body temperature). The term "pit viper" derives from the characteristic loreal pits. There is one pit on each side of the head, lying midway between the nostril and eye but below their level. Each pit contains sensitive nerve ends that react to radiant heat. The primary function of these sensory units is to assist the snake in detecting warm-blooded prey in darkness. Sight is fairly keen within a limited range; moving objects are perceived more readily than stationary ones.

The Copperhead is extremely sensitive to ground vibrations and can detect very slight ground disturbances. These vibrations are transmitted to the auditory nerve through the bones of the lower jaw. Its tongue is not a stinger, but rather a very delicate organ associated with a pair of cavities, known as Jacobson's organ, located in the roof of the mouth. The tongue reaches out and brings in particles from the air. The Jacobson's organ appears to be directly related to the nasal system and aids in smelling; however, each system can be used independently as well as together.

This species has two well-developed and enlarged venom-conducting fangs, located at the front of the mouth and secured to the upper jawbone. The fangs are movable and fold against the roof of the mouth when not in use. A fleshy sheath covers each fang when the mouth is closed. The fangs are not permanent; they are shed periodically. Each fang socket has several replacement fangs in various stages of development, located in the gum behind the functional fang. Before a fang is shed, a new one is already positioned. Each fang is connected internally to a venom gland. Through muscular action, venom is forced from the gland through a venom duct to the hollow fang and then into prey. Like most snakes, Cooperhead will also bite in defense. Although the Cooperhead is venomous and the bite can be painful, it is not considered life-threatening to a healthy human. In addition to these enlarged fangs, pit vipers have many curved smaller teeth on the palate and lower jaw.

In Massachusetts, the active season of the Copperhead runs from April to October. Beginning in mid-April, the Copperhead emerges from hibernation and begins basking on ledges during the day. It lingers in the area for several weeks. The Copperhead can be found sunning itself regularly, often in the same spot, with other Copperheads or other snake species nearby.

Copperheads are known to mate both in the spring and autumn. Males seem to be particularly active during courtship and have been observed in aggressive encounters with other males over territory during the spring and autumn mating seasons. Males are able to track females by sensing with their tongues the female's pheromones wafting through the air. Courting males will approach a female and begin moving his chin on the ground. If the female moves away, the male will follow and attempt to move alongside and place his head on some part of her body. The female responds with a series of tail movements: slow back-and-forth waving, rapid back-and-forth whipping, or extremely rapid tail vibration. The male will continue to rub his chin on the back and head of the female as he moves to align his body next to hers. This process may continue for an hour or more if the female does not respond. If the female is ready to mate, she will lift the rear part of her body and tail off the ground slightly allowing the male to maneuver his tail around and under hers. The duration of actual mating varies from 3 1/2 to 8 1/2 hours. This lengthy mating serves several important functions. Since females mate with only one male at a time, a long mating lessens the number of other males that could possibly mate with her. Also, the female's interest in mating may be reduced after prolonged mating. Males begin searching for new females within 24 hours.

After spring mating, most of the males and at least some of the females begin to migrate up to two miles from the den site. During the height of the summer, they are generally found in wetlands—wooded swamps and marshes—or lakes and reservoirs or may inhabit fields and meadows, wet woodlands, and quarries.

Females giving birth late in the season tend to gather together in areas called birthing rookeries, which may be at their winter dens or sometimes up to a mile away. Lingering at or near the den, to which the newborn young must return shortly after birth, eliminates the need for a long and presumably dangerous migration of the newborn that would arise if she had migrated some distance away.

The male and female Copperheads reach sexual maturity at five years with an estimated life span of 18 years. Breeding typically takes place in the spring (April-May) but may also occur from August to September. The gestation period is 3-9 months. The Copperhead is ovoviviparous (their young are born alive). Three to ten young (normally 4-6), measuring 18-23 cm (7-9 inches) in length, are born sometime in August or September. The mother does not care for her young. Each of the young is equipped with venom, fangs, and a supply of egg yolk for nourishment in their abdominal cavities. In addition, the young Copperhead has a unique yellow tail tip which fades as it gets older and is usually gone by their third or fourth year. The belief is that the young snake wiggles its tail as a sort of lure to frogs or insects that might be looking for small, caterpillar-like prey. When the animal gets close enough, the Copperhead can strike out and thus acquire its meal.

The diet of young Copperheads differs from that of the adult, probably reducing the competition between them. Juveniles rely heavily on a large supply of insects, particularly caterpillars, for survival, while adults feed mostly on amphibians and mammals. Mice are the principal food, but small birds, frogs, and insects also are eaten. It is believed that a Copperhead eats only about eight meals in a single growing season (totaling no more than 200% of its body weight). This may be due to a combination of a slow metabolism and the difficulty of finding prey. Females who are carrying young may not eat at all during the summer due to the growing embryos that take up a large volume of the body cavity.

During the spring and autumn, Copperheads hunt mainly by day as night temperatures are too low for normal activity. As the weather warms in the early summer, the Copperhead changes its diurnal hunting to nocturnal activity. This change has several advantages: the snake avoids the intense heat of the day, and the possibility of capturing prey is considerably better because rodents and amphibians are more active at night.

The typical hunting behavior of the Copperhead consists of long periods of lying motionless waiting to ambush prey with intervals of prowling. Copperheads waiting in ambush coil their bodies next to a fallen log and rest their heads or chin on the edge. The prey is detected by sight, scent, and the sensory pit which can detect the heat radiating from a warm-blooded animal. Thus guided, the snake strikes out at its prey and sinks its venom-conducting fangs into the prey. Usually it then recoils and waits for the venom to overcome the victim. After a strike, the Copperhead uses its sense of smell to track the victim. The length of time before the prey dies depends largely on the size and kind of prey and the amount of venom injected. The venom serves two important functions. In addition to being the killing agent, it contains enzymes that break down the victim's body tissue and aid in digestion.

The use of the venom as a defensive weapon is secondary. Copperheads' defensive actions are largely determined by the degree of intrusion and the accessibility of a refuge. A snake will resort to striking and biting only as a last resort—generally only when it has been cut off from retreat or when actually seized. Even when pushed to the limit, venomous snakes rarely use their poison to the fullest extent. The Copperhead is not boldly aggressive. In the field, this species usually lies motionless and rarely attempts to escape by rapid movement.

POPULATION STATUS IN MASSACHUSETTS: The Copperhead is listed as an Endangered species in Massachusetts under the Massachusetts Endangered Species Act (MESA), because of its rarity and declining population, and is protected by law. Copperheads have been documented in Massachusetts only in the Connecticut River Valley and the Boston area in the past 25 years. Destruction of rocky, wooded habitat and summer feeding grounds, excessive removal by collectors, and mortality at the hands of snake hunters and the general public imperil the Copperhead. Its dependence on traditional den sites (used for many years, perhaps indefinitely) makes this species particularly vulnerable to exploitation by humans.

MANAGEMENT RECOMMENDATIONS: If it were not for the existence of public conservation lands (national and state parks, national forests, state forest preserves) and of privately owned nature preserves, much of the remaining habitat of the Copperhead would have been destroyed. Thus, taking steps to increase public land holdings in prime Copperhead habitats through a variety of purchase or conservation easement mechanisms is an important conservation strategy for this species. In addition to land protection, management recommendations to safeguard known populations would include the following:

1. Protecting Copperheads at their known denning colonies through vigilance;
2. Maintaining a level of secrecy regarding the localities of den sites;
3. Avoiding behavioral disturbance of the snakes by restricting access to den and birthing rookery areas;
4. Patrolling the area during vulnerable times, particularly (a) the spring emergence period and (b) the summer gestating and birthing periods;
5. Limiting logging within Copperhead habitat to the winter months;
6. Educating the public with biologically accurate information and working with local residents to promote understanding of the Copperhead as a beneficial native species of the deciduous forest community.

Due to the location of preferred habitat, the denning sites are rarely affected by construction-type development, but the Copperhead is put at risk by construction and development nearby. Roads, even in state forests and parks, also place this species at risk due to mortality in crossing.

The Copperhead is one of two snake species (the other being the Timber Rattlesnake) that is significantly affected by direct intentional persecution; they are killed out of a deep-rooted sociological fear. Too frequently, a Copperhead coiled quietly in its natural habitat is a target of wanton killing. This species is currently listed as an Endangered species in Massachusetts and is protected under law. Educating the public about the Copperhead and the laws protecting it is critical to the long-term survival of the species.

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DESCRIPTION: Timber Rattlesnakes are large, heavy-bodied snakes in the pit viper family. As with all pit vipers, they have broad, triangularly shaped heads, with a distinct narrowing just behind the head. Color patterns are extremely variable in this species with some individuals almost jet black and others sulphur yellow with black, brown, or rust-colored blotches separated by cross bands on the back and sides. Timber Rattlesnakes are distinguished from other North American species of rattlesnakes by a lack of stripes or bands on its head and face and by a solid black tail.

The Timber Rattlesnake has a structure uniquely characteristic of all rattlesnakes at the tip of its tail that makes a rattle-like sound when vibrated. A new rattle segment is added each time the rattlesnake sheds its skin, although snakes often lose the rattle during shedding. The approximate age of the snake can be determined from the rattle only if the snake still has the "prebutton" with which it was born.

The Timber Rattlesnake has keeled scales (*i.e.*, a ridge protrudes from the middle of each scale), giving the snake a relatively rough-skinned appearance.

Adults are 90 to 152 cm (36-60 inches) long; the newborn young are usually 20 to 41 cm (8-16 inches). There is no reliable external cue to differentiate the sexes although males usually have longer tails. On average, male Timber Rattlesnakes weigh 2 pounds (max 3.9 lbs) and females average 1.3 pounds (max 3.1 lbs).

Timber Rattlesnake

Crotalus horridus

State Status: Endangered

Federal Status: None



The photos show the variation in colors possible among Timber Rattlesnakes. Top: The bands are clear on the lighter colored snake. Photo by and courtesy of Anne Stengle. Middle: The triangular head is obvious in this snake in sub-feeding posture. Photo by and courtesy of Brian Butler. Below: A black phase male Timber Rattlesnake. Photo: Bill Byrne MassWildlife.



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SIMILAR SPECIES IN MASSACHUSETTS: Three Massachusetts snakes have dorsal (back or upper side) blotches, saddles, or bands: Timber Rattlesnake, Northern Water Snake, and Milk Snake; however, they all have different ventral (belly or under side) markings. Timber Rattlesnakes are almost uniformly light below with just a little dark flecking; Eastern Milk Snakes (*Lampropeltis triangulum*) have a distinctive black and white checkerboard pattern; and Northern Water Snakes (*Nerodia sipedon*) have reddish and black crescents. Like Timber Rattlesnakes, Milk Snakes may vibrate their tails rapidly when disturbed, which, when they are in dry leaves, can produce a rattling sound.

Copperheads (*Agkistrodon contortrix*) are the only other pit vipers in Massachusetts, but they are more reddish-brown with an hour-glass pattern on the body. Although they have facial pits, their heads are narrower and less triangular.

Eastern Hognose Snakes (*Heterodon platirhinos*) have a dark phase that superficially resembles the dark phase of Timber Rattlesnakes, but Eastern Hognose Snakes have uniformly wide heads, distinctively sharply-upturned snouts, and lack a rattle.



RANGE AND HABITAT IN MASSACHUSETTS: Timber Rattlesnakes range throughout the eastern US, west to central Texas and Wisconsin. In the northeast, populations are small, declining or extirpated.

Timber Rattlesnakes are generally restricted to mountainous terrain characterized by second-growth deciduous or coniferous forest, with steep ledges, rock slides, and large rodent populations. Rattlesnakes hibernate communally in underground crevices.

In other parts of its range, Timber Rattlesnakes are sometimes found in pine barrens and wetlands, and may occasionally be found in fields and pastures.

LIFE HISTORY AND ECOLOGY: Like other reptiles, rattlesnakes are vertebrates (they have backbones) and they are ectothermic (they cannot control their body heat by physiological means and must move to a warmer or cooler environment to control their body temperature). Rattlesnakes belong to the family of snakes known as pit vipers. There is one pit on each side of the head, containing sensitive nerve ends that react to radiant heat. They assist the snake in detecting warm-blooded prey in darkness. Sight is fairly keen within a limited range; moving objects are perceived more readily than stationary ones. The Timber Rattlesnake is extremely sensitive to ground vibrations and can detect very slight ground disturbances which may aid with locating prey or avoiding their own predators.

This species has two well-developed and enlarged venom-conducting fangs in the front of the mouth. The fangs fold against the roof and are covered by a sheath when the mouth is closed. Timber rattlesnakes have control over the amount of venom injected, from none to the maximum volume. In addition to these enlarged fangs, pit vipers, like other snakes, have many curved smaller teeth on the palate and lower jaw.

In Massachusetts, Timber Rattlesnakes are active from mid-April to mid-October. For several weeks beginning in mid-April, rattlesnakes emerge from hibernation and begin basking on ledges during the day. There is little movement or feeding early in the spring and the snakes often appear lethargic. At this time, the population is concentrated in and around the hibernaculum with some courtship and mating taking place. Timber Rattlesnakes re-enter dens between early September and late October, depending on the weather.

Timber Rattlesnakes are known to mate both in the spring and autumn. After mating, snakes move up to 4.5 miles away from the den, although shorter distances are more usual. In the summer, male Timber Rattlesnakes use woods where the forest canopy is closed and females stay in open forest or edges of fields where temperatures are higher than in surrounding locations. Gravid (pregnant) females have the smallest movements, often remaining close to the den.

Female Timber Rattlesnakes retain their eggs in their bodies and young are born alive (ovoviviparity). Between late August and mid-September, four to five months after mating, five to nine young are born. The young stay in the vicinity of the "nursery" area for several weeks until after they shed their first skins. Each of the young is equipped with venom, fangs, and a single, tiny rattle segment called a prebutton. The young, nourished by egg yolk retained in their bodies, grow rapidly during their first few weeks.

Newborn rattlesnakes follow a trail left by their mother or other adult snakes to the wintering den.

In northern latitudes and at higher elevations, females give birth only every second or third year. Because gravid females generally fast for the summer and have little opportunity to eat in the autumn after giving birth, they may be under physical stress for some time and must use the next active season to restore their bodies.

Male Timber Rattlesnakes reach sexual maturity by age four, while females reach sexual maturity between 7 and 10 years of age. Estimated life span is 10-15 years

Timber Rattlesnakes feed almost entirely on warm-blooded rodents, although their diet may include birds, insects and amphibians. During the spring and in the autumn, they hunt mainly by day. As the weather warms, rattlesnakes change to nocturnal activity when rodents and amphibians are more active.

The typical hunting behavior of Timber Rattlesnakes consists of long periods of lying motionless, with intervals of prowling. The prey is detected by sight, scent, and the sensory pit which can detect the heat radiating from a warm-blooded animal. After a strike, the rattlesnake uses its sense of smell to track the victim. The length of time before the prey dies depends largely on the size and kind of prey and the amount of venom injected.

The use of the venom as a defensive weapon is secondary. A snake resorts to striking and biting only as a last resort—generally only when cut off from retreat or when actually touched or handled. Even when pushed to the limit and aggressively handled, Massachusetts Timber Rattlesnakes rarely use their venom to the fullest extent. In the field, this species tends to be shy, nervous, and will quickly seek shelter if approached. They really just want to be left alone. The last known human fatality from a Timber Rattlesnake bite in Massachusetts was in 1791.

POPULATION STATUS IN MASSACHUSETTS: The Timber Rattlesnake is listed as Endangered under the Massachusetts Endangered Species Act (MESA), because of its rarity and declining population. All listed species are protected from killing, collecting, possessing, or sale and from activities that would destroy habitat and thus directly or indirectly cause mortality or disrupt critical behaviors. Historically, this species was widespread throughout the state. In Massachusetts, Timber Rattlesnakes are currently (past 25 years) documented only in Berkshire County, the Connecticut River Valley, and the Boston area. Timber Rattlesnakes are imperiled by destruction of rocky and woodland habitats, excessive removal by collectors, and mortality and persecution at the hands of snake hunters and the general public.

MANAGEMENT RECOMMENDATIONS: Increasing public and conservation land holdings in prime Timber Rattlesnake habitats continues to be an important conservation strategy for this species. In addition to land protection, educating the public and residents local to Timber Rattlesnake populations with biologically accurate information remains important; highlighting the importance of Timber Rattlesnakes as beneficial native "top predators" of the deciduous forest communities is key.

Along with having a high level of protection of dens and basking sites, maintaining a level of secrecy about their locations is important for restricting human access to key habitat features in order to avoid disturbing and stressing snakes. Additionally, there continues to be a need to limit and eliminate trails on public lands near dens and basking areas and implement seasonal road closures in areas of high vehicle caused mortality.

Due to their locations, denning sites are rarely directly affected by construction-type development, but Timber Rattlesnakes are at risk from nearby development. When encountering roads, they tend to avoid small culverts, crossing over the road instead, with resulting high death rates. Timber Rattlesnakes also may bask along roads and trails, increasing their visual exposure with unfortunate resulting risk of mortality.

The Timber Rattlesnake is one of two Massachusetts snake species (the other being the Copperhead) that is significantly affected by direct intentional persecution; they are killed out of a deep-rooted sociological fear. Too frequently, a Timber Rattlesnake coiled quietly in its natural habitat is a target of deliberate, unprovoked killing. Timber Rattlesnakes' communal dens made them easy targets for historic "rattlesnake roundups" where all snakes in a den were killed at once. Since this species is currently listed as **Endangered** in Massachusetts and is protected under law, educating the public about the Timber Rattlesnake and the laws protecting it is critical to the long-term survival of the species.

At the other end of the spectrum from the fearful are people who are fascinated by Timber Rattlesnakes and Copperheads and make frequent visits to snake dens and basking areas. The development of unauthorized, but well-trodden paths puts Timber Rattlesnakes at risk from increased visibility of the dens and "nursery" areas. These unofficial paths provide easy trails for anyone, including individuals with an intention to harm or collect the snakes, to follow. In addition, frequent disclosure of dens and basking areas between enthusiastic individuals through verbal, photo, and digital means continues to place this species at risk.

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Description: Tiger Beetles are so named because of their "tiger-like" behavior of chasing down and capturing prey with their long mandibles. The Twelve-spotted Tiger Beetle (*Cicindela duodecimguttata*) is 12-15 mm in length (Pearson et al. 2006). It is dark brown in color with a metallic sheen, the elytra (wing covers) marked with white maculations (spots and bands). The Bronzed Tiger Beetle (*Cicindela repanda*) resembles the Twelve-spotted Tiger Beetle, although the Bronzed Tiger Beetle is smaller on average, a lighter shade of bronzed brown, and the elytra are marked with maculations that are more complete (the bands are less broken into spots). In addition, the Twelve-spotted Tiger Beetle has a thorax that is trapezoidal in shape (wider anteriorly than posteriorly), while the thorax of the Bronzed Tiger Beetle is cylindrical.

Habitat: Open areas with silty or sandy soil, typically in or near wetlands; particularly stream and river banks and lake and pond shores. Adult beetles may be found in anthropogenic habitats such as old sand pits and sand roads, particularly in or near wetlands. Larval habitats typically consist of eroding stream and river banks (Knisley & Schultz 1997).

Life History: The Twelve-spotted Tiger Beetle has a two-year life cycle. Adult beetles emerge in late summer, overwinter, and are active again in spring and early summer. In Massachusetts, mating and egg laying occur from about mid-May through mid-June. A few adults may survive into July. Larvae develop through the first summer and autumn, overwinter, and continue development the following spring and summer, emerging as adults in late summer.



Distribution in Massachusetts
1987 - 2012
Based on records in the
Natural Heritage Database

Twelve-spotted Tiger Beetle *Cicindela duodecimguttata*

State Status: **Special Concern**

Federal Status: **None**



Cicindela duodecimguttata • MA: Worcester Co., Hardwick • 14 Aug 2007 • Photo by M.W. Nelson

Adult Activity Period in Massachusetts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Geographic Range: The Twelve-spotted Tiger Beetle occurs throughout most of Massachusetts, although there are no recent records from the southeastern part of the state. Colonies are localized, restricted to areas of suitable habitat. The Twelve-spotted Tiger Beetle is widely distributed across much of North America, from the Maritime Provinces of Canada south to Georgia, and west to Alberta and Texas (Pearson et al. 2006).

Status and Threats: The Twelve-spotted Tiger Beetle is threatened by hydrologic alteration that disrupts natural seasonal flooding and deposition of silt and sand in its habitat. Other potential threats include invasion by exotic plants and eutrophication or other water pollution.

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Please allow the Natural Heritage & Endangered Species Program to continue to conserve the biodiversity of Massachusetts with a contribution for "endangered wildlife conservation" on your state income tax form, as these donations comprise a significant portion of our operating budget.

**CERTIFICATION PURSUANT TO
MASSACHUSETTS RULE OF APPELLATE PROCEDURE 16**

I hereby certify that, to the best of my knowledge, the brief filed herewith complies with the Massachusetts Rules of Appellate Procedure that pertain to the filing of briefs, including, without limitation, Rule 16 and Rule 20.



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December 18, 2013

CERTIFICATE OF SERVICE

I hereby certify that two copies of the foregoing brief were served upon counsel of record for each party by first class mail on December 19, 2013.



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