BioMap2

CONSERVING THE BIODIVERSITY OF MASSACHUSETTS IN A CHANGING WORLD

Concord

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 <u>not</u> intended for use in state regulations.

Commonwealth of Massachusetts Department of Fish & Game

Commonwealth of Massachusetts Division of Fisheries & Wildlife

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

The Nature Conservancy
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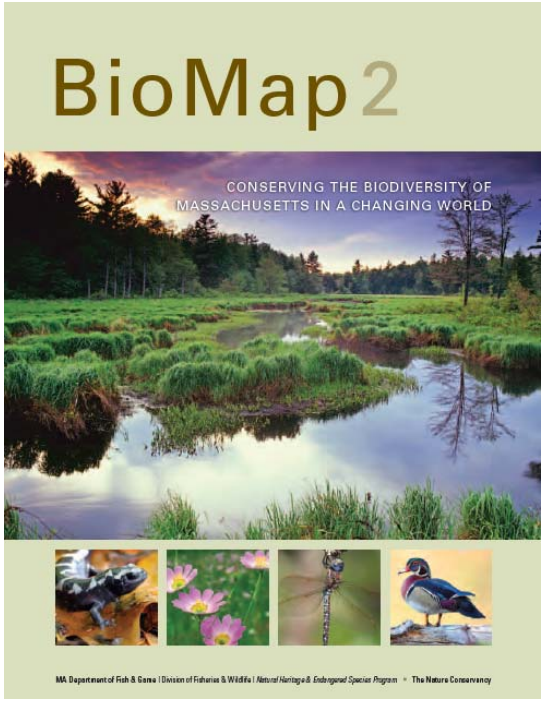
Table of Contents

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.



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

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, 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.
- 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

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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 sites or have very few remaining acres in the state.
- Imperiled communities typically have 6-20 sites or few remaining acres in the state.
- Vulnerable communities typically have 21-100 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 Habit 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

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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

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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 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.

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 http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/.

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.**

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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.mass.gov/nhesp.

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.mass.gov/nhesp. 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.

Town Overview

Concord lies within the Southern New England Coastal Plains and Hills Ecoregion, an area comprised of plains with a few low hills. Forests are mainly central hardwoods with some transition hardwoods and some elm-ash-red maple and red and white pine. Many major rivers drain this area.

Concord at a Glance

- Total Area: 16,532 acres (25.8 square miles)
- Human Population in 2010: 17,668
- Open space protected in perpetuity: 4,879 acres, or 29.5% percent of total area*
- *BioMap2* Core Habitat: 5,403 acres
- *BioMap2* Core Habitat Protected: 2,339 acres or 43.3%
- *BioMap2* Critical Natural Landscape: 3,738 acres
- *BioMap2* Critical Natural Landscape Protected: 2,053 acres or 54.9%.

BioMap2 Components

Core Habitats

- 3 Exemplary or Priority Natural Community Cores
- 1 Forest Core
- 9 Wetland Cores
- 12Aquatic Cores
- 11 Species of Conservation Concern Cores**
  - 8 birds, 1 reptile, 3 amphibians, 4 insects, 3 mussels, 10 plants

Critical Natural Landscape

- 1 Landscape Block
- 4 Wetland Core Buffers
- 9 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.

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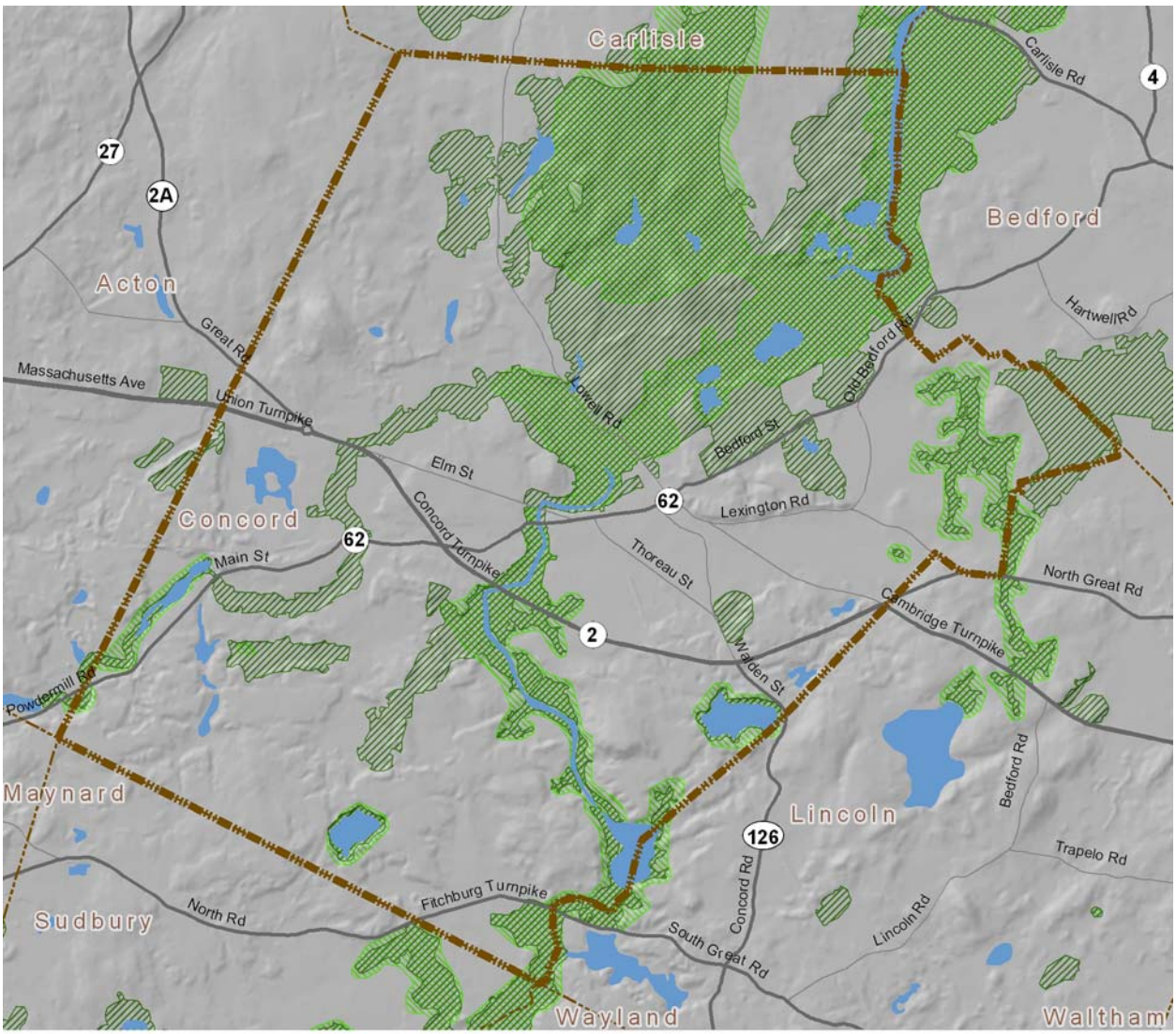
BioMap2 Core Habitat and Critical Natural Landscape in Concord



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 Concord

Mussels

Triangle Floater, (*Alasmidonta undulata*), Non-listed SWAP species
Eastern Pondmussel, (*Ligumia nasuta*), SC
Creeper, (*Strophitus undulatus*), SC

Insects

Moths

Two-striped Cord Grass Moth, (*Macrochilo bivittata*), Non-listed SWAP

Butterflies

Frosted Elfin, (*Callophrys irus*), SC

Dragonflies

Arrow Clubtail, (*Stylurus spiniceps*), Non-listed SWAP species
Umber Shadowdragon, (*Neurocordulia obsoleta*), SC

Amphibians

Four-toed Salamander, (*Hemidactylium scutatum*), Non-listed SWAP
Northern Leopard Frog, (*Rana pipiens*), Non-listed SWAP
Blue-spotted Salamander, (*Ambystoma laterale*), SC

Reptiles

Blanding's Turtle, (*Emydoidea blandingii*), T

Birds

Upland Sandpiper, (*Bartramia longicauda*), E
American Bittern, (*Botaurus lentiginosus*), E
Least Bittern, (*Ixobrychus exilis*), E
Pied-billed Grebe, (*Podilymbus podiceps*), E
Sora, (*Porzana carolina*), Non-listed SWAP
Common Moorhen, (*Gallinula chloropus*), SC
Grasshopper Sparrow, (*Ammodramus savannarum*), T
King Rail, (*Rallus elegans*), T

Plants

Acadian Quillwort, (*Isoetes acadiensis*), E
Violet Wood-sorrel, (*Oxalis violacea*), E
Pod-grass, (*Scheuchzeria palustris*), E
Lake Quillwort, (*Isoetes lacustris*), E
River Bulrush, (*Bolboschoenus fluviatilis*), recently de-listed
Climbing Fern, (*Lygodium palmatum*), SC
Long's Bulrush, (*Scirpus longii*), T
Britton's Violet, (*Viola brittoniana*), T

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Engelmann's Umbrella-sedge, (*Cyperus engelmannii*), T
Resupinate Bladderwort, (*Utricularia resupinata*), T

Priority Natural Communities

Small-river floodplain forest, S2
Kettlehole wet meadow, S3

Other *BioMap2* Components

Forest Core
Aquatic Core
Wetland 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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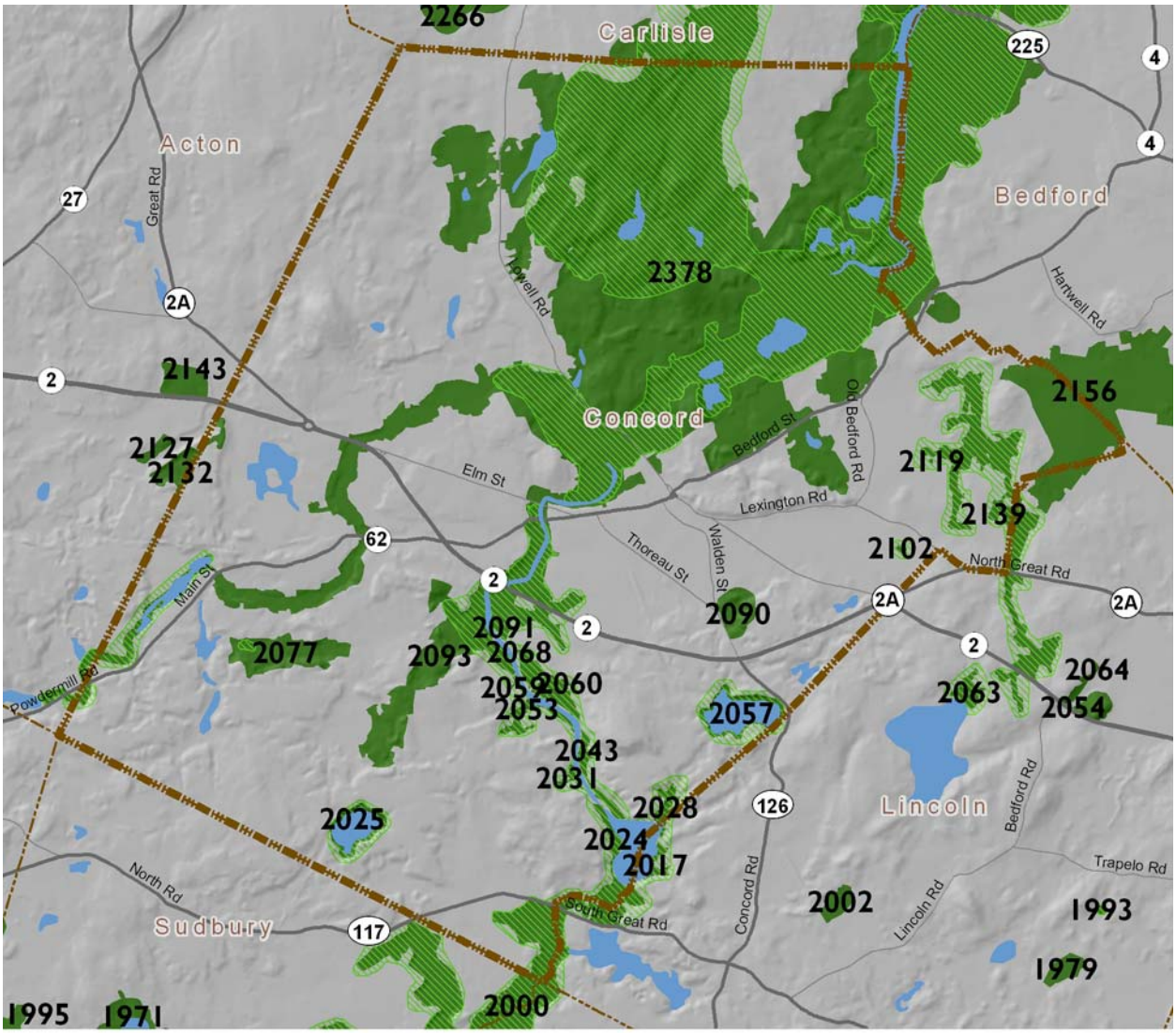
BioMap2 Core Habitat in Concord

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 Concord. The elements listed here may not occur within the bounds of Concord.

Core 2000

Aquatic Core
Wetland Core
Species of Conservation Concern

Deep emergent marsh		
Engelmann's Umbrella-sedge	*Cyperus engelmannii*	T
Long's Bulrush	*Scirpus longii*	T
Blue-spotted Salamander	*Ambystoma laterale*	SC
Northern Leopard Frog	*Rana pipiens*	Non-listed SWAP
Spotted Turtle	*Clemmys guttata*	Non-listed SWAP
American Bittern	*Botaurus lentiginosus*	E
Common Moorhen	*Gallinula chloropus*	SC
Least Bittern	*Ixobrychus exilis*	E
Pied-billed Grebe	*Podilymbus podiceps*	E
Sora	*Porzana carolina*	Non-listed SWAP

Core 2024/2028/2031/2043/2053/2059/2060/2068/2091

Wetland Core

Core 2025

Aquatic Core
Species of Conservation Concern

Engelmann's Umbrella-sedge	*Cyperus engelmannii*	T
Resupinate Bladderwort	*Utricularia resupinata*	T

Core 2057

Aquatic Core
Species of Conservation Concern

Acadian Quillwort	*Isoetes acadiensis*	E
Lake Quillwort	*Isoetes lacustris*	E

Core 2077

Aquatic Core
Species of Conservation Concern

Climbing Fern	*Lygodium palmatum*	SC
Pod-grass	*Scheuchzeria palustris*	E

Core 2090

Species of Conservation Concern

Four-toed Salamander	*Hemidactylium scutatum*	Non-listed SWAP

Core 2093

Wetland Core

Species of Conservation Concern

Blue-spotted Salamander	*Ambystoma laterale*	SC

Core 2102

Priority & Exemplary Natural Communities

Kettlehole wet meadow		S3

Core 2119/2139

Aquatic Core

Core 2132

Species of Conservation Concern

Frosted Elfin	*Callophrys irus*	SC

Core 2156

Species of Conservation Concern

Grasshopper Sparrow	*Ammodramus savannarum*	T
Upland Sandpiper	*Bartramia longicauda*	E

Core 2378

Forest Core

Aquatic Core

Wetland Core

Priority & Exemplary Natural Communities

Small-river floodplain forest		S2

Species of Conservation Concern

Britton's Violet	*Viola brittoniana*	T
Engelmann's Umbrella-sedge	*Cyperus engelmannii*	T
Few-seeded Sedge	*Carex oligosperma*	E
Long's Bulrush	*Scirpus longii*	T
Violet Wood-sorrel	*Oxalis violacea*	E
Creeper	*Strophitus undulatus*	SC
Eastern Pondmussel	*Ligumia nasuta*	SC
Triangle Floater	*Alasmidonta undulata*	Non-listed SWAP
Two-striped Cord Grass Moth	*Macrochilo bivittata*	Non-listed SWAP
Arrow Clubtail	*Stylurus spiniceps*	Non-listed SWAP
Umber Shadowdragon	*Neurocordulia obsoleta*	SC
Blue-spotted Salamander	*Ambystoma laterale*	SC

Four-toed Salamander	*Hemidactylium scutatum*	Non-listed SWAP
Northern Leopard Frog	*Rana pipiens*	Non-listed SWAP
Blanding's Turtle	*Emydoidea blandingii*	T
Eastern Ribbon Snake	*Thamnophis sauritus*	Non-listed SWAP
American Bittern	*Botaurus lentiginosus*	E
Common Moorhen	*Gallinula chloropus*	SC
King Rail	*Rallus elegans*	T
Least Bittern	*Ixobrychus exilis*	E
Pied-billed Grebe	*Podilymbus podiceps*	E
Sora	*Porzana carolina*	Non-listed SWAP

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Core Habitat Summaries

Core 2000

A 4,795-acre Core Habitat featuring Wetland Core, Aquatic Core, Priority Natural Communities, and 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.

The 2,475 Wetland Core is the largest of all Wetland Cores in the state and in this ecoregion.

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.

Deep Emergent Marshes are graminoid wetlands occurring on saturated soils that are seasonally flooded. They generally form in broad, flat areas bordering slow rivers or along pond margins, and often grade into shrub swamps. This species rich Deep Emergent Marsh is part of a large wetland system. Purple Loosestrife is abundant and a dam has altered natural water levels.

This umbrella-sedge or flatsedge inhabits exposed moist soil on pond or river shores. It is closely related to rusty flatsedge. Engelmann's Umbrella-sedge can be distinquished from rusty flatsedge by its divergent floral scales.

Long's Bulrush is a globally rare, robust sedge of open peaty wetlands. In Massachusetts, Long's Bulrush is known to occur in acidic fen and wet meadow communities associated with rivers.

Adult and juvenile Blue-spotted 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.

Adult Northern Leopard Frogs are found in marshes, wet meadows, and peatlands in the narrow transition zone between open water and uplands; they retreat to the water of ponds and small streams when threatened. The herbivorous tadpoles require open water of sufficient permanence for their development.

Strong populations of Spotted Turtles in good habitat - large, unfragmented, protected open space - continue to be of interest for the conservation of this species. This small, dark-colored turtle with yellow spots on its carapace inhabits a variety of wetlands year-round and nests in nearby uplands during spring. Road and collection are the primary conservation concerns.

American Bitterns are heron-like birds that nest primarily in large cattail, tussock or shrub marshes and are very sensitive to disturbance.

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Common Moorhens are fowl-like marshbirds that typically nest in dense cattail beds adjacent to open water.

Least Bitterns are heron-like birds that typically nest in cattail marshes interspersed with open water and are very sensitive to disturbance.

Pied-billed Grebes are secretive marshbirds that typically nest in dense cattail beds adjacent to open water. They are very sensitive to disturbance and changes in water levels.

Soras are secretive marshbirds that typically nest in dense cattail marshes with interspersed open water.

Core 2024

A 34-acre Core Habitat featuring Wetland Core.

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.

Core 2025

A 43-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.

This umbrella-sedge or flatsedge inhabits exposed moist soil on pond or river shores. It is closely related to rusty flatsedge. Engelmann's Umbrella-sedge can be distinquished from rusty flatsedge by its divergent floral scales.

Resupinate Bladderwort is a small carnivorous aquatic plant. It bears "upside-down" flowers that are strongly tilted backwards. Its pink blooms can be seen in late July to August. This species grows in shallow ponds and on muddy shores.

Core 2028

A 16-acre Core Habitat featuring Wetland Core.

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.

Core 2031

A 7-acre Core Habitat featuring Wetland Core.

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

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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.

Core 2043

A 19-acre Core Habitat featuring Wetland Core.

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.

Core 2053

A 23-acre Core Habitat featuring Wetland Core.

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.

Core 2057

An 82-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.

Acadian Quillwort occurs in shallow water along the borders of acidic, low-nutrient ponds and lakes. In Massachusetts, it inhabits sandy to gravelly soils in the shallow inundated edges of coastal plain ponds.

Lake Quillwort is an aquatic spore-bearing plant. It is only known from one sandy, acidic, low-nutrient pond in Massachusetts.

Core 2059

A 2-acre Core Habitat featuring Wetland Core.

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.

Core 2060

A 27-acre Core Habitat featuring Wetland Core.

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.

Core 2068

A 17-acre Core Habitat featuring Wetland Core.

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.

Core 2077

A 97-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.

Climbing Fern does not have the characteristic overall shape of most ferns. Instead, it is an evergreen, ivy-like plant which sprawls over the ground or climbs clockwise short distances up shrubs and coarse herbs. Climbing Fern grows in moist pine-oak-maple woods with an open understory, in moist thickets, and along stream margins. This plant prefers acidic soils that are sandy and rich in humus, but nutrient-poor.

Pod-grass, an erect, rush-like plant, inhabits open acidic peatlands, often in areas that are dominated by sedges and sphagnum mosses.

Core 2090

A 43-acre Core Habitat featuring a Species of Conservation Concern.

Four-toed Salamanders live in forested habitats surrounding swamps, bogs, marshes, vernal pools, and other fish-free waters that are used as breeding sites. Most breeding sites in MA are characterized by pit-and-mound topography with significant sphagnum-moss cover. Eggs are typically laid in mounds or patches of sphagnum moss that overhang water. Upon hatching, the larvae wriggle through the moss and drop into the water, where they will develop for several weeks prior to metamorphosis.

Core 2091

A 54-acre Core Habitat featuring Wetland Core.

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.

Core 2093

A 225-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.

Adult and juvenile Blue-spotted 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 2102

A 2-acre Core Habitat featuring a Priority Natural Community.

Kettlehole Wet Meadows are herbaceous communities found in glacial kettleholes in sandy soils with seasonal water level changes. For most of the summer, they look like shallow ponds, but by late summer they are covered by emergent vegetation. This large example of a Kettlehole Wet Meadow is relatively well buffered by surrounding forest despite occurring within a developed landscape.

Core 2119

A <1-acre Core Habitat featuring Aquatic Core.

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.

Core 2132

A 40-acre Core Habitat featuring a Species of Conservation Concern.

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports.

Core 2139

A 239-acre Core Habitat featuring Aquatic Core.

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.

Core 2156

A 599-acre Core Habitat featuring Species of Conservation Concern.

Grasshopper Sparrows nest in dry grasslands. Natural situations include sandplain grasslands, but they have adapted well to anthropogenic habitats such as airports and landfills. They are very sensitive to changes in plant composition and respond well to the effects of fire management.

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Upland Sandpipers require very large, unbroken tracts of grassland, and in Massachusetts are now relegated mostly to anthropogenic habitats such as airports. They are very sensitive to changes in plant composition and respond well to the effects of well-planned fire management and thoughtful mowing regimes.

Core 2378

An 8,090-acre Core Habitat featuring Forest Core, Wetland Core, Aquatic Core, Priority Natural Communities, and Species of Conservation Concern.

The Assabet and Sudbury Rivers meet in the town of Concord and become the Concord River. Just downstream of this confluence, the Concord opens out into the wide marshes of the Great Meadows National Wildlife Refuge. This complex of rivers, wetlands, and adjacent uplands supports 22 rare and uncommon species of birds, plants, freshwater mussels, and dragonflies, among others. The impoundments along the Concord in Great Meadows NWR are one of the few sites in southern New England that near-annually support breeding populations of the entire suite of rare and common marsh birds.

Small-River Floodplain Forests are silver maple/green ash forests occurring on alluvial soils of small rivers and streams. They occur on small tributaries of the Connecticut and Nashua Rivers and along some small rivers of eastern Massachusetts. One example of Small-River Floodplain Forest, though small, is relatively undisturbed and is well buffered by surrounding natural vegetation. Another large but narrow example of Small-River Floodplain Forest is in good condition, but its linear shape leaves it more vulnerable to disturbance because of its larger edge area.

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.

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.

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.

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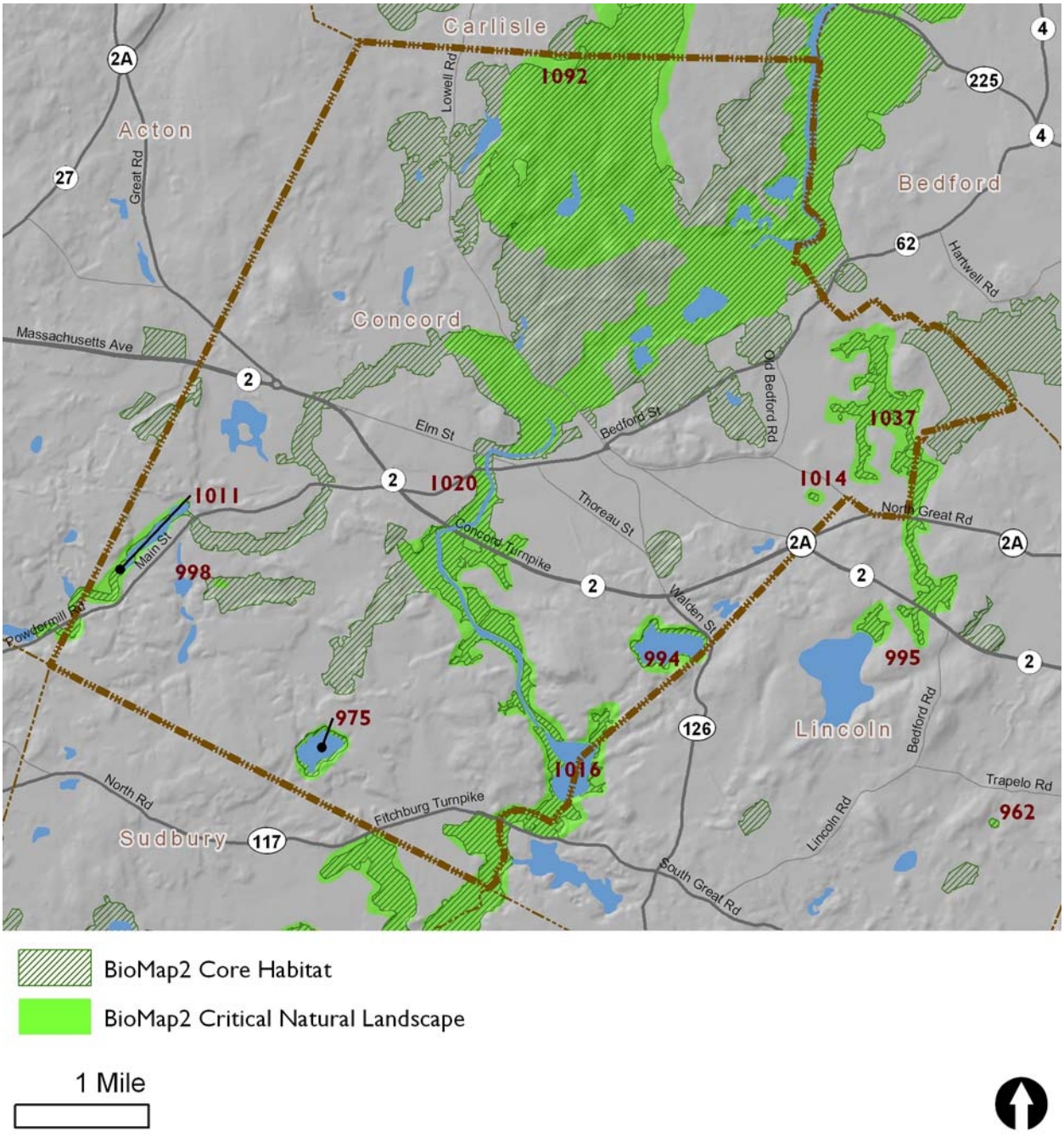
BioMap2 Critical Natural Landscape in Concord

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



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Elements of *BioMap2* Critical Natural Landscapes

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

CNL 975
Aquatic Core Buffer

CNL 994
Aquatic Core Buffer

CNL 998
Aquatic Core Buffer

CNL 1011
Aquatic Core Buffer

CNL 1014
Wetland Core Buffer

CNL 1016
Aquatic Core Buffer
Wetland Core Buffer

CNL 1020
Wetland Core Buffer

CNL 1037
Aquatic Core Buffer

CNL 1092
Aquatic Core Buffer
Landscape Block
Wetland Core Buffer

Critical Natural Landscape Summaries

CNL 975

A 75-acre Critical Natural Landscape featuring Aquatic Core Buffer.

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.

CNL 994

A 119-acre Critical Natural Landscape featuring Aquatic Core Buffer.

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.

CNL 998

A 4-acre Critical Natural Landscape featuring Aquatic Core Buffer.

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.

CNL 1011

A 128-acre Critical Natural Landscape featuring Aquatic Core Buffer.

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.

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CNL 1014

A 10-acre Critical Natural Landscape featuring Wetland Core Buffer.

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CNL 1016

A 4,343-acre Critical Natural Landscape featuring Aquatic Core Buffer and Wetland Core Buffer.

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.

CNL 1020

A 3-acre Critical Natural Landscape featuring Wetland Core Buffer.

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.

CNL 1037

A 474-acre Critical Natural Landscape featuring Aquatic Core Buffer.

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.

CNL 1092

A 4,277-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 & Endangered Species Fund

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