Connect the CONNECTICUT

A roadmap for conserving the Connecticut River watershed for future generations

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ABOUT CONNECT THE CONNECTICUT

What can we do today to ensure a sustainable future for the Connecticut River watershed? *Connect the Connecticut* is a collaborative effort to identify a unified network of priority lands and waters that can support wildlife and natural systems for future generations. Visit our website: connecttheconnecticut.org

Connect the Connecticut is supported by The North Atlantic Landscape Conservation Cooperative, an applied science and management partnership that builds upon a long history of conservation in the region to unite stakeholders around common goals for sustaining natural and cultural resources, and to develop tools and strategies to achieve those goals in the face of threats and uncertainty.

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Connect the Connecticut is intended to foster conservation of lands and waters of the Connecticut River watershed such as the Farmington River in Connecticut.

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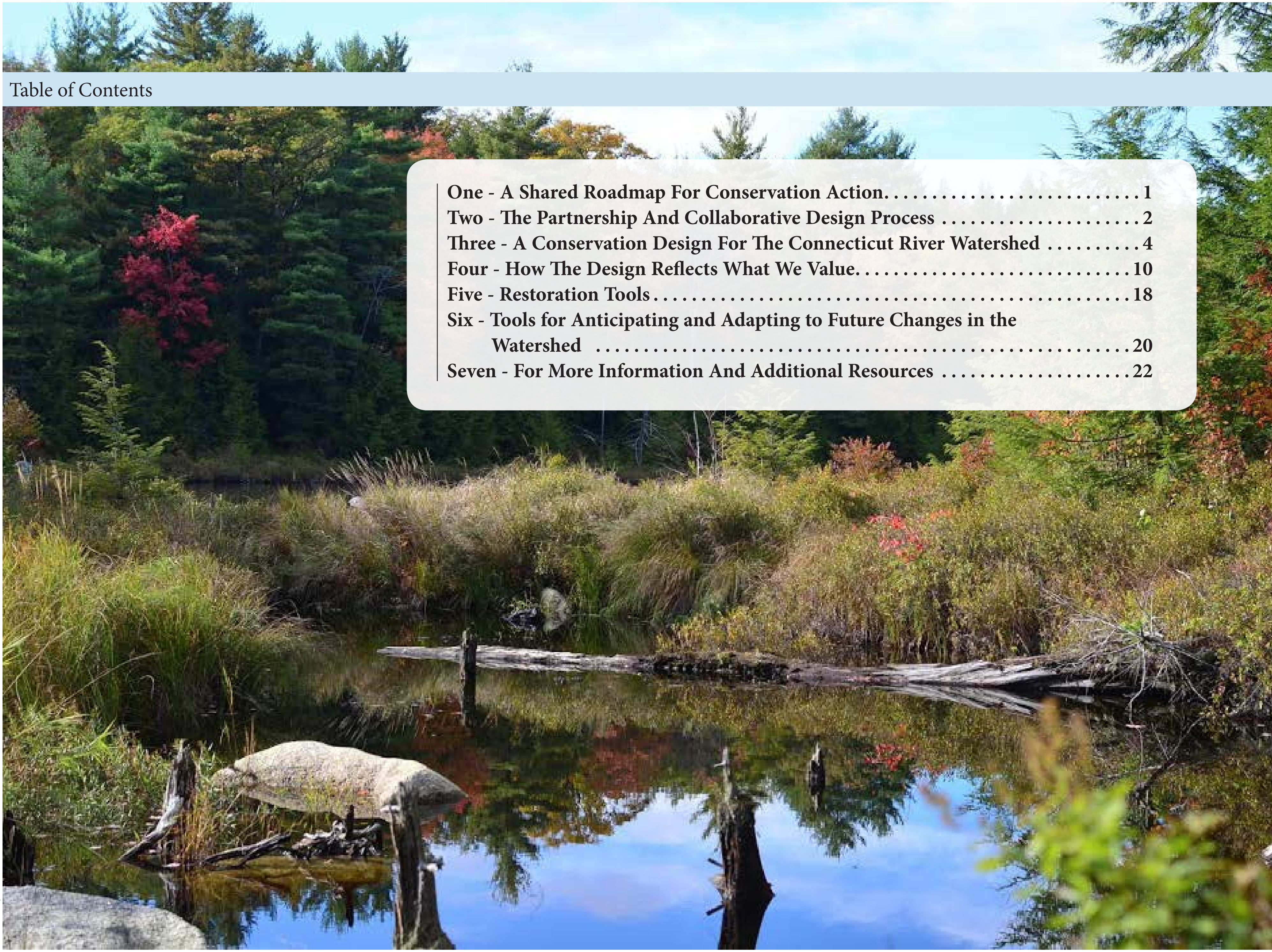
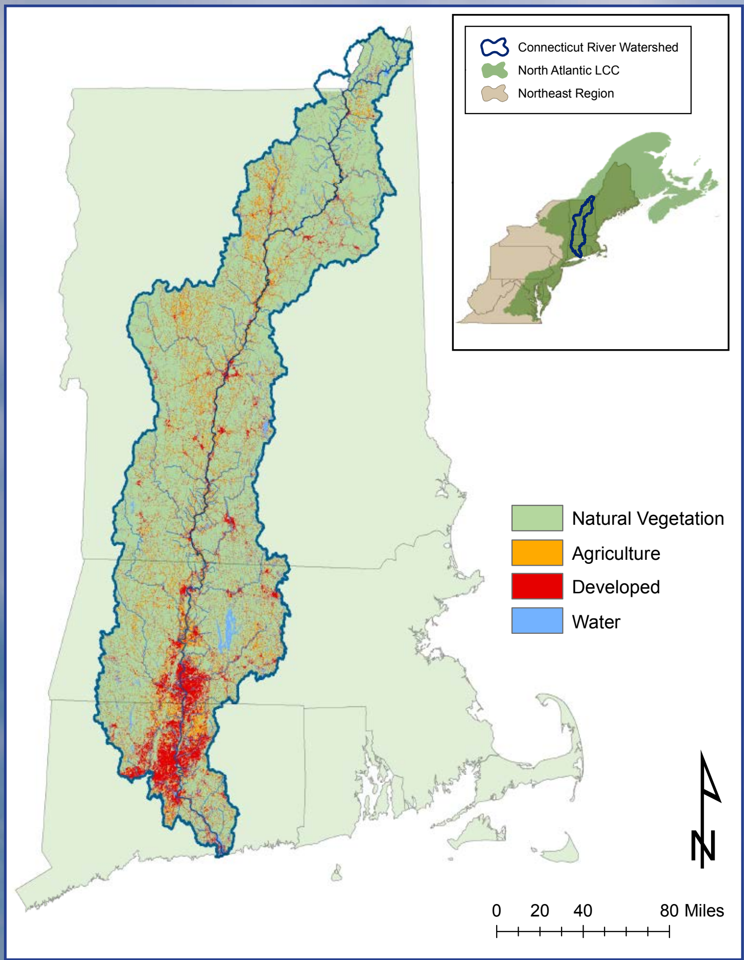
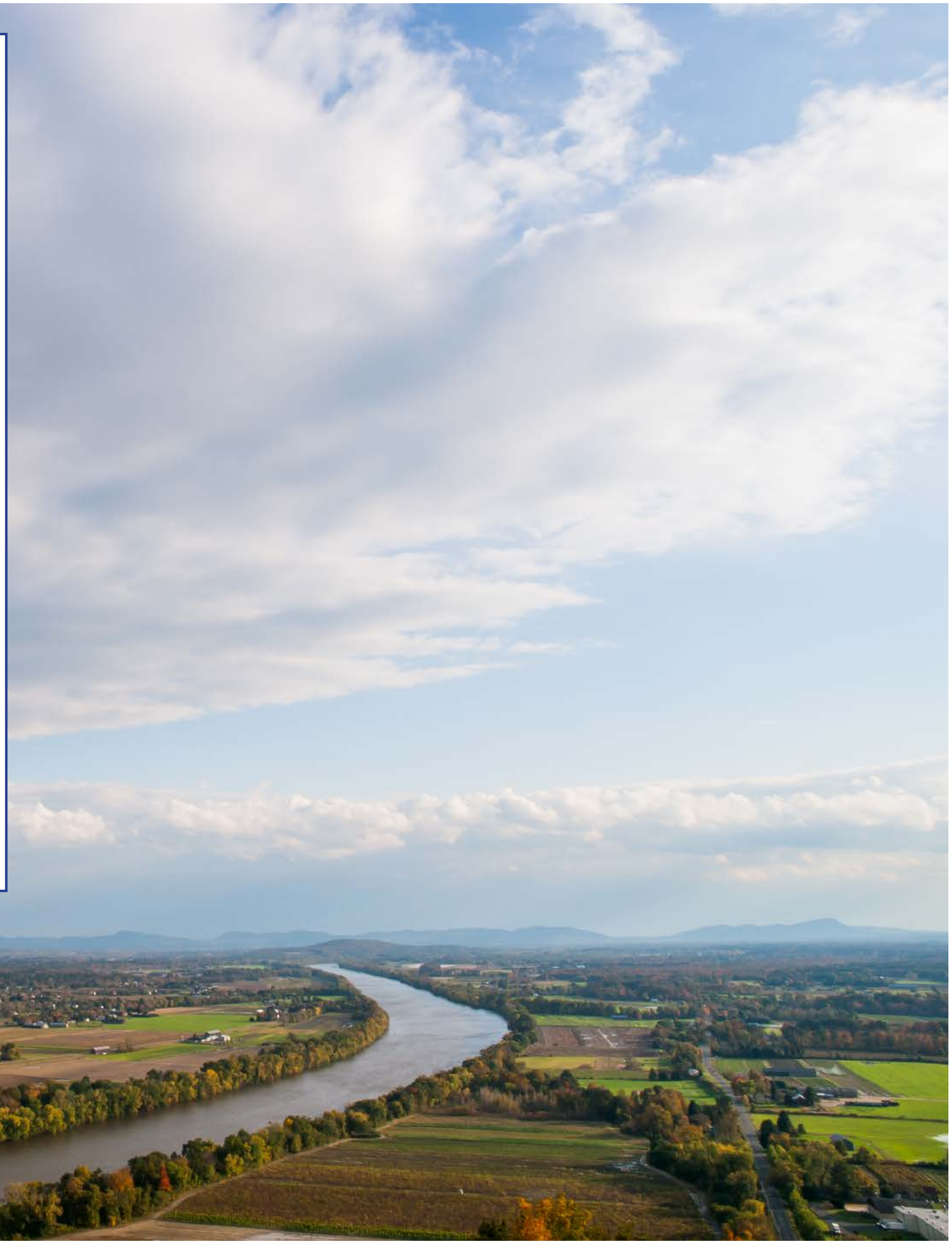




The Connecticut River watershed.



Lamar Gore

Bridget Macdonald

SECTION ONE - A SHARED ROADMAP FOR CONSERVATION ACTION

Encompassing New England's largest river system, the Connecticut River watershed provides important habitat for a diversity of fish, wildlife, and plants, from iconic species like bald eagle and black bear to threatened and endangered species like the shortnose sturgeon, piping plover, and dwarf wedgemussel. The 7.2-million acre watershed is also a source of clean water, recreation, food, jobs, and more for the millions of people living in Vermont, New Hampshire, Massachusetts, and Connecticut.

Decades of work to improve water quality, sustain working forests and farmlands, and restore endangered species have yielded substantial benefits in maintaining and revitalizing the watershed's natural resources. Nevertheless, threats remain in the form of habitat loss, degradation, and fragmentation from increasing development. Moreover, increasingly evident changes in the region's climate will continue to unfold in future decades. These changes may offer new opportunities for some species, but will also pose risks to fish, wildlife, and plants that cannot readily adapt or move in response to the changing climate.

In response to these ongoing and emerging threats, and building on a legacy of conservation success in the watershed, a team of partners from more than 20 state and federal agencies, private organizations, and academic institutions came together in 2014 to develop a shared conservation design for the watershed. This design, and a series of associated products, can help to achieve the shared goals of the partnership. Together, these products are known as *Connect the Connecticut.* The name reflects the fact that the most effective long-term strategy for sustaining natural resources across a large landscape like the Connecticut River watershed is to keep important parts of it intact and connected.

Connect the Connecticut takes advantage of emerging capabilities to map, analyze, and forecast changes to natural resources to a degree never before possible. These innovations allowed the partners to develop a detailed, strategic conservation *design*, which is described in more detail in this report. The design outlines a network of *core areas,* or intact, connected, and resilient places within the watershed. This design also includes connections and supporting landscapes that, along with the core areas, serve as a roadmap for conservation action.

Connect the Connecticut reflects a unified vision that considers the value of fish and wildlife species, and the ecosystems they inhabit, from Long Island Sound to the peaks of the White Mountains. Core areas include high quality, resilient examples of the full range of ecosystem types throughout the watershed, from spruce-fir forests to small streams to freshwater marshes. High quality habitat for a set of 20 fish and wildlife species — including American woodcock, wood thrush, and Eastern brook trout — is also a key component of the network of core areas. These species have been chosen to represent others that rely on similar habitats in the watershed.

In addition to the network of core areas, *Connect the Connecticut* provides a set of tools and information that resource managers, planners, and many others can use to prioritize effective conservation action to maintain and restore the natural resources of the watershed. It also provides information about how the watershed may change in future decades as human communities grow and climate changes. The information is intended to complement other state and local sources of knowledge and planning efforts. The partnership is committed to using these tools, learning from them and sharing these lessons back to the full partnership so that *Connect the Connecticut* can be a living document that informs conservation actions by the team and many others across the basin. For more information, including case studies in using the tools, opportunities for training, and ways to provide feedback, please visit our website, connecttheconnecticut.org.

The collaborative process to develop *Connect the Connecticut* was facilitated by the North Atlantic Landscape Conservation Cooperative (LCC) and the U.S. Fish and Wildlife Service (FWS). The North Atlantic LCC is an applied science and management partnership that builds upon a long history of collaborative conservation in the North Atlantic region, with staff based at the FWS Northeast Regional Office. The FWS protects fish and wildlife resources across the Northeast, including a network of more than 70 refuges, one of which is the Silvio O. Conte National Fish and Wildlife Refuge (Conte Refuge). The Conte Refuge was established to conserve, protect, and enhance fish, wildlife, plants, and ecosystems throughout the Connecticut River watershed. Its boundary is equivalent to the *Connect the Connecticut* design boundary.

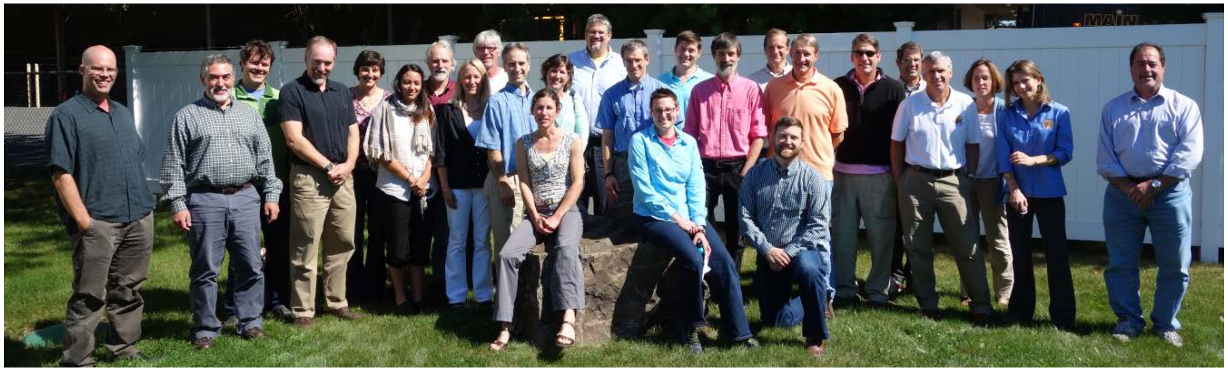
In January 2014, the North Atlantic LCC and FWS invited a variety of partners to participate in the collaborative design process. These partners included the four state fish and wildlife agencies in the watershed, other federal agencies, and nongovernmental organizations, drawing from the active coalition that makes up the Friends of the Conte Refuge. Beginning with the first meeting of the group in February 2014, more than 30 individuals from a number of organizations participated (page 3).

The innovative work of integrating the best available spatial and ecological scientific data into a unified conservation design, and of developing many of those components, was led by a team of scientists from the Department of Environmental Conservation at the University of Massachusetts Amherst (UMass). This effort, one part of the broader *Designing Sustainable Landscapes* project, was supported by the North Atlantic LCC and the Northeast Climate Science Center. UMass incorporated data and information from The Nature Conservancy, the U.S. Geological Survey, and state fish and wildlife agencies into the design process.

The partnership, including the UMass team, met regularly through October 2015 to make a series of decisions about the conservation design and to review interim products, ultimately leading to a complete design package. The process included meetings to identify shared conservation goals (Box 1) and objectives, decide on which datasets would be used in the design, deliberate on how to combine and balance trade-offs among the various species and ecosystem components of the design, and review and revise the design package. The partners who developed *Connect the Connecticut* are now using the design to guide decisions on implementing conservation actions as part of an ongoing learning process, which will be discussed in future meetings of the partnership. For example, partners at the Massachusetts Division of Fisheries and Wildlife plan to use the design to support ongoing efforts to identify the best habitat for rare species in the Commonwealth, and the Long Island Sound Regional Conservation Fund plans to use the design as a source of information to help identify priority locations for forest conservation.

The next four sections of this report include more details on these tools and datasets, and how they can be used to develop conservation strategies and take action. The complete design package consists of a series of spatial datasets mapped for the Connecticut River watershed, which have been grouped into four main categories.

1 The Core-Connector Network of the places most essential for conservation action, in both terrestrial and aquatic settings. Collectively, this network is intended to represent the areas most important for maintaining the benefits provided by the fish, wildlife, and ecosystems of the watershed. Components of the network include core areas, connectors, supporting landscapes, and aquatic buffers (described in Section Three).



Bridget Macdonald/NALCC

Connect the Connecticut partnership

2 Supporting Data used to create the Core-Connector Network. They can help in understanding and setting priorities within the interconnected network, but also can be used independently. Examples include datasets that depict ecological integrity and species habitat (Section Four).
3 Restoration Tools that can inform actions for re-connecting and enhancing the ecosystems of the watershed (Section Five).
4 Future Change Tools that provide context for making more strategic decisions in anticipation of future changes related to climate and land use (Section Six).

Box 1. *Connect the Connecticut* is guided by shared goals developed by the partnership.

Goal 1. The Connecticut River watershed sustains a diverse suite of intact, connected, and resilient ecosystems that provide important ecological functions and services that benefit society, such as clean water, flood protection, and lands for farming, forestry, and recreation.

Goal 2. The Connecticut River watershed sustains healthy and diverse populations of fish, wildlife, and plant species for the continuing benefit and enjoyment of the public.

Partner organizations:

Non-governmental

Audubon Connecticut

Connecticut River Watershed Council

Friends of the Silvio O. Conte National Fish and Wildlife Refuge

Highstead Foundation

Springfield Science Museum

The Nature Conservancy

State

Connecticut Bureau of Natural Resources, Department of Energy and Environmental Protection

Massachusetts Division of Fisheries and Wildlife

New Hampshire Fish and Game Department

Vermont Fish and Wildlife Department, Agency of Natural Resources

Federal

Environmental Protection Agency
- Mid-Atlantic Region
- Office of Research and Development, Atlantic Ecology Division

U.S. Geological Survey

U.S. Fish and Wildlife Service
- Ecological Services
- Fish and Aquatic Conservation
- Migratory Birds
- National Wildlife Refuge System
- Science Applications
- Wildlife and Sport Fish Restoration

Atlantic Coast Joint Venture

North Atlantic Landscape Conservation Cooperative

Academic

Cornell University (Observer)

University of Connecticut (Observer)

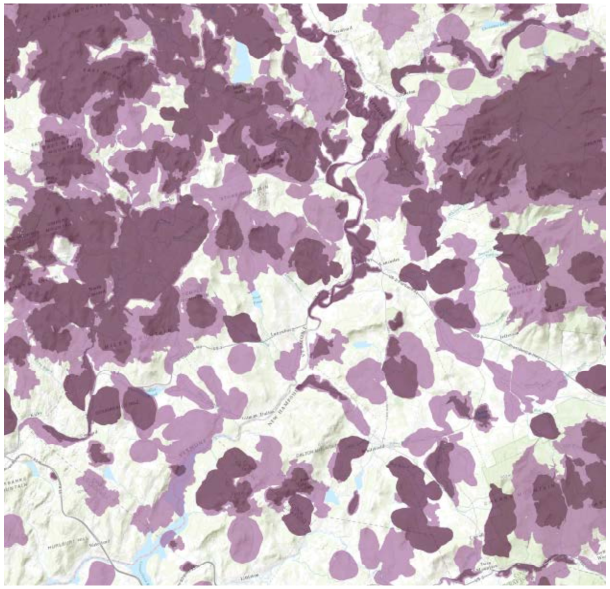
University of Massachusetts Amherst

Connect the Connecticut is an example of the increasingly common approach to large-scale conservation termed *Landscape Conservation Design*. Landscape Conservation Design refers to a collaborative, holistic process among partners that results in shared conservation strategies at specified locations. *Landscape* conveys the idea that the process encompasses a large area such as an entire watershed. *Design* conveys the idea of a creative process to identify specific areas for priority action that collectively comprise an integrated, interrelated whole.

In the case of *Connect the Connecticut*, the design was created by a group of stakeholders from different institutions, all united by the common cause of maintaining the fish, wildlife, and ecosystems of the Connecticut River watershed over the long term. Through an iterative and collaborative process, the partnership developed a framework for conservation action designed to achieve a set of shared goals. That framework is anchored by the terrestrial and aquatic Core-Connector Network.

High priority core areas: the best places to start

The backbone of *Connect the Connecticut* is a network of high priority core areas for both terrestrial and aquatic areas. Terrestrial core areas incorporate wetland and upland ecosystems. They often also extend across aquatic ecosystems such as ponds and streams, although these aquatic components are not specifically targeted for the terrestrial cores. Aquatic core areas encompass and are confined to streams, rivers, ponds, and lakes. Each terrestrial and aquatic core area contains important or unique features. The kinds of features they contain include especially intact, resilient examples of each ecosystem type present within the watershed. The core areas encompass widespread ecosystems such as hardwood forests, rare natural communities such as bogs, and important habitat for species such as brook trout and wood duck. Terrestrial cores, but not aquatic cores, are divided into two levels of priority (Tier 1 and Tier 2), with Tier 1 cores representing higher conservation priority.



Tier 1 terrestrial cores (dark purple) are the highest priority areas for conservation of terrestrial and wetland ecosystems. Tier 2 cores (light purple) are also priorities.

Michael Goulet

Core areas encompass large, intact forests that support fish and wildlife and provide many benefits to society.

The terrestrial Tier 1 core areas include a special category directed at the conservation of birds that depend upon pastures, hayfields, and other types of grasslands. Grasslands occur primarily in agricultural settings and are completely dependent upon human management to persist in the Connecticut River watershed. This dependency is unique among habitat types, and results in specialized management needs to sustain populations of birds like eastern meadowlark that inhabit these grasslands. Consequently, grassland core areas are generated separately from other terrestrial-based core areas in *Connect the Connecticut.*

Just as the timbers that frame a house contribute much more value than a collection of loose boards, the network of core areas provides many benefits beyond what could be expected from individual sites. These benefits include:

- Representation of a broad diversity of species and natural communities from the U.S.-Canada border to Long Island Sound.
- Stepping stones that allow plant and animal species to move or disperse among high quality habitats across the watershed.
- Redundancy, in case the natural features of any one core area are disturbed or degraded.
- Capacity to adapt to future alterations of the environment, such as those caused by a changing climate.

Even a large core area is unlikely to be large enough, in isolation, to support self-sustaining populations of wildlife species or withstand large catastrophic events such as hurricanes or forest fires. It is the network that confers the ability of individual locations to recover from and adapt to large-scale environmental changes.

USFWS

A black bear requires hundreds of acres of connected habitat to survive.

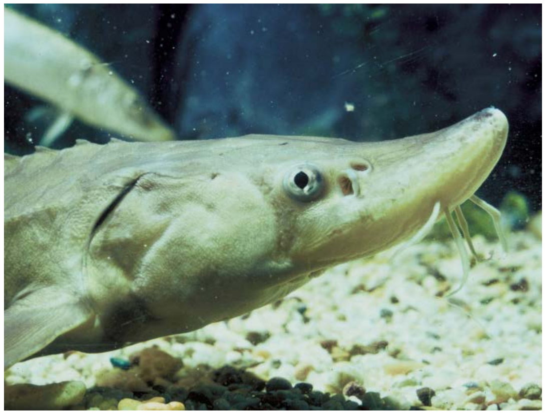
The *Connect the Connecticut* partnership agreed to set the extent of the Tier 1 terrestrial cores at 25% of land area of the Connecticut River watershed. Similarly, the aquatic cores constitute 25% of the entire stream network, and lake and pond area, of the watershed. The 25% value represents a reasonable balance between achieving substantial diversity and redundancy across the network, while still being sufficiently strategic and targeted for setting conservation priorities. While the Tier 1 core areas represent the best places to start, the full *Connect the Connecticut* design provides options for those who wish to further prioritize within the 25% of land comprising Tier 1 core areas or expand their reach beyond the initial 25% of the landscape. Nearly half of the area of the Tier 1 core areas is already protected.

Connectors to bind the network together

Vibrant towns and cities depend upon a well-functioning transportation network that links them together and allows for exchange of goods and services. Similarly, the long-term ecological condition of the core area network depends on connections that allow plants, animals, materials, and ecological processes to move and become re-distributed over time. Connections can serve many functions, such as fostering seasonal migration of mammals and birds, allowing young animals to disperse to new territories, and permitting plants to shift their ranges in response to changing climate conditions.

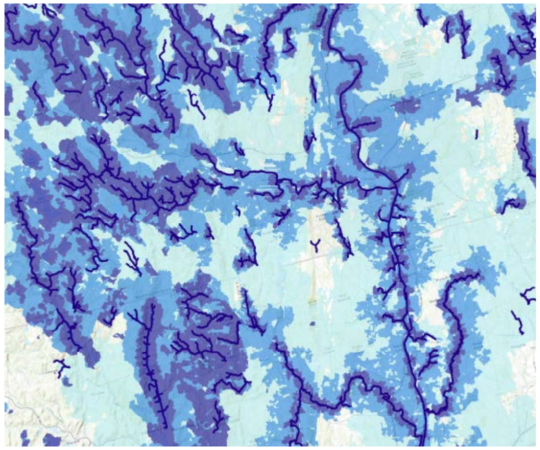
Connectivity needs for terrestrial species are met by linking terrestrial Tier 1 core areas through a defined set of connectors that represent the best available places for plants and animals to move across the landscape. The connectors are not designed for any particular species. Rather, they are intended to represent the needs of a variety of species with varying abilities to move and disperse. The terrestrial connectors are based on existing, intact landscapes. Connectivity needs for aquatic species are met through the full river and stream network connecting aquatic core areas, which is defined explicitly as part of the design.

As described in Section Five, *Connect the Connecticut* includes additional tools that can be used to identify opportunities to increase connectivity by removing or modifying aquatic barriers at dams and road-stream crossings and terrestrial barriers along roads.

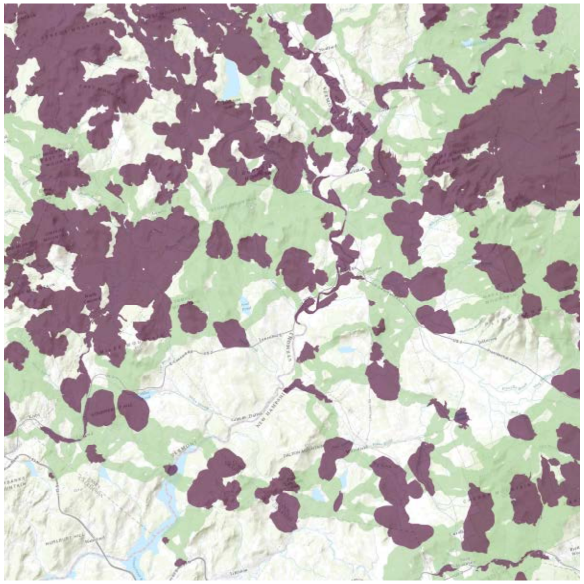


USFWS

The shortnose sturgeon is a federally listed endangered species that inhabits the Connecticut River.



Aquatic core areas are lakes, ponds, and segments of streams and rivers (dark blue) that are of the highest conservation priority. Their continued integrity depends upon proper management of surrounding buffers (lighter blues).



Connectors (green) link the Tier 1 terrestrial core areas

Secondary terrestrial tiers, supporting landscapes, and aquatic buffers: sustaining the core-connector network

While the highest priority Tier 1 terrestrial and aquatic core areas can be viewed as important anchors for conservation, they are not self-contained islands. Isolated from their surroundings, they will not be able to provide the habitat needed for species or maintain the full spectrum and amount of natural benefits that the public desires for the Connecticut River watershed. In fact, the ecological integrity and resilience of many of the core areas derives from being nested within a larger undeveloped matrix that buffers them from outside forces. Recognizing the importance of surrounding lands for supporting core areas, as well as for their inherent value in supporting fish, wildlife, and plants, *Connect the Connecticut* identifies additional conservation value of lands and waters outside of the core-connector network.

Both Tier 2 core areas and supporting landscapes can overlap connectors, which link Tier 1 core areas. Connectors are important for allowing plants and animals to move between core areas but are not necessarily situated on lands of high ecological integrity and resiliency. Tier 2 core areas also foster the movement of plants and animals between Tier 1 core areas but are identified primarily for the ecological value of features that occur within their boundaries. Lands that occur within both connectors and Tier 2 core areas can be interpreted as having important dual roles in connecting the network and supporting local biodiversity.

Terrestrial Tier 2 Core Areas

Tier 2 core areas support the Tier 1 terrestrial cores. Like the Tier 1 core areas, Tier 2 core areas encompass a variety of intact ecosystems and high quality habitat for wildlife distributed across the watershed and constitute 25% of the land area of the watershed. They can be considered the next most important portion of the landscape important for terrestrial conservation after the Tier 1 core areas and connectors. In addition to their inherent natural resource value, Tier 2 core areas help buffer and increase the resiliency of the Tier 1 core areas and the full network.

Supporting Landscapes

Supporting Landscapes are the lands surrounding Tier 1 and 2 core areas out to the nearest significant road or development. The inclusion of supporting landscapes recognizes the fact that the entire forest block or other natural area in which a terrestrial-based core area is located influences the integrity of core areas. Because supporting landscapes follow familiar road boundaries, conservation actions directed at core areas can be associated with convenient borders if desired. (Terrestrial core area boundaries are based on ecological value and may not follow recognizable jurisdictional or property boundaries, though they do not span major roads).

Wood turtles are a species of conservation concern that require both river and upland habitats.

Aquatic Buffers

The aquatic counterpart to the supporting landscapes for terrestrial-based cores is the set of aquatic buffers. *Aquatic buffers* represent areas upstream and upslope of aquatic-based core areas that are connected to core areas by surface runoff and other processes. Impervious surfaces, pollution, and other human-related stressors located within buffers may have a strong influence on the ecological condition of the core areas located downstream. Therefore, aquatic buffers may be candidates for protection or restoration activities to preserve and enhance the integrity and resilience of associated aquatic-based core areas.

In addition, although not designed for this purpose, aquatic buffers containing riparian forests and other natural areas that border the stream and river network can also serve as travel corridors for terrestrial animals. Therefore, they may contribute to connectivity among terrestrial core areas.

Box 2. How to Use the Tools – the Core-Connector Network

Connect the Connecticut offers many tools that can inform your work in conservation and planning in the watershed, but the core areas are great places to begin. The set of core areas represents the highest conservation priorities as defined by the partners. As a whole, they represent a substantial portion of the biodiversity of the watershed. The network's value extends beyond a collection of individual locations; the connections among the network provide resilience and the capacity to adapt to change.

Core areas Across the network, the Tier 1 aquatic and terrestrial core areas can be viewed as the best places to start for protection and management of lands and waters in their natural state. Examples of potential conservation applications include the following:

- Informing strategic acquisitions of parcels by fee title or easement by public agencies or nonprofit organizations, based on the regional context and relative ecological importance of certain lands.
- Directing in-stream restoration efforts to aquatic cores in headwater streams to enhance brook trout or other fish habitat.
- Developing information and educational materials for individual private landowners about how to sustain the watershed-wide value of their property, such as by implementing management plans for forests and for riparian corridors.
- Promoting stewardship and conservation actions by landowners and managers aimed specifically at maintaining the integrity of core areas.
- Targeting riparian restoration efforts adjacent to and near aquatic cores.
- Using forestry techniques to encourage the development of mature forest characteristics.
- Supporting the continued operation of working farms and agricultural practices that allow both successful nesting by grassland birds and continued local food production.

Terrestrial connectors Many of the same strategies outlined for core areas can be appropriately applied to connectors. Due to their spatial distribution, acquisition may be less practical, increasing the importance of educating and assisting landowners with implementing sound stewardship.

Aquatic buffers The integrity of aquatic core areas is dependent on the protection and management of upstream and upland areas that affect them. Specific actions that can be taken within the aquatic buffers include planting and maintaining native riparian vegetation, reducing human-caused erosion, and eliminating pollution in waterways.

Tier 2 terrestrial cores and supporting landscapes While the aquatic and Tier 1 terrestrial core areas are the highest priority for conservation, Tier 2 terrestrial core areas and supporting landscapes help confer value on their associated core areas and benefit from various stewardship activities. Supporting landscapes specifically provide practical boundaries within which to direct conservation actions where political or parcel boundaries are relevant, such as easement design or the implementation of forest management plans.

Many core areas already intersect with protected lands such as state parks, state forests, and wildlife management areas. These protected lands can serve as a nucleus for further conservation action around their borders.

Additional recommendations for using the core-connector network.

- Recognize that the boundaries within the plan, like most ecosystem maps, should be considered "fuzzy," meaning that the transition from core to not core will not happen precisely at the marked boundary.
- Verify information predicted by the design, such as the habitat quality in a particular location, before implementing conservation actions.
- Be flexible and prepared to adapt proposed work based on additional information or direct field verification.
- Take action in areas where aquatic and terrestrial core areas overlap and may amplify the benefit to affected ecosystems.
- Use other components of the design, discussed in the next three chapters, to refine the ranking and prioritizing of core areas for action.

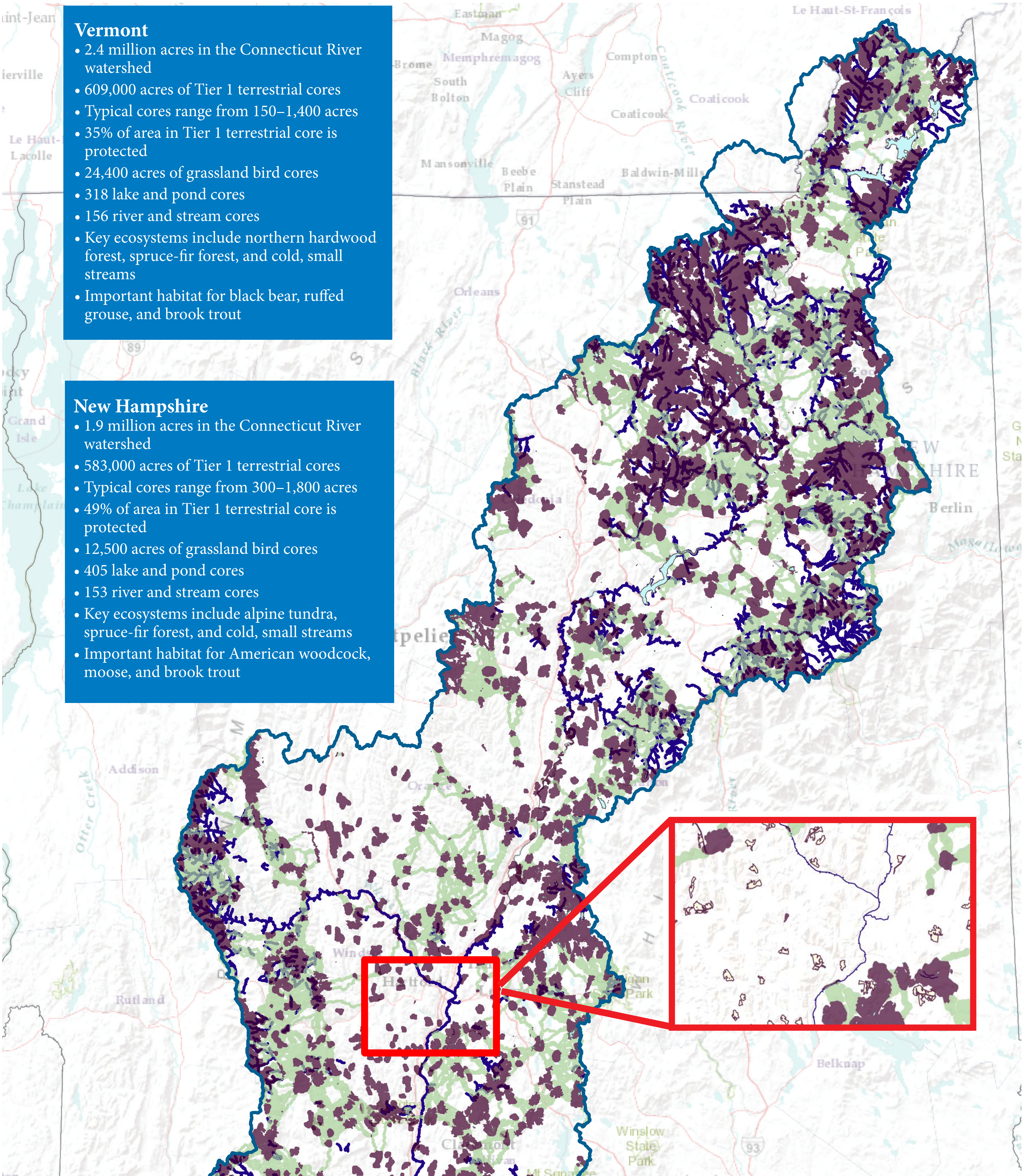
Fast Facts about the Core-Connector Network

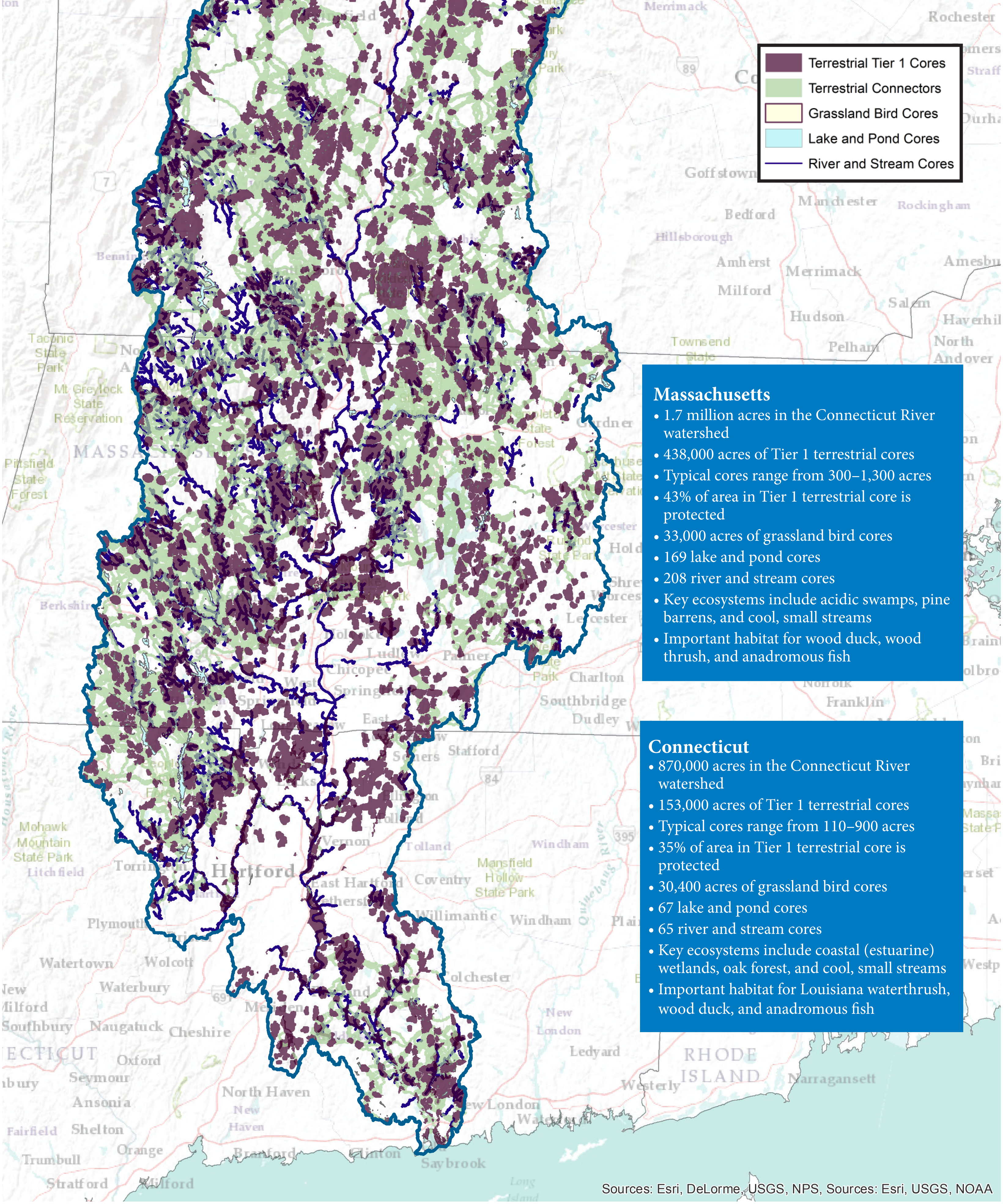
Vermont

- 2.4 million acres in the Connecticut River watershed
- 609,000 acres of Tier 1 terrestrial cores
- Typical cores range from 150–1,400 acres
- 35% of area in Tier 1 terrestrial core is protected
- 24,400 acres of grassland bird cores
- 318 lake and pond cores
- 156 river and stream cores
- Key ecosystems include northern hardwood forest, spruce-fir forest, and cold, small streams
- Important habitat for black bear, ruffed grouse, and brook trout

New Hampshire

- 1.9 million acres in the Connecticut River watershed
- 583,000 acres of Tier 1 terrestrial cores
- Typical cores range from 300–1,800 acres
- 49% of area in Tier 1 terrestrial core is protected
- 12,500 acres of grassland bird cores
- 405 lake and pond cores
- 153 river and stream cores
- Key ecosystems include alpine tundra, spruce-fir forest, and cold, small streams
- Important habitat for American woodcock, moose, and brook trout





Massachusetts

- 1.7 million acres in the Connecticut River watershed
- 438,000 acres of Tier 1 terrestrial cores
- Typical cores range from 300–1,300 acres
- 43% of area in Tier 1 terrestrial core is protected
- 33,000 acres of grassland bird cores
- 169 lake and pond cores
- 208 river and stream cores
- Key ecosystems include acidic swamps, pine barrens, and cool, small streams
- Important habitat for wood duck, wood thrush, and anadromous fish

Connecticut

- 870,000 acres in the Connecticut River watershed
- 153,000 acres of Tier 1 terrestrial cores
- Typical cores range from 110–900 acres
- 35% of area in Tier 1 terrestrial core is protected
- 30,400 acres of grassland bird cores
- 67 lake and pond cores
- 65 river and stream cores
- Key ecosystems include coastal (estuarine) wetlands, oak forest, and cool, small streams
- Important habitat for Louisiana waterthrush, wood duck, and anadromous fish

The natural resources of the Connecticut River watershed provide many benefits to the public. These include healthy populations of fish and wildlife, clean water, protection against flooding and erosion, and many economic, recreational, and educational opportunities. *Connect the Connecticut* is intended to contribute to the protection and enhancement of these resources. With guidance from the *Connect the Connecticut* partnership, sophisticated scientific analyses were used to assess the physical and biological value of resources present in the watershed and identify the most important places and connections for them. The resources that could be mapped and prioritized across the watershed consisted of a) ecosystems and natural communities, and b) habitat for fish and wildlife. *Connect the Connecticut* incorporates both categories of resources in multiple ways.

Ecosystems and Natural Communities

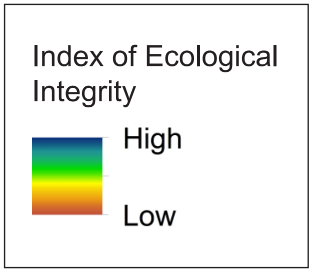
Connect the Connecticut uses an ecosystem-based approach to identify areas of high conservation priority. This approach integrates five products that each provide distinct ways to assess current and long-term ecological value.

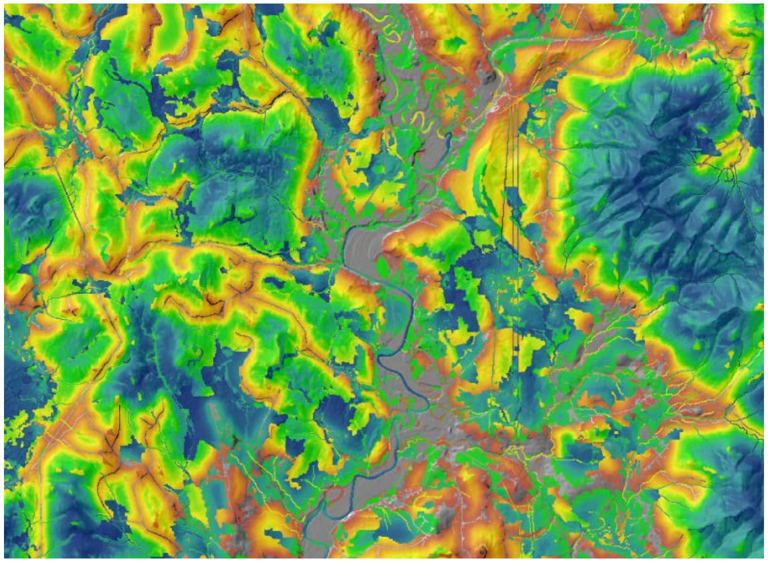
Ecosystems of High Ecological Integrity

Connect the Connecticut incorporates examples of ecosystems that are of high ecological integrity, based on analyses by UMass Amherst. *Ecological integrity* refers to the ability of an area to sustain important ecological functions and biodiversity over a timeframe of years to decades. Ecological integrity is assessed using the Index of Ecological Integrity (IEI), which is composed of 19 different metrics that can be assessed comprehensively across the Northeast. Examples of the metrics include intensity of habitat loss, the degree of connectedness, and the amount of upstream impervious surface. For sites in the watershed, the metrics collectively assess *intactness*, or freedom from human modifications and disturbance. They also assess *resilience*, the capacity to recover from environmental change, based on how well connected and similar they are to ecosystems in their vicinity. IEI is expressed on a relative scale (0 to 1), with higher values indicating greater relative ecological integrity.

IEI is individually assessed for each of the forty-four terrestrial and wetland ecosystem types that occur in the watershed, including examples such as "Acadian-Appalachian Alpine Tundra" and "North-Central Appalachian Acidic Swamp." Most terrestrial and wetland ecosystem types correspond to the "ecological system" classification developed by NatureServe and mapped across the Northeast by The Nature Conservancy. The National Wetlands Inventory classification was used for the coastal wetland types.

Example of Index of Ecological Integrity (IEI) results from Vermont and New Hampshire, just north of the White Mountain National Forest.





USFWS

Montane spruce-fir-hardwood forest is one example of an ecosystem type assessed by the Index of Ecological Integrity.

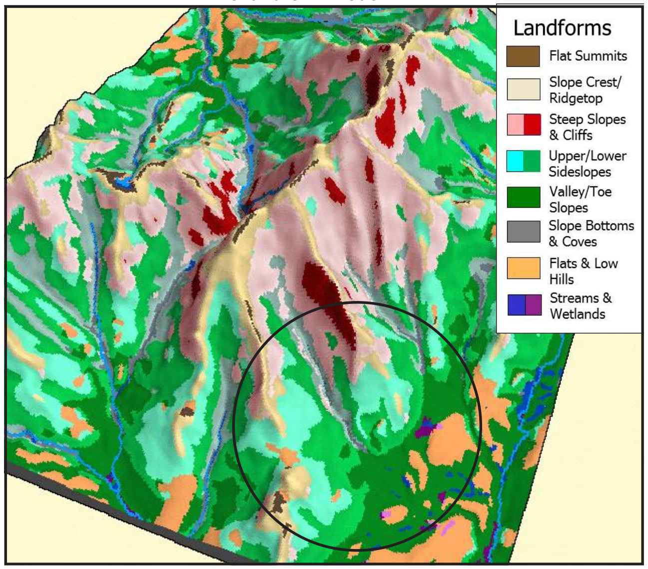
Twenty categories of aquatic ecosystems (lakes, ponds, and 18 stream classes) are also assessed by IEI, based on an aquatic classification developed by The Nature Conservancy.

Terrestrial Sites of High Resilience

The Nature Conservancy
Protecting nature. Preserving life.

Connect the Connecticut incorporates terrestrial sites assessed as having the greatest potential to be resilient over the long term, as identified by The Nature Conservancy. *Resilience* refers to the ability of living systems to adjust and adapt to long-term changes, including climate change. The premise behind the terrestrial resilience assessment is that areas with the most complex surroundings in terms of topography, elevation range, and wetland density offer the greatest potential for plants and animals to move and adapt as their current habitats become less hospitable in a changing climate. Terrestrial resilience also accounts for the degree to which an area's surroundings are free from barriers to plant and animal movement such as roads and dams. The terrestrial resilience of a site is assessed relative to other sites with similar combinations of geology and elevation.

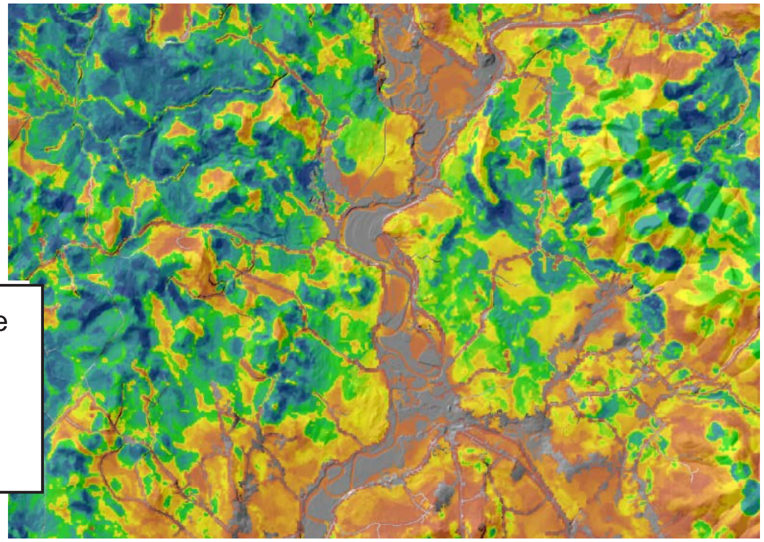
Terrestrial resilience complements IEI by emphasizing longer-time horizons (decades to centuries) over which species must adapt and the larger travel distances needed to accommodate long-term adaptation. Whereas IEI concentrates on the current condition and local connections of existing ecosystems, terrestrial resilience is more focused on long-distance connections across the landscape and the underlying "stage" – the geophysical features such as geology, elevation and landforms – across which species (the "actors") come and go over time.

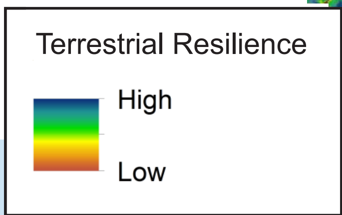


The Nature Conservancy

Resilient terrestrial sites feature complex landforms that allow species to find their preferred microclimates (eight different microclimates occur within the black circle).

Example of terrestrial resilience results from Vermont and New Hampshire, just north of the White Mountain National Forest.





Rare Natural Communities

Ecological systems are an appropriate unit for regional assessment by IEI given the reasonable number of categories and the spatial scale at which they occur, which typically is tens to hundreds of acres. However, ecological systems are also composed of groups of finer-scaled natural community types, and the biodiversity represented by these types could be missed if only the ecological system classification were used in mapping conservation priorities. Therefore, *Connect the Connecticut* also considers the natural community unit of ecosystem classification. Specifically, rare natural communities that have been mapped by the four state natural heritage programs of the watershed are incorporated into terrestrial-based core areas. Rare natural communities are those ranked as critically imperiled (S1), imperiled (S2), or vulnerable (S3). Examples include "Acidic Atlantic White Cedar Swamp," "Black Spruce Woodland Bog," and "Coastal Bluffs and Headlands."

Priority River Floodplains

The Nature Conservancy
Protecting nature. Preserving life.

Floodplain forests along the Connecticut River and its major tributaries provide critical habitat for fish and wildlife. They also provide benefits by serving as migration corridors for animals, filtering water, and protecting downstream cities and towns from flooding. The most important floodplain sites, based on their current functioning or potential for functioning if restored, are incorporated into *Connect the Connecticut.* These sites still experience the regular flooding needed to maintain their condition and consist of many of the largest remaining patches of floodplain forest in the watershed. These floodplains have been mapped by The Nature Conservancy.

Eric Sorenson

A Black Spruce Woodland Bog, an example of a rare natural community.

Christian Marks

Floodplain forests absorb flood waters and provide habitat for numerous plants and animals.

Stream Resistance to Temperature Change

USGS
science for a changing world

Water temperature is a critical factor in determining which plants and animals can occupy a stream. As air temperatures continue to rise due to the effects of climate change, stream temperatures are also expected to increase. Rising water temperatures pose risks to organisms that cannot tolerate or escape these temperatures. To account for these risks, small streams whose temperatures are anticipated to be most resistant to changes in air temperature have been mapped by the U.S. Geological Survey and are also incorporated into *Connect the Connecticut*. These streams are expected to provide a buffer against a changing climate.

Habitat for fish and wildlife

As a complement to the ecosystem-based approach for identifying conservation priorities, *Connect the Connecticut* also specifically considers the habitat needs of fish and wildlife. Because it is not possible to identify priority habitat locations for all of the hundreds of species that inhabit the watershed, *Connect the Connecticut* focuses on habitat needs for a carefully-selected set of 20 fish and wildlife species (Table 1). Five of these are anadromous fish chosen for their conservation importance. The remaining 15 species have been chosen to represent the habitat needs of a large number of species that share many of the same habitats. These 15 "representative species" have also been chosen because they are sensitive to landscape change, such as loss of habitat due to development, and because they are well studied, enabling researchers to map their habitats. Several are species of conservation concern.

Collectively, these 20 species represent all the geographic regions of the watershed and major ecosystem types that occur there. They reflect different kinds of sensitivity to threats such as development. For example, black bears have large home ranges and are sensitive to fragmentation of their habitat into smaller, disconnected patches. Wood turtles do not require home ranges as large as black bears, but they are at risk due to high vehicle mortality rates when crossing roads. Brook trout and Louisiana waterthrush are sensitive to water pollution and excess stream sedimentation.

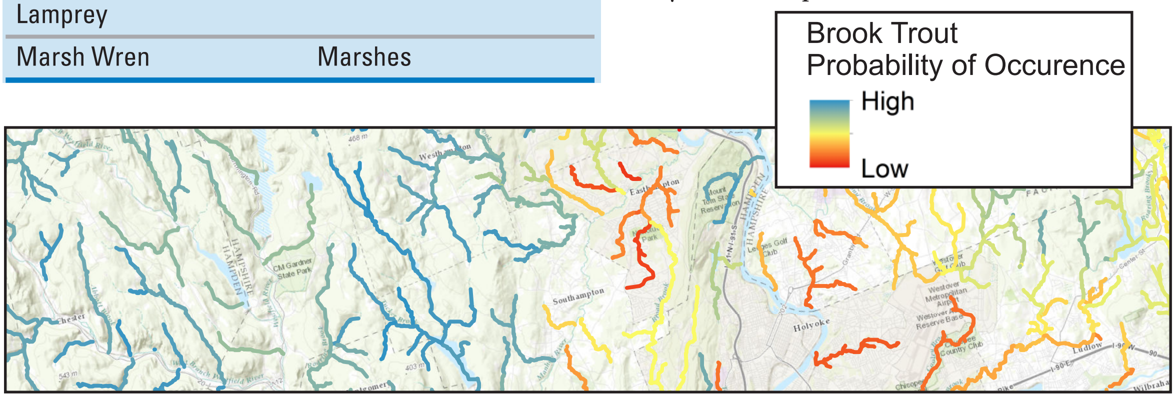
Table 1. Species of fish and wildlife whose habitat is specifically incorporated into *Connect the Connecticut*.

Species	Ecosystem/Habitat Types
Wood Thrush	Mature deciduous forest
American Woodcock, Ruffed Grouse	Young deciduous forest
Black Bear	Large forest blocks
Moose, Blackburnian Warbler	Mixed coniferous and deciduous forest
Blackpoll Warbler	Spruce-fir forest
Prairie Warbler	Pine barrens and young forest
Eastern Meadowlark	Grasslands
Louisiana Waterthrush	Riparian and floodplain forest
Northern Waterthrush, Wood Duck	Forested wetlands
Brook Trout, Wood Turtle	Streams and associated uplands
Alewife, American Shad, Blueback Herring, Shortnose Sturgeon, Sea Lamprey	Rivers
Marsh Wren	Marshes

Eric Engbretson/USFWS

Brook trout depend on cold, clean streams to survive.

The habitat needs of fish and wildlife species were incorporated into *Connect the Connecticut* in one of three ways, depending on the species. First, the five migratory fish species (alewife, American shad, blueback herring, short-nosed sturgeon, sea lamprey) rely on long, uninterrupted stretches of river that allow them to swim upstream from the mouth of the Connecticut River to the areas where they spawn each spring. The full extent of the river network currently used by these species is incorporated into aquatic core areas. Second, brook trout habitat (as identified by USGS) is incorporated into aquatic core areas. The focus is on including the highest quality brook trout habitat -- cold, undegraded streams -- rather than everywhere the species occurs.

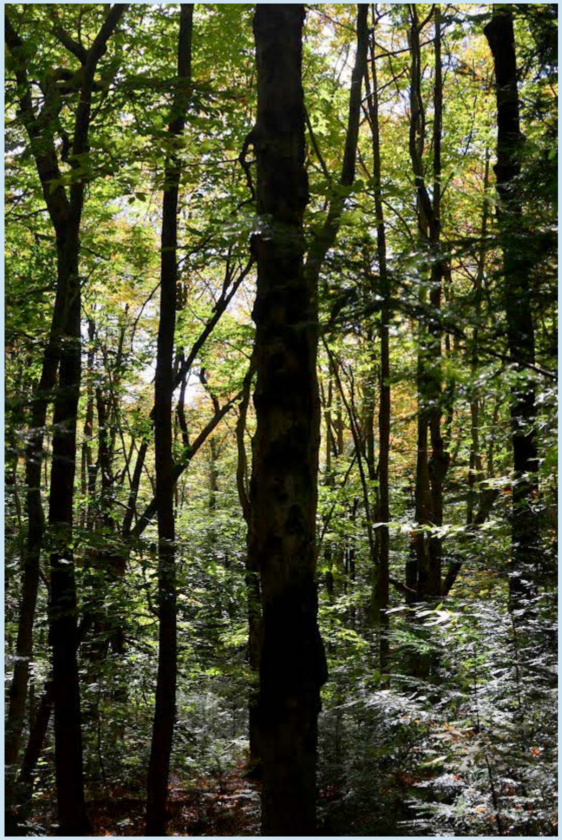


Example of brook trout probability of occurrence results from western Massachusetts.

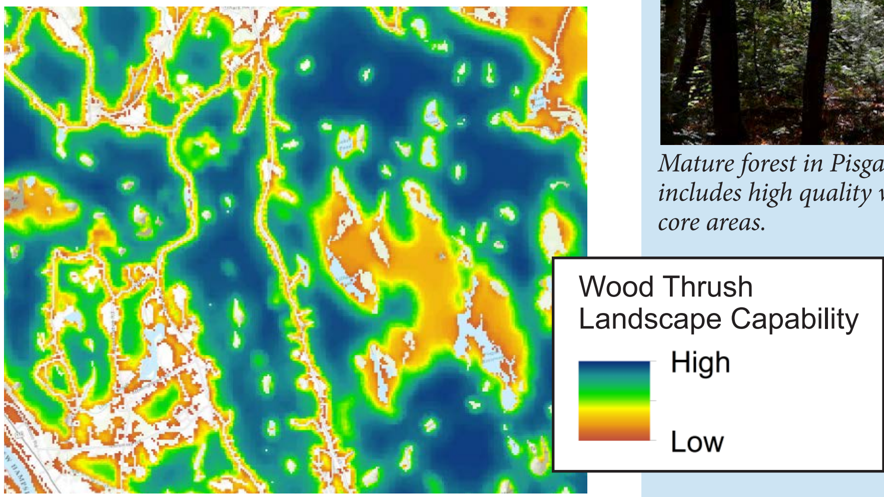
The third and final approach to incorporating wildlife habitat into *Connect the Connecticut* involves considering habitat needs in the development of terrestrial-based core areas. The best habitat for the 14 non-fish representative species has been identified using landscape capability models (developed by UMass) that relate characteristics of the landscape to those places where populations are most abundant or successful.

The *Connect the Connecticut* partnership set relative priorities for conservation action for these wildlife species and their associated habitats. The criteria used in setting priorities are 1) the degree of threat faced by the species both within the watershed and across their ranges; 2) the degree to which their habitat in the watershed is important considering the broader region in which they occur ("regional responsibility"); and 3) their regional rarity. While all the species are considered important, the priority-setting resulted in additional habitat being incorporated into core areas for higher-ranked species such as wood turtle and American woodcock. In addition to taking into account these relative priorities, the process for generating core areas preferentially sought overlapping or adjacent areas where high quality habitat for multiple species occurred. (The only exception, as described in Section 3, is the identification of core areas for grassland birds based on eastern meadowlark habitat.) As a result, the core areas reflect a strategic, efficient approach for simultaneously meeting the needs of many species and therefore differ from a core area network that reflects a single-species management focus.

The wood thrush is a migratory songbird that breeds in mature forests.



Mature forest in Pisgah State Park, NH. This area includes high quality wood thrush habitat and Tier 1 core areas.



Example of wood thrush landscape capability results in southern New Hampshire.

Integrating the Products into Core Areas

The question of how to integrate the important components of ecosystems and species habitats into the terrestrial and aquatic core-connector networks is a crucial one that was the subject of extensive deliberation among the partners and UMass technical team. Several principles that emerged from these discussions guided the resulting design:

- Core areas should encompass a full range and best examples of biodiversity in the watershed, including species and natural communities, and support a multitude of ecosystem functions and services.
- Core areas should be sufficiently large, and situated in an appropriate landscape context, to preserve their long-term resilience.
- Core areas should be well distributed across the Connecticut River watershed to facilitate both short-term movements and long-term range shifts of a diversity of aquatic and terrestrial species.

After reviewing a number of options and draft versions, the partnership agreed on an approach that generated a unified set of terrestrial and aquatic core areas. The process for generating core areas, which is highly technical, is summarized in Box 4.

Grassland bird core areas highlight important habitats for birds such as Eastern Meadowlark.

Box 3. How to Use the Tools – Applications of Individual Datasets Used to Develop the Core-Connector Network

The spatial datasets described in this chapter map important natural resources and can be used in concert with the core-connector network or applied independently. When used with the core-connector network, they can inform the setting of conservation priorities or can provide insights into the types of management that would be most appropriate and beneficial within the core-connector network. Examples of how the datasets can be used by land trusts, agencies, or landowners are described in Table 2.

Table 2. Examples of applications of individual datasets to inform conservation action both within and outside of the Core-Connector Network.

Conservation strategies	Applications using *Connect the Connecticut*
Focus or prioritize protection actions within core areas based on ecological value	Use *species landscape capability, Brook Trout current probability of occurrence,* or the *ecosystem-based core area selection index* to target actions within *terrestrial* or *aquatic core areas* that are of the highest quality for species or ecosystems.
Focus or prioritize protection actions within core areas based on degree of threat	Use datasets of potential future changes (such as *probability of development*) to target the most threatened *terrestrial* or *aquatic core areas.*
Conduct forest protection or management activities that maintain or enhance mature forest structure and intactness	Use *species landscape capability* for species that depend upon mature forest and forest interior habitat, such as Louisiana waterthrush, to identify existing areas of high quality forest habitat value to target forest protection or management
Conduct forest management activities that maintain or enhance young forests.	Use *species landscape capability* for species such as American woodcock and ruffed grouse to target areas of high habitat value for young forest species
Sustain and enhance the functioning of priority floodplains	Target actions to areas with *terrestrial core areas* important to floodplain forest ecosystems that are also near *river and stream cores.* Priority floodplains could be candidates for protection, restoration, and water management actions.
Manage specific fish and wildlife species of conservation concern	Use representative species datasets *(species landscape capability or Brook Trout current probability of occurrence)* identify potential high quality habitats for the modeled species or species that share their habitat. Use the *Index of Ecological Integrity* to identify examples of the most intact and resilient habitats used by the target species.

Box 4. Detailed Technical Summary of Methodology Used to Generate Core Areas

For those who are interested in the technical details of how the algorithmic approach used to create the core areas, a brief introduction is provided here. For an even more detailed account, please refer to the Designing Sustainable Landscapes Technical Documentation by McGarigal et al.

The process for generating **Tier 1 terrestrial core areas** is summarized as follows (see Box 5, opposite page, for illustration):

1. **IEI** (UMass) and **Terrestrial Resilience** (TNC) were combined using a weighted average. All mapped **priority floodplains** and **rare natural communities** were then added, creating a single dataset encompassing the entire watershed. The dataset was **stratified** in such a way that high values occurred in both the northern and southern halves of the watershed, facilitating a well-distributed network of core areas.
2. The top 5% of locations for each ecosystem type in this combined dataset, and the full extent of the priority floodplains and rare natural communities, were identified as **seeds**.
3. **Seeds** above a minimum size (8.9 ac, or 3.6 ha) were then "grown out" to form **core areas** until the total area of cores constituted 20% of the landscape, following rules that growth occurred readily in areas of high ecosystem value but was blocked by major roads and development.
4. The remaining 5% of the landscape -- resulting in core areas that comprise 25% of the landscape -- was identified by including the best remaining wildlife habitat as identified by the **representative species habitat models** (UMass). This approach **optimized** the habitat for multiple species simultaneously (except for grassland birds; see step 5). The decision to allocate only 5% of the landscape using the representative wildlife species was based on factors such as the finding that the first 20% of ecosystem core areas already encompassed much high quality habitat for the wildlife species, rather than a determination that the species were less important than ecosystems in generating core areas.
5. Finally, the **grassland bird core areas** were identified based on the best available 50% of their habitat, using the Eastern Meadowlark habitat model (UMass).

Tier 2 terrestrial cores were generated similarly. **Tier 1 core areas** that were defined using ecosystem data were grown out further until they encompassed an **additional 20%** of the landscape; these new areas became Tier 2 cores. Then additional cores generated using species habitat data were added until Tier 2 cores encompassed 25% of the landscape in total. Tier 2 cores differ from Tier 1 cores in that Tier 2 cores do not contain priority floodplains or rare natural communities, all of which are in Tier 1 cores. Tier 2 cores also contain less highly ranked examples of ecosystems and species habitat, in general. Tier 2 cores were not created for grassland birds.

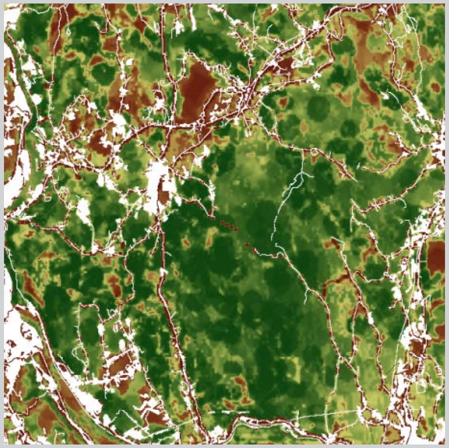
The process for identifying **aquatic core areas** shared some conceptual and technical aspects with the terrestrial process but also reflected elements unique to the aquatic environment. Steps in generating core areas for **rivers and streams** can be summarized as follows:

1. **IEI** (UMass) for streams and rivers was combined with the **Stream Resistance to Temperature Change** dataset (USGS), using a weighted average, to create a single dataset encompassing the entire river network of the Connecticut River watershed. The dataset was **stratified** in such a way that high values occurred in both the northern and southern halves of the watershed, as was done for terrestrial cores.
2. The top 7% of locations in this combined dataset were identified as **seeds** around which core areas are formed.
3. **Seeds** above a minimum size (1.11 ac, or 0.45 ha) were then extended upstream and downstream from the seed until the total length of streams in core areas constituted approximately 20% of the aquatic network, following rules that growth occurred most readily in areas of high ecosystem value but was blocked by dams and inhibited by lakes. Only core areas at least 1 km in length were retained.
4. All of the **identified habitat for the five migratory fish species** (compiled by TNC and U.S. FWS), which consisted of more than half of the mainstem of the Connecticut River as well as portions of its major tributaries, was incorporated into a contiguous aquatic core area.
5. The remaining 5% of the stream network -- resulting in core areas that comprise 25% of the river and stream network -- was identified based on stream reaches that constitute the **best habitat for brook trout** (USGS) not already captured in step 1.

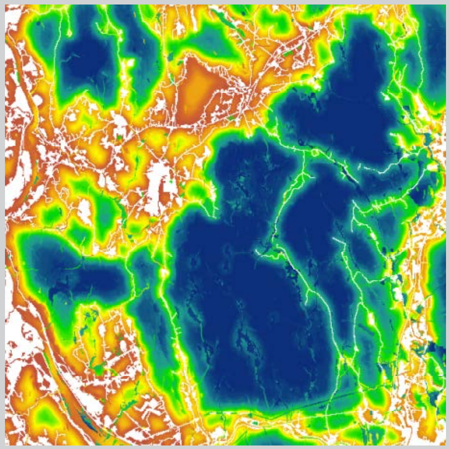
The process for identifying **lake and pond core areas** was simpler than other core areas because the only dataset used was **IEI**. The top 4% of locations of IEI for lakes and ponds served as **seeds** for core areas. If the seed was above a minimum size (1.11 ac, or 0.45 ha), then the entire water body was identified as a core area. IEI was **stratified** to ensure that lakes and ponds were well distributed across both the northern and southern halves of the watershed.

Box 5. Illustration of the methods for generating terrestrial Tier 1 core areas (described in Box 4) for a region centered on Pisgah State Park, New Hampshire

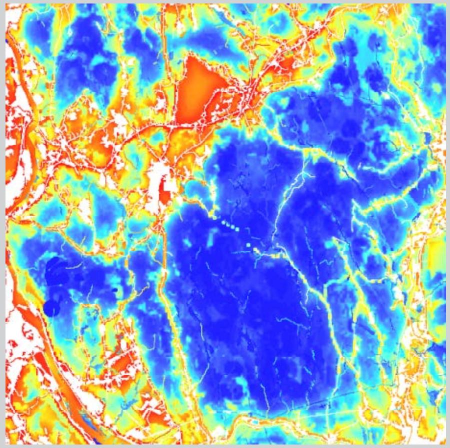
Aerial photo



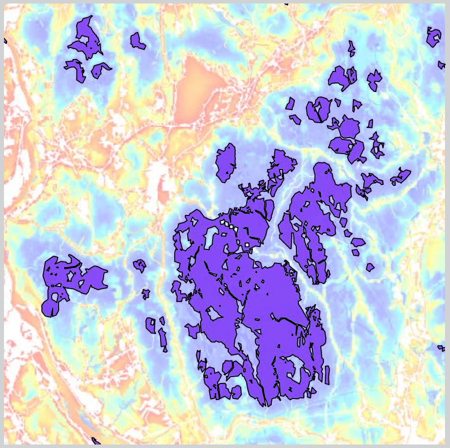
Terrestrial Resilience values



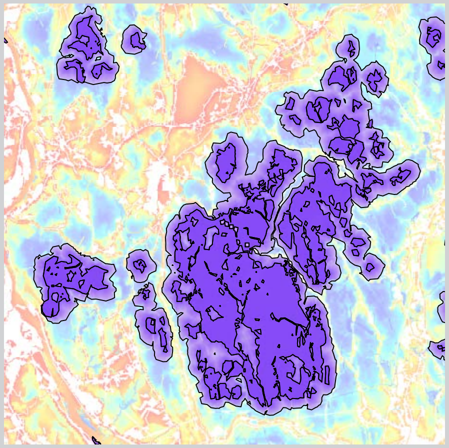
Index of Ecological Integrity (IEI) values



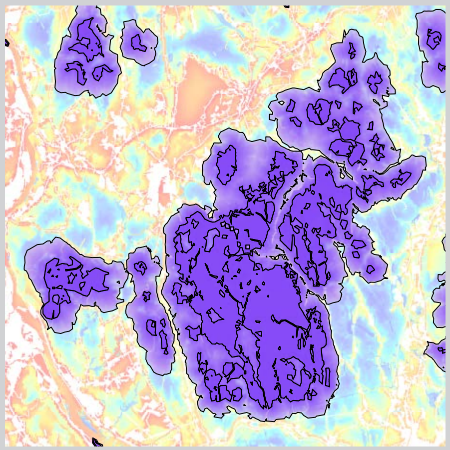
Weighted combination of Terrestrial Resilience and IEI (Step 1)



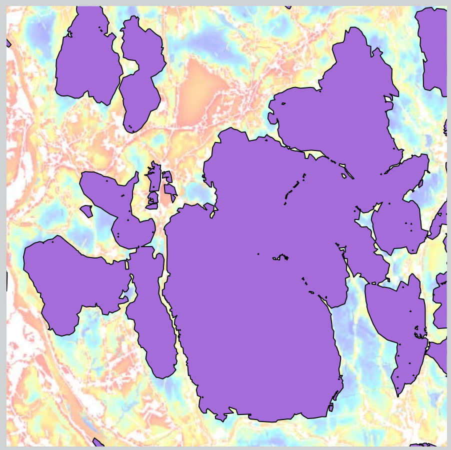
Seeds for core areas (Step 2), based on highest values from Step 1



Beginning growth of core areas from the seeds (Step 3)



Continued growth of core areas (Step 3)



Final core areas including additional high value habitat for wildlife (Steps 4 and 5)

The aquatic and terrestrial core area networks identify areas that are currently of high conservation value due to their importance as fish and wildlife habitat and the intact ecosystems they contain. Protection, stewardship, and management of these areas can help sustain the current natural benefits and ecological services of the watershed. However, such actions alone cannot reverse the decades or even centuries of degradation of the Connecticut River watershed brought by intensive land use, river modification, and resource extraction. But *Connect the Connecticut* also includes tools that can inform efforts to restore lost or diminished connections in both the aquatic and terrestrial realms. Restoration activities can complement conservation action directed toward the core-connector network, improving the overall vitality of the Connecticut River watershed.

The once deeply connected river and stream network of the watershed is now interrupted by more than 2,000 dams and 40,000 culverts that block or interfere with the movements of fish and other aquatic organisms. From the perspective of migratory fish like American shad, the river network is now hundreds of miles shorter than it used to be because they can no longer access large amounts of habitat that formerly served as spawning grounds. For organisms that reside in rivers and streams year round, habitat has been fragmented into hundreds of separated stream segments that impede movement and increase the risk of local extinction of organisms.

Farmington River Watershed Association

Removing dams allows migratory fish to more easily access spawning areas.

Fortunately, techniques exist to mitigate these impacts. Removal, replacement, or upgrades of dams and culverts can restore lost connectivity and help aquatic organisms flourish. Two tools of *Connect the Connecticut* can be used to inform where restoration techniques will be most beneficial:

- The Dam Removal Effects Tool scores more than 1,300 dams across the watershed based on the predicted improvement in aquatic connectivity if the dam were to be removed.
- The Culvert Upgrade Effects Tool scores more than 27,000 road-stream crossings across the watershed based on the predicted improvement in aquatic connectivity if the road crossing were enhanced to allow maximum passability for aquatic organisms.

These tools can best be used in concert with other information to prioritize locations for additional surveys and coupled with field visits to confirm predicted benefits from removals or upgrades. They do not take into account existing benefits of dams, such as storage for drinking water and flood mitigation, or costs of restoration actions. Most road-stream crossings have not yet been assessed in the field, so the Culvert Upgrade Effects Tool relies on assumptions about the type of road crossing structure likely to be present and the likely passability at that crossing. As more road-stream crossings are assessed in the future, the tool will become more and more reliable.

Just as dams and culverts impede the movements of aquatic organisms, the extensive network of roads that crisscrosses the Connecticut River watershed may deter wildlife from freely moving across the landscape and cause mortality to animals that venture into the roadway. *Connect the Connecticut* includes a product to inform efforts to mitigate these risks called the Terrestrial Road Passage Structure Impacts Tool. This terrestrial counterpart to the aquatic restoration tools projects the impacts of installing wildlife-friendly road passage structures. For all roads that are outside of urban areas but receive substantial vehicular traffic, the tool scores potential crossing locations for the benefits of increased terrestrial connectivity that road passage structures could provide. The analysis is based on examining more than 25,000 potential sites for road crossings, evaluating roads at 300 meter increments.

As with the aquatic restoration tools, this tool is best used in combination with other information such as the associated costs and engineering feasibility of road passage structures. The tool may be useful in identifying promising locations for further field surveys.

Connie Prickett/The Nature Conservancy

Wide culverts allow aquatic organisms to more readily pass beneath roads.

Scott Jackson

Road passage structures allow organisms such as turtles and salamanders to access habitat without crossing roads.

SECTION SIX - TOOLS FOR ANTICIPATING AND ADAPTING TO FUTURE CHANGES IN THE WATERSHED

If we can count on anything for the Connecticut River watershed, it is that it will change in the future. Twenty-thousand years ago, the earth's climate was much cooler than today and the entire watershed was buried under a massive ice sheet. The watershed has undergone dramatic and continual changes since then, as glaciers melted and a series of plant communities moved across the landscape, tracking a warming climate. As recently as 150 years ago, the climate of the region was noticeably cooler than at present. The climate is expected to continue to change in the future, accelerated by human-driven alterations of the global environment. The past 300 years have also produced remarkable changes to the landscape wrought by a steadily increasing human population. We can expect that human populations and land use practices in the Connecticut River watershed will continue to change in the future, further altering ecosystems and fish and wildlife populations.

While we cannot be sure of the nature and pace of future change, *Connect the Connecticut* includes tools that provide information about the kinds of changes that may occur. It also incorporates conservation approaches to accommodate and adapt to a variety of possible outcomes.

Tools for understanding potential impacts from future changes in the watershed

Connect the Connecticut provides information on three important types of change that are expected to impact the watershed in future decades: development, climate change, and sea-level rise.

The *probability of development* product depicts the likelihood that new development of varying intensities will occur anywhere in the watershed between now and 2080. The product is based on an urban growth model that combines observed patterns of human development over the past few decades with projections of where and how much the population is likely to grow in the watershed.

Several other products offer insight into the potential impact of climate change on wildlife species and ecosystems. The *climate stress* product projects the degree of stress that ecosystems may experience, based on the degree to which the climate conditions they are expected to experience in 2080 differ from the climate conditions (e.g., air temperature, precipitation patterns) where they are currently found. Additionally, for the representative wildlife species, two products provide information about how their habitat may be affected by climate change. The climate zones product depicts the regions expected to be suitable or unsuitable for the species, from a climate perspective, in 2080. The *climate response* product identifies areas that provide the best habitat today and are likely to continue to be suitable through 2080, considering potential climate change.

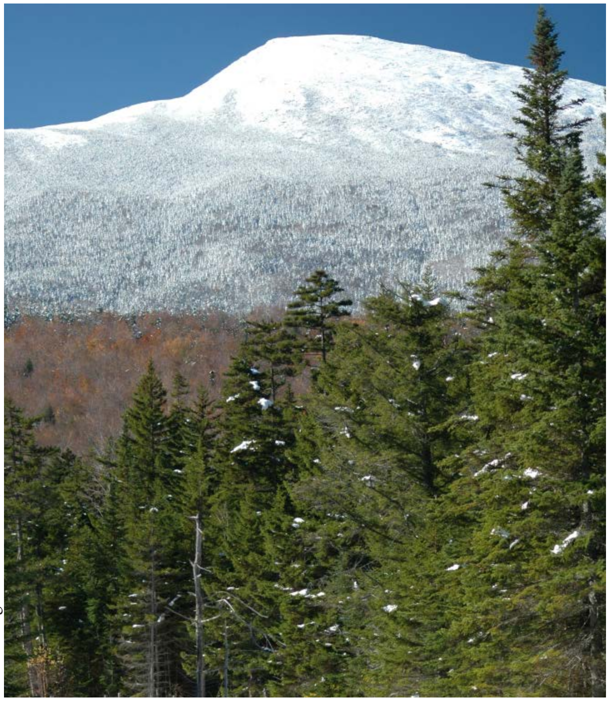
Sea-level rise is another change that will affect coastal and tidal areas along the lower Connecticut River. The *sea-level rise stress* product quantifies the likelihood that areas will be intermittently or permanently inundated by sea-level rise by 2080. It is based on a product developed by the USGS.

Tools for reducing or adapting to future changes in the watershed

Equipped with information about the kinds of changes expected in the future and where they are most likely to be acute, conservation managers can take many steps to 1) reduce or delay their impacts, or 2) facilitate natural adaptation to inevitable changes. This section describes some commonly recommended approaches to address climate change, sea-level rise, and development, and how the *Connect the Connecticut* package can be applied to these approaches.

Worldwide and in the Connecticut River watershed, loss and fragmentation of habitat continue to be among the greatest threats to fish, wildlife, and the ecosystems that support them. *Connect the Connecticut* is intended to inspire and support actions to reduce such threats. As described previously, the core areas, connectors, and supporting landscapes form an interconnected terrestrial and aquatic network to maintain the ecological benefits of the watershed. The *probability of development* product, and several related tools, can identify those locations within the network that appear most vulnerable to future development and consequent impacts from habitat loss or degradation. For example, the *aquatic vulnerability to development* product depicts areas where development, if it proceeds according to modeled projections, is most likely to degrade aquatic core areas. These tools can be used to prioritize actions to prevent degradation of the core-connector network.

Climate change adaptation strategies, which are grounded in sound ecological principles, make conservation sense even if managers are uncertain about the degree and rate of climate change impacts (Table 3).



Mountainous areas, like the White Mountains of N.H., have the potential to provide refugia to animals and plants as the climate changes.

Table 3. How to use *Connect the Connecticut* tools and datasets for climate change adaptation.

Climate change adaptation strategies	Applications using *Connect the Connecticut*
Protect and enhance connectivity to allow plants and animals to respond to changing climatic conditions	Protect the *terrestrial connectors* that link Tier 1 core areas. Apply the restoration tools (*dam removal, culvert upgrade, terrestrial road-passage structures*) to help prioritize restoration of sites to increase aquatic and terrestrial connectivity.
Increase the number and extent of protected areas	Use the *terrestrial core-connector network*, and *lake and pond cores*, and *river and stream cores* in prioritizing locations for additional protection or stewardship.
Implement an ecologically-connected network of terrestrial, freshwater, and coastal conservation areas resilient to climate change	Protect the terrestrial *terrestrial core-connector network*, and *lake and pond cores*, and *river and stream cores*, which are designed to comprise such an ecologically connected and resilient network. Apply the restoration tools in increasing connectivity.
Protect climate refugia (areas least likely to undergo rapid changes due to climate)	Use the *species climate response* and *climate zones*, *Brook trout climate response*, ecosystem *climate stress* products, and *stream resistance to temperature change*, in combination with the *core-connector network* (which incorporates areas resilient to future change) in prioritizing potential climate refugia for additional protection or stewardship.
Conserve geophysical diversity (a diversity of landscape units defined by geology, elevation and landforms), which helps maintain biodiversity	Protect *terrestrial core areas*, which incorporate geophysical diversity, in part through the *terrestrial sites of high resilience* product. The latter product can also be used on its own in conserving geophysical diversity.
Reduce threats to species from sources other than climate change	To reduce threats from fragmentation and development, protect the terrestrial *core-connector network, lake and pond cores*, and *river and stream cores*. Individual species *landscape capability models* and products showing where development is most likely to occur can inform actions for targeted species.
Facilitate migration or retreat of ecosystems and species threatened by sea level rise	Protect areas adjacent to those identified as being under stress from sea level rise and manage the areas to facilitate migration or colonization of the sites by coastal ecosystems. The *core-connector network* and *Index of Ecological Integrity* can also be used in prioritizing such locations for action.

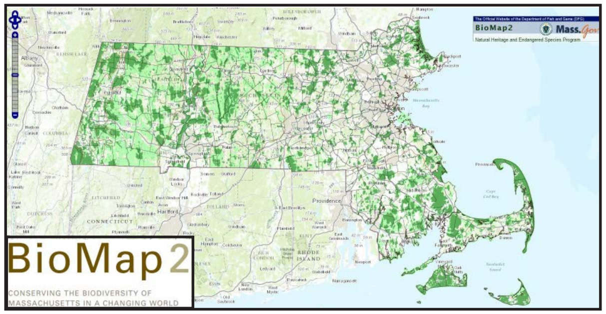
The *Connect the Connecticut* website (connecttheconnecticut.org) provides more information and access to all of the datasets described in this report. It also includes contact information for any additional questions that users may have. Users who are ready to go directly to online maps of the datasets described here can view or download them from the Conservation Planning Atlas gallery hosted by the North Atlantic LCC, however, we encourage users to begin with the *Connect the Connecticut* website.

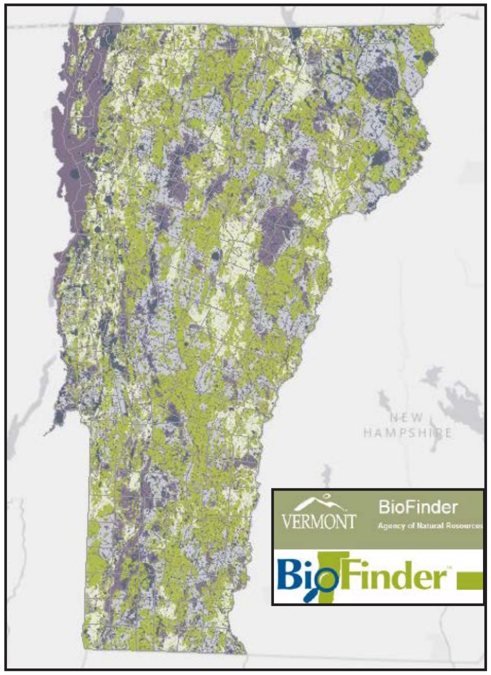
Connect the Connecticut is intended to complement, but not replace, other valuable sources of information about the occurrence and importance of ecosystems and habitats for fish, wildlife, and plants in the Connecticut River watershed. Areas identified as being of high value by both *Connect the Connecticut* and independent evaluations may be especially promising candidates for conservation action. Notable datasets and sources of information include the following:

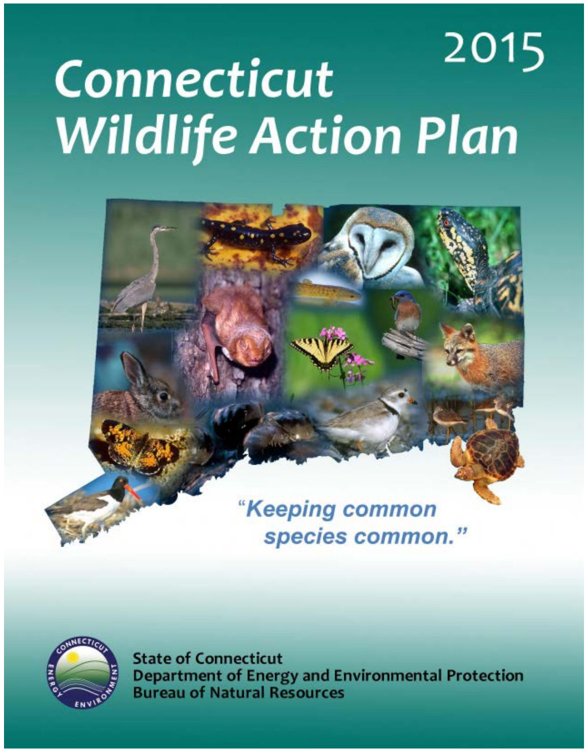
Massachusetts BioMap2. *BioMap2* is designed to guide strategic biodiversity conservation in Massachusetts by focusing land protection and stewardship on the areas that are most critical for ensuring the long-term persistence of rare and other native species and their habitats, exemplary natural communities,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

Biofinder (Vermont). *BioFinder* was created by the Vermont Agency of Natural Resources with help of its partners to provide citizens with a tool to explore the distribution and richness of Vermont's biodiversity and help secure our natural heritage for future generations. BioFinder is an interactive mapping tool that can be used in many different situations from exploring a possible development site to teaching students more about their natural heritage. Website: http://biofinder.vt.gov/biofindermap.htm.

State Wildlife Action Plans. In 2001, Congress charged each state with developing a statewide Comprehensive Wildlife Conservation Strategy (State Wildlife Action Plan) in order to strategically invest federal wildlife conservation grants. The goal of State Wildlife Action Plans (SWAPs) is to conserve fish and wildlife and their vital habitats proactively before they become more rare and costly to restore. The first round of plans was completed in 2005. As of spring 2016, a second round of plans is being completed. The revised SWAP for Connecticut has been finalized and the revised versions for Massachusetts, New Hampshire, and Vermont are in review.







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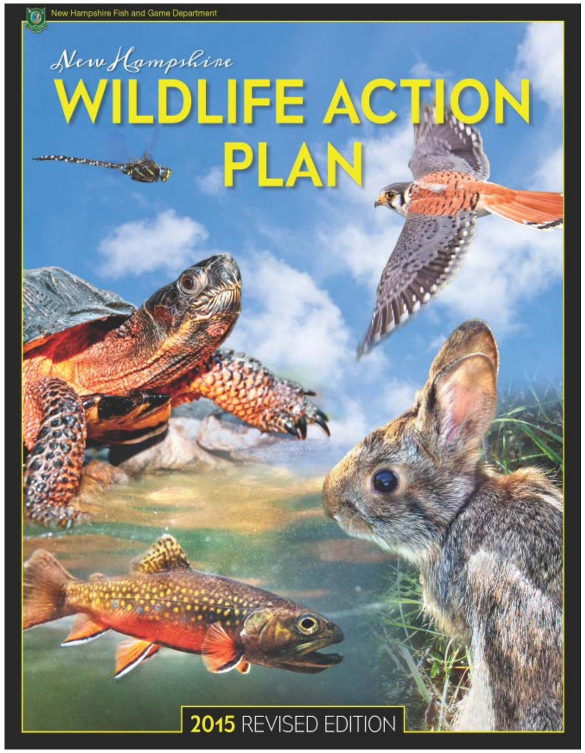

2015 New Hampshire Wildlife Action Plan


Al Braden

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http://connecttheconnecticut.org/