Chapter 2 / Land Conservation between 2005 and 2013

Land conservation in Massachusetts has reached a major milestone since the last edition of *Losing Ground*: thanks to the tireless work of a dedicated public and private land conservation community, more than one-quarter of the state is now permanently protected. As of April 2013, permanently protected land for all purposes totals 1,259,075 acres, representing 25.2 percent of the land area of the state. Of these acres, 91 percent are conserved as natural and agricultural land, with the balance protected for recreational, cultural, historic, and other values. This milestone is especially impressive considering that Massachusetts is the third most densely populated state in the country. Meeting this threshold is a moment for celebration and reflection, but only a moment; the pace of development is likely to accelerate again, and to meet the goals for land conservation expressed in documents such as Harvard Forest's *Wildlands and Woodlands*[5] our efforts to protect land must be redoubled.

Land is protected by many entities and for many reasons in Massachusetts. The largest conservation landowners are state environmental agencies, cities and towns, various not-for-profit organizations including land trusts, and the federal government. In addition, nearly 200,000 acres are protected by thousands of private landowners who have restricted use of their land via permanent conservation restrictions and other legal mechanisms limiting development potential.

The extensive network of protected land in Massachusetts contributes in many ways to our quality of life and supports the rich heritage of outdoor recreation that is an important part of life for so many in the Commonwealth. Land is protected for agriculture, the basis of the local food movement that is redefining how we shop and eat, and for forest products including fuelwood and lumber. Land is also protected expressly for drinking-water protection, most notably around the Quabbin Reservoir, Ware River watershed, and Wachusett Reservoir; but also around the lakes, reservoirs, and wells maintained by cities and towns throughout the state. Careful stewardship of these acres offsets the vast sums that would be needed to build or enhance water treatment systems.

Land is protected for active recreation in our parks and playgrounds, for preservation of historic structures and landscapes, and for our final resting places in cemeteries and churchyards. From the water we drink to the air we breathe to the space we need from cradle to grave, protected and well-tended land is essential to nearly every aspect of our modern lives.

Land is protected for the ecosystem services that undeveloped acres provide including plant and wildlife habitat, soil retention, air purification, water filtration, attenuation of storm runoff, and carbon sequestration. The Trust for Public Land's *The Return on Investment in Parks and Open Space in Massachusetts*[6] reported that every dollar invested in land conservation returns four dollars in economic value of natural goods and services.

A 20-year investment of $130 million for land protection around the Quabbin and Wachusett Reservoirs has avoided a cost of $280 million for water filtration.[7]

PROTECTED AND RECREATIONAL OPEN SPACE DATASET

The best source of information on the state of land protection in Massachusetts continues to be the Protected and Recreational OpenSpace data available from MassGIS. This is a Geographic Information Systems (GIS) database, continually updated by the Executive Office of Energy & Environmental Affairs staff to improve completeness and spatial accuracy. Our calculations are based on all lands coded as permanently protected in this dataset (minus land under water). As useful as this database is, it requires constant input from the land protection community. All entities involved in land protection should work closely with the Executive Office of Energy & Environmental Affairs to ensure that their holdings are up-to-date and accurately depicted. For more information on submitting information, contact Benjamin Smith at benjamin.smith@state.ma.us.

Who owns our protected lands?

Keeping these various landowners and purposes for land protection in mind, it is instructive to look at which entities are protecting which type of land. Table 2.1 presents the total permanently protected acreage in Massachusetts by type of ownership and primary purpose of protection. Land set aside for conservation purposes is far and away the largest category. These properties include most state parks and state forests, wildlife management areas, town forests, land trust holdings, and large federal sites such as the Cape Cod National Seashore. These properties are usually managed for multiple values including passive recreation, forestry, and wildlife habitat.

Table 2.1: Type of ownership and primary purpose of all permanently protected land in Massachusetts as of April 2013, in acres

	State	Municipal/ County	Private w/Restriction	Not-for-profit	Federal	Other	All Owners
Conservation	465,768	166,049	110,587	131,117	52,809	297	926,627
Water Supply	100,542	99,156	5,891	396	2,282	6,460	214,726
Agriculture	1,158	817	66,155	3,440		34	71,605
Recreation	3,826	27,522	1,016	1,015	881	15	34,276
Historic/Cultural	31	612	421	536	832		2,433
Other	1,942	2,299	133	278	4,755	1	9,408
All Purposes	573,268	296,456	184,203	136,782	61,559	6,806	1,259,075

The water supply category includes state holdings around the Quabbin and Wachusett Reservoirs and the Ware River watershed with nearly equal acreage held in widely distributed municipal lands. The recreation category includes actively used parks and playgrounds. Historic and cultural acres include cemeteries, heritage parks, and Minuteman National Historical Park, among other sites. The "Other" category of land type includes urban parks and some U.S. Army Corps of Engineers holdings.

PERMANENTLY PROTECTED OPEN SPACE IN MASSACHUSETTS

State and municipal conservation properties are usually accorded protection through Article 97 of the State Constitution, which prohibits conversion to other uses without legislative and town approval. The "private with restriction" lands included here are all protected by some form of perpetual easement or restriction held by another entity. The most common forms of these protections are the conservation restriction (CR) and the agricultural preservation restriction (APR). In either case, conservation goals can be achieved without requiring a transfer of ownership or removal from the tax rolls. Under these "less-than-fee" protection mechanisms, the landowner agrees to limit use of the land to activities agreed upon in the restriction, which is a legal document approved by the state Secretary of Energy and Environment and the municipal Board of Selectmen or City Council where the property is located, and then recorded in the registry of deeds. The restriction is granted (sold or donated) to a conservation entity such as a land trust, state agency, or municipality, which then has responsibility to regularly monitor the land to ensure that its use over time is consistent with the restriction. The land is permanently protected by the restriction, even when it is sold to another party.

Tables 2.2a and 2.2b present the information in Table 2.1 as percentages. Table 2.2a illustrates how the acres in each primary purpose category are distributed among the various types of landowner. Table 2.2b shows how each type of landowner's acres are distributed among the various categories.

Table 2.2a: Percentage of each primary purpose category by ownership type

	State	Municipal/ County	Private w/Restriction	Not-for-profit	Federal	Other	All Owners
Conservation	50%	18%	12%	14%	6%	0%	100%
Water Supply	47%	46%	3%	0%	1%	3%	100%
Agriculture	2%	1%	92%	5%	0%	0%	100%
Recreation	11%	80%	3%	3%	3%	0%	100%
Historic/Cultural	1%	25%	17%	22%	34%	0%	100%
Other	21%	24%	1%	3%	51%	0%	100%
All Purposes	46%	24%	15%	11%	5%	1%	100%

As seen in the "All Purposes" totals row of Table 2.2a, the Commonwealth owns the largest share of conserved land, nearly half (46 percent) of all permanently protected land in the state, mainly through the Department of Conservation and Recreation (state parks, water supply protection areas, recreation areas, etc.) and the Department of Fish and Game (primarily wildlife management areas). Agencies protect 50 percent of all land held primarily for conservation purposes. Ownership of water supply land is dominated by and nearly evenly divided between the state and municipalities. Protected agricultural land is almost entirely privately owned with restrictions held by the Massachusetts Department of Agricultural Resources. The "Other" category of land includes urban parks and land owned by the U.S. Army Corps of Engineers for flood control.

Table 2.2b: Percentage of each ownership type by primary purpose

	State	Municipal/ County	Private w/Restriction	Not-for-profit	Federal	Other	All Owners
Conservation	81%	56%	60%	96%	86%	4%	74%
Water Supply	18%	33%	3%	0%	4%	95%	17%
Agriculture	0%	0%	36%	3%	0%	0%	6%
Recreation	1%	9%	1%	1%	1%	0%	3%
Historic/Cultural	0%	0%	0%	0%	1%	0%	0%
Other	0%	1%	0%	0%	8%	0%	1%
All Purposes	100%	100%	100%	100%	100%	100%	100%

As shown in Table 2.2b, nearly three-quarters of permanently protected land is intended for conservation and passive recreation. State agencies are clearly protecting land for conservation and passive recreation as well as for water supply. Municipalities acquire land for largely the same purposes, with a bit more emphasis on water supply, as well as a substantial fraction for recreation. Not-for-profit and federal lands are also predominantly held for conservation. Restrictions over privately held lands are primarily intended for conservation and agricultural purposes.

Land Protection, 2005-2013

According to the MassGIS open space dataset, from April 2005 through April 2013, the same period as our land use change analysis, 120,389 acres of land were permanently protected, or *10 percent of all land that has ever been conserved in the state*. This represents a pace of 41 acres per day, more than three times the estimated pace of development.

Table 2.3: Newly protected acres by type of ownership and primary purpose from April 2005 to April 2013

	State	Municipal/ County	Private w/Restriction	Not-for-profit	Federal	Other	Total
Conservation	29,510	25,070	34,385	12,838	10	21	101,834
Agriculture		125	11,838	604			12,567
Water Supply	914	1,889	2,263	37			5,103
Recreation		835	2				837
Other		27	3				30
Historic & Cultural	1		7	10			18
Total	30,425	27,946	48,498	13,489	10	21	120,389

Table 2.3 shows that placing a restriction over privately owned land has become the most common form of land protection. This is likely due, at least in part, to the significant federal income tax incentives that have been in place for most of this period for conservation of private land through donation or bargain sale of some form of restriction. Conservation restrictions are also highly practical and flexible documents; they do not require a transfer of title, and they accommodate a variety of sustainable land uses, including forestry, agriculture, and even limited development. State agencies, cities and towns, and not-for-profits make up the other major forms of ownership. Conservation and passive recreation continue to be the dominant primary purposes; and the proportion of land being protected in this category is increasing: where 72 percent of all land protected before 2005 is in this category, between 2005 and 2013, over 84 percent of all protected acres were in this category. Agricultural land, almost all in the form of private land covered by an agricultural preservation restriction, is the second most common primary purpose for land protection in this period.

Figure 2.1: Newly protected acres by primary purpose expressed as acres per day, April 1, 2005*, to April 30, 2013**

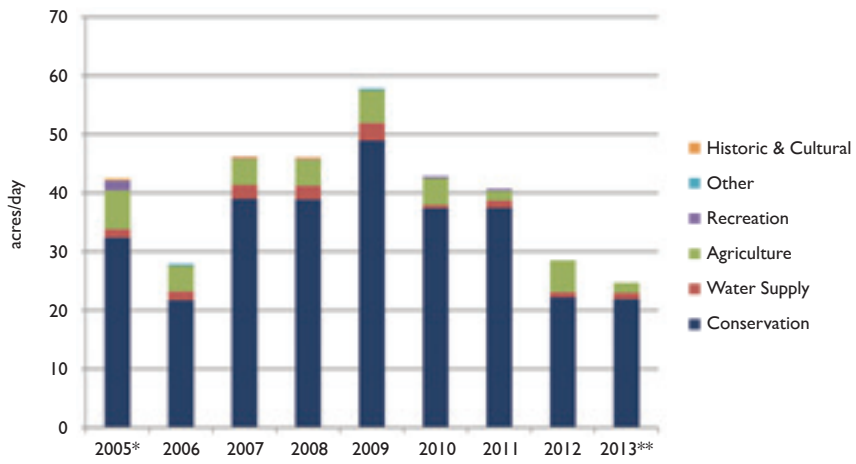


Figure 2.1 shows that the rate of land protection is not constant within the period of our analysis. The pace picked up dramatically in 2007, reflecting a renewed commitment to land protection at the state level under the administration of Governor Deval Patrick. Between 2007 and 2013, the administration's investment of $280 million in land conservation resulted in the permanent protection of 100,000 acres of land and the creation of 150 new parks across the Commonwealth. The Executive Office of Energy & Environmental Affairs (EEA) provided 1,200 grants to municipalities and land trusts and EEA's agencies—Department of Agricultural Resources, Department of Conservation and Recreation, and Department of Fish and Game—completed hundreds of conservation acquisitions.[8]

Figure 2.2: Newly protected acres by type of owner expressed as acres per day, April 1, 2005*, to April 30, 2013**

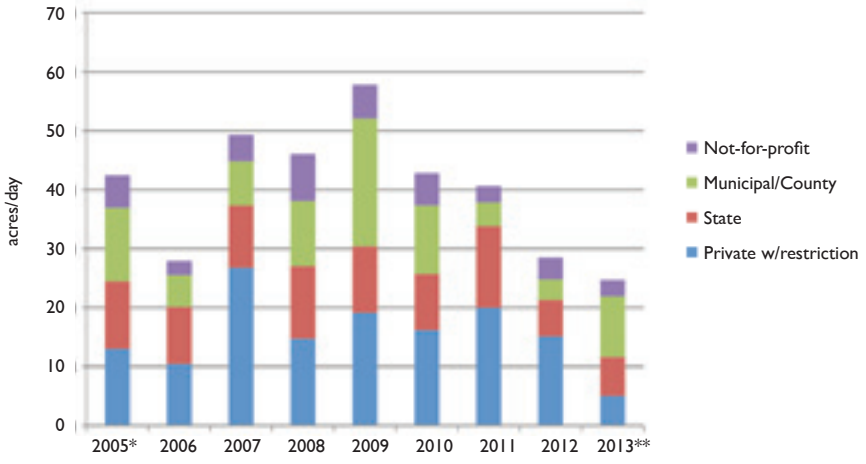


Figure 2.2 illustrates the relative importance of restricted private land and land protection by cities and towns in recent years. The 2009 peak in land protection activity was largely driven by a doubling of municipal acres from the previous year. While presenting this data as acres per day allows us to include only portions of 2005 and 2013 on the same scale, it is important to remember for 2013 that many projects are completed toward the end of the state's fiscal year in June or at the end of the tax year in December.

Figure 2.3: Ownership of land protected between April 2005 and April 2013. Bars indicate percent of all land protected through restrictions held by the various entities.

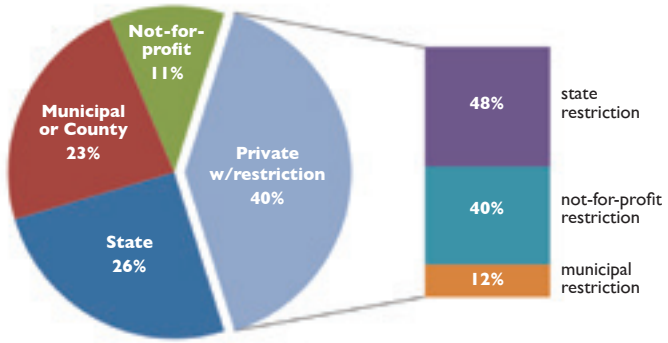


Figure 2.3 shows that restrictions over private lands represent 40 percent of all acres protected within the period of our analysis. Of those restricted acres, the largest share (48 percent) is protected by state agencies, with not-for-profits holding a nearly equal share (40 percent), and cities and towns holding a smaller proportion (12 percent). State agencies and municipalities were most active in direct acquisition of protected land, each representing roughly a quarter of all activity between 2005 and 2013.

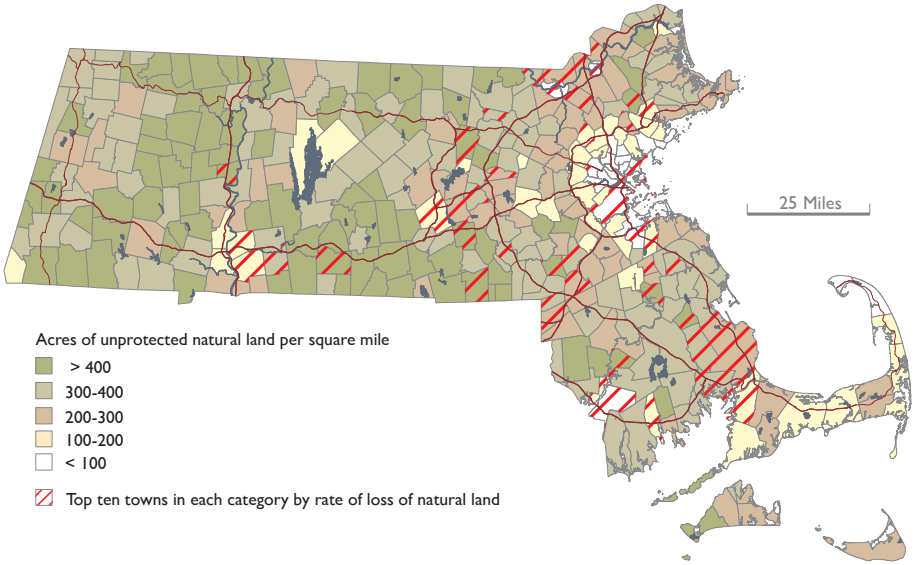
Where is natural land most under threat?

While the impressive rate of land protection between 2005 and 2013 is an encouraging sign, many acres remain at risk of being developed. Figure 2.4 shows that many towns in northern and southern Worcester County and the Berkshire hilltowns have more than 400 acres of unprotected natural land per square mile of town area. The red hatching in Figure 2.4 indicates that the towns in this category seeing the most rapid rates of development largely fall within the I-495 belt, each actually one town removed from the highway itself. Rapid development in these towns threatens opportunities for relatively large-scale land protection within each community.

Towns with 200 to 400 acres of unprotected natural land per square mile include suburban towns that retain a rural character and smaller towns in western Massachusetts, many of which already have large state forests or other protected areas. Those seeing the highest rate of development are clustered along the I-495 belt west of Boston. Municipalities with fewer than 200 acres of unprotected natural land include the inner suburbs of Boston and Springfield, small towns throughout the state, and towns on the outer Cape with large proportions protected by the Cape Cod National Seashore.

The land conservation community in Massachusetts, with exemplary leadership and funding support by Governor Patrick, the state legislature, and the Executive Office of Energy & Environmental Affairs, has made impressive gains in land conservation since 2005. More than one-quarter of the state is now permanently protected from development. These acres provide wildlife habitat, farmland, recreational opportunities, and critical ecosystem services and will continue to do so for generations to come. However, we cannot rest on the laurels of these accomplishments, because there are still more than 2.5 million acres of undeveloped, unprotected land across the state. As the Great Recession abates and development picks up, sustained and targeted land protection work remains critical.

Figure 2.4: Massachusetts towns classed by acres of unprotected natural land per square mile of town area. Towns with the highest rates of development in each class are indicated with red hatching.



Chapter 3 / Critical Landscapes: Resilience and *BioMap2*

The pattern and pace of development in Massachusetts influence the state's long-term ecological integrity and constrain opportunities for effective land management and protection. Land use planning can direct development and conservation toward the most appropriate locations for each and can guide decisions when conflict occurs. To be successful, however, planning frameworks must include the best available information on a range of factors, spanning social, economic, and biological domains.

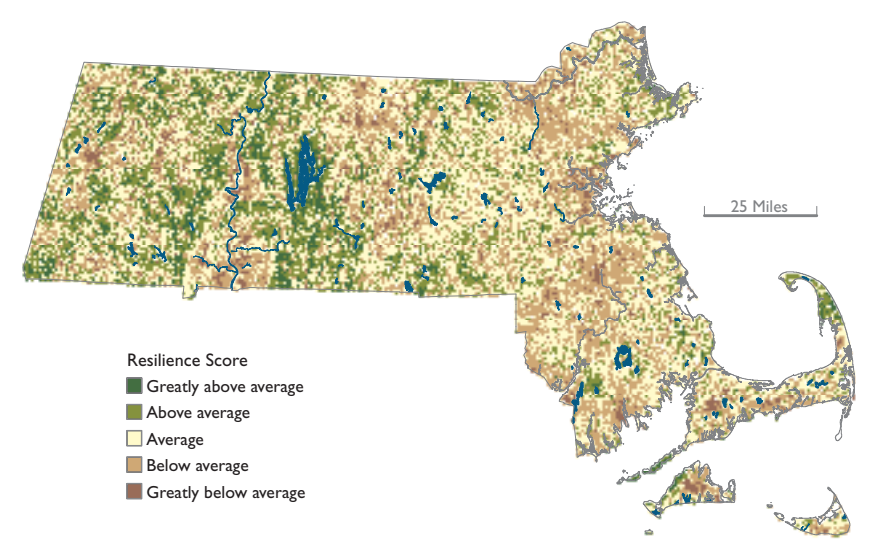
Human-caused climate change has emerged as one of the greatest environmental issues of our time, but currently few tools are being applied to incorporate climate change adaptation into land use decisions at the municipal level, where most land use decisions are made in Massachusetts. *BioMap2*,[9] a joint project of the Massachusetts Natural Heritage and Endangered Species Program and The Nature Conservancy (TNC), and a new TNC terrestrial climate change resilience model[10] address this gap. These two complementary approaches identify areas of the state that are—and are likely to remain—the most important for ensuring the long-term ecological health of the Commonwealth.

Although the Great Recession slowed the pace of development between 2005 and 2013 relative to preceding years, land continued to be developed in Massachusetts through this period at a rate of approximately 13 acres per day. Some of this development can be considered "smart growth"—for example, compact residential and commercial building concentrated around transportation hubs and brownfield sites that have been redeveloped. Another portion of this development, however, has occurred within areas that are critical for the conservation of Massachusetts' biodiversity. Across the Commonwealth, more than 2,500 acres of *BioMap2* Core Habitat, 2,400 acres of *BioMap2* Critical Natural Landscape, and 1,600 acres of highly climate-change resilient land were developed between 2005 and 2013 (some of these areas overlap), reducing the state's long-term ecological health and diminishing residents' quality of life. Additionally, the previous edition of *Losing Ground* showed that for each acre developed, the ecological integrity of several more acres of natural lands was diminished.

CONSERVATION IN A CLIMATE CHANGING WORLD

A long-standing approach to land conservation has rested on the idea of a *fine filter*, which means that parcels of land hosting populations of one or more rare species would be acquired by a conservation entity and managed for the benefit of those populations. The fine filter approach has been complemented by the *coarse filter*—rather than targeting individual species, acquisition and management have targeted natural communities, or assemblages of species and their habitats. Climate change challenges both the fine and coarse filter approaches because species ranges are generally shifting in latitude and/or elevation in response to increased temperature; even if managed skillfully, a specific parcel may no longer be able to host a species of conservation interest as a result of a fundamental change in climate. Recognizing this difficulty, TNC ecologists are turning to a new conservation approach based on relatively stable landscape features that are important for biodiversity, regardless of climate. This *enduring features* approach maintains that certain areas of the landscape, characterized by bedrock type, surficial geology, landform diversity, landscape connectivity, and other factors, inherently host diverse ecosystems with the flexibility to adapt. Conserving these areas will protect a wide range of species come what may.

Figure 3.1: TNC Resilient Landscapes (scaled to Massachusetts)

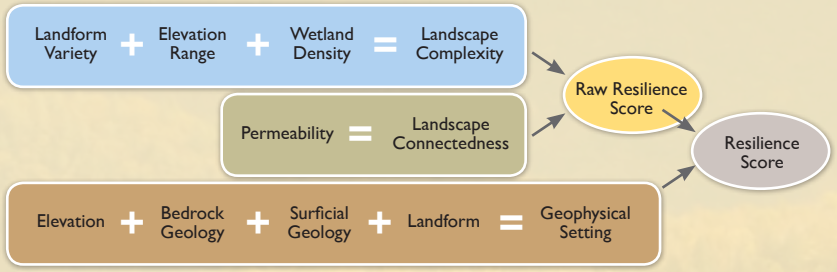


MASSACHUSETTS TERRESTRIAL CLIMATE CHANGE RESILIENCE

Resilience is the ability of a system to continue to recover from disturbance. Many factors influence the resilience of any particular system, and in ecology two main factors are diversity and connectivity. The Nature Conservancy's Eastern Conservation Science Center has developed a complex geographical analysis to model the most resilient landscapes in the Northeast, Mid-Atlantic, and Southeast regions of North America. This analysis provides a tool for focusing conservation efforts on the areas where conservation is most likely to have long-term success in a climate changing world. The regional resilience analysis covers 22 states in the eastern United States as well as Canada's Maritime Provinces. For this edition of *Losing Ground*, we worked with TNC's Massachusetts Program to downscale the regional analysis to the state scale, using more detailed information than in the regional analysis when it was available.

At its core, the resilience analysis combines measures of landscape diversity—called complexity in this context—and connectedness to indicate patterns of long-term ecological function. Resilient areas are expected to be those that offer a range of well-connected microhabitats along an elevation gradient, allowing organisms to move among and seek out new areas in response to changing conditions. Importantly, to create the final statewide resilience model, raw results were scaled within each geophysical setting, defined by landform, elevation, and geologic information. This ensured that the model captures the full breadth of geophysical settings (places like limestone valleys, mid-elevation granitic landscapes, and sandy coastal plains) that are represented in Massachusetts, and are the underlying drivers of biodiversity. The final analysis therefore estimates the resilience of lands relative to all results within each geophysical setting. A conceptual map of the resilience model is presented in Figure 3.2.

Figure 3.2: Conceptual map of the TNC resilience model



While the specific details of calculation inputs, processing steps, and other decisions are provided in the *Losing Ground* technical document, the basic method for developing the Massachusetts resilience dataset included defining a set of 20 geophysical settings, creating Massachusetts-specific landscape complexity and landscape connectedness layers, calculating resilience scores, and stratifying resilience scores by geophysical setting . (TNC's report *Resilient Sites for Terrestrial Conservation in the Northeast and Mid-Atlantic Region* more fully describes the concepts and methods used in the resilience analysis.) The land use dataset that was used to generate the permeability/connectedness data was from 2006, early in our 2005 to 2013 analysis window; development prior to 2006 is therefore already accounted for in the resilience model.

Figure 3.3: Development within Resilient Lands, 2005-2013

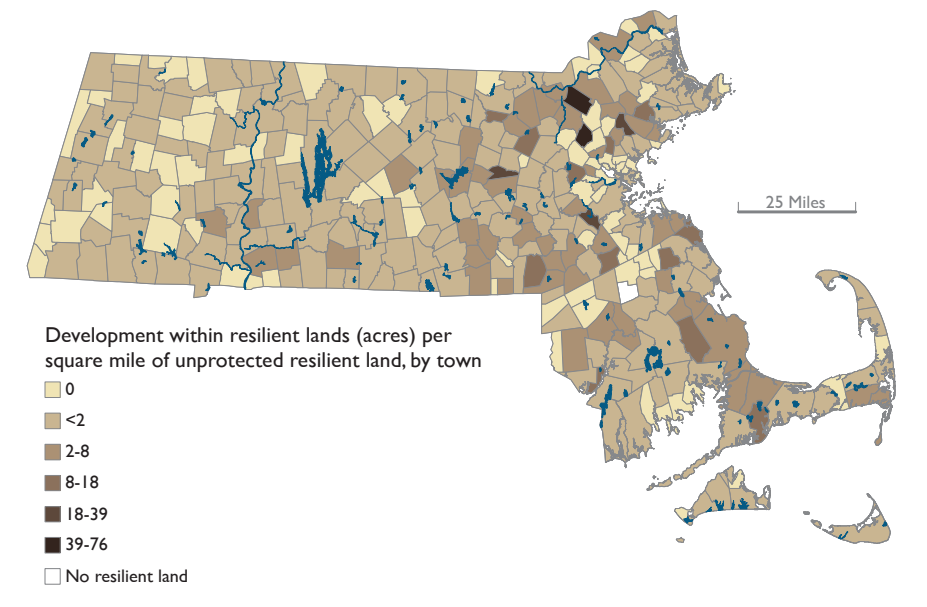
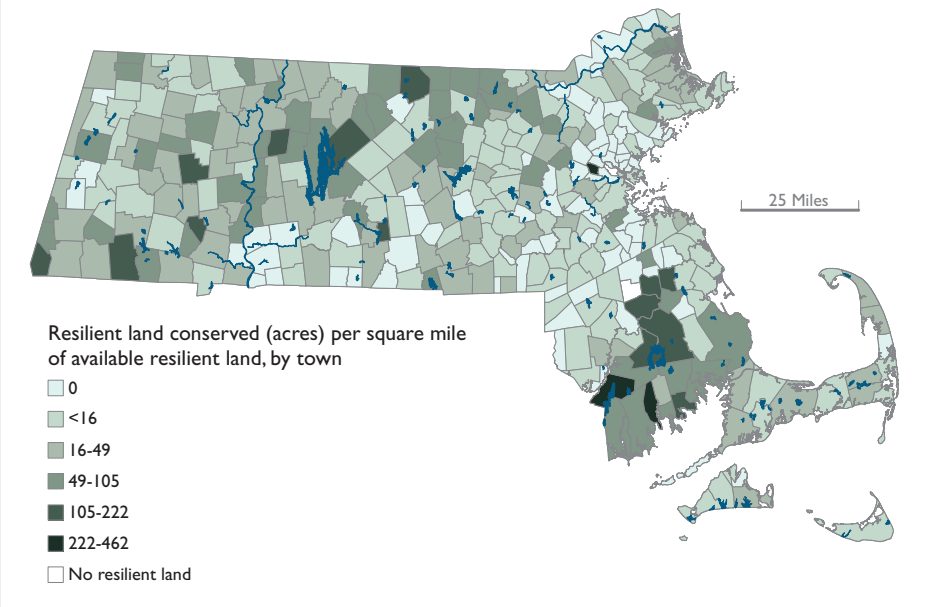


Figure 3.4: Land Protection within Resilient Lands, 2005-2013



Based on the land use change analysis described in Chapter 1, development within potentially developable highly resilient land has generally been minimal between 2005 and 2013 (Figure 3.3). Only 1,600 acres of highly resilient land were lost to development out of approximately 1.4 million highly resilient acres in the state. The general pattern of resilient land development largely echoes that of natural land conversion: most of the municipalities with higher rates of resilient land loss are within 10 miles of I-495. On an absolute basis, southeastern Plymouth County—Plymouth, Carver, Middleboro, and Plympton—had the greatest concentration of development on resilient land developed during this period.

It must be noted that the reported number of resilient acres lost to development should be considered a conservative estimate rather than an absolute. Inherent limitations in the land use change analysis, as well as a straightforward method of assessing the effects of development on resilience, likely result in an underestimate of the true impact of development on terrestrial resilience. Nevertheless, assuming that errors are spread evenly across the state, comparisons between communities and regions in the state are informative. This qualification also applies to the following analyses of *BioMap2* Core Habitat and Critical Natural Landscape.

The examples of Tewksbury and Burlington—the two communities with the highest rate of resilient land development during the 2005 to 2013 period—serve to illustrate the general pattern of greater resilient land development in eastern Massachusetts relative to western Massachusetts. In each of these communities, a single development (a residential subdivision and commercial development, respectively) affected a substantial portion of the small total area of resilient land in that town. The development of these areas marks an important transition: the remaining natural areas in these towns are less likely to be able to support a high level of biodiversity and certain ecosystem processes in the long term because they are insufficiently complex and/or connected in the landscape to function as they did in the past.

In contrast to the modest pace of development of highly resilient lands from 2005 to 2013, the pace of land protection of highly resilient lands was tremendous, with more than 48,000 acres of highly resilient land permanently protected. Newly conserved resilient land is scattered around the Commonwealth, but a large portion of the permanently protected acreage is associated with relatively few transactions, most of which involve augmenting existing state landholdings. The cooperation among municipalities, land trusts, and other partners with the state

Figure 3.5: Undeveloped and Unprotected Resilient Land, 2013

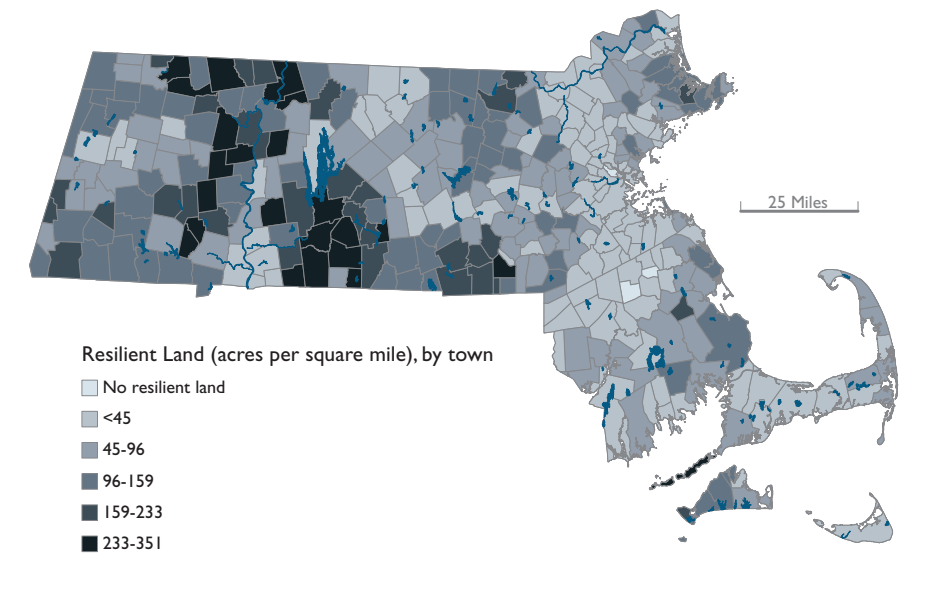
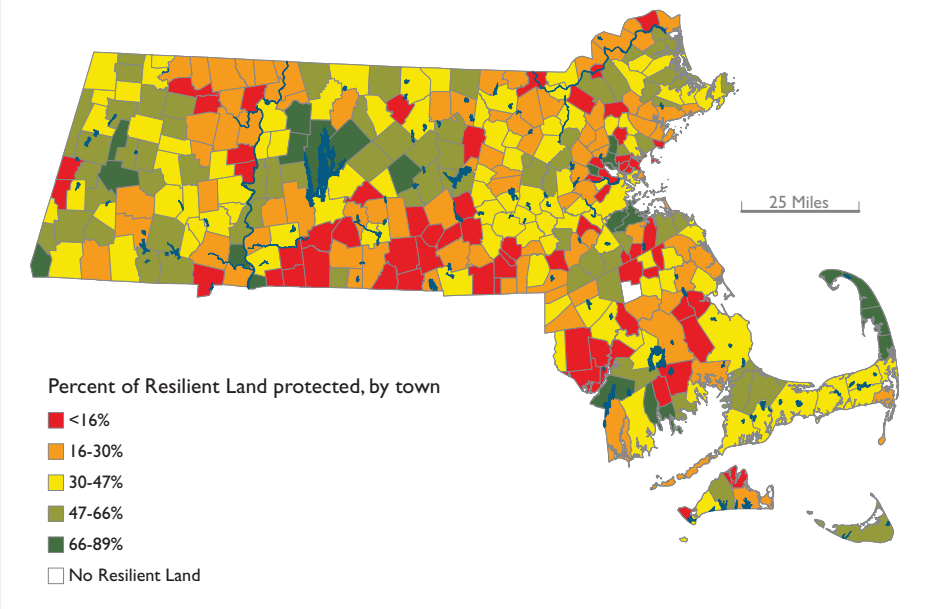


Figure 3.6: Protected Resilient Land, 2013



in this effort is also notable. For example, the two projects resulting in the greatest amount of newly conserved resilient land—the Southeastern Massachusetts Bioreserve (Fall River) and the Brushy Mountain/Paul C. Jones Working Forest (Leverett)—exemplify how many partners can work together toward landscape-scale conservation successes.

Consideration of long-term climate change resilience is a relatively new factor in land protection prioritization. Figure 3.5 depicts the patterns of undeveloped yet unprotected resilient land—essentially, the resilient land that remains "in play" for development or conservation—as of 2013. This highly resilient land totals nearly 790,000 acres, or approximately 60 percent of all resilient land. Two main concentrations of this resilient land are obvious: the region south of the Quabbin Reservoir to the Connecticut border, including Ware, Palmer, Monson, and several other communities; and the flanks of the Connecticut River valley, especially the western side extending loosely from Russell to Colrain. These areas, with the Berkshire highlands generally and sections of the Worcester Plateau, are the most important for building additional terrestrial resilience beyond the present conserved land network.

Figure 3.6 shows the status of conservation of resilient land across the state as of April 2013. Communities of the outer Cape, the Quabbin and Ware River watershed area, and the Berkshire highlands, and scattered elsewhere, stand out as protecting more than two-thirds of their resilient land. Many more communities, however, have protected less than one-sixth of their resilient lands; these communities must increase the pace of conservation to maintain the adaptive capacity of their landscapes. General regions with low proportions of conserved resilient land include the area south and southeast of the Quabbin Reservoir, the northern Connecticut River valley, and much of Plymouth County. Statewide, approximately 40 percent of resilient land (more than 490,000 acres) has been protected through April 2013.

BioMap2

In 2010, the Natural Heritage and Endangered Species Program and The Nature Conservancy released an updated guide for strategic biodiversity conservation in Massachusetts. *BioMap2* incorporates elements of the fine filter and coarse filter approaches to conservation, identifying the areas of the state that are most important for the suite of species, natural communities, and ecosystems that comprise the nature of Massachusetts. *BioMap2* designates a total of 2.1 million acres as key to conserving the state's biodiversity, separated into two categories: Core Habitat (1.2 million acres) is focused on specific conservation elements, including habitats for species of conservation concern, high-priority natural communities, high-quality

Figure 3.7: Development within *BioMap2* Core Habitat, 2005-2013

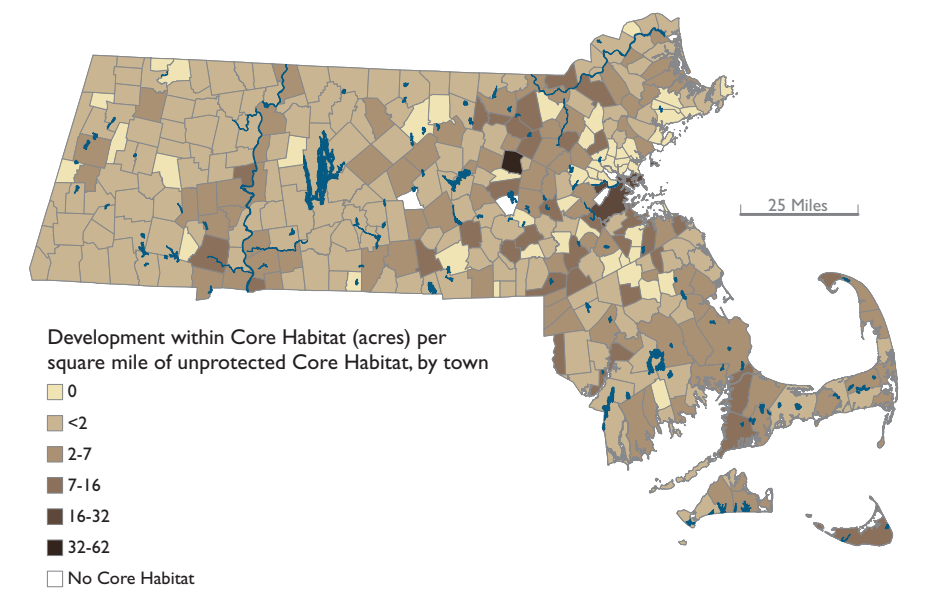
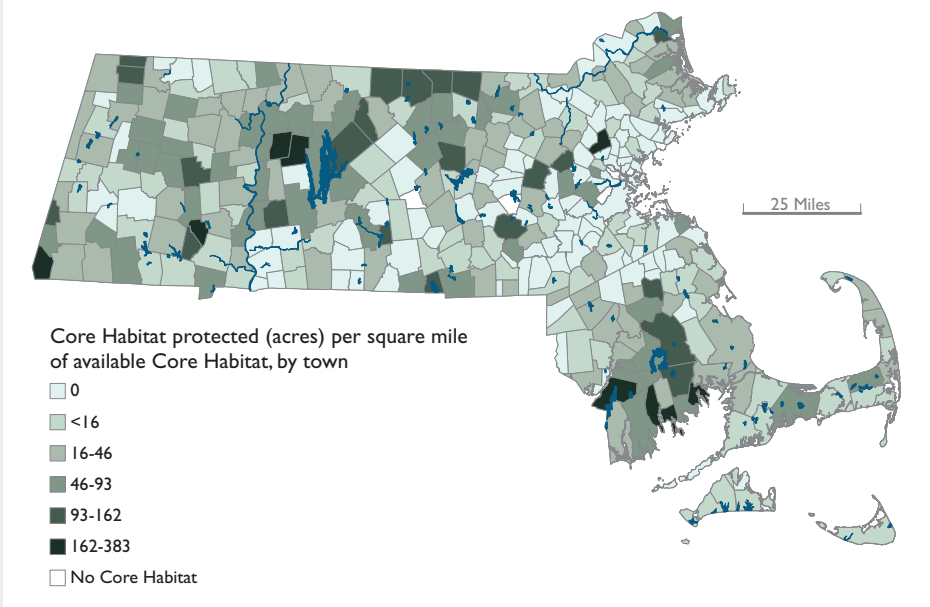


Figure 3.8: Land Protection within *BioMap2* Core Habitat, 2005-2013



aquatic and wetland habitats, and large forest blocks; and Critical Natural Landscape (1.8 million acres) addresses landscape-scale biodiversity elements such as the largest intact landscape blocks within each ecoregion and terrestrial buffers of high-quality aquatic and wetland habitats. Core Habitat and Critical Natural Landscape overlap in some areas: approximately 0.9 million acres of land are designated as both. Core Habitat and Critical Natural Landscape are complementary, and together they comprise a comprehensive conservation strategy. Although *BioMap2* was released in 2010, many of the input datasets used to create it are based on information collected in 2005 (e.g., statewide land use/land cover data), so it largely reflects conditions before or early in the period of analysis for this edition of *Losing Ground*.

Figure 3.7 depicts the pattern of development in unprotected Core Habitat between 2005 and 2013. The I-495 belt hosts most of the communities with higher rates of development, with others on the Worcester Plateau and in the Connecticut River valley. The checkerboard pattern in eastern Massachusetts partly occurs because many communities in this region either do not have much Core Habitat, or do not have much unprotected Core Habitat. Relatively small developments in these communities with little Core Habitat available can affect a large proportion of the remaining Core Habitat. This is almost certainly the case with Stow, the highest scoring community by this metric: less than 50 acres of Core Habitat were unprotected in 2005, but a single development converted 5 acres, or 10 percent, of that Core Habitat. While a community such as this has done a commendable job protecting much of its important habitat, the analysis illustrates the closing window of opportunity for conservation of important habitat in some towns.

What the last edition of *Losing Ground* labeled the Sprawl Danger Zone—the central area of the state under threat of increasing development—is reflected in Figure 3.7. Towns between I-495 and Quabbin Reservoir and towns along the Connecticut River are seeing moderate loss of Core Habitat resulting from development.

Figure 3.9: Undeveloped and Unprotected *BioMap2* Core Habitat, 2013

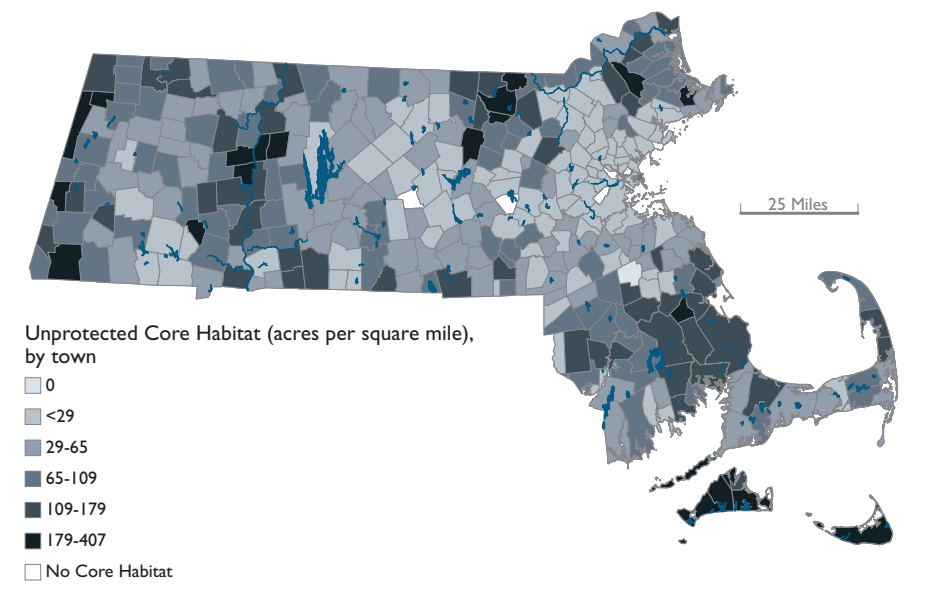
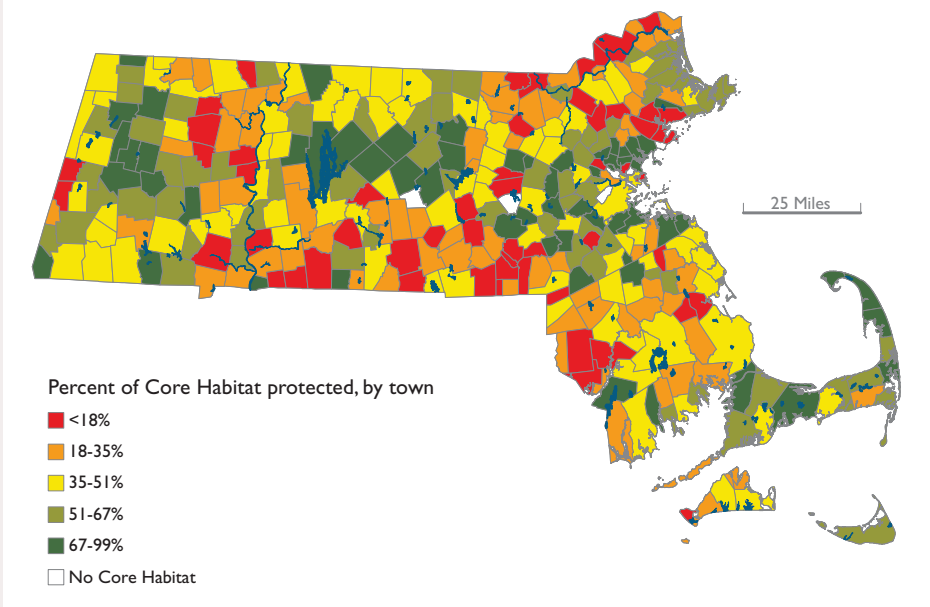


Figure 3.10: Protected *BioMap2* Core Habitat, 2013



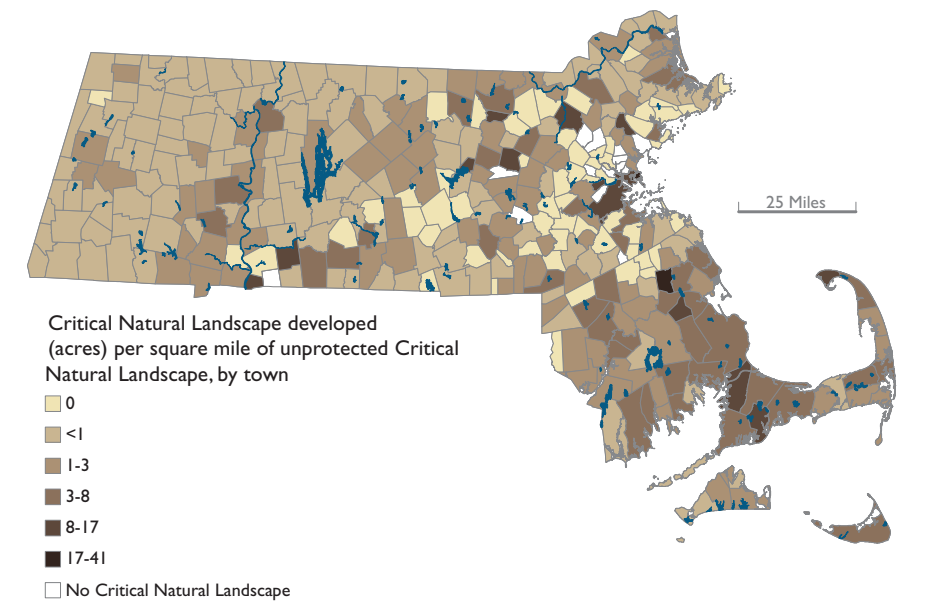
Between 2005 and 2013, a total of 44,200 acres of Core Habitat were protected across the state. Communities protecting the greatest proportion of their previously unprotected Core Habitat include the northern Worcester Plateau towns of Winchendon, Ashburnham, Ashby, and Townsend; other standout communities are scattered through the Buzzards Bay region and western Massachusetts. Several greater Boston suburbs are also included in this category. Remarkably, despite the relatively high total area of Core Habitat protected across the state since 2005, more than 100 municipalities conserved no Core Habitat. This lack of conservation action during this period, when rates of development have been lower than in previous periods, represents a lost, though potentially remediable, opportunity.

Core Habitat that remained both unprotected and undeveloped in 2013 occurs throughout the state, but is concentrated in Plymouth County and the Islands, in the area around Groton, the central Connecticut River valley, and the Taconic region (Figure 3.9). Some of these areas, especially in the eastern portion of the state, coincide with those experiencing the highest development rates. Strong municipal planning tools and continued conservation action in these areas are needed to ensure that these critical lands are protected before development overwhelms their conservation value.

Figure 3.10 shows the status of Core Habitat protection as of 2013 in each municipality. Over 540,000 acres of Core Habitat was protected as of April 2013. Similar to the resilient land protection status map, areas that stand out as requiring additional conservation effort include the area south and southeast of the Quabbin Reservoir, Plymouth County, and the northern Connecticut River valley. Additionally, this map emphasizes the opportunity to protect Core Habitat in the Merrimack River valley, where some of the highest development rates in the state are also occurring. In contrast, the central Berkshire highlands, the Ware River watershed lands, much of Cape Cod, and many suburbs in the greater Boston area have already conserved the majority of their Core Habitat.

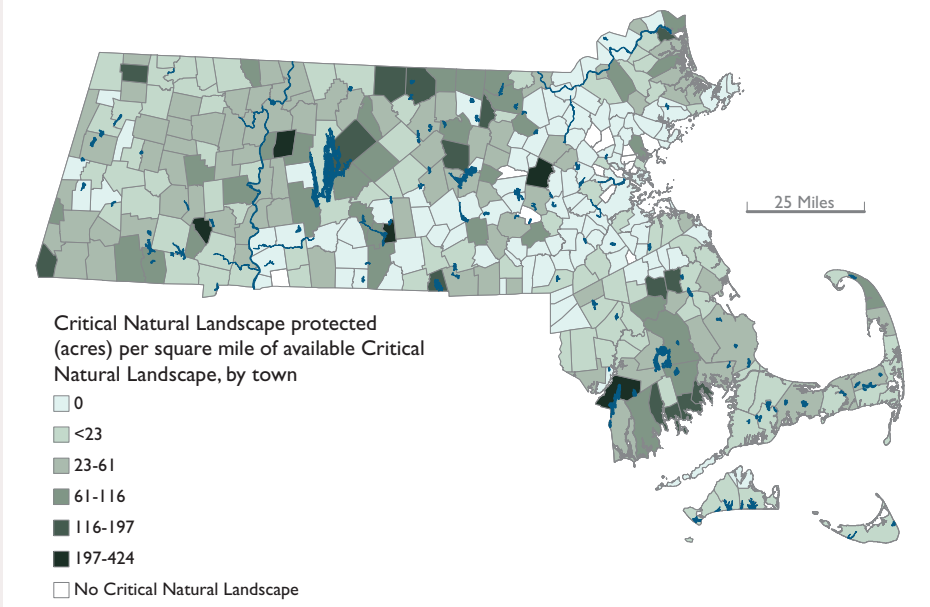
BioMap2: Critical Natural Landscape

Figure 3.11: Development within *BioMap2* Critical Natural Landscape, 2005-2013



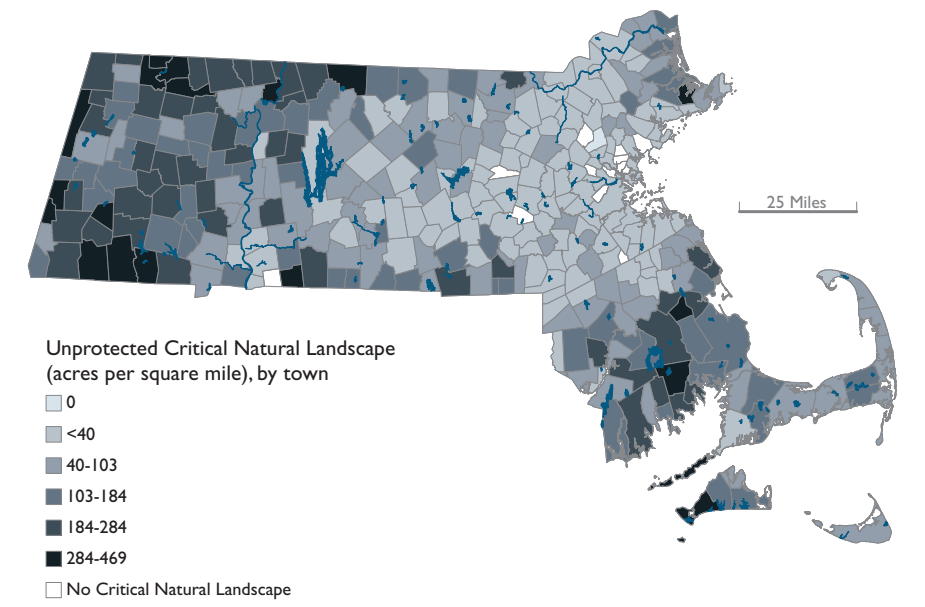
Development within Critical Natural Landscape (Figure 3.11) does not as directly reduce habitat value for species or communities of conservation concern as much as would development within Core Habitat. Nevertheless, loss of Critical Natural Landscape represents injury to the state's long-term ecological health and the values and functions these areas provide, as the piecemeal erosion and fragmentation of large landscape blocks undermines the viability of populations of both common and rare species. Between 2005 and 2013, 2,400 acres of Critical Natural Landscape were developed in the state. The communities experiencing the greatest loss are clustered in southeastern Massachusetts (Plympton, Plymouth, Dartmouth, and Bourne), the I-495 belt, and south of the Quabbin Reservoir (Wilbraham and Monson), echoing previously discussed development patterns.

Figure 3.12: Land Protection within *BioMap2* Critical Natural Landscape, 2005-2013



The communities with the greatest gains in protecting their remaining Critical Natural Landscape are located predominantly in the western counties of the state and northern Worcester County (for example, North Adams, Leverett, and Ashburnham), and with other concentrations in Plymouth County, Essex County, and scattered through the MetroWest region (Figure 3.12). Similar to the pattern with Core Habitat protection, more than 100 communities protected no Critical Natural Landscape during the 2005 to 2013 period, and for many of these communities the window of opportunity to protect these important lands closed further, as they experienced the highest rates of development over the same period.

Figure 3.13: Undeveloped and Unprotected *BioMap2* Critical Natural Landscape, 2013



Critical Natural Landscape remaining available for protection or development as of 2013 is mostly in the state's western counties, and Essex and Plymouth counties (Figure 3.13). Conservation of these lands, especially in the Berkshire highlands, would maintain large-scale connectivity in the landscape that will be increasingly important for population and genetic flows as climate change induces range shifts in a variety of plant and animal species.

Figure 3.14: Protected *BioMap2* Critical Natural Landscape, 2013

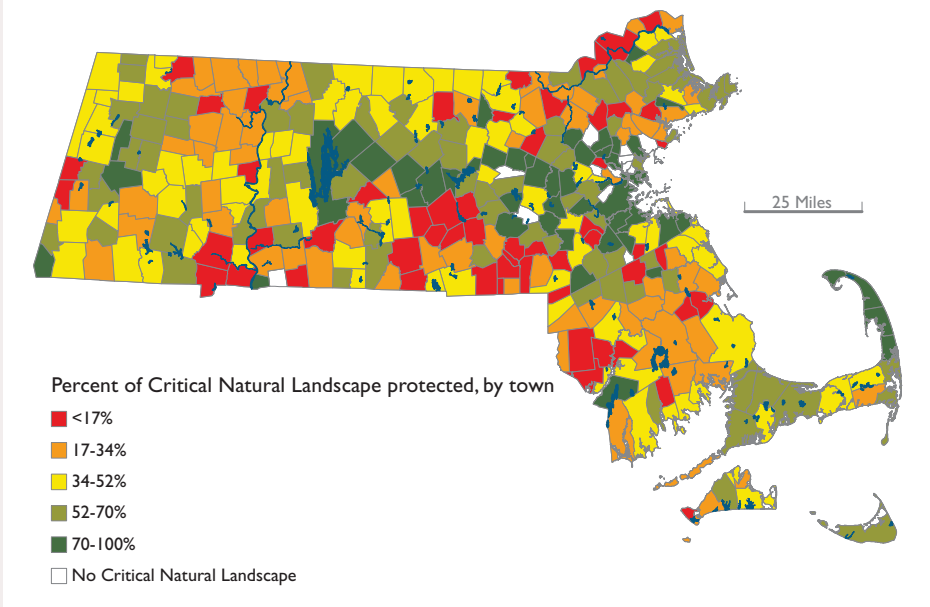


Figure 3.14 depicts the status of Critical Natural Landscape protection in Massachusetts as of 2013. Approximately 760,000 acres of Critical Natural Landscape was protected as of April 2013. The pattern here is similar to that discussed for resilient land and Core Habitat: substantial opportunities for strategic and impactful conservation action—whether through land protection or community planning—occur in certain regions in the state: Plymouth County, the Merrimack and Connecticut River valleys, south of Worcester, and south of the Quabbin Reservoir. Large areas of state or federal landholdings (for example, October Mountain State Forest, the Quabbin and Ware River watershed lands, and the Cape Cod National Seashore) anchor regions in the Berkshire highlands, central Massachusetts, and Cape Cod where Critical Natural Landscape is relatively well protected. Many communities in the greater Boston region have also protected a high proportion of their Critical Natural Landscape.