

CHAPTER 5: BIODIVERSITY IN MASSACHUSETTS— PROTECTION AND THREATS

Terrestrial Biodiversity

In 2001, the Massachusetts Natural Heritage and Endangered Species Program (NHESP) created the BioMap, which delineated habitat for the full complement of native species in Massachusetts. Based on their comprehensive database of rare and endangered species occurrences, the BioMap also used a sophisticated analysis to capture nonendangered species habitat as well. Almost 1.2 million acres of Massachusetts was delineated as BioMap Core Habitat—that is, habitat for a viable population of an important element of biodiversity. Overall, 45% of the BioMap Cores are permanently protected (544,400 acres). This includes the Quabbin Reservoir. Table 5.1 divides these protected acres by their primary purpose. Roughly 14% of Core Habitat is protected with the sole purpose of conservation.

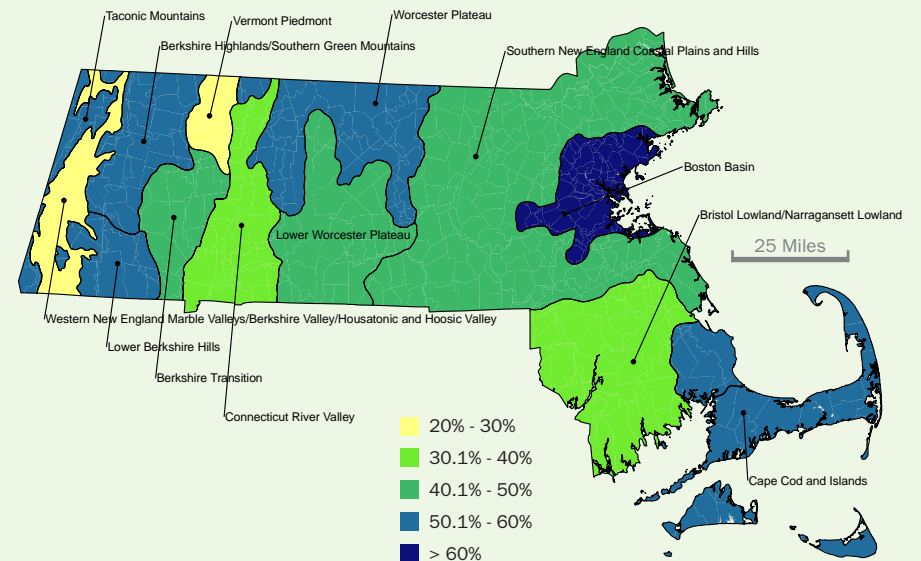
As part of the BioMap project, the NHESP team identified 963,600 acres overall of Supporting Natural Landscape: areas of high ecological value that provide habitat for nonendangered elements of biodiversity, that buffer populations of rare or endangered species, or that connect large roadless blocks of intact natural vegetation. Of those areas delineated as Supporting Natural Landscape, only 260,000 acres, or 27%, are protected.

Table 5.1: Protection of BioMap Cores by primary purpose

Primary Purpose of Protection	Acres protected	Percent of Bio Map Cores
All permanently protected lands	544,375	44.6%
Recreation and Conservation only	214,356	17.6%
Conservation only	170,200	14.0%
Water supply only	138,700	11.4%
Other	21,119	1.7%

Figure 5.1 shows the protection of BioMap Cores by ecoregion. BioMap Core Habitat in many of the ecoregions is more than 50% protected. The Western New England Marble Valleys (12,100 out of 55,200 acres protected) and the Vermont Piedmont (2,400 out of 12,300 acres protected) ecoregions have the smallest amounts of protected Core Habitat.

Figure 5.1 Percent of BioMap Core Habitat protected in each ecoregion



In order to further investigate threats to BioMap Core areas, we identified the portions of each Core that were unprotected, and then measured how much new development was present in 2005. As delineated in 2001, the BioMap Cores could contain development *inside* their boundaries. Large clusters of development were segregated into separate areas that were inholdings within the Core Habitat. These interior polygons were removed for this analysis. As a result, the development considered here is mostly new development. The amount of recent development in the Core is an indicator of development pressure on the

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remaining Core Habitat. Figure 5.2 shows the unprotected Cores in yellow, orange, and red that are at least 5% developed. Overall, 4.5% of the unprotected Core polygons are already developed. The majority of the Core Habitats under higher levels of threat are found east of the Wachusett Reservoir. Several Cores within the Connecticut River valley also fall in the higher levels of threat.

Figure 5.2: Threat of development in each BioMap Core

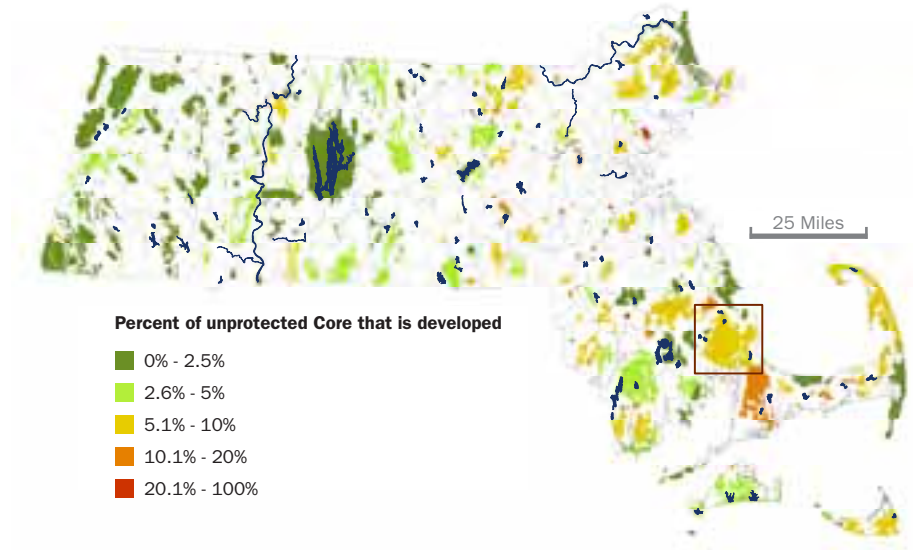
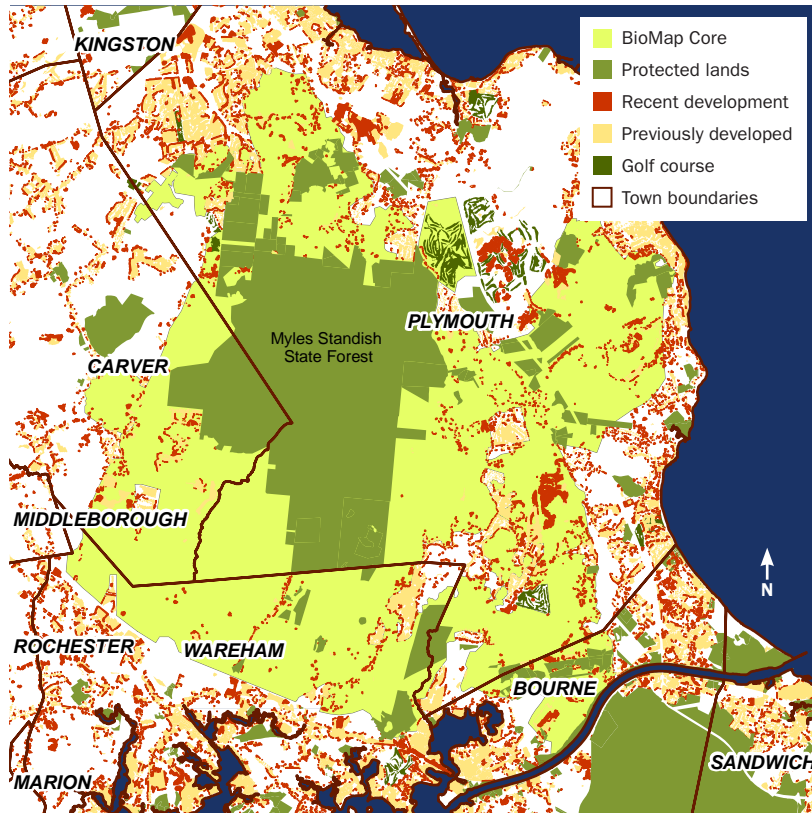


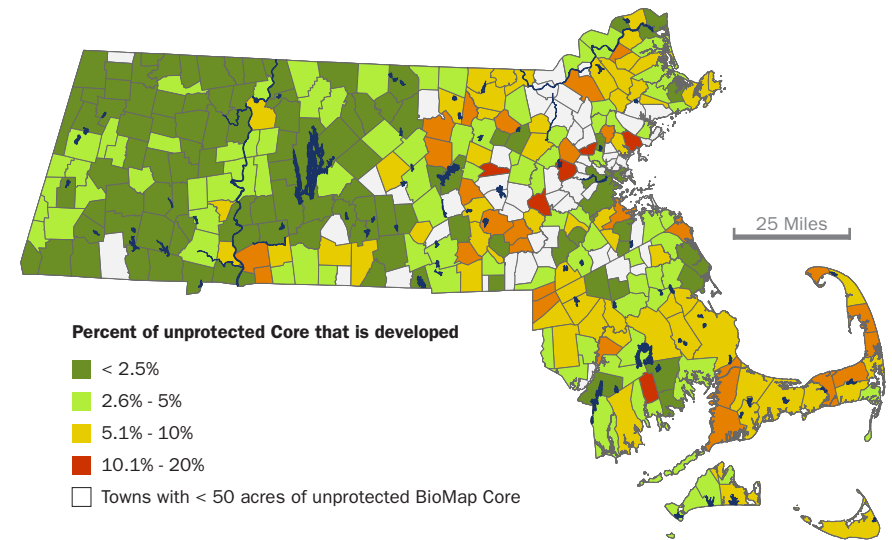
Figure 5.2 assigns to each Core a color based on the percent of development present in the unprotected portion of the Core. Individual consideration of each Core will reveal the much more complex interplay among protected lands, unprotected lands, and development. Figure 5.3 zooms into the yellow (5-10%) Core Habitat surrounding Myles Standish State Forest. Additional protected lands could clearly coalesce around the state land in the middle of this Core. However, such protection is not materializing quickly enough to stop fragmentation of the remaining Core. Significant amounts of recent development (shown in red) can be seen in the northern and eastern parts of the Core.

Figure 5.3: Recent development in a BioMap Core polygon



The results of this analysis have been converted into other levels—town/city, watershed, ecoregion, county, and regional planning agency—so that results can be used at different scales. Figure 5.4 shows these results at the town/city level. There are 33 towns in which the undeveloped BioMap Core is more than 10% developed and 63 in which between 5 and 10% of the Core is developed. For more details of these results, see the *Losing Ground* website found at www.massaudubon.org/losingground.

Figure 5.4: Encroachment of development into BioMap Cores by town/city



CLIMATE CHANGE AND BIODIVERSITY IN MASSACHUSETTS

The Massachusetts climate is changing rapidly as indicated by the increases in southern bird, dragonfly, and butterfly species. The rapidly warming Massachusetts climate threatens to disrupt natural communities and exacerbate the stresses of development. Conservation organizations are considering their missions with respect to climate change, and the dual strategies of “mitigation” and “adaptation” are being advanced. Mitigation strategies reduce the emissions of greenhouse gases to avoid the unmanageable effects of climate change, and adaptation strategies increase the resilience of natural communities as they respond to the unavoidable effects of climate change. The Manomet Center for Conservation Sciences, The Nature Conservancy, and MassWildlife are collaborating on an effort to include the impacts of climate change into the State Wildlife Action Plan, with particular focus on the relative vulnerability of Massachusetts’ natural communities to the stresses of climate change. Mass Audubon will be working with these partners to better understand the interaction between land use and development. See www.manomet.org for more information on the current status of this research.

Aquatic Biodiversity

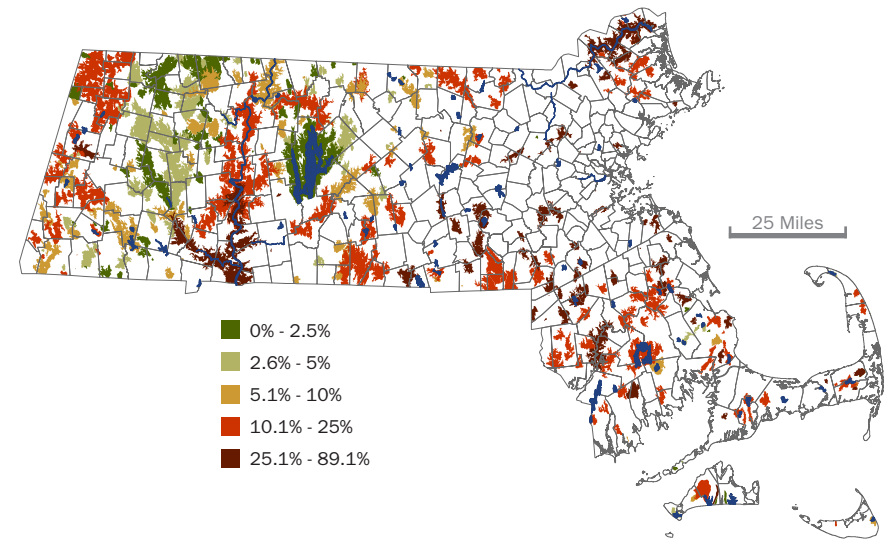
In 2003, the Natural Heritage and Endangered Species Program created the Living Waters map, which delineates habitat for aquatic biodiversity in Massachusetts. Living Waters Core Habitats represent lakes, ponds, rivers, and streams that are important for the protection of freshwater biodiversity in Massachusetts. According to the Open Space datalayer from MassGIS, of the 65,500 acres of Living Waters Core Habitat in the state, 47% is protected. However, if you remove the 24,300 acres of the Quabbin Reservoir, only 15.7% is protected. Only 2.5% of this habitat is protected with the primary purpose of conservation.

Table 5.2: Protection of Living Waters Core by primary purpose (Quabbin Reservoir removed from analysis)

Primary Purpose of Protection	Acres protected	Percent of Living Waters Core
All permanently protected lands	6,465	15.7%
Conservation, Recreation and Conservation, and Water supply	6,235	15.2%
Recreation and Conservation only	4,490	10.9%
Conservation only	1,020	2.5%
Water supply only	726	1.8%

The Living Waters project also identified Critical Supporting Watersheds, which are the terrestrial areas that have immediate hydrologic connections to the Living Waters Core Habitat. Because of the difficulty in assessing protection levels of dynamic hydrologic systems, we looked at the level of protection in the surrounding Critical Supporting Watersheds. To identify threatened Living Waters Core Habitats, we calculated for each Critical Supporting Watershed (CSW) the amount of the watershed protected and the amount of development present in the remaining unprotected portion of the watershed.

Figure 5.5: Threat of development in each Living Waters Critical Supporting Watershed



Of the 1,380,700 acres of CSW, roughly 364,300 acres have been protected (including the Quabbin Reservoir), or 26.4%. This level of protection is far less than the 45% protection of the BioMap Core Habitat. These watersheds are more threatened by development. Roughly 16% of the CSW that is unprotected is already developed, or 159,800 acres. Figure 5.5 shows that many of eastern Massachusetts' supporting watersheds are more than 25% developed already (shown in dark red). The southern portion of the Connecticut River in Massachusetts and the Westfield River are similarly threatened and rightly deserve the attention they are receiving from the conservation agencies and organizations.

CLIMATE CONNECTION

As Massachusetts develops renewable energy sources—through the Green Communities Act and otherwise—they must be sited appropriately so as not to impact aquatic resources identified by the Living Waters project. New hydroelectric projects should be sited on waterways without intact flow regimes, ones that have been previously diverted, so as to minimize the impact on freshwater biodiversity. Dam removal projects are also especially important in light of climate change, since restored flow would allow fish and other river organisms to seek out cooler upstream waters.

Figure 5.6: Encroachment of development into Living Waters CSWs by town/city

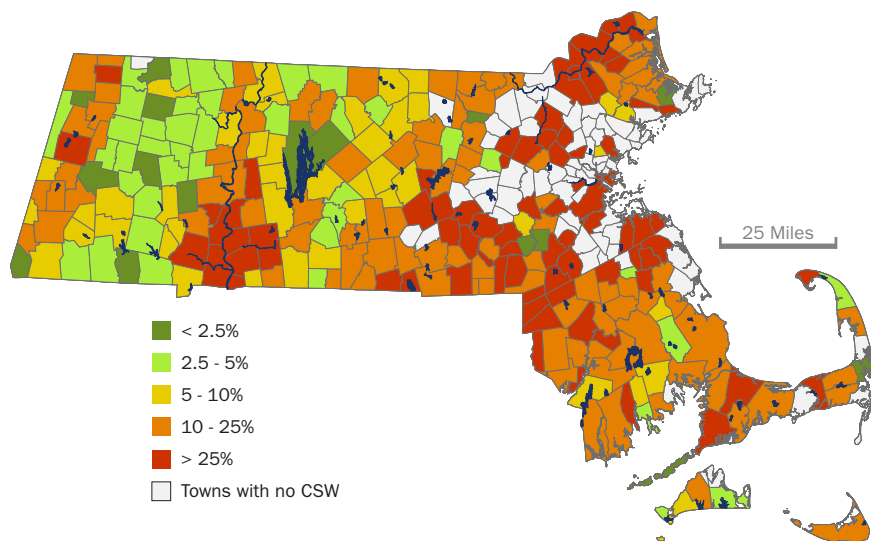


Figure 5.6 highlights the 78 cities and towns where more than 25% (shown in red) of the CSW is already developed. The location of remaining *unprotected* CSW must be evaluated by land trusts and in municipal documents such as open space plans and master plans. An additional 145 towns and cities have between 5 and 25% (orange and yellow) of their CSW already developed.

It is important to realize that a wide spectrum of acreages lie behind the summary depicted in Figure 5.6. Ayer has only 0.1 acres of CSW, hardly meaningful, while Petersham contains 35,400 acres of CSW. For detailed information from this analysis summarized by town or city, visit the *Losing Ground* website at www.massaudubon.org/losingground.

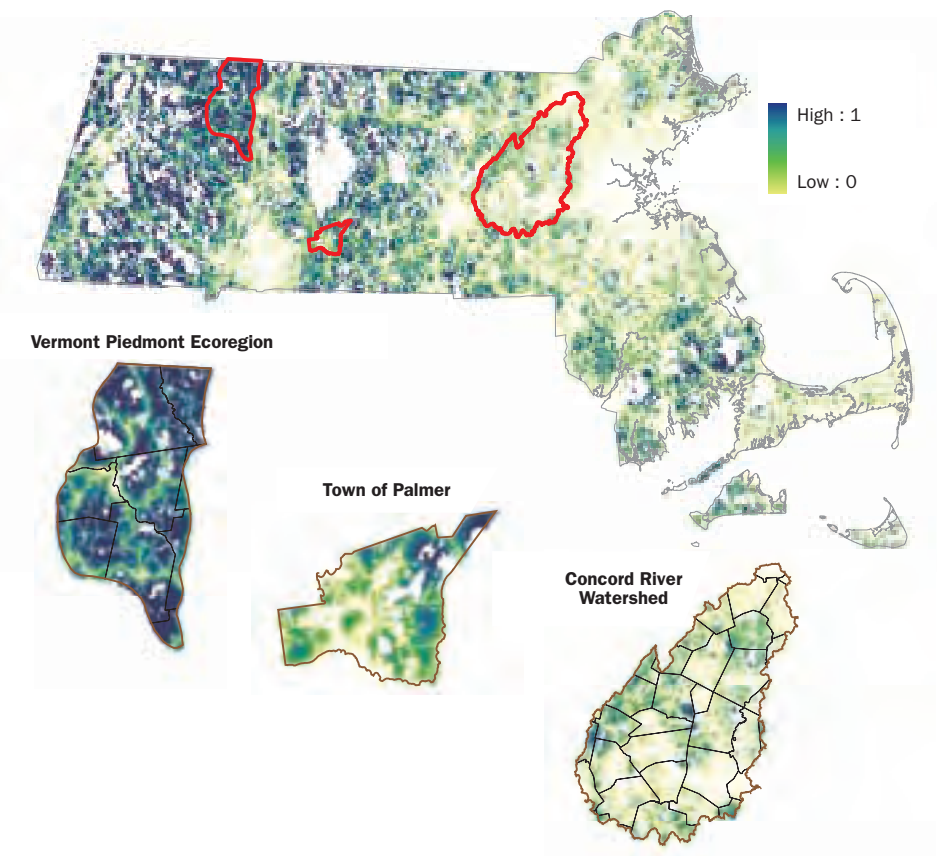
Quality of Unprotected Land as Evaluated by the CAPS Model

If we view the 2005 IEI map through the window of *unprotected* lands, it helps us to prioritize our future efforts. Figure 5.7 shows the results of the 2005 CAPS model, but with the protected lands removed so they are not visible. One is immediately aware of the high value of lands that are adjacent to the areas of existing protection. Displaying the results in this way illustrates how the CAPS model can help us to prioritize conservation efforts no matter what the scale at which we are operating. We can look at the results of the model statewide, within the Vermont Piedmont ecoregion, in the Concord River watershed, or for an individual town such as Palmer. The information used to prioritize conservation efforts must regularly be updated. For instance, the CAPS research team is currently working with

The Nature Conservancy, the Executive Office of Transportation, and the Massachusetts Department of Environmental Protection to generate a statewide model that incorporates more information than was possible when considering ecological integrity between 1971 and 2005. When the model is complete in the coming months, it will represent a new source of information that can be used to prioritize conservation efforts.

Figure 5.7: Ecological value of unprotected land in Massachusetts (2005)

The CAPS analysis has shown that the greatest loss in ecological value takes place during the initial stages of development. This finding suggests that significant attention needs to be given to towns that lie far beyond the Sprawl Frontier in western Massachusetts, in the Connecticut River valley, and in towns surrounding the Quabbin Reservoir.



CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

The third edition of *Losing Ground* recommended a variety of policy changes, and progress has been made since 2003. Currently, 140 towns have passed the Community Preservation Act, protecting 10,270 acres of open space in the last eight years. A new Environmental Bond recently has been passed with an administration promise to spend no less than \$50 million per year over the next five years for open space protection.

Conservation agencies and organizations in Massachusetts, both public and private, have made great progress in land protection since 1971. The current economic downturn is akin to the eye of a storm. This is an important opportunity to make changes in how we develop, conserve, and manage land. As the economy recovers, the pressures of sprawling development will likely continue to move across the landscape. While our estimate of the rate of development has decreased, the patterns of change continue to spread farther west and southeast. We have shown that the indirect impacts of development on ecological integrity are far greater than the direct impacts of development. To attain our goal of protecting habitat for our full suite of biodiversity—and therefore the nature of Massachusetts—more land must be permanently protected.

Protection of Biodiversity and Other Resources

Between 1999 and 2005, twice as much land was protected than was developed. This is largely due to three banner years in 2000, 2001, and 2002. While it is significant that the rate of protection is outpacing the rate of development, the indirect impacts of development remain three to eight times higher than the direct impacts of development. For this reason, Mass Audubon recommends the following actions to meet this goal.

- “One percent for nature”—spend at least 1% of the state’s total budget on operating support for environmental programs, including administration, enforcement, and implementation of environmental statutes.
- Ensure that \$50 million per year in capital funding from Environmental Bond funds continues to be appropriated for land protection.
- Focus resources and land protection efforts by conservation agencies and organizations on towns in the Sprawl Frontier, particularly in southeastern Massachusetts. Unprotected natural land remaining in these towns must be placed beyond the reach of development, for the benefit of both wildlife and people.

THE LOSING GROUND INTERACTIVE WEBSITE

This edition of *Losing Ground* is designed to aid in local and regional, as well as statewide, planning. The analysis presented in this document has been scaled to many different practical levels, including by town, county, watershed, ecoregion, and regional planning agency. Please visit www.massaudubon.org/losingground to view both *statistics and maps* that explore how land use change has affected your corner of the Commonwealth.

The results of the CAPS analysis demonstrate that significant ecological impacts have taken place beyond the Sprawl Frontier, in the Sprawl Danger Zone. While less land is being developed in these towns, the initial development has far greater negative ecological impact than subsequent development. Mass Audubon recommends the following.

- The creation of a robust and coordinated land protection strategy among state agencies and conservation nonprofits in western Massachusetts, in the Connecticut River valley, and in towns surrounding the Quabbin Reservoir, as well as sufficient resources to implement the strategy.
- The extension of planning resources to these towns in the form of circuit riders, funding for town planning and resource manager positions, or funding for education of town board members, so that the true impacts of zoning and development decisions can be understood. Small towns with largely volunteer boards can be overwhelmed by the number and complexity of land use decisions that must be made, and they require increased financial and technical support to help them do their jobs.
- Protection of remaining agricultural lands throughout Massachusetts. The amount of agriculture that remains in towns varies widely; in some towns just a few acres remain, and outright protection by a local organization might be an appropriate option, while in other towns thousands of acres remain, and outright protection may not be easily accomplished. A coalition of federal, state, and local, and nonprofit stakeholders is needed to protect these lands. Because of farmland’s habitat value to a number of native bird species, as well as its value as a resource for locally grown food and a more diverse landscape, Mass Audubon supports the protection of agricultural land in Massachusetts.

- The prioritization of protection efforts, regionally and locally, using the analyses of threat levels summarized in this edition of *Losing Ground* and available on the *Losing Ground* website (www.massaudubon.org/losingground). We analyzed threats to natural land, agricultural land, BioMap Core Habitat, and Living Waters Core Habitat.
- The creation of a coordinated restoration strategy for riverine and wetlands habitat within the Executive Office of Energy and Environmental Affairs, which would include significant resources for removal of obsolete dams and old culverts, restoring riverine connectivity. Significant investment in stream and river restoration would be an adaptive strategy for climate change. Aquatic rare species habitat is more difficult to protect, and as a result receives far less protection than important terrestrial biological resources. Although it is a challenge to protect these species, focusing on this habitat continues to be critical to the survival of freshwater aquatic biodiversity.
- The systematic analysis of how climate change will impact biodiversity when coupled with land use conversion and landscape fragmentation, disruption of ecological processes, invasive species, and incompatible human uses, would provide valuable insights for land use planning.

Zoning and Legislative Reform

Communities must engage in thoughtful planning to shape their future.

- We urge the Massachusetts legislature to act now to reform the Commonwealth's zoning laws by taking up the administration's Land Use Partnership Act (LUPA).
- We need to ensure the lasting success of the Community Preservation Act by broadening municipal participation and clarifying allowable uses to promote sustainable communities. We support the legislation that has been filed to advance and strengthen the CPA.

The Importance of Our Spatial Data Infrastructure

The foundation of each edition of *Losing Ground* is an updated Land Use/Land Cover derived from statewide aerial imagery. This data provides the ability to determine what opportunities have been missed as well as where we must focus our conservation efforts. The complement to this layer is up-to-date information on the protected lands in our Commonwealth. Mass Audubon recommends the following.

- Land Use/Land Cover data be regularly updated. The funding for this important resource should be incorporated into operating budgets, ensuring regular acquisition.
- Conservation agencies and organizations make a concerted effort to fully populate the open space data layer.

Conclusion

According to the best available data and analysis, the rate of land use change in Massachusetts has slowed from a high of 40 acres a day during the years 1985 through 1999, to 22 acres a day from 1999 to 2005. During the same time, the rate of land protection was double the rate of land use change. We commend the Commonwealth's Executive and Legislative branches of government along with municipalities and private conservation organizations that have collaborated over those six years to protect an additional 109,863 acres of land.

At the same time, there is much more to be done. Twenty-two acres a day is the equivalent of creating a new development the size of the cities of New Bedford, Lawrence, and Springfield combined every five years.

Furthermore, the ecological impacts of development multiply the scope of impact far beyond the immediate 22 acres of land developed. Our analysis found that for each acre developed, an additional three acres loses significant ecological integrity from such factors as fragmentation, edge effects, increased predation by domestic animals, encroachment of invasive species, and other secondary impacts of land use conversion from a natural to a developed state.

The Sprawl Frontier continues to extend farther from large cities like Boston and Providence. This type of unplanned development is not sustainable, and communities within the Sprawl Frontier are facing increased costs in infrastructure and services. Those communities on the leading edge of the Sprawl Frontier, the Sprawl Danger Zone, need better planning and zoning tools to address the pressures they face. Amending the Community Preservation Act and enacting meaningful zoning reform such as the Land Use Partnership Act will give municipalities new tools to guide growth and development in a sustainable direction.

In all past editions of *Losing Ground*, Mass Audubon has used the best available data to estimate the acres of direct impact due to development. In this edition of *Losing Ground*, we have used the CAPS analysis to show that the indirect impacts of development have an even larger negative impact on the ecological integrity of our natural lands. Faced with these conclusions, the challenge to conservation agencies and organizations is twofold: 1) protect as much of the high-quality habitat that remains at local, regional, and statewide scales; and 2) find ways to change the pattern of dispersed residential development that is currently so prevalent. The CAPS analysis clearly shows that it is exactly this type of development that will most quickly degrade the ecological integrity of the landscape. We have an opportunity that must be taken now to save the most important aspects of our treasured Commonwealth—biodiversity, wildlife habitat, clean water, agricultural resources—for the benefit of future generations.

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