

# A Land Conservation Plan for the Merrimack River Watershed of New Hampshire and Massachusetts

## EXECUTIVE SUMMARY

A Collaborative Conservation Planning Project  
Facilitated by the Society for the Protection of NH Forests

April 2014

SOCIETY FOR THE  
PROTECTION OF  
NEW HAMPSHIRE  
FORESTS

SINCE  
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Cover photo credits:

Top: Winter on the Merrimack River at Canterbury, New Hampshire, Monkman EcoPhotography.

Middle: Spring on the Concord River at Lowell, Massachusetts, Zoar Outdoor

Bottom: Summer at the Merrimack Estuary at Newburyport, Massachusetts, Norman Tabor

# Land Conservation Plan for the Merrimack River Watershed of New Hampshire and Massachusetts

## Collaborating Agencies/Organizations

Bear Paw Regional Greenways (NH)  
Eight Towns and the Bay Committee (MA)  
Essex County Greenbelt (MA)  
Lowell Parks & Conservation Trust, Inc. (MA)  
City of Manchester, NH Water Works  
Massachusetts Audubon  
Massachusetts Office of Energy and Environmental Affairs (EEA)  
Massachusetts EEA Department of Agricultural Resources  
Massachusetts EEA Department of Conservation and Recreation  
Massachusetts EEA Department of Fish and Game  
Merrimack River Watershed Council (MA/NH)  
City of Nashua, NH  
Nashua River Watershed Association (MA/NH)  
National Oceanographic and Atmospheric Administration  
NH Association of Conservation Districts  
NH Department of Environmental Services  
NH DRED Division of Forests and Lands  
NH DRED Division of Parks and Recreation  
NH Fish & Game Department  
NH Rivers Council  
Northern Middlesex Council of Governments (MA)  
Rockingham Planning Commission (NH)  
Society for the Protection of New Hampshire Forests  
Southeast Land Trust of New Hampshire  
Sudbury Valley Trustees (MA)  
Town of Tewksbury, MA Water Treatment Plant  
Trust for Public Land  
The Trustees of Reservations (MA)  
US Army Corps of Engineers  
US Environmental Protection Agency, Region 1  
US Fish & Wildlife Service  
USDA Natural Resources Conservation Service  
USDA Forest Service, State & Private Forestry

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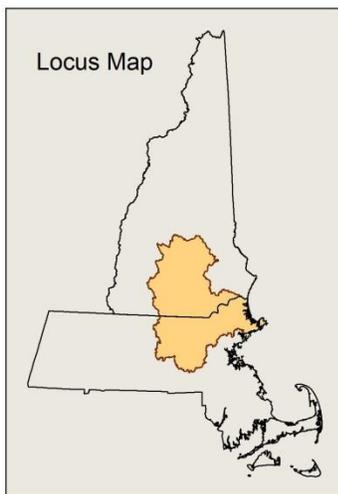
GIS Data Development, Mapping and Analysis: Dan Sundquist, SPNHF and Anne Deely, Neatline Associates  
Technical Report: Dan Sundquist and Anne Deely  
Executive Summary: Chris Wells, SPNHF

## Executive Summary

This document is the final product of two years of effort by a dedicated group of conservation and planning professionals representing 33 private organizations and public agencies in New Hampshire and Massachusetts. In early 2012, this broad partnership committed itself to an ambitious effort to develop a conservation plan that would focus and accelerate land conservation in the Merrimack River watershed of New Hampshire and Massachusetts. Working together, the group developed a science-driven, consensus land conservation plan that integrates the best-available natural resource data with expert judgment to prioritize land protection to protect water quality (especially drinking water supplies), preserve aquatic and terrestrial ecosystems, conserve the region's working farms and forests, and provide recreational open space. Organizational support for the Merrimack planning project was provided by the Society for the Protection of New Hampshire Forests (Forest Society), the state's oldest and largest private conservation organization.

***In 2010, the US Forest Service identified the Merrimack watershed as the most threatened in the nation.***

### Why the Merrimack?



From its start in Franklin, N.H., the Merrimack flows through eight of New Hampshire's ten largest cities, including Manchester, Nashua and Concord. The river continues into Massachusetts, running through Lowell and Lawrence to its mouth at Newburyport. The Merrimack River watershed – the land area that ultimately drains to the river -- totals about 3,275 square miles or 2.1 million acres, divided almost evenly between New Hampshire (54%) and Massachusetts (46%).<sup>1</sup> Despite being highly developed, the Merrimack Valley still contains critical terrestrial and aquatic habitats and contributes to the larger Gulf of Maine marine ecosystem. The watershed's 2.6 million residents directly depend on the Merrimack watershed for drinking water, local food and forest products, and close-to-home outdoor recreation.

Against this backdrop, there is still much to do to conserve the region's resources. 17.6% of the Merrimack region is permanently conserved -- significantly less than the share for New Hampshire as a whole (30.6%) or Massachusetts (24.5%). Even more importantly, some of the lands most in need of conservation are under-protected, particularly those directly tied to protecting public drinking water supplies. For instance, in the New Hampshire portion of the Merrimack region, less than 10% of all the land classified as "wellhead protection area" by state regulators is in permanent conservation. Another area of concern is the imbalance between population and local open space – to illustrate, 22% of all state residents live in the Massachusetts portion of the Merrimack region, but the region has only 17% of the state's conservation land. In the New Hampshire portion of the watershed, 57% of the state's population lives in a region with only 10% of the state's conservation land. Unfortunately, there is limited time to correct these imbalances.

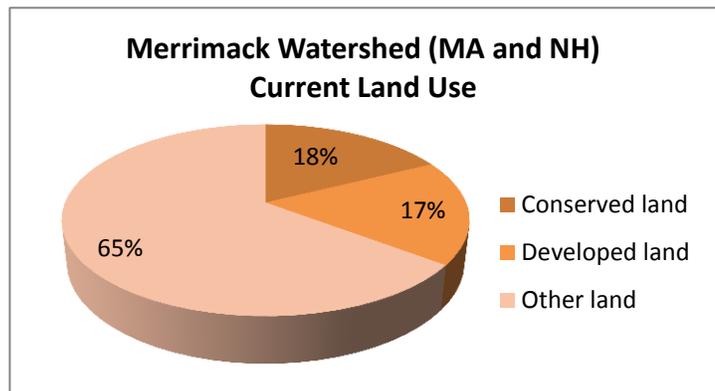
<sup>1</sup> For purposes of the Merrimack conservation plan, the Merrimack watershed was defined as the Merrimack River mainstem in both states, plus related tributary watersheds that share a similar land use pattern: the mainstem of the Contoocook River in NH, the Nashua River in MA and NH, and the Sudbury-Assabet-Concord River Watershed in MA, and the Shawsheen, Ipswich and Parker Rivers in MA.

***Lands most in need of conservation are the least protected, particularly those directly tied to protecting public drinking water supplies.***

In 2010, the US Forest Service identified the Merrimack watershed as *the most threatened in the nation* in terms of projected loss of private forest land over the next 20 years.<sup>2</sup> This projection was based on an expectation of continued robust population growth coupled with a land-intensive suburban development pattern. The most recent

census confirmed that the watershed continues to add new residents. Between 2000 and 2010, the population of the Merrimack watershed grew by almost 115,000 people, equivalent to adding another city the size of Lowell, Mass., or Manchester, N.H.<sup>3</sup> During the same period, the New Hampshire portion of the watershed -- which comprises just 19% of the state's land area -- absorbed almost 42,000 new residents, or 52% of all the population growth in the state. The Forest Service study also ranked the Merrimack watershed as highly threatened because it *still has* ample (and largely forested) land left to develop. Based on the best available land-cover data, almost two thirds of the Merrimack watershed remains largely undeveloped and available for development or conservation.<sup>4</sup>

The Forest Service report reinforced the already growing interest of land conservationists in both states to see more conservation activity in the Merrimack Valley. Forty people attended a scoping meeting held in December, 2011, representing a wide spectrum of public agencies and private organizations. There was broad, and in many cases passionate agreement that a land conservation plan for the Merrimack watershed was needed, and was indeed overdue. After six months of fundraising and organizational work, the project was ready to move ahead.



### How the Plan Was Developed

The primary tool used to develop the Merrimack conservation plan was computer-aided mapping using Geographic Information System (GIS) software. In widespread use since the early 1990s, GIS mapping allows data to be tied to specific geographic locations. In the case of conservation planning, GIS mapping shows where different natural resource data – forest cover, aquifers, agricultural soils, and unique habitats to name a few examples -- occur on a given piece of ground, and how they overlap and inter-relate with each other. A second and equally critical tool used in the Merrimack conservation plan was human judgment. By bringing together multiple organizations, the planning process gained the specialized expertise, accumulated experience and differing viewpoints of literally dozens of conservation professionals. While time-intensive, this collaborative approach yielded a thoroughly-vetted consensus product.

<sup>2</sup> *Forests on the Edge: Private Forests, Public Benefits*, USFS, 2010. See <http://www.fs.fed.us/openspace/fote/benefits.html>

<sup>3</sup> The 2010 census reflects, at least in part, the slowdown in population growth following the financial crisis of 2008.

<sup>4</sup> It should be stressed that data for developed land is not always reliable in “exurban” and rural settings – i.e. widely-scattered houses on large lots – so the developed land cover data used in the Merrimack planning process likely undercounts total acres.

The Merrimack planning process began in earnest in the summer of 2012, with a series of “focus group” meetings held in Lowell, Mass.,<sup>5</sup> to establish working contacts, discuss goals, flesh out process steps and vet possible data sources. Based on these discussions, the Forest Society<sup>6</sup> worked over the balance of the year to assemble and troubleshoot what ultimately became 43 different natural resource GIS data sets covering the two watershed states. In early 2013, participants ranked these data sources through a “Delphi” voting process in which each participating organization allocated points to give greater or lesser statistical weight to each data set. The purpose of this democratic weighting process was to emphasize those natural resource values that were the highest priority for the most stakeholders, and then use this prioritization to drive the GIS analysis of priority conservation areas. Eighteen agencies and organizations participated in the Delphi weighting exercise.

Because not all data sets were available for both states, the stakeholders made the strategic decision to include state-specific data, and to allow each state to weight their data independently. As a result, the mix of data used and its prioritization is different between New Hampshire and Massachusetts. To illustrate, in New Hampshire the top three data sets voters said should be emphasized were source water protection areas (larger watersheds feeding surface drinking water supplies), drinking water protection areas (smaller protective zones around water-supply wellheads and intakes), and the highest ranked wildlife habitat according to N.H. Fish & Game. In Massachusetts by contrast, the top three data sources were top-ranked habitat from the state’s “Biomap” project, the next highest ranked habitat from Biomap, and then gaps in existing hiking trails. Having pointed out these differences, the level of agreement between the states on overall conservation priorities was high when looking at a longer list of top-ranked data. In other words, while there were differences in emphasis across the top five or 10 individual data sources, there was a high degree of agreement on what should be in the top 15 or 20, so the statistically-driven analysis of both states did not yield radically different results. A full list of data sets and how they were ranked can be found in the Technical Report.

***The plan’s Conservation Focus Areas provide a combination of three core natural values: clean water, wildlife habitat, and good soils for growing food and forest products.***

Once there was agreement on how natural resource data would be weighted, the Forest Society moved ahead with a first phase of GIS mapping in the spring of 2013. This yielded an initial map of the Merrimack watershed showing the “co-occurrence”<sup>7</sup> of multiple natural resource values across the study area. The analysis also made a first pass at winnowing down the simple overlap of data to begin identifying those areas with the highest concentration of natural resource values. After reviewing the results of the co-occurrence analysis, process participants agreed that areas of concentrated resource value should be further distilled into geographic focus areas with defined “edges”<sup>8</sup> based on on-the

<sup>5</sup> Staff from participating organizations self-selected to be part of one or more resource-defined focus groups: farm and forest resources, habitat resources, water resources, and recreational open space and trails.

<sup>6</sup> The Society for the Protection of NH Forests provided the GIS capacity and staff for the Merrimack Project. The Society’s Director of Conservation Planning Dan Sundquist led the GIS project from 2012 until his retirement in April 2013. GIS consultant Anne Deely completed the GIS work through the balance of 2013 via a contract with the Forest Society.

<sup>7</sup> In the parlance of GIS analysis, co-occurrence means how many different data points occur at the same geographic location on the ground. For the Merrimack plan, the co-occurrence values were mapped at a resolution of 30 x 30 meters, equivalent to approximately 1/5 of an acre.

<sup>8</sup> Defined edges allow for clarity of decision-making on whether a given property is “in” or “out” of a priority area.

ground features like roads and other developed land uses. Over a series of three meetings between August and December 2013, the stakeholders and the Forest Society’s GIS consultant painstakingly delineated and vetted these final conservation focus areas, or CFAs. The CFAs, which are discussed below, form the heart of the Merrimack conservation plan. The Technical Report provides a thorough description of the data, weighting process, and GIS processing techniques used to develop the plan’s conservation priority areas.

## How the Plan Prioritizes Land Conservation

### Conservation Focus Areas

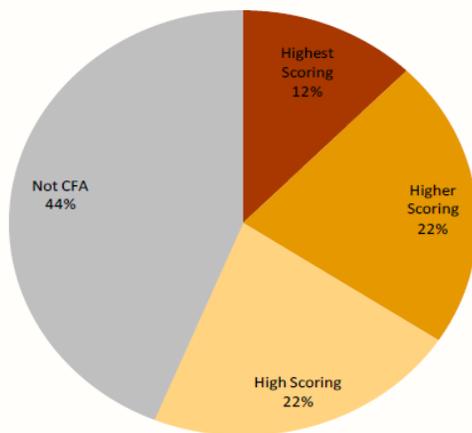
Conservation focus areas, or CFAs, are the main decision-making tool in the Merrimack conservation plan (see map on page 10). While they are the product of more than 40 different data sets and sophisticated statistical analysis, the CFAs can be summarized as geographic areas where undeveloped land provides a combination of three core natural values: clean water, wildlife habitat, and good soils for growing food and forest products. The balance between these natural services varies from one CFA to another, but they are common to all.

***We have a good running start at land conservation in the Merrimack watershed, but there is still a long way to go.***

The Merrimack conservation plan stratifies the CFA’s into three qualitative tiers: Tier 1 focus area (darkest brown in map and chart below), Tier 2 focus area (medium brown), and Tier 3 “supporting natural landscapes” (lighter tan). All three tiers were statistically derived using natural break points (standard deviations) in the GIS co-occurrence data, with Tier 1 focus areas representing the smallest total acreage (about 250,000 acres out of 2.1 million) of the highest scoring land. The Tier 2 focus areas comprise a larger total acreage (about 443,000 acres) of high scoring land. Tier 3 comprises another substantial area (about 441,000 acres) of “supporting” natural lands that function to buffer and connect

the Tier 1 and 2 focus areas. The ultimate purpose of the tiered conservation focus areas is to allow an objective “apples to apples” comparison of land conservation opportunities across the watershed, and provide qualitative guidance on the relative resource value of different conservation projects.

**Proportion of Study Area in each CFA Classification**



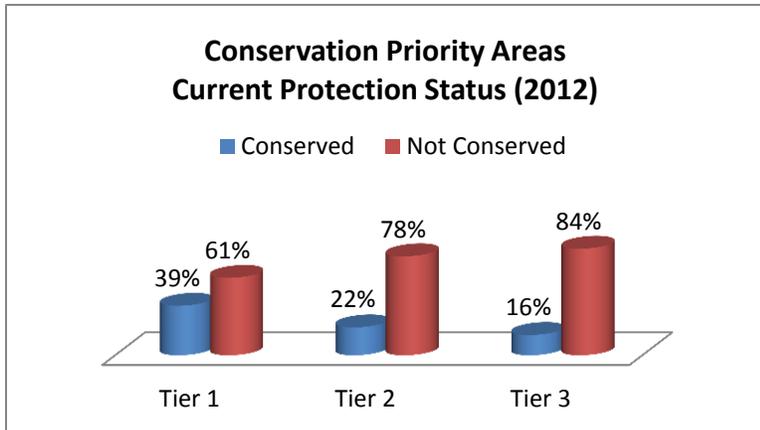
### Current Protection Status of Focus Areas

Of the 1.3 million acres of land identified as a priority for protection in the Merrimack plan (Tiers 1, 2 and 3 combined), only 23% has already been permanently conserved. Overall levels of land protection are significantly higher in Massachusetts than in New Hampshire. It is also notable that almost 72% of all the existing protected land in the watershed is in priority areas identified in the Merrimack conservation plan. In

other words, a healthy majority of the conservation land we have now is in the “right” places. The bottom line is that we have a good running start at land conservation in the Merrimack watershed, but there is still a long way to go.

## From Planning to Action

From its inception, the Merrimack watershed land conservation plan has been intended to be a blueprint for action. Its fundamental purpose is to *prioritize and accelerate* voluntary<sup>9</sup> land protection in the watershed in coming decades. The plan's conservation focus areas, which integrate the best available science and expert judgment, are a powerful tool for prioritization in a world where there is and never will be enough time or money. If the Merrimack watershed conservation plan is *used* in a consistent and sustained way to guide land protection project decisions, future conservation in the watershed will protect lands with the highest concentration of natural resource values.



Increasing the *pace* of land protection in the Merrimack watershed will depend on the sustained commitment of public agencies and private organizations, and, equally critically, on adequate financial resources being made available by public and private decision makers. If this collective commitment is made and *kept* over the next two decades, we can still change the trajectory of the Merrimack watershed predicted by

Forest Service researchers in 2010. The most critical lands can still be conserved, project by project, as the population, economy and human footprint in Merrimack Valley steadily grows. Twenty years from now, these lands can be quietly supporting our health, prosperity and quality of life as they do today. The choice is still ours to make.

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<sup>9</sup> Voluntary land protection is defined as a voluntary real estate transaction between a willing seller/donor (typically a private landowner) conveying property rights to a willing buyer/donee (a public or private conservation entity).

# Merrimack Plan Conservation Focus Areas

