Presented by:

The Society for the Protection of NH Forests and

The Nature Conservancy, New Hampshire Chapter

This report was prepared for the Society for the Protection of New Hampshire Forests and The Nature Conservancy. Data development and analysis was provided by Dan Sundquist of GreenFire GIS and by Pete Steckler of TNC. Questions should be directed to Will Abbott at the Forest Society (wabbott@forestsociety.org) or Jim O'Brien at The Nature Conservancy (jim_obrien@tnc.org).

Executive Summary

This report is offered by the Society for the Protection of NH Forests and The Nature Conservancy with the purpose of providing baseline information on the status of conserved lands in New Hampshire for consideration by the SB 388 Study Committee. In addition to surveying the current state of conserved lands, the report provides a summary of strengths and weaknesses of the present portfolio of conserved lands and identifies opportunities and priorities for future land conservation.

Data Sources

The primary baseline for assessing conserved lands in New Hampshire is the Conservation and Public Lands database which was updated and released publically by GRANIT in July 2014. Additional significant tracts of conserved land not yet incorporated into the GRANIT database were added by TNC staff to increase accuracy.

Many other GIS-based natural and cultural resource databases were assembled to determine the extent and distribution of resource protection statewide. The majority of these are found in the GRANIT data library, but others have been made available from various federal and state agencies responsible for such data.

Highlights of Findings

The most current data from GRANIT for conservation and public lands shows that **1,850,584 acres** of land are in public ownership or permanently protected. This amounts to **32.3%** of the state's land area, and a gain of nearly 590,000 acres of protected land since 1996 when records were first systematically developed. Agencies and organizations responsible for conservation land in N.H. are grouped into five broad categories, as follows:

Agency Type	Number of Tracts	Total Acres	Percent of Total
Federal	715	822,252	44.4%
State	1,376	456,840	24.7%
Municipal	4,343	180,280	9.7%
Quasi-Public	230	10,320	0.6%
Private	3,560	380,892	20.6%
	10,224	1,850,584	

There are twelve types of protected land in N.H., some of which are not permanent or otherwise outdated (leases, deed restrictions, reverter clauses). More than **98%** of conservation land is in **fee ownership or conservation easement.** See table on the next page with a breakdown of area and percentage of total for each type of protected land.

Primary Protection Type	Number of Tracts	Acres	Percent of Total
Agricultural Preservation Restriction	68	3,164	0.2%
Conservation Easement	4,154	486,991	26.3%
Deed Restriction	177	17,061	0.9%
Flowage Easement	193	3,658	0.2%
Fee Ownership	5,152	1,330,408	71.9%
Historic Preservation Easement	4	28	0.0%
Long-term Lease	11	684	0.0%
Protective Easement (Water Supply Lands)	35	711	0.0%
Reverter Clause	7	487	0.0%
Right of Way	26	92	0.0%
Open Space Set-Aside	362	6,813	0.4%
Scenic Easement	35	487	0.0%
	10,224	**1,850,584**	

The extent and distribution of conserved land in New Hampshire has been grouped into four classifications: by county, by DRED tourism region, by regional planning commission service area, and by ecoregion. The data highlight that the extent and distribution of conservation lands varies significantly across the state. Northern municipalities and counties along with areas of high elevation tend to have much higher rates of land conservation. More southerly regions and lower elevation zones have far less area in conservation ownership, even though those areas often have tremendous natural resource significance and are typically at greater risk of conversion.

See the following four tables on this page and the next for a summary of conserved land in each category.

County	Total Area (Ac)	Water Area (Ac)	Total Land Area (Ac)	Land Protected	Percent of County Land Area
Belknap	300,787	43,724	257,063	34,425	13.4%
Carroll	635,821	38,837	596,983	252,992	42.4%
Cheshire	466,516	14,160	452,355	101,402	22.4%
Coos	1,171,973	21,919	1,150,054	622,443	54.1%
Grafton	1,119,748	24,653	1,095,095	450,598	41.1%
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Merrimack	611,150	15,802	595,348	114,337	19.2%
Rockingham	465,173	19,558	445,614	73,585	16.5%
Strafford	244,862	10,321	234,541	39,030	16.6%
Sullivan	353,363	9,602	343,761	55,822	16.2%
	5,940,547	**210,177**	**5,730,370**	**1,850,584**	**32.3%**

NHDRED Region	Total Land Area	Percent State Land Area	Protected Land Area	Percent Protected
Dartmouth/Lake Sunapee	881,552	15.4%	161,427	18.3%
Great North Woods	863,964	15.1%	420,817	48.7%
Lakes Region	953,562	16.6%	172,651	18.1%
Merrimack Valley	824,161	14.4%	132,515	16.1%
Monadnock Region	730,746	12.8%	168,131	23.0%
Seacoast	273,991	4.8%	52,121	19.0%
White Mountains	1,202,395	21.0%	742,923	61.8%
	5,730,370		**1,850,584**	**32.3%**

Regional Planning Commission	Total Land Area	Total Acres Protected	Percent of State Land Area	Percent of All Protected Land
North Country Council	2,152,679	1,174,724	54.6%	63.5%
Lakes Region Planning Commission	733,131	147,536	20.1%	8.0%
Upper Valley/Lake Sunapee Regional Planning Commission	657,012	118,929	18.1%	6.4%
Southwest Region Planning Commission	631,754	147,414	23.3%	8.0%
Central NH Regional Planning Commission	479,675	93,902	19.6%	5.1%
Southern NH Planning Commission	307,057	49,003	16.0%	2.6%
Nashua Regional Planning Commission	202,094	26,084	12.9%	1.4%
Rockingham Planning Commission	236,417	36,462	15.4%	2.0%
Strafford Regional Planning Commission	330,552	56,530	17.1%	3.1%
	5,730,370	**1,850,584**		

NH Ecoregion Sub-Sections	Total Land Area	Percent of State Land Area	Area Protected	Percent Protected
Coastal Lowland	183,092	3.1%	36,475	19.9%
Coastal Plain	982,145	16.5%	146,647	14.9%
Connecticut Lakes	372,314	6.3%	230,207	61.8%
Mahoosuc-Rangely Lakes	617,709	10.4%	228,335	37.0%
NH Uplands	1,646,741	27.7%	354,497	21.5%
Northern Connecticut River Valley	258,886	4.4%	33,910	13.1%
Sebago-Ossipee Hills and Plain	896,344	15.1%	137,889	15.4%
Vermont Uplands	190,461	3.2%	30,165	15.8%
White Mountains	792,841	13.3%	652,460	82.3%

Protection of Drinking Water Supplies

In 2012, there were 1,151 community wells serving approximately 608,000 residents; another 511 wells serve businesses, schools, industry, and a host of transient uses such a restaurants, motels, ski areas, and campgrounds, with a population served of more than 128,000. **This means that about 46% of the state's population and most of our places of employment rely on public drinking water supplies.**

Four resource features have been evaluated in order to determine the protection status of drinking water supplies in New Hampshire: sand and gravel aquifers (groundwater), remaining future site for potential groundwater wells, and both wellhead and source water protection areas defined by NHDES.

Aquifers

Sand and gravel aquifers are the primary source of community drinking water for one-third of municipal and other public water supplies (wells) in New Hampshire, and serve more than 600,000 persons statewide, or about 46% of the state's population. Aquifers cover about 14% of the state's land area, and are **slightly more than 14% protected**. At present, **nearly 24 % of aquifer land area is currently developed** with roads and urban/suburban land uses.

Favorable Sites for Future Wells

NHDES has mapped the areas of the state's aquifers which are not impacted by potential contamination sources, and are the most likely locations for future municipal water supply wells pending more detailed hydro-geological investigation. These areas represent less than 1% of the state's land area, and are **currently only 23% protected**.

Wellhead Protection Areas

NHDES has delineated hydrological-based protection areas around community wells and surface water intakes at drinking water reservoirs. These protective areas represent somewhat more than 5% of the state's land area, and are **less than 16% protected at present**. **A little more than 19% of these areas are already developed with roads and other land uses,** and no regulatory mandate exists to require further protection of these lands.

Source Water Protection Areas

NHDES had also delineated certain watersheds deemed critical to maintaining water quality within community drinking water supplies. These areas amount to somewhat more than 7% of the state land area, and are **slightly more than 45% protected.** Although most of these watersheds are rural, **about 7% of their area is currently developed.**

Farmland Protection

The status of farmland protection in New Hampshire can be estimated using two sources of data: highly productive agricultural soils and currently active farming based on land cover information for cropland and hay/pasture utilization.

Highly Productive Agricultural Soils

The most productive soils in N.H. are defined by NRCS soils mapping in two classes: prime agricultural soils and soils of statewide importance. Together, the two soils groups total somewhat less than 7% of the state land area, and are **approximately 12% protected**. **These soils are about 20% developed currently**, and unavailable for farming.

Actively Farmed Land

Land cover data released in 2010 shows two levels of farming: actively cropped land and orchards, and open land maintained for hay or pasture. Statewide, these two classes **represent about 4% of the state's land area, of which nearly 13% is protected.**

Forest Protection

Forest Blocks

Intact forest blocks greater than 500 acres in size, regardless of land ownership pattern, provide important water quality, wildlife habitat, as well as remote recreational opportunities, as well as the threshold for long-term economic forest management. **Forest blocks greater than 500 acres account for two-thirds of the land cover in New Hampshire, and are currently about 40% conserved,** although blocks in the lower size ranges close to urban centers are less well conserved (18% for blocks 500 to 5,000 acres).

Forest blocks greater than 5,000 acres represent an important threshold of ecological significance in term of maintaining the structure, function, and processes of local and regional ecosystems. These blocks **total more than 2.3 million acres statewide, and are currently about 57% protected**. Blocks in the range of 5,000 to 10,000 acres, which are important for ecological linkages among larger blocks, **are only about 27% protected**.

Prime Forest Soils

The most productive forest soils in New Hampshire total more than 3.8 million acres, or about 60% of the state's land area, **and are currently about 22% protected**. However, the group of forest soils that represents the state's best high-volume white pine growing land **totals only about 11% of the these soils, and is only 14% protected at present**.

Habitat Protection

The status of fish and wildlife habitat conservation has been assessed in several ways:

- Protection of broad eco-regions;
- NH Wildlife Action Plan data on habitat quality (terrestrial and aquatic habitats combined;
- NH Wildlife Action Plan data on aquatic habitat quality;
- NH Wildlife Action Plan habitat types;
- Rare species occurrences
- Extent of wetlands protection;
- Extent of floodplain protection; and,
- Habitat conserved by elevation.

Habitat Quality

The NH Wildlife Action Plan (NHWAP) data update released in 2010 ranks habitat quality statewide in three tiers: Tier 1 is best in state, Tier 2 is best in ecoregion, and Tier 3 are supporting landscapes that work as buffers to protect the integrity of the higher two tiers. Taken together, **the three tiers total to slightly more than 2/3 of the state land area.** Protection status for each tier is as follows:

NHWAP Habitat Quality Tier	Total Area Statewide	Area Protected	Percent Protected
Tier 1	1,540,387.3	806,592.5	52.4%
Tier 2	488,522.9	173,158.0	35.4%
Tier 3	1,844,006.0	573,535.4	31.1%
	3,872,916.2	**1,553,286.0**	**40.1%**

Aquatic Habitat

The NHWAP has developed data on the highest quality aquatic habitats, which include certain watershed-related stream networks as well as lakes and ponds that rated highly for habitat quality and ecological intactness.

The stream networks are ranked in three tiers similar to the habitat quality tiers above, with Tier 1 representing the top 15% in quality statewide (by watershed group), Tier 2 is ranked in the top 30%, and Tier 3 are streams with occurrences of selected aquatic species of concern. Each watercourse is buffered by 100 meters (328') to form a protective corridor along its length. Statewide and taken together, these corridors cover about 10% of the state, **and are nearly 38% protected**. Of 327 watersheds statewide, only 99 contain Tier 1 or 2 ranked watercourses.

The protection status for the NHWAP aquatic habitat tier rankings is as follows:

NHWAP Ranking	Total Acreage of Stream Corridor	Area Protected	Percent Protected
Tier 1	226,670	99,830	44.0%
Tier 2	205,251	71,504	34.8%
Tier3	124,904	38,941	31.2%
	556,825	**210,275**	**37.8%**

Rare Species Occurrences

The New Hampshire Natural Heritage Bureau maintains a database documenting over 4,000 distinct occurrences of rare plant and animal species in New Hampshire. **Approximately 37% of these occurrences are found on permanently protected or public land, while 63% remain unprotected.**

Top-Ranked Lakes and Ponds

As part of the NHWAP, lakes and ponds in New Hampshire were evaluated for habitat quality and ecological integrity. The top 10 water bodies in each of ten watershed groups were selected based on size, depth, and acidity, and a 200' protective buffer was established around each water body which is critical to maintaining water and habitat quality. Land cover data was used to estimate the amount of land associated with the buffer that is already developed.

The total area of the top-ranked lake/pond buffer is about 14,770 acres statewide, of which **28% is currently protected**. **About 28% of the buffer is estimated to be developed by roads and other land uses.**

Wetlands

Wetlands data has been generated using NRCS data for hydric soils – poorly and very poorly drained soils which are typically classified as wetlands, and include forested as well as marsh, bog, and shrubby types of wetlands, in combination with National Wetlands Inventory on wetlands types in the state. The total area of hydric soils and mapped wetlands in N.H. is nearly 772,000 acres, or about 13.5% of the state land area. **These wetlands are currently slightly under 25% protected**.

Floodplains and Riparian Areas

Floodplains: Just over 6% of the state is mapped as 100-year floodplain by FEMA (note: FEMA mapping is not available for Belknap county), of which **21% is protected or in public ownership**. **Of the 79% of unprotected floodplains, 7% is developed and 6% is agricultural**.

Riparian areas: Riparian areas cover approximately 28% of the state's land area (not including open water), of which **30% is protected or in public ownership**. **Of the 70% unprotected riparian areas, 12% is developed and 5% is agricultural.**

Elevation

Elevation and terrain have a distinct correlation to various habitat types. The elevation classes in the table below are based on studies of ecological systems in New Hampshire by The Nature Conservancy. Higher elevations are typically better conserved, largely due to the historic emphasis on conserving peaks and scenic places in more mountainous areas. **The lower terrain (20' – 800') in southeastern N.H. is the least protected, and the most densely populated and developed region of the state.**

Elevation Range	Total Acres	Percent of Total State Area	Acres Protected	Percent Elevation Zone Protected
0 - 20'	17,603	0.3%	4,378	24.9%
20 - 800'	2,146,872	37.5%	316,308	14.7%
800 - 1700'	2,444,925	42.7%	657,532	26.9%
1700 - 2500'	799,604	14.0%	560,780	70.1%
2500 - 3600'	278,237	4.9%	256,293	92.1%
> 3600'	42,709	0.7%	42,671	99.9%

Recreation Opportunities

Public Access

Coding with regard to public access on conserved lands in the GRANIT conservation and public lands database indicates that **slightly more than 70% of conserved tracts allow public access for hunting, fishing, and recreation**. Another 2% restrict public access in some manner or at certain times. However, almost 26% of records in the database represent public access as unknown, so it is probable that many more tracts allow public access.

The distribution of conserved land has been analyzed for convenient accessibility from the most populated municipalities in New Hampshire (communities of 10,000 or greater). **Nearly 20% of all conserved land is within a 20-minute drive time of 718,000 persons, or about 54% of the state's population. Of communities greater than 20,000 persons (38% of the state's population), about 10% of conserved land is closely located.**

Regional Recreation Trails

Current data on local and regional recreation trails (hiking, biking, etc.) has mapped nearly 2,700 miles of trails statewide, **of which about 82% lie on conserved land**. Rail trails along abandoned railroad rights-of-way **amount to about 443 miles of long-distance recreation opportunity, but are only 30% protected**. Privately maintained long-distance hiking trails (Monadnock-Sunapee Greenway, Sunapee-Ragged-Kearsarge Greenway, and the Monadnock-Metacomet Trail) **total about 150 miles, and are 52% protected at present**.

Introduction

Study Purpose

An analysis of the status of conserved lands in New Hampshire has been conducted jointly by the Society for the Protection of NH Forests and The Nature Conservancy with the purpose of providing baseline information for consideration by the SB 388 Study Committee.

The primary focus of this analysis is keyed to the following paragraphs of the enabling legislation:

"I. Survey the current composition of conservation lands in New Hampshire including, but not limited to, the number of acres in conservation, how these lands are distributed geographically, the purposes for which land is being protected, and what entities hold conservation lands.

VI. Identify strengths and weaknesses of New Hampshire's current portfolio of public and private conservation lands, and study whether the state's approach to land conservation is appropriate to meet future challenges including, but not limited to, ***securing current and future drinking water supplies, maintaining a land base for farming and forestry, protecting fish and wildlife habitat, and providing outdoor recreation opportunities****."* [Emphasis added.]

Each of the topical areas cited in the paragraphs above involves a range of natural resource features which are addressed below and in the main body of the report.

Report Organization

This report is divided into six major sections, as follows:

Section 1: Overview of Conserved Lands in New Hampshire

Section 2: Protection of Drinking Water Supplies

Section 3: Farmland Protection

Section 4: Forest Protection

Section 5: Habitat Protection

Section 6: Recreation Opportunities

Each section contains several topical areas that are discussed in some detail, and is accompanied by statistical tables and statewide maps for each resource feature.

Several appendices are also attached to this report in order to provide more detailed information on certain topical areas, as follows:

- **Appendix A** includes a map of the state with the names of all municipalities and unincorporated places in addition to a list by county for geographic reference.
- **Appendix B** lists the land area, area of conserved land, and percent of land area protected for all municipalities and unincorporated places.

- **Appendix C** shows a map of the NH Wildlife Action Plan "top 10" lakes and ponds for eleven watersheds across the state.

Data Sources

The primary baseline data for assessing conserved lands in New Hampshire is the **Conservation and Public Land** database which was updated and released publically by GRANIT in July 2014. Additional significant tracts of conserved land not yet incorporated into the GRANIT database were added by TNC staff to increase accuracy.

Many other GIS-based natural and cultural resource databases were assembled to determine the extent and distribution of resource protection statewide. The majority of these are found in the GRANIT data library, but others have been made available from various federal and state agencies responsible for such data.

Several natural resource features evaluated in this report have been analyzed to assess the current level of development associated with those resources. Examples include drinking water protection areas, aquifers, floodplains, agricultural soils, and so forth. The data utilized is the **2011 NOAA National Land Cover Dataset**, which utilizes satellite imagery and advanced GIS processing to identify various types of natural and developed land cover. In this study, four land cover types are grouped into "developed lands": low, medium, and high intensity development, and developed open space. Many major roads and highways are included in these land cover types, but smaller local roads typically do not appear. The resolution of this data is about 1/5 acre, and the overall accuracy assessment is 85%. Therefore, the land cover data can be considered somewhat coarse, but it also represents the best available data for the analyses conducted in this study.

Section 1: Overview of Conserved Lands in NH

Conserved v. Protected

While the terms "conserved" and "protected" are used inter-changeably in this report, it should be noted that not all tracts of land found in the NH GRANIT[1] conservation and public lands database are permanently protected by legal means. "Permanently protected" is understood to mean that no development can take place on the land; however, various uses of the land, including timber harvest and agricultural uses, are typically allowed except on tracts that are ecologically significant.

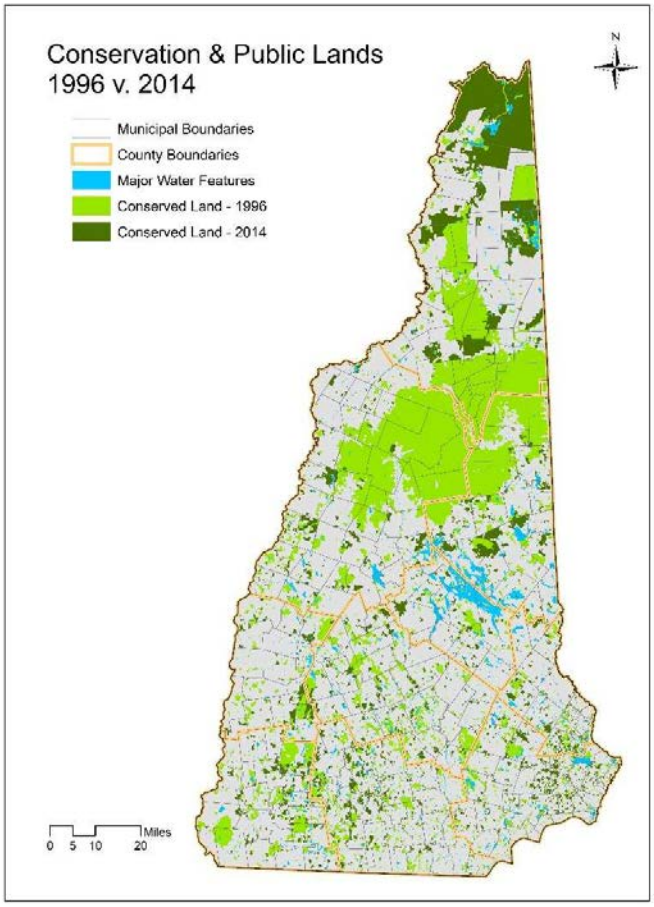
Slightly more than 4% of land that is considered to be conserved has no legal protection, but is subject to mandates to manage for natural land cover; this land includes large tracts such as the Second College Grant in the North Country (26,770 acres owned by Dartmouth College), and many UNH properties. Another 1% of land included in the GRANIT database is comprised of town parks and other unprotected land that are presently more than 50% utilized in non-natural land cover, or may be in the future. Finally, the status of legal, permanent protection for about 5% of the land considered conserved is unknown, pending further information gathering.

Therefore, readers should understand that about 90% to 95% of the land GRANIT conservation and public land database is permanently protected, pending revisions to the database. **Data presented in this report utilize <u>all</u> tracts of land currently mapped and included in the GRANIT database, regardless of legal protection.**

Statewide Profile: Historical and Current

The most current data from NH GRANIT for conservation and public lands shows that **1,850,584 acres** of land are in public ownership or are private lands that are permanently protected by legal means. This amounts to **32.3%** of the state's land area. Comparing data from 1996, when records were first systematically developed and mapped, the state has seen a gain of nearly 590,000 acres of protected land.

The map to the right illustrates the extent and distribution of conservation and public lands 1996 versus 2014. The most obvious changes are in the North County, principally Coos County, where large tracts of forest land have come under permanent protection. Much of



[1] NH GRANIT stands for the New Hampshire Geographically R
the state's manager of digital geographic data used by enviro

this land continues to be managed for economic forestry and recreation uses; certain areas are currently ecological preserves. Other large tracts have been added south of the White Mountain National Forest, especially in the Lakes Region and centering on the Ossipee Range.

Further south, the pattern of newly protected lands is more diverse and fine-grained, with significant gains in southwestern New Hampshire and the Seacoast Region. Much of this change has been due to the efforts of local, regional, and statewide land trusts, often working in partnership.

Role of Various Agencies and Organizations

More than 350 separate agencies and organizations are listed as Primary Protecting Agencies[2] in the GRANIT database, and these are grouped into five broad categories, as follows:

Agency Type	Number of Tracts	Total Acres	Percent of Total
Federal	715	822,252	44.4%
State	1,376	456,840	24.7%
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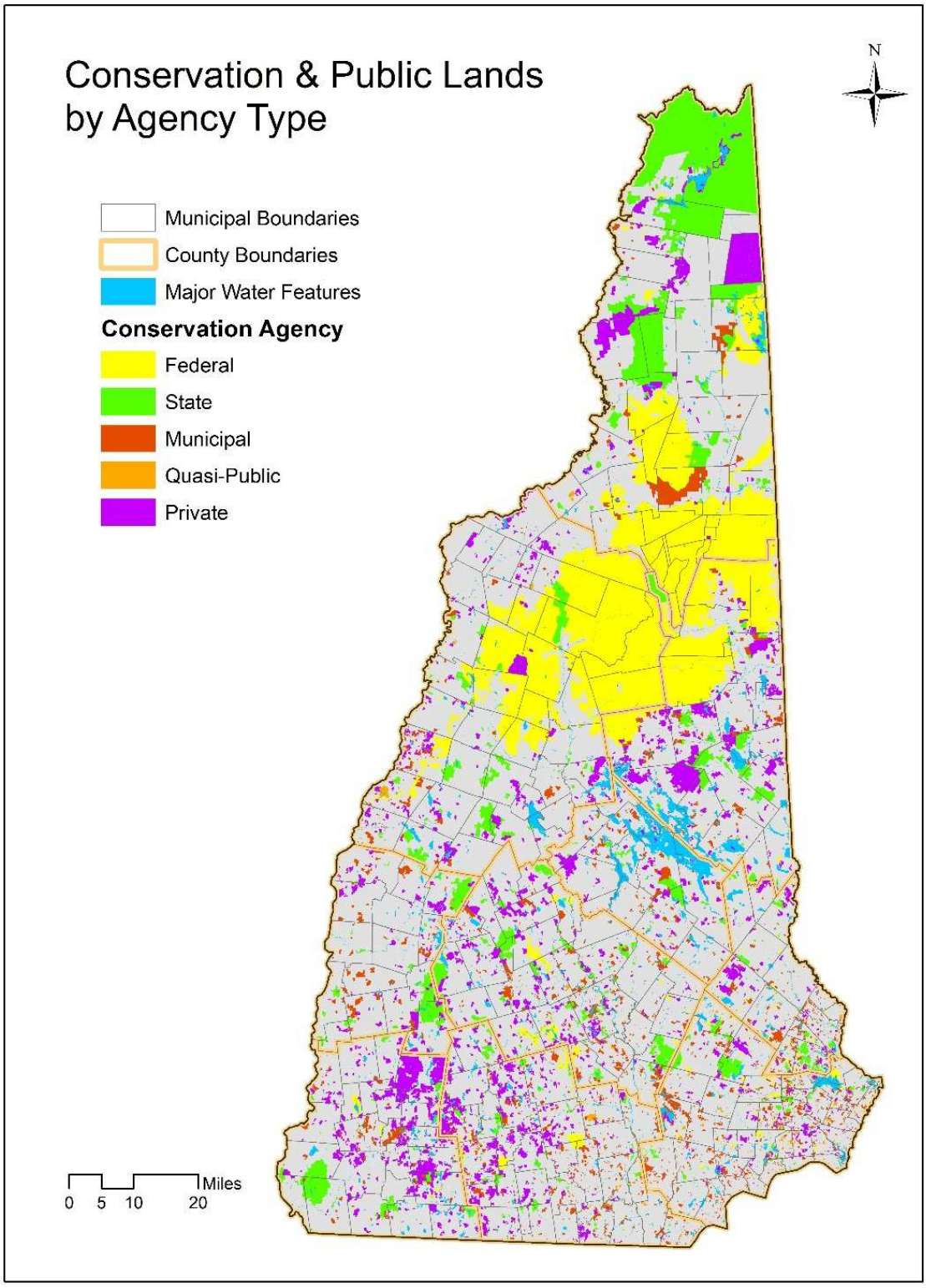
As can be seen in the table, nearly 70% of all conserved and public land is under federal and state jurisdiction; another 10% is held by municipalities. Private conservation land (land trusts, NGO, etc.) account for a little more than 20% statewide. Quasi-Public entities, such as water and school districts, make up the remainder. The detailed map on the next page shows the five agency types statewide.

[2] A Primary Protecting Agency is defined as the agency or organization holding the first level of legal protection on conserved land. Secondary, or "back up" protection interests are also typical on tracts of conservation and public land.


Conservation & Public Lands
by Agency Type
N
Municipal Boundaries
County Boundaries
Major Water Features
Conservation Agency
Federal
State
Municipal
Quasi-Public
Private
Miles
0 5 10 20

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The extent and distribution of conserved land in New Hampshire has been further grouped into four classifications: by county, by DRED tourism region, by regional planning commission service area, and by ecoregion (see **Section 5: Habitat Protection**). The data highlight that the extent and distribution of conservation lands varies significantly across the state. Northern municipalities and counties along with areas of high elevation tend to have much higher rates of land conservation. More southerly regions and lower elevation zones have far less area in conservation ownership, even though those areas often have tremendous natural resource significance and are typically at greater risk of conversion.

The table below, and the color-shaded maps that follow, illustrate the varying levels of land protection by county and by municipality around the state; darker colors in the map indicate higher levels of protected land overall.

County	Total Area (Ac)	Water Area (Ac)	Total Land Area (Ac)	Land Protected	Percent of County Land Area
Belknap	300,787	43,724	257,063	34,425	13.4%
Carroll	635,821	38,837	596,983	252,992	42.4%
Cheshire	466,516	14,160	452,355	101,402	22.4%
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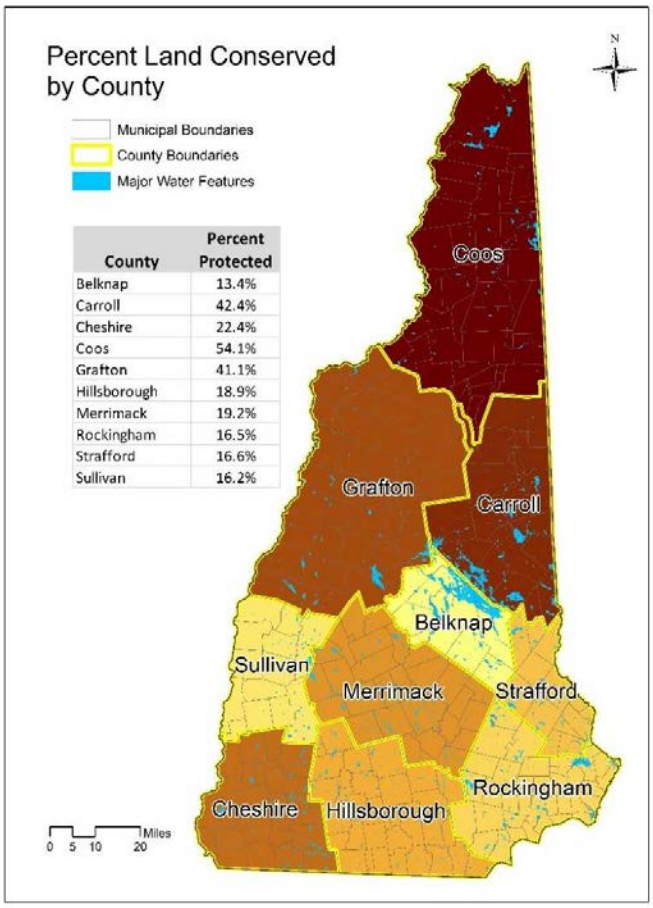
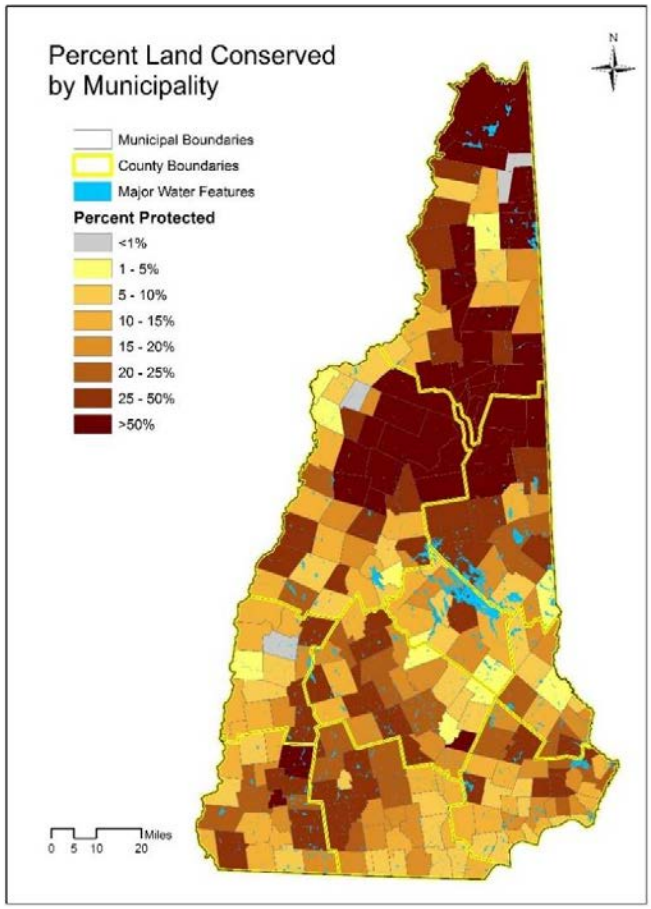




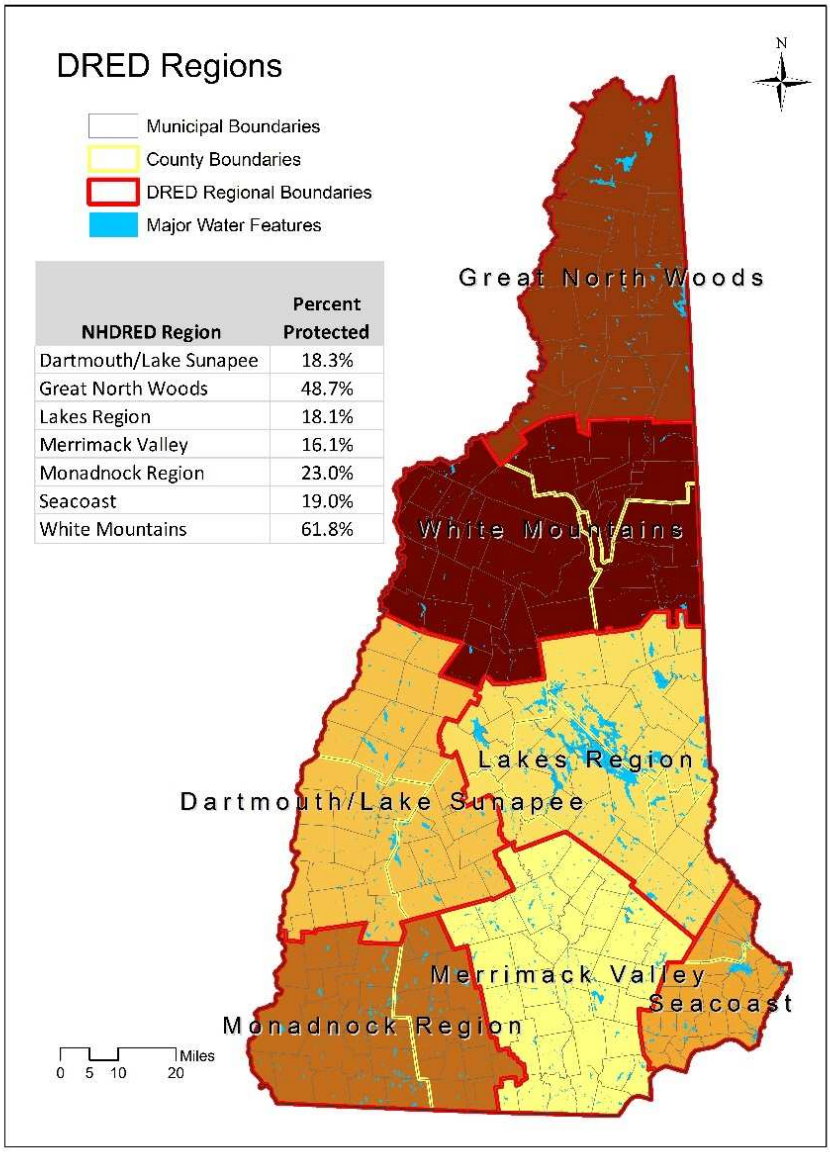
Note how the difference in scale between the two political subdivisions of the state tell a somewhat different story in geographic patterns. At municipal scale, Coos County shows a great deal of variability place-to-place; clearly, it is the White Mountain National Forest that is driving the high levels of conserved land in Coos, Grafton, and Carroll Counties. Southwestern New Hampshire also exhibits a large, contiguous area of relatively high land protection, as does parts of the Seacoast Region. In contrast, many individual communities with relatively low levels of conserved land are also apparent throughout the state.

Appendix B contains an extensive table of all municipalities and unincorporated places in New Hampshire listing the land area and the extent of conserved land in each place.

Viewing the data for conserved land by DRED region is one way of looking at the relationship of protected lands to the economic drivers in each region. The seven DRED regions are delineated for the most part based on the travel and tourism economy themes and landscapes which vary around the state. The table below lists each region and the percent of protected land; note that the White Mountains and the Great North Woods regions have a large share of land in conservation and/or public status. The Merrimack Valley which is the most highly urbanized has the least land protected.

See also the map that follows for the boundaries of each DRED region and percent protection color-shaded similar to the county map above.

NHDRED Region	Total Land Area	Percent State Land Area	Protected Land Area	Percent Protected
Dartmouth/Lake Sunapee	881,552	15.4%	161,427	18.3%
Great North Woods	863,964	15.1%	420,817	48.7%
Lakes Region	953,562	16.6%	172,651	18.1%
Merrimack Valley	824,161	14.4%	132,515	16.1%
Monadnock Region	730,746	12.8%	168,131	23.0%
Seacoast	273,991	4.8%	52,121	19.0%
White Mountains	1,202,395	21.0%	742,923	61.8%
	5,730,370		**1,850,584**	**32.3%**



Section 2: Protection of Drinking Water Supplies

In New Hampshire, we have been blessed with clean water, in large measure due to our extensive forests, and massive investment in waste water treatment. Clean water and conservation go hand in hand. Natural lands – our forests and wetlands -- are ideal "pre-treatment plants" that help to ensure both the quality and the quantity of our drinking water. Conservation of drinking water supplies also results in protection of other natural resources such as surface waters and wildlife habitat.

Decades ago, at a time when watersheds were only sparsely settled, our major cities and villages created reservoirs and river intakes to supply their residents with drinking water. Now, with soaring population growth, our thirst for water has outstripped our clean surface supplies, and we have turned to groundwater wells. In 2012, there were 1,151 community wells serving approximately 608,000 residents; another 511 wells serve businesses, schools, industry, and a host of transient uses such a restaurants, motels, ski areas, and campgrounds, with a population served of more than 128,000. **This means that about 46% of the state's population and most of our places of employment rely on public drinking water supplies.**

The land around our reservoirs and wells is under increasing pressure from development, which translates into increased risk of contamination. New water sources are also becoming scarce in many communities, with some towns having to look in neighboring towns for water supplies. The latest scientific information tells us that the extent of our drinking water supply lands is very limited. Yet, these scarce lands are being transformed by development, thereby increasing not only the threat of contamination and the consequent expense of water treatment, but also the difficulty of locating new water supplies to meet growing demand.

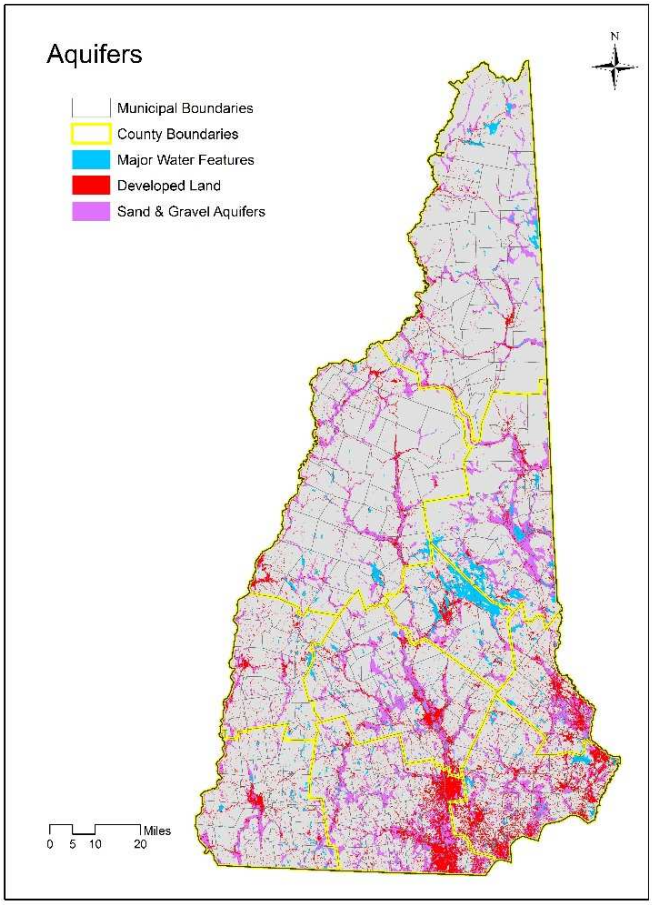
For the purposes of this report**, critical water supply lands** are defined as high-yield aquifer formations and the drinking water protection areas delineated by the NH DES Water Division around wellheads and surface water intakes on rivers and reservoirs that supply public drinking water (wellhead protection areas and source water protection areas). In many areas of the state, these two features overlay one another since the volumes of water required in municipal systems are available only in the porous layers of our extensive sand and gravel aquifers laid down during the retreat the last glacial age. Additional data is provided below on the remaining future sites for potential groundwater wells on aquifers, as determined and mapped by NHDES.

Note that bedrock sources of municipal water supply have not proved to be abundant in New Hampshire due to its geology, so the sand and gravel aquifers represent our best existing and future source of drinking water.[3]

[3] USGS *Assessment of Groundwater Resources in the Seacoast Region of N.H.*, SIR 2008-5222.

Sand & Gravel Aquifers

The map at the right shows the extent of stratified drift aquifers[4] statewide, as mapped by the U.S. Geological Survey. The pink color represents the surface area of the aquifers, while the red color shows where roads and urban land use development are found on the aquifers.



The scale of the map does not allow for detail indication of areas with deeper pools of groundwater and high levels of transmissivity[5], but it should be understood that not all of the aquifer area is suitable for development of municipal water supplies (see also the following discussion of favorable gravel well areas). However, the entire aquifer surface area does provide for primary recharge to the groundwater within the aquifer, and is therefore important to water quality and water balance.

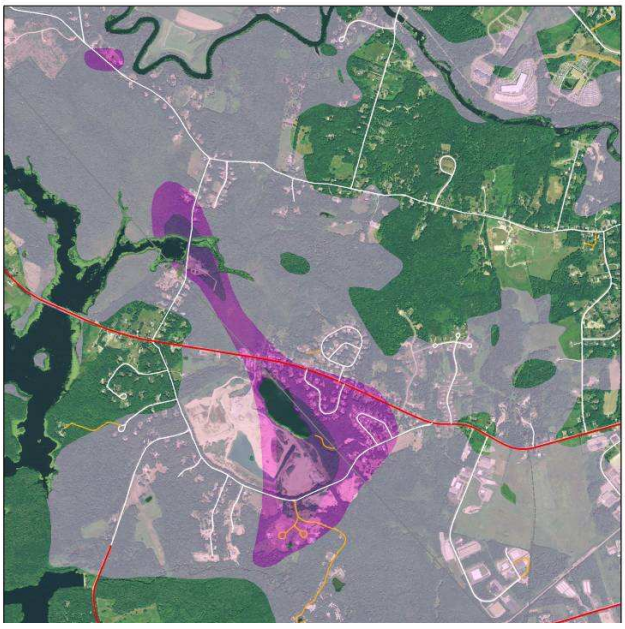
These aquifer formations are found in valley bottoms, often associated with major river drainages, but also in broad, flat areas where the glacial melting formed outwash plains and deltas during the warming period after the last ice age. Historical settlement patterns typically followed the river drainages and flat plains inland, with exploitation of water power at strategic points, so road networks and villages or town centers are commonly found on the deep, dry surface of aquifer formations. More recently, the easy terrain and sandy soils have been prime sites for various levels of significant land development, ranging from residential subdivisions to large-scale commercial and industrial land uses. The old and new development of the aquifers has greatly affected the natural land cover and water balance in these areas, making them one of the most impacted natural resources in the state.

The aerial photo on the next page illustrates the typical level of development on the Cocheco aquifer, in the Seacoast Region. The Bellamy Reservoir appears along the left side of the image, and the Cocheco River flows along the top of the photo. The transparent pink colors show the extent of the aquifer, with the darker colors indicating higher groundwater availability.

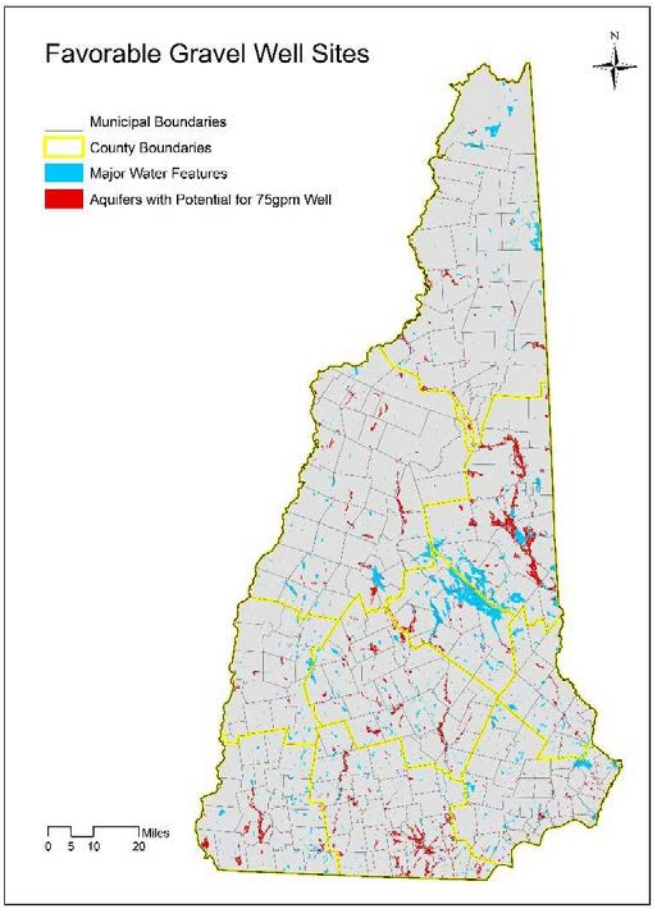
[4] Stratified drift is a geological term to describe the water-bearing sand and gravel formations layers where much of the state's groundwater resources are found.

[5] Transmissivity reflects the rate at which water can move through the sands, gravels, and sometimes clay deposits in the aquifers, and are used as a measure of water availability for municipal use.

Note the modern residential development on the aquifer, with scattered housing along cul-de-sacs and loop roads. In the lower right quarter of the photo are what appear to be commercial or industrial developments along an access road. Perhaps most notable, just west of the pond, is a large gravel extraction operation, which is typical on aquifer formations due to the sand and gravel resources found in glacial outwash features such as eskers and kames.



Sand and gravel aquifers are the primary source of community drinking water for one-third of municipal and other public water supplies (wells) in New Hampshire, and serve more than 600,000 persons statewide, or about 46% of the state's population. Aquifers cover about 14% of the state's land area, and are **slightly more than 14% protected**. At present, **nearly 24 % of aquifer land area is currently developed** with roads and urban/suburban land uses.

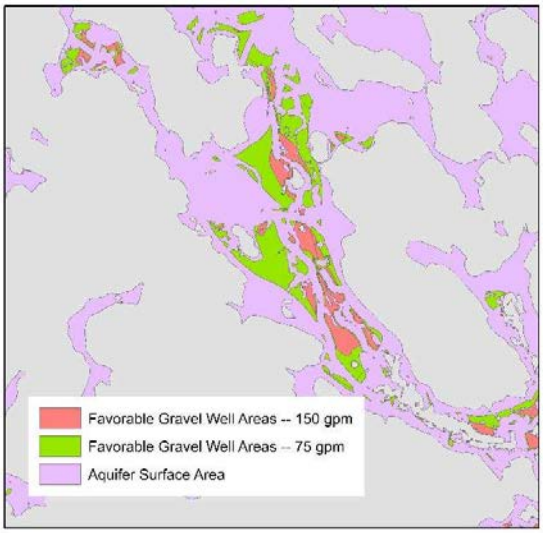


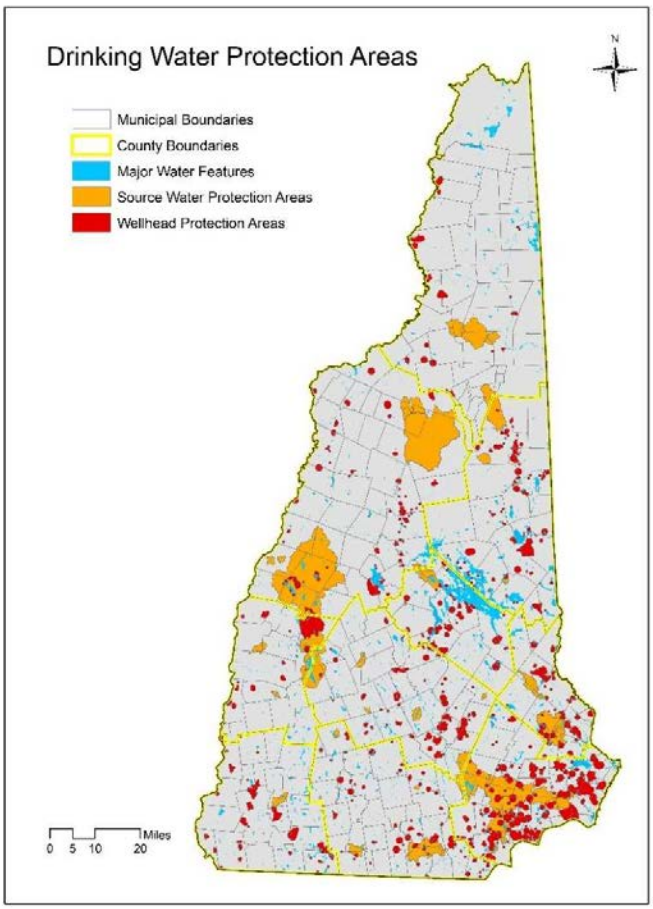
Favorable Sites for Future Wells

NHDES has mapped the areas of the state's aquifers which are not currently impacted by potential contamination sources (developed areas, roads, known and potential contamination sites, wetlands, etc.), and are the most likely locations for future municipal water supply wells pending more detailed, site-scale hydro-geological investigation.

Based on the transmissivity of the aquifers (see discussion above), two thresholds of water withdrawl rates are included in the NHDES analysis: 75 gallons per minute (gpm) and 150 gallons per minute (gpm). 75 gpm is considered the minimum practical water supply for municipal purposes. The map at the left shows the location of aquifer areas with potential for 75 gpm wells.

These favorable gravel well areas (75 gpm yield) represent only about 6% of the total sand and gravel aquifer area statewide, and are less than 1% of the state's land area, and are **currently only 23% protected**. The complexity and limited areas suitable for future water well development is shown in the non-specific inset map to the right. Note that the areas suitable for 150 gpm (red) are much smaller than the areas delineated for 75 gpm. This is due to the differences in estimated transmissivity in the sand and gravel aquifers, as well as the depth of the groundwater "pool" within the aquifer. The 150 gpm yield areas – the state's best potential for future municipal wells and water supplies -- amount to **less than 0.5% of the state's land area, less than 3% of the total aquifer area statewide, and are only 25% protected at present.**





Wellhead Protection Areas

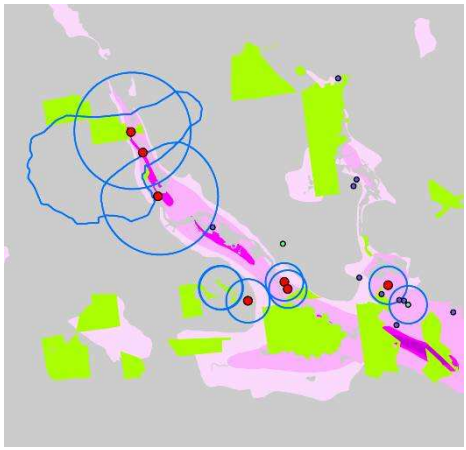
NHDES has delineated hydrological-based protection areas around community wells and surface water intakes at drinking water reservoirs. These wellhead protection areas (WHPA) are defined as the surface area from which water is likely to flow toward and reach a water supply source (well or intake), and include only community and non-community, non-transient public water systems[6]. The program focus is on land and water management, not prohibition of land use activities.

Water suppliers are required to maintain a small sanitary radius around the well or intake in a natural condition, to mitigate against contamination close to the water source.

aving its own source of supply, serving 15 or more services or 25 systems can be divided into three categories:
t 15 service connections used by year-round residents or regularly serve at least 25 year-round residents;

- Non-transient, Non-community systems which are not community systems and which serve the same 25 people or more over 6 months per year, i.e., schools, hospitals, businesses; and,
- Transient public water systems serving 25 people or more per day for 60 days or more per year, but not the entire year, i.e., hotels, restaurants, campgrounds.

However, they are not required to maintain the WHPA area in a natural condition. This is understandable since, for example, a 4,000 foot radius WHPA encompasses nearly 1,200 acres of land area, and with multiple ownerships and varying land uses, it is unlikely that the entire area can be permanently protected.



Due to the proximity of wellheads and intakes to one another in more built-up areas, the WHPA often overlap considerably, sometimes creating added, complex land management challenges for water supply owner/operators. However, many WHPA still have large, undeveloped areas in natural land cover, and to the extent possible, these areas should be a conservation priority in the interest of clean water in the future. To illustrate this, the inset to the left shows a non-specific area of aquifer (pink colors) with water supply wells (red dots), WHPA (blue outlines), and protected land (green).

These protective areas represent somewhat more than 5% of the state's land area, and are **less than 16% protected at present**. **A little more than 19% of these areas are already developed with roads and other land uses,** and no regulatory mandate exists to require further protection of these lands.

Source Water Protection Areas

NHDES had also delineated certain watersheds deemed critical to maintaining water quality within community drinking water supplies. Termed source water protection areas (SWPA), these water supply protection areas are similar to WHPA but are watershed-based. Since some of the SWPA watersheds are very large, only the smaller watersheds that typically relate to one or more community water supply features have been analyzed in this report. The map above shows these SWPA in orange.

These areas amount to somewhat more than 7% of the state land area, and are **slightly more than 45% protected.** Although most of these watersheds are rural, **about 7% of their area is currently developed.** In total, **NHDES data indicate that more than 761,000 persons are served by these SWPA,** although this number includes a share of the population served by wellhead protection areas embedded within the SWPA (see overlaps of WHPA and SWPA in the map above).

Section 3: Farmland Protection

The status of farmland protection in New Hampshire can be estimated using two sources of data: highly productive agricultural soils and currently active farming based on land cover information for cropland and hay/pasture utilization. Detailed data on the number of farms, the relative sizes of farms, and their productivity is found elsewhere in the National Agricultural Statistical Survey (NASS); however, these data – and the location of farms -- are not available spatially for confidentiality reasons, and cannot be mapped and analyzed for level of protection.

Highly Productive Agricultural Soils

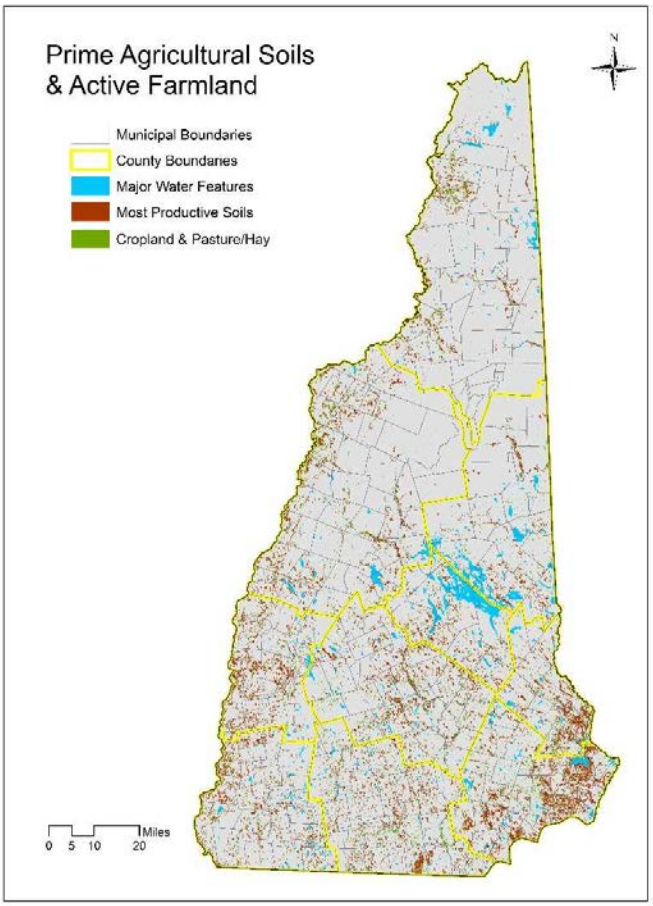
The most productive soils in N.H. are defined by NRCS soils mapping in two classes: prime agricultural soils and soils of statewide importance. Together, the two soils groups total somewhat less than 7% of the state land area, and are **approximately 12% protected**. **These soils are about 20% developed currently**, and unavailable for farming. Note that due to the coarse nature of the land cover data used in estimating the extent of development, it is probably that the level of conversion of these soils to other land uses is actually somewhat higher, and it is certainly higher in the southeastern portion of the state where urbanization has been most intensive.

The National Resources Conservation Service (NRCS) has classified agricultural soils according to criteria set forth in the Farmland Protection Policy Act of 1981, a program that seeks to minimize the unnecessary and irreversible conversion of farmland to non-agricultural uses, among other goals. Two of these soils classifications, taken together, can be viewed as the state's **most productive agricultural soils**. Brief definitions of these two soils classifications[7] follow:

- Prime Farmland – The NRCS defines these soils using highly technical physical attributes, but generally these soils possess the ideal range of moisture capacity, permeability, water table depth, pH, lack of flooding, and tilth to produce the commonly cultivated crops adapted to New Hampshire. Cultivation is a key factor in the use of these soils, so row cropping is typical, as with corn.

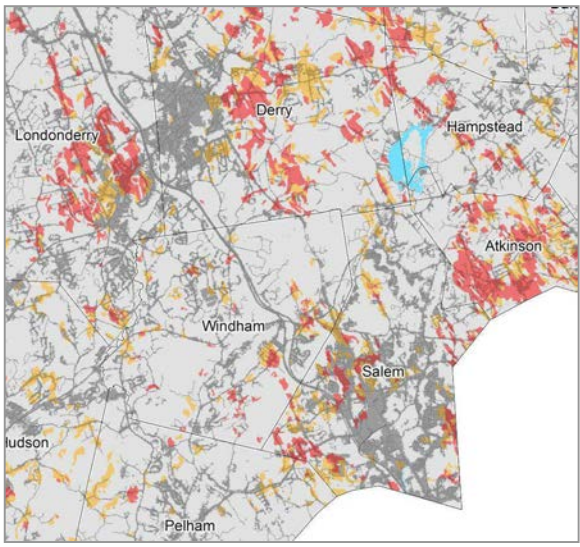
- Farmland of Statewide Importance – Land that is not prime, but is considered farmland of statewide importance for the production of food, deed, fiber, forage and oilseed crops. These soils have slopes of less than 15%, are not stony, are not wet, generally are deep soils, and are not excessively drained soils with low water holding capacity. This soil class may be utilized for row cropping or hay production, depending on site specific conditions.

[7] There are two other soils classes: Soils of Local Importance and Unique Farmland that is not discussed here because the former is so extensive and not of statewide significance to agriculture, and the latter is site scale and is not related to soils map units but rather the presence of fruit orchards and intensive vegetable production fields.



The map to the left shows the extent and distribution of the two most productive agricultural soils classes. Note how fine-grained the mapped pattern is statewide; this is due to the typically small size of each occurrence of these agricultural soils.

However, due to bedrock geology and glacial influence, the extent and distribution of these soils is much denser in southeastern New Hampshire. This coincides with the region of the state that has seen the most intensive land development over the last few decades, with conversion of farms and farmland to urban land uses.



The map inset to the right shows the area southeast of Manchester in more detail. Urban areas and the road system are shown in gray, with the productive agricultural soils in red and orange overlaid in a transparent format. Note the extent to which these soils are now developed where the gray tones appear in the red and orange.

Actively Farmed Land

Land cover data released in 2010 shows two levels of farming: actively cropped land and orchards, and open land maintained for hay or pasture. Although difficult to notice in the map above, the green color shows where the land cover data indicates farmed lands. Statewide, these two classes **represent about 4% of the state's land area, of which nearly 13% is protected.**

Overlaying the most productive agricultural soils and the actively farmed land data, **about 41% of farmed land in New Hampshire is located on the best soils**. Looked at conversely, **only 25% of the most productive soils are currently being farmed**, indicating that a reservoir of these soils exists under our forests, unmanaged grasslands, and other natural land cover, or is already developed (20%).

Section 4: Forest Protection

Forest Land Area in New Hampshire

The most current report from the USDA Forest Inventory and Analysis for 2012 estimates approximately 4,833,300 acres of forest land in New Hampshire, or about 84.2% of the state's land area, making New Hampshire the second most forested state in the nation after Maine. 1960 was the peak in forest area in the state, with a high of about 87% forest cover. Since then, forest area has declined by nearly 300 square miles due to development --- the conversion of forest land to non-forest uses.

For about the last 150 years, it was agricultural land that was reverting to forest leading to the 1960 high, but in the last two or three decades the trend has been from forests, and farms to a lesser extent, to a built environment. The ever-expanding infrastructure of residential, commercial, and other land uses has irretrievably committed that land to those uses. Where farmland may flow to forest, then back again, ***the process today is largely a one-way process.*** All the values associated with the natural resource base of forests or farmland – timber, food, clean water, wildlife habitat, recreation, and so on – are lost when this modern conversion takes place.

Forest Blocks

While the estimated amount of forest cover offers an indication of the extent of the resource on the landscape, the metric is limited in its ability to address issues of fragmentation or how intact the forest is, and how cohesively the forest is likely to function. . The concept of quantifying and measuring land cover in contiguous blocks allows one to consider the extent to which forests are capable of carrying out the functions and processes mentioned in the previous section. In general terms, the more intact forested land is, the better it is able to provide a resilient resource capable of supporting wildlife habitat, timber management, water regimes, recreational opportunities, and other amenities.

Forests also provide many invisible amenities, that we are coming to appreciate more and more. Among these "ecosystem services" provided by forests are abundant clean water and air, the ability to capture and store atmospheric carbon, and the capacity to mitigate the effects of flooding and other climate-change related events.

A ***forest block*** is an area of intact forest with continuous canopy, without regard to ownership. Thus it functions as a structural matrix for wildlife habitat, with block-to-block connections being important for the movement of wildlife. Large forest blocks are also important for the natural management of water quality and quantity, and as an economic resource to sustainable forestry. Block edges are defined by highways and local roads, non-forest land uses, and/or by large water feature (rivers and other water bodies greater than ten acres in size.

Each block includes embedded features of other types of land cover, such as open wetlands, grass, and shrublands, that while less common on the landscape, serve critical roles in terms of wildlife habitat, hydrologic cycles, and other important process functions. In this sense, a forest block may also be thought of as a "natural land cover block" which tends to emphasize the multiple ecosystem functions at work within what may appear as forested areas from a ground level perspective.

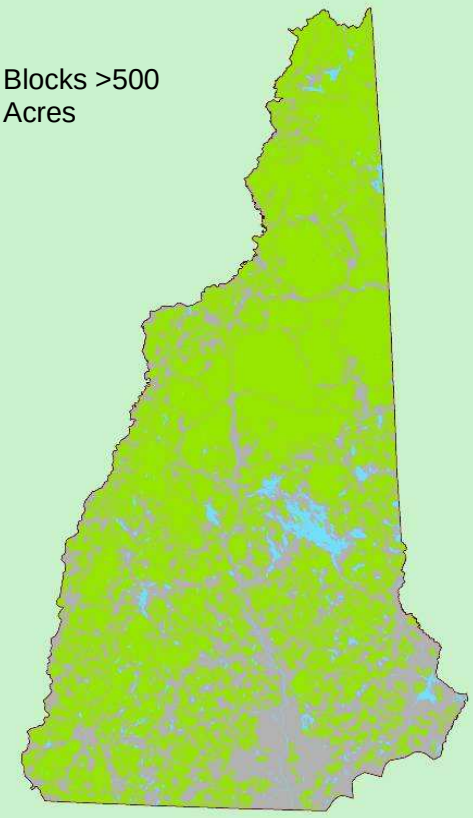
A minimum size of 500 acres was selected for this study to favor the mosaic of larger blocks which in turn reveals forest structure patterns at landscape scale. A block of 500 acres can provide adequate wildlife habitat for some species, help protect water quality, allow for long-term economic forest management, and offer a relatively remote recreation experience. **Forest blocks greater than 500 acres account for about two-thirds of the land cover in New Hampshire, and are currently about 42% conserved,** although blocks in the lower size ranges close to urban centers are less well conserved **(18% for blocks 500 to 5,000 acres)**.

As milestones of greater significance, blocks of 5,000 acres or more represent a minimum for sustainable economic forest management at regional scale, as well as a minimum size for long-term ecological significance. These blocks **total more than 2.3 million acres statewide, and are currently about 57% protected**. Blocks in the range of 5,000 to 10,000 acres, which are important for ecological linkages among larger blocks, **are only about 28% protected**.

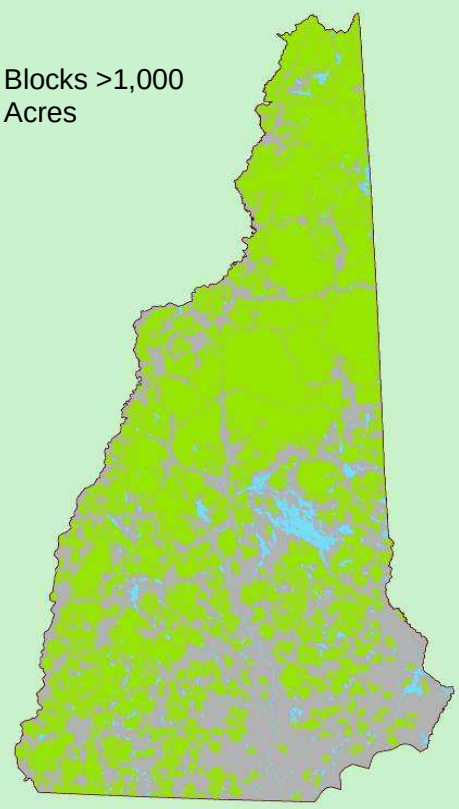
Blocks greater than 10,000 acres, and especially greater than 25,000 acres, represent the best scale to ensure that ecological structure, function, and processes such as soil nutrient accumulation and formation of old growth forests have sufficient framework to foster true ecological stability over the long term. **Blocks greater than 10,000 acres in size cover 1.9 million acres, and are 63% protected.**

The spatial distribution of forest blocks across New Hampshire is shown in **the map on the following page**. The gray background shows where the forest cover is fragmented by transportation corridors and developed land uses, or existing forest blocks are less than 500 acres. The four acreage classes in the maps are intended to show that while the distribution of smaller blocks in the range of 500 to 1,000 acres is fairly extensive statewide, blocks of 5,000 acres or more are geographically scarce in southern New Hampshire except for the highlands area that marks the watershed divide of the Connecticut and Merrimack Rivers, and north of the White Mountain National Forest.

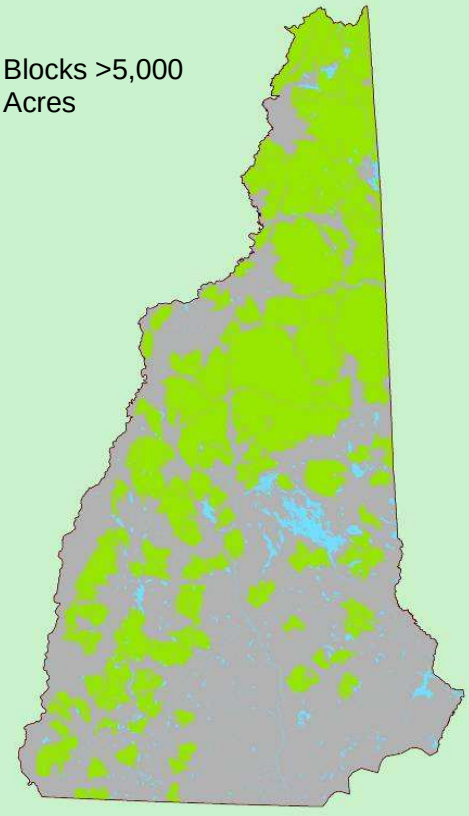
Blocks >500 Acres



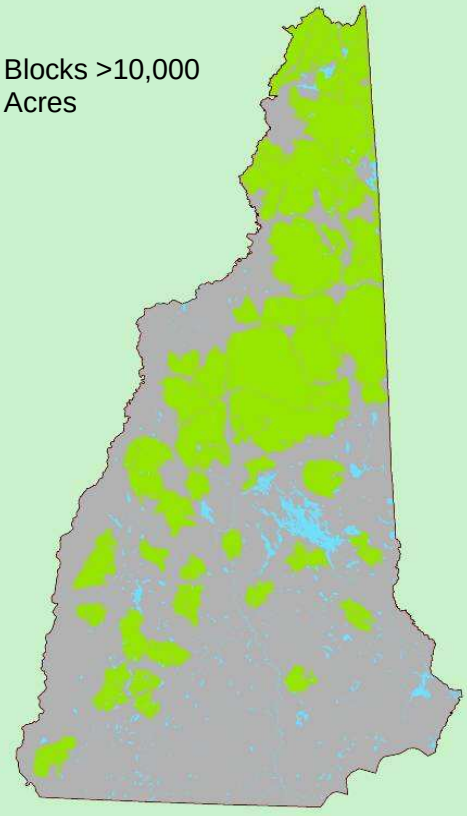
Blocks >1,000 Acres



Blocks >5,000 Acres



Blocks >10,000 Acres



Productive Forest Soils

New Hampshire soils are complex and highly variable due primarily to their glacial origins. The Natural Resource Conservation Service (NRCS) soil mapping recognizes and inventories these complex patterns and organized them into a useful and understandable planning tool termed Important Forest Soil Groups. The objective—a simplified yet accurate tool that will be helpful to natural resource professionals and landowners.

The most productive forest soils groups are listed and briefly described below. Note that this is a general overview, and forest species composition vary significantly north to south in New Hampshire.

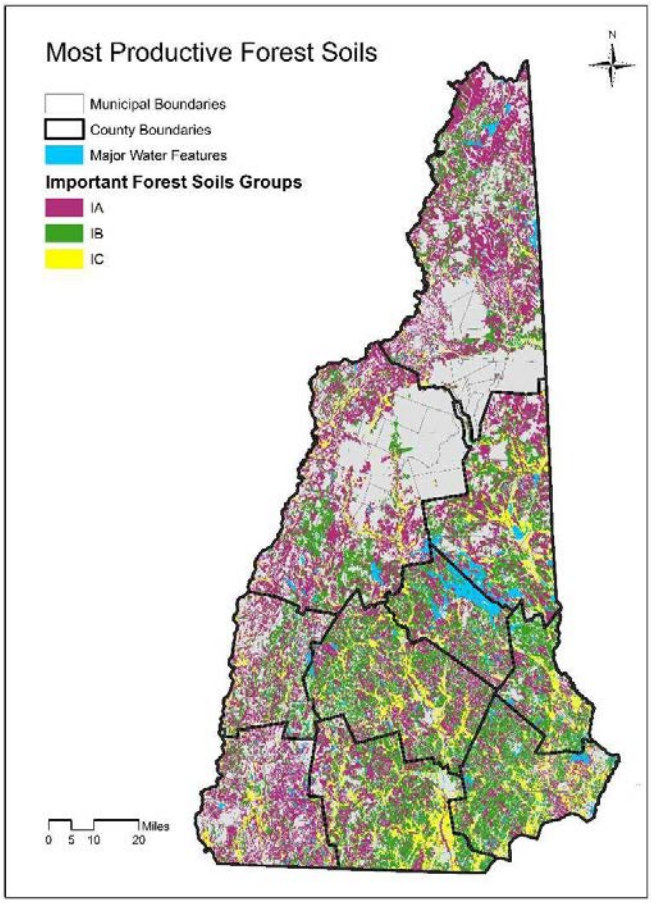
- **Group IA** consists of the deeper, loamy, moderately well-drained and well-drained soils. Generally, these soils are more fertile and have the most favorable soil-moisture conditions. Successional trends are toward climax stands of shade-tolerant hardwoods such as sugar maple and beech. The soils in this group are well-suited for growing high-quality hardwood veneer and sawtimber, especially, sugar maple, white ash, yellow birch, and northern red oak.
- **Group IB** generally consists of soils that are moderately well-drained and well-drained, sandy or loamy-over-sandy, and slightly less fertile than those in group 1A. Successional trends are similar to those in group IA. However, beech is usually more abundant on group IB and is the dominant species in climax stands. Group IB soils are also well-suited for growing less-nutrient-and-moisture-demanding hardwoods such as white birch and northern red oak.
- **Group IC** soils are derived from glacial outwash sand and gravel. The soils are coarse textured and are somewhat excessively drained to excessively drained and moderately well-drained. Soil moisture and fertility are adequate for good softwood growth but are limiting for hardwoods. Successional trends on these soils are toward stands of shade-tolerant softwoods, such as red spruce and hemlock. These soils are well-suited for high quality softwood sawtimber, especially white pine in nearly pure stands, and therefore represent the best high-volume white pine soils in New Hampshire.

Two other, significantly less productive soils groups are also mapped: IIA soils (physical limitations due to ledge, steep slopes, etc.) and IIB soils (wet). These soils groups are not considered in this analysis.

The table below lists the three most productive forest soils groups with total area statewide. Group 1A accounts for about 50% of all three soils in terms of overall land area, while Group 1B represents nearly another 40%. Note that Group 1C – our best high-volume white pine growing soils – **are limited to about 11% of the total area, and are only about 14% protected at present.** These soils are typically found in river valleys along the major highway system, and are easily developed for other land uses. **Group 1C soils are currently more than 27% developed**; Groups 1A and 1B are 7% and 8% developed, respectively.

Forest Soils Group	Total Acres	Percent of Total	Acres Protected	Percent Protected
IA	1,676,050	49.5%	410,187	24.5%
IB	1,331,234	39.3%	283,676	21.3%
IC	377,205	11.1%	52,468	13.9%
	3,384,489		**746,331**	**22.1%**

The map to the right shows the extent and distribution of the most productive forest soils in New Hampshire (Groups 1A, 1B, and 1C). Note that soils mapping is non-existent in large areas of Grafton and Carroll Counties in the area of the White Mountain National Forest.



Section 5: Habitat Protection

The status of fish and wildlife habitat conservation has been assessed in several ways:

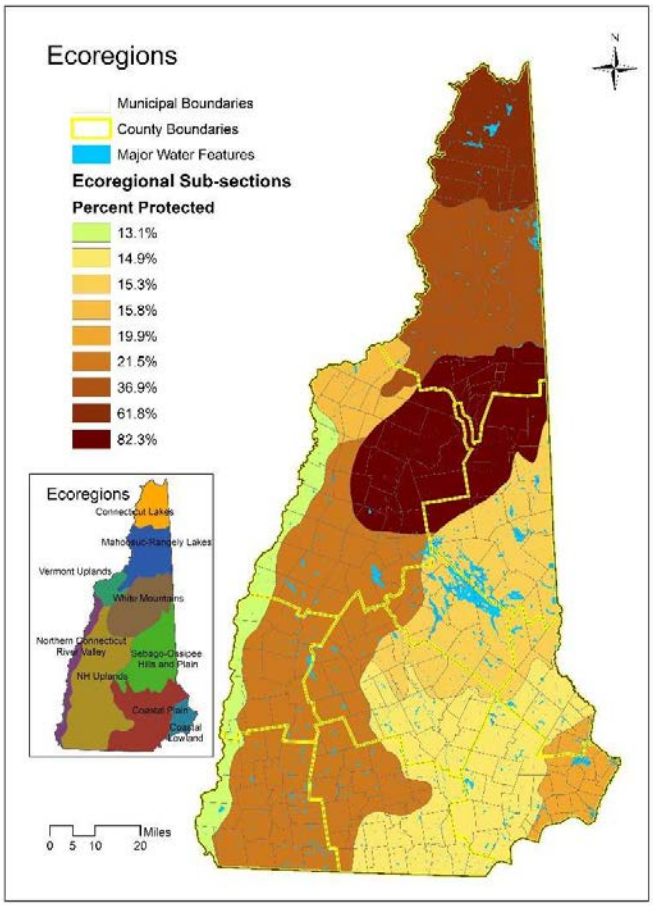
- Protection of broad eco-regions;
- NH Wildlife Action Plan data on habitat quality (terrestrial and aquatic habitats combined;
- NH Wildlife Action Plan data on aquatic habitat quality;
- NH Wildlife Action Plan habitat types;
- Rare species occurrences
- Extent of wetlands protection;
- Extent of floodplain protection; and,
- Habitat conserved by elevation.

Ecoregions

Ecoregions are defined by several geo-physical attributes that tend to determine the ecology of a regional-scale landscape, including bedrock geology and soils, climate characteristics, elevation ranges, and so forth. The map to the right shows the percent protection for the nine eco-regions for New Hampshire.

Note that relatively low levels of protection exist in the Northern Connecticut River Valley and Coastal Plain ecoregions, while the northern ecoregions are already much more protected due to the White Mountain National Forest and extensive conservation land in the North County.

Data for the nine eco-regions found in New Hampshire are listed in the table on the following page.

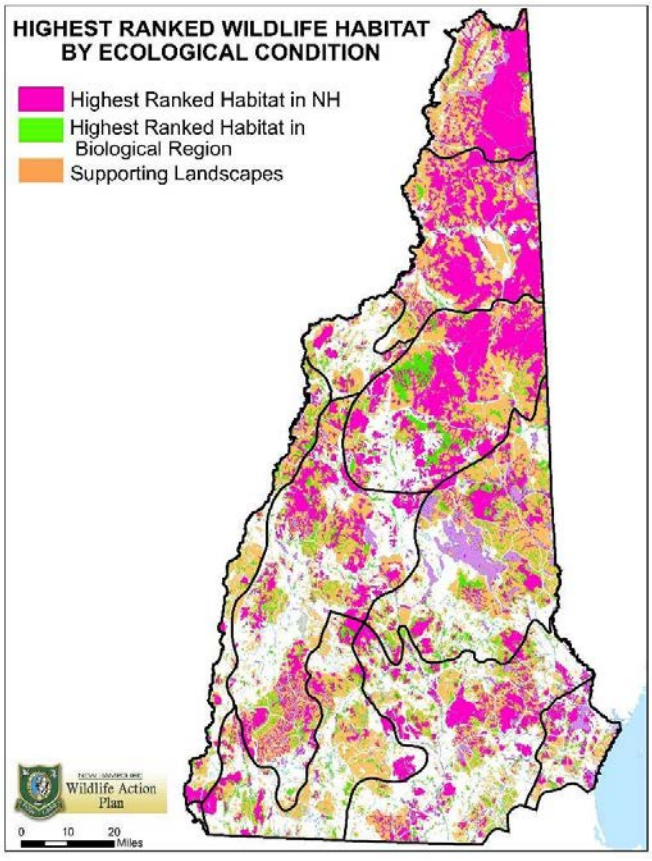


NH Ecoregion Sub-Sections	Total Land Area	Percent of State Land Area	Area Protected	Percent Protected
Coastal Lowland	183,092	3.1%	36,475	19.9%
Coastal Plain	982,145	16.5%	146,647	14.9%
Connecticut Lakes	372,314	6.3%	230,207	61.8%
Mahoosuc-Rangely Lakes	617,709	10.4%	228,335	37.0%
NH Uplands	1,646,741	27.7%	354,497	21.5%
Northern Connecticut River Valley	258,886	4.4%	33,910	13.1%
Sebago-Ossipee Hills and Plain	896,344	15.1%	137,889	15.4%
Vermont Uplands	190,461	3.2%	30,165	15.8%
White Mountains	792,841	13.3%	652,460	82.3%

NHWAP Habitat Quality

The NH Wildlife Action Plan (NHWAP) data update released in 2010 ranks habitat quality statewide in three tiers: Tier 1 is best in state, Tier 2 is best in ecoregion, and Tier 3 are supporting landscapes that work as buffers to protect the integrity of the higher two tiers. Taken together, **the three tiers total to slightly more than 2/3 of the state land area.**

The map to the right is the official NHWAP map identifying the three-tier approach to classifying habitat quality statewide.



More information on how the habitat quality tiers have been delineated and the NH Wildlife Action Plan can be found at:

http://www.wildlife.state.nh.us/Wildlife/wildlife_plan.htm

Protection status for each tier is as follows:

NHWAP Habitat Quality Tier	Total Area Statewide	Area Protected	Percent Protected
Tier 1	1,540,387.3	806,592.5	52.4%
Tier 2	488,522.9	173,158.0	35.4%
Tier 3	1,844,006.0	573,535.4	31.1%
	3,872,916.2	**1,553,286.0**	**40.1%**

Aquatic Habitat

The NHWAP has developed data on the highest quality aquatic habitats, which include certain watershed-related stream networks as well as lakes and ponds that rated highly for habitat quality and ecological intactness.

The stream networks are ranked in three tiers similar to the habitat quality tiers above, with Tier 1 representing the top 15% in quality statewide (by watershed group), Tier 2 is ranked in the top 30%, and Tier 3 are streams with occurrences of selected aquatic species of concern. Each watercourse is buffered by 100 meters (328') to form a protective corridor along its length. Statewide and taken together, **these corridors cover about 10% of the state**, **and are nearly 38% protected**. Of 327 watersheds statewide, only 99 contain Tier 1 or 2 ranked watercourses.

The protection status for the NHWAP aquatic habitat tier rankings is as follows:

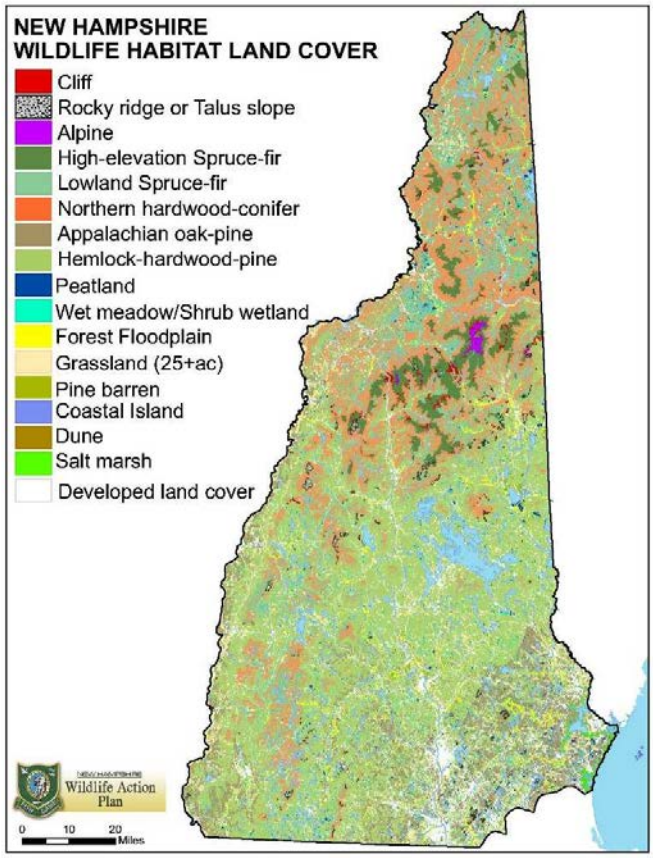
NHWAP Ranking	Total Acreage of Stream Corridor	Area Protected	Percent Protected
Tier 1	226,670	99,830	44.0%
Tier 2	205,251	71,504	34.8%
Tier3	124,904	38,941	31.2%
	556,825	**210,275**	**37.8%**

NHWAP Habitat Types

The NHWAP classifies 16 distinct habitat types in New Hampshire, 15 of which are considered in this report. Several of these habitat types are forest types, amounting to 75% of the state's land area. One extensive forest type – Hemlock-Hardwood-Pine – accounts for nearly 40% of all habitat type land cover.

The map to the right is the official NHWAP habitat land cover map. Note the range of the Appalachian Oak-Pine forest type in southeastern N.H., typical of lower topographic elevation and a milder climate regime, and compare to the Northern Hardwood-Conifer forest type in the northern half of the state, and at higher elevations.

At the other end of the scale, several habitat types are found in much smaller and more localized areas of the state, and can be considered scarce and unique.



The table that follows lists the habitat types in rank order of rarity, along with the area and percentage of the habitat type that is currently protected. Several habitat types are less well protected, including Salt Marsh, Pine Barrens, Peatlands, Floodplain Forests, Marshes & Shrub-Scrub Swamps, and especially, Grasslands. Note also that the Appalachian Oak-Pine Forest type is only about 19% protected, although accounts for 10% of the state's land area.

NHWAP Habitat Types in Rank Order of Rarity				
NHWAP Habitat Types	**Total Land Area**	**Percent of State Land Area**	**Area Protected**	**Percent Protected**
Dunes	192.5	0.003%	123.7	64.3%
Cliffs	5,807.8	0.1%	5,445.2	93.8%
Salt Marsh	6,692.2	0.1%	1,721.6	25.7%
Alpine	7,716.8	0.1%	7,692.3	99.7%
Pine Barrens	18,664.3	0.3%	4,695.7	25.2%
Rocky Ridge/Talus Slopes	28,049.2	0.5%	18,669.5	66.6%
Peatlands	57,111.5	1.0%	19,799.6	34.7%
Floodplain Forests	112,705.1	2.0%	37,480.9	33.3%
Marsh & Shrub Wetlands	142,073.3	2.5%	39,597.4	27.9%
Grasslands >25 Acres	232,385.1	4.1%	28,687.4	12.3%
High Elevation Spruce-Fir Forest	243,264.4	4.2%	228,958.4	94.1%
Appalachian Oak-Pine Forest	576,639.6	10.1%	107,681.2	18.7%
Lowland Spruce-Fir Forest	770,051.7	13.4%	362,692.0	47.1%
Northern Hardwood-Conifer	1,027,549.5	17.9%	566,813.6	55.2%
Hemlock-Hardwood-Pine Forest	2,263,495.0	39.5%	471,214.9	20.8%
	5,492,398.2		**1,901,273.5**	**34.6%**
Note: Habitat area does not include water area or developed land.				

Rare Species Occurrences

New Hampshire's natural landscape supports a diverse assemblage of native plants and animals, including almost 200 natural community types, about 2,000 plant and tree species, and over 20,000 animal species. Through field surveys and with a comprehensive database, the Natural Heritage Bureau (NHB) finds, tracks, and facilitates the protection of New Hampshire's rare plants and exemplary natural communities.

The Bureau's mission, as mandated by the Native Plant Protection Act of 1987, is to determine protective measures and requirements necessary for the survival of native plant species in the state, to investigate the condition and degree of rarity of plant species, and to distribute information regarding the condition and protection of these species and their habitats. The Bureau also maintains information on rare wildlife in cooperation with the NH Fish & Game Department's Nongame and Endangered Wildlife Program.

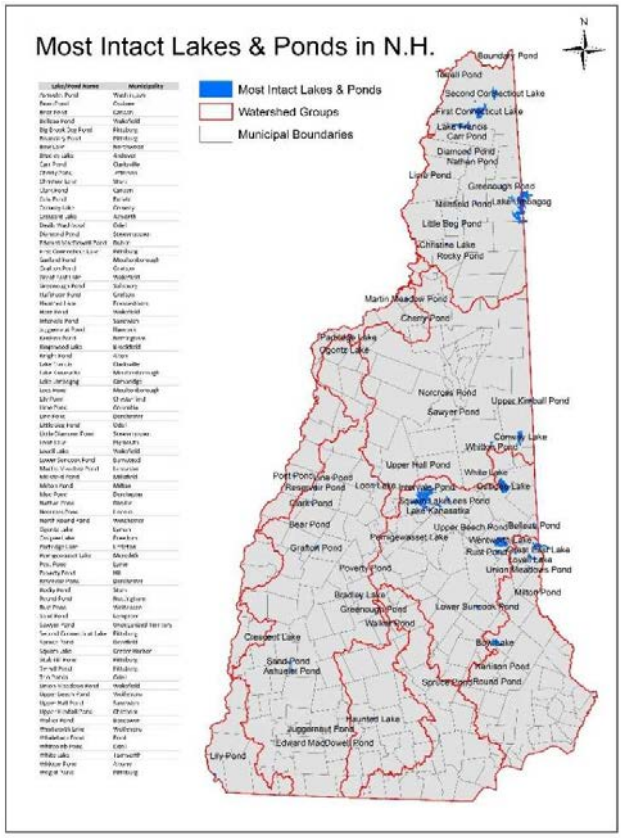
The New Hampshire Natural Heritage Bureau maintains a database documenting over 4,000 distinct occurrences of rare plant and animal species and exemplary natural communities in New Hampshire. **Approximately 37% of these occurrences are found on permanently protected or public land, while 63% remain unprotected.**

Due to the confidential nature of the database, mapping of the NHB plant and animal species database is not available publicly.

Top-Ranked Lakes and Ponds

As part of the NHWAP, lakes and ponds in New Hampshire were evaluated for habitat quality and ecological integrity. The top 10 water bodies in each of ten watershed groups were selected based on size, depth, and acidity, and a 200' protective buffer was established around each water body which is critical to maintaining water and habitat quality. Land cover data was used to estimate the amount of land associated with the buffer that is already developed.

The map at the right shows the 109 water bodies ranked in the "top 10" lakes and ponds statewide. Several of these water bodies are large in size, and familiar – Squam Lake, Ossipee Lake, Wentworth Lake being examples. Many of the water bodies are much smaller, often classified as a pond and located in remote, undeveloped areas of the state. See **Appendix C** for a larger version of this map with the list of lakes and ponds by municipality.



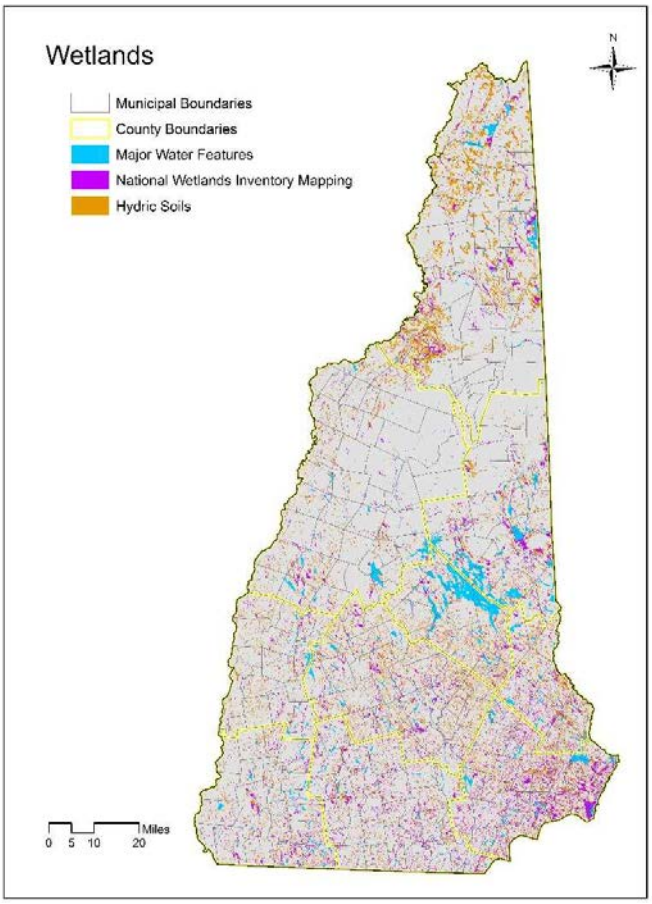
The total area of the top-ranked lake/pond buffer is about 14,770 acres statewide, of which **28% is currently protected**. **About 28% of the buffer is estimated to be developed by roads and other land uses.**

Wetlands

The functional values of wetlands are well understood and broadly documented. Formerly regarded as useless land and subject to extensive dredging and filling, the many ecosystem services (stormwater storage, biological filtration and water quality enhancement, etc.) and complex wildlife habitat and ecological systems are now recognized as critical natural resources in the broader landscape.

The availability of digital soils mapping statewide in New Hampshire has also made it possible to map hydric soils[8], which underlie and surround what we see in the physical environment as marshes, beaver flows, and forested wetlands, and extends the geography of wetlands mapping significantly beyond the earlier mapping of visible wetlands by the federal government as part of the National Wetlands Inventory (NWI)[9]

[8] Hydric soils are classified by the NRCS as poorly drained and very poorly drained.
[9] NWI wetlands mapping relied primarily upon aerial photo interpretation to locate wetlands.



hydric soils is evident. The lack of soils data on the White Mountain National Forest creates the emptiness in that area. Note the density of wetlands in the Seacoast region, where the flat coastal lowlands left by the glacial age are favor the creation of wetlands. Hydric soils (orange) also appear more abundant in the North Country. This is due in part to the unique landforms and soils of the area.

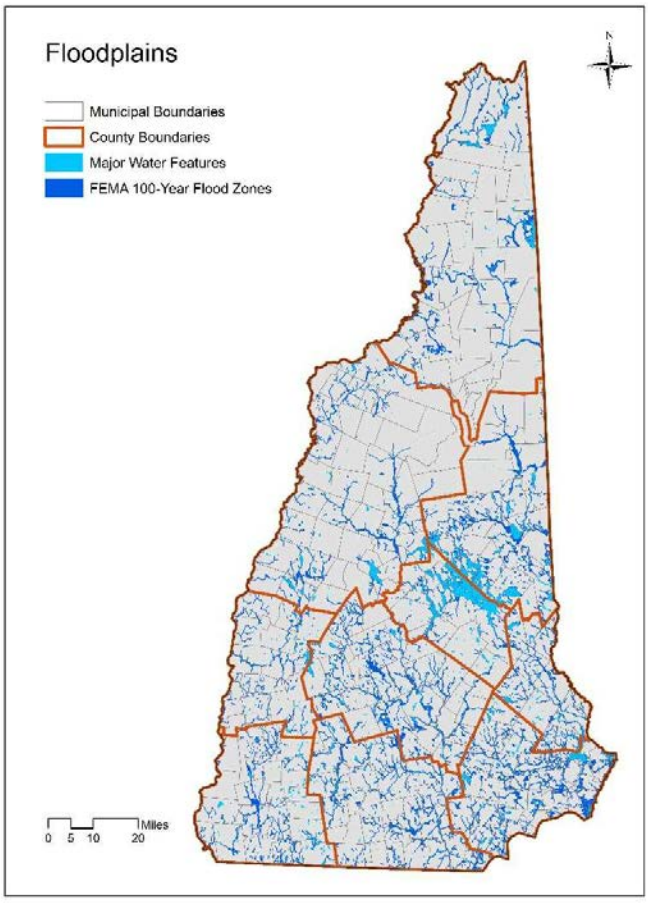
Floodplains and Riparian Areas

Floodplains have been mapped statewide by FEMA as floodways and flood zones that vary depending upon the severity of storms (FEMA mapping is not available digitally for Belknap county). For this study, the focus is on 100-year floodplains, which

For the purposes of this study, both hydric soils data and the NWI wetlands mapping are used, with overlaps between the two datasets removed to generate a single calculation for wetlands in New Hampshire. There are about 495,000 acres of hydric soils statewide, plus just over 277,000 acres of separately mapped NWI wetlands[10], Therefore, **the aggregate total of soils data and wetlands is actually a little more than 772,000 acres statewide, or about 13.5% of the state's land base. About 25% of these wetlands is currently protected.**

The map to the left shows the distribution of wetlands – both hydric soils and NWI wetlands – statewide.

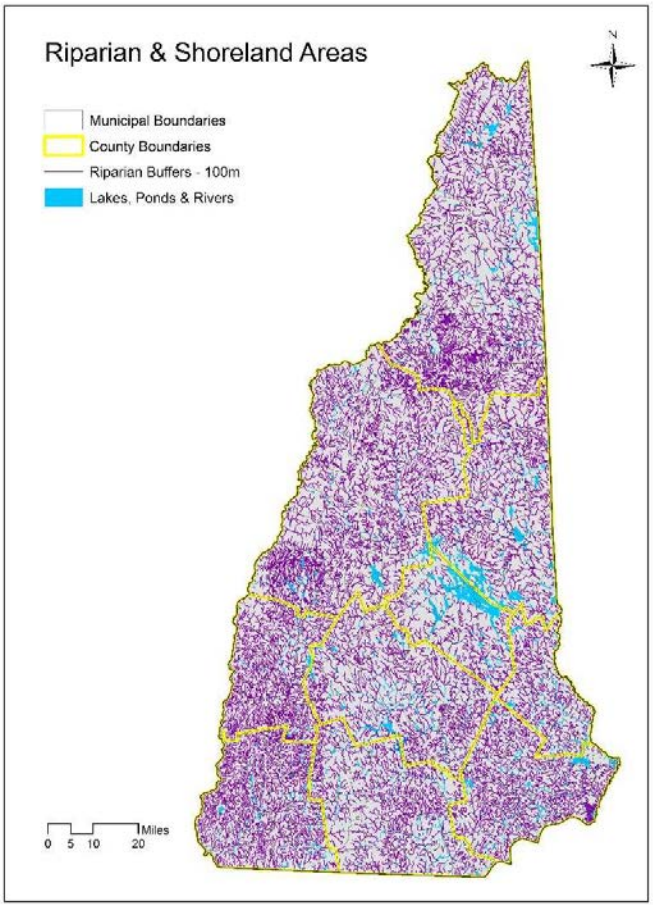
Although the mapped data are somewhat fine-grained, the rather even extent of wetlands and



[10] This number reflects only estuarine, marine and palustrine wetlands. Riverine and lacustrine are not counted since they fall in the surface water area of the state.

have a statistical probability of 1% per year of flooding to the full extent of the zone[11].

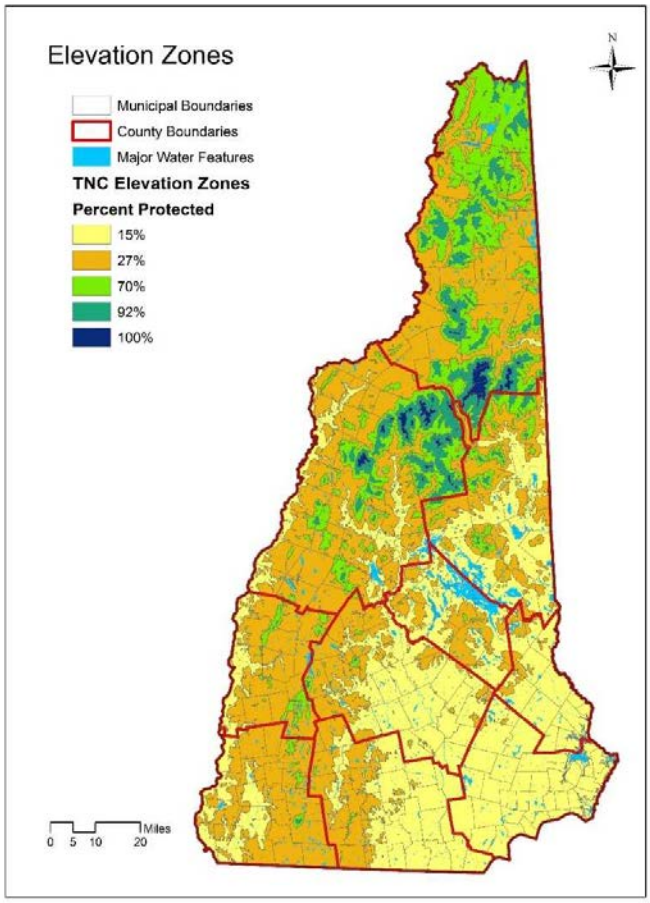
Floodplains are critical conduits of flood waters, especially along larger water courses, and also perform flood storage functions that reduce the severity of flooding downstream. Floodplains are also important and unique wildlife habitat, and are home to several natural communities such as floodplain forests. Just over 6% of the state is mapped as 100-year floodplain by FEMA, of which **21% is protected or in public ownership**. Of the 79% of unprotected floodplains, **7% is developed and 6% is agricultural.**



While the 100-meter buffer is relatively small feature at state-scale, the aggregate area of all the buffers totals more than 1.6 million acres of land.

Riparian areas cover approximately 28% of the state's land area (not including open water), of which **30% is protected or in public ownership**. **Of the 70% unprotected riparian areas, 12% is developed and 5% is agricultural.**

Riparian areas are defined as a 100-meter buffer (328') on either side of perennial streams and as a shoreland buffer of 100 meters along rivers, lakes, and ponds. These buffer zones serve a critical function in maintaining water quality by storm water filtration, and the corridors they form along water features are important wildlife habitat and ecological areas when in a natural condition. The map to the left gives an idea of the extensive pattern of streams with their associated riparian buffers statewide. Shoreland buffers are found adjacent to lakes, ponds, and rivers, shown in blue.



Elevation

[11] While the probability of flooding is low, severe storms may occur over a time span of a few years, resulting in several 100-year floods.

Elevation and terrain have a distinct correlation to various habitat types. The elevation classes in the table below are based on studies of ecological systems in New Hampshire by The Nature Conservancy. Higher elevations are typically better conserved, largely due to the historic emphasis on conserving peaks and scenic places in more mountainous areas.

The table below lists the elevation ranges, the extent of land area for each, and the current status of protection

The lower terrain (20' – 800') in southeastern N.H. is the least protected, and the most densely populated and developed region of the state.

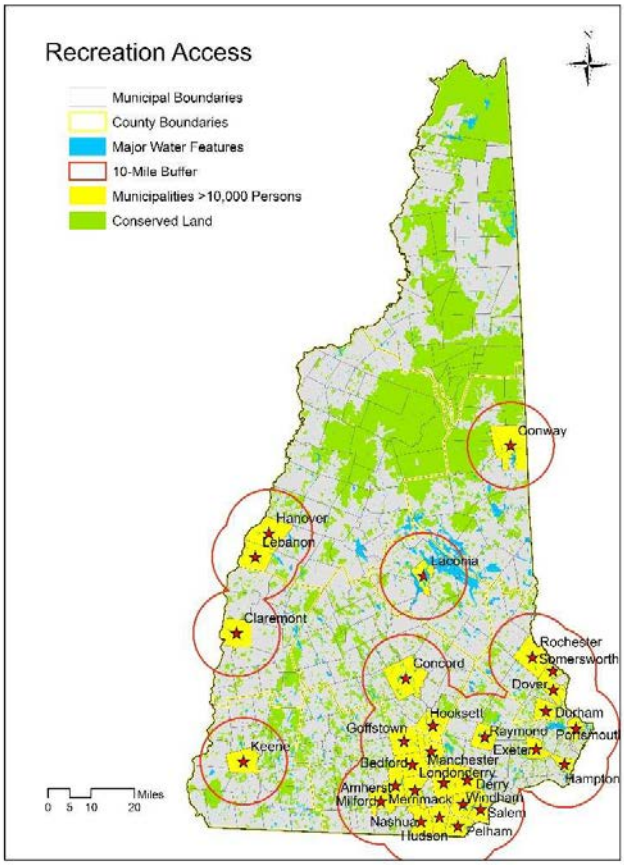
Elevation Range	Total Acres	Percent of Total State Area	Acres Protected	Percent Elevation Zone Protected
0 - 20'	17,603	0.3%	4,378	24.9%
20 - 800'	2,146,872	37.5%	316,308	14.7%
800 - 1700'	2,444,925	42.7%	657,532	26.9%
1700 - 2500'	799,604	14.0%	560,780	70.1%
2500 - 3600'	278,237	4.9%	256,293	92.1%
> 3600'	42,709	0.7%	42,671	99.9%

Section 6: Recreation Opportunities

Public Access to Conserved Land

There is a general perspective that any and all conserved land is open to public access. This is true in most cases on federal, state, and municipal land which is held in the public trust, as well as much of the privately held protected land in New Hampshire. However, public access to some land, especially privately-owned land under conservation easements or other forms of permanent protection, is restricted or not allowed.

Coding with regard to public access on conserved lands in the GRANIT conservation and public lands database indicates that **slightly more than 70% of conserved tracts allow public access for hunting, fishing, and recreation**. Another 4% either restrict public access in some manner or at certain times, or do not allow public access, either for privacy reasons or land management considerations. However, **almost 26% of records in the database represent public access as unknown**, so it is probable that many more tracts allow public access. Adequate funding for the GRANIT program which manages the conservation and public lands database would allow for a more accurate assessment of public access to conserved land.



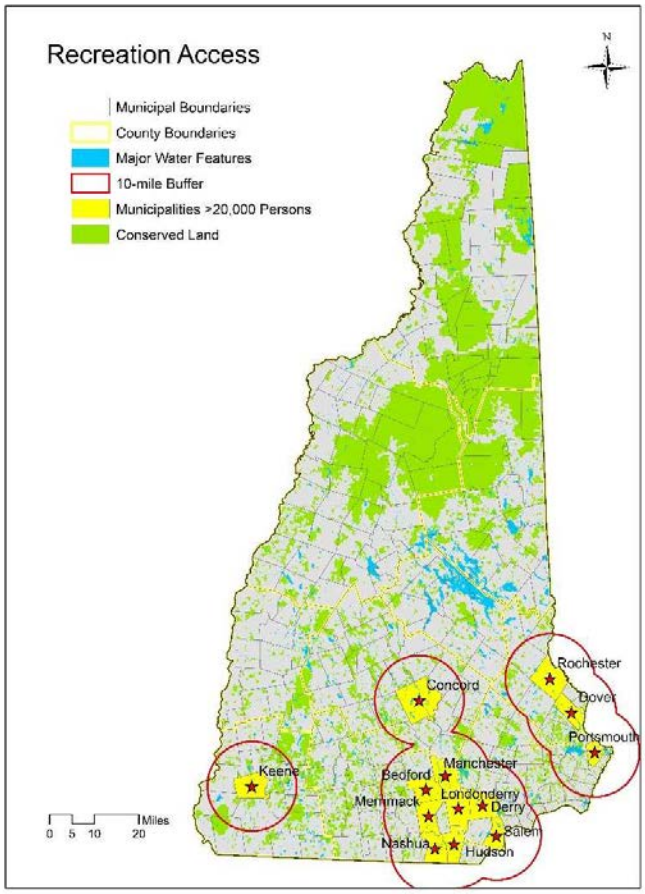
While abundant recreation opportunities exist on conserved land statewide, a question remains as to how well-served are the more populated regions of the state by the existing network of protected lands. In order to better understand this question, the distribution of conserved land has been analyzed for convenient accessibility from the most populated municipalities in New Hampshire (communities of 10,000 or greater).

Convenient access here is defined as a 20-minute drive from home, or about 10 miles at rural road speeds. This travel radius is likely more preferable for families and/or individuals with busy schedules, but who wish to enjoy natural surroundings close to home.

The map at the left shows 29 cities and towns in New Hampshire with a population of 10,000 persons or more (yellow). The red circles represent a 10-mile radius from the center of each community. As can be seen, the more populated communities are typically located in the southeastern portion of the state.

Factoring in the latest population data from NH Office of Energy and Planning**, nearly 20% of all conserved land is within a 20-minute drive time of 718,000 persons, or about 54% of the state's population.**

Of communities greater than 20,000 persons (38% of the state's population), about 10% of conserved land is closely located. See map to right.



Regional Trails Systems

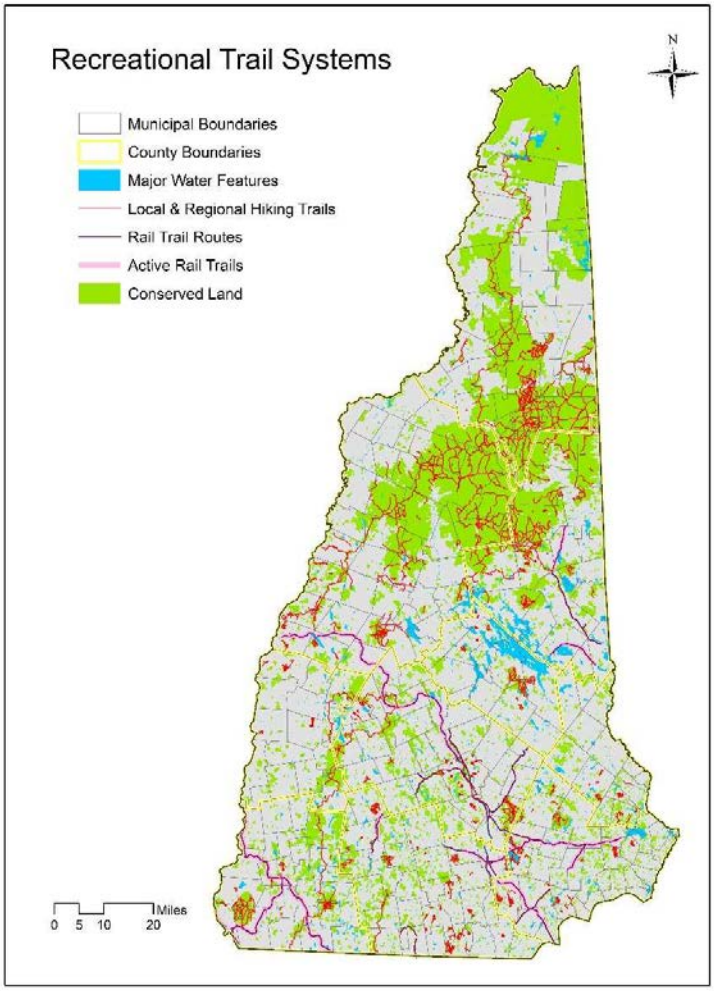
Current data collected by various agencies and organizations on local and regional recreation trails (hiking, biking, XC skiing, snowshoeing, ATV use, etc.) has mapped nearly 2,700 miles of trails statewide, **of which about 82% lie on conserved land**, as can be seen on the map to the right. A great majority of these trail systems lie on state and federal lands. Municipal and privately-held lands also commonly offer public access to trail systems at the local level; however, many of these trails are only locally known and maintained, and they have not yet been mapped statewide.

In addition to multiple-use trails mentioned above, the state enjoys an extensive system of snowmobile trails, some of which link region-to-region across the state. Since these networks are privately maintained for the most part, depend upon landowner permission on private land, and are not typically available for summer use, that aspect of New Hampshire's recreational trails is not considered in this study. However, it should be noted that many municipal, state, and federal trails are also devoted to snowmobile and other winter trails uses.

Two other significant trail systems include rail trails and long-distance through hiking trails.
Rail trails are found along abandoned railroad rights-of-way that have been minimally developed to support hiking and biking uses. Many of these former railroad rights-of-way have been acquired by the state, allowing users to traverse long distances at easy grades. The state's rail trail system is in a developmental stage in New Hampshire, with needed improvements (bridges, access acquisition, etc.) waiting for funding to complete various links, especially in the more urban areas around Concord and

Manchester. Nevertheless, the rail trail system has the greatest potential to link various, more localized trails systems, and to expand long-distance enjoyment of the state's trail network.

Apart from the rail trail systems, the most well-known of the more traditional long-distance hiking trails is the 160-mile Appalachian Trail which crosses New Hampshire from the vicinity of the upper Connecticut River Valley to Maine, and beyond. **Steady land protection along the 33-mile non-federal portion of the Appalachian Trail over the years has resulted in a trail corridor across private lands that is largely protected (90%) from development encroachment.**



Also well-known and highly utilized are the Monadnock-Sunapee Greenway, Sunapee-Ragged-Kearsarge Greenway, and the Monadnock-Metacomet Trail, all located in the western portion of the state. These privately maintained long-distance hiking trails **total about 150 miles, and are 52% protected at present**.

Taken together, **the long-distance hiking trails systems amount to about 443 miles of recreation opportunity, but are only 30% protected overall.**

Appendix A: Map & List of Municipalities & Unincorporated Places

List of Municipalities & Unincorporated Places by County

Belknap	Carroll	Cheshire	Coos	Grafton	Hillsborough	Merrimack	Rockingham	Strafford	Sullivan
Alton	Albany	Alstead	Atkinson & Gilmanton	Alexandria	Amherst	Allenstown	Atkinson	Barrington	Acworth
Barnstead	Bartlett	Chesterfield	Beans Grant	Ashland	Antrim	Andover	Auburn	Dover	Charlestown
Belmont	Brookfield	Dublin	Beans Purchase	Bath	Bedford	Boscawen	Brentwood	Durham	Claremont
Center Harbor	Chatham	Fitzwilliam	Berlin	Benton	Bennington	Bow	Candia	Farmington	Cornish
Gilford	Conway	Gilsum	Cambridge	Bethlehem	Brookline	Bradford	Chester	Lee	Croydon
Gilmanton	Eaton	Harrisville	Carroll	Bridgewater	Deering	Canterbury	Danville	Madbury	Goshen
Laconia	Effingham	Hinsdale	Chandlers Purchase	Bristol	Francestown	Chichester	Deerfield	Middleton	Grantham
Meredith	Freedom	Jaffrey	Clarksville	Campton	Goffstown	Concord	Derry	Milton	Langdon
New Hampton	Hales Location	Keene	Colebrook	Canaan	Greenfield	Danbury	East Kingston	New Durham	Lempster
Sanbornton	Harts Location	Marlborough	Columbia	Dorchester	Greenville	Dunbarton	Epping	Rochester	Newport
Tilton	Jackson	Marlow	Crawfords Purchase	Easton	Hancock	Epsom	Exeter	Rollinsford	Plainfield
	Madison	Nelson	Cutts Grant	Ellsworth	Hillsborough	Franklin	Fremont	Somersworth	Springfield
	Moultonborough	Richmond	Dalton	Enfield	Hollis	Henniker	Greenland	Strafford	Sunapee
	Ossipee	Rindge	Dixs Grant	Franconia	Hudson	Hill	Hampstead		Unity
	Sandwich	Roxbury	Dixville	Grafton	Litchfield	Hooksett	Hampton		Washington
	Tamworth	Stoddard	Dummer	Groton	Lyndeborough	Hopkinton	Hampton Falls		
	Tuftonboro	Sullivan	Errol	Hanover	Manchester	Loudon	Kensington		
	Wakefield	Surry	Ervings Location	Haverhill	Mason	New London	Kingston		
	Wolfeboro	Swanzey	Gorham	Hebron	Merrimack	Newbury	Londonderry		
		Troy	Greens Grant	Holderness	Milford	Northfield	New Castle		
		Walpole	Hadleys Purchase	Landaff	Mont Vernon	Pembroke	Newfields		
		Westmoreland	Jefferson	Lebanon	Nashua	Pittsfield	Newington		
		Winchester	Kilkenny	Lincoln	New Boston	Salisbury	Newmarket		
			Lancaster	Lisbon	New Ipswich	Sutton	Newton		
			Low & Burbanks	Littleton	Pelham	Warner	North Hampton		
			Martins Location	Lyman	Peterborough	Webster	Northwood		
			Milan	Lyme	Sharon	Wilmot	Nottingham		
			Millsfield	Monroe	Temple		Plaistow		
			Northumberland	Orange	Weare		Portsmouth		
			Odell	Orford	Wilton		Raymond		
			Pinkham's Grant	Piermont	Windsor		Rye		
			Pittsburg	Plymouth			Salem		
			Randolph	Rumney			Sandown		
			Sargents Purchase	Sugar Hill			Seabrook		
			Second College	Thornton			South Hampton		
			Shelburne	Unorganized Territory			Stratham		
			Stark	Warren			Windham		
			Stewartstown	Waterville Valley					
			Stratford	Wentworth					
			Success	Woodstock					
			Thompson & Meserve						
			Wentworths Location						
			Whitefield						

Appendix B: List of Municipalities and Land Area Currently Protected

County	Municipality	Total Area (Ac)	Water Area (Ac)	Total Land Area (Ac)	Land Protected	Percent of Municipal Land Area
Belknap	Alton	53,230.7	12,524.0	40,706.7	5,016.4	12.3%
Belknap	Barnstead	28,758.7	1,401.4	27,357.4	1,113.7	4.1%
Belknap	Belmont	20,427.6	1,175.1	19,252.5	997.5	5.2%
Belknap	Center Harbor	10,394.5	1,882.7	8,511.7	826.2	9.7%
Belknap	Gilford	34,243.8	9,423.4	24,820.4	6,938.9	28.0%
Belknap	Gilmanton	38,127.3	1,290.0	36,837.3	6,589.4	17.9%
Belknap	Laconia	16,712.3	3,974.1	12,738.2	1,228.1	9.6%
Belknap	Meredith	34,919.8	9,227.0	25,692.8	3,932.7	15.3%
Belknap	New Hampton	24,560.1	979.8	23,580.3	3,266.6	13.9%
Belknap	Sanbornton	31,774.5	1,391.5	30,383.0	4,416.6	14.5%
Belknap	Tilton	7,637.8	455.2	7,182.6	98.7	1.4%
Carroll	Albany	48,475.7	347.5	48,128.3	42,438.0	88.2%
Carroll	Bartlett	47,882.5	237.0	47,645.4	31,718.5	66.6%
Carroll	Brookfield	14,880.4	266.1	14,614.3	2,480.5	17.0%
Carroll	Chatham	36,639.3	347.9	36,291.4	29,743.7	82.0%
Carroll	Conway	45,886.7	1,353.9	44,532.8	11,761.4	26.4%
Carroll	Eaton	16,383.2	795.1	15,588.1	2,686.0	17.2%
Carroll	Effingham	25,556.0	715.1	24,840.9	6,532.8	26.3%
Carroll	Freedom	24,262.0	2,187.6	22,074.4	4,844.8	21.9%
Carroll	Hales Location	1,594.4	0.0	1,594.4	1,303.0	81.7%
Carroll	Harts Location	12,302.5	60.3	12,242.3	10,813.8	88.3%
Carroll	Jackson	42,758.2	11.2	42,747.0	33,235.8	77.8%
Carroll	Madison	26,157.4	1,422.3	24,735.1	3,364.6	13.6%
Carroll	Moultonborough	48,048.5	9,817.3	38,231.1	14,100.1	36.9%
Carroll	Ossipee	48,168.7	2,947.6	45,221.1	9,064.0	20.0%
Carroll	Sandwich	60,251.1	1,948.0	58,303.1	25,593.8	43.9%
Carroll	Tamworth	38,812.7	648.1	38,164.6	14,704.2	38.5%
Carroll	Tuftonboro	31,638.6	5,697.3	25,941.3	5,049.6	19.5%
Carroll	Wakefield	28,717.2	3,373.2	25,344.0	1,025.0	4.0%
Carroll	Wolfeboro	37,405.7	6,662.0	30,743.6	2,532.0	8.2%
Cheshire	Alstead	25,211.0	368.6	24,842.3	1,438.7	5.8%
Cheshire	Chesterfield	30,427.9	1,185.4	29,242.5	7,165.4	24.5%
Cheshire	Dublin	18,553.1	574.1	17,979.0	5,225.6	29.1%
Cheshire	Fitzwilliam	23,059.9	844.8	22,215.1	1,274.9	5.7%
Cheshire	Gilsum	10,681.9	47.1	10,634.8	1,676.0	15.8%
Cheshire	Harrisville	12,945.5	934.0	12,011.5	2,731.7	22.7%
Cheshire	Hinsdale	14,497.3	1,419.7	13,077.6	1,585.8	12.1%
Cheshire	Jaffrey	25,708.6	1,131.4	24,577.3	7,665.7	31.2%
Cheshire	Keene	23,867.5	226.3	23,641.3	4,913.6	20.8%
Cheshire	Marlborough	13,212.1	130.7	13,081.5	2,580.0	19.7%
Cheshire	Marlow	16,921.6	214.4	16,707.2	2,144.6	12.8%
Cheshire	Nelson	14,898.2	841.4	14,056.8	4,280.5	30.5%
Cheshire	Richmond	24,152.4	90.4	24,062.0	2,988.5	12.4%
Cheshire	Rindge	25,469.0	1,694.3	23,774.7	4,624.8	19.5%

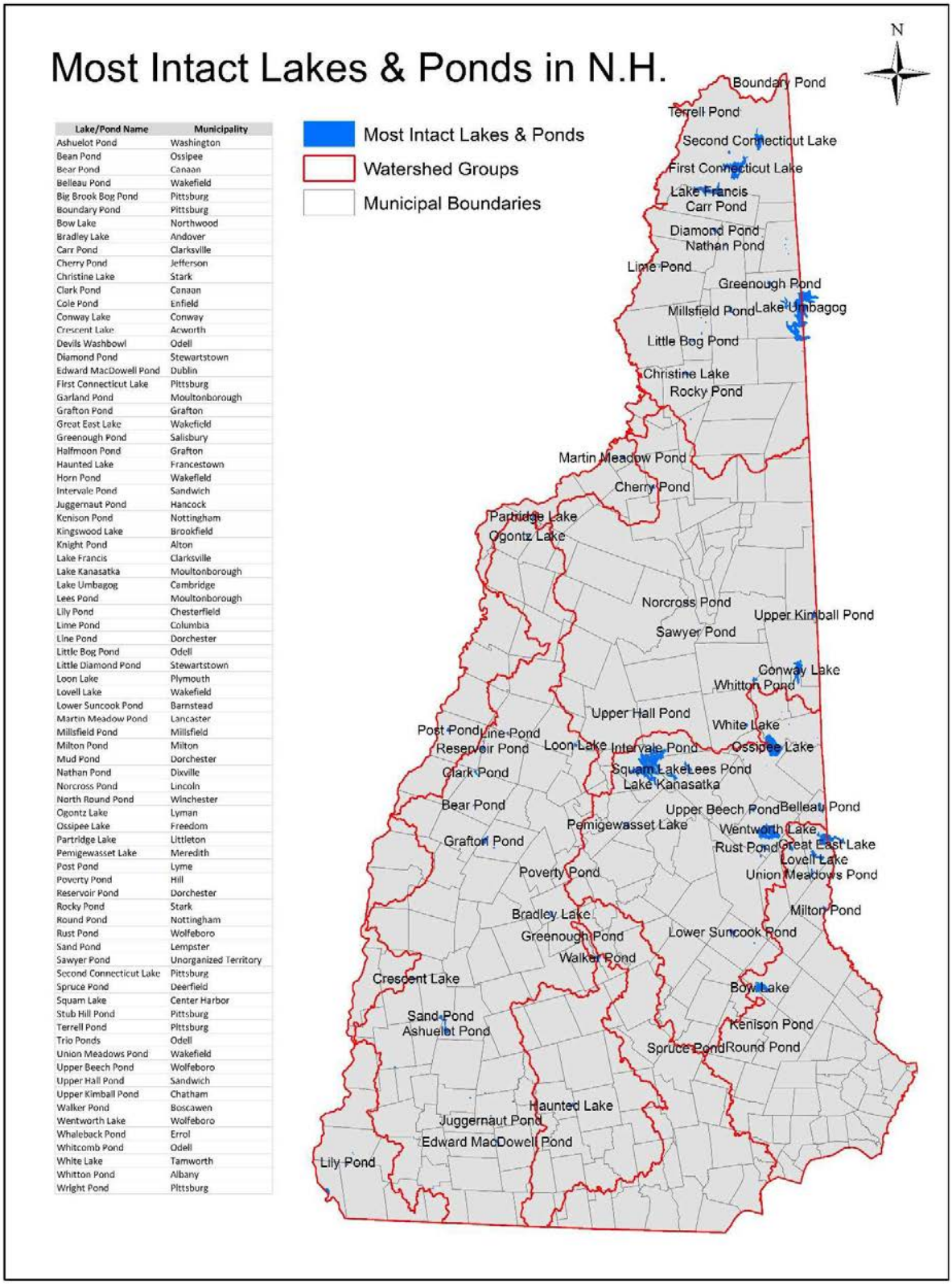
County	Municipality	Total Area (Ac)	Water Area (Ac)	Total Land Area (Ac)	Land Protected	Percent of Municipal Land Area
Coos	Shelburne	31,212.0	493.4	30,718.6	16,498.6	53.7%
Coos	Stark	38,222.0	535.5	37,686.4	27,733.2	73.6%
Coos	Stewartstown	30,019.3	370.8	29,648.4	8,342.1	28.1%
Coos	Stratford	51,231.7	446.4	50,785.3	24,549.3	48.3%
Coos	Success	36,491.7	299.0	36,192.7	7,039.6	19.5%
Coos	Thompson & Mese	11,848.9	0.0	11,848.9	11,792.2	99.5%
Coos	Wentworths Locati	12,326.2	531.4	11,794.8	11,679.8	99.0%
Coos	Whitefield	22,232.0	294.2	21,937.8	2,853.3	13.0%
Grafton	Alexandria	27,921.3	97.4	27,823.9	4,085.6	14.7%
Grafton	Ashland	7,533.8	309.3	7,224.5	1,094.6	15.2%
Grafton	Bath	24,684.2	529.3	24,155.0	727.4	3.0%
Grafton	Benton	31,201.7	130.4	31,071.2	27,603.8	88.8%
Grafton	Bethlehem	58,206.1	167.2	58,038.9	32,627.5	56.2%
Grafton	Bridgewater	13,890.3	117.6	13,772.7	391.1	2.8%
Grafton	Bristol	14,022.2	3,277.5	10,744.7	905.4	8.4%
Grafton	Campton	33,620.1	392.4	33,227.7	3,742.1	11.3%
Grafton	Canaan	35,276.1	1,194.7	34,081.4	2,656.3	7.8%
Grafton	Dorchester	28,890.0	325.5	28,564.5	3,649.5	12.8%
Grafton	Easton	19,934.1	0.0	19,934.1	13,625.7	68.4%
Grafton	Ellsworth	13,781.3	50.4	13,730.9	11,648.8	84.8%
Grafton	Enfield	27,615.7	1,752.8	25,862.9	5,958.1	23.0%
Grafton	Franconia	42,124.2	82.0	42,042.2	31,067.1	73.9%
Grafton	Grafton	27,139.1	502.2	26,636.8	2,112.6	7.9%
Grafton	Groton	26,085.3	32.6	26,052.6	4,369.2	16.8%
Grafton	Hanover	32,087.2	640.2	31,447.0	8,104.7	25.8%
Grafton	Haverhill	33,510.0	801.4	32,708.5	3,737.9	11.4%
Grafton	Hebron	12,150.5	1,437.8	10,712.8	1,286.3	12.0%
Grafton	Holderness	22,970.4	3,430.4	19,540.0	4,964.1	25.4%
Grafton	Landaff	18,223.7	64.4	18,159.3	5,130.6	28.3%
Grafton	Lebanon	26,415.3	674.2	25,741.1	2,999.5	11.7%
Grafton	Lincoln	83,844.1	273.8	83,570.3	79,788.5	95.5%
Grafton	Lisbon	17,065.6	240.0	16,825.6	128.8	0.8%
Grafton	Littleton	34,555.5	2,559.5	31,996.0	2,717.9	8.5%
Grafton	Lyman	18,355.9	131.8	18,224.2	1,520.6	8.3%
Grafton	Lyme	35,215.9	694.3	34,521.7	12,587.2	36.5%
Grafton	Monroe	15,249.0	894.6	14,354.4	456.8	3.2%
Grafton	Orange	14,799.8	24.4	14,775.4	5,645.3	38.2%
Grafton	Orford	30,578.0	815.6	29,762.4	3,145.0	10.6%
Grafton	Piermont	25,582.3	818.6	24,763.7	5,796.7	23.4%
Grafton	Plymouth	18,232.7	241.7	17,990.9	1,504.3	8.4%
Grafton	Rumney	27,270.3	544.0	26,726.3	12,649.2	47.3%
Grafton	Sugar Hill	11,027.6	103.5	10,924.1	1,798.3	16.5%
Grafton	Thornton	32,443.6	293.0	32,150.6	15,471.9	48.1%
Grafton	Unorganized Territ	40,924.7	83.1	40,841.6	40,844.7	100.0%

County	Municipality	Total Area (Ac)	Water Area (Ac)	Total Land Area (Ac)	Land Protected	Percent of Municipal Land Area
Grafton	Warren	31,356.1	272.4	31,083.6	18,008.1	57.9%
Grafton	Waterville Valley	41,248.2	95.7	41,152.5	40,397.8	98.2%
Grafton	Wentworth	26,963.9	246.6	26,717.3	4,857.2	18.2%
Grafton	Woodstock	37,752.2	310.6	37,441.6	30,791.6	82.2%
Hillsborough	Amherst	22,025.4	342.9	21,682.5	3,457.8	15.9%
Hillsborough	Antrim	23,367.7	639.3	22,728.3	4,559.3	20.1%
Hillsborough	Bedford	21,156.1	161.8	20,994.3	1,650.4	7.9%
Hillsborough	Bennington	7,412.5	213.9	7,198.6	527.0	7.3%
Hillsborough	Brookline	12,924.5	216.3	12,708.2	975.2	7.7%
Hillsborough	Deering	19,988.0	550.7	19,437.3	6,430.5	33.1%
Hillsborough	Francestown	19,442.1	411.7	19,030.4	5,614.1	29.5%
Hillsborough	Goffstown	24,064.6	367.2	23,697.4	3,107.9	13.1%
Hillsborough	Greenfield	17,303.5	359.1	16,944.3	4,958.7	29.3%
Hillsborough	Greenville	4,401.9	8.7	4,393.2	366.9	8.4%
Hillsborough	Hancock	20,003.7	858.5	19,145.3	8,685.6	45.4%
Hillsborough	Hillsborough	28,606.9	818.1	27,788.8	5,760.8	20.7%
Hillsborough	Hollis	20,668.1	317.2	20,350.9	3,943.3	19.4%
Hillsborough	Hudson	18,779.9	578.7	18,201.2	1,131.3	6.2%
Hillsborough	Litchfield	9,783.8	255.7	9,528.2	1,059.8	11.1%
Hillsborough	Lyndeborough	19,369.8	129.8	19,239.9	3,649.6	19.0%
Hillsborough	Manchester	22,354.7	1,282.9	21,071.8	2,539.1	12.0%
Hillsborough	Mason	15,352.7	52.1	15,300.6	1,077.9	7.0%
Hillsborough	Merrimack	21,412.4	682.6	20,729.8	2,000.3	9.6%
Hillsborough	Milford	16,298.9	97.1	16,201.8	1,951.8	12.0%
Hillsborough	Mont Vernon	10,820.1	32.4	10,787.7	1,647.2	15.3%
Hillsborough	Nashua	20,305.0	660.0	19,645.0	1,500.0	7.6%
Hillsborough	New Boston	27,653.7	261.2	27,392.5	6,568.5	24.0%
Hillsborough	New Ipswich	21,149.2	221.0	20,928.2	3,908.9	18.7%
Hillsborough	Pelham	17,151.4	457.2	16,694.2	1,843.9	11.0%
Hillsborough	Peterborough	24,592.5	353.9	24,238.7	7,693.7	31.7%
Hillsborough	Sharon	10,022.2	3.8	10,018.4	4,175.8	41.7%
Hillsborough	Temple	14,381.6	154.7	14,226.8	2,997.5	21.1%
Hillsborough	Weare	38,463.6	783.9	37,679.7	7,797.9	20.7%
Hillsborough	Wilton	16,447.3	123.1	16,324.2	2,923.8	17.9%
Hillsborough	Windsor	5,450.6	204.9	5,245.7	1,446.4	27.6%
Merrimack	Allenstown	13,167.5	167.2	13,000.3	7,151.6	55.0%
Merrimack	Andover	26,271.6	552.0	25,719.6	6,479.9	25.2%
Merrimack	Boscawen	16,252.1	473.3	15,778.9	3,058.0	19.4%
Merrimack	Bow	18,269.4	291.6	17,977.8	2,957.8	16.5%
Merrimack	Bradford	22,993.8	488.7	22,505.0	2,804.8	12.5%
Merrimack	Canterbury	28,696.7	592.7	28,104.0	4,742.9	16.9%
Merrimack	Chichester	13,628.2	151.9	13,476.3	886.3	6.6%
Merrimack	Concord	43,000.0	2,185.9	40,814.1	9,335.4	22.9%
Merrimack	Danbury	24,343.5	162.3	24,181.2	2,719.6	11.2%

County	Municipality	Total Area (Ac)	Water Area (Ac)	Total Land Area (Ac)	Land Protected	Percent of Municipal Land Area
Merrimack	Dunbarton	20,045.7	276.9	19,768.8	5,278.1	26.7%
Merrimack	Epsom	22,152.8	251.3	21,901.5	1,866.0	8.5%
Merrimack	Franklin	18,661.6	1,118.6	17,543.0	3,471.6	19.8%
Merrimack	Henniker	28,671.9	564.3	28,107.6	4,866.3	17.3%
Merrimack	Hill	17,107.1	106.2	17,000.9	5,094.2	30.0%
Merrimack	Hooksett	23,760.7	684.1	23,076.6	4,211.3	18.2%
Merrimack	Hopkinton	28,851.7	1,135.5	27,716.2	8,031.4	29.0%
Merrimack	Loudon	29,896.7	368.3	29,528.4	2,463.1	8.3%
Merrimack	New London	16,267.9	2,041.3	14,226.6	2,726.8	19.2%
Merrimack	Newbury	24,382.7	1,515.4	22,867.2	7,726.0	33.8%
Merrimack	Northfield	18,485.8	201.1	18,284.6	197.1	1.1%
Merrimack	Pembroke	14,597.3	210.7	14,386.6	479.1	3.3%
Merrimack	Pittsfield	15,558.8	303.4	15,255.3	725.7	4.8%
Merrimack	Salisbury	25,468.4	202.4	25,266.0	5,126.6	20.3%
Merrimack	Sutton	27,734.9	665.7	27,069.2	3,540.3	13.1%
Merrimack	Warner	35,502.2	328.5	35,173.6	9,833.2	28.0%
Merrimack	Webster	18,425.8	625.3	17,800.6	4,320.0	24.3%
Merrimack	Wilmot	18,955.5	137.3	18,818.2	4,243.7	22.6%
Rockingham	Atkinson	7,258.5	75.6	7,182.9	778.0	10.8%
Rockingham	Auburn	18,438.0	2,170.1	16,267.9	4,833.3	29.7%
Rockingham	Brentwood	10,863.0	84.5	10,778.6	2,913.3	27.0%
Rockingham	Candia	19,557.2	165.7	19,391.5	2,419.0	12.5%
Rockingham	Chester	16,717.8	61.4	16,656.4	1,311.5	7.9%
Rockingham	Danville	7,569.4	123.8	7,445.7	667.0	9.0%
Rockingham	Deerfield	33,347.8	680.9	32,666.8	6,881.6	21.1%
Rockingham	Derry	23,225.7	458.0	22,767.7	2,303.5	10.1%
Rockingham	East Kingston	6,380.8	43.4	6,337.3	999.1	15.8%
Rockingham	Epping	16,775.7	212.0	16,563.7	3,298.7	19.9%
Rockingham	Exeter	12,812.9	190.8	12,622.1	3,703.0	29.3%
Rockingham	Fremont	11,142.4	88.8	11,053.6	856.8	7.8%
Rockingham	Greenland	8,523.9	1,774.5	6,749.3	1,438.6	21.3%
Rockingham	Hampstead	9,014.2	425.3	8,588.8	1,598.9	18.6%
Rockingham	Hampton	9,072.8	680.8	8,392.0	910.2	10.8%
Rockingham	Hampton Falls	8,078.0	290.1	7,787.9	1,168.4	15.0%
Rockingham	Kensington	7,667.8	0.0	7,667.8	1,769.4	23.1%
Rockingham	Kingston	13,450.3	923.5	12,526.8	2,313.1	18.5%
Rockingham	Londonderry	26,958.2	42.2	26,916.0	3,461.0	12.9%
Rockingham	New Castle	1,347.6	840.5	507.1	110.6	21.8%
Rockingham	Newfields	4,646.7	98.7	4,548.0	1,262.8	27.8%
Rockingham	Newington	7,916.8	2,675.5	5,241.2	1,343.4	25.6%
Rockingham	Newmarket	9,080.3	1,012.8	8,067.6	1,991.2	24.7%
Rockingham	Newton	6,364.9	94.0	6,270.9	787.7	12.6%
Rockingham	North Hampton	8,922.8	19.9	8,903.0	1,195.8	13.4%
Rockingham	Northwood	19,357.0	1,310.5	18,046.4	3,065.9	17.0%

County	Municipality	Total Area (Ac)	Water Area (Ac)	Total Land Area (Ac)	Land Protected	Percent of Municipal Land Area
Rockingham	Nottingham	30,996.7	1,058.2	29,938.5	8,937.9	29.9%
Rockingham	Plaistow	6,789.6	0.0	6,789.6	514.2	7.6%
Rockingham	Portsmouth	10,763.4	716.2	10,047.2	1,434.6	14.3%
Rockingham	Raymond	18,943.6	465.3	18,478.2	1,918.0	10.4%
Rockingham	Rye	8,405.9	346.2	8,059.7	1,705.3	21.2%
Rockingham	Salem	16,569.4	689.6	15,879.8	1,169.4	7.4%
Rockingham	Sandown	9,231.8	314.6	8,917.2	1,064.8	11.9%
Rockingham	Seabrook	6,161.3	456.9	5,704.4	496.2	8.7%
Rockingham	South Hampton	5,146.6	81.1	5,065.5	358.5	7.1%
Rockingham	Stratham	9,901.6	210.4	9,691.2	1,665.4	17.2%
Rockingham	Windham	17,772.4	676.6	17,095.8	938.7	5.5%
Strafford	Barrington	31,117.3	1,314.4	29,802.9	4,294.5	14.4%
Strafford	Dover	18,592.1	1,496.1	17,096.0	3,168.8	18.5%
Strafford	Durham	15,852.3	1,549.6	14,302.7	6,442.3	45.0%
Strafford	Farmington	23,640.0	303.8	23,336.2	2,139.6	9.2%
Strafford	Lee	12,927.3	205.3	12,722.0	3,148.7	24.7%
Strafford	Madbury	7,799.1	379.6	7,419.5	1,838.6	24.8%
Strafford	Middleton	11,843.0	265.6	11,577.4	2,302.7	19.9%
Strafford	Milton	21,935.9	789.1	21,146.8	3,851.7	18.2%
Strafford	New Durham	28,054.0	1,660.7	26,393.3	1,911.4	7.2%
Strafford	Rochester	29,080.7	607.4	28,473.3	1,285.5	4.5%
Strafford	Rollinsford	4,842.8	148.5	4,694.3	766.5	16.3%
Strafford	Somersworth	6,398.3	151.0	6,247.3	410.6	6.6%
Strafford	Strafford	32,778.9	1,449.8	31,329.2	7,468.9	23.8%
Sullivan	Acworth	24,999.0	122.8	24,876.3	3,656.0	14.7%
Sullivan	Charlestown	24,345.5	1,509.0	22,836.6	2,511.4	11.0%
Sullivan	Claremont	28,193.1	704.8	27,488.3	977.9	3.6%
Sullivan	Cornish	27,269.8	412.4	26,857.4	3,539.6	13.2%
Sullivan	Croydon	24,028.9	544.4	23,484.5	145.7	0.6%
Sullivan	Goshen	14,420.1	148.3	14,271.8	6,029.3	42.2%
Sullivan	Grantham	17,951.0	518.6	17,432.4	2,338.6	13.4%
Sullivan	Langdon	10,446.1	60.6	10,385.5	1,215.6	11.7%
Sullivan	Lempster	20,956.3	248.5	20,707.8	3,960.4	19.1%
Sullivan	Newport	27,930.4	220.3	27,710.1	1,436.4	5.2%
Sullivan	Plainfield	33,914.4	453.6	33,460.8	3,835.3	11.5%
Sullivan	Springfield	28,478.9	538.9	27,940.0	11,029.1	39.5%
Sullivan	Sunapee	16,099.2	2,627.1	13,472.1	2,096.2	15.6%
Sullivan	Unity	23,806.4	137.9	23,668.5	2,115.5	8.9%
Sullivan	Washington	30,524.1	1,354.8	29,169.3	10,934.5	37.5%
		5,940,547.1	**210,177.4**	**5,730,369.6**	**1,850,583.8**	**32.3%**

Appendix C: NHWAP "Top 10" Lakes and Ponds Map & List



Lake/Pond Name	Municipality
Ashuelot Pond	Washington
Bean Pond	Ossipee
Bear Pond	Canaan
Belleau Pond	Wakefield
Big Brook Bog Pond	Pittsburg
Boundary Pond	Pittsburg
Bow Lake	Northwood
Bradley Lake	Andover
Carr Pond	Clarksville
Cherry Pond	Jefferson
Christine Lake	Stark
Clark Pond	Canaan
Cole Pond	Enfield
Conway Lake	Conway
Crescent Lake	Acworth
Devils Washbowl	Odell
Diamond Pond	Stewartstown
Edward MacDowell Pond	Dublin
First Connecticut Lake	Pittsburg
Garland Pond	Moultonborough
Grafton Pond	Grafton
Great East Lake	Wakefield
Greenough Pond	Salisbury
Halfmoon Pond	Grafton
Haunted Lake	Francestown
Horn Pond	Wakefield
Intervale Pond	Sandwich
Juggernaut Pond	Hancock
Kenison Pond	Nottingham
Kingswood Lake	Brookfield
Knight Pond	Alton
Lake Francis	Clarksville
Lake Kanasatka	Moultonborough
Lake Umbagog	Cambridge
Lees Pond	Moultonborough
Lily Pond	Chesterfield
Lime Pond	Columbia
Line Pond	Dorchester
Little Bog Pond	Odell
Little Diamond Pond	Stewartstown
Loon Lake	Plymouth
Lovell Lake	Wakefield
Lower Suncook Pond	Barnstead
Martin Meadow Pond	Lancaster
Millsfield Pond	Millsfield
Milton Pond	Milton
Mud Pond	Dorchester
Nathan Pond	Dixville
Norcross Pond	Lincoln
North Round Pond	Winchester
Ogontz Lake	Lyman
Ossipee Lake	Freedom
Partridge Lake	Littleton
Pemigewasset Lake	Meredith
Post Pond	Lyme
Poverty Pond	Hill
Reservoir Pond	Dorchester
Rocky Pond	Stark
Round Pond	Nottingham
Rust Pond	Wolfeboro
Sand Pond	Lempster
Sawyer Pond	Unorganized Territory
Second Connecticut Lake	Pittsburg
Spruce Pond	Deerfield
Squam Lake	Center Harbor
Stub Hill Pond	Pittsburg
Terrell Pond	Pittsburg
Trio Ponds	Odell
Union Meadows Pond	Wakefield
Upper Beech Pond	Wolfeboro
Upper Hall Pond	Sandwich
Upper Kimball Pond	Chatham
Walker Pond	Boscawen
Wentworth Lake	Wolfeboro
Whaleback Pond	Errol
Whitcomb Pond	Odell
White Lake	Tamworth
Whitton Pond	Albany
Wright Pond	Pittsburg