Shaping a Vision For Strategic Conservation In New Hampshire's Lakes Region

The Lakes Region Strategic Conservation Plan
Technical Report

SOCIETY FOR THE PROTECTION OF NEW HAMPSHIRE FORESTS
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The Lakes Region Strategic Conservation Plan
Technical Report

Prepared by the
Society for the Protection of NH Forests
Land Protection Department

Authors:
Dan Sundquist
Director of Land Conservation Planning

Paul Doscher
Vice President, Land Conservation

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Acknowledgments

The Lakes Region Strategic Conservation Plan is a collaborative effort of the following organizations and agencies working with the Forest Society to further land conservation efforts in the Lakes Region of New Hampshire:

Lakes Region Conservation Trust

Squam Lakes Conservation Society

Green Mountain Conservation Group

Newfound Lake Region Association

The Nature Conservancy

Lakes Region Planning Commission

NH Fish & Game Department

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Preface

The following excerpt from a Forest Notes article written by Paul Doscher, Forest Society Vice President for Land Conservation Programs provides an excellent overview of the conceptual basis and development of the Lakes Region strategic conservation plan. A detailed summary of the many steps and decisions that have given shape and form to the plan are found in later sections of this report.

What's the image in your mind when you hear the words "Lakes Region"? Is it a glistening lake with loons calling in the distance? Is it casting a line with kids on a calm summer morning? Or boating over the broad expanses of the "big lake"? Perhaps it's the view from Mt. Major, Belknap or Gunstock. Chances are that any image you have includes clear, clean and abundant water in a landscape of verdant green trees and fields.

For many years, a number of conservation and other organizations have been engaged in efforts to ensure that these images remain the future of the Lakes Region. Many thousands of acres have been protected by the landowners, municipalities, land trusts, and other public agencies in the area. Those acres, more often than not make a significant contribution to securing the clean streams, wetlands, rivers, lakes and ponds that are the life blood of New Hampshire's Lakes Region.

But as we all know, development (some of it well planned and some not) has an impact on the ability of the land to produce clean water. Those impacts are even more notable when the land consumed is important wildlife habitat, waterside or riparian areas, unfragmented forests or soils where groundwater is recharged.

Those special areas that contribute most to the quality of life and environmental integrity of the Lakes Region are the places that deserve attention when land conservationists are deciding where to expend their limited resources. Whether constrained by money or time, land trusts and conservation agencies will always have to pick and choose among land conservation opportunities. Knowing which places have the highest conservation values, and the most importance to the future of the region is important. That's where strategic land conservation planning becomes essential.

With the introduction of computer mapping systems in the 1980s and 1990s (now called Geographic Information Systems) all that changed. Soon soil maps were available "digitally" and other resources information soon followed. Before long even aerial photos were digital and could be used in combination with computer generated maps. Today, the library of digital landscape data is enormous and growing rapidly. The ability to gather information, combine it, slice it, dice it and generate maps that show the "co-occurrence" of various natural resources on a selected acre of land is simply enormous.

Back in the day when land protection was "reactive" to offers from conservation minded landowners, the limit on our ability to protect land was how much staff time we had for the work. Today, while staff time (and budgets) still limit the amount of land conservation a land trust can complete, there's also the limit of how much money is available for buying land and easements.

While purchasing easements and land has become commonplace in New Hampshire, fueled largely by municipal votes to approve bonds, and somewhat by the LCHIP program and federal conservation dollars, that money is not unlimited. Using it wisely, for the best conservation outcomes is even more important than ever.

Making those wise decisions involves developing GIS based "strategic land conservation plans". In recent years, the Forest Society has worked with many partners to develop regional land conservation plans for the Coastal area of the state, the bi-state Quabbin to Cardigan (Q2C) region, and the Merrimack River Valley. The most recent priority for strategic planning is the Lakes Region.

To do a plan that is realistic and reflects community priorities, a group of "stakeholders" from the area must be involved. In the Lakes Region, that group is the Forest Society, Lakes Region Conservation Trust, Squam Lakes Conservation Society, Green Mountain Conservation Group, Newfound Lake Region Association, the Nature Conservancy, Lakes Region Regional Planning Commission and the NH Fish and Game Department.

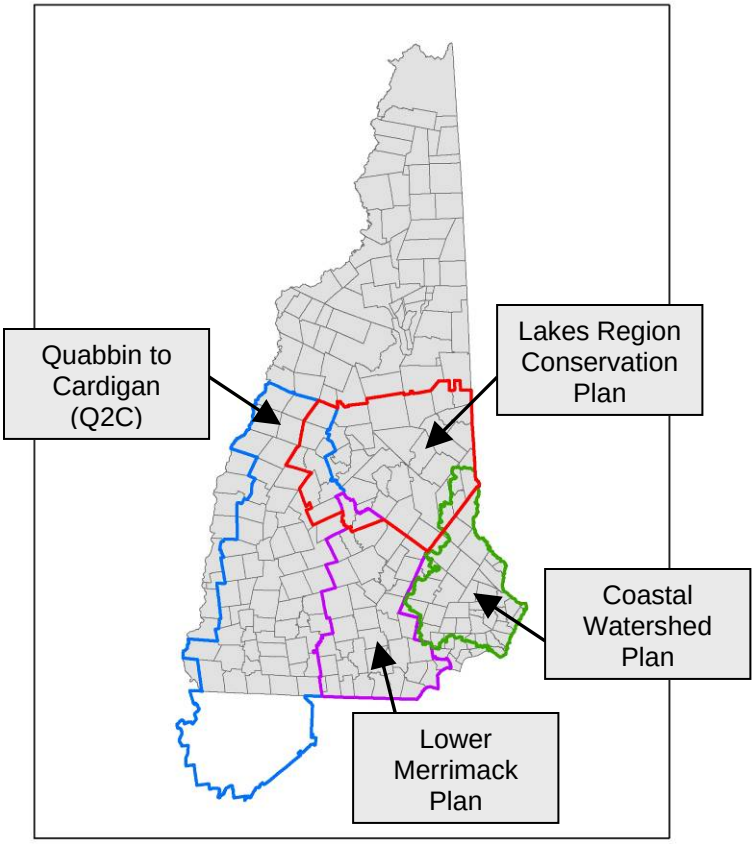
Each group brings its own set of priorities for conservation to the table, and each gets a vote in how the various "layers" of conservation data are weighted in the priority setting process. That process is called a "Delphi" analysis. In effect, it's a voting scheme where each group gives each resource value points. When all the votes are in, the "weighting" of the votes gives levels of "consensus" importance to each resource. These data can then be turned into a colorful map, with varying shades that illustrate the conservation importance of each part of the landscape, acre by acre.

The new Lakes Region Conservation Plan is now complete -- a tool for each of the participating organizations to prioritize its land protection efforts. It can help guide municipalities as they develop their own open space conservation plans, or evaluate proposed development projects. In the final analysis, this plan, unlike some that "sit on a shelf" will live in the computer systems of conservation groups and help guide them in decision making for years. It is also a dynamic plan in that it can be updated periodically as new data about natural resources becomes available. That's a tool that is really useful and helps ensure that when we look back from decades in the future, the view we'll see will contain those same images we have of clean and abundant water and verdant hillsides that we see today.

Introduction

The Lakes Region Strategic Conservation Plan is the newest of four significant regional planning initiatives by the New Hampshire land conservation community. Each plan has involved the leadership and partnership of the Forest Society in its development.

The map to the right illustrates the service areas for each of the four plans. The Lakes Region plan is significant in the statewide scheme of conservation planning because it addresses the last region south of the White Mountains to experience a concerted, collaborative effort to shape a vision for land conservation in New Hampshire. Each plan varies somewhat in its visions, approach and end result, but each plan is also unified with the others in terms of the evolution of the planning process used in all four planning efforts.



The *Quabbin to Cardigan* (Q2C) plan involves the largest region – about 3,000 square miles – and is unique in that it is an interstate plan with stakeholder input from Massachusetts. It was the first landscape scale planning effort in the state to developed a shared vision of land conservation goals and strategies.

The *Coastal Watershed Plan* was a partnered effort of the NH Chapter of the Nature Conservancy and the Forest Society, and was the first plan to introduce the concept of ***core conservation focus areas*** into regional plans in the state. This approach has been incorporated into the Q2C plan, and most recently, in the Lakes Region plan (see later sections of this report for more detail).

The *Lower Merrimack Plan* is centered on the Merrimack River valley, and is intended to bridge between the two plans above. Forest Society staff have generated a mission-driven plan for this region to assist in its land protection decision-making in this region, with the intention to develop a collaborative interstate plan similar to the Q2C in the near future.

Therefore, it is important to understand the relevance of the Lakes Region plan in the context of the other, ongoing regional plans in southern New Hampshire. Each builds upon its neighbors with the idea of an eventual continuity of purpose across the state.

Vision Statement

Any strategic planning effort requires a sense of focus at the outset, and the Lakes Region plan is no exception. With several stakeholders collaborating on the plan, and each bringing their own mission-driven emphasis to the table, it is critical in the early discussion phase to work towards a common goal. Having a clear, concise vision statement is also key to the success of the Delphi process – a consensus building model used in this and other regional conservation plans in New Hampshire. This planning process is discussed in more detail later in this report.

After a round of discussion among the plan collaborators about what they felt was important to strategic land conservation, especially in light of the importance of water to the region's ecology and economy, the following group vision statement was crafted and has served to guide the development of the plan to its end result.

We seek to identify those features in the broader landscape that are key to maintaining and enhancing water quality in the region.

There are three important concepts in that statement which drive the planning process:

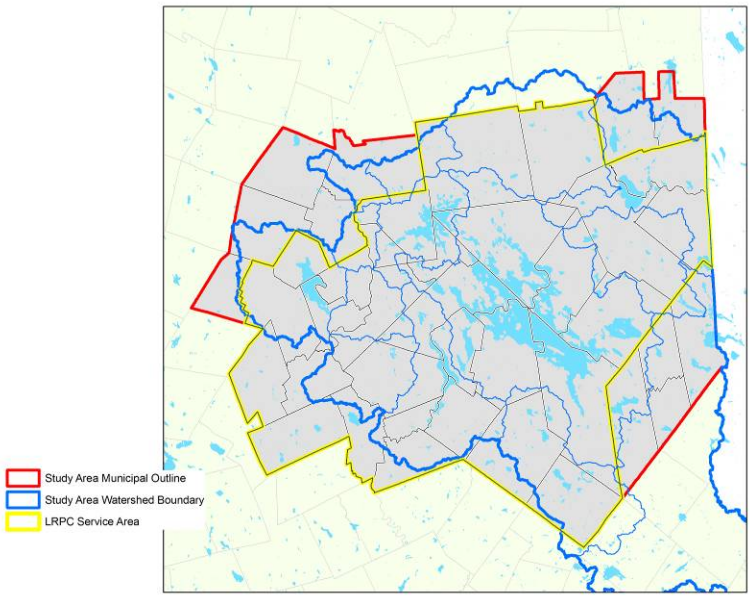
- **It is feature-oriented**. In other words, the focus is on *physical features* in the region that affect natural processes which in turn impact water quality. This is also critical to the GIS-based spatial mapping process used to model the data and identify strategically important locations.
- **It addresses the broader landscape**. Regional planning by definition must take a broad and inclusive view. This means a certain amount of generalization is necessary in the mapping and decision-making process. The plan must then focus on structure, function and processes in the larger landscape, rather than on details which may provide excellent data, but do not span the region (water quality sampling data in specific location is an example).
- **It strives to understand what is key to water quality in the region.** To be a strategic plan, all things cannot be equal. This is where ample research, interpretation, and best professional judgment are critical to this planning process, using the Delphi model, noted above, to stratify and apply relative importance values for a range of natural resource features in the region.

Study Area Definition

Before mapping and analysis for conservation priorities can begin, the group must define the boundaries of the region to be studied. As indicated in the vision statement of the group mentioned previously, the focus of this planning effort is on water quality, so identifying the "watershed address" of the Lakes Region was a first step in defining the study are.

The Lakes Region is comprised of several large watersheds that feed its many lakes and ponds, so the aggregate of those was used to create an outer boundary, even though those watersheds drain to different rivers and in different directions. The outline of that group of watersheds was then intersected with the municipalities in the region, and a political boundary that totally encompassed the lake watersheds was selected to define the entire study area. Including entire communities in the study area is important, as well, when thinking forward to plan outreach and implementation at the municipal level. With this in mind, a few communities were added to the ultimate study area boundary because they fall into the Lakes Region Planning Commission (LRPC) service area.

The resulting study area contains 41 communities and spans 1,660 square miles, or nearly 20% of the land area of New Hampshire. It contains 224 lakes and ponds greater than 10 acres in size, with a total water area of 90,834 acres or about 53% of the combined area of all lakes and ponds statewide. It also embraces 1,270 square miles of watershed area important to water quality, community economies, and the ecosystems of the Lakes Region proper. The inset map to the right shows the study area with the watersheds nested within it.



Planning Process Overview

With the study area defined, a series of exploratory natural resource maps were produced for review and discussion by the collaborator group. At this point in the planning process, the strategy used is one of divergence and inclusiveness, so a wide range of maps and data factors used in other planning studies and models was laid out for group consideration. This approach also works to educate all members of the group and establish consistent understanding of various data factors that might or might not be included in the later steps of the mapping and analysis. It was also from this exploration phase that the vision statement was generated, after the group had absorbed the key resource factors and broadened their understanding of the character of the region which extends beyond some of the collaborators' service areas.

With this initial phase complete, the group embarked on a multi-step mapping and analysis process aided by GIS processing and statistical analysis. In brief, the steps of the planning process are as follows:

- Decide the range of data factors appropriate to the regional planning vision statement.

- Use a Delphi model to develop a ***consensus-built, "shared vision"*** of the natural resource factors considered in the plan.

- Incorporate the results of the Delphi process in the GIS mapping to generate a ***co-occurrence map*** of the study area showing high to low conservation values across the entire study area.

- Refine the co-occurrence modeling using statistical analysis to identify ***"hot spots"*** of high-value natural resources across the region.

- Delineate ***conservation focus areas*** and ***buffer zones*** centering on the areas of high conservation values, converting the statistical mapping to actual, physical elements in the landscape.

Each of these steps is discussed in greater detail in later sections of this report.

Natural Resource Factors

As mentioned previously, the group considered a wide range of natural resource factors to be used in the development of a ***strategic conservation plan***. "Strategic" implies two important underlying principles in this planning process: as indicated in Paul Doscher's narrative above, land conservation must scale its efforts due to resource limitations, and a strategic plan must identify the highest concentrations of conservation values in the broader landscape.

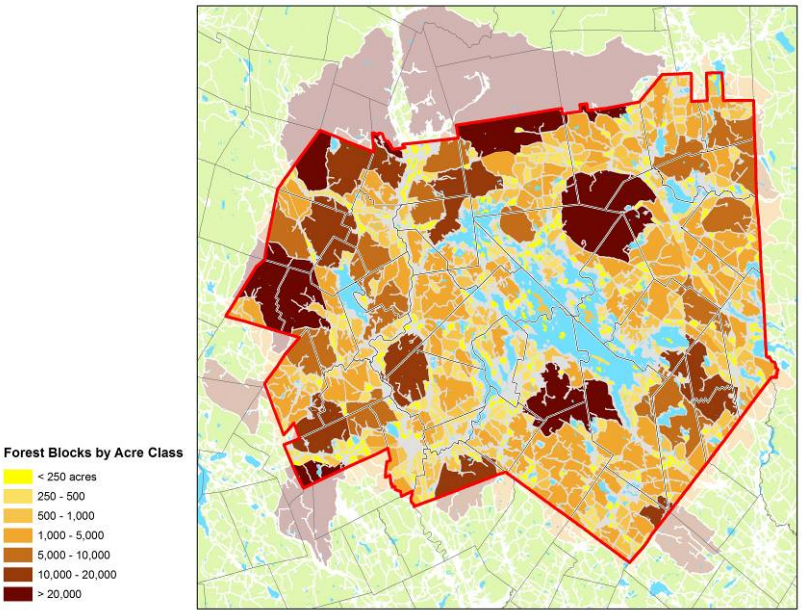
This section provides a brief overview of the various natural resource data factors used in the mapping and analysis. A few data factors were considered as part of the early stages of the planning process, but were set aside as not germane for one reason or another. Two examples are data on community water supplies and associated protection areas, and data on impaired waters in the region. Both information sources were thought to be important as reference datasets for later use in detailed community and conservation planning, but not appropriate to the scale and tenor of the regional scoping. In some cases, only specific elements of data factors were used. For example, only a few statewide wildlife habitat features were incorporated because they are so limited in representation in the region.

Note the extent and distribution of the various resources in terms of their scale and the patterns they produce in the Lakes Region. Some factors, such as large forest blocks, are building blocks in the last steps of delineating the conservation target areas in the region. Others, such as the riparian corridors, score high in the weighting process used in the Delphi model, and are evident in the co-occurrence mapping.

Forest Blocks

Large forest blocks provide important structure and setting for functions and processes important to a wide array of embedded natural resources and ecosystem services: wildlife habitat, water quality and quantity, economic forestry, remote recreation opportunities, and so forth. A ***forest block*** is defined as intact forest defined by fragmenting features such as roads, other human land uses, and large water bodies. While a forest block may be composed of several or many ownerships, it is considered an integral part of the conservation planning process in New Hampshire which is more than 80% forested.

Larger blocks are generally regarded as having more ecological significance, so a classification system based on acreage is often used in conservation planning. The six forest block classes depicted in



the map to the right are based on an arbitrary, but easily understood set of acreage ranges decided by the planning roup: 250 to 500 acres, 500 to 1,000 acres, 1,000 to 5,000 acres, 5,000 to 10,000 acres, and >10,000 acres.

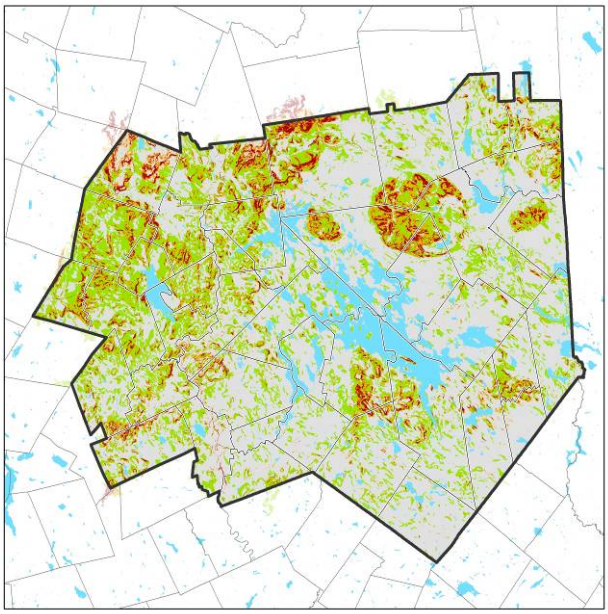
The largest two classes are shown in dark brown in the map. Note the very large blocks to the north that are part of the White Mountain National Forest, and the blocks of >20,000 acres centering on the Ossipee and Belknap Ranges, and Cardigan Mountain to the west. These two classes probably have the greatest ecological significance and importance to sustainable economic forestry in the region. Orange represents the mid-range of 1,000 to 5,000 acres; these form a connective matrix throughout the region, and are at the low end of regional significance. The smallest two block classes may be important locally, at community scale.

The table below analyses of Lakes Region forest blocks by size classification:

Clipped to Study Area Boundary

Block Class	Acre Range	Count	Total Acres	Percent Total Block Acres
1	250 - 500	155	53,925	8.1%
2	500 - 1,000	131	85,993	12.9%
3	1,000 - 5,000	129	213,356	32.0%
4	5,000 - 10,000	15	103,468	15.5%
5	10,000 - 20,000	9	95,027	14.3%
6	>20,000	6	114,182	17.1%
			665,951	

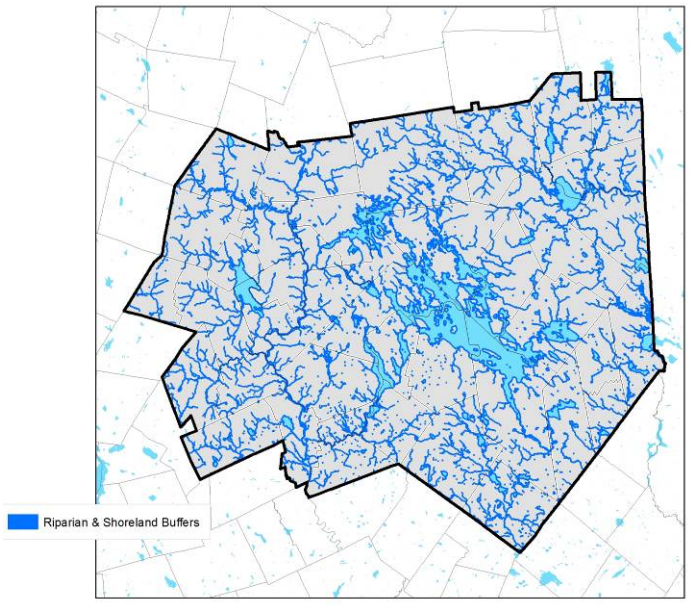
Topographic & Soil Constraints



Slopes greater than 25% are generally viewed by community planners as not suitable for development without special engineering and impact mitigation. For many municipalities in NH, steep slopes are regulated against development. Slopes in excess of 35% (red) are generally considered as inoperable for timber harvest. Slopes 25 to 35% are shown in orange (see map on next page).
Highly erodible soils (green) are often found on or adjacent to such steep slope areas. Note the association in the Ossipee and Belknap Ranges, north of Squam Lake, and generally

surrounding Newfound Lake. Risks to water quality are greatly increased due to erosion if these areas are disturbed. In combination, the two datasets represent high priority sites for land conservation.

Riparian & Shoreline Buffers

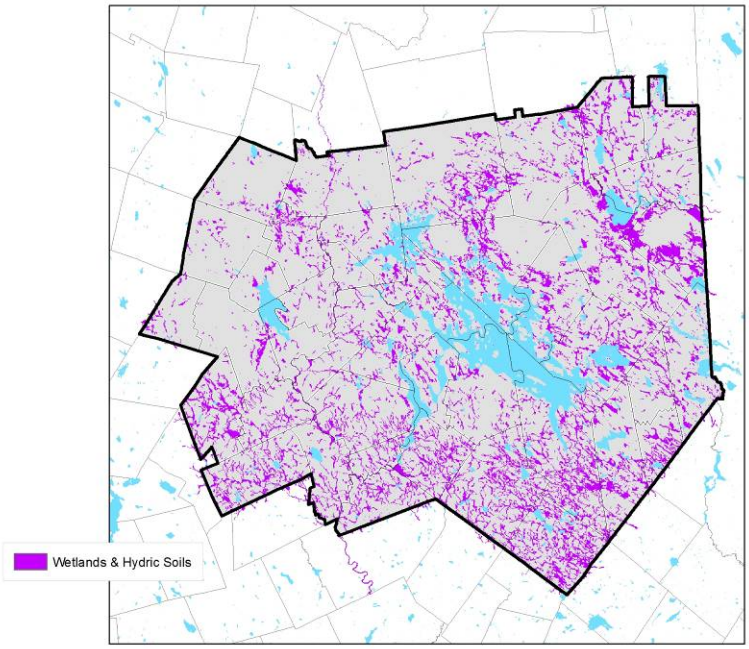


Riparian and shoreline buffer zones are important for both water quality and wildlife habitat reasons. A buffer of undisturbed, natural vegetative cover for a distance of 100m (~300') is a generally accepted standard in conservation planning that provides filtration for soil sedimentation and ample movement corridors for a variety of wildlife species.

The NHWAP has also developed a ranking of aquatic networks based on habitat quality that is discussed below, and incorporated into the co-occurrence mapping.

Wetlands & Hydric soils

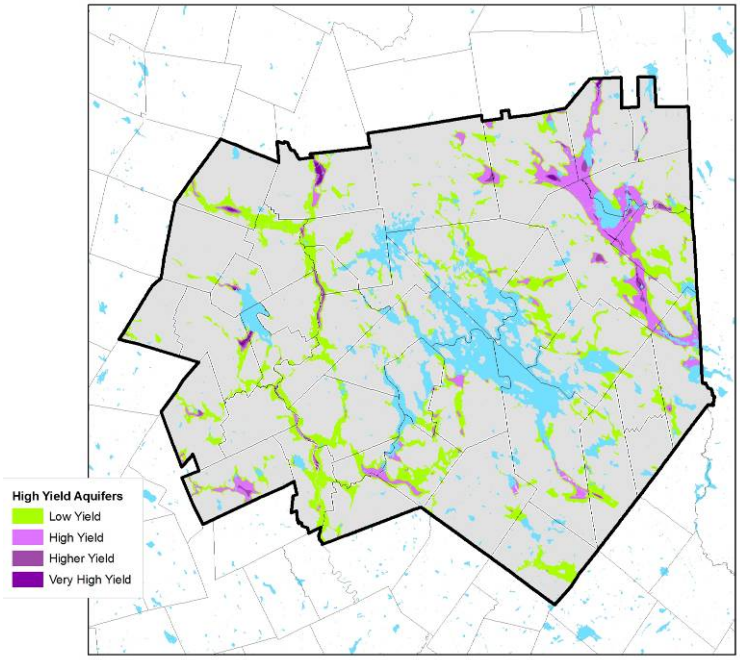
National wetland inventory (NWI) mapping when combined with hydric soils data provides a comprehensive view of the pattern and extent of jurisdictional wetlands in the study area. NWI mapping was generated by aerial photo analysis; forested wetlands are not well detected by this means, so hydric soils are a good proxy for those wetland types. Note the rather even distribution of wetlands/hydric soils across the planning area, with concentrations in the Ossipee region.



High-yield & Low Yield Aquifers

The Lakes Region study are enjoys some of the state's most significant groundwater resources in extensive sand and gravel outwash plains in the Ossipee Lake area and along major river valleys. Certain areas in these aquifers contain enormous reservoirs of water (darker pink), as yet undeveloped for human uses, and thus may represent some of the best water supply resources into the future.

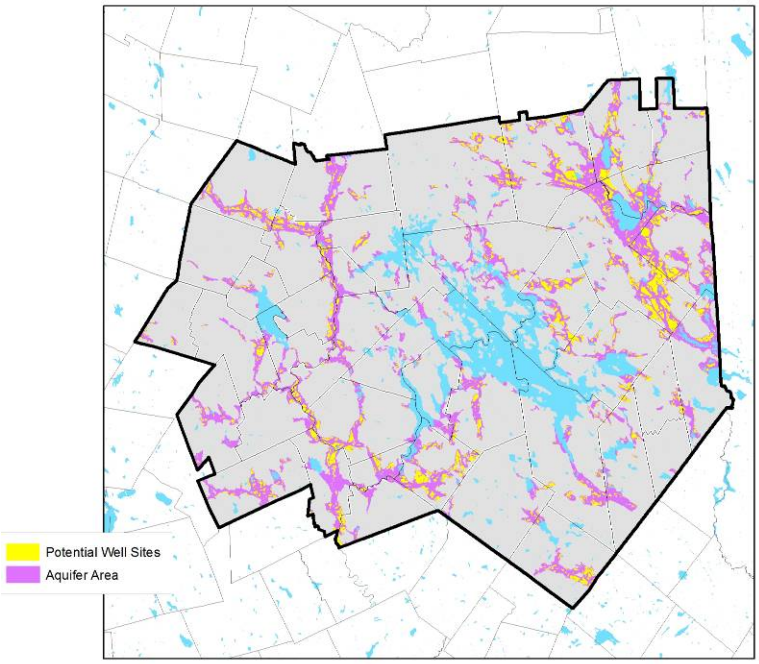
Low yield aquifers are shown in green, and serve as primary recharge to the aquifer. Several large lakes, including the Silver Lake and the Ossipee Lake complex, are partly fed by groundwater in the aquifer, and thus directly linked in terms of water quality.



Aquifer formations also support special natural communities, such as pitch pine barrens and wetlands complexes. These areas are also well-suited to high-volume white pine management, with high economic value. The flat, sandy soils are also easily developed, with the Route 16 corridor in the eastern portion of the region seeing intensive residential and commercial development historically.

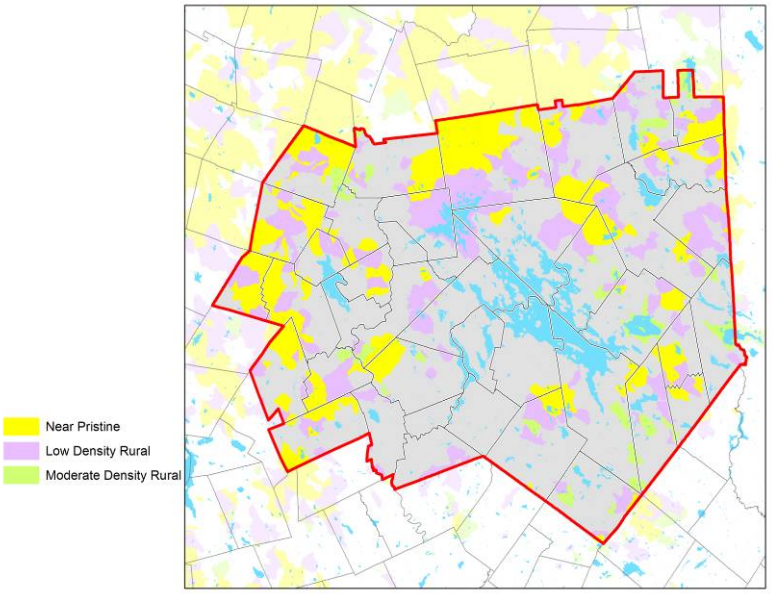
<u>Favorable gravel well sites on aquifers</u>

NH DES has mapped the remaining sites on sand and gravel aquifers that are favorable for municipal water supply development. This process focuses on "high-yield" areas in the aquifer and removes all areas threatened by potential contamination from various land uses. Only the yellow areas in the map to the right are likely water supply development sites.



High Quality Stream Watersheds

This dataset is built on high-resolution mapping of individual stream watersheds statewide as part of the USGS *SPARROW* water quality project. The purpose of the project was to identify watersheds with adverse loading of phosphorus or nitrate. However, by "reverse engineering" the *SPARROW* model, it is possible to locate watersheds with highest water quality statewide.



The yellow watersheds in the map to the right are EPA-defined as "near pristine", and represent the highest water quality in the state.

Since population density is a primary parameter used in the *SPARROW* model, a slight adjustment to population density within a given stream catchment area generates a "low density rural" watershed (pink) which also qualifies as a high quality stream watershed, which in turn, expands and adds contiguity to the near pristine watersheds. (The moderate density watersheds shown were not used in the project, but are shown to emphasize the aggregate of high quality stream watersheds in various areas.)

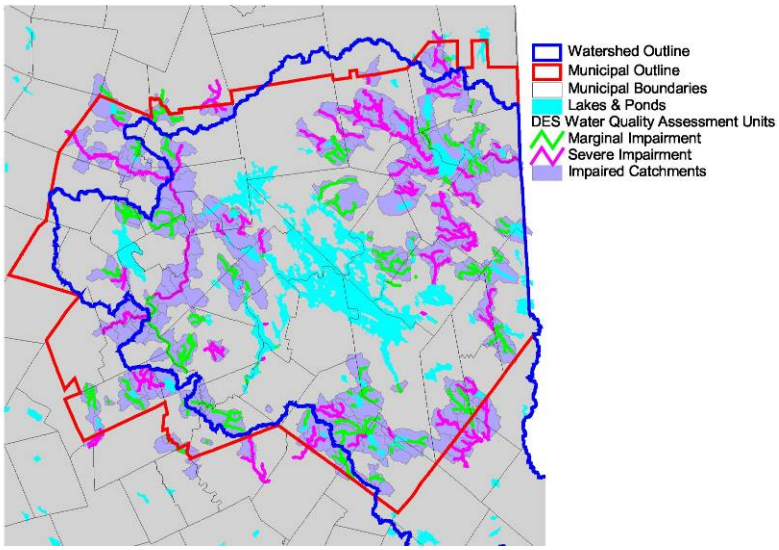
NHDES Public Water Supplies & Drinking Water Protection

Public water supplies (wells) may be found in aquifer formations or they may be developed in bedrock formations. In the study area, 40% of community wells are groundwater sources, and 60% are deep bedrock wells. While aquifer groundwater is more susceptible to contamination, bedrock wells are also at risk.

NH DES has defined drinking water protection zones around all community water supplies in the state. The population served by community water supplies in the Lakes Region planning area is 55,724, or 42% of the total population in the region's 41 communities. Public water supply sites and associated protective zones are not displayed in this report due to security issues. However, the data have been used in the GIS processing which masks the actual locations of these features.

Stream Watersheds Immediate to Impaired Waters

NH DES has assessed and mapped "impaired waters" in the state per its statutory obligations to the federal Clean Water Act. Two classes of impaired waters are found in the planning region: severe (pink) and marginal (green) in the map at right. Although the source of impairment to a lake, pond or watercourse may be due to causes outside the region or the scope of the Lakes Region conservation plan to remedy, it is generally true that land development or disturbance near impaired waters or within the DES "No Additional Load" buffers along these watercourses represents a potential problem.



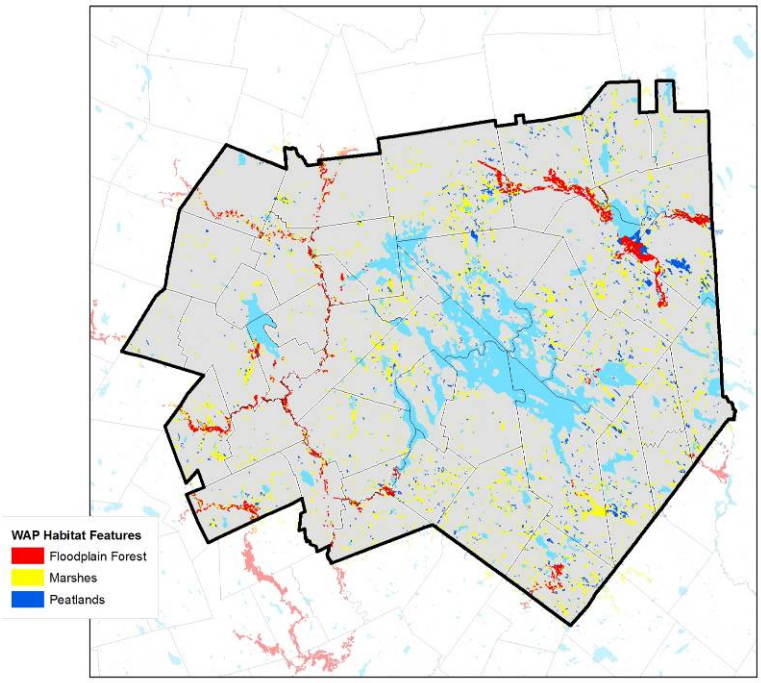
However, the DES No Additional Load buffer does not typically take a "whole watershed" approach to protection. By applying the *SPARROW* catchments data discussed above to the DES impaired waters buffers, we have generated a pattern of stream watershed-based conservation priority areas that address entire hydrological and aquatic systems; see the lavender colored "impaired catchments" in the map above (the term may be a misnomer since it is the watercourse that is impaired).

Wildlife Habitat Factors

The following three descriptions are drawn from the N.H. Wildlife Action Plan (NHWAP), perhaps the most comprehensive and important assembly of wildlife habitat data available in the state. The reader is encouraged to learn more about the NHWAP at the following link.
http://www.wildlife.state.nh.us/Wildlife/wildlife_plan.htm

Three types of data from the NHWAP were selected for use in the development of the Lakes Region plan. One focuses on special habitat types unique and important in the region; the second is a synthesis of a range of habitat condition ratings drawn from a several science-based modeling efforts conducted by the NH Fish and Game Department with assistance from the NH Chapter of the Nature Conservancy; and, the third is a similar statewide assessment of aquatic habitat quality in particular.

Habitat Features

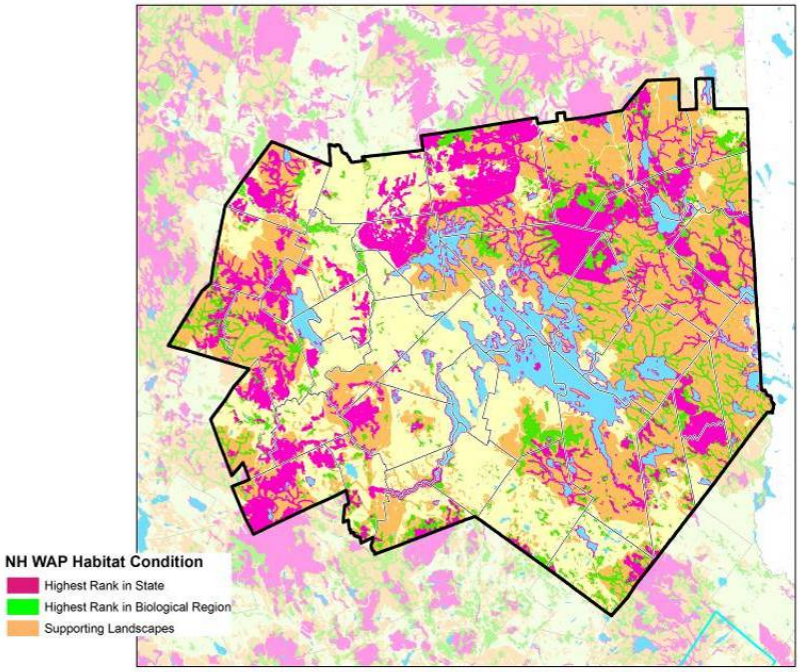


Selected NHWAP habitat types (or features) can be mapped using available data. Several of the habitats tend to be "patchy" in terms of size and distribution within the study region. Of these, three aquatic habitat types were selected as data factors in the plan, based on water quality interests: **floodplain forests** (red), **marsh complexes** (yellow), and **peatlands** (dark blue).

It is important to note that the level of precision in locating and delineating each of these habitat types varies considerably in the NHWAP. In some cases, the habitat type is delineated by a predictive model that indicates the likelihood of such habitat being found in a given location.

However, this habitat information is considered "best available data" currently, and is used in the study as one of the key ecological components.

NH WAP Habitat Condition Data



The WAP habitat quality ranking model yields three tiers of aggregated physical habitat features (both upland and aquatic). **Tier 1** (red) is ranked highest statewide, **Tier 2** (green) is highest rank in the biological region; these two tiers may be thought of as "core areas" in the vocabulary of conservation biology.
Tier 3 (orange) habitat is designed to serve as supporting landscapes, or buffers that help ensure the integrity, quality and function of the Tier 1 and 2 cores areas.

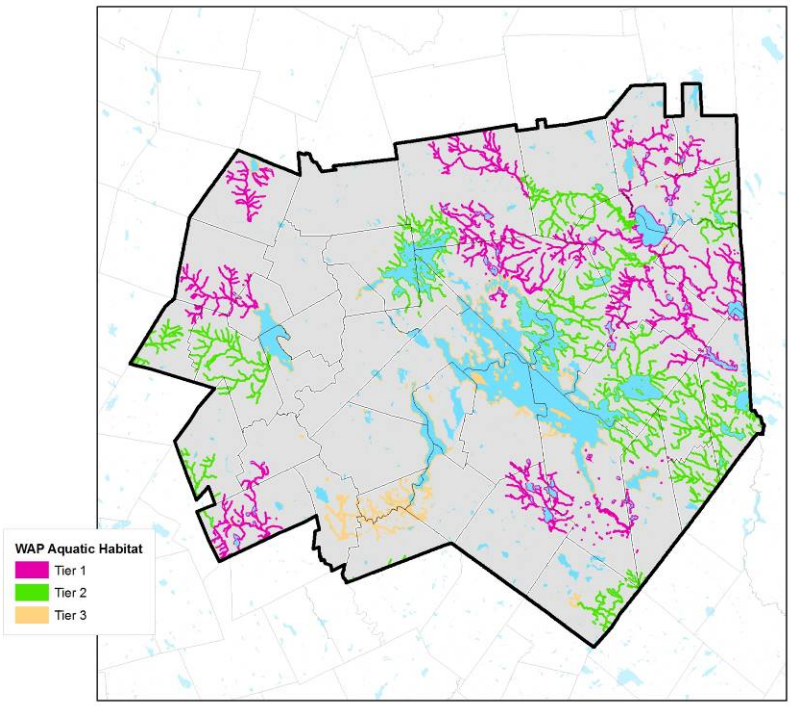
WAP Aquatic Habitats

A synthesis of the above two analyses, the aquatic habitats dataset is similar to the tiered forest block data in that it rates only certain riparian networks statewide according to the quality ranking of the larger watershed.

Tier 1 aquatic habitat (pink) includes a 100 meter buffer on streams and shorelines in the top-ranking 15% of Tier 1watersheds.

Tier 2 aquatic habitat (green) includes a similar buffer on streams and shorelines in the top 30% of Tier 2 watersheds.

Tier 3 aquatic habitat (beige) includes a 100 meter buffer for water bodies with occurrence of certain aquatic species of interest, such as brook trout, sturgeon, whitefish, and various small fish species.



Transforming Vision to Mapping

Delphi Process and Co-Occurrence Model

A ***co-occurrence model*** is used in landscape-scale conservation planning to determine where a variety of natural resource factors are co-located, thus implying potentially higher conservation importance. In its most simple form, a co-occurrence model simply overlays all spatial data and records the number of times resource coincide by using an additive arithmetic 1+1+1…n. However, no relative importance values among resource factors are reflected in this method. To discriminate resource value, the *datalayers* need to be scored in the GIS according to a weighted set of values reflecting more or less importance in the total scheme of factors being considered.

How the weighted values are decided is important. In some co-occurrence models, a team of scientific experts rates and ranks each factor, with an emphasis on mathematic modeling and statistical analysis. Because of the broad group of stakeholders and viewpoints in the Lakes Region Conservation Collaborative, a "shared vision" of relative values was generated by way of a Delphi process of voting and group consensus-building.

The process is simple once the ground rules are understood. First, the group discusses the list of datalayers to be rated; this is to be sure that everyone agrees that what needs to be on the list is there, and that everyone understands the information displayed in the mapping process. Then the group engages in anonymous voting in which each participant distributes a budget of 100 points across the datalayers in the list, according to their own professional judgment of relative worth and importance to conservation planning. The individual votes are pooled and summarized by a neutral third party – in this case, the Forest Society staff conservation planner who did not vote in the process. A mean (average) value is calculated for each datalayer, and fed into the GIS model to produce a first-run co-occurrence map.

At this point, the group has an opportunity to review the anonymous vote/value range, along with the map, and questions or comments can be posed that serve to clarify each person's understanding of the result of the first-round voting. The point of the anonymous voting is to eliminate the usual group dynamic where the most skilled debater wins the point, so the results are not intended to be debated. Each participant then has a second chance to vote, perhaps shifting points with better understanding or changed viewpoint. With the Delphi process, consensus is usually reached in two rounds of voting, which was the case with the Lakes Region plan.

Results of Delphi voting

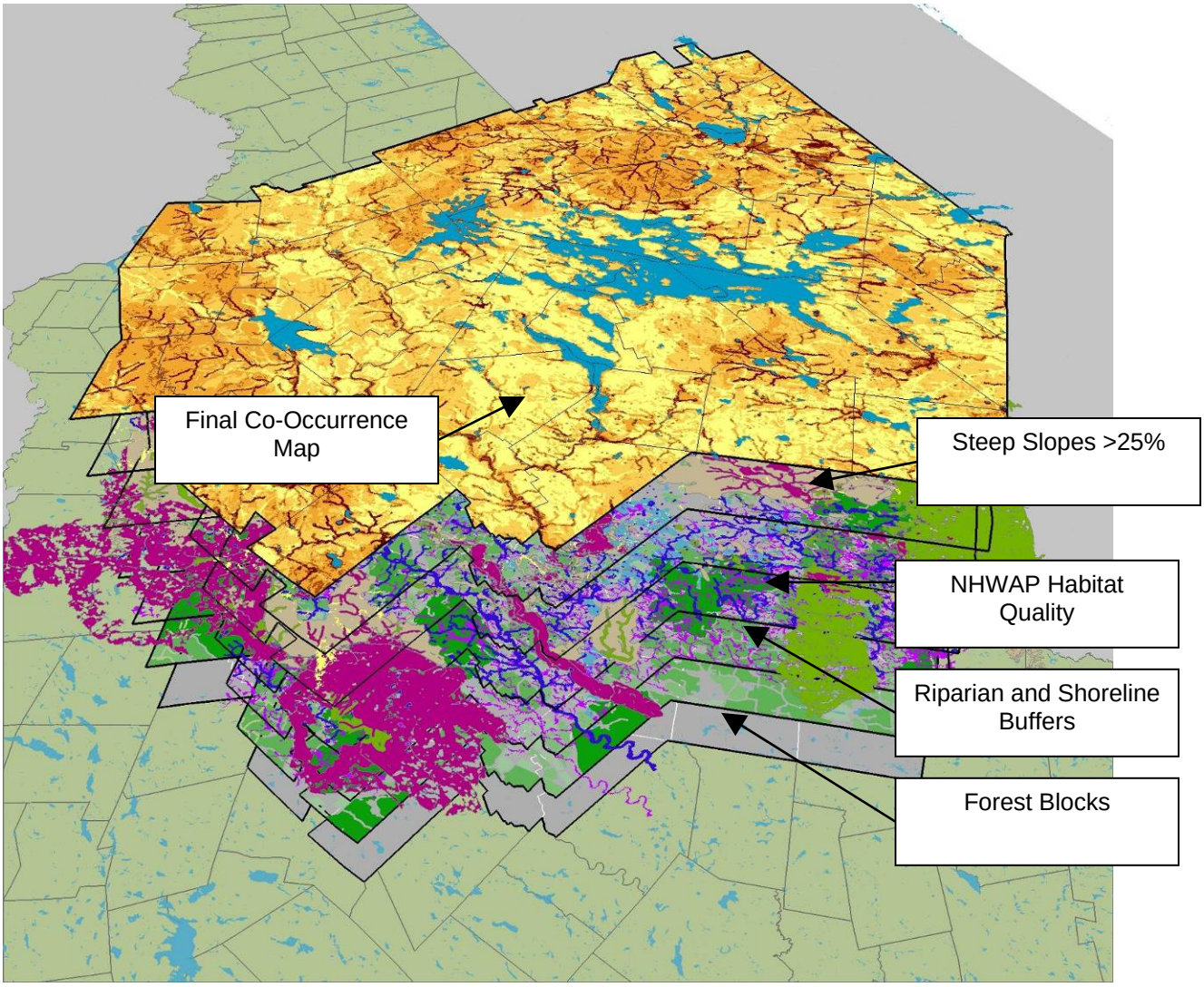
The table below lists the final data factors used in the Delphi process in rank order scoring by the group voting. High and low scores are included to give an idea of how much emphasis certain voters put on a specific resource area (as score of 20 indicates that at least one voter put 20 of 100 points on that factor). Note that riparian and shoreland buffers scored highest overall, and well above the second ranked forest blocks >10,000 acres. Note also that the high-yield aquifers scored equal to forest blocks >10,000 acres. At the other end of the value scale, data factors such as wellhead protection areas and impaired waters scored very low, and favorable gravel well

sites received no votes, although the group decided it should be in the voting list. By studying the list and rankings, the "shared vision" of the collaborator group becomes evident, with a clear emphasis on features and natural processes related to water quality, thus linking back into the original vision statement, which was crafted before the list of data factors and voting began.

Factor	Mean Value	High	Low
Riparian & Shoreland Buffers	12.00	20	6
Blocks >10,000	7.86	14	0
High-yield sand/gravel aquifers	7.86	20	0
NWI wetlands & Hydric Soils	7.29	20	0
Blocks 1,000 - 5,000	7.14	10	5
Blocks 5,000 - 10,000	6.71	10	0
Steep slopes >25%	6.71	15	0
WAP Tier 1: Best in NH	6.71	10	0
WAP Tier 2: Best in Eco-region	5.43	10	0
EPA reference reach	4.71	8	0
Low density rural watersheds	3.71	10	0
Top 15% of Tier 1 watersheds	3.29	5	0
Blocks 500 - 1,000	3.00	6	0
Lower-yield aquifers	3.00	10	0
WAP Tier 3: Supporting Landscape	2.57	5	0
Floodplain forest complexes	2.43	7	0
Top 30% of Tier 2 watersheds	2.14	5	0
Species of interest habitat	1.86	5	0
Highly erodible soils	1.57	5	0
Blocks 250 - 500 acres	1.43	5	0
Marsh complexes	1.14	4	0
Peatlands complexes	0.71	2	0
Wellhead protection areas	0.43	3	0
Impaired waters	0.29	2	0
Favorable gravel well sites	0.00	0	0

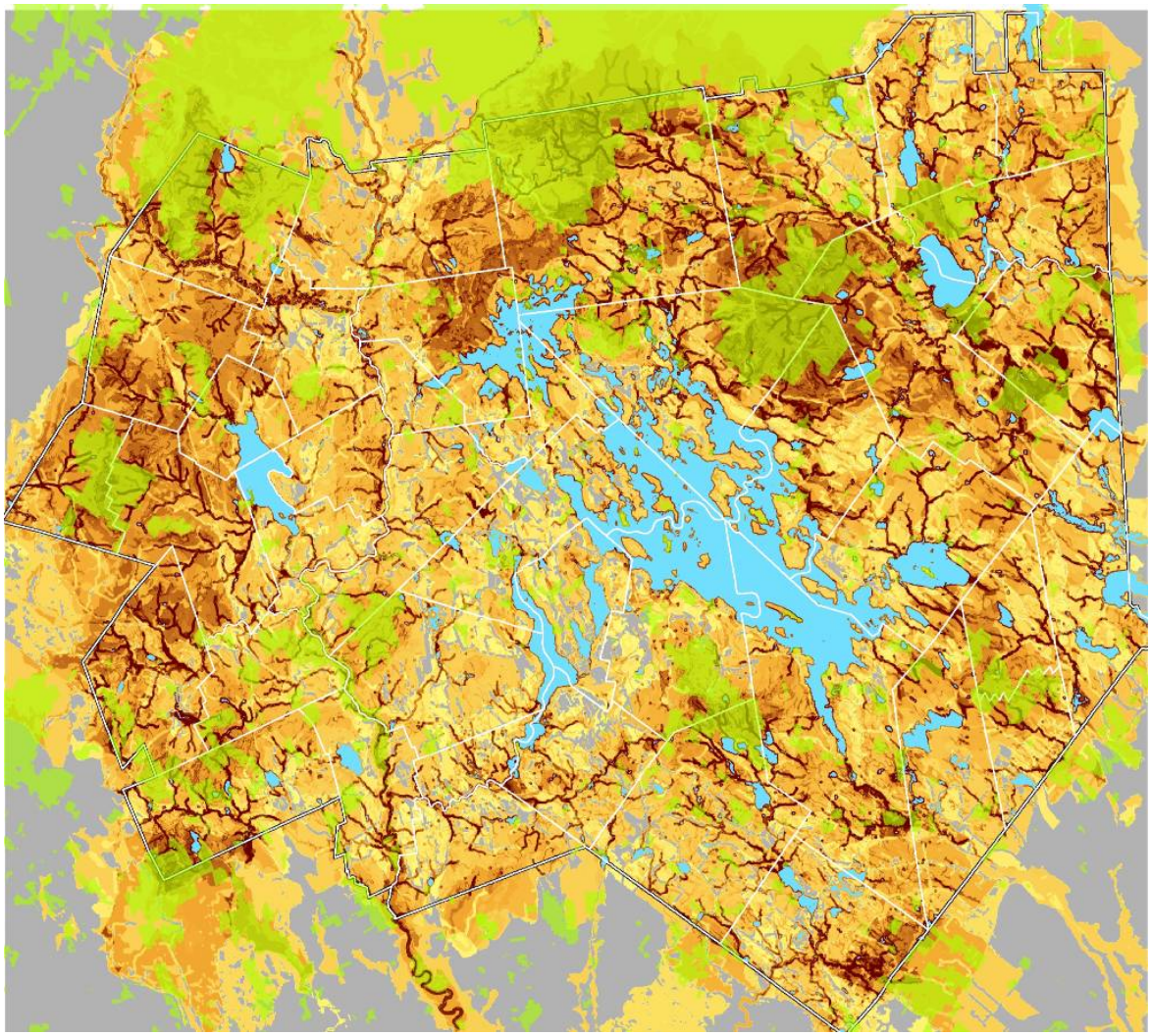
Co-Occurrence Model Results

With the weighted values listed above fed into the spatial data for each natural resource data factor, the GIS can calculate the range of conservation values for the entire study area. To do this, data are converted to a high-resolution grid of 10 meters (about 30 feet square), and the numerical data is linked to each grid cell where the data factors exist. The graphic on the next page gives a schematic idea of how the mapping process works, with only a few datalayers depicted for clarity. The GIS simply adds values for every grid cell through all the layers being considered.



The final co-occurrence map is shown on the next page, with colors graded from dark (highest aggregate values) to light (least value accumulation). Note how the stream networks are clearly evident in the total scheme; this is due to both the high score of the riparian buffers and the coincidence of the stream networks with other data factors. In some cases, this might be a riparian buffer within a large forest block as an embedded feature. In other instances, there is, in effect, a double counting of riparian buffer and NHWAP habitat quality mapping; these potential double count situations were identified and decided by the group before the Delphi voting took place, so are intentional for emphasis.

Note also the small gray areas within the map. These are locations that had no natural resource features in the voting list. One reason there is no score is that the lower limit of forest blocks was set by the group at 250 acres, and the land closer to the large lakes is more intensively developed. Forest blocks do exist, however, and some contain high value natural resource features. Many of these smaller forest blocks were elevated in importance in the later stages of delineating conservation focus areas. See the section below on the *Shoreland Conservation Zone*.



The co-occurrence mapping can be and often is the end result in conservation planning, especially at community scale where combined with reference maps of each data factor, site-scale conservation priorities and decisions can be guided. However, at a regional scale of 1,660 square miles, detail is not important when the goal is informing broader, strategic purposes. So, a next step has been taken in this study to further analyze the data in the co-occurrence map and to identify those areas with the highest conservation values, with the final goal of delineating strategic focus areas as sub-sets of the entire region. This process is discussed in the next section.

Delineating Conservation Focus Areas

Definitions

Before moving to the details of how ***conservation focus areas*** are delineated, it is key to understand the vocabulary and concepts that are the foundation of this important step in developing the final strategic plan. A conservation focus area is considered to be of exceptional significance for the protection of critical and coincident natural resource features, and is composed of two typical components.

- Core Area:
  A contiguous geographic area that contains a high concentration of natural resource values for which the conservation focus area was identified, defined in the Lakes Region plan by major natural features such as large forest blocks, near-pristine stream watersheds, and highest-ranked habitat features identified by the NH Wildlife Action Plan (NHWAP).

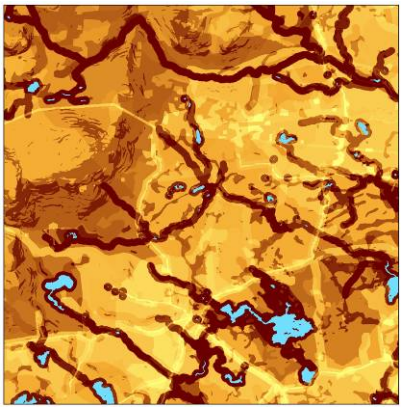
- Supporting Landscape:
  The surrounding area that helps to safeguard the intergrity of the core area, typically composed of forest blocks >1,000 acres, relatively high quality stream watersheds, and lower ranked NHWAP habitat features. This corresponds to the buffer concept basic to all bio-regional conservation planning where a core is protected by a buffer which also contains high-value features, and helps to maintain the structure, function and natural processes within the core.

A third component has been added to the Lakes Region plan to address the fact that the highest scoring natural resource factors all tend to be apart from the largest and most developed water bodies in the region. Critical natural resources remain to be protected immediate to the lakes and developed areas, but they do not scale up to the size of conservation focus areas in the majority of the regional plan. Thus, a shoreland zone was generated from the data to serve conservation interests in those places.

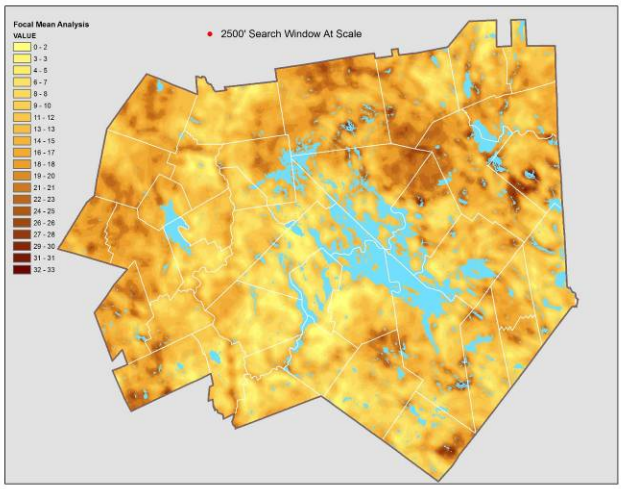
- Shoreland Conservation Zone:
  Comprised of forest blocks >50 acres in size and within 1,000 feet of the shoreline of major water bodies, this zone can be considered a special conservation priority area distinct from the core areas defined above. Some of the forest blocks contain high-quality habitat immediately along the shoreline where undeveloped land occurs, while all of the remaining blocks work to maintain water quality in streams nearest the lakes and ponds

Focal Mean Processing

A general first-pass goal in delineating conservation focus areas is to reduce the total study area to 30% to 40% of its area in targeting highest regional priorities. The co-occurrence mapping described and depicted previously cannot be easily used to find areas of consistently high conservation values. A close look at the co-occurrence map in detail (see inset to right) shows the complexity of value patterns and the significant difference in scale and texture of the data (a large forest block with embedded ecological and water features, for example).



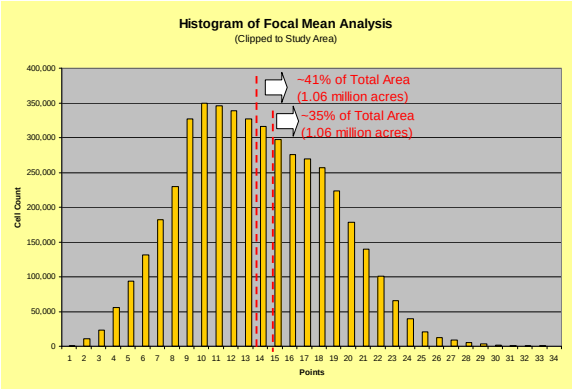
Further GIS processing is necessary to zero in on these areas. This is accomplished using a *focal mean model* which uses a moving "window" to average values across the entire study area. This, in turn, has the effect of smoothing the conservation values, and revealing larger more coherent areas with inherent potential to qualify as conservation focus areas.

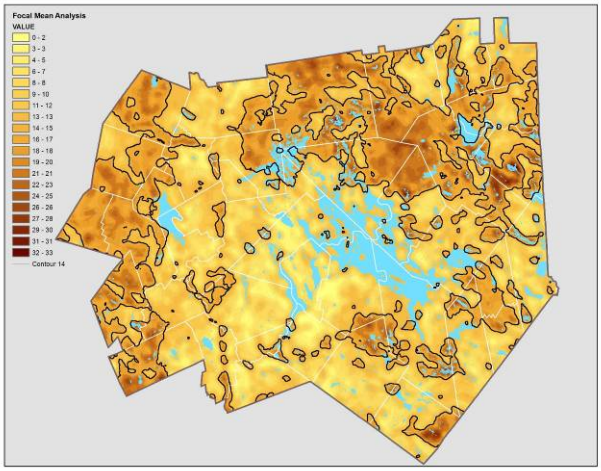


The map to the left shows the results of the focal mean processing using a 2,500' search window (shown at scale as a small red dot). Although a half-mile diameter, as search window this size yields a highly resolved gradient of mean values for the GIS processing time involved.

The color gradient uses darker colors to show higher averaged scores. Compared to the co-occurrence map the focal mean version now reveals significant groupings of higher scores. A further step is used to narrow the results to get to an initial fraction of the total study area.

The chart at right shows the distribution of focal mean values seen in the map and the actual cell count for each value. Looking at the actual area falling under each focal mean value, a "break-point" of 14 points, or about 40% of the total area was selected for the areas to be used in the next step which is the actual delineation of the core areas and supporting landscapes.





The spatial patterns of the break-point value of 14 is shown in the black line on the focal mean map. Note how area from Squam Lake east to Ossipee Lake and including the Ossipee Mountains area in northeast quarter of the map is defined with a very large and complex shape, as is the entire western tier. Specific geographic locations such as the Belknap Range south of Lake Winnipesaukee, parts of the Pemigewasset River valley, and the Moose Mountains to the east are also emphasized. This then begins to indicate the areas where core areas and supporting landscapes will emerge in the final analysis.

However, it is important to understand that this map is only a statistical artifact, and says nothing about the actual resources in the broader landscape. The focal mean data is therefore only a guide, and the next step moves from a statistical representation of the region's conservation values back to actual physical features that define the conservation focus areas with an eye to implementing strategic land conservation.

Delineating the Conservation Focus Areas

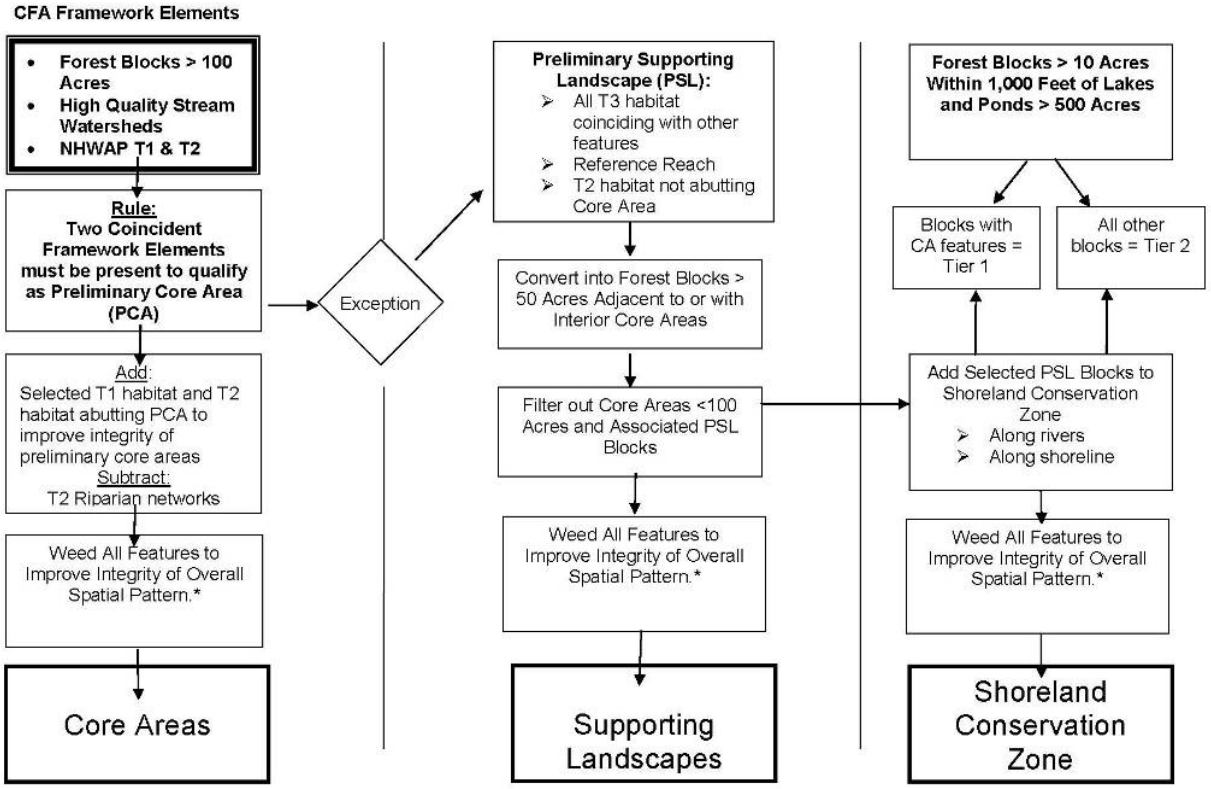
The primary building blocks of the conservation focus areas (CFA) are large forest blocks, high quality stream watersheds, and NHWAP Tier 1 and Tier 2 habitat quality polygons. All three are based on features with distinct edges that can be aggregated into core areas, or segregated and used as supporting landscapes. The three CFA components were evaluated and decided by the planning collaborators after reviewing the shape and form of the actual data factors that yielded the higher scores in the co-occurrence mapping and therefore had a significant effect on the later GIS processing ahead of delineating the CFA.

Delineation of CFA was also an iterative process with several steps of refinement after review and comment by the stakeholders. It was during this process that the discovery was made that the land near the major lakes did not qualify for CFA status due to the lack of the three building block components. Subsequently, the shoreland conservation zone, discussed previously, was added to the mix of conservation priorities. Ultimately, the criteria for the final run of GIS processing to identify boundaries for the CFA resulted in a complex protocol in order to stratify the results into core areas, supporting landscapes, and shoreland conservation zone candidates.

As can be seen in the protocol flow chart on the next page, grading of forest block sizes and segregation of various NHWAP data represent careful and important decisions by the group.

Lakes Region Plan

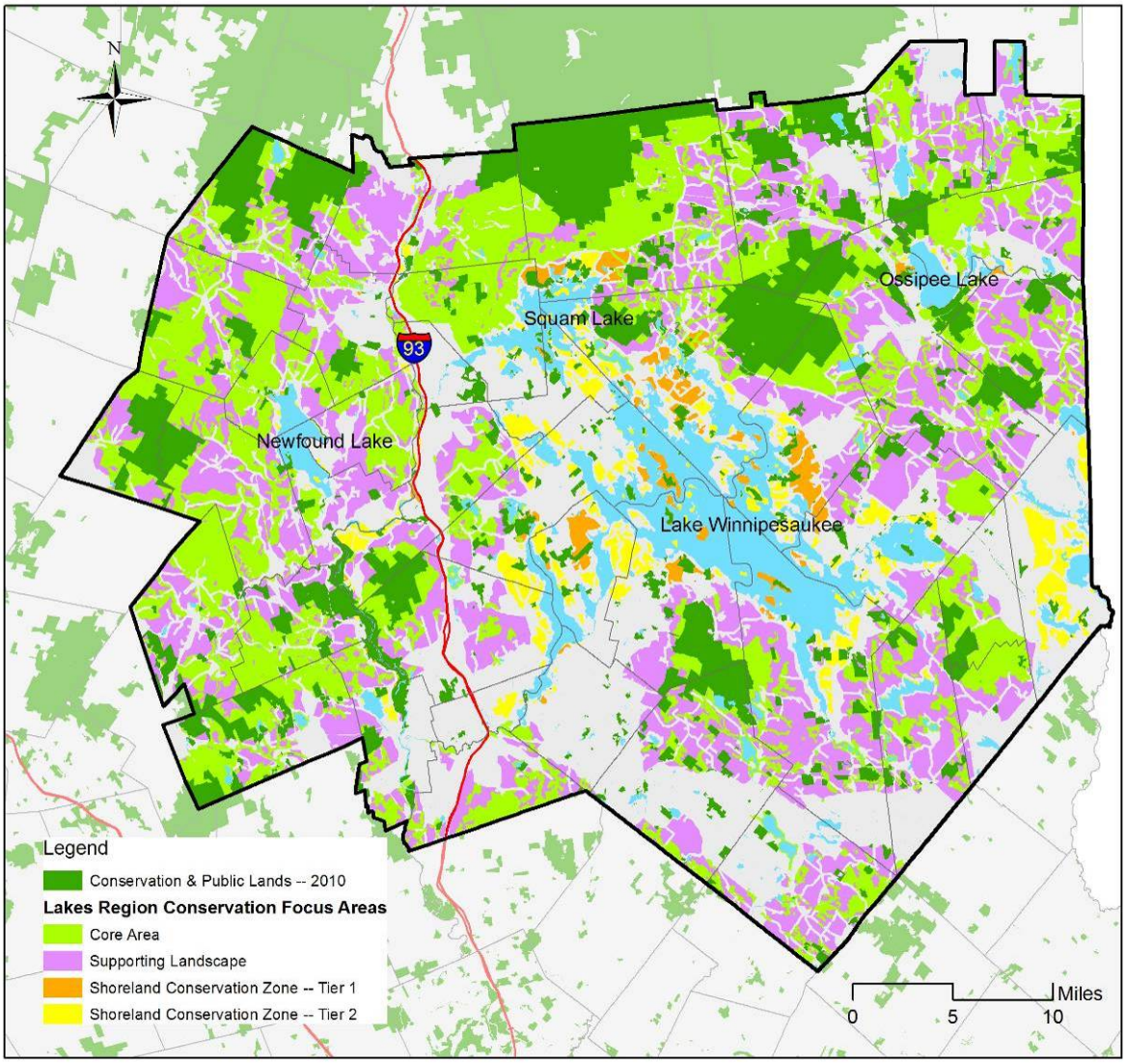
Protocol for Delineating Conservation Focus Areas (CFA)



* This procedure is necessary mainly to remove polygon remnants typically less than 10 acres in size from GIS processing, but also includes operator judgment on removing outlying polygons that do not contribute to the integrity of the overall pattern.

Conservation Focus Area Summary

The final delineation of the CFA is shown in the map below. The light green areas represent the core areas and the pink areas the supporting landscapes. The shoreland conservation zone is subdivided into to tiers: forest blocks with NHWAP Tier 1 habitat quality (orange) and all other forest blocks (yellow). Existing conservation and public land is shown in the darker green.



The following table summarizes the total area, percent of study area land, and extent of protected land in each of the three CFA components. As can be noted, the end result is that 65% of the Lakes Region study area fell into one or another CFA, putting the total well above the rule-of-thumb goal of 30% to 40%. Using the carefully considered protocol described above, and the extensiveness of the natural resource factors that drive it, the result is as we see it in the table. That nearly two-thirds of the study area should qualify as CFA in turn says something about the scale and importance of the region's conservation values in the stakeholder's "shared vision" of maintaining and enhancing the region's water quality.

Plan Components	Acres	Percent of Total Land Area	Acres Protected	Percent Protected
Core Area	339,140	35.0%	112,368	33.1%
Supporting Landscape	275,700	28.4%	33,075	12.0%
Shoreland Conservation Zone	15,400	1.6%	2,920	19.0%
Totals	630,240	65.0%	148,363	23.5%

Statistical Summary of Lakes Region Conservation Focus Areas

The following table lists extent of the various natural resource data factors used in the co-occurrence model according to whether it is located within a core focus area, a supporting landscape, or the two shoreland conservation zone tiers.

Natural Resource Data Factor	Total Area in Lakes Region Plan	Core Focus Area	Supporting Landscape	Shoreland Zone Tier 1	Shoreland Zone Tier 2	Total within CFA	Percent of Total Regional Area in CFA
Forest Blocks							
250 - 500 Acres	57,284	10,645	12,126	1,632	8,733	33,136	57.8%
500 - 1,000 Acres	88,449	16,755	26,551	6,301	6,679	56,286	63.6%
1,000 - 5,000 Acres	215,278	67,368	99,628	3,308	3,388	173,692	80.7%
5,000 - 10,000 Acres	116,638	68,013	45,346	0	0	113,359	97.2%
>10,000 Acres	185,717	127,859	57,426	0	0	185,286	99.8%
	663,366	**290,640**	**241,078**	**11,241**	**18,801**	**561,759**	**84.7%**
Steep Slopes & Erodible Soils							
Steep Slopes > 25%	136,747	73,318	37,607	1,100	1,667	113,692	**83.1%**
Erodible Soils	341,431	155,156	100,970	3,710	6,450	266,286	**78.0%**
Riparian & Shoreline Buffers	169,908	55,110	18,695	3,815	5,180	82,800	**48.7%**
Wetlands & Hydric Soils	125,874	42,119	26,127	3,439	4,183	75,868	**60.3%**
Aquifers							
Low-Yield Primary Recharge Zones	143,700	28,315	16,877	3,028	2,393	50,613	**35.2%**
High-Yield Zones	53,545	20,150	7,488	1,102	845	29,585	**55.3%**
Favorable Municipal Well Areas	43,934	17,510	14,076	1,884	1,262	34,732	**79.1%**
Drinking Water Protection Areas	82,774	10,761	14,310	2,268	2,370	29,709	**35.9%**

High Quality Stream Watersheds							
Near Pristine	169,209	151,591	5,387	5	85	157,068	**92.8%**
Low Density Rural	172,621	78,829	49,889	2,175	3,955	134,848	**78.1%**
NHWAP							
Floodplain Forests	14,569	8,744	1,017	487	147	10,395	**71.4%**
Marsh Complexes	23,705	10,311	3,514	923	842	15,590	**65.8%**
Peatlands	9,277	4,949	1,559	452	264	7,224	**77.9%**
Habitat Quality Tier 1	297,650	179,140	7,785	3,636	2,851	193,412	**65.0%**
Habitat Quality Tier 2	95,062	59,561	10,738	1,533	2,090	73,922	**77.8%**
Habitat Quality Tier 3	353,514	45,735	160,791	5,725	13,426	225,677	**63.8%**
Aquatic Habitat Tier 1	43,167	37,102	538	659	153	38,452	**89.1%**
Aquatic Habitat Tier 2	42,152	9,638	9,660	1,240	2,920	23,458	**55.7%**
Aquatic Habitat Tier 3	22,880	1,477	398	2,243	2,452	6,570	**28.7%**

The table below summarizes the extent of land protection in 2010 for each natural resource factor found in the table above broken down to show the acreage for each component of the Lakes Region CFA, and the total within the CFA.

		Acres Protected					
Natural Resource Data Factor	**Total Area in Lakes Region Plan**	**Core Focus Area**	**Supporting Landscape**	**Shoreland Zone Tier 1**	**Shoreland Zone Tier 2**	**Total within CFA**	**Percent Protected in CFA**
Forest Blocks							
250 - 500 Acres	57,284	1,480	920	320	860	3,580	6.2%
500 - 1,000 Acres	88,449	3,002	2,945	2,142	825	8,914	10.1%
1,000 - 5,000 Acres	215,278	17,190	10,904	326	98	28,518	13.2%
5,000 - 10,000 Acres	116,638	18,520	8,207	0	0	26,727	22.9%
>10,000 Acres	185,717	63,897	11,053	0	0	74,950	40.4%
	663,366	**104,089**	**34,029**	**2,788**	**1,783**	**142,689**	**21.5%**
Steep Slopes & Erodible Soils							
Steep Slopes > 25%	136,747	35,968	8,023	555	167	44,713	**32.7%**
Erodible Soils	341,431	58,326	16,213	1,149	669	76,357	**22.4%**
Riparian & Shoreline Buffers	169,908	13,345	2,546	824	954	17,669	**10.4%**
Wetlands & Hydric Soils	125,874	10,842	3,101	714	729	15,386	**12.2%**
Aquifers							
Low-Yield Primary Recharge	143,700	7,423	1,815	480	303	10,021	**7.0%**

Zones							
High-Yield Zones	53,545	6,689	830	342	147	8,008	**15.0%**
Favorable Municipal Well Areas	43,934	5,922	1,365	343	187	7,817	**17.8%**
Drinking Water Protection Areas	82,774	2,165	1,633	474	246	4,518	**5.5%**
High Quality Stream Watersheds							
Near Pristine	169,209	65,056	2,150	4	24	67,234	**39.7%**
Low Density Rural	172,621	22,938	8,827	739	1,022	33,526	**19.4%**
NHWAP							
Floodplain Forests	14,569	2,174	127	174	66	2,541	**17.4%**
Marsh Complexes	23,705	2,618	584	188	221	3,611	**15.2%**
Peatlands	9,277	2,081	237	141	34	2,493	**26.9%**
Habitat Quality Tier 1	297,650	65,050	2,512	841	465	68,868	**23.1%**
Habitat Quality Tier 2	95,062	20,263	1,298	297	416	22,274	**23.4%**
Habitat Quality Tier 3	353,514	13,078	22,822	1,259	1,463	38,622	**10.9%**
Aquatic Habitat Tier 1	43,167	11,116	97	161	16	11,390	**26.4%**
Aquatic Habitat Tier 2	42,152	2,715	1,509	332	582	5,138	**12.2%**
Aquatic Habitat Tier 3	22,880	447	18	670	406	1,541	**6.7%**

Interpretation

Several highlights can be distilled about the protection status of the natural resources listed and within the Lakes Region CFA. Note that the term "protected" here means land that is protected from development in perpetuity by legal means. In most cases this land is managed for multiple uses, including forestry, wildlife habitat, water supply and recreation, but it also includes lands set aside for undisturbed natural areas.

- While overall, about one-fifth of forest blocks greater than 250 acres are protected with the CFA, the larger block classes are better protected. This may point to a need for increased focus on protecting forest blocks in the range of 500 to 5,000 acres.

- One-third of steep slopes greater than 25% and about one-fifth of highly erodible soils are currently protected within the CFA, but given the critical need to protect these areas from disturbance and erosion, protecting more of these factors should be a priority for land conservation.

- Only about 10% of riparian and shoreland buffer zones are protected within the CFA, but half of the Lakes Region area of these critical zones is found within the CFA, warranting more work to protect this resource.

- Similarly, about 60% of the region's wetlands and hydric soils are found within the CFA, but are only 12% protected.

- High percentages of aquifers and favorable sites for future municipal water supplies are within the CFA, but also have relatively low levels of protection. This is especially important on the Saco River basin aquifer which is the largest and least developed groundwater source left in New Hampshire.

- A little more than one-third of the region's drinking water protection areas designated by NHDES are included in the CFA, but are less than 6% protected.

- Over 90% of the highest quality headwaters stream watersheds in the Lakes Region are within the CFA, but are only 40% protected

- More than two-thirds of the region's floodplain forests, marsh complexes and peatlands identified in the NH Wildlife Action Plan (NH WAP) are within the CFA, but currently have relatively low levels of protection.

- The same is true of the NH WAP habitat quality Tiers 1, 2, and 3, as well as the NH WAP aquatic habitat tiers which are a subset of the former.

In summary, the data above show that while the Lakes Region strategic conservation plan has used best-available natural resource data, sound science, and strong consensus-building in the development of the conservation focus areas within the region, the rich array of high-priority resources within the CFA are not well-protected, and much land conservation remains to be done in all areas.

Next Steps

With the conservation focus areas defined, the next phase of the project involves outreach activities that work to foster the plan in various communities in the region and potentially collaborative land conservation work among the collaborators. Several well-received presentations of the planning process and resulting CFA have been made to boards of the regional conservation organizations in the area, including a newly formed group of communities centering on Laconia plus the Belknap Range Conservation Coalition. Additional meetings are planned for the Lakes Region Planning Commission staff and commission members, lakes protective associations in the planning area, and other conservation-oriented organizations such as the *Friends of the Ossipees,* which recently completed its own planning exercise on the Ossipee Range, and an informal group interested in wildlife corridor connectivity in Tamworth and Sandwich.

Translation of the regional plan to community-scale interests is also a goal. Many communities have conducted *natural resource inventories* and conducted sufficient conservation planning to identify priority lands for protection. In some cases, these conservation targets match the regional CFA priorities of the Lakes Region plan almost perfectly. In other instances, local communities are working with more detailed information, e.g., a natural resource inventory informed by field ecology investigations, and therefore locations of very high-value natural resource features have emerged that could not be anticipated in the broader regional planning effort.

It is hoped that eventually a cadre of trained volunteers can be established in communities which share significant portions of the Lakes Region CFA. These volunteers may be members of one or more of the plan collaborators, but all would receive special training in the planning process and the natural resources that are key within the CFA. They can then act as community liaisons at the grassroots level, and provide a two-way continuity for the Lakes Region plan over time by interpreting and advocating for the plan at the local level on the first, and secondly, by informing collaborators of land conservation priorities and opportunities.

Continuity of the plan is important not only to leverage its implementation in various ways in the region, but also because the component data is constantly changing. One important example of this occurred at the two-thirds completion of the Lakes Region plan development when new NHWAP data were released in 2010. To ensure plan currency, the GIS work from the co-occurrence model onwards had to be revisited and revised. To keep current into the future, new and better natural resource data must be incorporated “on the fly”, and outreach and interpretation efforts must be dynamic and responsive to these inevitable changes.

The ongoing work of the Forest Society in the nearby Quabbin to Cardigan Conservation Collaborative (Q2C) planning region also points the way to ensuring that the Lakes Region plan becomes effective in its long-term implementation. Various private, state and federal funding sources have developed expressly for use in land conservation projects in the Q2C. These tailor-made funding streams have provided much needed transaction assistance and/or a portion of the actual cost of protecting certain lands that qualify under the criteria established by the Q2C collaborators themselves. While not an immediate action item for the Lakes Region, its

implementation vision includes a similar scheme of funding support for land conservation work in the plan CFA.

One final note:

The Lakes Region strategic plan is about enhancing land conservation decision-making by land conservation entities serving the region. While it may be a useful educational tool for regulatory bodies and developers, it was not intended or designed to be incorporated into land use regulations. Rather, it serves as a guide for prioritizing opportunities for land trusts, conservation commissions, and state agencies to work with willing landowners who seek to donate or sell their land or conservation easements that will protect their land holdings.