UVLSRPC Regional Plan 2014

Chapter 5

Air, Land & Water Resources in the UVLSRPC Region

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5.1 AIR RESOURCES

Vision

The region will have a high quality of air protecting public health, clear skies, and our natural environment.

Existing Conditions

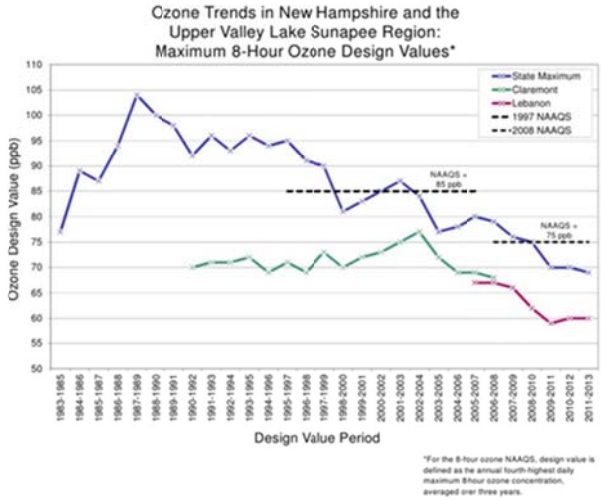
Direct health-related costs to New Hampshire from transported pollution from out-of-state sources were estimated to exceed $1 billion per year in 2004. This figure does not include the economic impacts associated with increased health claims and risks, loss of worker productivity, and higher electricity costs and costs of doing business as well as higher fuel costs due to increased requirements for operation in "dirty air" regions.[1]

In a December 2013 press release, Governor Maggie Hassan announced that "New Hampshire has joined with seven Northeast and Mid-Atlantic states in petitioning the U.S. Environmental Protection Agency (EPA) to require upwind states to reduce air pollution generated within their borders, which causes asthma, respiratory disease, and other public health problems downwind." The purpose of the petition was to require Illinois, Indiana, Kentucky, Michigan, North Carolina, Ohio, Tennessee, Virginia, and West Virginia to reduce the air pollution emissions carried by prevailing winds and contributing to ozone generation in downwind states such as New Hampshire.

The petition further asks that the upwind states join the Ozone Transport Region (OTR). Under the federal Clean Air Act, states within the OTR must take air pollution reduction actions consistent with downwind states. New Hampshire is an OTR state and has aggressively reduced air pollution emissions within the state over the last several years. On days in New Hampshire when the ozone reaches unhealthy levels, over 95% of that ozone originated in upwind states. The petition is based upon a multi-state report by the states of Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New York, Pennsylvania, Rhode Island, and Vermont. (NH DES, et al, 2013)

Ozone

"Smog" or "ground-level ozone" describes the results of chemical reactions in the atmosphere caused by nitrogen oxides and volatile organic compounds (VOCs) in the presence of strong sunlight. On hot sunny days, these compounds react with oxygen in the air to produce ozone, or smog, at ground level.



These pollutants come from local sources, such as cars, trucks, industrial boils, power plants, paints, solvents, and other commercial and consumer products. About half of all human-made nitrogen oxide and VOC emissions come from cars and

trucks. In addition, ozone and its precursors are transported to NH from sources up to several hundred miles away to our south and west.[2] NH DES has one monitoring station in the Region: the Lebanon monitoring station represents a consolidation of the former stations in Haverhill and Claremont. It is located on a ridge at the Lebanon Airport. The station provides information on ozone and particulate matter. The National Ambient Air Quality Standards exceedence days between 2008 and 2012 at the Lebanon site include one day in 2008 for ozone and none for particulate matter.

In 2008, the US EPA set a National Ambient Air Quality Standard (NAAQS) of 0.075 parts per million (ppm), averaged over 8-hours, for ground-level ozone. All of New Hampshire is meeting this standard.

Small Particle Pollution

Small particles can be emitted directly from burning materials or they can be formed from other gases which react in the atmosphere. Most of the small particles found in the Northeast result from burning coal, diesel, gasoline, wood, and other fuels, with the large coal burning industries and power plants in upwind areas contributing the largest amounts. These particles carry toxic and often carcinogenic materials.

Portions of NH experience elevated levels of small particles, defined as particles that are less than 2.5 micrometers in diameter. For comparison, a human hair is about 70 micrometers in diameter. Small particle pollution results in reduced visibility and hazy views.These microscopic particles can be inhaled deep into the lungs where they can induce or aggravate respiratory illnesses such as asthma, chronic bronchitis or emphysema. They can also cause coughing or wheezing in healthy individuals, complicate cardiovascular disorders, alter the respiratory system's defense against foreign materials; and damage lung tissue.

Although annual concentrations have not exceeded the federal standard (NAAQS), the concentrations frequently reach unhealthy levels for people who are sensitive to the effects of particle pollution. This includes the elderly, children, and people with lung or heart conditions. Wood smoke is a particular concern in the winter when cold air and temperature inversions limit air movement. Communities located in valleys are more strongly affected. On cold, clear and calm nights, smoke is unable to rise and disperse. Pollutants are trapped and concentrated near the ground, and the small size of the particles allows them to seep into houses through closed doors and windows. Choosing low-emission units, operating them properly, and using good quality, dry firewood can reduce this health risk.

Acid Rain and Deposition

Acid rain and deposition are primarily comprised of acids that form when emissions of sulfur dioxide and nitrogen oxides react in the atmosphere with compounds such as water and oxygen. The source of sulfur dioxide and nitrogen oxides is principally from the burning of fossil fuels by electric utilities, industries, and motor vehicles.

Once the acids form in the atmosphere, they can travel long distances and be deposited by precipitation, particles, gas, or vapors—and also by clouds or fog affecting high altitudes and

coastal areas. The high elevation mountain-tops in New Hampshire receive the highest acid deposition on an annual basis. Much of the pollution in NH has been transported by the wind from other states.

Deposits of acidic compounds negatively impacts aquatic and terrestrial ecosystems, public health, visibility and materials and structures such as buildings, monuments, and statues. Acid depletes nutrients from the soil, slowing growth of trees and other vegetation. Trees stripped of nutrients become stressed and are more susceptible to insect infestation, drought, freezing, and ozone damage. Many studies have shown the decline of red spruce to be directly linked to the impacts of acid deposition. Acid also leaches aluminum from soils and rocks and carries it to soil water, vegetation, lakes and streams where it can limit trees' ability to absorb water and nutrients. It can also be toxic to organisms such as plants and fish. Acid deposition in lakes and streams impacts the survival of aquatic organisms reducing diversity and abundance of organisms.

Mercury

Mercury is usually emitted as a gas that is absorbed into clouds and deposited by precipitation leading to mercury contamination. Coal burning and medical/municipal solid waste incinerators are the major sources of mercury emissions. Mercury is highly toxic and has been linked to many health effects including neurological and developmental problems, cancer, and endocrine disruption in fish, wildlife, and humans. Once mercury is ingested by humans, it is readily distributed throughout the body, including the brain, and is passed through the placenta to a developing fetus.

Once mercury enters the environment, it can remain as an active toxin for over 10,000 years. Mercury concentrations can be highly variable from year to year depending on weather factors, including wind direction and precipitation. In 2008, the NH DES published a Fish Consumption Advisory.[3] Water bodies with mercury levels above a specified level are considered impaired and recommended to have an advisory about eating the fish. In our region these water bodies include Mascoma Lake in Enfield, Ashuelot Pond and May Pond in Washington.

An additional analysis explored mercury concentrations of fish specimens of length-restricted fish species (bass, pickerel and perch) that were greater than 12 inches long and in specific water bodies. These large fish have the highest fish tissue mercury concentrations measured in the State, and fish from Goose Pond in Canaan were included in this category.

Motor Vehicles and Toxic Air Pollutants

Motor vehicle exhaust contains numerous toxic air pollutants (TAPs) such as benzene, formaldehyde, 1, 3-butdiene, and diesel particulate matter. Some additional TAPs emitted by motor vehicles include acrolein, cadmium, chromium and lead. These components have the potential to cause serious adverse health effects in humans ranging from neurological to cardiovascular to respiratory effects.

These toxins are emitted into the air when gasoline evaporates during refueling or when gasoline remains in a hot engine after it is shut off. These same compounds can also be emitted through the tailpipe and crankcase when the fuel is not completely burned in the engine.

Starting in 2006, New Hampshire began its on-board diagnostics test program for all 1996 and newer vehicles. These tests are run on your car during the annual inspection. In 1999, New Hampshire inspectors began checking heavy-duty diesel trucks to ensure their particulate emissions meet specific standards. Since this air quality testing has begun, vehicles emit 90% less hydrocarbons and 50% less toxic air pollutants over than lifetimes than earlier uncontrolled models. .According to EPA's National Emissions Inventory, total emissions of toxic air pollutants from mobile sources in New Hampshire have decreased from over 24 million pounds in 2002 to approximately 18 million pounds in 2008. Despite these improvements, if the number of cars and miles they are driven increase at a rate that offsets the benefits of current mandates, overall emissions of air toxics may again begin to rise.

Air Quality Regulations

The Federal Clean Air Act originated in 1970 and regulates air emissions from stationary and mobile sources. The law required the Environmental Protection Agency to establish its National Ambient Air Quality Standards (NAAQS). In 1985, the New Hampshire Acid Rain Control Act was begun to reduce emissions of sulfur dioxide from stationary sources (power plants and industrial facilities) within the state by 25 percent and to set an annual sulfur dioxide emissions cap on major sources. The NH Clean Power Act passed in 2002, amended in 2006, calls for annual reductions of multiple pollutants including sulfur dioxide, nitrogen oxides, carbon dioxide, and mercury. NH rules (Env-A 2900) were adopted to implement the Act which calls for substantial reductions in sulfur dioxide and nitrogen oxides emissions from the 1999 levels.

In 1997, the Conference of the New England Governors and Eastern Canadian Premiers recognized that acid deposition continues to negatively impact the resources in northeastern U.S. and eastern Canada, in spite of significant reductions of sulfur emissions that have taken place since 1990. In response to the need for further action, representatives of the states and provinces developed an Action Plan finalized in 1998 to further reduce emissions of sulfur dioxide and nitrogen oxides.

Although sulfur deposition has declined, research from Hubbard Brook Experimental Forest in Thornton, NH and other study sites in the Northeast demonstrate that acid deposition is still a problem. While sulfur emissions have decreased, nitrogen emissions have not decreased substantially since the 1980s. Also, the loss of acid-neutralizing minerals from the soil and the long-term accumulation of sulfur and nitrogen in the soil have left many ecosystems more sensitive to additional acids. Greater reduction in polluting emissions are needed to truly address this problem—including in states where much of the pollution originates and is transported to New Hampshire.

Indoor Air Quality

The State of NH Indoor Air Quality Program was discontinued due to a lack of funding. Why care about indoor air quality? Americans, on average, spend more time indoors than outdoors. The indoor concentrations of pollutants can exceed levels typically found outdoors due to the confining space of our homes. Health effects associated with indoor air pollutants include irritation of the eyes, nose, and throat; headaches, dizziness, and fatigue; respiratory diseases; heart disease; and cancer. Some of the indoor contaminants come from outdoor air and building

materials; others are produced by indoor activities such as cooking, smoking, and cleaning materials. Natural substances, such as mold and radon, can also affect indoor air quality.[iv]

For indoor air pollution, the Commission has developed a "Healthy Home: Clean Safe and $ave" program to teach people to use less toxic cleaning products than those typically found on the store shelf. There are very few regulations to restrict toxic ingredients in these cleaning products, yet consumers feel if they are on the shelf, the products must be safe. Reading the "small print" on the backs of some of these products is pretty frightening. Simple white vinegar, liquid castile soap, baking soda, and water can deal with most cleaning jobs in a home without releasing toxic emissions

Regional Efforts

Public transit and carpooling opportunities available in the Region can help improve air quality by reducing vehicle emissions. Advance Transit provides free transportation on their buses in the Upper Valley including in Vermont along the Connecticut River. The current primary service areas are for shopping, the hospitals, and Dartmouth College in and around Hanover and Lebanon and Hartford, Vermont. There is also a route out Route 4 to Canaan. The goals of Advance Transit include reducing traffic and parking congestion. Three of their 31 buses are hybrid diesel and electric. Upper Valley Rideshare provides a weekly listing of hundreds of carpool connections to help keep fewer cars on the road.

Improvement Strategies

Air Quality Improvement Strategies
• Expand carpooling and public transportation options in the region (per the recommendations in the Transportation Chapter of this Plan).
• Improve public outreach programs to encourage consumers to buy non-toxic, low VOC products.
• Provide technical assistance to municipalities considering local ordinances to reduce idling.
• Deploy electric vehicle charging stations on arterial roads in the region.
• Promote the use of clean, efficient woodstoves.
• Support stronger federal fuel economy standards.

5.2 AGRICULTURAL LANDS

Vision

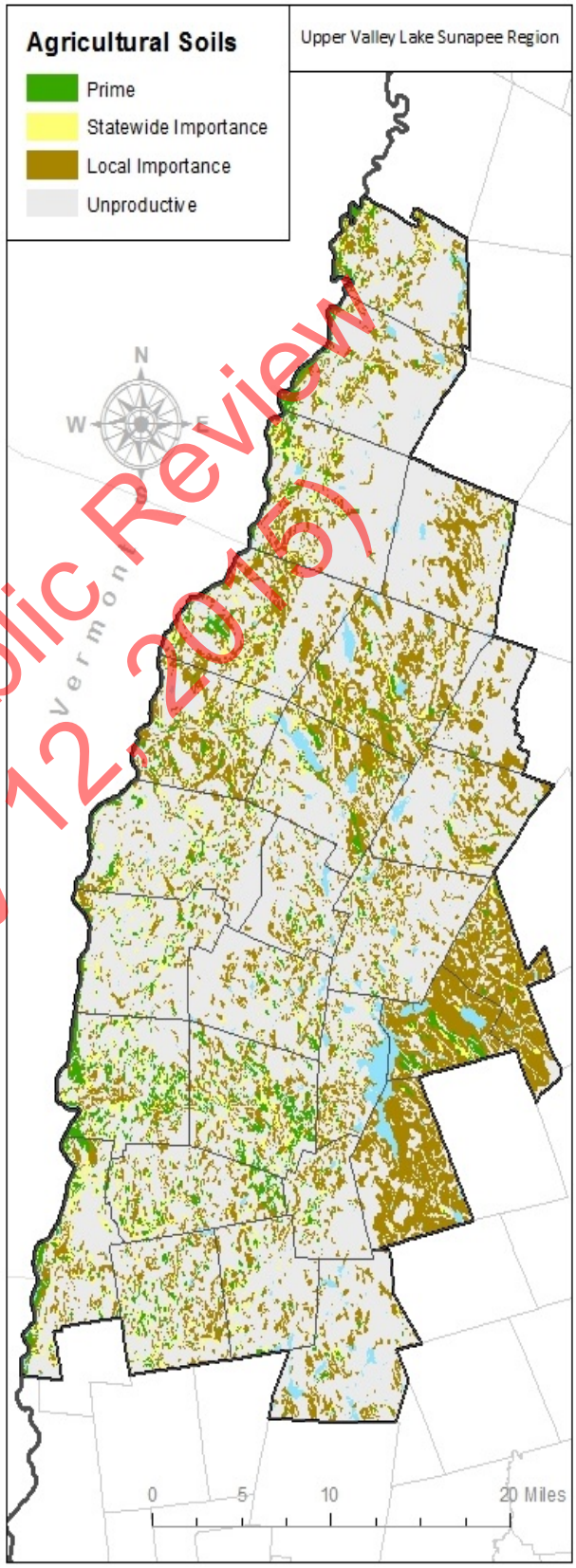
The region will support abundant agricultural opportunities to promote economic development and production of food and other products for diverse markets, preserve rural community character, and foster a sense of community through agricultural events such as farmers markets, fairs and festivals.

Existing Conditions

The Region is fortunate to have some of the best agricultural soils in the state. This is primarily due to the enriched river valley alluvial soils that make up the floodplain terraces.

Agricultural Soil Classification	Acres in UVLS Region	% of UVLS Region
Prime Agricultural Soil	32,060	4.7%
Statewide Significant Agricutural Soil	25,645	3.7%
Locally Important Agricultural Soil	152,235	22.2%
Total Important Agricultural Soils in the UVLS Region	209,940	30.6%
UVLS Region	686,123	acres

Data based on geographic USDA NRCS soil survey data obtained from NH GRANIT.



These soils are valuable resources for growing food crops and hay as well as providing scenic qualities for the Region. The US Department of Agriculture's Natural Resources Conservation Service (NRCS) has classified soils by agricultural potential. NRCS classifies agricultural soils according to their comparable value nationally, statewide and locally. Prime agricultural soils are of national significance and are the most productive soils because of the combination of physical and chemical properties. Soils of statewide significance are those that are very important to agriculture in the state. Soils classified as locally important to agricultural are productive soils that have been identified

by County Conservation Districts. These soils may be less productive than Prime or Statewide significant soils, but may be historically farmed and known to be productive on a local scale. The USDA's Web Soil Survey, is a good resource for learning about soils in the Region.[5]

Physical characteristics of land that contribute positively to agricultural potential are the zero to low grade slope, moisture, good drainage, depth to bedrock and seasonal high groundwater table. Some land use techniques can increase the productivity of soils such as crop rotation and applying compost before the growing season. Other techniques can be detrimental to productivity and certainly land conversion from farming to residential uses would remove the soils from farming completely.

In 2011, an estimated 1% of the State's GDP was sales and receipts in the agricultural sector.[6] In 2010, an estimated $43 million in sales of harvesting crops was reported. According to the National Crop Insurance Services in March 2014, New Hampshire's agriculture industry contributes more than $239 million to the State's economy. Milk and ornamental horticulture (greenhouse and nursery products) are the largest sectors of the state's agricultural economy, each accounting for roughly one-third of total farm sales. The other chief commercial crops are hay and silage corn, fruit (including apples and berries), livestock, eggs and poultry, maple syrup, Christmas trees, sweet corn and other vegetables. Grafton and Sullivan counties are the two top counties for dairy farming in New Hampshire. The UVLSRP region is also home to agricultural supply and service provider businesses that support farm businesses here and across the two states of New Hampshire and Vermont.

There are about 140 commercial dairy farms in the State. New Hampshire and New England dairy farms produce about 1/3 of the dairy consumed in the state. Growth of the local agricultural and food movement is difficult to measure, but the NH Department of Agriculture, Markets & Food points to the quadrupling of local farmers markets in the state from 2007 to 2014. During the same period, winter farmer's market locations in the state went from 2 to nearly 30.

	New Hampshire	Grafton County	Merrimack County	Sullivan County
Number of Farms	4,391 (2012)	500 (2012)	600 (2012)	298 (2012)
	4,166 (2007)	552 (2007	583 (2007)	294 (2007)
Farmland Acres	474,065 (2012)	82,372 (2012)	64,950 (2012)	39,015 (2012)
	471,911 (2007)	99,964 (2007)	64,642 (2007)	43,199 (2007)
Market Value of Products Sold	$190,907K (2012)	$29,831K (2012)	$45,266K (2012)	$17,311K (2012)
	$199,051K (2007)	$34,393K (2007)	$55,286K (2007)	$14,972K (2007)

The Farmland Information Center of the American Farmland Trust (AFT) reported that one-fifth of the farmland in NH has been lost in the last thirty years.[7] A 2014 study completed by the AFT ranked sections of Cheshire, Grafton and Sullivan counties, and part of the Connecticut River Valley, as 19th on the list of the *Top 20 Most Threatened High-Value Farmland Regions in New England*.[8]

Protection of local farmland has many benefits, including:

- Ensures that land remains available farming
- Provides access to fresh local farm products, without significant transportation costs
- Makes productive use of floodplains
- Keeps local money in the local economy
- Provides open space and habitat for wildlife, including deer, turkey, bluebird and woodcock
- Provides scenic views while making productive use of the land and maintains rural and cultural qualities of the land
- Continues the visual and land use tradition of the region's working landscape
- Enhances the Region's economic development potential including agricultural tourism and rural enterprises

Benefits of the Farm and Ranch Lands Protection Program	
Keeps land available for agriculture	96% of landowners said that at least some of their protected land was in active agricultural use, and nearly 50% said that all of their protected land was in production
	70% of owners are farmers, and the proportion of producers is higher among those who purchased protected farms
Improves agricultural viability	84% of landowners who sold easements invested at least some of the proceeds in their operations or agricultural land
	Easement proceeds spent on agruicultural purposes tend to be spent locally, bolstering the entire agricultural sector of in communities with protcted farms
Encourages on-farm conservation	75% reported the application of at least one conservation practice
	20% used proceeds from the easement sale to install or expand conservation practices
Helps farmers gain access to land	55% of landowners who sold easements spent proceeds repaying loans on farm and ranch land they already owned or buying additional agricultural land
	65% of landowners who had purchased protected land said the price was lower than comparable unprotected land
	69% of the owners with succession plans said the next owner would be a farmer
Adapted from a summary of the American Farmland Trust: http://www.farmlandinfo.org/FRPPImpactsSummary	

Agricultural lands can be protected in a number of ways. The NH Farm Viability Task Force suggests that current use taxation is the single most important public policy benefit for farmers.[9]

The federal Agricultural Conservation Easement (ACEP) Program was enacted under the 2014 Farm Bill and takes the place of the Farm and Ranch Lands Protection Program (FRPP). This program is

administered by the Natural Resources Conservation Service (NRCS) and provides financial and technical assistance for land protection.

There are two components of the ACEP: the Agricultural Easements component; and the Wetland Reserve Easement component. Program benefits include protecting the long-term viability of the nation's food supply by preventing conversion of productive agricultural lands, protecting environmental quality and providing habitat for wildlife, fish, and improving water quality. The program assists state and local governments and NGOs in protecting eligible cropland, grassland, pastureland, nonindustrial private forestland, and wetlands in the state.[10]

The state of NH also has a legacy of contributing to the permanent protection of land through the state's Land and Community Heritage Investment Program (LCHIP) offers grants to assist non-governmental organizations (NGOs) in land protection. For the next two years, beginning in 2015, all of the proceeds from the NH deed recording fee will be dedicated to the LCHIP. This is estimated to be about $8.5 million toward land conservation. Significant portions of these funds had been diverted into other programs in previous years.

A municipality can also implement local land use regulations using a variety of tools such as agricultural zoning and other districts or district overlays which limit or restrict development of agricultural areas. [11]

Threats and Challenges

Agriculture is a cornerstone of the rural character favored by most of the Region's communities, yet farmers struggle with local regulatory pressures and unfriendly attitudes toward farm enterprises. The public yearns for rural quality of life, but may not understand the realities of working farms and woodlots of the productive, resource-based rural economy, as opposed to the consumptive uses of land and natural resources found in a typical suburban community. Working farms and rural character come with both pretty and gritty sides. Farms are businesses that may have some commercial and industrial aspects. Trucks deliver supplies, haul crops from field to barn, and produce to market. Along with peaceful cows or woolly sheep grazing in the meadows, odors may emanate from stored silage feeds, and from storing and applying manure in accordance with environmental standards. UNH Cooperative Extension and the USDA NRCS offers technical assistance to farmers and communities to assist with educating and funding best management practices. Following agricultural BMPs can also reduce the negative impacts of agriculture applications such as pesticides and fertilizers.

Economic sustainability is the greatest challenge to the sustainability of farms of all types. Farm businesses must be able to adapt and grow. The very small and small farms that predominate New Hampshire's landscape are generally part-time or supplementary-income enterprises. Farms of any size may seek to diversify by adding new enterprises or finding alternative sources of income. The history of agriculture in the region is a story of continual change and evolution.

Municipalities can establish local agricultural

commissions (RSA 673:4-b), with the purpose of protecting agricultural lands, preserving rural character, providing a voice for farmers, and encouraging agriculture-based businesses. At this time, no municipalities in the Region have agricultural commissions. Agricultural commissions can provide a voice for agriculture, to help inform municipal boards and authorities, and to enhance understanding of agriculture in the community. A guide to can be found on The UNH Cooperative Extension is a great resource and offers several helpful documents including *Creating a Local Agricultural Commission in Your Hometown*[12] and *Preserving Rural Character through Agriculture: Resource Kit for Planners*.[13]

Nutrient Management

Under RSA 431:33, the Department of Agriculture, Markets & Food is responsible for responding to complaints involving the mismanagement of manure, agricultural compost and chemical fertilizer. The Division of Regulatory Services coordinates inspections to sites where these materials are suspected of causing environmental contamination or nuisance problems. When merited, complaint resolution focuses on corrective measures in accordance with the *Manual of Best Management Practices (BMPs) for Agriculture in New Hampshire*, published by the department in accordance with RSA 431:34.

The division also administers the Agricultural Nutrient Management (ANM) grants program to assist agricultural land and livestock owners with efforts to minimize adverse effects to waters of the state by better managing agricultural nutrients. The ANM grant program provides financial assistance with implementing Best Management Practices that prevent or mitigate water pollution, and often works in tandem with the USDA Natural Resources Conservation Service.

Improvement Strategies

Agricultural Land Improvement Strategies
• Assist communities in developing Local Agriculture Commissions to promote local farming.
• Promote and provide technical assistance to communities the wishing to protect productive farmland through local ordinances or overlay districts.
• Provide assistance to municipalities in the prioritization of agricultural soils protection and work cooperatively with owners and conservation easement holders.
• Enhance public education programs promoting good forest stewardship and best management practices for the sustainability of private nonindustrial forests.
• Prioritize the conservation of large, connected blocks of unfragmented forests.
• Support agricultural education programs such as UNH Cooperative Extension, local 4-H clubs, and "*Ag in the Classroom"* school events .

5.3 FOREST LANDS

Vision

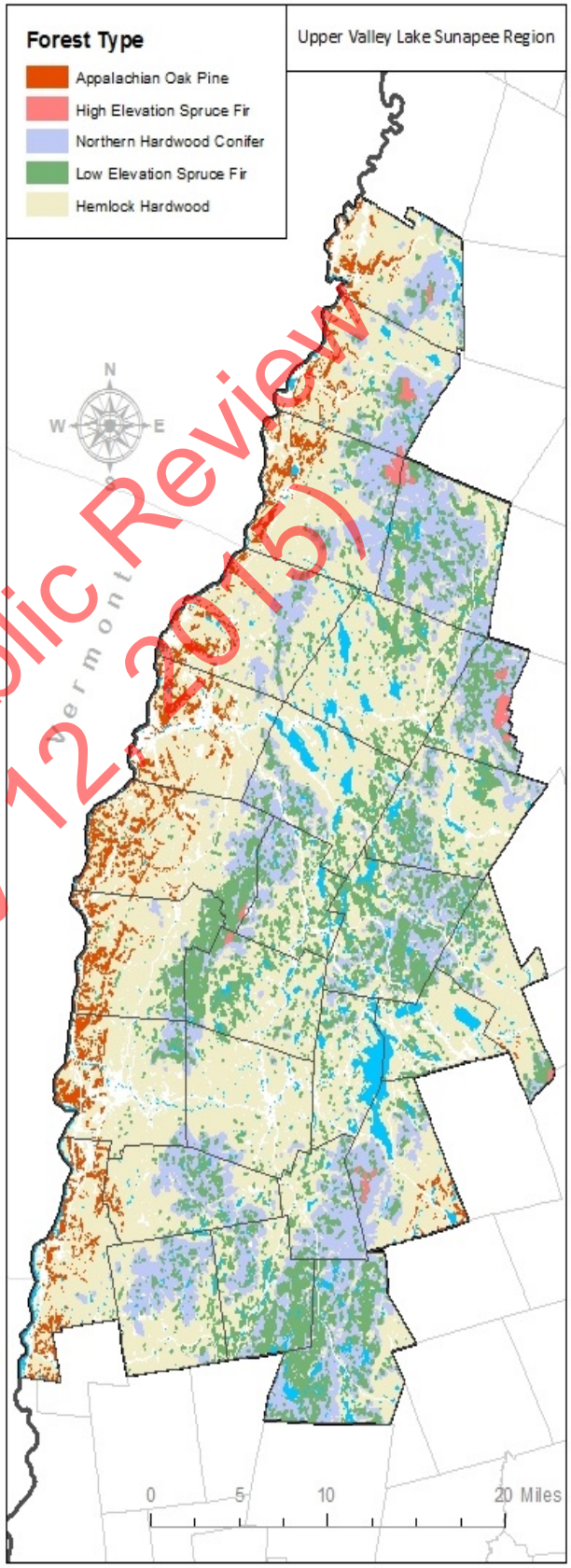
The region's forests will be effectively managed to ensure unfragmented wildlife habitat, a healthy environment, economic opportunity, recreation, and aesthetic identity.

Existing Conditions

A "forest block" is an area of forest that is not fragmented by roads or development. A 500-acre block is generally large enough to support significant wildlife, protect water quality and allow some economic forest management. Sustainable forest management and ecological significance requires blocks of at least 5,000 acres, and these values increase with block size. (Society for the Protection of NH Forests, 2005)

Nearly all of the Region's land is capable of growing repeated forest crops. This represents a significant economic potential. In addition to providing a permanent supply of fuel wood, lumber and other wood products, as well as forest industry jobs, the Region's forests have several functions and associated benefits. These include:

- Soil stabilization, especially on hillsides. Deforestation diminishes the soil's ability to absorb and hold water and results in the erosion of slopes, sedimentation in streams and lakes, and more frequent and severe flooding;
- Providing natural wildlife habitats;
- Offering areas for outdoor recreational opportunities such as hiking, skiing, hunting and camping;
- Acting as a screen or buffer of sights, sounds and the wind; and
- Providing natural beauty and scenic views for both residents and tourists, especially in the fall.

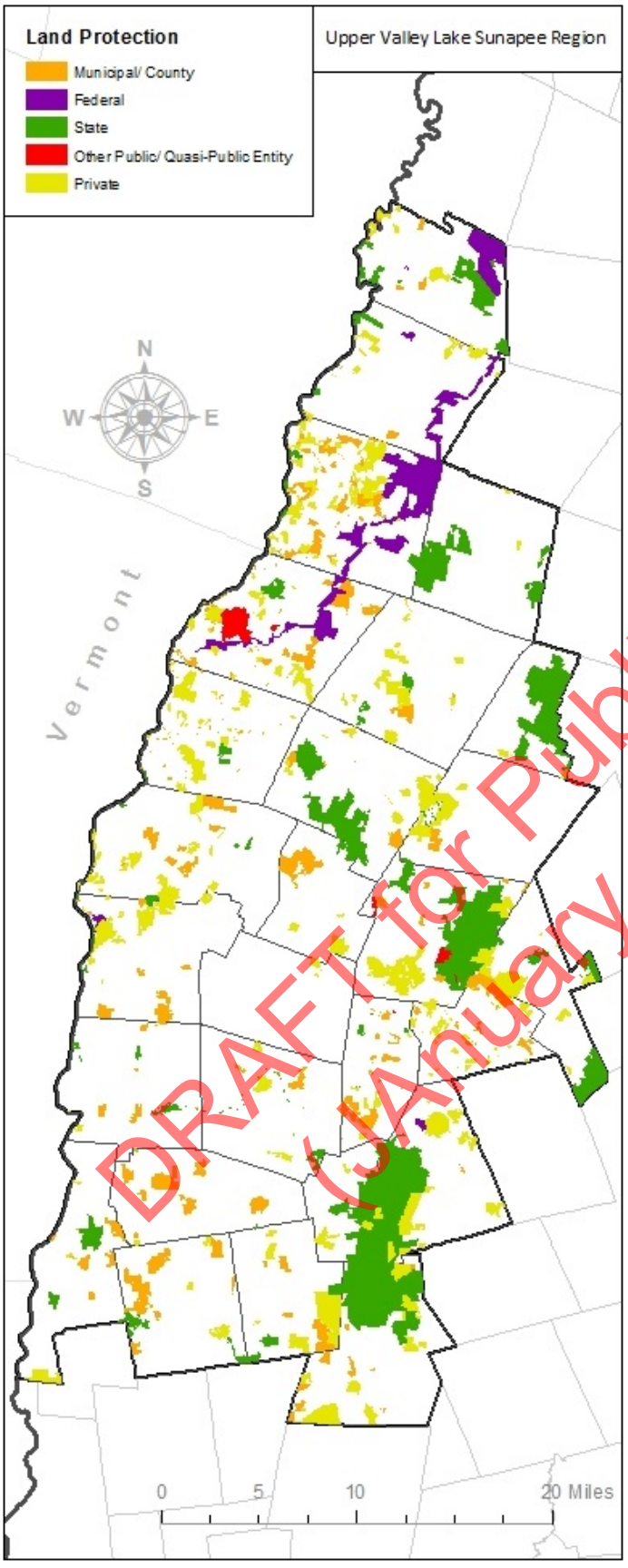


Ownership of forested lands in the Region is predominantly private. Many communities have town forestlands. Many town forests are used for recreational and educational purposes, as well as a source of income when timber is harvested. The State of New Hampshire owns over 23,000 acres of State Forest lands in the Region. These tracts, constituting just over 3.45% percent of the Region's land area, contribute to the pattern of open spaces in the Region and are managed with a multiple use philosophy geared toward timber production, recreation, and wildlife habitat.

Figure 5.3.1- State Lands in the Region

Name	Municipality	Acres within Region
State Forests:		
Annie Duncan State Forest	Plainfield	113
Cardigan Mountain State Forest	Orange	4,742
Connecticut River State Forest	Charlestown	216
Dodge Brook State Forest	Lempster	222
Fall Mountain State Forest	Charlestown	520
Gile State Forest	Springfield, Wilmot	6,675
Hubbard Hill State Forest	Charlestown	759
Lake Tarleton State Park	Piermont	48
Lovewell Mountain State Park	Washington	478
Mascoma State Forest	Canaan	216
Max Israel State Forest	Washington	628
Mount Sunapee State Forest	Newbury	2,893
Province Road State Forest	Dorchester	1,072
Sentinel Mountain State Forest	Piermont	235
Sugar River Recreational Trail	Newport	3
Total Acres in State Forests		*18,820*
State Parks:		
Cardigan State Park	Orange	Part of Cardigan State Forest
Gardner Memorial Wayside Park	Springfield	Part of Gile State Forest
Pillsbury State Park	Washington	4,455
Winslow State Park	Wilmot	Part of Gile State Forest
Total Acres in State Parks		*4,455*
Wildlife Management Areas:		
Cemetery Hill WMA	Sunapee	99
Enfield WMA	Enfield	2,896
Lower Shaker WMA	Enfield	1,056
Mascoma River WMA	Canaan	125
McDaniels Marsh WMA	Springfield	626
Reeds WMA	Orford	77
Spaulding WMA	Canaan	88
Webster WMA	Canaan	88
Wilder WMA	Lyme	59
Total Acres in WMAs		*5,114*
State Conservation Easements on Private Property:		
Piermont Mountain	Piermont	1,650
Pillsbury & Sunapee (2 properties)	Goshen	9,366
Ragged Mountain	Wilmot	695
Yatsevitch	Cornish	973
Total Acres State Easements:		*12,684*
Total State Land including Easements		**41,073**

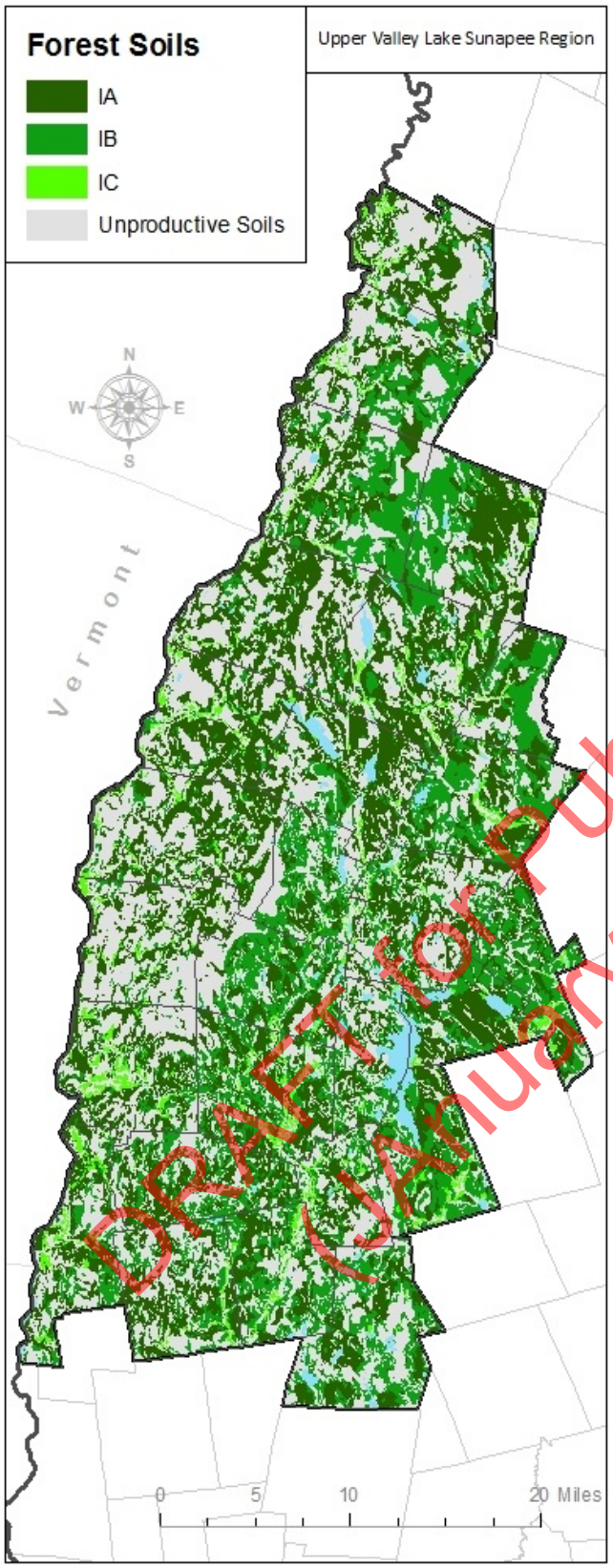
Source: NH Division of Forests and Lands



As with agricultural soils, the US NRCS has identified soils that have the best potential for timber production. Soil productivity is a key factor in the economic value and ecological diversity of our forested landscape. Most of NH's best forest soils are found in the southeastern part of the state. This information is available in soil surveys and at the offices of the NRCS and UVLSRPC.

There are three major types of soils for forest are described below and shown on Group IA: These are deeper, loamy, moderately well-drained and well-drained soils. Generally these soils are more fertile and have the most favorable soil-moisture conditions. The climax forest stands on these soils include shade-tolerant hardwoods such as sugar maple and beech. Early successional stands often include a mix of hardwoods including sugar maple, beech, red maple, yellow, gray and white birch, aspen, white ash, and northern red oak in combinations with red and white spruce, balsam fir, hemlock, and white pine. The soils in this group are well-suited for growing high quality hardwood veneer and saw timber. The less abundant softwoods require intensive management to establish larger stands due to the highly competitive hardwoods.

Group IB: These soils are moderately well-drained and well-drained, sandy or loamy-over-sandy, and slightly less fertile than those in group IA. Soil moisture is adequate for good tree growth but may not be quite as abundant as in group IA. Successional trends and the trees common in early successional stands are similar to those in group IA. However, beech is usually more abundant on group IB soils and is the dominant climax species. Group IB soils are well-suited for growing hardwoods with less nutrient and moisture demands such as white birch and northern red oak. Softwoods generally are scarce to moderately abundant and managed in groups or as a part of a mixed stand.



Group IC: Group IC soils are derived from glacial outwash sand and gravel with coarse texture which is 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 include stands of shade tolerant softwoods such as red spruce and hemlock. White pine, northern red oak, red maple, aspen, gray birch, and paper birch are common in early successional stands. These soils are well-suited for high quality softwood saw timber, especially white pine. Less site-demanding hardwoods such as northern red oak and white birch have fair to good growth on sites where soil moisture is more abundant.

Timber harvesting, like any removal of vegetative cover, increases the velocity and volume of stormwater runoff and can result in sedimentation of surface waters. This is a particularly important concern on land areas with steep slopes, where much of the commercially marketable timber in the Region is located.

Much progress has been made regarding the development of best management practices, which, if followed, enable logging to be done without causing damage to the land or surface waters.

A number of factors suggest that there is an increased need to develop local and statewide policies that specifically address land use issues relating to the Region's forests, including:

- The Region's growth is placing pressures on forest land for conversion to more intensive uses;
- Housing development on the fringes of large tracts of forested land increases the dangers of forest fires and also increases the threat to life and property should a fire occur as well as the increased likelihood of invasive species penetrating the forest;
- National demand for lumber and finished wood products makes timber harvesting attractive to woodlot owners;
- High energy costs and the uncertainty of energy supplies have spurred a rapidly expanding fuel wood market, placing additional reliance on our forests as an energy resource; and
- Ownership of forestland is increasingly fragmented, complicating efforts directed toward sound forest management and providing critical wildlife habitats.

Forest Health

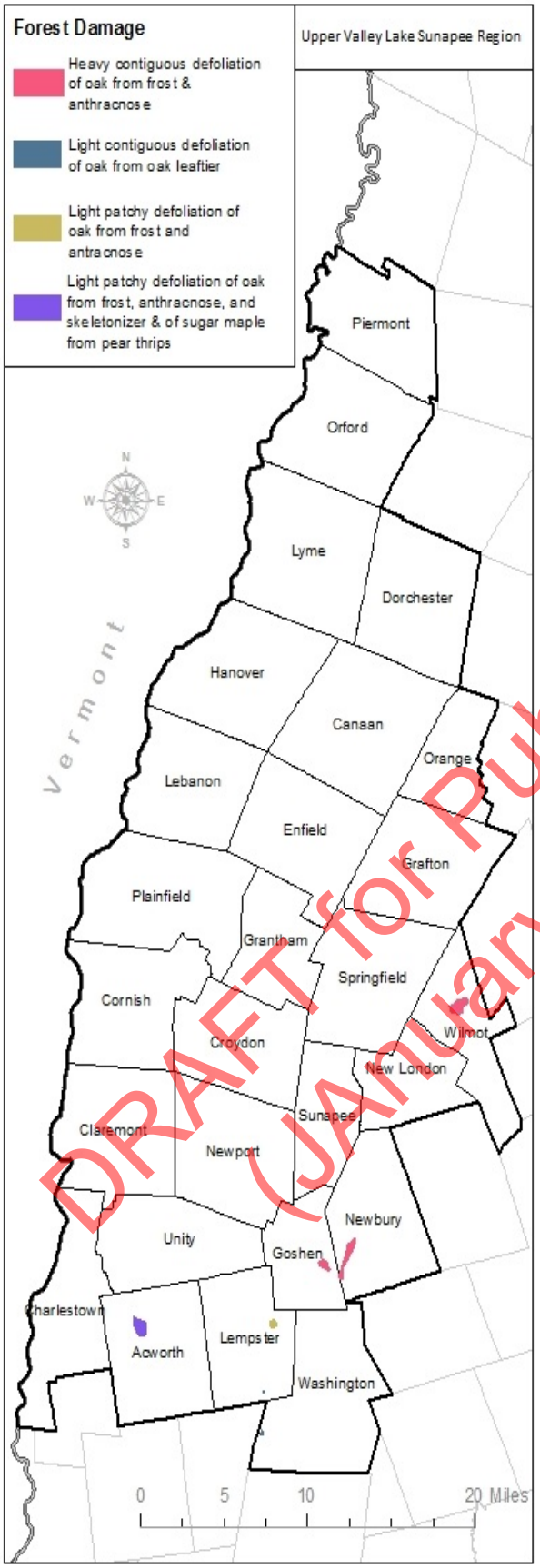
The effects of climate change on the forests of New Hampshire remain uncertain. This phenomenon may even increase forest growth, and we simply do not know enough to suggest long-term effects on the trees directly from climate change.

As we have more international and interstate travel, more invasive species enter our lives and affect the natural environment. Many invasive insects, fungi, and bacteria have been introduced to our forests causing disease and killing various species of trees. In 2011, the State of NH implemented a ban on untreated, out-of-state firewood in NH without a commercial or home heating compliance agreement to prevent the spread of invasive species to our forests. The State also implemented a quarantine of all hardwood firewood, ash wood products and all nursery stock is in effect for Merrimack County.

The three insects of greatest concern today are hemlock woolly adelgid, emerald ash borer and Asian longhorned beetle. At the moment, the Asian longhorned beetle is still in the Worcester, MA area and heroic efforts, at great cost, are attempting to eradicate it. The other two insects are found in New Hampshire, but fortunately, only affect two genera: ash and hemlock. No big losses have occurred yet in New Hampshire, but hemlock wooly adelgid is being found throughout southern NH counties and a recent discovery of emerald ash borer in the Concord area is substantial.

Spruce budworm may show up again which could affect acreage in New Hampshire including ecologically sensitive high elevation zones. The last outbreak was in the late 1970s, and it resulted in the mortality of vast acreages of spruce-fir forests from Maine to New York. Should another outbreak of spruce budworm appear, it could have significant effects in the very spruce-fir forests that regenerated beginning in the late 1970s following the last outbreak.

There are many other invasives in our midst including pine canker, gypsy moths, elongate hemlock scale, red pine scale, white pine blister rust, and the winter moth. Defoliation of trees has been caused by Anthracnose (sugar maple and birch), Oak Leaftier, Pear Thrips (fruit trees and other trees, especially sugar maple), Oak Skeletonizer, and Balsam Wooley Adelgid..



And there are even more invasives which are no longer as well-known since they have killed off certain species of trees and are no longer in the media. However, we should not forget elm trees that lined our main streets and which disappeared due to Dutch Elm Disease, or butternut trees that succumbed to Butternut Canker, or the chestnut tree that used to inhabit the Connecticut River Valley before the Chestnut Blight was brought from Asia in the early 1900s. Research still goes on to find elm, butternut, and chestnut trees that are resistant to these earlier invasive killers.

Lastly, invasive plants, such as autumn olive, buckthorn, Japanese knotweed, bittersweet and garlic mustard all appear to be growing in area and reach. As these invaders become more established, forest trees are being affected and in some cases are crowded out by these invasive plants. Factors impacting the spread of invasive species include soil disturbance, poor land management, and little control of the spread of invasive species by seeds and plant parts.

Economics of Forests

New Hampshire forests cover 84% of the State and have been at this level since the 1980s. Individuals, families, and businesses own over 76% of the forest, the State owns 5%, and the federal government, primarily through the White Mountain National Forests, owns 14%. The annual value of sales or output of NH's forest products industry totals nearly $1.4 billion while the forest-based recreation economy is also worth approximately $1.4 billion. Landowners received approximately $30 million in stumpage payments for timber harvested in 2012. Of that, approximately $3 million was paid in timber tax to NH communities. (North East State Foresters Association, 2013)

There are many reasons for a private owner to

hold on to forested land including wildlife habitat protection and viewing; recreation; land protection; and timber production. Although some may enjoy the resources to own land for its own sake, most of us rely on income from the forest to hang onto it. This income can be generated from logging for building materials, pulp, and chips; maple syrup production; and Christmas trees.

The economics of forests is not just about production and sale of wood products or wood fuel. Indirect benefits include employment; purchases such as equipment, parts, fuel, insurance; and taxes such as timber tax. The NH Timberland Owners Association and Plymouth State University have recently begun a study to evaluate direct and indirect economic activity associated with timber harvesting. This will provide information not currently available, and the study should be complete by the beginning of 2015.

Carbon in Our Forests

Carbon dioxide is a naturally occurring greenhouse gas that contributes to global warming and climate change, and has been on the rise from various human activities. The largest amounts of carbon dioxide emissions are from the burning of fossil fuels for electricity, transportation and industry. Many laws and strategies have been put into place to try to regulate and reduce carbon emissions.

Forests help to naturally take carbon dioxide out of the atmosphere and emit the oxygen we breathe. The trees capture and store most of the carbon in the process of terrestrial carbon capture and sequestration. Trees absorb carbon dioxide through photosynthesis and are often referred to as carbon sinks. Most of the carbon is initially stored in the stem, branches, and foliage. The carbon can also travel through the tree and is stored in the roots, soil, and fallen leaves. This process stores a significant amount of carbon. However, some is lost back into the atmosphere through respiration and the decomposition of organic matter.

A recent study by the University of Connecticut's Center for Land Use Education and Research (CLEAR) and the Department of Energy and Environmental Protection (DEEP) researching the loss of carbon sinks (forests and vegetated landscape) due to land use change due to sprawling regional development. The purpose of the study was to find out if "land conservation and strategic land use planning could prove more cost-effective public policy instruments, on a dollar per dollar basis, for states to reduce carbon emissions". The study found that over a 25 year period (1985-2010), through deforestation for development and land use change, the amount of carbon sequestration by carbon sinks in the state of Connecticut has decreased below the amount of carbon emissions of the state per year. The amount of carbon emission has not changed much over the 25-year period. The conclusion was that forests and vegetation provide an important resource to reducing the amount of carbon that gets into the atmosphere affecting global warming and climate change. The results also indication that avoided deforestation, more compact development, or redevelopment of carbon sinks can reduce carbon levels more cost effectively than many current emissions proposals.

The Upper Valley Lake Sunapee Region has a vast amount of forested land but has also been affected by development and sprawl. Although this particular study has not been done for the Region or the state of New Hampshire, the results of Connecticut's study show the importance of the protection of forests and its affects on climate change.

Regional Efforts

New Hampshire RSA 79-A:1 states that it is in the public interest to encourage preservation of open space by conserving forest and other natural resources. There are a few mechanisms to accomplish conserving forest lands available and which have been used in the region.

A zoning ordinance may be used to protect large forest tracts by requiring large lots in specific areas of the municipality where the goal is to encourage forestry and timber harvesting. For example, the Town of Lyme established a Mountain and Forest District with a minimum lot size of 50 acres. Their master plan supported the larger lot size and the selection of the lot size was not arbitrary as noted in a 1995 NH Supreme Court Case.

According to 1995 court expert testimony, 50 acres is the minimum size for profitable forestry. Smaller lots create access problems as the timber harvester must gain permission to cross abutting lots, and there is less opportunity for harvesting on smaller lots.

Other methods to maintain large tract forests are voluntary conservation easements by the property owner and purchase of tracts of forest by the municipality.

5.4 WATER RESOURCES

Vision

All of the region's water resources will be maintained, restored, and/or protected to ensure the quantity and high quality of drinking water and aquatic habitat.

Existing Conditions

Watersheds

Watersheds are the catch basins for all precipitation. Rain or snow falling on the area of land within the confines of a watershed's interconnected ridge crests or high points eventually becomes surface water and groundwater. A watershed is usually associated with the particular river or stream it feeds. For example, the Connecticut River drains a watershed including parts of Canada, New Hampshire, Vermont, Massachusetts and Connecticut. Each tributary to the Connecticut River has its own watershed area that ultimately feeds into the Connecticut River and is a sub-watershed of the larger watershed. The Sugar River is a tributary river feeding into the Connecticut River. Surface water in one watershed will not enter another watershed on the opposite side of the ridge because higher elevation ridges divide one watershed from another. Groundwater can move between watersheds.

The area contained within a watershed is a very important consideration in community planning efforts. Quite often, a particular small watershed lies entirely within a single community, while larger watersheds usually do not. Water resources management and protection in a community may have a substantial impact on the water resources of a neighboring town at a lower elevation with connecting watersheds. Therefore, it is very important for communities to work together in order to plan effectively to protect water resources.

For more than 40 years, policy makers have been working to reduce acid rain, a serious environmental problem that can devastate lakes, streams, and forests and the plants and animals that live in these ecosystems. Now new research funded by the NH Agricultural Experiment Station (NHAES) at the University of New Hampshire College of Life Sciences and Agriculture indicates that lakes in New England and the Adirondack Mountains are recovering

rapidly from the effects of acid rain.

Researchers found that sulfate concentration in rain and snow declined by more than 40 percent in the 2000s, and sulfate concentration in lakes declined at a greater rate from 2002 to 2010 than during the 1980s or 1990s. During the 2000s, nitrate concentration in rain and snow declined by more than 50 percent and nitrate concentration declined in lakes.

"This is really good news for New England. Lakes are accelerating in their recovery from the past effects of acid rain. Our data clearly demonstrate that cleaning up air pollution continues to have the desired effect of improving water quality for our region's lakes," said NHAES researcher William McDowell, professor of environmental science and director of the NH Water Resources Research Center.

In addition to McDowell, the research team included Kristin Strock, assistant professor at Dickinson College; Sarah Nelson, assistant research professor with the Senator George J. Mitchell Center and cooperating assistant research professor in Watershed Biogeochemistry in the UMaine School of Forest Resources; Jasmine Saros, associate director of the Climate Change Institute at UMaine and professor in UMaine's School of Biology & Ecology; Jeffrey Kahl, then-director of environmental and energy strategies at James Sewall Company.

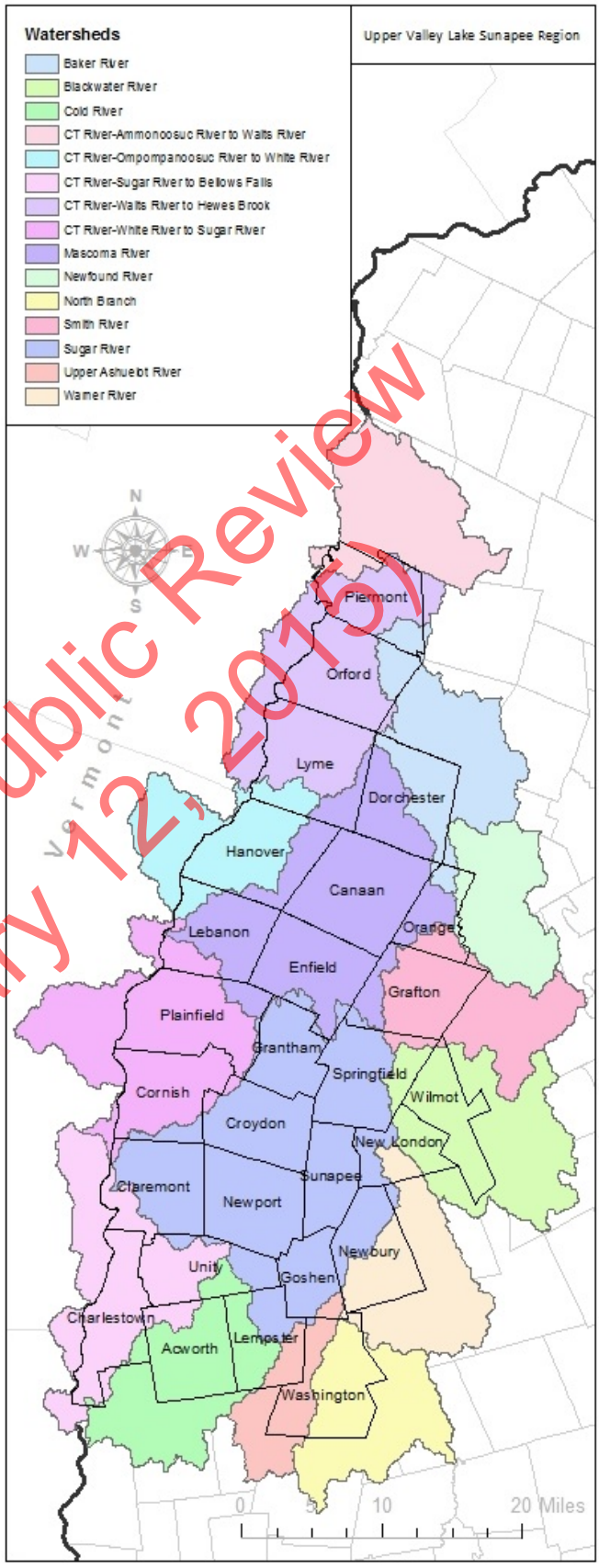
Researchers analyzed data collected since 1991 at 31 sites in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and southern New York and 43 sites in the Adirondack Mountains of New York. The results are presented in "Decadal Trends Reveal Recent Acceleration in the Rate of Recovery from Acidification in the Northeastern U.S." in the journal Environmental Science & Technology.

According to the U.S. EPA, acid rain refers to a mix of wet and dry materials from the atmosphere containing higher-than-normal amounts of nitric and sulfuric acids. The precursors of acid rain formation result from both natural sources, such as volcanoes and decaying vegetation, and man-made sources, primarily emissions of sulfur dioxide and nitrogen oxide resulting from fossil fuel combustion.

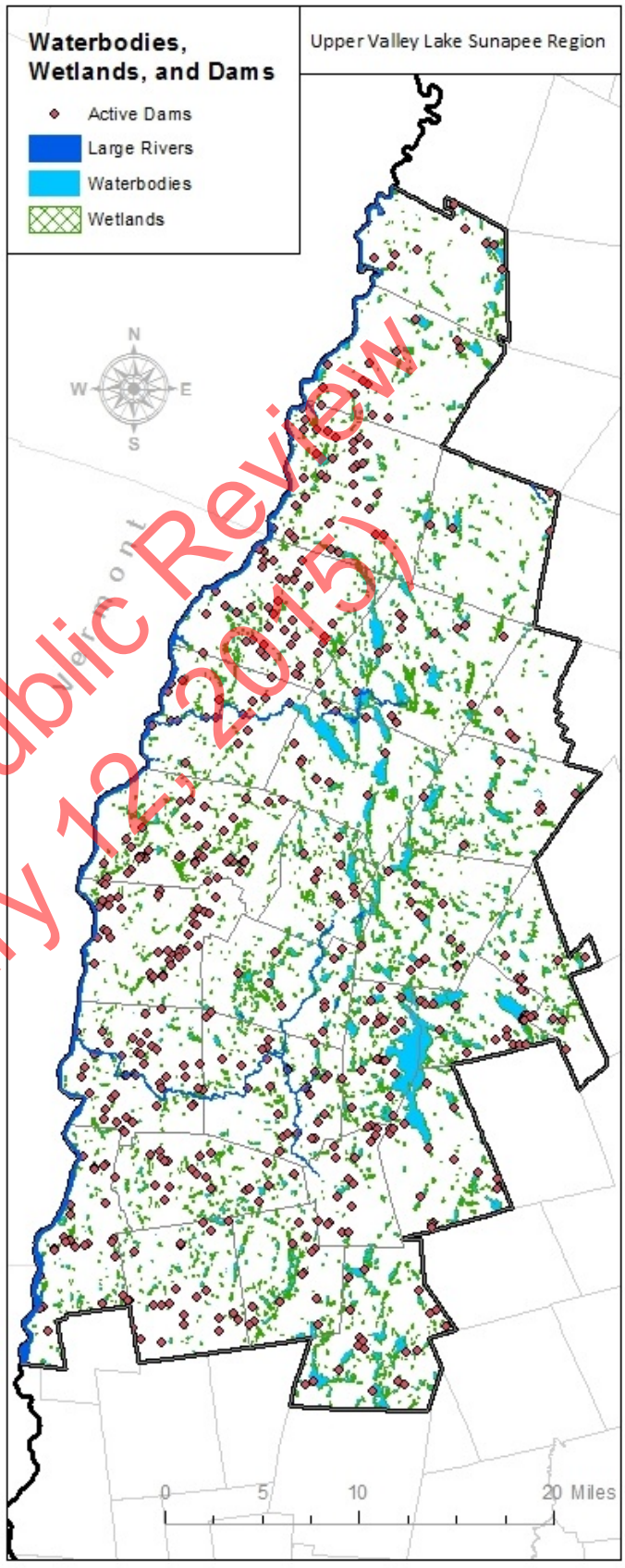
In the United States, roughly two-thirds of all sulfur dioxide and a quarter of all nitrogen oxide come from electric power generation that relies on burning fossil fuels, such as coal. Acid rain occurs when these gases react in the atmosphere with water, oxygen, and other chemicals to form various acidic compounds. The result is a mild solution of sulfuric acid and nitric acid. When sulfur dioxide and nitrogen oxides are released from power plants and other sources, prevailing winds blow these compounds across state and national borders, sometimes over hundreds of miles.

The watershed approach to water resources planning makes sense because watersheds are the main units of surface water and groundwater recharge. The size and physical characteristics of the watershed have a large influence on the amount of water that, ultimately, will end up as surface water and groundwater. In addition, the land uses located within a watershed have a direct impact on the water quality and flow.

Watersheds with a large proportion of forested land are more likely to provide high water quality. Forests are living filters that protect our aquatic ecosystems, drinking water supplies, and human health. Forests protect soils and moderate stream flow, and support healthy aquatic systems thus creating better water quality. Conversion of forest to other land use leads to reduced water quality due to an increase in runoff, soil erosion, downstream flooding, and pollutants entering rivers and streams. These contaminants in surface water can directly affect the quality of groundwater. Surface water and groundwater can be connected by the stream feeding the groundwater, the groundwater feeding the stream, or a system where they both feed each other. It is all the same water and can carry contaminants from one to the other. This is especially significant in the northeastern U.S. and our region due to the use of many private wells—60% of NH residents rely on groundwater for drinking water.



The largest watershed in our Region is the Connecticut River Watershed. The Connecticut River Watershed is broken up into sections beginning and ending with tributaries. Two of the major tributaries of the Connecticut River that have large watersheds in our Region are the Mascoma River and the Sugar River.[14] These two tributaries as well as the other HUC 10 watersheds in our Region can be seen on Watershed Map.[15]



Surface Water

The Region has a large number of rivers and streams including the Connecticut, Mascoma, and Sugar Rivers that carry water resources throughout the region. Water bodies, such as lakes and ponds, constitute nearly 25855 acres, or 3.9%, of the area of the Region not including wetlands.[16] Aside from their recreation, wildlife habitat and scenic values, surface waters directly or indirectly contribute to our drinking water supplies. Depending on prevailing hydrologic conditions and their setting, surface waters often recharge groundwater during times of excess precipitation; likewise, groundwater discharges into surface water maintaining the base flow which becomes especially important during times of little or no precipitation or melting.

Wetlands and Buffers

Wetlands occur in every community in the Region as you can see on the Waterbodies, Wetlands, and Dams Map.[17] Wetlands and adjacent upland buffers are important in maintaining wildlife habitat an adequate water supply and quality.

Wetlands support almost two-thirds of New Hampshire's wildlife in greatest need of conservation.[18] Wetland conservation is important to wildlife habitat connectivity. Wetlands and natural, vegetated buffers

serve as protection, homes, breeding grounds, and food sources to many diverse species of plants and animals. Buffers help maintain microclimate, protect the wetland habitat, maintain diversity, and reduce human impacts on the natural habitat.

Wetlands are important to maintaining water supply and quality. In times of flooding, wetlands can help store water and slow down the velocity of the water coming from the uplands to help prevent flash flooding. In times of drought, wetlands can release water to stream from stored water and groundwater that drains into the wetland. Wetlands remove excess nitrogen and trap sediment and contaminants, such as phosphorus, metals, solids, toxic waste, and stormwater runoff. Vegetated buffers of at least 100 feet can protect water quality by filtering most nutrients and contaminants. Buffers also help to stabilize soils and prevent erosion.[19]

Water Resource Protection

Under the Rivers Management and Protection Act (RSA 483), a Designated River is managed and protected for its outstanding natural and cultural resources. In the Upper Valley, the Connecticut River and the Mascoma River are Designated Rivers. The NH DES has developed management and protection plans for these rivers to keep the water quality and resources at their best.[20]

A water body is classified as impaired if it does not meet NH DES standards of water quality under the Water Pollution Control Act (RSA 485-A: 12) and is in need of a clean-up. If a water body is on the impaired list, no additional pollution loading that could contribute to impairment is allowed. The Water Quality Certification Program addresses these impaired waters and is designed to protect water quality and uses such as swimming and aquatic life (NH DES WQC Program). Some notable impaired water bodies in the UVLS Region are Lake Sunapee, the Connecticut River in Plainfield and Lebanon, Mascoma Lake, the Mascoma River from Mascoma Lake to the Connecticut River, and the Sugar River in parts of Claremont, Newport, Goshen, and Croydon.[21]

Lake and watershed associations, such as the Lake Sunapee Protective Association (LSPA), Connecticut River Watershed Council, and Connecticut River Joint Commissions (CRJC), can work to coordinate protection efforts when water bodies straddle boundaries. The Upper Valley Lake Sunapee Regional Planning Commission should continue to take a lead role in coordinating inter-municipal protection efforts.

In recent years, UVLSRPC's Connecticut River water resource planning activities have focused on a watershed approach to tributaries. UVLSRPC has continued working closely with the Connecticut River Joint Commissions and their local subcommittees to implement their Connecticut River Corridor Management Plan and has also been working with a few Connecticut River sub-watershed committees UVLSRPC assisted with a successful nomination of the Cold River to the NH Rivers Management and Protection Program and now provides staff support to the Cold River Local Advisory Committee, assisting with the development of a corridor management plan and providing other forms of technical assistance. In the Sugar River, UVLSRPC has developed and implemented an outreach program to educate officials about water quality protection needs. UVLSRPC has also been providing technical assistance and outreach to the Mascoma Watershed Conservation Council.

In the Lake Sunapee area, a number of projects have been undertaken. In the late 1980's, as a first step toward working together to protect the area's important resources, the three towns of Sunapee, Newbury and New London began

receiving direct assistance with the day-to-day activities of the towns' planning boards through UVLSRPC's Circuit Riding Planner program. This led to the creation of a full-time position for planning and zoning in Sunapee. In the early 1990's, UVLSRPC worked closely with representatives from each of these three shoreline communities to develop a model shoreline ordinance for the Lake and continued to work with the towns' planning boards to successfully gain adoption of many of the provisions of this model. Most recently, UVLSRPC, in cooperation with LSPA, conducted a comprehensive watershed study as the first step in a nutrient modeling project that will provide further insight into Lake Sunapee's land use-water quality connection.

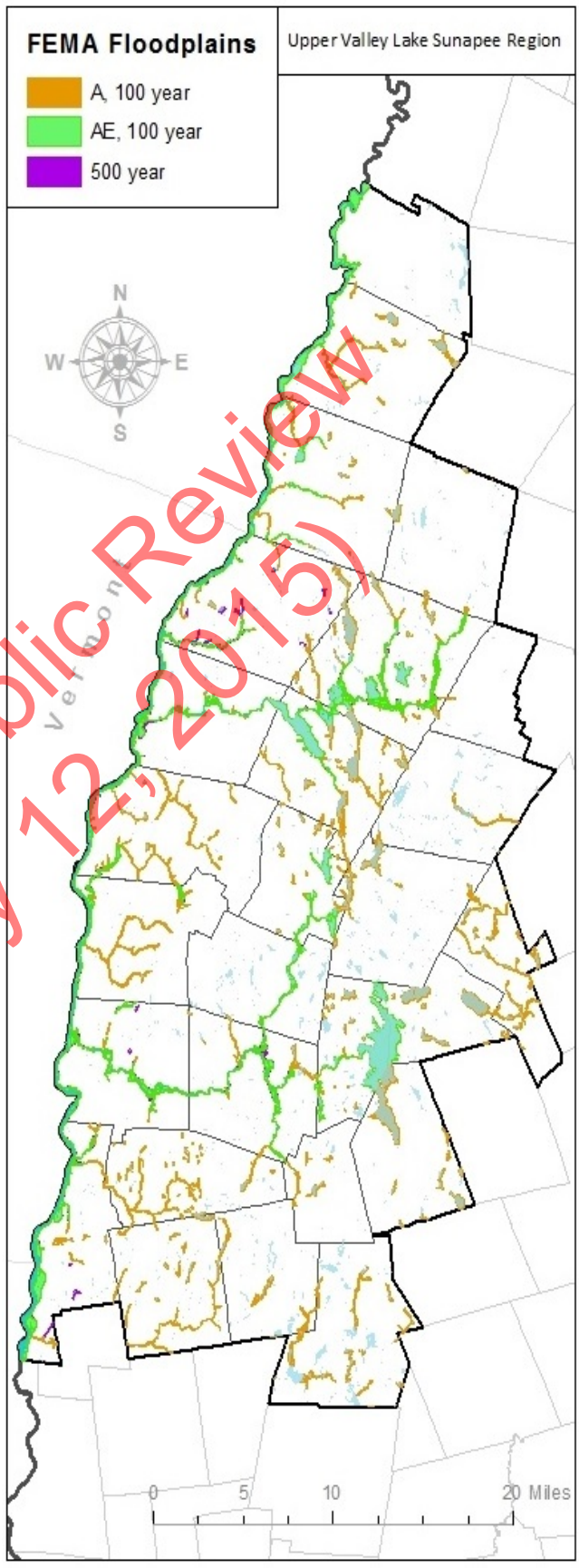
Floodplains

After major flooding from Hurricane Irene in late August of 2011, the Region has made a lot of efforts to reevaluate development in its floodplains. Floodplains are those low-lying lands onto which water spreads out after overflowing the banks of streams and rivers during periods of snowmelt or heavy precipitation. In addition to providing critical storage areas for floodwaters, they provide the surface over which a river's meanders can shift over time. The Floodplains Map shows the Regions 100 year and 500 year floodplains.[22]

Floodplain development results in damage to private property and public investments such as roads and utilities, risks to public health and safety, and increased flooding downstream. Floodplains provide important habitat for furbearing mammals, a number of amphibians, several species of turtles, and numerous breeding and migrating birds.[23]

Surface Water Quality

The establishment of water quality standards is one of the key components of the federal Clean Water Act, setting the desired water quality



goals to be met by the state.

Water quality standards can be defined as specific provisions of state or federal law that are adopted to "protect the public health and welfare, enhance the quality of the water, and serve the purposes of the Clean Water Act."

Water quality standards set a goal for the physical, chemical, and biological integrity of the state's waters are maintained and provide for the protection and propagation of fish, shellfish, wildlife, and recreation that takes place in and on the water. Water quality standards require states to designate various uses to their water bodies, which in turn determine the level of water quality to be achieved in order to meet the goals of the Clean Water Act. New Hampshire defines these designated uses by classifying the water bodies.

Since 1991, the surface waters of New Hampshire have been classified by the state legislature (RSA 485-A:8) as either Class A or Class B. Class A waters are considered optimal for use as water supplies after adequate treatment. Sewage discharges are prohibited in these water bodies. Class B waters are considered acceptable for fishing, swimming, and other recreational purposes, and for use as water supplies after adequate treatment has been applied. Classification reflects water usage but does not reflect actual water quality. Prior to 1991, some water bodies were in a Class C category and were considered usable only for non-contact recreational purposes such as fishing and boating, and for some industrial purposes. All Class C water bodies were legislatively upgraded to Class B in 1991. Water body classifications can be made for entire river or stream systems, or only for specific segments.[24]

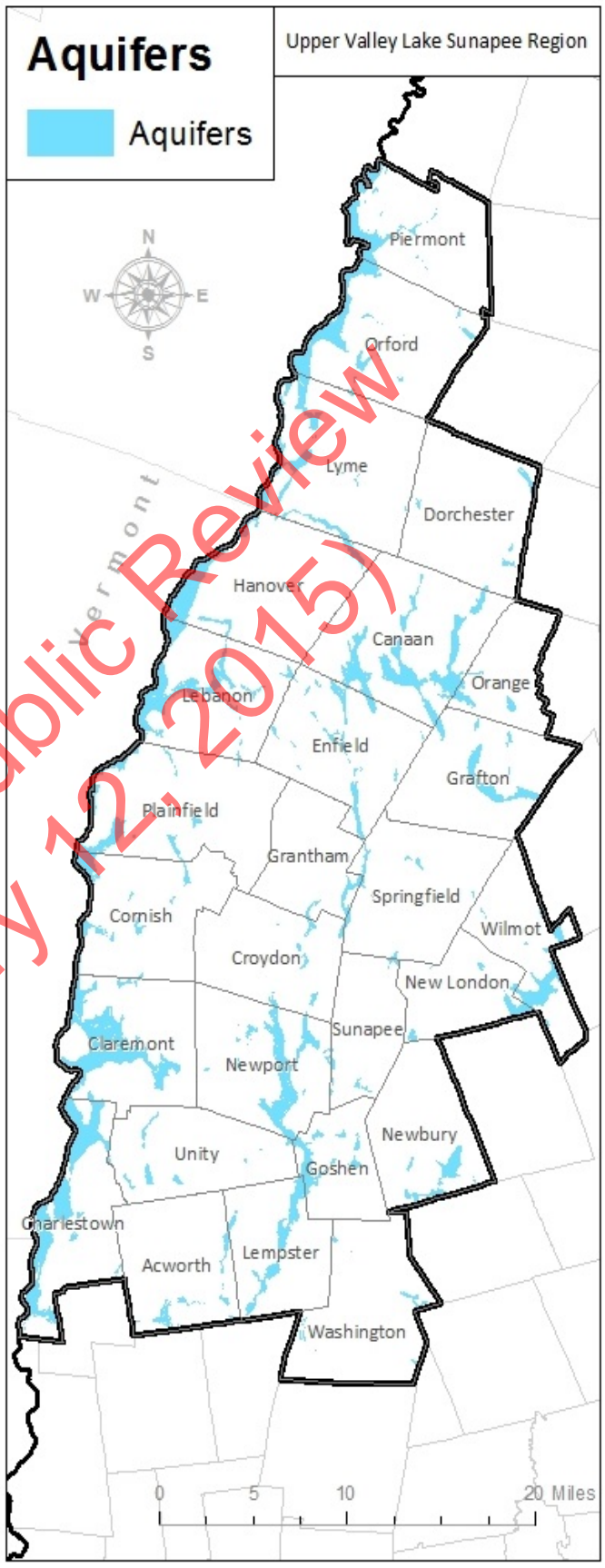
Water body classifications are supported by establishing numeric and narrative criteria. Numeric criteria are specific measures of water quality that are considered scientifically sound in order to protect the designated use of the water body/segment. These usually include parameters such as dissolved oxygen, temperature, pH, metals, and toxic pollutants.

The final component of New Hampshire's Water Quality Standards are specific provisions established to ensure that degradation of existing beneficial uses and the level of water quality necessary to protect the existing uses are maintained and protected. These anti-degradation provisions apply to such things as new or increasing point and nonpoint discharges of pollutants, alterations to the hydrology of a system caused by dams or flow diversions, and all activities that would lower water quality and affect the beneficial uses. Provisions are established for Class A, Class B, and Outstanding Resource Waters, which include national forest waters and those designated as natural under the New Hampshire Rivers Management and Protection Program.[25]

The quality of our surface water is threatened by uses that take place not only on the shores of, but also within the watersheds of, our lakes, ponds, rivers and streams. For example, runoff from developments in steep slope areas in one town may result in erosion and the sedimentation of a brook or water body in another town far from the boundary of the parcel being developed. Improper silvicultural and agricultural practices may also result in erosion and sedimentation downstream. Contamination of water resources may be caused by nonpoint sources, such as road sand and salt, snow dumps, septic systems, pesticides, herbicides and fertilizer, or by discharge of domestic or industrial wastes. Some nonpoint pollution sources have been identified for New Hampshire towns by the Water Division of the NH Department of

Environmental Services.

It is the nonpoint sources of water pollution that are difficult to effectively control. Unlike point sources of pollution where the effluent from the end of a pipe can be sampled, monitored and treated, nonpoint sources of pollution are incremental and dispersed making them difficult to manage. Land use developments generate nonpoint sources of water pollution temporarily during construction and on an ongoing basis after construction. The more intensively land is developed, such as higher density residential use and commercial and industrial use, the more impervious surface coverage is created, resulting in poorer water quality for receiving waterways. High density areas could be beneficial by leaving other areas open for protection, as opposed to allowing people to have large housing lots filled with chemically managed lawns or paved driveways and patios that increase impervious surfaces and nonpoint pollution. Increased imperviousness prevents water from soaking into the ground, increasing the amount of runoff, and the rate at which runoff occurs, thereby increasing the contributions of nonpoint source pollution to nearby waterways. In this Region, we are fortunate to currently have surface waters with good water quality.



Groundwater

Water that is found in the ground in the saturated zone of the ground – below the water table - pores of subsurface deposits is known as groundwater. The term aquifer describes water-saturated earth materials from which a water supply can be obtained. Sixty percent of the Region depends on groundwater aquifers as a main source of drinking water. (See Aquifer Map[26]). There are three types of aquifers in New Hampshire: stratified drift, till and bedrock. The basic difference is that stratified drift and till

aquifers are composed of unconsolidated glacial deposits (loose earth materials), while bedrock aquifers are solid rock. In stratified drift aquifers, the materials are sorted sand and gravel. In till aquifers, the materials are an unsorted mixture of gravel, sand, silt and clay. In bedrock aquifers, the rock contains a varying size and quantity of fractures allowing the water to seep through and collect in the aquifer.

The amount of water that an aquifer can yield depends on factors such as aquifer material type, porosity, depth of saturation, and the extent (size) of the aquifer. Considering this type of information for the aquifers in the Region, an assessment of an aquifer's capability and importance as a water supply could be made. The higher the transmissivity (the potential for an aquifer to supply water to a well at any given location – calculated by multiplying the hydraulic conductivity of the aquifer material by the saturated thickness of the aquifer at that location), the more likely it will supply larger volumes of groundwater for longer periods.[27]

Wells are used by communities and private individuals to draw groundwater from an aquifer. In the Region there were over 3100 reported water wells in 2005.[28] Water users, such as a community or a commercial-industrial operation, typically require large volumes of water. To supply this amount of water on a continual basis, the well must have a large yield capacity. Only certain aquifers with the right hydrogeological characteristics may yield these amounts. On the other hand, the small volume residential or commercial user may not need a large volume well to supply its needs. A small volume domestic well will usually suffice and can be located most anywhere. However, when considering an aquifer's ability to supply water, the combined affect of many individual wells pumping from the same aquifer must be considered. In addition, large-volume wells may have a localized negative impact on an aquifer, unless well locations and pumping rates are regulated.

The water being pumped from wells generally comes from some of the precipitation landing within a watershed that seeps into the ground through a layer of permeable material. This water is commonly referred to as groundwater or aquifer recharge. Aquifer recharge may be differentiated into what is called direct and indirect recharge. Direct recharge is water falling directly over an aquifer's surficial extent, which is not lost to plants, soil moisture or evaporation, and which makes it way down into the aquifer. The direct recharge areas for stratified drift and till aquifers are the respective glacial deposit's surface areas. Direct recharge for bedrock aquifers is basically the entire overlying watershed. Indirect recharge involves water that is direct recharge to till or bedrock aquifers but moves through these aquifer areas and into stratified drift aquifers from which most high yielding wells draw water.

For the purpose of managing potential threats to the quality of water that reaches public water supply wells, the NHDES identifies a "wellhead protection area" (WHPA) for each well. The WHPA is the area from which groundwater and surface water are likely to reach the well. The Region has 75 WHPAs. WHPAs have been delineated for Enfield's Water Department's wells and those associated with the Eastman Estates, as well as many other systems in the study area. These studies provided good examples of the inter-town nature of groundwater resources. Enfield's wells are located along the Enfield-Canaan line, with the bulk of the wellhead protection area in Canaan and a small portion in Hanover. Eastman Estates, a development primarily in Grantham, has its wells in neighboring Springfield. The

majority of the associated wellhead protection area is also in Springfield.

Groundwater favorability maps have been produced by NH state agencies in cooperation with the United States Geological Survey. These maps show the general stratified-drift aquifer with a high, medium or low potential to yield water. The information is not presented at a scale which permits accurate boundary delineation but it does identify the general areas likely to be important as future groundwater sources, and therefore good areas for protection. The maps show that many of the Region's important aquifers are located along watercourses.

The NH Department of Environmental Services has been conducting detailed studies and GIS mapping of stratified-drift aquifers for several years in cooperation with USGS. GIS data for the lower Connecticut River basin is available at UVLSRPC and has been supplied to communities in that basin. A report and paper maps with the new detailed data are also available for the Lower Contoocook basin, which includes portions of Newbury and New London. This information will be of great help to communities for planning the protection of potential future water supplies.

With a view to identifying areas that have the greatest potential for high-yielding municipal wells, NHDES has also analyzed the available information about stratified-drift aquifers in light of the constraints to siting high-yield wells. The result, DES's Favorable Gravel Well Analysis, is available in both hard-copy and electronic forms. It is particularly useful in visualizing the extent to which potentially high- or medium-yield well sites are no longer available as a result of land uses that are incompatible with water supply wells, and which areas remain available.

The primary sources of groundwater contamination in New Hampshire are: fuel storage and transfer, improper management of hazardous waste, salt piles and salted roads. The State has instituted underground storage tank regulations to prevent groundwater contamination by leaky tanks and the associated piping. However, the state regulations only apply to commercial tanks over 1,000 gallons. Other groundwater protection techniques are discussed in a later section of this chapter.[29]

Improvement Strategies

- *Shift Program Focus to Watersheds and Sub-Watersheds and not just Water Bodies*

Currently most programs and regulations are focused on separate types of resources (e.g rivers, lakes, wetlands, groundwater) and uses. All of these issues are interconnected and need to be managed as a single watershed resource to better ensure the quality and quantity of water for the Region. State and local governments can work together to create and manage watershed programs.

- *Include local wetland protection requirements in zoning ordinances*

Assist municipalities in reviewing and developing a wetlands overlay district for zoning ordinances. The NHDES Innovative Land Use Planning Techniques : A Handbook for Sustainable Development is a good tool to use.

- *Require Stormwater Management Plans for Large-scale Developments*

All new major development proposals should include a stormwater management plan emphasizing infiltration, encouraging on-site stormwater management, emphasizing open vs. closed drainage systems, encouraging vegetated vs. mechanical systems and minimizing impervious surfaces.

- *Develop local NWI and soil combination maps to best represent all wetlands*

Current NWI Maps do not show all wetlands. Combining local NWI and soil maps will better represent all wetlands in a municipality.

- *Protect Forests Uplands for Water Quality Assurance*

Forests play an important role in protecting surface drinking water quality. Working with the USDA and its Forests to Faucets project data to help identify areas that supply surface drinking water, have consumer demand, and are facing significant development threats; develop conservation and management plans based on these locations; identifies watersheds where a payment for watershed services (PWS) project may be possible.

- *Assist Municipalities in Developing Drinking Water Source Protection Plan*

Identifies long-term water supply protection and management issues and options. A source protection plan consists of 1.) identification of drinking water sources and the areas that contribute water to those sources (source water protection areas); 2.) inventory of potential contamination sources (PCSs) within source water protection areas; 3.) assessment of risks posed by those PCSs; 4.) management plan to minimize risks to the water sources; and 5.) contingency plan for responding to emergency loss of the water supply. This plan sets priorities for actions to take to protect a water source. Actions taken by water system management, surrounding landowners, and the larger community are key to achieving comprehensive protection.

- *Assist Municipalities in Developing a Water Resources Chapter in Local Master Plans*

The Master Plan is the key document in local planning determining what ordinances and regulations a municipality may adopt. This chapter of the master plan should inventory groundwater and surface water resources, with emphasis on the connection between drinking water supply, and wetlands, lakes, ponds, and streams.

- *Collect and Evaluate Data Related to Existing Sources of Drinking Water Supplies (Public and Private)*

Identifies issues related to the total quantity and quality of existing water supplies; growing water consumption; locates studies concerning future water supplies; evaluates gaps in protection (ordinances, regulations…); identifies potential natural and human-made contaminants in local surface and ground waters; evaluates whether they influence the viability of a water source; and identifies long-term public health risks.

- *Develop/Adopt Private Water Well Testing Program*

Private water wells supply drinking water to 35 percent of New Hampshire's population. Private wells are not regulated or monitored for water quality or quantity by federal or state agencies. DES registers new private wells and recommends communities to require water quality and quantity testing. Hollis has a good

example of this type of program in its zoning ordinance overlay districts.

- *Adopt Local Regulations to Require Native Vegetation Riparian Buffers and Setbacks for Wetlands and Surface Waters*

Natural riparian buffers around wetlands and surface water (rivers, streams, lakes, ponds) are the most effective ways to protect water quality and quantity, as well as wildlife habitat. Lyme is a good example of the recommended 100ft vegetated buffer. Lyme regulates activities in the buffer zones to forestry, agriculture, conservation, and passive recreation.

- *Assist Municipalities in Developing Local Groundwater Protection Efforts*

Establish procedures for the classification and development of groundwater; protective management and remediation of groundwater affected by regular contaminants; develop Best Management Plans and work alongside New Hampshire's Groundwater Protection Act.

- *Assist Municipalities in Developing other Water Source Protection Plans and Ordinances (Groundwater, Surface Water, Drinking Water)*

Assesses current and potential future land uses and impacts on water supply protection needs; limits high-risk uses; establishes a district boundary based upon technical studies delineating watersheds, stratified drift aquifers, or wellhead protection areas; and requires buffers and setbacks, measurable performance standards related to stormwater management and control of regulated substances.

- *Develop Floodplain Management Programs that Consider Water Quality*

Assist in developing a regional watershed approach to manage water resources, quality, quantity, and development. Develop a flood hazard overlay zoning district. A common problem is new development directly outside of floodplain causing more impervious surfaces leading to more stormwater runoff. This causes an extension of the floodplain and more contaminants being carried to source drinking water. (See Hazards Chapter for more Floodplain Management details and Strategies).

5.5 BIODIVERSITY

Vision

The region will protect and enhance our biodiversity by minimizing high value habitat loss and effectively controlling invasive species.

Existing Conditions

Biodiversity is the variety of life in all its forms and all the interactions between living things and their environment[30]. Biodiversity includes all of the species which inhabit an area, the interactions among species and the interactions with the immediate and surrounding environment. Biodiversity is a fundamental component of ecosystem health and integrity.[31] For example, the number of plants in an ecosystem has a profound effect on ecosystem functioning. Therefore, greater diversity is likely to enhance ecosystem functioning. Long-term scientific experiments conducted in Cedar Creek, CO, studying "Big Biodiversity," found that ecosystems with greater biodiversity were more productive and stable, better able to soak up carbon dioxide emissions, and that the value of biodiversity grew over time. The loss of biodiversity has the potential to negatively

Status and distribution of 21,395 plant & animal species in the US (NH rank)	
State Plant & Animal Diversity	2327 (rank 44)
Risk Level	2.8% (rank 43)
Endemism	5 (rank 33)
Extinctions	Total extinct (2) / Presumed Extinct (1) / Possibly Extinct (1) / (rank 44)
Vasular Plant Diversity	1631 (rank 40)
Vasular Plant Risk	2.1% (43)
Mammal Diversity	64 (42)
Mammal Risk	1.6% (45)
Bird Diversity	283 (rank 38)
Bird Risk	1.4% (rank 38)
Reptile diversity	19 (rank 46)
Reptile risk	10.5% (rank 14)
Amphibian Diversity	21 (rank 34)
Amphibian Risk	0.0 (rank 32)
Freshwater Fish Diversity	50 (rank 41)
Freshwater Fish Risk	6.0% (rank 40)

Source: Bruce A. Stein. 2002. States of the Union: Ranking America's Biodiversity. Arlington, Virginia: NatureServe.

impact ecosystem functioning as a whole. [32] Biodiversity in New Hampshire is relatively stable, according to data from NatureServe (2002), compared to other states in the country. While there may be *less* risk to biodiversity here, there is still risk. NH is the fastest growing state in the Northeast, with an increase of more than 17% from 1994 to 2004.[33] The greatest threat to biodiversity in New Hampshire is the conversion of wildlife into development also called habitat destruction.[34] Habitat degradation and habitat fragmentation are also part of development and increase risk to the long-term survival of species. Therefore, limiting future threats from of the impacts of climate change and non-native invasive species will be critical.

In the Upper Valley Lake Sunapee (UVLS) region this can be partially addressed by municipalities through the Master Planning process, and regulatory means such as subdivision regulations and zoning ordinances. An important step to protecting biodiversity and other natural resources in our communities is, of course, to first learn what exists. This can be effectively accomplished by conducting a town-wide natural resource inventory (NRI). Many of the towns in the UVLS Region have already addressed the importance of protecting biodiversity within their communities through some of these measures.

Fragmentation, especially in combination with habitat loss, poses one of the greatest challenges to conserving biodiversity and is compounded by a changing climate. Maintaining habitat connectivity has emerged as a point of agreement among scientists for providing a permeable landscape in which all species can adapt to changes, especially when this is done in conjunction with protecting high quality habitat.[35]

Protected Lands and Protected Habitats

About 27% of the state of NH is protected. Most of this land is federally protected as part of the White Mountain National Forest, but about 75% of that land is predominantly in the northern part of the state.[36] The State Department of Resources and Economic Development owns a variety of lands referred to as "reservations," which includes state forests, state parks, natural areas, historic sites, geologic sites, recreation trails, memorial areas, wayside areas, resource centers, state forest nurseries, heritage parks, information centers, agricultural areas, fishing piers, administrative facilities, demonstration forests, islands, and lands under lease to the department.[37] Each land category has different management goals. For example, state parks are properties with developed or otherwise specific recreation uses and state forests are associated with undeveloped land and managed for a variety of natural resource values and may have some public restrictions.[38] About 5.7% of the state-owned forest lands are within the UVLS Region.

State-Owned Forests

Forest Name	Town	Acres
Connecticut River State Forest	Charlestown	216
Annie Duncan State Forest	Plainfield	113
Gile State Forest	Wilmot	6675
Hubbard Hill State Forest	Charlestown	759
Mascoma State Forest	Canaan	216
Providence Road State Forest	Dorchester	1071.9
Tarleton State Forest	Piermont	48
Total of State-Owned Forest Acres in UVLS Region		9098

The Fish and Wildlife Department manages lands primarily as Wildlife Management Areas (WMAs). The State of New Hampshire, Fish and Game Department owns more than 5,000 acres in the Region and manages the lands for wildlife habitat, called *Wildlife Management Areas*.

New Hampshire Wildlife Mangament Areas		
Town	Name	Acres
Canaan	H.L. Webster WMA	91
Canaan	Mascoma River WMA	125
Charlestown	Spaulding WMA	56
Cornish	Chase Island WMA	13
Enfield	Lower Shaker WMA	1096
Enfield/ Grantham	Henry Laramie Wildlife WMA	3062
Grafton/ Springfield	McDaniels Marsh WMA	609
Lebanon	Lebanon WMA	28
Lyme	Wilder WMA	60
Orford	Reeds WMA	64
Sunapee	Cemetery Hill WMA	99
Sunapee	Gordon WMA	20
Sunapee	Wendall Marsh WMA	9
Unity / Lempster	Gallop Marsh WMA	19
Total acres of State-Owned Wildlife Management Areas in the UVLS Region		5351
A Wildlife Management Area (WMA) is undeveloped land, owned by the NH Fish & Game Department and designated as an area for wildlife resource conservation, hunting & fishing. Hunting & fishing is allowed at all WMAs.		
Source: www.wildlife.state.nh.us/Wildlife/WMA_index.htm		

Regardless of ownership, permanent land protection, both public and private, is viewed as the surest and most effective tool to ensuring the protection of biodiversity.[39] In sum, the state owns approximately 22,170 acres of land within the UVLS region and UVLS municipalities own another 3,926± acres. Municipal lands are typically held for facilities, town forests, parks and public open space. There is a variety of levels of protection on both state and municipal lands. An additional 2,785± acres of privately protected permanently conserved lands are within the Region. This amounts to nearly 60,000 acres of relatively protected, widely undeveloped land within the Region which provides essential habitat for wildlife and plants.[40]

State of NH - Conservation Land - by Municipality and Ownership Type

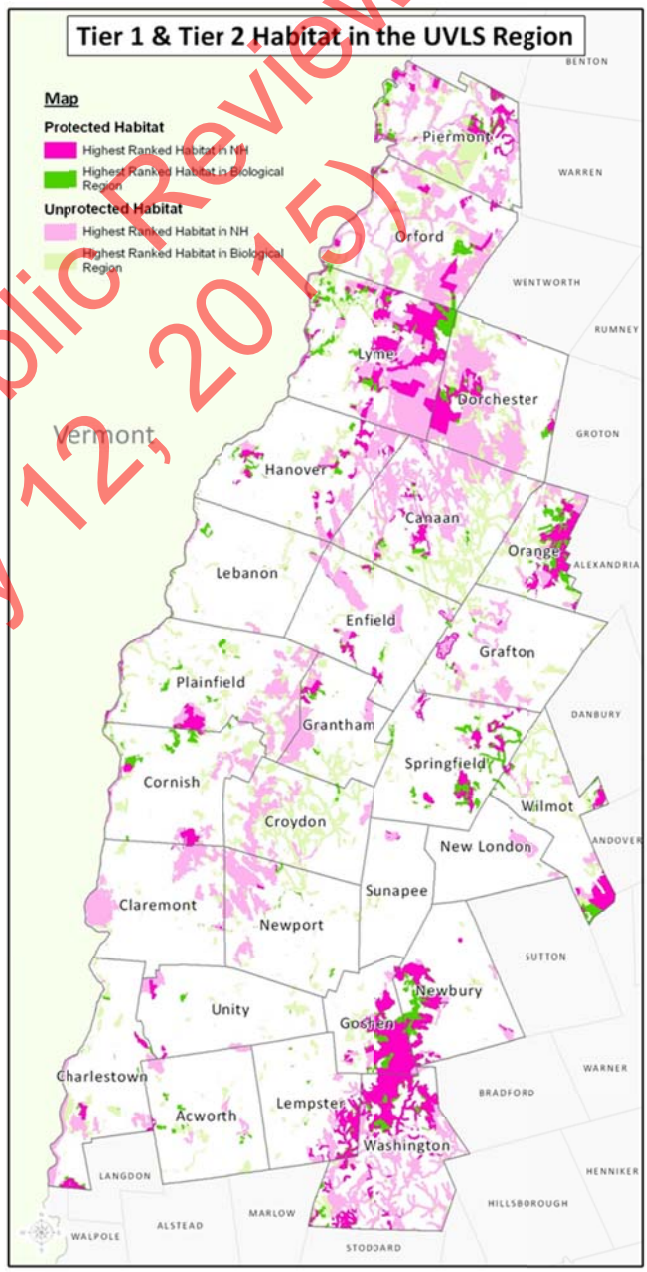
Source: Provided by NH Department of Revenue Administration, Municipal & Property Division; Data source: NH GRANIT Conservation Lands Layer, most recently updated April 2013

Municipality	Fee Ownership Type				Total Fee Ownership Acres
	Federal Acres	State Acres	Municipal Acres	Non-Profit Acres	
Acworth		208.59	1,724.89		1,933.49
Canaan		437.15	20.20	62.33	519.68
Charlestown		1,021.98	496.73		1,518.71
Claremont		111.70	435.47		547.17
Cornish	139.12	55.26	493.70	669.44	1,357.52
Croydon					0.00
Dorchester	64.77	510.19		11.87	586.84
Enfield		4,166.80	54.10	616.32	4,837.22
Goshen		1,017.53		114.82	1,132.35
Grafton		209.31		1,434.84	1,644.16
Grantham		22.20	443.37	456.43	922.00
Hanover	1,943.86	19.38	1,744.45	640.76	4,348.44
Lebanon		27.94	85.11		113.05
Lempster		395.73	980.07	1,992.30	3,368.10
Lyme	3,340.30	59.41	304.79	351.49	4,055.99
New London			363.21	233.84	597.05
Newbury	165.05	2,860.90		1,242.96	4,268.92
Newport		72.98	269.45		342.42
Orange		4,741.98		71.25	4,813.22
Orford	1,261.82	72.03			1,333.85
Piermont	2,207.71	295.52	199.33		2,702.56
Plainfield		108.77	388.02	630.11	1,126.89
Springfield		7,105.74	374.97		7,480.71
Sunapee		151.53	420.92		572.45
Unity		12.44	1,514.65		1,527.09
Washington		5,008.42	759.16	668.62	6,436.20
Wilmot		1,740.02		172.78	1,912.81
Total in UVLS Region		**22,170.33**	**3,926.50**	**2,785.72**	**59,998.89**

State and Federal Programs

In 2001, Congress created the Wildlife Conservation and Restoration Program and State Wildlife Grants Program to support wildlife conservation before species become endangered and expensive to protect. Part of this program required that each state devise a Wildlife Action Plan (WAP) to conserve wildlife habitat and critical habitat. The New Hampshire WAP, first approved in 2006, updated in 2010 and amended to include a section about change in 2013, is unparalleled to any prior planning effort in the state. The plans must have a variety of components at minimum including: the distribution and abundance of wildlife species; descriptions of locations and relative condition of key habitats and community types; descriptions of risks which may affect species or their habitats and should include priority research and survey efforts; descriptions of conservation actions; proposed plans for monitoring identified species and their habitats; 10 year plan review; plans for coordinating the development, implementation, review and revision of the plant with federal, state and local agencies; and a public participation strategy.[41]

While the WAP is not regulatory in nature, the science-based approach helps inform municipalities about existing natural resources. Scientific and geographic modeling, largely co-occurrence modeling, was utilized to identify areas within the state of the greatest conservation need. In the Plan, habitat types were digitally mapped and then ranked according to their biological condition and risk of degradation. The figure right illustrates the Region's protected and unprotected Tier 1 & Tier 2 wildlife habitat. Tier 1 is of greatest conservation priority because it represents the top 10-15% of habitat in the entire state. Tier 2 is habitat that is of high conservation priority at a regional scale because each region has unique species and habitat types that are unique and therefore important to that particular area. Some of these habitats are already protected either as state, municipal or private conservation lands. Municipalities can



prioritize permanent protection by identifying lands in their community which are unprotected Tier 1 or Tier 2 habitat, of highest priority to the State and the Region. Figure 2 clearly illustrates that there is still a lot of important habitat unprotected and vulnerable to development and other risks in the UVLS region, particularly the northern section.

The Natural Heritage Bureau (NHB) facilitates the protection of the state's biodiversity by maintaining records about rare, threatened and endangered plant and animal species within our state as well as rare and/or exemplary locations of natural communities. Municipalities can use this information to assist prioritizing areas of biological priority within their community. While this may be considered a "coarse" approach and may not capture other important species occurring within a region, it is useful, particularly in towns which have not invested in a natural resource inventory (NRI). An NRI would yield the most comprehensive information and would incorporate the NHB information into the report as well as verifying the NHB information. Additionally, the NHB suggests that its statewide data can be used as a reference to assist in the identification of high quality examples of natural community types and that by protecting these areas and connections among them this would ensure that ecological processes remain functionally intact, and therefore, regionally important.

The Land and Community Heritage Investment Program (LCHIP) is a competitive program funded through state appropriations and license plate fees to help fund public and private land conservation projects throughout the state. For the fiscal years of 2014 & 2015 there is approximately $4,000,000 available. Towns, cities, counties and not-for-profits can present a project with request for funding which much matched by private funds or funds from another grant. Depending on the project, the information in the application may include data from the NH WAP and from the NH NHB. Of the more than 700 applications that the program has received since it began in 2000 it has helped conserve over 260,000 acres in the state, impacting more than 141 different communities.[42]

A commonly used statewide program which assists in protecting natural resources, although not permanently, is the Current Use (CU) Program (RSA 79-A). Current Use was enacted in 1973 with the purpose of protecting open space. Today, it serves an important role in maintaining traditional land uses and therefore preserving the rural character or the state. This is incentivized through the utilization of a tax rate which is based on the traditional uses of the land, such as agriculture and woodlots, rather than that of the economic "highest and best use" which is typically development[43].

Qualifying parcels, generally those with greater than 10 contiguous acres of undeveloped land used for farming, forestry or so-called unproductive land, can receive a significant reduction in their tax assessment. Wetlands of any size may also qualify. A substantial penalty is assessed when a tract is removed from the program for development. This program has effectively protected open space in the state of NH, with about 74% of eligible land enrolled in the program.[44] From 2000 to 2013 the program has enrolled an additional 5,324± acres into the program in the UVLS Region, an increase of about 0.8 %, amounting to a total of 464,435± acres, or 69.8% of the Region's land

area enrolled in the CU program.[45] Over the past thirteen years, the most significant change in the type of enrollment is the amount of forestland that has documented stewardship, meaning the landowner is working with a forester and has a forest management plan.

Town	County Name	Farm Land Acres	Forest Land Acres	Forest Land With Documented Stewardship	Unproductive Land Acres	Wetland Acres	Total CU Acres	Total of Parcels In CU	Total Town Acres
Acworth	Sullivan	1892.12	11524.94	5986.83	209.77	124.4	19738.06	449	24998.9
Canaan	Grafton	1669.27	15026.69	7252.15	422	1326.21	25696.32	714	35275.9
Charlestown	Sullivan	2614.96	8934.45	2654.92	559.78	103.3	14867.41	394	24345.5
Claremont	Sullivan	3320.54	10956.98	3400.63	578.13	0	18256.28	477	28193
Cornish	Sullivan	2500.86	10521.98	8911.83	122.05	179.69	22236.41	527	27269.7
Croydon	Sullivan	561.57	6026.3	12329.4	1275.97	696.46	20889.7	158	24028.8
Dorchester	Grafton	218.6	3418.28	21950.78	119.76	510.5	26217.92	206	28889.9
Enfield	Grafton	637.15	10628.94	1271.46	73	368.13	12978.68	429	27615.6
Goshen	Sullivan	445.68	4744.49	5201.42	559.71	164.87	11116.17	210	14420
Grafton	Grafton	536.62	12875.16	5338.92	690.99	45.22	19486.91	400	27139
Grantham	Sullivan	193	3203	5411	1373	138	10318	194	17950.9
Hanover	Grafton	1374	12551	5101	187	233	19446	407	32087.1
Lebanon	Grafton	1449.31	6914.61	4069.83	446.51	475.67	13355.93	282	26415.2
Lempster	Sullivan	379.9	12025.76	1798.42	42.93	527.2	14774.21	345	20956.2
Lyme	Grafton	2946	12521	9805	293	600	26165	419	35215.8
New London	Merrimack	604	4177	1678	317	0	6776	281	16267.9
Newbury	Merrimack	313.51	5475.07	5694.44	485.79	271.04	12239.85	270	24382.6
Newport	Sullivan	1173.61	14459.94	3052.92	170.37	632.28	19489.12	501	27930.3
Orange	Grafton	160.69	7587.76	682.57	81.74	83.4	8596.16	134	14799.7
Orford	Grafton	1657.61	7809.77	14464.11	1274.38	73.57	25279.44	414	30577.8
Piermont	Grafton	2582.08	7439.96	7017.13	1172.55	530.03	18741.75	253	25582.2
Plainfield	Sullivan	2946.04	17128.37	6522.77	528.49	798.07	27923.74	604	33914.3
Springfield	Sullivan	608.61	8749.42	4178.89	53.19	498.59	14088.7	277	28478.8
Sunapee	Sullivan	497	4574	1007	260	407	6745	226	16099.1
Unity	Sullivan	829	13358.85	1847.05	822.67	23.28	16880.85	379	23806.3
Washington	Sullivan	465.3	10926.77	6873.63	334	610.99	19210.69	452	30524
Wilmot	Merrimack	648.13	9163.71	2650.46	189.89	268.8	12920.99	365	18955.4

Figure represents information provided by the NH Department of Revenue, Municipal and Property Division, for the state of NH in 2013. Information above pertains only to the Upper Valley Lake Sunapee Region.

Open forest lands which are provided as state lands, town lands and private conservation lands each play an important role in protecting biodiversity by:

- increasing permeability and connectivity which allows species to adapt to climate change and the ability to shift ranges and maintain genetic diversity;
- Preserving large blocks of forested habitat which is necessary for a number of species that are important to our state such as the black bear, bobcat, moose & white tailed deer.

Climate Change Impacts

How will climate change impact the Region's biodiversity? The complete answer is complicated because species will respond to changes in their environment based on their individual and specific habitat needs and physiological tolerances, which in turn influence community composition, structure and resilience.[46] In an attempt to understand this question, the State of NH amended the Wildlife Action Plan (2006) in 2013 with a document titled *Ecosystems and Wildlife: Climate Change Adaptation Plan*.[47] In just the eight years since the first WAP, the scientific community has developed a greater understanding of the potential changes of climate change and the magnitude of those changes. A large component of the 2013 NH WAP amendment was a set of habitat-based vulnerability assessments based on a modified list of the habitat classifications in the 2006 NH WAP. Of the 24 habitat types that the Plan addresses, there are 19 in the UVLS Region.

The 2013 NH WAP Amendment summarized the predicted changes to the NH climate as the following:

- Temperatures will increase, with a slightly larger median increase in winter than summer
  - More days per year with extremely high temperatures (> 90°F)
  - Fewer days with snow
  - Longer growing season (more frost free days)
  - Earlier ice-out, later ice-in of lakes and rivers
- Changes in total precipitation are uncertain, but seasonality and intensity is likely to vary
  - Increased winter precipitation, with more of it falling as rain
  - More frequent heavy rains
  - Increased likelihood of summer drought
  - Stream flow is likely to become more variable as a result of higher temperatures, drought, and more intense precipitation events
  - Fire is more likely as a result of higher temperatures and increased drought
  - Increased frequency of intense storms is predicted, including wind and rain
  - Sea level is expected to rise
  - Changes in ocean and estuary pH and salinity may occur as a result of increased freshwater runoff, temperature changes, shifting ocean currents, and increased CO2 dissolution.

These changes will undoubtedly affect all plant and animal species in the State and in the Region. The effects will directly impact plant and animal physiology, range location and extent, and phenology. Wildlife that may be more biologically and/or physically resistant to change will be required to adapt to the changes in their habitat distribution, altered plant species composition within ecosystems, altered physical conditions and/or a

combination of these factors.[48] Many species will change their geographic range, migrating northerly and to higher latitudes. The changes are expected to have rippled effects within ecosystems and not all species responding to the changes at the same rate. Changes in phenology, such as timing of resource availability and changes in flowering or nesting dates may also alter community dynamics including such interactions as predator-prey competition and herbivore-vegetation dynamics as well as species co-occurrence patterns.[49] Many changes will impact those species which will have the most difficulty adapting. According to the USDA's Climate Resource Center, characteristics of species and communities most at risk include those with specific and restricted geographic ranges, currently fragmented distributions or at risk of fragmentation, and those that already survive at the margins of their range. Additional risk factors include limited dispersal ability, low genetic diversity, a species strong affinity to aquatic habitats, narrow physiological tolerance, and late maturation.[50]

Habitats

Freshwater Ecosystems

Freshwater ecosystems are as physically diverse as they are biologically diverse. They include channelized surface waters with continuous flow, open and relatively still waterbodies – either connected or isolated – and an enormous variety of wetland habitats. Because nearly all wetlands are in lowland areas and channel precipitation from the surrounding landscape, sometimes distant upland activities impact these often sensitive ecosystems.[51] An enormous number of plants and animals – vertebrates, invertebrates, and microorganisms depend on freshwater ecosystems for their survival. Freshwater fish alone accounts for over ¼ of all living vertebrate species on earth.[52] Unfortunately, freshwater habitats are the most vulnerable to climate change. Freshwater biodiversity in North America is projected to experience an extinction rate five times greater than that of terrestrial biodiversity.[53] These extreme predictions are due to the sensitive nature of freshwater ecosystems. Additionally, they depend on physical features, such as volume, quality and flow as well as water temperature and the impacts to these ecosystems often come from distant locations.[54] Currently, freshwater ecosystems make up about 6% of the Region's land area. While total annual precipitation is not expected to change significantly the timing and stochastic nature of the predicted storm events will likely have sometimes dramatic impacts. The predicted increase of the frequency of 100-year floods and overall changes in precipitation will likely mean less predictable, seasonal increases in surface water as well as seasonal changes in soil moisture due to higher temperatures and longer periods of drought.[55] These effects are certain to changes water temperatures which may result in reduced oxygen levels in streams and lakes, leading to declines in aquatic species diversity and increased stress on coldwater fisheries.[56]

Terrestrial Ecosystems

The UVLS region is approximately 84% forested, consistent with the rest of the state. In general terms, forested ecosystems are thought to be more resilient to climate change than freshwater habitats. However, some forest types may be more vulnerable than others. The complex community dynamics within forested ecosystems make it quite difficult to precisely predict the impacts to the biodiversity in the Region. As individual species react to increases and changes in temperature based on individual tolerances entire communities may change and shift within the region, and new community compositions may form as southern species that were at the northern edge of their range migrate north. Some species complex groups may migrate together, such as the predicted expansion of the oak-hickory complex northward and the contraction of aspen-birch habitat.[57] Some species that already subsist in restricted habitats may be extirpated from the Region, such as the balsam fir, if there is no habitat available to move to. The greater stress on trees from changes in temperature and precipitation will likely increase the frequency of the pine beetle pest and other insect attacks will become more frequent as milder winters encourage the early emergence forest pests and reduced mortality of some forest insect pests.[58] In general, it is predicted that the hardwood-pine forests of the state and Region will move northerly and upslope and that the Appalachian oak-pine forests will increase in extent.[59]

The Region's forests ecosystems will also continue to be threatened by development and land use conversion. This causes a loss of forestland, but also causes habitat fragmentation which reduces species capacity to adapt to a changing climate as their habitats become increasingly smaller and disconnected. While NH is the second most forested state in the US, with about 84% of the land forested, the state has lost more than 148,000 acres of forest to development since 1997. Another 288,000 acres (5% of forestland, statewide) are projected to be lost by 2025.[60] Increased demand for alternative energy facilities and their associated transmission lines is likely to add additional fragmentation of habitat to the Region's forest landscapes, particularly higher elevation forests and ridge lines.[61]

Another current concern of many scientists is the compounded interactions among ecosystems and increased carbon dioxide (CO_2) in the atmosphere. In the eastern U.S., elevated temperature and atmospheric CO_2 concentrations will likely continue to enhance sequestration by forests, but this sequestration may be offset by forest fragmentation and losses due to disturbances by invasive insects.[62] Currently, US forests take up 250 million metric tons of carbon per year, but that figure is expected to decrease as forests, especially in the northeast, reach maturity.

Special Habitat Areas

Floodplain Forests

Floodplain forests are the critical habitat areas that have developed over centuries in the low, flood prone areas along rivers, typically less than 20 ft above the river channel.[63] Floodplain forests are a unique disturbance-adapted habitat. They provide a number of ecosystem services including filtering pollutants from our water sources and improving water quality, controlling erosion and buffering against flooding.[64] In the UVLS Region there are more than 5,500 acres of this special habitat, located primarily along the Connecticut River and its major tributaries including the Mascoma River and the Sugar River. There are thirteen different river channel and floodplain natural communities in NH.[65] Along the Connecticut River, floodplain forests consist of silver maple trees and a diversity of wildflowers and fern.[66]

Whereas, along the smaller rivers and streams, floodplain forests are mostly red maples, black ash, black cherry, and ironwood with shrubs and vernal pools.[67] A number of species are associated with floodplain forests including the Jefferson salamander, northern leopard frog, the wood turtle, the red shouldered hawk, cerulean warbler, eastern red bat and the silver haired bat.[68]

In the future, as the climate continues to change, floodplain habitats may experience more flooding, possibly with unpredictable timing and/or duration, and will also be affected by summer droughts.[69] This may impact species composition and species richness due to greater colonization of non-native plant species and the migration of generally more southern plant species. [70]

Grasslands

Grasslands are characterized by their vegetation: native and non-native grasses and wildflowers and the absence of trees and shrubs. Most grasslands are the result of land clearing and require maintenance or they will eventually revert back to forest. Most of the grasslands in the Region today are agricultural hay fields and pasture. Grasslands may also wet meadows and may be the result of other land uses and land management practices. Grasslands in New England are not as expansive as those in the Midwest and some parts of the southern and western United States, but they all provide similar benefits to humans and ecological communities. They are major contributors to food production and provide ecological services such as aquifer recharge, pollination, and recreational opportunities.[71] The history of grasslands in NH, similar to that of the Midwest, includes burning by Native Americans for agricultural purposes and to improve forage for game species.[72] Beavers have also had a critical role in the historic conversion of habitat to grassland meadows. Today, grassland acreage is declining across the state. A portion of the Region, primarily Grafton County, has the highest concentration of remaining grassland acres in the State.[73] The largest threat to grassland habitats is land conversion. Grasslands are frequently considered high-value developable lands, with permeable soils. However, in NH

grasslands provide food and habitat to more than 70 species of wildlife.[74] There are a number of obligate species which require managed grasslands in part of their life cycle. The bobolink, a migratory songbird, is the most common grassland-nesting bird in NH.[75] It breeds exclusively in grasslands larger than five acres from the northern United States to southern Canada. Bobolink populations have experienced decline for the last forty years due in part to grassland management practices.[76] Mortality increases if management practices, such as cutting regimes, interfere with the bobolink nesting periods. The eastern meadowlark, Savannah sparrow, grasshopper sparrow (state threatened species) and the northern harrier (state endangered species) all require grassland breeding habitat between 15 and 30 acres or greater and have been documented in portions of our Region. Today, this habitat is thought to be relatively resistant to climate change, as it is found in a large variety of climates across the world.[77] There are approximately 57,000 acres of grassland habitat in the UVLS region, about 8% of the land area.

Vernal Pools

Vernal pools are little studied and often overlooked micro that provide important habitat. Vernal pools exist everywhere, but are most common in the river floodplain. They characteristically appear as the ground thaws and snow melts following the winter season, and they provide important breeding habitat for many invertebrate and vertebrate species, including spotted salamanders. Other unique ecosystems that provide important habitat and functions are forested floodplains and meadowlands, which are important nesting habitat for bird species such as the declining Eastern meadowlark.

Wildlife

Mammals

Mammals are both advantaged and disadvantaged by the resources required for their lifecycle. Often there are different seasonal requirements and habitats for their food, denning and breeding. In the northeast, many of our mammals are migratory and require a separate winter and summer or breeding habitat. This also increases the size of their range requirements and therefore, often increases their risk to damaging impacts of habitat fragmentation, habitat destruction and climate change. There are more than 60 mammals in NH, and many of them live at least a portion of their life in the Region (see table below). The largest mammals in the Region, such as the black bear and moose, have the largest ranges. While the small mammals, such as rodents and insectivores (shrews), often have smaller ranges. Small mammals comprise the largest and most diverse group and occur in greater abundance. All mammal groups are expected to be affected by climate change and are presently affected by habitat loss and fragmentation. In sum, changes in mammalian communities will have profound impacts on ecosystems and may directly affect human societies.

Mammals of New Hampshire			
Mammal Name	Regional Extent	Mammal Name	Regional Extent
Bat, Big Brown	Throughout Region	Mouse, Woodland Jumping	Throughout Region
Bat, Eastern Red	Seasonal; Documented in Piermont, potentially in Springfield	Muskrat	Throughout Region
Bat, Hoary	Seasonal; Potentially found in Springfield	Opossum, Virginia	Throughout Region
Bat, Little Brown	Limited at risk distribution since 2010	Otter, River	Throughout Region
Bat, Northern Long-eared	Proposed for listing as Federally Endangered in August 2014	Pipistrelle, Eastern	Not in Region
Bat, Silver-haired	Not in Region	Porcupine	Throughout Region
**Bat, Small-footed	Documented in Piermont	Porpoise	Not in Region
Bear, Black	Throughout Region	Raccoon	Throughout Region
Beaver	Throughout Region	Rat, Norway (i)	Throughout Region
Bobcat	Throughout Region	Seal, Harbor	Not in Region
Chipmunk, Eastern	Throughout Region	Shrew, Long-tailed	Throughout Region
Cottontail, Eastern	Throughout Region	Shrew, Masked	Throughout Region
**Cottontail, New England	Not in Region	Shrew, Pygmy	Throughout Region
Coyote	Throughout Region	Shrew, Short-tailed	Throughout Region
Deer, White-tailed	Throughout Region	Shrew, Smoky	Throughout Region
Dolphin, Common	Not in Region	Shrew, Water	
Fisher	Throughout Region	Skunk, Striped	Throughout Region
Fox, Gray	Throughout Region	Squirrel, Gray	Throughout Region
Fox, Red	Throughout Region	Squirrel, Northern Flying	Throughout Region
Hare, Snowshoe	Throughout Region	Squirrel, Red	Throughout Region
Lemming, Northern Bog	Not documented in Region	Squirrel, Southern Flying	Throughout Region
Lemming, Southern Bog	Throughout Region	Vole, Meadow	Throughout Region
**Lynx, Canada	Federally Threatened; Not predicted in Region	Vole, Rock	Throughout Region where habitat is available
*Marten, American	Not in Region	Vole, Southern Red-backed	Throughout Region
Mink	Throughout Region	Vole, Woodland	Throughout Region
Mole, Hairy-tailed	Throughout Region	Weasel, Long-tailed	Throughout Region
Mole, Star-nosed	Throughout Region	Weasel, Short-tailed (Ermine)	Throughout Region
Moose	Throughout Region	Whale, Humpback	Not in Region
Mouse, Deer	Throughout Region	Whale, Minke	Not in Region
Mouse, House (i)	Throughout Region	Whale, Pilot	Not in Region
Mouse, Meadow Jumping	Throughout Region	**Wolf, Gray (not yet in NH)	Not in Region
Mouse, White-footed	Throughout Region	Woodchuck	Throughout Region
*State Threatened **State Endangered (i) Introduced +Breeds in NH			
State Totals: There are a total of 63 mammal species in NH. 8 of the species are of Conservation Concern (vulnerable to extinction due to rarity and biological fragility) and 5 species are threatened/endangered listed species.			

Amphibians

Amphibians are already in trouble on a global scale. About 1/3 of amphibian species are at risk of extinction due to factors including habitat loss, disease, invasive species, and pollution.[78] Adding the effects of climate change to the already struggling taxa is worrisome.[79] Amphibians are often very sensitive to temperature and moisture regimes and have a narrow tolerance for variation.[80]

Alterations and/or increased fluctuations in a habitat's hydroperiod, or the timing of water availability, due to climate change may negatively impact pond-breeding amphibians, for example, by disrupting the annual reproductive cycle or increasing mortality or increasing exposure to predation.[81]

Additionally, changes in the seasonal timing of events and fluctuating weather conditions are also predicted to have negative effects on amphibian populations.[82]

Amphibians of New Hampshire

Frogs & Toads	Currently documented	Historically documented
Bullfrog (*Rana catesbeian* a)	Throughout most of Region	
Green frog (*Rana clamitan* s)	Throughout most of Region	
Mink frog * (*Rana septentrionalis*)	Not documented	
Northern leopard frog * (*Rana pipien* s)	Orford, Lyme, Springfield, Charlestown	Piermont, Claremont
Pickerel frog (*Rana palustri* s)	Throughout most of Region	
Wood frog (*Rana sylvatica*)	Throughout most of Region	
Spring peeper (*Pseudacris crucifer*)	Throughout most of Region	
Gray treefrog (*Hyla versicolor*)	Hanover, Grafton, Newbury	Cornish, Orford
American toad (*Bufo americanus*)	Throughout most of Region	
Fowler's toad** (*Bufo fowleri*)	Canaan, Grafton	
Salamanders	**Currently documented**	**Historically documented**
Eastern newt (*Notophthalmus viridescens*)	Throughout region	Throughout region
Blue-spotted salamander* (*Ambystoma laterale*)	Washington	Cornish
Jefferson salamander** (*Ambystoma jeffersonianum*)	Washington	Cornish
Marbled salamander*** (*Ambystoma opacum*)	not documented	not documented
Spotted salamander (*Ambystoma maculatum*)	Throughout most of Region	Throughout most of region
Four-toed salamander (*Hemidactylium scutatum*)		Hanover
Dusky salamander (*Desmognathus fuscus*)	Newbury	Orford, Lyme, Dorchester, Cornish, Springfield
Spring salamander (*Gyrinophilus porphyriticus*)	Newbury	Orford
Two-lined salamander (*Eurycea bislineata*)	Throughout most of Region	
Northern Redback salamander (*Plethodon cinereus*)	Plainfield, Orford, Piermont, Grafton, Newbury, Washington	Cornish
Slimy salamander[@] (*Plethodon glutinosus*)	not documented	not documented
Mudpuppy (*Necturus maculosus*) thought to be introduced	Piermont, Charlestown	Cornish

Source: NH Wildlife Action Plan http://www.wildlife.state.nh.us/Wildlife/Nongame/frogs.htm

*State Concern **State Threatened ***State Endangered Species [@]Reported historically but uncertain if still exists in state or if native

State Totals: There are a total of 22 amphibian species in NH. 5 of the species are of Conservation Concern (vulnerable to extinction due to rarity and biological fragility) and 2 species are threatened/endangered listed species.

There are 22 species of amphibians in NH. All but three of the amphibian species in NH are found in our Region, however, many species are only documented in a handful of towns (see Table below). Protecting amphibian habitat today is essential to assisting the survival of the species in the future.

Reptiles

Like amphibians, reptiles are animals that are highly vulnerable to climate change as well as habitat loss. In NH, the list of reptiles includes 11 snake species and 7 turtle species. In the Region, there are only two snake species commonly found throughout, the Garter snake and the Milk snake. There are also only two species of turtle found commonly in the Region. The Wood turtle, a species of state concern, is documented in most of the Region's towns, but its population is relatively low (see table right).

Reptiles of New Hampshire

Snakes	Currently documented	Historically documented
Garter snake (*Thamnophis sirtalis*)	Throughout most of Region	
Ribbon snake* (Thamnophis sauritus)	Not documented	Newport
Brown snake (*Storeria dekayi dekayi*)	Not documented	Sunapee
Northern red-bellied snake (*Storeria occipitomaculata occipitomaculata*)	Throughout most of Region	
Northern Ringneck snake (*Diadophis punctatus edwardsii*)	Lebanon, Claremont, Charlestown	
Smooth green snake (*Opheodrys varnalis*)	Lyme, Newport, Croydon, Sunapee, Springfield	Orford, Canaan, Acworth, Lempster
Milk snake (*Lampropeltis traingulum triangulum*)	Throughout most of Region	
Eastern hognose snake*** (*Heterodon platirhinos*)	Not documented	
Norther black racer** (*Coluber constrictor constrictor*)	Not documented	
Northern water snake (*Nerodia sipedon sipedon*)	Washington	
Timber rattlesnake*** (*Crotalus horridus*)	Protected distribution	
Turtles	**Currently documented**	**Historically documented**
Blanding's Turtle*** (*Emydoidea blandingii*)	Not documented	
Eastern Box Turtle* (*Terrapene carolina carolina*)	Not documented	
Common Musk Turtle (*Sternotherus odoratus*)	Not documented	
Eastern Painted Turtle (*Chrysemys picta*)	Throughout Region	
Snapping Turtle (*Chelydra serpentina*)	Throughout Region	
Spotted Turtle** (*Clemmys guttata*)	Canaan	Cornish, Grafton
Wood Turtle* (*Glyptemys insculpta*)	Throughout most of Region	

Source: NH Wildlife Action Plan http://www.wildlife.state.nh.us/Wildlife/Nongame/frogs.htm

*State Concern **State Threatened ***State Endangered Species @Reported historically but uncertain if still exists in state or if native

State Totals: There are a total of 18 reptile species in NH. 7 of the species are of Conservation Concern (vulnerable to extinction due to rarity and biological fragility) and 2 species are threatened/endangered listed species.

Reptiles are ectothermic, meaning their body temperature, and therefore energy, is controlled by the outside temperature, which makes them highly sensitive to fluctuations in temperature as well as seasonal changes, both predicted to influence the Region as the climate changes.[83] Climate change therefore may have indirect effects on the population dynamics of species through indirect means. For example, a study found that a warmer climate may be causing snakes to become

more active and seek more food, including a larger number of baby bird, which may in turn affect some bird species around the world.[84] Turtles are also greatly affected by changes in temperature. Specifically, turtles have temperature-sensitive sex determination (cooler temperatures may produce male only nests, and the alternative, female only) which means that temperature changes have the potential to alter the sex ratios of populations, potentially affecting future reproduction and evolutionary fitness.[85] Additionally, the increased frequency of floods and the resulting fluctuations in water levels have been documented to displace and cause increased mortality in semi-aquatic turtles, particularly the

wood turtles, in the northeast.[86] In addition to the threats posed by climate change, reptiles in the Region are continually threatened by habitat loss and adults being killed on the roadways.[87]

Birds

NH and the northeastern US, is home to the greatest diversity of breeding bird species in the continental US.[88] NH supports more than 300 different species of birds. Many species, including warblers and thrushes, have, in some cases, 90% of their global population breeding in this region. However, the populations of many seemingly common species are declining at alarming rates. For NH's breeding bird species, 37% (69 species) have increasing or stable populations, 35% (65 species) are in decline and 28% (52 species) have uncertain or unknown population trends.[89] Shrubland bird populations are experiencing the greatest decline. The top threats to populations in the northeast include: climate change; forest fragmentation and conversion to commercial and residential development; and incompatible forest management or land use.[90] Wind farms are another deadly threat to birds, but clearly little in comparison to climate change.[91] Climate change is expected to affect bird populations across the world quite rapidly over the next 50 or more years. It will affect the geographic range of these sensitive animals along elevational gradients, shifting breeding ranges to higher latitudes and higher altitudes.[92]

NH Bird Species predicted to lose summer and winter ranges

Bird Name	Summer Range Lost	Winter Range Lost
Bohemian Waxwing (*Bombycilla garrulus*)	100%	52%
Canada Warbler (*Cardellina canadensis*)	100%	
Black-Throated Blue Warbler (*Setophaga caerulescens*)	100%	40%
Blackburnian Warbler (*Setophaga caerulescens*)	100%	
Evening Grosbeak (*Coccothraustes vespertinus*)	98%	58%
Black-Throated Green Warbler (*Setophaga virens*)	98%	30%

Source: National Audubon Society. 2014. Audubon's Birds and Climate Change Report: A Primer for Practitioners. National Audubon Society, New York. Contributors: Gary Langham, Justin Schuetz, Candan Soykan, Chad Wilsey, Tom Auer, Geoff LeBaron, Connie Sanchez, Trish Distler. Version 1.2.

State Totals: There are a total of 315 bird species in NH. 33 of the species are of Conservation Concern (vulnerable to extinction due to rarity and biological fragility) and 19 species are threatened/endangered listed species.

A recent study by the National Audubon Society found that of the 588 North American bird species with ranges in the United States, 314 will lose more than fifty percent of their current climatic range by 2080.[93] Of the species which frequent New Hampshire, four will loose 100% of their summer range and two species will lose 98% of their summer range by 2080, making their presence in NH less visible (see table above).

Improvement Strategies

One of the greatest threats and challenges to maintaining or even enhancing biodiversity across the Region is parcelization. It is essential for communities to identify where their critical habitats and most important unprotected resources are and make a plan to protect them. However, funding for conserving lands is becoming more and more competitive. Federal and state grants seem to be dwindling. It would be proactive for communities to begin to think about what lands are important to protect and strategies on how they will fund their protection.

Municipal land use planning and regulations play an important role in reducing risk to important and critical habitat in communities. With regard to biodiversity, the overarching priorities for the region should have a long-term focus and prioritize the areas with significant existing biodiversity and provide for connectivity to other areas of significant biodiversity which therefore provides the ability for movement. A town must identify and map, through comprehensive means such as a natural resource inventory, the natural resources it has presently where they are located and what the threats are. A good exercise for prioritizing the results would be to use a planning model such as the Forest Land Evaluation and Site Assessment (FLESA) process.[94] For this process, each parcel is evaluated and weighted and ranked using a point system.

Zoning changes which incorporate Conservation Zoning Districts; Forest Zoning Districts which help prevent fragmentation of forest blocks; Overlay Districts; Subdivision Regulations ex Conservation Subdivision Design which is designed around the site's natural resources and incorporates land conservation into the subdivision permanently protecting the area with natural resources; Buffer Zones can be created based on the conservation objective; Clustering & planned Unit Development.

Biodiversity Improvement Strategies
• Assist municipalities in auditing their local Master Plan and regulations to identify barriers and opportunities for the protection of important habitat and natural resources.
• Assist municipalities in conducting Natural Resource Inventories (NRIs) to identify the existing natural resources and critical habitat areas within the town.
• Assist municipalities in maintaining landscape connectivity and wildlife corridors through land use planning to facilitate permeability and therefore, provide capacity for range shifts and species adaptation as the climate warms and changes.
• Assist municipalities in the identification of local land priorities for open space protection that include core areas of important wildlife habitat.
• Assist towns in developing Forestry and/or Conservation Districts or Natural Resource Overlay Districts which require a biological impact report prepared by a qualified consultant prior to the approval of development in identified sensitive habitat areas.

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