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**(CULTURAL AND HISTORIC
PRESERVATION)**

MOVING SOUTHERN NH FORWARD

VOLUME 2:
Culture and Historic
Preservation



2015-2035

Regional Comprehensive Plan 2015



Southern New Hampshire Planning Commission works to make our region better by facilitating cooperative and long term decision making. We believe a promising future can be achieved through fiscally sound and responsible planning and development decisions that improve the economy, efficiency and health of our region.

DRAFT June 2014

Cultural and Historic Resources



*Prepared by the
Southern New Hampshire Planning Commission*

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CULTURAL AND HISTORIC RESOURCES

PURPOSE

The purpose of this chapter is to review existing state of cultural and historic preservation planning within the Southern New Hampshire Region and to identify which cultural and historic preservation practices, actions and strategies are important in moving the region forward to the year 2035. This chapter also identifies and describes a variety of planning tools and programs as well as funding opportunities for municipalities and non-profit organizations for preserving the region's historic resources and enhancing local arts and culture.

VISION

Residents of the SNHPC Region place a high value on community and local identity, including respecting the settlement patterns and historic characteristics of their communities. These values are reflected in the Adopted Vision Statement for this plan (see Volume I).

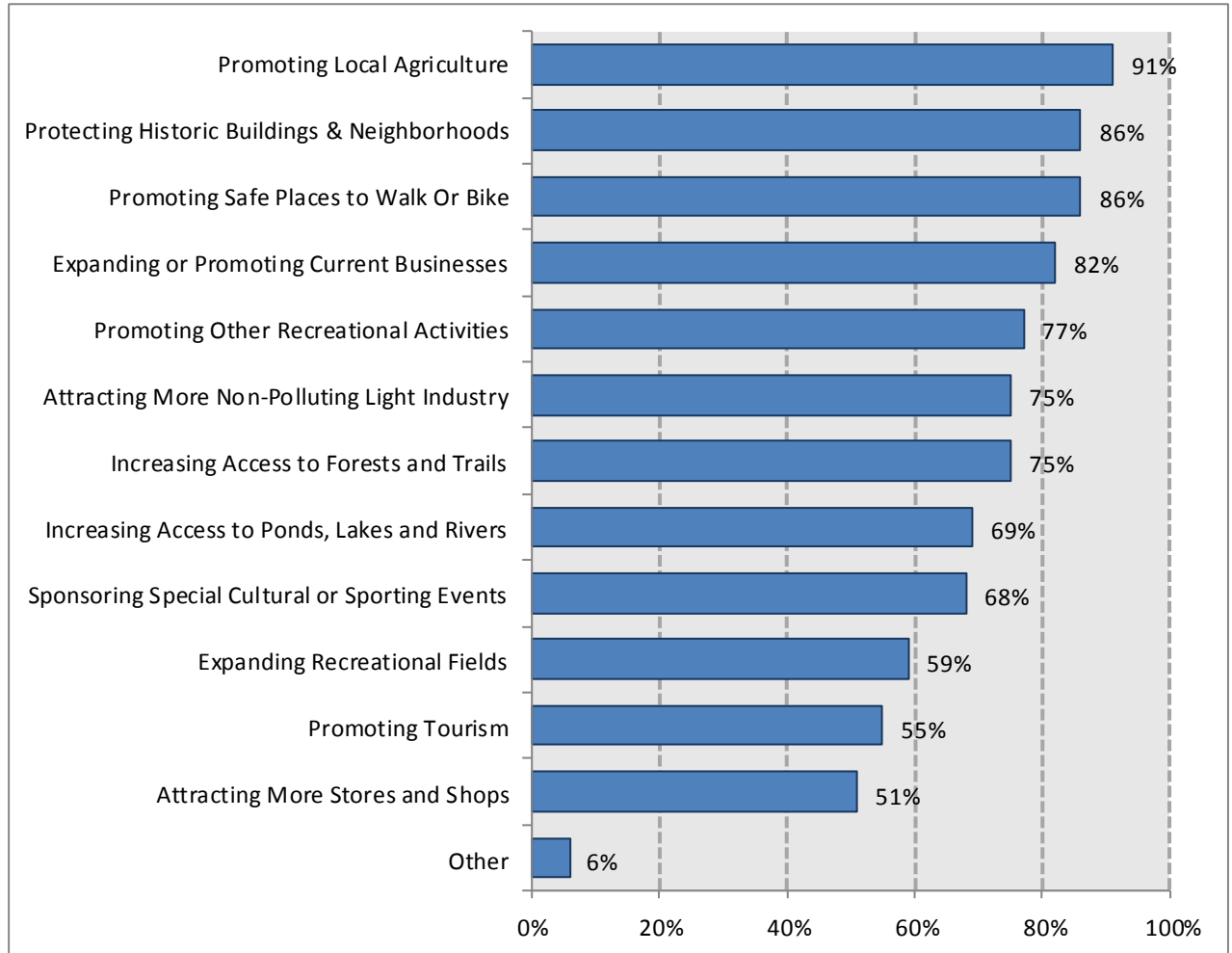
PUBLIC INPUT AND SURVEY RESULTS

In July 2013, the Survey Center of the University of New Hampshire conducted a telephone survey through the *Granite State Future* project seeking public input across the state of New Hampshire on a variety of planning related topics including the arts, culture and historic preservation. The survey results indicate 86 percent of New Hampshire residents value protecting historic buildings and neighborhoods; the second highest scoring response among 13 categories. In addition, when asked the question "what should actively be encouraged in your community?" 68 percent of the respondents indicated that their community should sponsor cultural and sporting events (see overall survey results in

Figure 1).

The SNHPC also conducted several online surveys and organized and facilitated a number public outreach events seeking input from residents and business owners within the region (see SNHPC's *Public Outreach Report* for more information). The results of this public outreach effort indicate that when residents were asked what is best about community and economic vitality in the region, over 45 percent of the respondents replied they value a variety of activities and recreational opportunities. This response likely refers to cultural events and activities as well as recreational opportunities.

FIGURE 1 WHAT SHOULD BE ACTIVELY ENCOURAGED IN YOUR COMMUNITY?



Source: UNH Survey Center, 2013

SNHPC staff also polled the Manchester Arts and Cultural Group. Discussions held with this group yielded three main themes concerning arts and culture in the SNHPC Region:

1. The need to reinstate arts programs that have been cut, and protect remaining arts programs in public schools;
2. Raise awareness of the importance of arts and culture;
3. Establish arts and culture leadership.

It was also noted that arts and culture serve important educational, economic and community development purposes. In addition, the economic development aspect of the arts was stressed, with respondents stating that “arts and culture institutions bring in millions of dollars in revenue for the city (property taxes aside).” The group called for leadership from various sectors of the community, such as the state, Southern New Hampshire University, businesses, and the immigrant

community. With this leadership, awareness can be raised and arts programs in public schools can be expanded. The economic and educational importance of the historic, artistic, and cultural resources of the Southern New Hampshire region underpin the content of this technical component and helps to inform about the issues, concerns, key goals and strategies identified herein.

KEY ISSUES AND CONCERNS

Key Issues:

- Increased planning attention is needed at both the regional and local level to actively promote and preserve the region's historic and cultural resources today and in the future. Specifically more communities in the region need to be positioned to achieve Certified Local Government status which opens more doors for preservation success.
- Many communities within the region need a comprehensive vision as well as a plan to effectively protect and promote their historic resources and cultural qualities and assets. Not all community master plans adequately address cultural and historic preservation.
- In addition, a greater emphasis is needed at both the region and local level to include and expand the arts and promote cultural activities as an economic development tool.

Additional Concerns:

1. The SNHPC Region is rich with history and contains significant historic and cultural resources, but many municipalities have not participated in the full suite of historic and cultural planning tools and programs that are available to them.
2. Many communities have historic societies, heritage and historic commissions, and other historic/cultural organizations which have been active in their communities for many years, but very few municipalities and planning boards have taken the next step -- that is implementation -- e.g. tapping into the creative arts economy and putting into place effective and available preservation tools and programs.
3. To be successful, cultural and historic preservation planning must be proactive and communities must be committed and fully supportive of their cultural and preservation vision and goals.
4. In most cases, it is the lack of funding and lack of effective public/private partnerships that have been the largest impediment and roadblock to implementation.

HISTORIC RESOURCES

EXISTING CONDITIONS

Cultural and historic resources play an important role in the identity and natural beauty of Southern New Hampshire. These attributes are what draw many visitors to the region and entice residents to further explore the area. These resources are also key economic drivers for many communities throughout Southern New Hampshire. From the beauty of our region's stone walls, historic homes and buildings to our cultural institutions, villages and city centers, history and culture are ever present in the lives of Southern New Hampshire residents.

The purpose of this section of the plan is to describe the region's history and to identify what planning tools and techniques are available to advance the preservation and enhancement of historic and cultural resources within the region. This section also explores existing practices as well as available funding. The following subsection contains a brief history of the region.

HISTORY OF THE REGION

The rich history of the Southern New Hampshire Planning Commission region goes as far back as the 17th century. From barns, farmlands and meandering stone walls, to bridges, dams, and massive millworks, the area's history is captured in those remnants. Through preservation we can tell stories of the past while ensuring resources are available for the future.

The SNHPC region's history can be generally described in terms of economic pursuits. In the 18th century, the region's residents pursued farming, fishing, and timber trades. The Merrimack River provided rich farmlands along its banks, a plentiful fishery, and access to the ocean and European markets for timber.

The SNHPC region's towns were all first settled in the early to mid-18th century. As settlements spread outward from the seacoast, tensions between early settlers and Native Americans increased and a number of wars broke out. The towns settled before 1740 experienced the violence associated with displacing the Native Americans. These towns include Londonderry, Chester, Manchester, Raymond, and Bedford.

The Town of Londonderry was first settled as Nutfield, in 1719 by Scottish-Irish immigrants. This original land grant included present-day Derry, parts of Windham, Manchester, Salem, and Hudson. The town was re-named Londonderry in 1722 and incorporated in 1740. In 1827, the Town of Derry was incorporated and separated from Londonderry.

The Town of Chester, incorporated in 1722, was one of the earliest settlement grants to accommodate seacoast area growth. Auburn, Candia, and Hooksett, which were part of the original Chester land grant, were eventually cleaved off to form the towns we know today. Auburn was first settled in 1734 and incorporated in 1845. Candia was first settled in 1748 and incorporated in 1763. Hooksett was the first settled in 1749 and was not incorporated until 1822, despite having been called Hooksett for the previous 50 years.

The land area that became the City of Manchester was originally granted by Massachusetts in 1722 and encompassed land granted by New Hampshire to the towns of Chester and

Londonderry in the same year. This happened often until King George settled the boundary dispute between Massachusetts and New Hampshire in 1740. Called Harrytown, Old Harrytown, and Tyngstown, it was incorporated in 1751 as the town of Derryfield. In 1810, it was renamed Manchester and was incorporated as a city in 1846.

The Town of Raymond was first settled in 1725 as a parish of Chester. It was called Freetown initially and was incorporated in 1764. The Town of Bedford was first granted in 1730 to soldiers who fought against the Narragansett Indians in Rhode Island. Originally called Narragansett No. 5, it was incorporated in 1750 as Bedford.

The Town of New Boston was first settled in 1742 and was called Lanestown. It was re-granted in 1748 to families from Londonderry, and was incorporated in 1763. The Town of Goffstown was originally established as Narragansett No. 4 by Massachusetts. It was re-granted in 1748 by New Hampshire, re-named Goffstown, and incorporated in 1761. The Town of Weare was granted to soldiers of the Canadian wars in 1735 by Massachusetts and called Beverly-Canada. The town has also been known as Halestown, Robiestown, and Wearestown. It was incorporated as Weare in 1764. The Town of Deerfield was first settled in 1756 as a parish of Nottingham. Despite being one of the last towns to be settled, it was incorporated in 1766 prior to other towns. The Town of Windham was first settled in 1719 as part of a larger settlement known as “Nutfield” which also encompassed the towns of Derry and Londonderry. Windham was officially incorporated in 1741.

Due to the North-South flow of the major rivers in the state, communication with Boston was more likely and easier than with Portsmouth, the provincial capital. This familiarity caused New Hampshire to play an important role in the events of the Revolutionary War and the subsequent formation of the new Republic. Troops from New Hampshire fought in the Battles of Bunker Hill and Lexington and Concord. New Hampshire was also the first to draft a state constitution, instruct their delegates to vote for independence at the Continental Congress in Philadelphia, and the ninth and deciding state to ratify the new U.S. Constitution in 1788.

The 19th century brought a transition to textile manufacturing and the boom of the mill towns. Situated along the Merrimack River, the SNHPC Region, particularly Manchester, was an international center for mill technology and the railroad. The rise of manufacturing and westward national expansion resulted in a decline in farming pursuits in New Hampshire during this time. The textile boom brought in an influx of immigrants to the Manchester area. By the beginning of the 20th century, the percentage of foreign-born residents in New Hampshire was higher than the national average.

New Hampshire was a dominant player in the manufacturing trade at the beginning of the 20th century, but at the end of World War I, New Hampshire's importance in the textile mill industry began to decline and continued through the depression of the 1930s. Manufacturing pursuits shifted to shoes and electronics, while smaller towns took advantage of the New Hampshire scenery and began to promote themselves as tourist destinations. The mid-20th century saw continuing declines in economic growth, but by the 1960s efforts to attract businesses, combined with the growth of Boston, helped to promote New Hampshire as one of the fastest-growing states in the Northeast.¹

¹ New Hampshire Division of Historical Resources. 2013. *New Hampshire Historical Highway Markers*. www.nh.gov/markers/brief.html (last accessed 8/9/2013).

Preserving this historic legacy can be a challenge amid current and projected population and economic growth trends in Southern New Hampshire. Local communities can work together with regional, state and federal agencies to accomplish successful preservation. The establishment of a historical society, historic district commission, or heritage commission is an important first step in the preservation process which Manchester and many of the region's communities have done. Once established, these committees can serve as advisors for planning boards and can help facilitate the listing of properties on various national and state registers. These registers raise awareness of the importance and value of historic preservation, foster civic pride and facilitate tourism and a sense of place within communities.

HISTORIC PRESERVATION TOOLS

"Preservation saves energy by taking advantage of the nonrecoverable energy embodied in an existing building and extending the use of it"²

The Southern New Hampshire Planning Commission region is a rich and vibrant repository of cultural and historic resources. Many of these sites are being preserved and have designation locally and nationally. However, there are still more historic and cultural landmarks that many communities would like to see preserved.

To be successful, historic preservation planning must be proactive in its preservation goals. There are a number of tools available to help communities with their preservation efforts. These include, but are not limited to:

- Landmark Designation and National and State Register of Historical Places
- Establishment of Historical Societies, Heritage and Historic District Commissions
- Zoning Regulations such as Historic and Neighborhood Districts
- Historic Easements
- Grants, Loans, and Tax Credits

LOCAL ACTIONS TO ENCOURAGE HISTORIC PRESERVATION EFFORTS

Historical Society. There are many different approaches communities can pursue to encourage historic preservation. The most important and basic step is the formation of a historical society. Historical societies can be organized by historic preservation minded individuals or as non-profit organizations. It is important to note that historical societies can be formed with no affiliation to the municipality. Once formed these organizations can conduct the research, inventory and nomination work necessary for historic preservation. Members can also be active in local, state and national organizations and nonprofits which actively work to protect key resources and gain public support in this effort.

² Advisory Council on Historic Preservation. 1979. Assessing the energy conservation benefits of historic preservation: Methods and Examples.

Historic District Commissions. New Hampshire RSA 673:4 and 673:4a also allows communities to form historic district commissions (HDC) and heritage commissions (HC). Once formed, communities can vote to allow historic district commissions to take on the duties and responsibilities of a heritage commission and vice versa. Historic district commissions are concerned solely with historic districts, primarily administering historic zoning districts and related building guidelines. HDCs can regulate the appearance within a designated historic district, such as review building permits, site plan review applications, and demolition requests.

Heritage commissions are non-regulatory bodies that focus on the entire town. The purpose of heritage commissions is to identify, preserve, protect, and enhance the historic character of the municipality. Considered the 'town preservation experts,' heritage commissions are empowered to conduct surveys and advise planning boards on preservation issues.

According to RSA 674:45, historic districts are designed to showcase the cultural, social, economic, political, and architectural history of an area, while conserving property values, fostering civic beauty, and strengthening the local economy.³ Historic district commissions can also assist local planning boards with technical and historic advice and work to establish and administer historic districts. The citizens of the municipality generally formulate the powers and responsibilities of historic district commissions. Thus, citizens should not fear that a historic district commission would enforce severe rules or restrictions. The only requirement that historic district commissions must complete is a local historic resources survey.

Currently, the following municipalities in the region have established historic district zoning: Bedford, Goffstown, Londonderry, Manchester, Raymond, Weare and Windham. Communities that have established historic district or heritage commissions, a historic district ordinance, and have completed the local historic resources survey can then apply for Certified Local Government status.

Certified Local Government: The designation as a Certified Local Government (CLG) can provide additional preservation funding and resource opportunities for communities. In order to be granted CLG status, municipalities must meet specific state and federal standards. These standards pertain to the entire community, not only a historic district. Once certified, communities are members of a network made up of the National Division of Historic Resources and other CLGs. Additionally, there are federal matching grant funding opportunities reserved exclusively for CLGs. Currently, three communities in the region – Derry, Goffstown and Londonderry – are certified local governments. A summary of the municipalities in the region which currently have in place an historical society; historic district or heritage commission; and have achieved CLG status is provided in the following Table 1.

³ New Hampshire Division of Historic Resources. 2003. What are Historic Districts Good for, Anyway?.

TABLE 1: LOCAL HISTORIC PRESERVATION ORGANIZATIONS IN THE SOUTHERN NEW HAMPSHIRE PLANNING COMMISSION REGION

Municipality	Historical Society	Heritage Commission	Historic District Commission	Certified Local Government Program
Auburn	X		X	
Bedford	X		X	
Candia	X	X		
Chester	X	X	X	
Deerfield		X		
Derry	X	X		X
Goffstown	X	X	X	X
Hooksett	X	X		
Londonderry		X	X	X
Manchester	X	X		
New Boston	X			
Raymond	X	X	X	
Weare	X			
Windham	X	X	X	

Source: New Hampshire Division of Historical Resources

HISTORIC RESOURCES SURVEY AND INVENTORY

The most important historic preservation planning tool is the historic resources survey and inventory. According to the New Hampshire Department of Environmental Services (NHDES), less than 25 percent of New Hampshire's communities have completed this step. Many years ago SNHPC compiled a list of properties in the region that were considered historically and culturally significant to its member communities as part of the 2004 NHDES Regional Environmental Planning Program (REPP) (see final report on the SNHPC website). This report of Local Resource Protection Priorities, while providing a starting point, is by no means all-inclusive and cannot substitute for a detailed inventory.

At the same time, the REPP cannot substitute for a prioritized history survey of the most important or endangered historic sites, properties and buildings within a community. A town-wide comprehensive survey and inventory must be conducted in accordance with state and federal standards. Once compiled, such an historic inventory can guide future planning decisions and provide a starting point for historical societies and heritage commissions in nominating decisions for the National and State Registers of Historic Places.

HISTORIC DISTRICT OVERLAY & OTHER ZONING TOOLS

Historic zoning or historic district overlay zoning is a tool for preservation. Typically, this type of zoning consists of an overlay zone applied over existing zoning regulations in designated historic districts. The heritage commission, historic district commission or a design review board reviews building permits and demolition requests within the district. In some cases, the heritage commission or historic district commission may only review demolition requests; while an independent design

review board reviews permits. In either case, the efforts of the preservation groups and the planning board need to be coordinated for best results, otherwise, problems can arise. For instance, zoning in historic districts could be incompatible with current uses, or there could be density, lot size, or off-street parking issues.

To determine the need for historic zoning overlays or revised zoning ordinances, communities should first map historic districts, properties and landmarks, along with the boundaries of existing zoning ordinances to determine potential conflicts and areas of compatibility. Additionally, historic zoning ordinances may allow historic properties special exceptions for uses typically not permitted by the municipality's zoning ordinance. One example is to allow historic residences, which can be large and expensive to maintain, to be used as office space or multi-family housing. Another consideration is the use of existing mill buildings for mixed use, such as residential or commercial purposes. By providing for mixed uses in historical districts, communities can facilitate revitalization.

Transfer of Development Rights. Another important zoning tool is transfer of development rights (TDR). TDRs allow the development rights for low-density historic buildings, or the "air" above a historic building or site where zoning allows for more stories to be sold or transferred to another location where higher-density development is allowed or desired. Density bonuses can also be utilized to preserve open space with archeological potential.

Conditional Zoning. Conditional zoning is another preservation tool in which zoning change requests are granted only if certain conditions are met. The conditions might be preservation of open space or built structures, among others. All of these zoning tools require a willingness to cooperate between planning boards and preservation groups and knowledge of zoning regulations, potential historic and archeological areas in need of preservation, and development objectives.

Neighborhood Heritage District: As defined by the New Hampshire Division of Historical Resources, a Neighborhood Heritage District (NHD) is a zoning mechanism that helps protect the key character of an area.⁴ The district is a group of buildings and their settings that are architecturally or historically distinctive and are worth protecting based on their contribution to the character of the community.⁴ A NHD differs from other types of historic preservation in that its objective is to protect neighborhood character, whether residential, commercial or a mix of uses, rather than design details of individual buildings. The features that are determined to be significant in maintaining the character of a neighborhood are determined by the community seeking to establish a NHD.

In the SNHPC region the Town of Hooksett is undergoing a two-year process to explore the feasibility of a NHD around the area of Robie's Store. The purpose of this study is to determine the viability of a zoning overlay designed to help preserve and protect the visual character of the village and perhaps the surrounding neighborhoods.

Demolition Delay Ordinances. According to the New Hampshire Division of Historical Resources, "Demolition review is a preservation tool that ensures potentially significant buildings and structures are not demolished without notice to the community and review by a heritage or historic district commission."⁵ These reviews, or delays, are most commonly adopted as an amendment to

⁴ For more information, please visit: http://www.nh.gov/nhdhr/documents/neighbor_hert_handbook.pdf

⁵ New Hampshire Division of Historical Resources. 2007. Protecting Historic resources Through Demolition Review.

the building code, as a bylaw in an existing historic preservation or zoning ordinance, or as a stand-alone ordinance.⁵

Demolition delay or review ordinances allow for a review process by a local historic preservation agency or group to determine the structure's historic value or significance. If it is determined that the structure is architecturally significant, a delay on a demolition permit is issued, during which time a public hearing is scheduled to consider alternatives to demolition and options for preservation. However, this is simply a delay to review alternatives to demolition; this does not guarantee that a building will not eventually be demolished. In the SNHPC region the Towns of Goffstown, Weare and Windham have some form of demolition delay ordinance.

Scenic Road Designation. New Hampshire RSAs 231:157 and 231:158 also allows towns to make scenic road designations. Any town road, other than a Class I or II highway, can be designated a scenic road by petition of 10 or more people. A local scenic road designation can be useful for the protection of natural landscapes; roadway repair or maintenance cannot disturb or harm trees or stone walls without written consent of the responsible board.

FEDERAL & STATE PRESERVATION PROGRAMS

There are a number of state and federal programs that provide designations which can assist in preservation efforts. Such designations can also make communities more attractive to businesses and tourists, providing an economic boost to the area. It is important to note that a designation does not guarantee permanent preservation of a site, but most citizens and communities would rather maintain the designation, rather than allow such a site to be lost.

HISTORIC PRESERVATION TAX CREDIT PROGRAM

The Federal Historic Preservation Tax Credit Program allows a 20 percent tax credit for the preservation of historic buildings. The tax credit is only available for income-producing structures, not individual private residences. To qualify for the tax credit, the structure has to be listed, or at least be eligible to be listed on the National Register of Historic Places, as an individual structure or as part of a historic district. The structure must meet the ten Standards for Rehabilitation, set by the Secretary of the Interior and the rehabilitation efforts must be substantial. This means the cost of the rehabilitation must exceed the pre-rehabilitation value of the structure. The National Park Service, along with the Internal Revenue Service and State Historic Preservation Offices, administer the tax credit.

HISTORIC PRESERVATION EASEMENTS

Historic preservation easements allow a property owner to grant a portion of the rights of the property to a group that commits to preservation. The property owner retains the right to sell the property; however all subsequent property owners forever relinquish the development, demolition, alteration, or other rights waived as part of the easement. Historic preservation is not inexpensive. Easements provide property owners with a mutually beneficial alternative. Not only does the property owner retain ownership, along with any potential financial benefits, but there is also the possibility of a federal tax deduction. These benefits are balanced by the knowledge that the owner has contributed to the preservation of a historic or culturally significant place. Owners can claim a federal tax deduction of the value of the easement up to 30 percent of their adjusted

gross income. The balance of the easement tax benefit can be carried forward up to five years.⁶ The value of the easement, as determined by an appraiser, is typically the difference between the appraised fair market value of the property and the value with the easement in effect. Properties must meet certain qualifications set by the IRS in order to qualify for tax benefits.

To be eligible, properties must be on the National Register of Historic Places or be located within a nationally registered Historic District and certified by the U.S. Department of the Interior as historically significant to the district.⁷ Certification must come prior to an historic preservation easement, or before the owner files a tax return for the year the easement was granted.

Additionally, qualified properties must be accessible to the public. Depending on the nature of the site, this could mean as few as a couple of hours or days per year, or even the ability to view the site from a distance. Historic preservation easements generally prohibit the destruction or alteration of the property without review and approval by the easement holder. Development and subdivision restrictions are also common. Additionally, some easements require the owner to maintain or restore the property to certain conditions. Historic preservation easements provide ownership of the property, thereby alleviating the financial burden of maintaining the property alone. As of 2010, there were four organizations that hold historic preservation easements in New Hampshire. These include: the New Hampshire Division of Historical Resources, the Manchester Historic Association, the New Hampshire Land & Community Heritage Investment Program (LCHIP), and the New Hampshire Preservation Alliance.⁸

THE NATIONAL REGISTER OF HISTORIC PLACES

When individuals think about historic designations, the National Register of Historic Places is perhaps the most commonly known. The National Register is maintained by the National Park Service and contains over 80,000 listings. Listings on the National Register are eligible for special federal tax benefits, preservation assistance, and acknowledgement that the property has national, state or community significance. Properties must meet certain criteria to be considered for designation. Map 7-2 on page 29 in this chapter identifies both national and state listed registry properties within the SNHPC Region.

Essentially, properties are generally at least 50 years old and are associated with significant events or people in the past, or exhibit distinctive characteristics of a historical time period or architectural style. National Register designation does not, however, equal preservation. Properties on the list can be privately owned, and the designation does not limit the owner's right to change or demolish the property.

The National Park Service has created a publication that guides communities through the application process; communities considering nominating properties for National Register designation should consult this document.⁹

More information on tax deductions can be found at: <http://www.nps.gov/tps/tax-incentives/taxdocs/easements-historic-properties.pdf>

⁷ For a description of historically important land areas, as defined by the IRS visit http://www.irs.gov/Businesses/Small-Businesses-&-Self-Employed/Conservation-Easement-Audit-Techniques-Guide#_Toc156

⁸ For more information on the National Park Service Historic Preservation Planning Program, please visit: <http://www.nps.gov/hps/pad/index.htm>

⁹ See the National Register Bulletin at: <http://www.nps.gov/nr/publications/bulletins/pdfs/nrb39.pdf>

FIGURE 2: THE ROBERT FROST FARM, NATIONAL HISTORIC SITE, DERRY, NH



There are 54 properties listed on the National Register of Historic Places in the SNHPC region. These properties represent a diverse mix of structure types, including town halls, churches, cemeteries, factories, and homesteads. Also represented are historic districts, schoolhouses, and public buildings. Communities with properties listed on the National Register include: Bedford, Chester, Deerfield, Derry, Goffstown, Hooksett, Londonderry, Manchester, Raymond, Weare and Windham.

NATIONAL HISTORIC LANDMARKS

National Historic Landmarks are places that have meaning for all Americans. They are designated by the Secretary of the Interior and nominated by the National Park Service. Landmarks can be buildings, districts (villages or communities), sites without built structures, uninhabited structures, or objects. There are fewer than 2,500 designated landmarks nationally and only about 20-25 new landmarks are designated per year. To be designated a National Historic Landmark, areas must be associated with historic events, people or ideals, be prime examples of design or construction, or exhibit a way of life. New Hampshire is home to 23 National Historic Landmarks. Two of these are in the SNHPC region – the Robert Frost Homestead and the Matthew Thornton House – both of which are in Derry.



FIGURE 3: THE JOHN STARK HOUSE, MANCHESTER, NH

THE NEW HAMPSHIRE STATE REGISTER OF HISTORIC PLACES

Properties listed on the State Register of Historic Places are eligible for the same types of benefits as the National Register, only the source of the funding, planning assistance, and tax benefits are at the state level, rather than federal. The criteria for properties to be considered for inclusion on the State Register are also similar to the National Register. In general, properties must be at least 50 years old and must tell a historically significant story. Eligible property types include buildings; districts; sites such as parade grounds or a village green; landscapes; structures such as stone walls or bridges; and objects. The New Hampshire Division of Historical Resources offers guidance to

communities that desire to apply to the State Register. Currently, there are 23 properties from seven towns in the region listed on the State Register of Historic Places.

NEW HAMPSHIRE HERITAGE LANDMARKS

Pursuant to RSA 227-C: 25, all National Historic Landmarks owned by the state, as of July 1, 1993, were designated as New Hampshire heritage landmarks. Currently the program is not active in the state, but the Robert Frost Homestead in Derry qualifies under this designation.

THE NEW HAMPSHIRE BARN SURVEY

The New Hampshire Division of Historical Resources has been administering a barn survey, in an attempt to identify and record the locations of historically significant barns in the State. As previously stated, the first step for any large-scale preservation effort is the completion of a survey of the historic resources. The completion of a town-wide barn survey can help both town and state preservation efforts. Deerfield conducted such a survey from November 2000 through July 2002. Chester and Hooksett each completed a town-wide barn survey. New Boston has compiled an informal survey of town barns, chicken houses, school houses and old mills as well.

New Hampshire state law also provides for the preservation of barns through RSA 79-D. This law allows municipalities to provide property tax breaks to barn owners that meet certain requirements. The owners' barns must provide a public benefit with the preservation of their barn and agree to maintain the barn or structures throughout the minimum 10-year discretionary preservation easement. The barn owners are granted tax relief, enabling them to repair and maintain their barns. The easement also provides that the town will not increase the assessed value after the repair work has been completed and tax relief can be equivalent to a 25 to 75 percent reduction of the structure's full-assessed value. To qualify as a "historic agricultural structure," the structure, including the land it was built on must be or have been used for agricultural purposes and also be at least 75 years old.¹⁰ The town must also adopt the provision.

STATE HISTORIC MARKERS PROGRAM

The New Hampshire Historical Markers Program commemorates New Hampshire's places, people, or events of historical significance. The New Hampshire Division of Historic Resources, with the help of the New Hampshire Department of Transportation, administers the program. Marker requests can be made by communities, organizations, or individuals and must be accompanied by accurate documentation including footnotes, a bibliography, copies of supporting research and a petition signed by at least 20 citizens.

The SNHPC region is home to 17 historic markers in ten of the 14 towns in the region. These markers commemorate people, places, and events such as an early clockmaker, poets, war heroes, early settlers and settlements, engineering works, manufacturing buildings, cemeteries, and landscapes.

PRESERVE AMERICA

Created by the White House and supported and promoted by First Lady of the United States Michelle Obama, Preserve America Communities are recognized for celebrating their heritage.¹¹ Designated communities are allowed to display the Preserve America logo, are included in the

¹⁰ For more information on New Hampshire's barn preservation efforts, visit the New Hampshire Division of Historical Resources at www.nh.gov/nhdhr

¹¹ For more information please visit: <http://www.preserveamerica.gov/>

Preserve America directory, and receive a Preserve America Community road sign. Additionally, some communities are eligible to receive funding to support planning, development, implementation or enhancement of heritage programs. To date, more than 800 communities have been designated Preserve America Communities, more than triple the number since 2003. The towns of Hooksett, Portsmouth and Keene currently represent New Hampshire.¹²

HISTORIC LANDSCAPES

The National Historic Landscape Initiative is not a list of designated properties, but rather a resource for the preservation of landscapes.¹³ It provides publications, workshops, technical assistance and national policy direction. Landscapes are an essential part of how New Englanders identify with the region and the image of the New England village would be incomplete without landscapes. By protecting landscapes, communities can provide enjoyment for their citizens and an improved quality of life. Landscapes are more than just open space; they include residential sidewalks, lawns, and trees, as well as agricultural fields, forests, and stones. Currently no towns in the region have preserved historic landscapes, but historic landscape preservation is a method that can work well in concert with existing open space conservation efforts in the region.

HISTORIC AMERICAN BUILDINGS SURVEY

The Historic American Buildings Survey is a program that works toward preservation through documentation. The program documents important architectural sites throughout the U.S. Begun in the 1930s, it was originally performed by professional architects. Today, college students complete the fieldwork and documentation during the summer months.

Currently, there are 30 buildings in Manchester listed on the survey. These include residential homes, commercial and industrial buildings, bridges, and even portions of the Manchester Airport.

NATIONAL UNDERGROUND RAILROAD PROGRAM

The National Underground Railroad Program is a National Park Service project to record and map the locations of the highly secretive network of stations providing safe haven on the road to freedom in the North or Canada. Locations that are part of the network can display the network logo, receive technical assistance and participate in program workshops. Many communities in New Hampshire contain properties with a folklore connection to the Underground Railroad. The Moses Sawyer Homestead is one of four known stops in Weare along the Underground Railroad. The Network provides an opportunity for local historical societies or heritage commissions to preserve these traditional stories, while garnering national recognition as important historic places. Sites are not limited to buildings or 'stations' but can also be river crossings, routes, or hiding places.

SCENIC BYWAYS PROGRAM

The State of New Hampshire is home to 14 State Scenic Byways and three National Scenic Byways—the Connecticut River, the Kancamagus, and the White Mountain. A scenic byway is a designation that showcases the state's most beautiful vistas and landscapes. There are currently five state scenic byways in the SNHPC Region. The state recently approved the Robert Frost/Old Stage Coach Byway and the Upper Lamprey Scenic Byway in 2014 which become the state's newest scenic byways. The Amoskeag Millyard Scenic and Cultural Byway located in Manchester is

¹² New Hampshire Division of Historical Resources. The Old Stone Wall. Fall 2005: Vol. XIV, No.1.

¹³ For more information please visit the National Center for Preservation Technology and Training: <http://ncptt.nps.gov/programs/historic-landscapes/>

only one mile long, but historic and cultural attractions are abundant along its route. Londonderry's Apple Way is ten miles long and provides visitors with a snapshot of Londonderry's agricultural history.

The General John Stark Scenic Byway (GJSSB), designated in 2008, loops through the towns of Dunbarton, Goffstown, New Boston and Weare. The 34 mile loop showcases the many historical features that date back to the Revolutionary War and Industrial Revolution. It is named for General John Stark, who coined the State's motto, "Live Free or Die". The byway's moniker is due to the numerous features relating to General Stark and the Stark family that can be found along the route, such as the Molly Stark Cannon in New Boston. The GJSSB Council meets quarterly, discussing such topics as events, marketing, and an interactive website.

While funding for these byways has been available in the past under federal transportation legislation, there is no longer standalone scenic byway funding under MAP-21, which took effect in October 2012. Eligible projects under the Surface Transportation Program and the Transportation Alternatives Program that may have previously been eligible as part of the National Scenic Byways Program include: the construction of turnouts, overlooks, and viewing areas; historic preservation and rehabilitation of historic transportation facilities related to a byway; bicycle and pedestrian facilities along a byway.¹⁴

ARCHAEOLOGICAL SITES AND PROGRAMS

There has been human habitation in New Hampshire for at least the past 10,000 years. Our knowledge of settlements and archaeological sites is limited, however, because most of the State has not been fully explored. This explains why a map of archaeological sites cannot be produced. The New Hampshire State Conservation and Rescue Archaeology Program (NH SCRAP) is hesitant to describe known archaeological sites on a map because people have a tendency to assume that blank space on a map equates to the absence of archaeological significance. This is not the case in New Hampshire; the blank space simply means it has not been explored yet.

There are a few generalizations about potential archeological sites that communities can use to determine preservation efforts. Generally, SCRAP has found that sites tend to be within 300 feet of rivers or other water bodies. Areas near a waterfall or rapids pose a good chance of hosting former settlements. Certain soil types, such as well-drained alluvial soils are indicators of activity. Settlements have been known to occur on high ground near wetlands or swamps because these areas provided good resources for hunters and gatherers. A slope grade of 20 percent or greater could rule out a site, since steep slopes are not attractive for habitation. These environmental guidelines are imprecise indicators of settlement because the environmental landscape of the State has changed many times over the last 10,000 years. Unfortunately, there is no predictable model to determine settlement areas in New Hampshire.

THE MAIN STREET PROGRAM

The National Trust for Historic Preservation's Main Street Center, Inc. currently provides a staff person to assist communities in establishing and maintaining local Main Street Programs in New Hampshire. At one time there was a New Hampshire Main Street Program organized through the NH Community Development Finance Authority; however this program is no longer active in the state. Many existing Main Street initiatives in NH are also recognized as Nationally Designated Main Street Programs under the National Trust Main Street Center. While Main Street Programs contribute significantly in helping to revitalize and maintain local business growth and expansion,

¹⁴ 23 U.S.C. 101(a)(29), 23 USC 213(b), MAP-21 (1101, 1122)

they also play a crucial role in the education, health and well-being of our citizens. Exposure to the arts and creative industries fosters growth in youth populations, creates jobs and increases overall quality of life. The creative economy in the SNHPC Region is an engine of growth and community vitality and will continue to play a role in shaping our region through creative industries and by adding to the cultural activity and rich history of the area.

Main Street Programs are designed to improve the economic vitality of a downtown center, while supporting historic preservation. The National Trust's Main Street Center located in Concord, NH is open to all NH towns and cities and provides at least three years of technical support to participants, which are competitively selected. A successful Main Street Program requires both public and private cooperation and relies on four principles to accomplish revitalization. These are: organization; promotion; design; and economic restructuring. Participants in the program need to understand that results are incremental. While the focus is limited to central business districts, an economically vibrant downtown can impact the overall vitality of the town. Currently, Goffstown is the only town in the region which is a member of the National Trust's Main Street Center.¹⁵

VILLAGE OR DOWNTOWN DESIGN GUIDELINES

Village or Downtown Design guidelines outline locally acceptable site and architectural design and can be formulated to identify desirable community characteristics. They focus on the aesthetic and promote new development and substantial improvements to existing structures that is harmonious with the surrounding area, town center, or historic district. The guidelines can specify locally desired architectural styles, construction materials, building scale, window and door design, sign size and design, awnings and canopies, lighting fixtures, landscaping, fencing, and screening methods.

In the SNHPC Region, the towns of Derry, Chester, Goffstown, Hooksett, Londonderry, Windham and the City of Manchester have established design guidelines to ensure that future growth and development in their historic village centers and downtowns is compatible with its surroundings. These guidelines are typically incorporated in the communities' Site Plan Review or Land Use Development Regulations. Within the SNHPC region, these regulations range from providing a general clause requiring the preservation and protection of historic features to location specific guidelines for new development.

VILLAGE PLAN ALTERNATIVE

The Village Plan Alternative (VPA) is a planning tool that allows for the creation of new villages within a municipality that promote compact development with a mix of land uses, including residential, small-scale commercial, recreation and conservation.¹⁶ The purpose of a VPA is to promote mixed-use development in close proximity to one another within a neighborhood. The development is then at scale to the smaller populations and lower density of many New Hampshire towns.

The VPA is designed to implement the specific provisions of RSA674:21.VI(a). The ordinance was designed "to respond to the economic, environmental and social consequences of conventional two-acre lot zoning that segregates the locations of work, home, and recreation and produces a

¹⁵ For more information on the National Trust for Historic Preservation Main Street Center, visit <http://www.preservationnation.org/main-street>

¹⁶ NHOEP; Frost, Benjamin. The "Village Plan Alternative" RSA 674:21,VI [HB 1344]

sprawling development pattern.”¹⁷ The VPA addresses these concerns by promoting smart growth principles, preserving the working landscape, and protecting environmental resources.

In the SNHPC Region the towns of Auburn, Hooksett and Windham have adopted Village Plan Alternative subdivision regulations.

FUTURE PRESERVATION PROGRAMS

Clearly, the largest impediment to historic preservation is planning and financing. Most people would agree that the preservation of their town or region’s historic and cultural resources is desirable and important. There are many planning tools and funding programs to assist historic preservation efforts. All it takes is public support, committed volunteers and public/private partnerships. Currently the best available funding for historic preservation includes the following programs and funding sources.

The National Trust provides both grants and loans to non-profit organizations and public agencies. Some of the grants require that the property be designated a National Historic Landmark to qualify. Grant opportunities range from \$500 to \$10,000. Typically, the money must be used for professional advice, public outreach, educational materials, preservation planning and land use planning.

The New Hampshire Preservation Alliance sponsors a Historic Barn Assessment Grant Program. This program provides matching grants of \$250 to \$400 to barn owners for the hiring of a barn assessment consultant, who will determine the required steps to stabilize, repair, and reuse the barn.

Another local resource is the New Hampshire Land and Community Heritage Investment Program (LCHIP). This organization provides matching grants to NH communities and non-profit organizations for the preservation of local natural, cultural, and historic resources. Currently six municipalities in the SNHPC Region – Bedford, Derry, Hooksett, Londonderry, Manchester and Windham – have taken advantage of this program, with grants ranging from \$109,000 to \$300,000. Unfortunately, the State has reduced the allocated budget for LCHIP by 85 percent.¹⁸

With the exception of Bedford, Londonderry and Windham, most communities in the SNHPC region have ten percent or more of their homes built prior to 1940. This indicates there is great preservation potential existing today and in the future for the region. While not all of these structures should be preserved, the general age of the building stock is illustrative of patterns or clusters of development within historic neighborhoods. These areas could potentially be analyzed and grouped as historic districts in the future.

In addition to the need for funding, a review of municipal master plans indicates that little preservation work has occurred within the SNHPC Region. While most communities recognize the importance of maintaining their historic character, there are very few historic plans that have been developed and few goals or objectives have been adopted. At best, simple historic planning efforts could be conducted including an audit, inventory or review of existing zoning ordinances

¹⁷ Community Technical Assistance Program. Village Plan/Context Sensitive Solutions.
<http://www.nhctap.com/documents/ctap/products/CTAP%20Factsheets/Village%20Plan%20Alternative%20Factsheet.pdf> last accessed 8/9/2013.

¹⁸ Visit www.lchip.org for more information.

and local land use policies for historic preservation needs. While every town in the region has important historic or cultural resources to protect, many of the region's towns are at different stages in implementing effective historic preservation programs.

Examples of some of the historic preservation goals in the towns' master plans include:

- Establish a Heritage Commission, Historic District Commission or Historical Society
- Designate historic areas as historic districts
- Establish zoning and land use regulations that recognize the value of historic resources and strive to preserve those features
- Organize public group walks through local historic districts
- Prepare educational brochures about the local historic district, town center or areas of historic pride and importance
- Prepare informational materials or a website to promote local resource management and protection
- Incorporate historic landmarks and cultural resources into school field trips and curriculum
- Promote private voluntary preservation
- Develop cohesive town centers within the historic setting
- Promote town center development consistent with historic character

These goals provide a starting point, but continued emphasis and proactive historic preservation planning is still needed in the region. Implementation takes both committed volunteers and effective leadership. This leadership can often be found in existing organizations and non-profits as well as in the establishment of public/private partnerships which can work together to protect and revitalize significant historic buildings and cultural landmarks within a community.

During 1998 and 1999, the New Hampshire Department of Environmental Services contracted SNHPC, along with the other regional planning commissions around the state, to collaborate with communities to identify and map what each community believed their Local Resource Protection Priorities (LRPP) to be. This inventory and data was then reviewed and updated again in 2004 and 2011. Today most of these mapped priorities still represent unprotected natural and cultural resources worthy of preserving. The overall project's intent was to gain an understanding of local priorities for two purposes – to assist the LCHIP program to identify projects to fund and to assist planners, regional planning commissions, and state agencies in their planning efforts.

Within the SNHPC Region, a total of 256 cultural and historic features were identified in the most recent LRPP as future preservation priorities by 12 of the 14 communities; Deerfield did not participate in the LRPP effort and the Town of Windham was added to the SNHPC Region in 2013 (see Table 2).

Features listed in Table 2 include historic homes, barns and farms, mills, cemeteries, schools, stores and taverns, and many other sites unique to the region's communities. Six of the cultural features identified in the original 1998-99 listing were removed from the LRPP in 2004 due to successful preservation efforts. Of those, three were added to the National Register of Historic Places, two were protected through new private development that included preservation of the historic structures, and the Town of Chester protected the last through outright purchase. No properties were removed from the list due to new development that negatively impacted the historic feature or for demolition.

TABLE 2: LOCAL RESOURCE PROTECTION PRIORITIES IN THE SOUTHERN NEW HAMPSHIRE PLANNING COMMISSION REGION

Municipality	Cultural Resources	Cultural and Natural Resources
Auburn	23	0
Bedford	10	0
Candia	13	0
Chester	1	1
Deerfield	N/A	N/A
Derry	27	0
Goffstown	12	1
Hooksett	71	4
Londonderry	50	6
Manchester	5	3
New Boston	1	2
Raymond	0	0
Weare	24	2
Windham	N/A	N/A
SNHPC Region	237	19

Source: SNHPC

By comparison, 22 of the natural features identified in 1998-99 were preserved as of 2004 and removed from the list and another five natural features were removed due to recent growth and development. Today it is not known how many of the features identified in the 2010 update have been protected or preserved. This represents an important project and survey that should occur to help better inform the public and each community of its overall historic and cultural preservation needs.

ARTS AND CULTURAL RESOURCES AND DESIGN

Arts, culture and visual design are important aspects to a community and create a unique local identity or brand that allow communities to stand out among similar municipalities at the local, regional and national level. Examples include community arts centers and land, art classes, pottery studios, retail shops, art and music galleries and performances, etc. The arts also include new and emerging computer related businesses and industries as well as graphic design. All of these resources offer both established and new emerging business opportunities to help support economic development around institutions and venues as well as promote tourism and the influx of tourist dollars. The entire creative arts economy in total helps to enhance a community's vitality, sense of place, and overall quality of life. In short, these resources help to bolster a community's economy, tax base and foster important social connections that may otherwise not occur.

EXISTING CONDITIONS

SOUTHERN NEW HAMPSHIRE'S CREATIVE ECONOMY

According to the New Hampshire Business Committee for the Arts, the creative economy "encompasses the cultural core of artists, cultural nonprofits, and creative businesses that produce and distribute cultural goods and services that impact local and regional economies by generating jobs, revenue and quality of life. The creative economy is a powerful and positive force that drives community growth and vitality."¹⁹ While the current iteration of the creative economy may include molecular engineers and graphic designers, it has its roots in the arts and is often identified with cultural nonprofits.

Cultural nonprofits play a significant economic role in Southern New Hampshire. According to Dunn & Bradstreet, New Hampshire is home to 4,618 arts-related businesses that employ 13,111 people.²⁰ Art schools, design, publishing, film, radio, performing arts, visual arts/photographers and museums employ a creative workforce, spend money locally, generate government revenue, and are a cornerstone of tourism and economic development. A 2012 survey by Americans for the Arts found that in NH \$115 million was spent by nonprofit arts and cultural organizations which added/translated to \$62.1 million in local sales in retail, lodging and restaurants.²¹

The SNHPC Region is home to over 300 commercial and nonprofit cultural organizations that employ a significant number of employees with total salaries and compensation of over \$20 million for fiscal year 2010.²² These institutions and businesses generated over \$23 million in revenue in 2010 with total net assets topping \$175 million (see Table 3).²² At the local level, these institutions and businesses are the creative engines that can fuel growth.

¹⁹ New Hampshire Business Committee for The Arts. © 1999-2004. All Rights Reserved.
<http://www.nhbca.com/> last accessed 8/9/2013.

²⁰ New Hampshire Business Committee for the Arts. 2013. Creative Economy Facts.
http://www.nhbca.com/news_040610_ce.php last accessed 8/9/2013.

²¹ Americans for the Arts. *The Economic Impact of Nonprofit Arts and Culture Organizations and Their Audiences*. Arts and Economic Prosperity IV: Report for the State of New Hampshire. Copyright 2012 Americans for the Arts, 1000 Vermont Avenue NW, 6th Floor, Washington, DC 20005.

²² Select data from the New England Foundation for the Arts (NEFA) is for the Towns of Bedford, Candia, Chester, Deerfield, Derry, Goffstown, Hooksett, Londonderry, Manchester, New Boston and Windham for

A 2012 study conducted by Americans for the Arts attempted to track how many times a dollar is “re-spent” in the local economy and the economic impact generated with each round of re-spending. This input-output analysis revealed that direct expenditures by cultural organizations in New Hampshire was more than double the national average and average spending by nonprofit arts and culture event attendees in New Hampshire was \$22.31 per person, excluding the cost of admission to the event.

While these institutions contribute significantly to our region’s economy, they also play a crucial role in the education, health and well-being of our citizens. Exposure to the arts and creative industries fosters growth in youth populations, creates jobs and increases overall quality of life. The creative economy in the SNHPC Region is an engine of growth and community vitality and will continue to play a role in shaping our region through creative industries and by adding to the cultural activity and rich history of the area.

TABLE 3: SELECT CHARACTERISTICS OF ARTS AND CULTURAL INSTITUTIONS IN SNHPC REGION 2010

Municipality*	Total Cultural Businesses	Total Cultural Nonprofits	Number of Employees**	Number of Employees per 1,000 population	Total Net Assets at Year End	Total Revenue
Auburn	4	4	93	18.8	NA	NA
Bedford	17	14	320	15.1	\$350,358	\$1,229,125
Candia	5	2	91	19.1	\$902,251	\$192,266
Chester	3	5	78	16.4	\$34,190	\$21,028
Deerfield	7	7	68	15.9	\$3,514,522	\$1,843,787
Derry	21	9	1,001	30.2	\$66,184	\$186,536
Goffstown	10	2	607	34.4	\$50,477	\$61,809
Hooksett	13	9	425	31.6	\$403,969	\$519,471
Londonderry	12	6	776	32.2	\$323,326	\$277,028
Manchester	87	62	4,352	39.7	\$170,170,914	\$19,698,244
New Boston	7	3	116	21.8	\$73,206	\$85,005
Raymond	8	0	277	27.3	NA	NA
Weare	5	6	169	19.2	NA	NA
Windham	9	2	198	14.6	\$52,188	\$28,621

* All data from NEFA, 2010; (NA=Data Not Available)

** Includes Arts, Entertainment, Accommodation, Recreation and Food Service Employees

The figures in this table are representative of two sources from the CultureCount project. Where the figures differ from those publicly available a second, non-public data source was used. The reasoning for this was to capture the largest number of cultural institutions represented. For instance, publicly available data for the Town of Bedford, NH can only account for financial information from four institutions, while there are 14 cultural non-profits listed for the Town. In this case a supplementary data set was used that accounts for more, if not all, institutions.

cultural nonprofits only. Financial data for the Towns of Auburn, Raymond and Weare was not collected for 2010. Definitions and more information can be found at:

http://www.nefa.org/creative_economy/research_data all data Copyright © 2011 New England Foundation for the Arts/Culture Count <http://www.culturecount.org>.

PERFORMING ARTS CENTERS

Performing arts centers are part of the Southern New Hampshire region's cultural heritage. For the purpose of this plan, a performing arts center is defined as a multi-use performance space that is intended for use by various types of the performing arts, including dance, music and theatre. A range of spaces, private and public, may host performances; see the Tables 3, The Dimension of Arts and Culture. The American Planning Association produced this table as part of a briefing on the role of the arts and culture in planning practice.

Table 4 identifies all the known performing arts centers and venues within the Southern New Hampshire Planning Commission Region. The locations of these sites are also identified and shown on Map 1, Performing Arts Centers in Southern New Hampshire.

Table 4 Dimensions of Arts and Culture ²³

DEGREE OF PROFESSIONALISM	
Professional or Formal (—) Vocational or Informal	
Creator or producer is recognized as artist by peers, has received advanced training in the art form, makes at least a portion of his or her living through artwork, or is presented or exhibited by arts-specific venue	Creator or producer is engaged in project solely for purposes of expression (e.g., ethnic, religious, personal) and enjoyment
TYPE OF PRODUCT OR ACTIVITY	
Tangible (—) Intangible	
Painting, sculpture, monument, building, multimedia, or other permanent or temporary physical work of art	Event, performance, or gathering (temporary activity); oral history or cultural expressions passed on from generation to generation
LOCATIONS AND SPACES	
Specific-purpose venues (—) Non-arts venues	
Museums, theaters, galleries, community art centers, music clubs, etc.	Schools, churches, parks, community centers, service organizations, libraries, public plazas, restaurants, bars, shops, businesses, homes, etc.
LEVEL OF PARTICIPATION AND INVOLVEMENT	
Creator (—) Consumer	
Creator (responsible for the creation of the artistic, cultural, or creative expression)	Audience member, supporter, or critic (indirectly involved or associated with the artistic or cultural activity)

²³American Planning Association. 2011. The Role of the Arts and Culture in Planning Practice. <http://www.planning.org/research/arts/briefingpapers/overview.htm> (last accessed October 3, 2013).

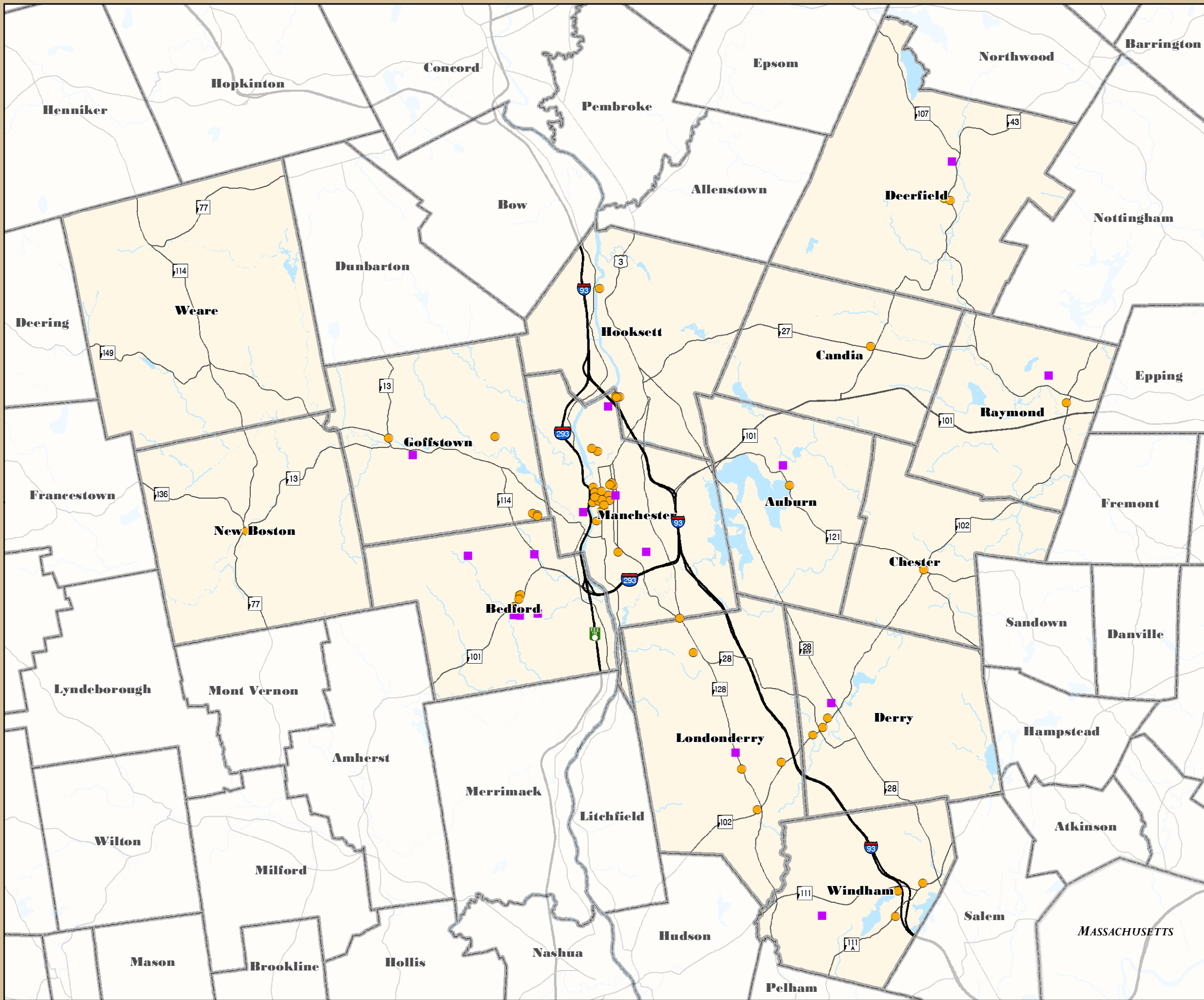
The following locations throughout Southern New Hampshire have been identified as hosting performances such as dances, plays, concerts, live music, recitals, and comedy acts. Venues include various private and public spaces, such as stadiums, town halls, auditoriums, theaters, libraries, banquet halls, churches, schools, recreational centers, taverns, parks, and town commons. While institutions such as the Palace Theater, Verizon Wireless Arena, Tupelo Music Hall, and Currier Museum of Art may be among the most well-known performing arts centers, the region has over 70 centers of varying types and sizes. All of these centers and venues provide a positive economic impact to the region and each community.

TABLE 5 PERFORMING ARTS CENTERS

AUBURN			
1. Auburn Village School	Auburn	18. Adams Memorial Opera House	Derry
2. Circle of Fun Playground Gazebo	Auburn	19. Black Box Theatre - Pinkerton Academy	Derry
BEDFORD		20. Church of Transfiguration	Derry
3. Bedford Dance Center	Bedford	21. MacGregor Park	Derry
4. Bedford High School Theater	Bedford	22. Stockbridge Theatre - Pinkerton Academy	Derry
5. Bedford Old Town Hall	Bedford	GOFFSTOWN	
6. Bedford Public Library	Bedford	23. Goffstown High School Theater	Goffstown
7. Bedford Village Common	Bedford	24. Goffstown Town Common	Goffstown
8. McKelvie Intermediate School	Bedford	25. YMCA Allard Center	Goffstown
9. Memorial Elementary School	Bedford	HOOKSETT	
10. Riddle Brook Elementary School	Bedford	26. Donati Park	Hooksett
11. Ross Lurgio Middle School	Bedford	LONDONDERRY	
CANDIA		27. Londonderry High School	Londonderry
12. Candia Gazebo	Candia	28. Londonderry Senior Center	Londonderry
CHESTER		29. Londonderry Town Common	Londonderry
13. Congregational and Baptist Church	Chester	30. Tupelo Music Hall	Londonderry
14. Stevens Memorial Hall	Chester	31. Whippersnappers	Londonderry
DEERFIELD		MANCHESTER	
15. Deerfield Community School	Deerfield	32. Alva de Mars Megan Chapel Art Center - Saint Anselm College	Manchester
16. Deerfield Gazebo	Deerfield	33. Manchester High School Central	Manchester
17. Deerfield Town Hall	Deerfield	34. Manchester High School West	Manchester
DERRY		35. Currier Museum of Art	Manchester

36. Dana Humanities Center - Saint Anselm College	Manchester
37. Dance Studio of Manchester	Manchester
38. First Congregational Church	Manchester
39. Franco-American Centre	Manchester
40. Grace Episcopal Church	Manchester
41. Jewish Federation Theatre (JFNH)	Manchester
42. Last Chapter Pub - SNHU	Manchester
43. Manchester Memorial High School	Manchester
44. Midnight Rodeo Bar	Manchester
45. Mill-Around-Dance Studio - Waumbec Mill	Manchester
46. Milly's Tavern	Manchester
47. Nancy S. Boettiger Theater - The Derryfield School	Manchester
48. Northeast Delta Dental Stadium	Manchester
49. Palace Theater	Manchester
50. Samuel & May Gruber Recital Hall- Manchester Community Music School	Manchester
51. SNHU Dining Center Banquet Hall	Manchester
52. St. Joseph's Cathedral	Manchester
53. Stark Park	Manchester
54. Strange Brew Tavern	Manchester
55. Studio 550	Manchester
56. The Chateau Restaurant and Event Center	Manchester
57. The Clarion Hotel	Manchester
58. The Jam Factory	Manchester
59. The Shaskeen	Manchester
60. Universalist Unitarian Church	Manchester
61. University of New Hampshire at Manchester Third Floor Auditorium	Manchester
62. Verizon Wireless Arena	Manchester

63. Veterans' Park	Manchester
64. Walker Auditorium - SNHU	Manchester
NEW BOSTON	
65. New Boston Town Common	New Boston
RAYMOND	
66. Raymond High School	Raymond
67. Veronica Laffs Comedy Club	Raymond
WINDHAM	
68. Castleton Banquet and Conference Center	Windham
69. Candia Gazebo - Griffin Park	Windham
70. St. Matthew Parish Catholic Community	Windham
71. Windham High School Theater	Windham



Map # 7 - 1

Granite State Future Cultural & Historic Resources Performing Arts Centers**



- Performing Arts Centers in Schools**
- Performing Arts Centers**
- ↗ Interstates
- ↘ State and US Routes
- Town Boundary
- ~ Rivers
- ~ Lakes

**Performing Arts Center: A multi-use performance space that is intended for use by various types of the performing arts, including dance, music and theatre.

Data Sources:
Granit Digital Data (1:24,000)
NH Department of Transportation
All SNHPC Communities



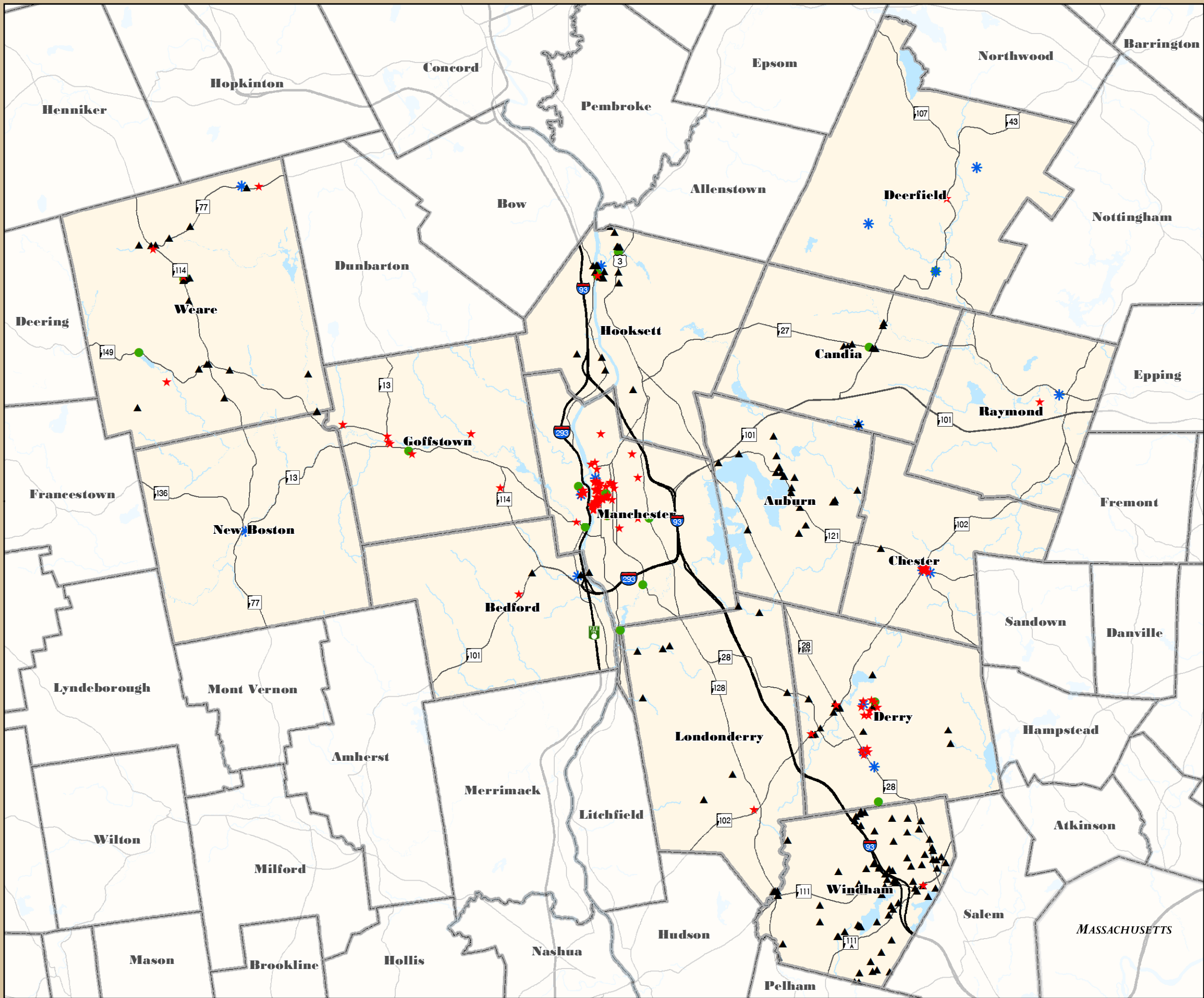
The individual municipalities represented on this map and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.

This map is prepared for planning purposes only and is not to be used for legal boundary determinations or for regulatory purposes.

Map Produced by GIS Service SNHPC 2013.
Contact: SNHPC, gis@snhpc.org or (603) 669-4664

0 1.25 2.5 5
Miles





Map # 7 - 2

Granite State Future



Cultural & Historic Resources Historic Resources

- ★ National Register of Historic Places
- ▲ Individual Structures and Features
- * NH Historical Marker
- State Register of Historic Places
- Interstates
- State and US Routes
- Town Boundary
- Rivers
- Lakes

Data Sources:
Granit Digital Data (1:24,000)
NH Department of Transportation
All SNHPC Communities

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0 1.25 2.5 5
Miles



ARTS AND CULTURAL RESOURCES

PUBLIC ART & CREATIVE SPACES

Public Art are artworks located in public places and/or created using public funds. They usually consist of all forms of visual art conceived in any medium, material or combination thereof, which are placed in areas accessible or visible to the public. Works may be permanent, temporary, or functional. Public art does not include any architectural or landscape design, except when commissioned and designed by an artist.

In the Southern New Hampshire Region, the City of Manchester is home to numerous outdoor art displays, from small, neighborhood installations to large, iconic murals evidenced by the mural on the Manchester College of Pharmacy and Health Sciences building. These projects can be a point of pride for a community or help to combat blight through the repurposing of blank walls or publicly visible areas with murals, drawings or lighting displays. The Manchester community group known as Eagle Eyes is working with young adults in the city to clean up graffiti in publicly visible spaces and replace it with art that reflects the space or the values of the local community. More information on this group can be found on their website: <http://eagleeyes1.org/>

In addition to public art, throughout New Hampshire businesses, non-profits and communities are developing creative spaces to support artists and cultural organizations. Among them:

- Langer Place (Manchester)
- Salmons Falls Mills (Rollingsford)
- The Button Factory (Portsmouth)
- AVA Gallery and Arts Center (Lebanon)
- Riverview Mills (Wilton)
- Mennino Place (Concord)
- Washington Street Mills and Cultural Center (Seacoast area)
see <http://www.onewashingtoncenter.com/space.php>

PLANNING TOOLS FOR THE ARTS

To foster creative business and promote local arts and a creative economy, a variety of planning and zoning tools have been implemented in many communities throughout New England. The City of Lowell, Massachusetts offered financial and regulatory incentives in select areas of their downtown to revitalize under-utilized properties. The city adopted an Artist Overlay District that allowed artists to live and work in the same facility. This mix of uses was previously restricted under the city's zoning code. Lowell also advertised and sponsored these live/work units housed in properties in the Artist Overlay District, some of which the city had acquired through foreclosure. Through partnerships with local property owners, marketing and a zoning overlay, Lowell was able to transform its image as a disinvested, post-industrial city to a creative arts hub north of Boston.

At the state level, a 1998 declaration from the State of Rhode Island's General Assembly allows for tax incentives to be utilized by artists living in locally designated arts districts. Under Rhode Island General Laws §44-18-30B(6) the state offers an exemption from sales tax and personal income tax to all works of art sold by artists so long as they live and work within a locally designated arts district. This sales tax exemption also extends to galleries located within the district.

While the aforementioned tax incentives may not apply to New Hampshire, similar incentives could be offered to New Hampshire residents. Currently New Hampshire offers reduced property tax bills to elderly and disabled property owners under RSA 72:38-a and also offers tax relief to low and moderate income home owners. In addition, RSA 79-E known as the Downtown Tax Incentive was recently expanded to include the potential for tax relief to owners seeking to rehabilitate historic buildings, whether they are located within downtowns and village centers or not; and also adds provisions for making qualified energy improvements. Even if RSA 79-E has already been adopted locally, the town meeting or city council must vote to accept these latest amendments before it can take effect.

Generally all of these articles could be used as model legislation to create a property tax relief program at the local and state level through the application of zoning changes or overlays granting relief to those property owners using commercial or residential space for creative purposes. While it should be noted that many artists, gallery owners, and those participating in other creative industries often rent their work space, this does not rule out an exception that limits the property owner to collecting tax relief in the identified zone. This exception could be implemented if the property owner can demonstrate a certain percentage of their renters are involved in a creative industry. It would be necessary to define exactly what constitutes a creative industry, or any industry type for which a similar moniker is used; however, this would be at the discretion of the enabling legislative body/municipality.

BEST PRACTICES FOR CREATIVE ECONOMIC DEVELOPMENT

There are many examples and best practices in promoting the arts and implementing creative economic development. These strategies and best practices generally center around building creative communities by convening stakeholders, building partnerships and promoting successes. Many of these strategies engage economic development professionals, chambers of commerce, artists/organizations, creative businesses, entrepreneurs, and public officials.

Faced with increasingly tighter budgets and limited resources, municipalities, arts organizations, arts advocates, and artists themselves are challenged to further the important work of bringing art to citizens, visitors, and all sectors within New Hampshire's communities. The **Guide to Creating an Arts and Cultural Plan** is an extensive gathering of local, state and national resources to help community arts organizers, local and regional planners and business leaders. Town and city officials, and economic development professionals who understand the connection between the creative industries and community vitality, can create an action plan to move toward a creative economy planning focus.

Creating an Arts and Culture Plan is a planning strategy that can support community economic development, tourism, and quality of life goals. Working together, community and regional planners, town and city officials, arts and cultural councils, and citizens interested in growing the creative economy and celebrating the role that arts and culture play in community vitality can:

- Identify businesses, individuals, non-profits, and academic organizations that contribute to the creative economy;
- Collect data showing the role that creative industries, public art, and the arts education play in engaging citizens and sustaining community vitality;
- Explore collaborations and partnerships to share resources and ideas;

- Include citizens in creating a plan that is unique to the needs and desires of their individual communities or regions.²⁴

Different organizations, including local and state governments, non-profits, businesses and local and regional planning agencies can take the initiative to create policies to establish and maintain support for building the creative economy. Samples of various policy initiatives are identified and discussed below.

a. Creating an Arts and Cultural Commission

Communities can choose to create an Arts and Cultural Commission to conduct a cultural asset inventory, develop arts and cultural programming, oversee percent for art fund disbursement, and manage public art installations. Example ordinances in New Hampshire include:

- Nashua, NH – Establishing the Nashua Arts Commission
- Rochester, NH – Arts and Culture Commission

It is also important to consider what role an Arts and Cultural Commission will play in the community. Will it have purchasing authority? Will it be a stand-alone nonprofit or part of the City or Town governance structure? Will City or Town resources be available to support the Commission such as office space, accounting services and liability insurance?

b. Establishing an Arts and Cultural District

ArtistLink, a non-profit resource addressing artist needs for space, health insurance, financial support, and business planning, identifies cultural districts as “...a well-recognized, labeled area of a city in which a high concentration of cultural facilities and programs serve as an anchor of attraction. Typically, cultural districts are geographically defined and have many different names, including: arts districts, arts and entertainment districts, arts and science districts, artists’ quarter, museum district, and theatre district.” Communities can choose to create an arts and cultural district to develop tourism, and revitalize neighborhoods.

The Project for Public Spaces (PPS), a non-profit planning, design and educational organization dedicated to helping people create and sustain public spaces, outlines 11 principles for creating great community places. Their pioneering Placemaking approach helps citizens transform their public spaces into vital places that highlight local assets, spur rejuvenation and serve common needs.²⁵

c. Percent for Art Programs

The New Hampshire Percent for Art Program enacted by the State Legislature in 1979 through RSA 19-A:9 and RSA 19-A:10 authorizes one half of one percent of the capital budget appropriation for new buildings or significant renovations to be set aside in a non-lapsing account for the acquisition or commissioning of artwork. The Percent for Art Program is dedicated to aesthetically enriching state-funded buildings, enhancing the effectiveness of the services provided in state buildings through the art displayed there and making the arts more available to our citizens. The program takes a unique approach to the acquisition of artwork by creating a Site Selection Committee that engages in a process where planners, architects, state employees, art professional and private citizens collaborate in the selection, commissioning or purchasing of works of art by artists and craftspeople for state buildings. The

²⁴ <http://nhcreativecommunities.org/Resources/GuidetoCreatinganArtsCulturalMasterPlan/tabid/384/Default.aspx>

²⁵ http://www.pps.org/reference/what_is_placemaking/

themes developed by the committee and the artwork selected often help the agencies housed within the buildings to better meet their mission. Some examples of existing programs in New Hampshire include:

- Hampton Beach Percent for Art Project
- Portsmouth Ordinance for Funding of Public Art
- Portsmouth Public Art Acquisition Policy

d. New Hampshire Creative Communities

There are many examples of creative communities in New Hampshire. New Hampshire's creative community efforts take many forms. They are evolving and established local and regional arts councils, municipally associated arts commissions, statewide arts service organizations, and organizations (chambers of commerce, main street programs, municipal economic development departments) that support strengthening the arts infrastructure in their communities/regions.

The City of Concord offers inspiration and guidance for what can be achieved in other communities in the state. In 2006, the City of Concord set out to develop and enhance the city's creative economy. Their efforts resulted in the 2008 creative economy plan titled: *New Hampshire's Creative Crossroads: The Concord Creative Economy Plan*. The goals of this plan include:

- **Capacity** – Build capacity of Concord's creative sector through strategies such as public and private funding for not-for-profits, information, networking, management assistance, and coordination.
- **Creative Climate** – Develop a business and public policy climate that encourages creativity with a public commitment to creative economic development that actively enables creative enterprises and individual artists.
- **Identity** – Define and promote a creative identity and brand Concord so residents, current and prospective employers, potential creative workers, and visitors understand Concord's unique and authentic identity as a home and destination.
- **Downtown** – Develop and enhance Concord's downtown, implementing Main Street Concord plans for upper-story residential and creative enterprises, special events, restaurants, shopping, and streetscape and façade development that results in a vibrant, lively downtown with activity into the evenings and weekends.
- **Greater Concord** – Enhance neighborhoods and surrounding communities as walkable villages that encourage creative businesses, artist housing, cultural programming, parks and open space, and cultural attractions.²⁶

The achievement of these goals will represent a significant investment in defining Concord as a creative city. Already the Concord Chamber of Commerce has partnered with the City's Economic Development Advisory Council to publish the previously mentioned report and the goal of retaining the offices of the League of New Hampshire Craftsmen has been achieved. Artist housing has also been provided in newly developed units and a feasibility study of incubator space in downtown Concord has been completed.

²⁶ City of Concord Economic Development Advisory Council; Creative Economy Task Force. New Hampshire's Creative Crossroads: The Concord Creative Economy Plan. June 30, 2008.

According to the NEFA, Concord has excelled in defining their creative industries and worked toward breaking down negative stereotypes between contrasting industries. The Creative Crossroads plan notes that a creative economy consists of:

“a cultural core that includes occupations and industries, both for profit and not for profit that focus on the production and distribution of cultural goods and services, as well as intellectual property – but specifically intellectual property that has a cultural component. The **Creative Economy involves** a cultural workforce [consisting of] occupations that represent work that directly produces cultural goods and services, regardless of industry, or work within an industry that makes cultural goods/services regardless of the actual work task. [The creative economy consists of] **Cultural Enterprises** [or] those industries that are involved in the production and or distribution of cultural goods and services.”²⁶

Through the use of public/private partnerships, definition of goals and the addition of a housing component into the long-term feasibility of the expansion of Concord’s creative economy, the city is leading the way in planning for creativity. Municipalities in the SNHPC Region could benefit from the lessons learned in Concord. These municipalities could use the Crossroads plan as a model for creating a regional identity or brand that is amenable to cultural and creative industries.

A thriving arts environment is important to communities. In New Hampshire we know that change happens at the local level and the arts are no exception. Local efforts support and bring new focus to the arts and creativity and what they do for our communities. Provided below is a list of many creative communities and local efforts currently in the works in New Hampshire:

NH Creative Communities

- Arts Alive! (Keene area) www.monadnockartsalive.org
- Arts Alliance of Northern New Hampshire – www.aannh.org
- Art Esprit Rochester – www.artesprit.org
- Art-Speak, Portsmouth Cultural Commission (seacoast) www.art-speak.org
- ArtVentures New Hampshire (statewide)
- AVA Gallery & Arts Center (Lebanon) www.avagallery.org
- City Arts Nashua – www.2.cityartsnashua.org
- Creative Concord – www.concordnhchamber.com
- Dover Arts Commission – www.ci.dover.nh.us
- Great Mills Management (statewide) www.chinburgbuilders.com or www.onewashingtoncenter.com
- Lake Sunapee Region – www.centerfortheartsnh.org
- Lamprey Arts and Cultural Alliance (Newmarket) www.lampreyarts.org
- Lebanon Recreation & Parks Department – <http://recreation.lebnh.net/>
- Manchester Arts Commission
- Manchester Economic Development Office – www.yourmanchesternh.com
- MoCo Arts (Keene) www.moco.org
- New Hampshire Business Committee for the Arts – www.nhbca.com
- Peterborough Cultural Planning Committee
- Portsmouth Economic Development Program
- Rochester Main Street Program – www.rochestermainstreet.org
- Upper Valley Arts Alliance – www.uvarts.org

Provided below is a short summary of some of these programs and local efforts.

Arts Alive!, a Keene-based non-profit that works to sustain, promote, and expand access to arts and cultural resources in the Monadnock region, and Americans for the Arts conducted an 11-month study to quantify the broad economic impact of arts and cultural activities in the Monadnock region. The Arts and Economic Prosperity III study provides compelling new evidence that the nonprofit arts and culture are a \$16.6 million industry in the Monadnock Region supporting 477 full-time equivalent jobs and generates \$1.3 million in local and state government revenue. (see <http://monadnockartsalive.org>)

Art-Speak is a City of Portsmouth Cultural Commission. It was created to support Portsmouth's arts and culture following a recommendation by the Mayor's Blue Ribbon Committee on Arts and Culture in 2002. Art-Speak strengthens Portsmouth's position as a world-class City in which to live, work and play in by supporting and giving voice to its vibrant arts and cultural sector. Art-Speak achieves the following on behalf of Portsmouth's citizens, arts and cultural-related organizations, businesses and the City of Portsmouth itself:

- Promotes appreciation, awareness, participation and dialogue in support of the invaluable contribution that arts, culture and history makes to our city's vitality and quality of life;
- Implements and periodically updates the Portsmouth Cultural Plan;
- Markets and promotes Portsmouth as a cultural destination;
- Creates new resources to support local artists and cultural organizations;
- Performs a coordination function for local arts and cultural organizations and advocates on their behalf at local, state and national levels;
- Convenes an annual forum for community dialogue related to arts and culture;
- Introduces businesses to expectations and the importance of supporting the cultural community;
- Serves as an advisory to all departments of City government on arts and cultural issues;
- Prepares annually a state-of-the-city State of the Arts Report for the City Council;
- Collaborates with regional and state arts and cultural organizations;
- Surveys and measures Portsmouth's arts and culture industry as a \$41.4 million industry; and
- Seeks funding for arts and cultural activities and events.

Art-Speak has non-profit status, which enables the organization to secure private funding from donations, sponsorships and grants to accomplish Portsmouth's arts and cultural goals, as stated in the City's Master Plan. The City of Portsmouth provides office space and associated services as well as limited funding to Art-Speak.

Lakes Creative Economy project is a joint initiative of Belknap EDC, Lakes Region Chamber of Commerce, and Lakes Region Tourism Association that began in the summer of 2012. The mission is to support the growth of a strong creative arts sector in the Lakes Region. The vision for 2020 is the Lakes Region will have a vibrant creative arts community that is valued and supported by residents and visitors. In 2013, the Lakes Creative Economy worked to carry out the following activities:

- Facilitated quarterly Arts Roundtables of creative artists and businesses interested in supporting the arts in the Lakes Region. The purpose of these roundtables is to encourage artists and businesses to partner in new ways and to educate local artists about tools available to them to help them promote their work.
- Established a central, on-line "Arts & Entertainment Calendar" for the Lakes Region.
- Established an on-line "Arts & Entertainment Directory" for the Lakes Region.

CONCLUSIONS AND RECOMMENDATIONS

The Southern New Hampshire Planning Commission region's history spans centuries and encompasses many facets. From agricultural legacies seen in the region's farms and orchards to manufacturing traditions evidenced in the many mills and dams, the region is home to a variety of potential preservation gems. The towns in the region recognize the importance of preserving the historic character of the region, but this is not enough. To transition from the goal of preservation to the execution of preservation, towns should organize a Historic District Commission or a Heritage Commission. Once established, these organizations can utilize the tools for preservation, such as the historic resources survey and inventory, historic district overlay zoning, various preservation easements, grants and loans.

Towns that have created a Historic District Commission or Heritage Commission, and have utilized the various preservation tools, may find it easier to apply for a variety of state and federal designations outlined previously in the types of preservation. By garnering various designations, communities can showcase their unique heritage. It is recommended that municipalities interested in pursuing historic preservation practices should begin researching sites identified in the LRPP for preservation designations or purchase.

Despite the advantages of designation, it is important to realize that historic sites are still vulnerable to loss. Communities should educate themselves and their citizenry about the advantages and disadvantages of historic preservation and implement the types that are most suited to their historic resources.

Many of the aforementioned challenges and goals for the protection and preservation of historic resources are applicable for the region's cultural venues and industry. Without proper foresight and follow through of suggested policies cultural and artistic venues may go in need of new facilities or desperately needed funding sources. For municipalities to move toward expanding local creative economies the City of Concord's policies should be review to determine applicability when crafting municipal policy. Furthermore, cooperation between local business leaders and the creative community should be encouraged. Municipal administrators are in a position to take a leadership role in facilitating this dialogue and should be encouraged to do so.

Historic preservation designations and policies geared toward bolstering arts and cultural resources can provide education – not only to visitors and patrons of the sites and venues, but also to their own citizens thereby encouraging future efforts. Historic, artistic and cultural resources can attract visitors, which can add dollars to the community's economy. Provided below are the key goals and recommendations identified through this chapter and the Project Leadership Team.

Identified Key Goals and Recommendations:

1. Promote greater collaboration between the public and private sector in historic preservation and the arts and culture. The SNHPC should work individually with each of the region's communities to actively collaborate in establishing historic, arts and cultural commissions and developing local arts and historic preservation plans, visions and goals and recommendations that can advance historic preservation and promote the arts and culture in local and regional economic development initiatives and strategies. This includes taking stock and conducting necessary inventory of existing regulations, policies and programs.
2. SNHPC can also help build local leadership and set up appropriate commissions and promote "place-making" as the centerpiece of local historic, arts and cultural plans. This planning must involve the public and key stakeholders within each community and address "place making", arts and culture, and historic preservation.

3. Some additional important goals and recommendations include: (a) keeping arts in regional and local budgets and reinstating arts programs that have been cut; (b) promoting businesses and organizations that can provide the leadership skills necessary to build and maintain public and private support, partnerships and volunteers in the arts and historic preservation; (c) conduct comprehensive inventories of the historic and cultural infrastructure, including cluster and target analysis of specialized historic, arts and culture-related industries and businesses; (d) obtain and provide planning grants and training to communities to promote the arts; (e) consider establishing cultural and mixed use zoning districts; (f) seeking legislative authority to create and implement new tools such as cultural enterprise zones; (g) most importantly, creating and fostering an environment, places, amenities and events that can stimulate investment, create new jobs and business opportunities, attract young workers and build a talented workforce; (h) promoting and supporting historic preservation and the arts and cultural programs in community planning and as a local economic development tool within the community; (i) restoring and protecting arts programs in local schools and raising the importance of arts and culture in the community; and (j) establishing a coordinated and organized network of arts and culture leadership in the state.
4. Artistic talent and historic preservation are essential for revitalization and economic growth. Artists need places to live, work, perform and to exhibit their work. Communities need historic buildings and places to sustain community character and place. All of these actions including the reuse of existing older industrial space and historic properties as space for artists and cultural events and organizations will improve quality of life and attract creative industries and businesses and promote economic growth and development.

H

**(CLIMATE CHANGE IMPACT
ASSESSMENT)**

MOVING SOUTHERN NH FORWARD

VOLUME 2:
Climate Change
Impacts



2015-2035

Regional Comprehensive Plan 2015



Southern New Hampshire Planning Commission works to make our region better by facilitating cooperative and long term decision making. We believe a promising future can be achieved through fiscally sound and responsible planning and development decisions that improve the economy, efficiency and health of our region.

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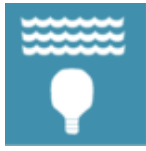
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CLIMATE CHANGE IMPACTS ASSESSMENT

PURPOSE

The purpose of the Climate Change Impacts Assessment Chapter is to identify and evaluate projected changes in the Southern New Hampshire climate outlined in national and regional studies; to encourage that climate change be considered and incorporated into local municipal master plans, hazard mitigation plans and other planning processes; and to offer recommendations for local adaptation strategies and actions.

This chapter is not meant to serve as a comprehensive source of climate change information; rather, it is based upon the Impact Assessment conducted for Southern New Hampshire, *Climate Change in Southern New Hampshire: Past, Present, and Future* (Cameron Wake, et. al., 2014) and the *Northeast Climate Impacts Assessment* (NECIA) (from the Union of Concerned Scientists). These reports offer detailed analyses of the impacts of future climate change and variability over the 21st century. For background information on climate change, please refer to the Resources Section (**Appendix A**, page 46).

VISION

This Chapter is based upon the following identified Value Statement of residents within the region:



Climate Change and Energy Efficiency

Residents support renewable energy choices such as solar, wind, and geothermal that are climate-friendly. They support policies for higher energy efficiency standards in new buildings and incentives for home energy efficiency improvements. Many residents are also concerned about various weather-related events.

This Value Statement is in line with New Hampshire's Livability Principles, which provide:

"Climate Change and Energy Efficiency – identify opportunities to save energy and costs and reduce risks to our communities, businesses and citizens. In recent decades, New Hampshire has seen an increase in extreme storms and flooding coupled with steadily rising fuel and energy prices. How can we reduce dependence on outside sources of energy, construct homes and buildings that are more efficient, and reduce impacts to our communities and infrastructure from extreme storms and flooding?"¹

Public input collected through the Granite State Future (GSF) public outreach efforts, including regional visioning workshops, comments submitted online, and a telephone survey conducted by the University of New Hampshire, demonstrate public support for policies that would serve climate change mitigation by reducing carbon emissions, such as renewable energy and energy efficiency initiatives.

¹ Granite State Future, 2012. History and Principles. <http://www.granitestatefuture.org/about/history-and-overarching-principals/> (last accessed January 27, 2014)

Dr. Cameron Wake, author of *Climate Change in Southern New Hampshire: Past, Present, and Future* (2014), emphasizes three key points about climate change in his public presentations. These points are helpful to keep in mind when considering the vision and purpose of this chapter. First, humans are the main cause of current global warming, and the future is in our hands. Second, climate change is a moral issue since our actions today will disproportionately affect vulnerable populations such as the elderly, sick, and impoverished. Additionally, today's youth and future children and grandchildren will have the greatest burden of climate change without having agreed to or received benefits from burning the fossil fuels that caused global warming. Third, Dr. Wake asserts that on the topic of economy and climate, it is time to replace the tyranny of "or" with the opportunity of "and." The economy is interconnected with and impacted by the environment, and addressing climate change makes economic sense.

OUR COMMUNITY PREPAREDNESS

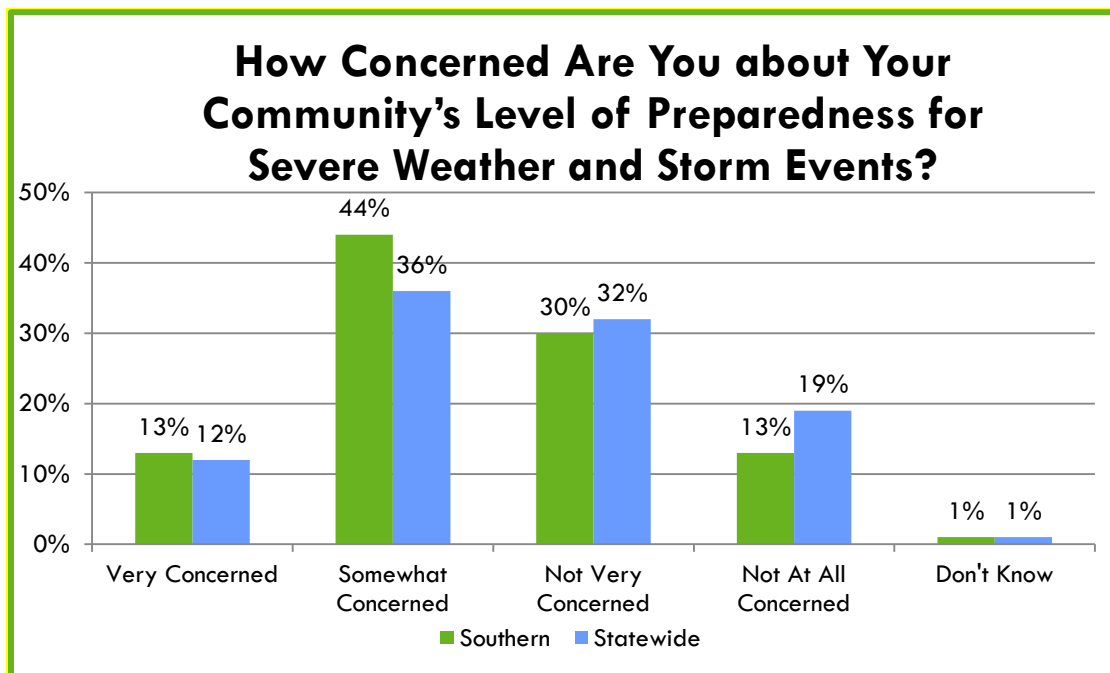
UNH Telephone Survey (2013) results provide further insight into residents' values and opinions regarding community preparedness.

- 57 percent of residents in the region are concerned about their community's level of preparedness in weather-related situations; 13 percent are very concerned and 44 percent are somewhat concerned.
- Older people (70 years of age and older) are more likely to be very concerned with their community's preparedness. 28 percent are very concerned, more than twice the rate of residents overall.

57 percent
of residents are concerned
about their community's
level of preparedness

See **Figure1** for more information from the UNH Telephone Survey on the opinions of the region's residents. Full results can be found in the Granite State Future 2013 Statewide Survey Southern Region Report for NH Regional Planning Commissions.

FIGURE 1 CONCERN ABOUT COMMUNITIES' LEVELS OF PREPAREDNESS (SOURCE: UNH)



WEATHER-RELATED EVENTS

According to the UNH Telephone Survey, many residents are concerned about weather-related events.

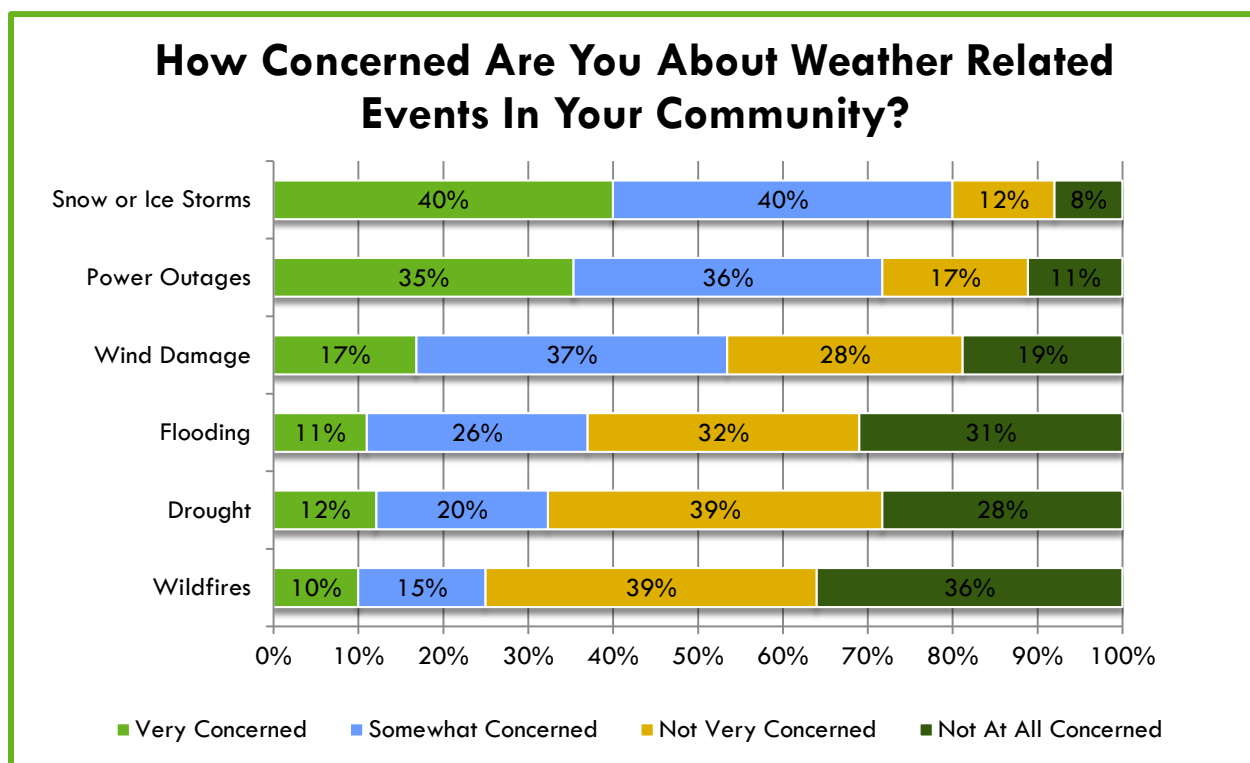
- 80 percent, or four in five residents, are concerned (40 percent “very concerned” and 40 percent “somewhat concerned”) with snow or ice storms in their community.
- 71 percent of residents are concerned about power outages; 35 percent are very concerned and 36 percent are somewhat concerned.
- 54 percent of residents are concerned about wind damage; 17 percent are very concerned and 37 percent are somewhat concerned.
- 37 percent of residents are concerned about flooding; 11 percent are very concerned and 26 percent are somewhat concerned.
- 32 percent of residents are concerned about drought; 12 percent are very concerned and 20 percent are somewhat concerned.
- 25 percent of residents are concerned about wildfires; 10 percent are very concerned and 15 percent are somewhat concerned.
- Older people (70 or older) are more likely to be very concerned about wind damage (30 percent). Older people and those who are retired are also more likely to be very concerned about flooding (22 percent and 14 percent) and wildfires (33 percent and 27 percent).
- Non-white residents and households earning less than \$40,000 are more likely to be very concerned about snow or ice storms (65 percent for non-white residents, 51 percent for those earning less than \$20,000 and 58 percent for those earning \$20,000 to \$39,000). Non-white residents and those who work at home are more likely to be concerned about power outages (52 percent and 51 percent).
- Conversely, young people (18 to 29) are less likely to be very concerned about wind damage and power outages.

71 percent
are concerned about
power outages

Climate change increases the
frequency of strong storms that
can cause outages.

See Figure 2 for more information from the UNH Telephone Survey on the opinions of the region's residents. Full results can be found in the Granite State Future 2013 Statewide Survey Southern Region Report for NH Regional Planning Commissions.

FIGURE 2 CONCERN ABOUT WEATHER-RELATED EVENTS IN YOUR COMMUNITY (SOURCE: UNH)



AT-RISK POPULATIONS

As climate change increases the frequency and severity of weather-related events, community preparedness for these events will become increasingly important.

A major concern in New Hampshire is the aging of the state's population (see Chapter 2: Housing). Residents of 70 years of age and older are more likely to be very concerned with their community's preparedness (28 percent). They were also more likely to be very concerned with three different weather-related events – wind damage, flooding, and wildfires. This heightened concern is perhaps a reflection of limited mobility and/or other challenges faced by seniors. (On a related note, 56 percent of the region's residents want investments in improving the availability of senior and special needs transportation.) As the region's population ages and the share of the population in the older demographic increases, communities may need to take extra steps to ensure their safety in weather-related events.

Other disadvantaged populations are also more likely to be very concerned about various weather-related events, suggesting they may likewise experience extra challenges from adverse weather conditions. Examples of such populations with heightened concerns include non-white residents and households earning less than \$40,000.

NATIONAL CLIMATE CHANGE OPINION

National conversation on climate change influences policies at the various levels of government. A recent poll by the Yale Project on Climate Change Communication found that overall; Americans want their government to take actions to address rapid climate change. The majority of people want less fossil fuels and more low-carbon energy, and many are willing to pay more for those benefits.

- 83 percent of Americans want their country to make an effort to reduce global warming, even if it has economic costs.
- 60 percent of Americans think the U.S. should act “regardless of what other countries do.”
- 73 percent think global warming should be at least a medium priority and 44 percent say it should be a high priority.
- 72 percent want more research funding for renewable energy
- 71 percent support providing tax rebates for people who purchase energy-efficient vehicles or solar panels
- 67 percent want to regulate carbon dioxide as a pollutant
- 59 percent want to cut fossil fuel subsidies entirely. At the same time, 60 percent think cutting renewable subsidies is a bad idea
- 56 percent support requiring electric utilities to produce at least 20 percent of their electricity from renewable energy sources, even if it costs the average household an extra \$100 a year²

87 percent
of Americans want to
reduce global warming,
even if it has economic costs

Interrelated issues such as achieving energy independence (90 percent say it should be at least a medium priority), developing “clean” sources of energy (87 percent say it should be at least a medium priority), and protecting clean water (88 percent say it should be at least a medium priority) received widespread support as well. Increasing energy efficiency and increasing use of renewable energy can lessen dependence on fossil fuels such as foreign oil. Energy efficiency and renewable energy can also help avoid pollution produced through the extraction, transportation, and combustion of fossil fuels. Roughly half of Americans support different revenue-neutral tax swap approaches to a carbon tax. Pricing carbon through a carbon tax helps incentivize the market to choose less carbon-intensive energy sources. A carbon tax can be implemented in the place of an existing tax so that additional taxes are not passed on to consumers.²

² Yale Project on Climate Change Communication and George Mason University Center for Climate Change Communication, 2013. Public Support For Climate And Energy Policies In November 2013. <http://environment.yale.edu/climate-communication/article/public-support-climate-energy-policies-November-2013> (last accessed February 14, 2014)

KEY ISSUES & CONCERNS

Climate Change Impacts in Southern New Hampshire and beyond:

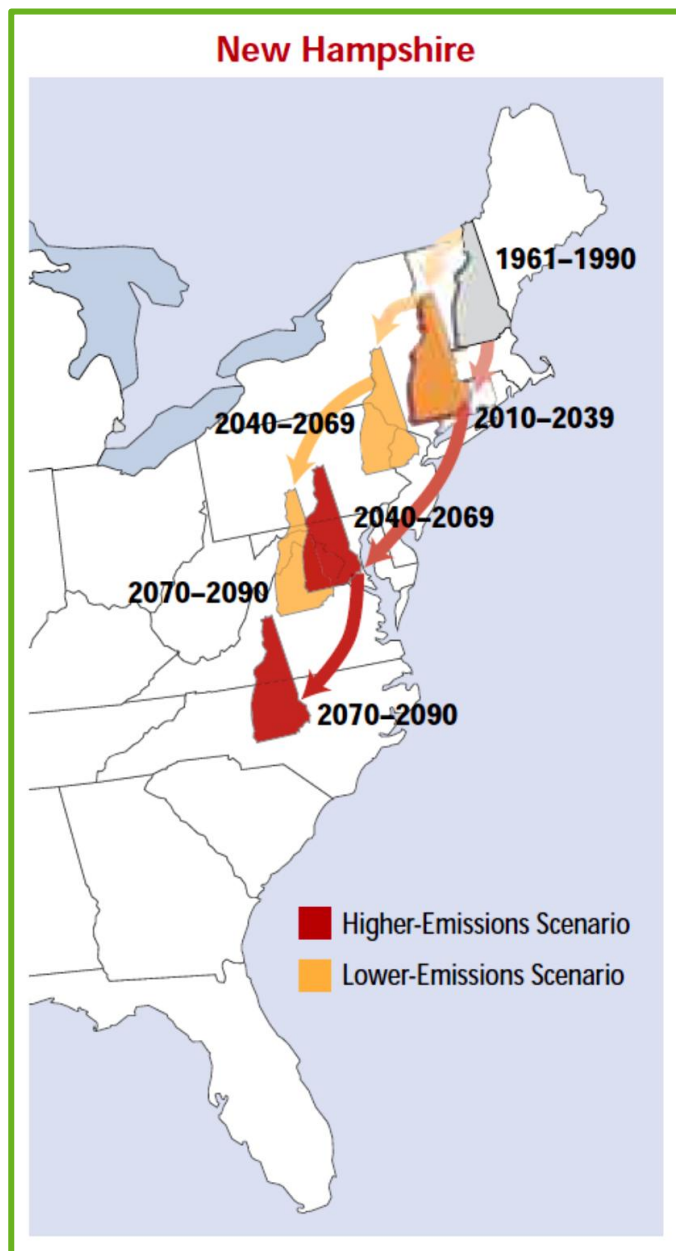
- Summer droughts
- Winter/ spring floods
- Rising food prices
- Ecosystem disruption
- Economic losses
- Health impacts
- Infrastructure damage
- Potential for increased global conflict

Key Issues:

- Political feasibility of adequately addressing climate change in order to achieve the low emissions scenario and maintain a relatively stable climate
- Lack of knowledge about climate change among both elected officials and the public
- The complexity of climate change complicates education efforts
- Difficulty of swiftly transitioning away from fossil fuel infrastructure
- Challenges of rapidly decreasing carbon emissions through energy efficiency and renewable energy measures
- Investing in climate change adaptation
- Developing local, state, and national climate change leadership
- Adopting policies that will lead to achieving emissions goals

EXISTING AND FUTURE CONDITIONS

FIGURE 3 NEW HAMPSHIRE'S MIGRATING CLIMATE
(SOURCE: NECIA)



Climate change, or global warming, has already started and will continue according to the best available science.¹⁶ This section examines present climate changes and two possible scenarios or paths that climate change may take in the future, depending on humanity's energy choices. Global warming is causing changes in Southern New Hampshire's temperature, precipitation, and severe weather events. Impacts affect the region's health, ecosystem, food supply, economy, infrastructure, and military involvement.

SCENARIOS

"[There are] two future global emission scenarios, each of which paints a very different picture. In the low emissions scenario, improvements in energy efficiency combined with the development of renewable energy reduce our emissions of [greenhouse gases] below those of today by 2100. In the high emissions scenario, fossil fuels are assumed to remain a primary energy resource, and emissions of heat-trapping gases grow to three times those of today by 2100. Our current global emissions trend, up through 2012, places us on the high emissions scenario."

- Climate Change in Southern New Hampshire: Past, Present, and Future, 2014

According to the New England Climate Impact Assessment (NECIA, 2007), the climate in New Hampshire of 2040 could be more like that currently in Maryland, and the New Hampshire of 2070 could be more like North Carolina. New Hampshire's climate is migrating – see Figure 3.

CLIMATE CHANGE IMPACTS IN SOUTHERN NEW HAMPSHIRE

LOCAL TEMPERATURE CHANGE

Temperatures in Southern New Hampshire are rising and will continue to rise as global warming progresses. Since 1970, average annual maximum temperatures in Southern New Hampshire have warmed 1.1 to 2.6°F, with the greatest warming occurring in winter (1.6 to 3.4°F). The number of days per year with minimum temperatures below 32°F has decreased by 15 days, and the coldest winter nights are warming. These shifts in temperature have caused the length of the growing season to increase.³

**4°F warming
with low emissions scenario
in Southern NH avg. annual
temperatures by 2100**

**8-9°F warming
with high emissions scenario
in Southern NH avg. annual
temperatures by 2100**

By 2100, maximum and minimum daily temperatures are projected to rise significantly in both the high and low emissions scenario, but the increase in the high emissions scenario is roughly twice that of the low emissions scenario. The difference between the 2100 outcomes for the two scenarios is even starker for minimum temperatures than for maximum temperatures.

Depending on the scenario, mid-century annual average temperatures may increase on average by 3 to 5°F, and end-of-century annual average temperatures may increase as much as 4 to 8°F.

Summer temperatures are expected to experience the most dramatic change, up to 11°F warmer under the higher emissions scenario: “Extreme heat days are projected to increase dramatically, and the hottest days will be hotter, raising concerns regarding the impact of extreme, sustained heat on human health, infrastructure, and the electricity grid.”³

Climate scientist Dr. Cameron Wake has depicted potential future summers in Southern NH where four-fifths of the summer is a heat wave (around 90 °F or higher) punctuated by more bearable cooler days – “think North Carolina.” Summers will experience drought conditions despite the trend of more total precipitation over the course of a year. By 2100, Southern New Hampshire will likely see between **20 and 54 days per year above 90°F** depending on either the low or high emissions scenario. Factoring in the urban heat island effect, Manchester, NH could see over 70 days per year above 90°F by 2100 in the high emissions scenario.³

**>70 days/year above 90°F
in Manchester, NH
by 2100 in the
high emissions scenario**

Temperature data from the Impact Assessment conducted for Southern New Hampshire is displayed in Figure 4 and

Figure 5. The maximum temperatures graphed in Figure 4 are the annual averages of the maximum temperature on each day of the year (e.g. daily highs). The minimum temperatures graphed in

Figure 5 are the annual averages of the minimum temperature on each day of the year (e.g. nightly lows). The red lines represent the high emissions (A1fi) scenario and the blue lines represent the low emissions (B1) scenario. See Appendix C for detailed data.³

³ Wake, C., Burakowski, E., Wilkinson, P., Hayhoe, K., Stoner, A., and Keely, C. 2014. Climate Change in Southern New Hampshire: Past, Present and Future. *Climate Solutions New England*.

FIGURE 4 MODELED MAXIMUM TEMPERATURES FOR SOUTHERN NEW HAMPSHIRE FROM THE HIGH EMISSIONS SCENARIO AND LOWER EMISSIONS SCENARIO FOR ANNUAL TEMPERATURES
(SOURCE: C. WAKE, ET. AL., 2014)

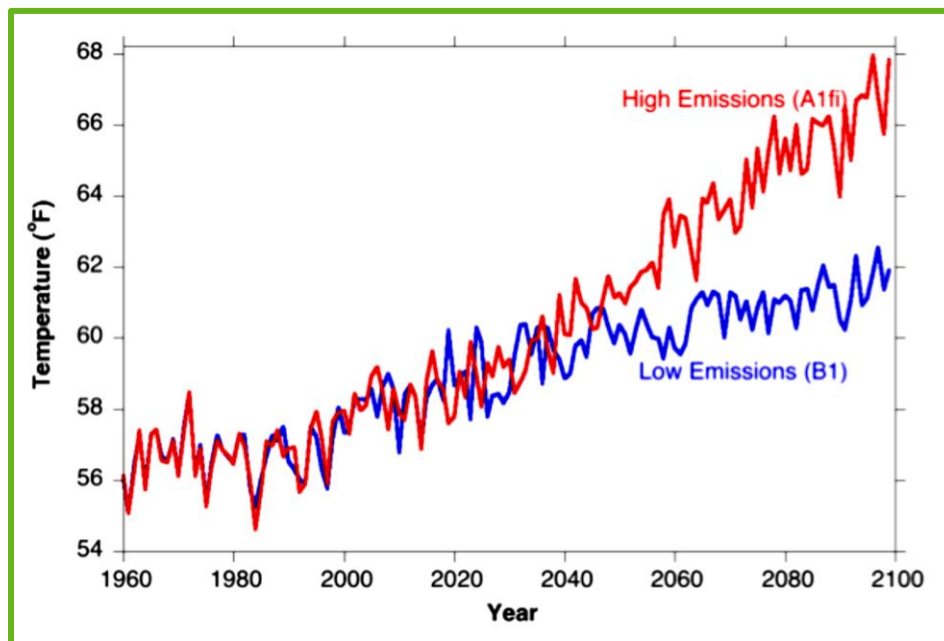
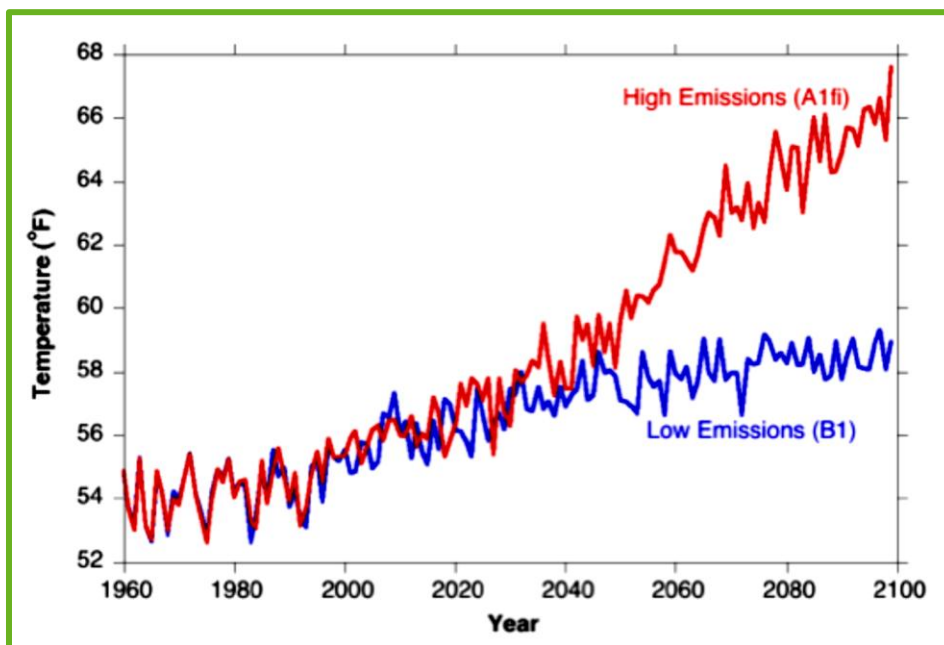


FIGURE 5 MODELED MINIMUM TEMPERATURES FOR SOUTHERN NEW HAMPSHIRE FROM THE HIGH EMISSIONS SCENARIO AND LOWER EMISSIONS SCENARIO FOR ANNUAL TEMPERATURES
(SOURCE: C. WAKE, ET. AL., 2014)



LOCAL PRECIPITATION CHANGE

Climate change has already altered precipitation patterns in the region. Since 1970, annual precipitation in Southern New Hampshire **has increased 12 to 20 percent**. Extreme precipitation events, where at least 1 inch of precipitation falls in 24 hours, have also increased across the region. At some locations the increase in extreme precipitation events has been “dramatic.” The consequence of this increase in large precipitation events is evident in the several large floods that have occurred across New Hampshire over the last decade, such as the 2007 flooding shown in Figure 6 at right.³

FIGURE 6 2007 FLOODING IN DEERFIELD, NH (SOURCE: TOWN OF DEERFIELD)



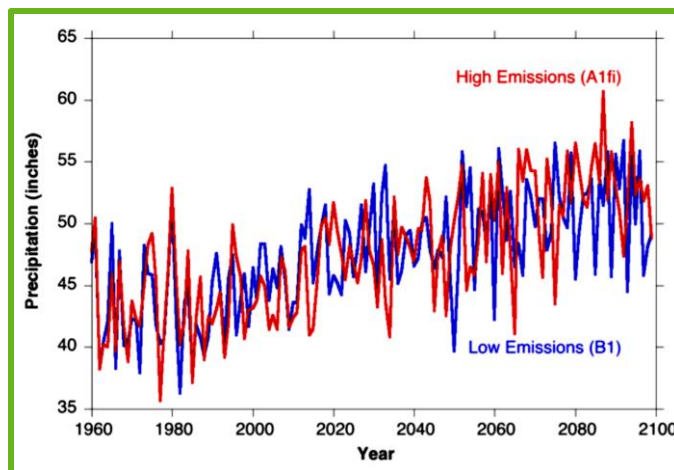
**Triple the severe storms with 4 in.
of precipitation in 48 hours
in Manchester, NH
by 2100 under both scenarios**

Global warming will continue to bring increased precipitation to the region, under both the low emissions and high emissions scenario. Much of the added precipitation will fall in the winter and spring, leading to concerns for increased flooding in these seasons. This extra precipitation will also fall in the

form of more frequent extreme precipitation events. For example, in Manchester it is anticipated that the frequency of storms where 4 inches of rain fall in 48 hours will **double** by 2040-2069 and **triple** by 2070-2099 (relative to the historical amounts from 1980-2009) under both the low emissions and high emissions scenarios.³

Paradoxically, summer droughts are also projected to be an issue since the added precipitation will be competing with longer and strong heat waves that cause faster evaporation rates.³

**FIGURE 7 HISTORICAL AND PROJECTED ANNUAL PRECIPITATION FOR SOUTHERN NEW HAMPSHIRE FOR THE HIGHER EMISSIONS SCENARIO AND LOWER EMISSION SCENARIO
(SOURCE: C. WAKE ET. AL., 2014)**



IMPACTS TO THE BUILT ENVIRONMENT

Climate change can negatively affect the built environment in a number of ways. More frequent extreme precipitation events and higher temperatures in particular can damage infrastructure. For this reason, climate change adaptation efforts are key to protecting investments and saving money in the long term.

Extreme precipitation events result in adverse effects, such as:

- excessive stormwater runoff
- flooding
- increased erosion
- degradation of water quality
- damage to critical infrastructure (e.g. buildings, roads, dams, bridges, culverts, water supply)³

**FIGURE 8 2007 FLOODING IN RAYMOND, NH
(SOURCE: TOWN OF RAYMOND)**



As the data for Manchester displayed in Table 1 and Figure 9 indicate, the number of extreme precipitation events is projected to significantly increase in both the low emissions and high emissions scenarios. The frequency of the most extreme (4" in 48 hours) precipitation event is projected to increase by at least half (56 percent) in the short term and more than triple (328 percent) in the long term. The second most extreme (2" in 48 hours) event is projected to occur at least a quarter more frequently (26 percent increase) in the short term and at least half (56 percent) more often in the long term. The third most extreme (1" in 24 hours) event is projected to occur at least one-sixth (17 percent) more often in the short term and at least one-third (31 percent) more frequently in the long term.

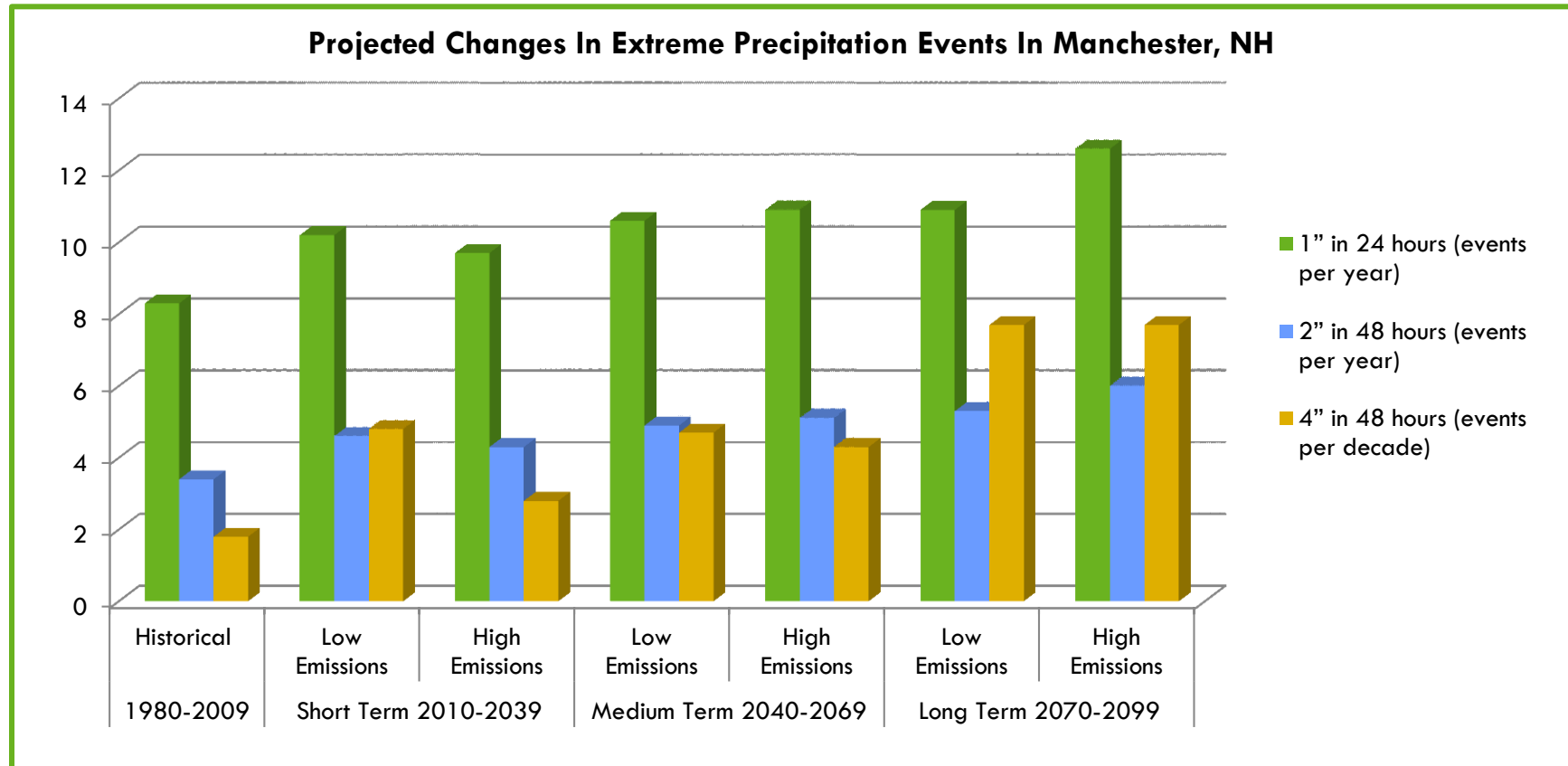
Interestingly, the low emissions scenario would result in higher frequencies of extreme precipitation events in the short term. However, by mid-century the frequencies are similar and by the end of century the high emissions scenario results in more frequent events than does the low emissions scenario.⁴

TABLE 1 PROJECTED CHANGES IN EXTREME PRECIPITATION EVENTS IN MANCHESTER, NH

MANCHESTER	Historical 1980- 2009	Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099	
		Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
1" in 24 hours (events per yr)	8.3	10.2 23% inc	9.7 17% inc	10.6 28% inc	10.9 31% inc	10.9 31% inc	12.6 52% inc
2" in 48 hours (events per yr)	3.4	4.6 35% inc	4.3 26% inc	4.9 44% inc	5.1 50% inc	5.3 56% inc	6.0 76% inc
4" in 48 hours (events per decade)	1.8	4.8 167% inc	2.8 56% inc	4.7 161% inc	4.3 139% inc	7.7 328% inc	7.7 328% inc

⁴ With the exception of 4" in 48 hours events, which are of equal frequency.

FIGURE 9 PROJECTED CHANGES IN EXTREME PRECIPITATION EVENTS IN MANCHESTER, NH 1980-2099



Extreme precipitation and flooding can temporarily block roadways with standing water. Water can tear through roads and destroy bridges, leaving areas impassable and facing millions of dollars in repairs. Homes and businesses in flood zones are susceptible to expensive damage as well. Severe storms can impact the larger economy when extensive damage to key infrastructure occurs. The impact of Hurricane Irene upon New Hampshire and New England provides a recent example of economic ramifications of extreme precipitation events. Thousands of tourists typically travel in autumn to view the fall foliage and enjoy other activities – the Vermont tourism season alone is worth \$300 million – but after the 2011 hurricane, some communities faced major business losses due to the decrease in tourism. In New Hampshire, the Kancamagus Highway suffered from collapses and buckling from Woodstock to North Conway, and several campgrounds were destroyed before one of their busiest weekends.⁵ Like other floods in recent memory in the state, damage was greatest where bridges and culverts were unable to adequately convey flood flows, or where long ago actions such as channel straightening increased the speed of river flow, increasing the force available to erode and undermine river banks and lead to collapse.⁶

FIGURE 10 EMERGENCY CREWS KEEP PEOPLE AT A SAFE DISTANCE FROM THE QUECHEE COVERED BRIDGE IN LEBANON, NH, AS IT FLOODED WITH WATER FROM THE OTTAUQUECHEE RIVER (THE ASSOCIATED PRESS)⁷



⁵ Rathke, L., 2011. Irene's flooding threatens Vermont's fall tourism.

http://seattletimes.com/html/travel/2016094689_trvermont02.html (last accessed March 3, 2014)

⁶ New Hampshire Department of Environmental Services, 2013. Fluvial Erosion Hazards and River Geomorphic Assessment Program. Environmental Fact Sheet.

⁷ The Associated Press, 2011. Hurricane Irene: Wet, deadly and expensive, but no monster.

http://www.nola.com/hurricane/index.ssf/2011/08/hurricane_irene_wet_deadly_and.html (last accessed May 2, 2014)

ECONOMIC IMPACTS

“New Hampshire's social and economic health is predicated in part upon the health of its lakes and rivers, oceans and beaches, mountains, scenic towns, and natural areas.”⁸

— NH Department of Environmental Services, 2008

In the extensive outreach conducted to the region's residents for this updated Regional Comprehensive Plan, one of the most common things that people said was best about where they lived was the natural resources. As the quote above states, New Hampshire's natural resources are linked to its social and economic health.

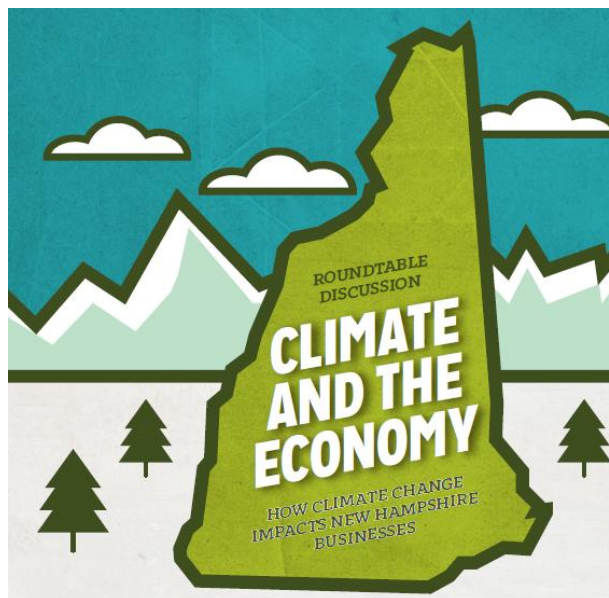
New Hampshire's economy is susceptible to impacts of climate change. While some economic sectors – such as agriculture, forestry, and fisheries; or travel and tourism – are obviously impacted by the environmental damage caused by climate change, all sectors of the economy, regionally and globally, face increased risks from climate change. Severe storm events can wreak havoc on businesses and infrastructure. A 2011 study by the consulting firm Mercer warns that climate change could increase investment-portfolio risk by 10 percent over the next two decades by disrupting supply chains.

In New Hampshire, government and business leaders are already discussing climate and the economy. In August 2013, the NH Institute of Politics hosted a Roundtable Discussion on Climate and Economy: How Climate Change Impacts New Hampshire Businesses. The panel discussion emphasized the need to address climate change to protect businesses from climate change impacts such as flooding damage, price increases of agricultural products, and general economic downturns caused by severe storm events.

FIGURE 11 DISCUSSION OF CLIMATE CHANGE IMPACTS TO THE ECONOMY IN NEW HAMPSHIRE

Stories at the roundtable discussion, like that from Smuttynose Brewery owner Peter Egleston, offer concrete examples of the economic impacts of climate change. Mr. Egleston said that Smuttynose lost a large warehouse in New York City due to heavy flooding caused by Superstorm Sandy in 2012, but the biggest impact of flooding was the lost customers - many restaurants and bars that were unable to recover from the flooding remained closed. Storms like Sandy are becoming increasingly frequent in a warming world. Global droughts have also led to a 200 percent increase in the price of barley, one of the main ingredients in beer, driving up production costs. Mr. Egleston encourages climate change action.

Climate change impacts the bottom line of not only businesses, but also of government.



⁸ New Hampshire Department of Environmental Services, 2008. Global Climate Change and Its Impact on New Hampshire. *Environmental Fact Sheet*. <http://des.nh.gov/organization/commissioner/pip/factsheets/ard/documents/ard-23.pdf> (last accessed April 14, 2014)

Also at the roundtable discussion, New Hampshire Department of Resources and Economic Development (DRED) Commissioner Jeff Rose spoke of the impacts of climate change upon major industries and state revenue sources closely connected to natural resources and vulnerable to bad weather. He highlighted the travel and tourism industry, the ski and snowmobile industry, and state parks as industries and state revenue sources that are particularly sensitive to the impacts of adverse weather.

The New Hampshire Climate Action Plan emphasizes the economic imperative to mitigate climate change – quickly:

The sooner [greenhouse gas emission] reductions are accomplished, the greater the economic benefit; actions can either begin more quickly to provide a fairly steady rate of greenhouse gas emission reductions or they could be delayed, thus requiring larger reductions at a later time. **Delays in achieving reductions would result in increased implementation costs, thus reducing their economic benefit and making it more difficult to reach the long-term goal** [bold in original].⁹

⁹ New Hampshire Climate Change Policy Task Force, 2009. The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future. *NH Department of Environmental Services*. http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf (last accessed February 14, 2014)

AGRICULTURE



FIGURE 12 CROPS SUCH AS APPLES AND BLUEBERRIES MAY BE ADVERSELY IMPACTED BY CLIMATE CHANGE

Farming in Southern New Hampshire will need to adapt to many agricultural changes and a number of adverse impacts from global warming. While farmers expect a longer growing season brought by higher temperatures, there are also risks that gains could potentially be offset and exceeded by adverse impacts such as increased pressure from invasive weeds, pests and disease; changing rainfall patterns; summer droughts and heat waves; warmer winters, and more frequent damaging storm events.³

According to *Climate Change in Southern New Hampshire: Past, Present, and Future*: “The growing

“As temperatures rise, farms and fisheries will likely face increasing problems with productivity, potentially damaging livelihoods and the regional economy.”¹⁰

– U.S. Environmental Protection Agency, 2007

season will get longer, which may provide opportunities for farmers to grow new crops. However, many existing crops will likely experience yield losses associated with increased frequency of high temperature stress, inadequate winter chill period for optimum fruiting, and increased pressure from invasive weeds, insects, or disease.”³ Large portions of the Northeast may become unsuitable for growing some traditional New England fruit varieties of apples and blueberries and some varieties of staple crops such as grain, and soybeans. Error! Bookmark not defined.

Rising minimum temperatures in winter will also likely open the door to invasion of cold-intolerant species that prey on the region’s forests and crops. Error! Bookmark not defined. Climate change further enables the orthward expansion of invasive insects like the woolly adelgid (*Adelges tsugae*), an aphid-like insect that has decimated stands of eastern hemlock from Georgia to Connecticut since the 1950s.³

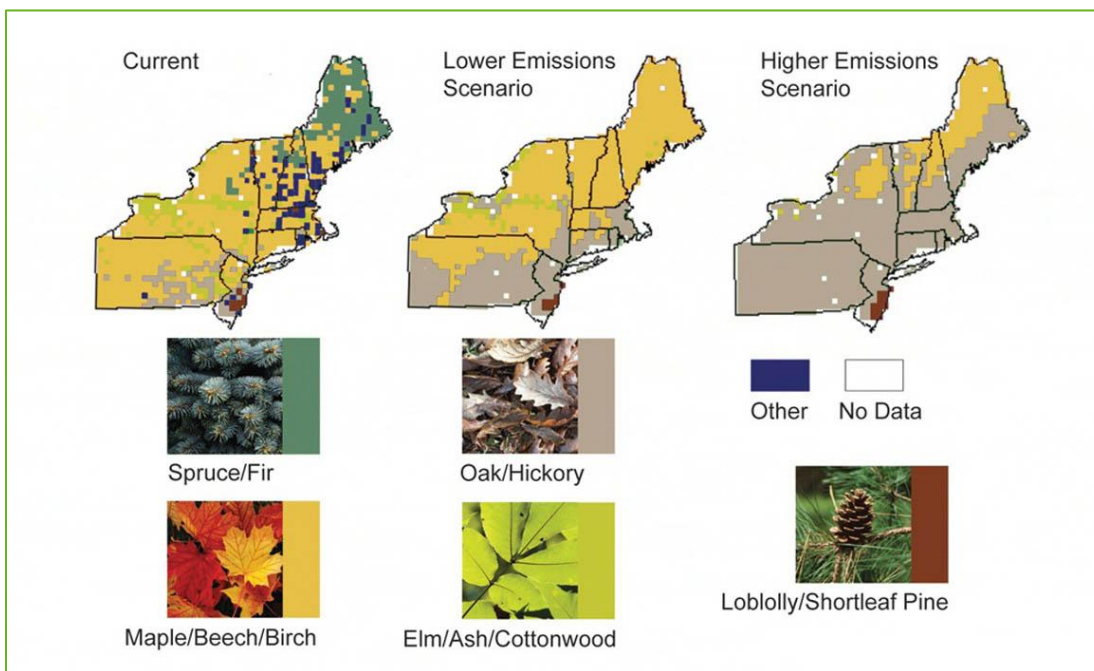
The timber industry will experience further challenges since the spruce and fir forests that serve a source of sawlogs and pulpwood are projected to “all but disappear from the Northeast.” According to the *Northeast Climate Impacts Assessment* (NECIA), if the higher-emissions scenario prevails, productivity of spruce/fir forests is expected to decline and suitable habitat will nearly vanish by 2100; see Figure 13. Major losses are projected even under the lower-emissions scenario. This would greatly exacerbate stresses on the pulp and paper industry in New Hampshire and the rest of the Northeast.¹⁰

Dairy production, another aspect of the Northeast’s agricultural economy, will also face adverse impacts. Increases in temperature and associated heat stress will likely reduce milk yields and slow weight gain in dairy cows. According to NECIA, “the projected increases in temperature would negatively affect operations, since production costs would increase with reductions in milk and meat production.

¹⁰ Frumhoff, P. C., McCarthy, J. J., Melillo, J. M., Moser, S. C., Wuebbles, D. J., 2007. Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions. *Northeast Climate Impacts Assessment (NECIA)*. Union of Concerned Scientists. <http://www.northeastclimateimpacts.org/pdf/confronting-climate-change-in-the-u-s-northeast.pdf> (last accessed February 3, 2014)

A BROWN AUTUMN?

**FIGURE 13 CHANGES IN HABITAT FOR DIFFERENT FOREST TYPES BY LATE CENTURY
(SOURCE: NECIA, 2007)**



Changes to New Hampshire's forests will also affect the fall tourism and maple syrup industries. As the Union of Concerned Scientists reports, "Because forests cover most of New Hampshire, projected changes in forest species will change the character of the state." Sugar maples, with their characteristic foliage and maple sugar producing properties occur exclusively in the northeastern United States and southeastern Canada.¹¹ Unfortunately, this species is one of many that will be adversely impacted by climate change:

"Maple sugar production depends on prolonged cold temperatures with freezing nights and warm daytime temperatures to create the optimal sugar content and sap production. With warming under way, the maple sugar industry long associated with New England has already felt some impact. Over the last two decades, the center of maple sugar production has shifted from the United States into Canada. Global climate models project a substantial northward shift in maple tree distribution. Such shifts in forest vegetation could cause lower elevations in New Hampshire to lose their brilliant fall foliage and resemble instead the brown autumns currently experienced in southern Pennsylvania."¹¹

As the maps in Figure 13 show, the higher emissions scenario is projected to eliminate maple habitat from Southern New Hampshire by 2100. The colors in the map correspond to the different forest types shown in the color-coded photos.

¹¹Ekwurzel, B., n.d. Global Warming in New Hampshire: Our Climate, Economy, and Health. The Union of Concerned Scientists. http://www.ucsusa.org/assets/documents/global_warming/nh_warming_webfinal.pdf (last accessed February 7, 2014)

WILDLIFE

According to the New Hampshire Wildlife Action Plan, the state's coastal habitats outside the region will likely be the most immediately affected by climate change due to sea level rise. Sea level rise inundates habitat, changes water salinities and increases the damaging effects of storm surge. In inland areas with freshwater habitats such as the SNHPC region, more precipitation occurring in stronger storms and longer summer droughts will alter stream flooding and wetland recharge. Increasing temperature will also affect the ranges and reproductive cycles aquatic species, while in terrestrial habitats species will relocate to accommodate their preferred temperature and moisture ranges. Species composition will shift and will potentially result in altered food webs and other natural process.¹²

According to NH Fish and Game biologists and other experts, who spoke at a July 2013 workshop of the N.H. Coastal Adaptation Workgroup, animal species face pressure from shifts in temperature and the plants they depend on. Some animal species such as moose are not expected to be able to migrate north, and will face climate change impacts in the current ranges without relocating to more suitable habitats. Species such as loons which are at the southern end of their ranges may move northward. Particularly sensitive species, such as purple finches, are expected to disappear as early as 2050. Migratory birds, who comprise the vast majority of New Hampshire's breeding birds, that winter far away from the state in the Caribbean and Central America, are expected to have difficulties timing their migration to match the changing start date of spring and the start of available food for their young. Migratory birds will be exposed to climate change impacts not only in New Hampshire, but wherever else they stay around the year. Species that live at higher elevations in the state, such as Bicknell's Thrush, may find that the majority of their suitable habitat disappearing if temperatures continue to rise.¹³

FIGURE 14 NEW HAMPSHIRE'S MOOSE ARE IMPACTED BY CLIMATE CHANGE



New Hampshire's moose are already facing stresses worsened by climate change, and many biologists are concerned about their ability to adapt to future changes.¹³ The New Hampshire moose population has plummeted by more than 40 percent in the last decade; only 4,500 moose remain today from the previous population of 7,500. Biologists attribute some of this decline to increasing parasite loads – namely, ticks and brain worm– influenced by shorter winters caused by climate change. Ticks leave moose weakened from blood loss, and many die of anemia. Individual moose have been found to be infested with 150,000 ticks, five times more than normal. After the 2001 winter, of the collared moose in New Hampshire, 75 percent of the calves died along with 20 percent of the adult cows. Over a five year period, ticks accounted for 41 percent of all moose deaths in the state.¹³

Heat also negatively affects moose directly, as summer heat stress leads to weight loss, reduced pregnancy rates, and increased susceptibility to predators and disease. When it gets too warm, moose typically seek shelter rather than foraging for nutritious foods needed to keep them healthy. For the past

¹² New Hampshire Fish and Game Department, 2013. Ecosystems and Wildlife Climate Change Adaptation Plan. Amendment to the New Hampshire Wildlife Action Plan. http://www.wildlife.state.nh.us/Wildlife/Wildlife_Plan/climate_change/Eco_Wildlife_CC_Adapt_Plan.pdf (last accessed March 3, 2014)

¹³ National Wildlife Federation, n.d. New Hampshire: Help Save the Moose from a Changing Climate. <http://www.nwf.org/pdf/2013-State-Facts-Postcards/NH%20Fact%20Sheet.pdf> (last accessed March 3, 2014)

few years, many New Hampshire cows have been under the weight necessary to successfully bear calves, and fewer calves are born today than were born a decade ago. The many impacts that moose face from climate change are examples of the ways in which other species can similarly be affected.¹³

HEALTH IMPACTS

New Hampshire and the Northeast are projected to experience a number of adverse health impacts due to climate change. One reason for this is the amount of extremely hot days per year will greatly increase over the coming century, especially under the higher-emissions scenario. These heat waves will increase the risk of heat-related illness and death among vulnerable populations, especially in urban areas.

For example, under the higher-emissions scenario, the greater Manchester area could experience 23 days over 100°F and over 65 days over 90°F each summer by 2100 according to the *Northeast Climate Impact Assessment* (NECIA); see Figure 15.¹⁰

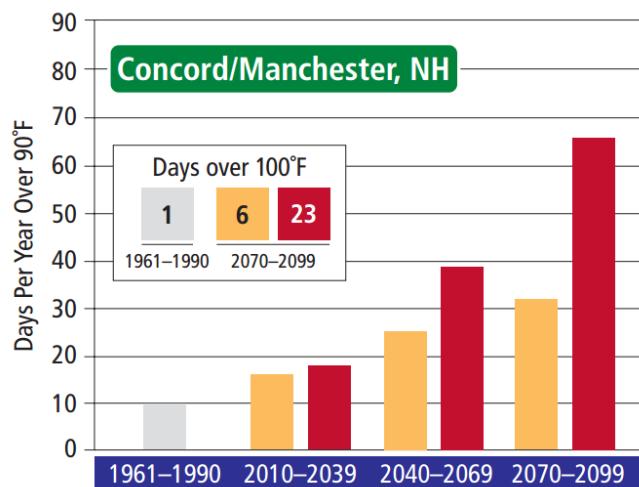
According to the most recent climate change assessment, Manchester will experience 38 to 73 days over 90°F each summer depending on the scenario.³ The 2003 heat wave in Europe that caused up to 70,000 excess deaths shows just how deadly heat can be, even in “developed” countries.¹⁴

Due to higher temperatures, global warming could worsen air pollution in the state, creating more days when national air-quality standards cannot be met. Again, this impact will be worse under the higher-emissions scenario. Poor air quality will exacerbate the risk of respiratory, cardiovascular, and other ailments, if local vehicle and industrial emissions of ozone-forming pollutants are not reduced.¹⁰ Ground-level ozone concentrations cause direct lung injury and increase the severity of respiratory diseases such as asthma and chronic obstructive pulmonary disease.⁹ Allergy sufferers can expect rising temperatures and carbon dioxide levels to worsen pollen-based allergies across the Northeast, particularly under the higher-emissions scenario.¹⁰

More frequent outbreaks of mosquito-borne diseases such as West Nile virus may be another consequence of hotter, longer, drier summers punctuated by heavy rainstorms, which create favorable conditions for mosquito habitat.¹⁰

Ticks are another pest whose New Hampshire population could grow in a warming world. The Center for Disease Control and Prevention (CDC) warns that climate change is causing ecosystem changes that include the migration of vectors and animal hosts that carry Lyme disease, which is transmitted via ticks.¹⁵ The NH

FIGURE 15 INCREASING FREQUENCY OF EXTREME TEMPERATURES CORRESPONDS TO INCREASED HEALTH IMPACTS (NECIA, 2007)



¹⁴ University College London and The Lancet Medical Journal, 2009. Climate change: The Biggest Global-Health Threat Of The 21st Century. <http://www.ucl.ac.uk/news/news-articles/0905/09051501> (last accessed February 19, 2013).

¹⁵ Center for Disease Control and Prevention (CDC), 2010. Health Effects. *Climate and Health Program*. <http://www.cdc.gov/climateandhealth/effects/default.htm> (last accessed March 3, 2014)

Climate Action Plan states that public health officials need better data/analysis for vector-borne infectious disease forecasting and an understanding of what indicators to track, such as weather patterns, mosquito pools, and tick populations.⁹

FIGURE 16 TICK AND MOSQUITO POPULATIONS COULD INCREASE IN NH DUE TO CLIMATE CHANGE



The CDC also links drought caused or worsened by climate change to impacts on human health. Droughts can potentially strain agricultural productivity and result in increased food prices and food shortages, worsening strain on those affected by hunger and food insecurity in the U.S., including here in New Hampshire. Droughts can also result in shortages of clean water and may concentrate contaminants that negatively affect surface waters in some areas.¹⁵

IMPACTS IN NEW HAMPSHIRE AND BEYOND

ECOSYSTEMS AND INTERRELATED IMPACTS

Climate change “poses an immediate and grave threat, driving ill-health and increasing the risk of conflict, such that each feeds upon the other.”

– British Medical Journal, 2011

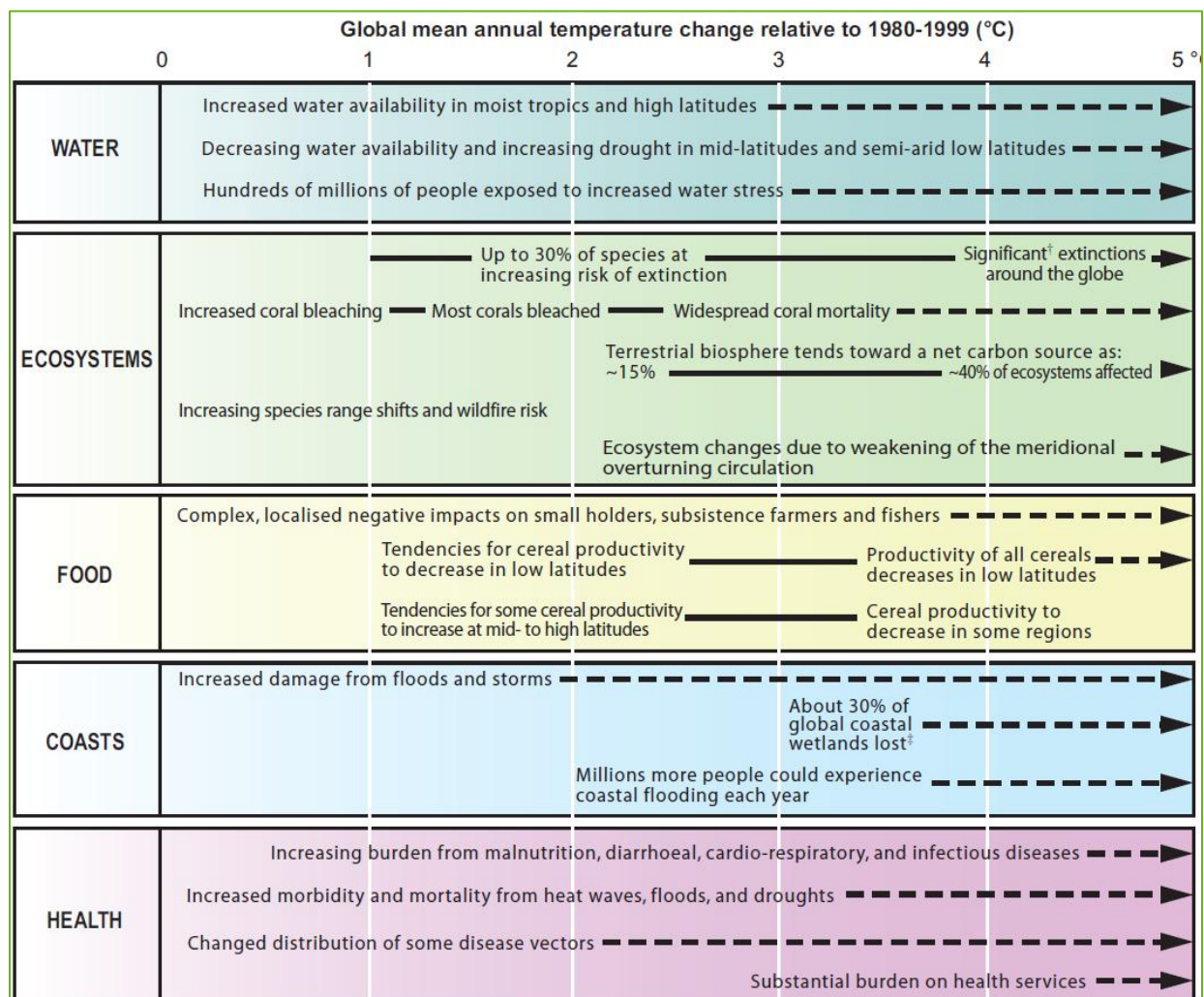
According to the IPCC, “the resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change, associated disturbances (e.g., flooding, drought, wildfire, insects, ocean acidification), and other global change drivers (e.g., land use change, pollution, over-exploitation of resources).”¹⁶

If increases in global average temperature exceed 1.5-2.5°C (2.7-4.5°F), roughly 20 to 30 percent of plant and animal species assessed so far are likely to be at increased risk of extinction. For increases in global average temperature exceeding 1.5-2.5°C (2.7-4.5°F) with rising atmospheric carbon dioxide emissions, the IPCC predicts that there will be “major changes in ecosystem structure and function, species’ ecological interactions, and species’ geographical ranges, with predominantly negative consequences for biodiversity, and ecosystem goods and services e.g., water and food supply.” More than 40 percent of species could be threatened with extinction by the end of the century in the high emissions scenario.¹⁶

In North America disturbances from pests, diseases and fire are projected to have increasing impacts on forests, causing extended periods of high fire risk and large increases in acreage burned. The IPCC joins many other sources in noting that increases in the frequency of droughts and floods are also expected to impact local crop production negatively. Carbon dioxide emissions will also cause progressive acidification of oceans, which is expected to have negative impacts on marine shell-forming organisms and their dependent species. Regional changes in the distribution and production of particular fish species are projected, with adverse effects for aquaculture and fisheries.¹⁶

Table 2, from the Intergovernmental Panel on Climate Change (IPCC), displays increasing global impacts of climate change to water, ecosystems, food, coasts, and health as a function of temperature.¹⁶ The temperature at which the impact begins corresponds to the left-most boundary of the text. Note that some scientists have criticized the IPCC’s analysis for being too conservative with regard to food supply impacts and sea level rise/ coastal impacts, which the latest science shows are worsening at a faster rate than anticipated.

¹⁶ Intergovernmental Panel on Climate Change (IPCC), 2007. Climate Change 2007: Synthesis Report.

TABLE 2 KEY IMPACTS AS A FUNCTION OF INCREASING GLOBAL AVERAGE TEMPERATURE CHANGE (IPCC, 2007)


Notes: [†]Significant is defined here as more than 40 percent. [‡]Based on average rate of sea level rise of 4.2 mm/year from 2000 to 2080.

Directions for reading chart: an impact begins at the left-most end of its text. Fahrenheit temperature change conversions as follows: 0°C=0°F, 1°C=1.8°F, 2°C=3.6°F, 3°C=5.4°F, 4°C=7.2°F, 5°C=9°F

Many of the impacts listed in the chart begin before as little as 1°C (1.8°F) of climate change occurs. Some of these immediate impacts include:

- Hundreds of millions of people exposed to increased water stress
- Increasing species range shifts and wildfire risk
- Increased deaths from heat waves, floods, and droughts
- Changed distribution of some disease vectors
- Complex, localized negative impacts on small holders, subsistence farmers and fishers
- Increased damage from floods and storms [coastal]

Impacts that occur by 5°C (9°F) of warming, which a business-as-usual, high emissions scenario track takes the planet to by 2100:

- More than 40 percent of species extinct
- About 30 percent of global coastal wetlands lost
- “Substantial burden on health services”

Alarming, the 2011 rate of global emissions puts the world on track to hit 5°C (9°F) of warming even sooner than projected, to reach 6°C (11°F) of warming the end of the century. According to the chief economist of the International Energy Agency, “When I look at this data, the trend is perfectly in line with a temperature increase of 6 degrees Celsius, which would have devastating consequences for the planet.”¹⁷ Similarly, 2011 emissions data shows the door for achieving the low emissions scenario is “about to close.”¹⁸ Not much time is left in which to swiftly transition away from fossil fuels in time to avoid commitment to a higher emissions scenario.

The long-term nature of the worst of these effects is another challenge of climate change. According to research from the National Oceanic and Atmospheric Administration:

“...the climate change that is taking place because of increases in carbon dioxide concentration is largely irreversible for 1,000 years after emissions stop.... Among illustrative irreversible impacts that should be expected if atmospheric carbon dioxide concentrations increase from current levels near 385 parts per million by volume (ppmv) to a peak of 450-600 ppmv over the coming century are irreversible dry-season rainfall reductions in several regions comparable to those of the “dust bowl” era and inexorable sea level rise.”¹⁹

New Hampshire is susceptible to the effects of sea level rise as coastal state and “dust-bowl” like conditions in the mid-west and western United States could have a profound impact on our food security.

FOOD INSECURITY

As the weather patterns change across the world, the future predictability and reliability of crop yield has been called into question. Mild changes to weather will have growing effect on the output of farms, either positive or negative, in many parts of the world. However positive effects will be eroded by severe weather events, which are increasing in severity and frequency due to climate change, and which will have decidedly negative effects on crop yield. Severe weather events include events such as floods, strong storms, and droughts.

A 2011 report by Oxfam International, a nonprofit organization focused on global poverty, shows the price of corn (or maize) is expected to double in the United States by 2030. It states that if a drought

¹⁷ Reuters, 2012. Global CO2 emissions hit record in 2011 led by China-IEA. <http://uk.reuters.com/article/2012/05/30/co2-iea-idUKL5E8GO6B520120530> (last accessed February 19, 2014)

¹⁸ International Energy Agency (IEA), 2012. Global carbon-dioxide emissions increase by 1.0 Gt in 2011 to record high. <http://www.iea.org/newsroomandevents/news/2012/may/name,27216,en.html> (last accessed February 19, 2014)

¹⁹ National Oceanic and Atmospheric Administration (NOAA), 2009. New Study Shows Climate Change Largely Irreversible. http://www.noaa.gov/stories2009/20090126_climate.html (last accessed February 19, 2014).

event occurs in the year 2030, due to reduced resilience in yield, the price will rise an additional 140 percent. The drought and flood patterns that continue to test crops in southern Africa could increase the price of a 25kg bag of corn meal, a nutrition staple, 220 percent by 2030. Similarly, the cost of rice could rise 25 percent due to drought in some areas and flooding and other areas of India and Southeast Asia,²⁰ with implications on the price of rice for consumers worldwide.

Luxury crops such as coffee will also be hit by the effects of climate change. According to the executive director of the World Coffee Research program, "The rise in global temperature is of great concern for us in the coffee industry because it will – and has already started – putting the supply of quality coffee at great risk. It is also obvious that increasing temperatures – as well as extreme weather events – have a very negative affect on production. Over the long term, you will definitely see coffee prices going up as a result of climate change."²¹ Coffee companies such as Starbucks also recognize the need to address climate change.²²

FIGURE 17 THE PRICE OF GROCERIES IS PROJECTED TO RISE DUE TO CLIMATE CHANGE



The recent drought in the mid-west United States in 2013 serves as an example of how crop yield can be stressed by extreme weather

events. California is now experiencing one of the worst droughts in over 100 years, again straining farms to meet expected yields. According to NOAA, if CO₂ emissions are allowed to peak at 450-600 parts per million, the results would include persistent decreases in dry-season rainfall comparable to the 1930s North American Dust Bowl in multiple zones, including here in the United States in southwestern North America, as well as in southern Europe, northern Africa, southern Africa and western Australia.¹⁹ Beyond the direct effects to the resilience of the farming industry, the decrease in food availability disproportionately and devastatingly affects the world's poor, who according to Oxfam spend up to 75 percent of their income on food. As an Oxfam policy advisor stressed, "The huge potential impact of extreme weather events on future food prices is missing from today's climate change debate. The world needs to wake up to the drastic consequences facing our food system of climate inaction."²⁰

Weather and climate-related food shortages in other parts of the United States and the world are of particular concern for those of us in the State of New Hampshire because "we rely on outside sources for 96 percent of the food we consume. Although famine in New Hampshire may sound absurd, the possibility of widespread hunger hides behind fewer than five days of grocery supply. If travel and transport

²⁰ Oxfam International. 2011. Food Price Spikes Will Get Worse As Extreme Weather Caused By Climate Change Devastates Food Production. <http://www.oxfam.org/en/grow/pressroom/pressrelease/2012-09-05/food-price-spikes-will-get-worse-extreme-weather-climate-change> (last accessed February 18, 2014).

²¹ Carrington, D., 2014. How climate change will brew a bad-tasting, expensive cup of coffee. *The Guardian*. <http://www.theguardian.com/environment/2014/mar/28/climate-change-bad-expensive-coffee-ipcc> (last accessed April 14, 2014)

²² Starbucks Corporation, 2014. Climate Change. <http://www.starbucks.com/responsibility/environment/climate-change> (last accessed April 14, 2014)

restrictions were enforced to halt the spread of deadly disease, how could we possibly avoid food shortages? This looming threat to our sustenance and security cannot go unnoticed.”²³

Food insecurity is already an issue for families in New Hampshire and in Manchester in particular. Feeding America’s “Map the Meal Gap 2013” study estimated that 11 percent of residents in New Hampshire remain food insecure, and the number of seniors and children in need are rising. Five percent of seniors ages 60 and over (13,000 people) are food insecure. The “Map the Meal Gap” study has shown a steady increase in senior hunger and projected that if the growth remains consistent, 22 percent of seniors will be food insecure in 2030. 14 percent of children in New Hampshire are food insecure, and nearly half are not eligible for federal nutrition assistance.²⁴

In Manchester, more than 10% of families are below of poverty level and the City is categorized as at moderate risk of food insecurity. Although its risk was categorized as moderate rather than high since its high poverty level was somewhat offset by its high urban population density, researchers with the Children’s Alliance of New Hampshire and the Carsey Institute stress it is important to note that Manchester has neighborhoods that “are at serious risk of food insecurity due to poverty alone.”²⁵ The families in these neighborhoods especially could be adversely impacted by rising food prices caused by climate change impacts.

²³ Lougee, Jeremy. Sustaining Agriculture in the Granite State. 2009.
<http://www.conservationtrust.org/Keep%20Growing%20resources/SustainingNHAggriculture.pdf> (last accessed April 14, 2014)

²⁴ The New Hampshire Food Bank, 2013. New Data Shows NH's Most Vulnerable Populations Have Increased Need for Food Assistance. <http://www.nhfoodbank.org/news-and-events/6/18/2013/New-Data-Shows-NH-s-Most-Vulnerable-Populations-Have-Increased-Need-for-Food-Assistance> (last accessed April 14, 2014)

²⁵ Wauchope, B. and Ward, S. K., 2012. Mapping food Insecurity and Food Sources in New Hampshire Cities and Towns. *Children’s Alliance of New Hampshire and the Carsey Institute*.
<http://www.carseyinstitute.unh.edu/publications/1B-Wauchope-CAofNH-NH-Food-Insecurity.pdf> (last accessed April 14, 2014)

IMPACTS TO THE ECONOMY

“In corporate boardrooms and the offices of CEOs, climate change is a real and present danger. It threatens to disrupt the water supplies and supply chains of companies as diverse as Coca-Cola and ExxonMobil. Rising sea levels and more intense storms put their infrastructure at risk, and the costs will only get worse.”²⁶

- The World Bank

On the national level, America’s government, businesses, and citizens are already being financially impacted by events made more frequent by climate change. Storms are damaging infrastructure and causing power outages and fuel-price spikes, larger and more frequent wildfires require expensive measures, and relief aid for Superstorm Sandy alone cost the federal government over \$60 billion. Shipping traffic on the Mississippi River has been disrupted by alternating droughts and floods, and lowered water levels on the Great Lakes have raised shipping companies’ costs by an average of up to 22 percent.²⁷

Recently, extreme events have been notably on the rise. 2011 and 2012 were the two most extreme years on record for destructive weather events. A record 14 weather disasters occurred in 2011, sustaining more than \$1 billion each in economic losses for a total of \$60.6 billion. In 2012, there were \$11 billion weather disasters, and the total economic loss is almost certain to exceed 2011’s. The insurance industry estimates that its losses from 2012’s natural disasters will total \$58 billion, more than double the average yearly losses of \$27 billion over the previous ten years.²⁷

A recent report by DARA International, an independent nonprofit that works toward humanitarian action in vulnerable populations, quantified the global economic impact of climate change and effects of the carbon emissions industry (e.g. fossil fuel companies). It estimates that the deleterious effects were equivalent to losing 1.6 percent of the global economy in 2010, and this percentage rises to an average of 7 percent in the least developed countries. The impacts include crop losses, sea level rise effects, and the effect of reduced water availability in drying areas. The report states that the percentage is expected to rise as the effects of climate change continue grow. By 2030, the negative economic impact is expected to rise to a loss of 3.2 percent of global GDP annually.²⁸

Comparatively, the 2006 Stern Review on the Economics of Climate Change, published by the London School of Economics at Leeds University, estimated that the economic cost of action to keep below proposed targets of 2 degrees Celsius (3.6 Fahrenheit) average global temperature rise (low emissions scenario) was approximately 1 percent of GDP per year. While the exact value has been subject of some debate, and changes constantly as climate models are revised and as economic markets fluctuate, this serves as a reasonable estimate to help understand the global economic impacts of climate change.

²⁶ The World Bank Group, 2014. World Bank Group President: This Is the Year of Climate Action. <http://www.worldbank.org/en/news/feature/2014/01/23/davos-world-bank-president-carbon-pricing> (last accessed March 3, 2014)

²⁷ Davenport, C., 2013. The Scary Truth About How Much Climate Change is Costing You. *National Journal*. <http://www.nationaljournal.com/member/magazine/the-scary-truth-about-how-much-climate-change-is-costing-you-20130207> (last accessed March 3, 2014)

²⁸ DARA, 2012. Climate Vulnerability Monitor 2nd Edition: A Guide to the Cold Calculus of a Hot Planet. *Climate Vulnerable Forum*. <http://daraint.org/climate-vulnerability-monitor/climate-vulnerability-monitor-2012/>. (Last accessed: February, 18, 2014).

Comparing 1 percent, the cost of action, to 3.2 percent, the cost of inaction, the analysis suggests that action is a fiscally responsible decision.²⁹

In order to avoid committing to over 2 degrees Celsius average global temperature rise (preventing the low emissions scenario) and “climate chaos,” no new fossil fuel infrastructure can be built after the year 2017 (International Energy Agency). For every \$1 of investment avoided before 2020, it will cost \$4.30 after 2020 – a drastic four-fold increase – to compensate for the lost time and emissions, once again suggesting the large economic impact of climate change and the incentive for undertaking climate change mitigation to avoid the high emissions scenario.³⁰

CLIMATE REFUGEES

“Assessments conducted by the intelligence community indicate that climate change could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and the further weakening of fragile governments. Climate change will contribute to food and water scarcity, will increase the spread of disease, and may spur or exacerbate mass migration.”³¹

- U.S. Department of Defense

While New Hampshire has not yet had to deal with an event that displaced significant portions of the population, the state could potentially see an influx of climate refugees displaced from other areas of the United States or the world when such events displace the population in those areas. As Hurricane Katrina demonstrated, populations displaced by severe storms may become permanently relocated and can present long-term challenges. New Hampshire military servicemen could also face consequences of potential military involvement due to instability and conflict associated with climate refugees. As severe weather events become more frequent and more severe, droughts, floods, and storms will displace growing numbers of people around the world.

Populations in the West Coast and Mid-West affected by severe drought may be vulnerable to being displaced by climate change and could become a potential source of increased in-migration to other regions of the United States in the next decades. Climate change projections for these regions indicate increased risk of drought, and climate experts warn the drought conditions are already historic. Reports such as one by the U.S. Geological Survey explain that models of the Southwest project “a permanent drying by the mid-21st century that reaches the level of aridity seen in historical droughts, and a quarter of the projections may reach this level of aridity much earlier.”³² NOAA warns that with high carbon emissions, the U.S. Southwest faces “**irreversible** dry-season rainfall reductions in several regions comparable to those of the ‘dust bowl’ era” by the end of the century [bold added].¹⁹

²⁹ Stern, N., 2006. Stern Review on the Economics of Climate Change. *HM Treasury*.
http://webarchive.nationalarchives.gov.uk/20130129110402/http://www.hm-treasury.gov.uk/stern_review_report.htm (last accessed March 17, 2014)

³⁰ International Energy Agency, 2011. *World Energy Outlook 2011*.
http://www.iea.org/publications/freepublications/publication/WEO2011_WEB.pdf

³¹ U.S. Department of Defense, 2010. Quadrennial Defense Review Report.
http://www.defense.gov/qdr/images/QDR_as_of_12Feb10_1000.pdf (last accessed February 24, 2014)

³² U.S. Climate Change Science Program And the Subcommittee on Global Change Research, 2008. *Abrupt Climate Change: Final Report, Synthesis and Assessment Product 3.4*. U. S. Geological Survey, National Oceanic and Atmospheric Administration and National Science Foundation.
http://digital.library.unt.edu/ark:/67531/metadc12027/m2/1/high_res_d/sap3-4-final-report-all.pdf (last accessed March 3, 2014)

For comparison, to put drought projections in terms of climate refugees, the drought experienced in the Dust Bowl of the 1930s caused the largest migration in American history in a short period of time. The 2.5 million migrants of the Dust Bowl included not only those who worked on farms, but also a significant portion of proportion of professional or white-collar workers affected by the larger economic hardships of the drought; one-third of Dust Bowl migrants to California were from this demographic.

Another one of the many effects of climate change is sea level rise, which has been estimated between 3.3 and 4.7 feet by the end of this century.^{33,34} In low-lying coastal nations, this can cause significant changes in their available land. Given the predictions of sea level rise, Bangladesh is expected to lose 17 percent of its land by 2050, which will lead to as many as 20 million climate refugees who will need resettlement. Back home in the United States, in places such as Louisiana, sea level rise already contributes to the loss of about 25 square miles of land each year. Counterintuitively, this decreases the size of the state's fisheries by altering the transition habitats between land and water.³⁵ Severe storm events like Hurricane Katrina or Typhoon Haiyan are another source of climate refugees in these low-lying areas.

Desertification is another trend that is expected to be exacerbated by climate change. Deserts are spreading in once-productive croplands in Morocco, Tunisia and Libya, where more than 386 square miles are lost annually to the expanding Sahara Desert in each nation. The loss of approximately 1390 square miles in China to the Gobi Desert every year is also causing more and more people to forcibly relocate due to collapsing agriculture and livelihoods caused by changing climates.³⁵

In Bangladesh, the potential for military conflict in the face of mass migration from sea level rise and severe storm events is already becoming apparent, as are the global ramifications. India has built a \$1.2 billion, 1,790 mile fence to keep out potential Bangladesh refugees of climate-driven sea level rise and any other would-be immigrants from Bangladesh. This fence has already become one of the world's bloodiest border fortifications; since 2000, Indian troops have shot and killed nearly 1,000 people. This conflict is a concern not just in Southeast Asia, but also in the United States and elsewhere. The U.S. Defense Department and almost a dozen other security agencies have commissioned studies that warn "if Bangladesh is hit by the kind of Hurricane Katrina-grade storm that climate change is likely to make more frequent, it would be a 'threat multiplier,' sending ripples of instability across the globe: new opportunities for terrorist networks, conflicts over basic human essentials like access to food and water, and of course millions of refugees."³⁶

Climate refugees pose not only military risks, but also economic losses. Locations such as Venice, Italy rely heavily on tourism to sustain their local economy. As flooding in Venice increases in frequency, as it has over the past century, less people will make a viable living in the tourism industry. Island nations like the Maldives see a much exacerbated version of the same affect, where tourism supports over 25 percent of the national economy. The Maldives is 8 feet above sea level at its highest point, meaning a considerable portion of its land is threatened by sea level rise directly. Its tourism industry, which revolves around coral

³³ U.S. Environmental Protection Agency, 2014. Future Climate Change.

<http://www.epa.gov/climatechange/science/future.html> (last accessed March 3, 2014)

³⁴ National Research Council Of The National Academies, 2010. Advancing the Science of Climate Change. Washington, D.C: The National Academies Press.

http://www.nap.edu/openbook.php?record_id=12782&page=244 (last accessed March 3, 2014)

³⁵ National Geographic, 2014. Climate Refugee. National Geographic Encyclopedia. Retrieved from http://education.nationalgeographic.com/education/encyclopedia/climate-refugee/?ar_a=1 (last accessed February 18, 2014).

³⁶ Carney, S., Miklian, J., Hoelscher, K., 2011. Fortress India: Why is Delhi building a new Berlin Wall to keep out its Bangladeshi neighbors? *Foreign Policy*. http://www.foreignpolicy.com/articles/2011/06/20/fortress_india (last accessed March 3, 2014)

reefs, will also be highly jeopardized as oceans acidify and change in salinity.³⁷ Similarities and connections can be perhaps drawn to coastal areas in the United States with demonstrated vulnerability to sea level rise with tourism-based economies, such as Louisiana, Hawaii and Florida.

MILITARY CONFLICT

“Climate change and energy are two key issues that will play a significant role in shaping the future security environment.”³¹

“[Climate change] may act as an accelerant of instability or conflict, placing a burden to respond on civilian institutions and militaries around the world.”³¹

-The U.S. Department of Defense

While potential wars abroad might be far away geographically from the United States and Southern New Hampshire, international conflict, disruption to the global economy and deployment of U.S. armed forces certainly affect people living in the SNHPC region. Members of the armed forces, their families, and their communities feel the consequences of active duty. Global economic instability, which can be linked to war, likewise can have far-reaching impact, as the Great Recession of 2007 has recently demonstrated. While the Great Recession began as a recession limited to the United States, by 2009 it became a global economic downturn that affected the entire world economy (to varying degrees in each country) and is recognized as the worst global recession since World War II.

Organizations such as the U.S. Department of Defense, the Central Intelligence Agency (CIA), and the World Health Organization (WHO) have warned that the impacts of climate change are likely to spur global conflict. U.S. veterans and national security experts in the coalition Operation Free provide an example of military advocates for fighting climate disruption and reducing oil dependence again due to the recognition that these issues pose national security threats.³⁸ Experts warn that health challenges arising from population displacement and conflict are unlikely to stay confined within national borders.³⁹ Ensuring all populations are on track toward improved rather than worsened health conditions and disease protection is a vital contribution to global public health security.⁴⁰

Climate change will “inevitably affect” the basic requirements for maintaining health: clean air and water, sufficient food and adequate shelter; and also threatens to potentially reverse the progress made in combating infectious diseases. However, WHO warns that in the long run “the greatest health impacts may not be from acute shocks such as natural disasters or epidemics, but from the gradual build-up of pressure on the natural, economic and social systems that sustain health, and which are already under stress in much of the developing world.” Gradually increasing stresses of global warming include decreased availability of fresh water, reduced food production, and sea level rise; and “each of these changes has the potential to force population displacement and increase the risks of civil conflict.”⁴⁰

³⁷ National Geographic. Climate Refugee. National Geographic Encyclopedia. http://education.nationalgeographic.com/education/encyclopedia/climate-refugee/?ar_a=1 (last accessed February 18, 2014).

³⁸ Operation Free, 2014. About Operation Free. <http://operationfree.net/the-mission/about-operation-free> (last accessed March 3, 2014)

³⁹ World Health Organization, 2008. Protecting Health from Climate Change: World Health Day 2008. http://www.who.int/world-health-day/toolkit/report_web.pdf (last accessed February 24, 2014)

⁴⁰ World Health Organization, 2008. Protecting Health from Climate Change: World Health Day 2008. http://www.who.int/world-health-day/toolkit/report_web.pdf (last accessed February 24, 2014)

In short, competition over dwindling or degraded natural resources can increase the risks of conflict and war. Military leaders and researchers have emphasized that climate change, national security and energy dependence are closely related, with dependence on foreign oil heightening vulnerability to hostile attacks and involvement in foreign conflicts. Concern about the link between climate change and war is now reflected at the highest level. The United Nations Security Council has discussed climate change, as has a special session of the United Nations General Assembly.⁴⁰

KEY STRATEGIES & PROJECTS

The Energy Efficiency and Green Building Chapter contains many energy-focused strategies and projects that can reduce greenhouse gas emissions. In this chapter, a few additional climate change mitigation strategies are proposed that offer broader approaches to slowing climate change. Climate change adaptation strategies and projects are also offered.

NATURAL HAZARDS MITIGATION

“Prevention pays. It outperforms Wall Street hands down, and at the same time, it pays dividends that you can’t calculate in dollars and cents. It saves lives. It saves suffering. It saves loss of property. Prevention saves jobs. Bottom line, prevention works.”

- James Lee Witt, Director, Federal Emergency Management Agency

The effects of climate change will greatly increase the need for natural hazards mitigation and adaptation in the present and future years for our region and our state. *Hazard mitigation* is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards (44 CFR 201.2). Hazard mitigation activities may be implemented prior to, during, or after an event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.⁴¹ It includes both structural interventions, such as flood control devices, and nonstructural measures, such as avoiding construction in the most flood-prone areas. Mitigation includes not only avoiding the development of vulnerable sections of the community, but also making existing development in hazard-prone areas safer. For example, a community could identify areas susceptible to damage from natural disasters and take steps to make these areas less vulnerable. It could also steer

FIGURE 18 VIEW OF THE 2006 MOTHER’S DAY FLOOD IN HOOKSETT, NH



⁴¹ FEMA. *Local Mitigation Plan Review Guide*. October 1, 2011.

growth to less risky areas. Keeping buildings and people out of harm's way is the essence of mitigation.

Mitigation should not be seen as an impediment to growth and development. On the contrary, incorporating mitigation into development decisions can result in a safer, more resilient community, one that is more attractive to new families and businesses.

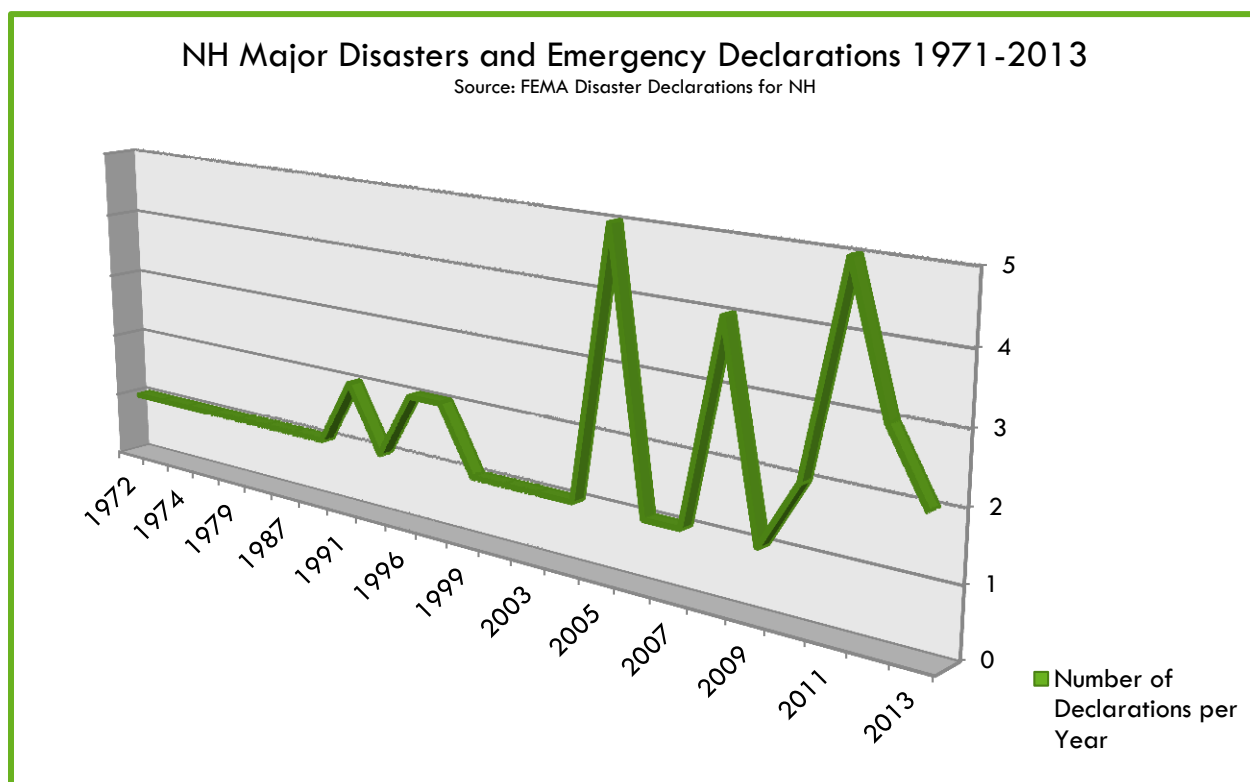
Natural Hazards that we are susceptible to in the Southern New Hampshire Region include:

- Flooding
- Dam Failure
- Erosion / Mudslides
- Landslides
- Earthquakes
- Drought
- Wildfire
- Lightning
- Hurricanes
- Tornado/Downburst
- Severe Winter Weather
- Debris-impacted Infrastructure / River Ice Jams
- Rapid Snowpack Melt
- Radon
- Geomagnetism
- Hailstorms
- Extreme Heat

The effect of the world's changing climate on our region has been dramatic in recent years. In the past ten years between 2004 and 2013 there were more FEMA declared major disasters and emergencies than there were in the previous five decades from 1953 through 2003 (Figure 19).⁴² Major disaster events are on the rise in New Hampshire, with the frequency and severity of storms and storm related damage increasing annually. Over \$68 million in FEMA public assistance grants were given to the State of New Hampshire between 2007 and 2011 alone. This number does not include the added economic costs of property damage, cleanup and restoration that communities, residents, and businesses sustained as a result of major disasters.

⁴² Federal Emergency Management Agency, 2014. Disaster Declarations for New Hampshire. *U.S. Department of Homeland Security*. <https://www.fema.gov/disasters/grid/state-tribal-government/33> (last accessed February 28, 2014)

FIGURE 19 NEW HAMPSHIRE DISASTER AND EMERGENCY TRENDS, 1971-2013

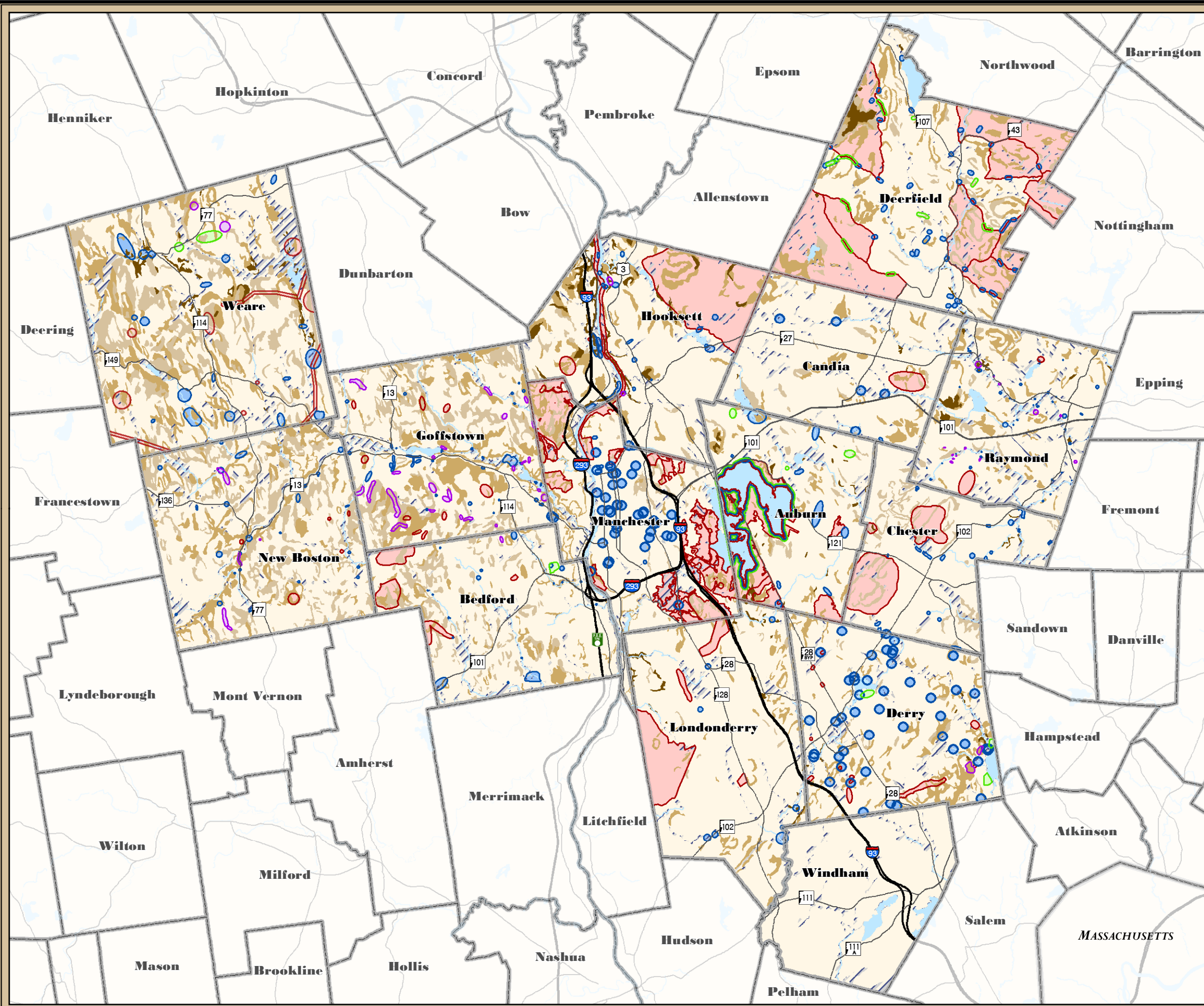


All of the 16 major declarations in the state in the past ten years have been caused by severe storms, and ten of them (63 percent) involved flooding. See Table 3 for details. The climate change projections for Southern New Hampshire indicate the frequency of severe storms with extreme precipitation is increasing significantly. By late century, the most severe (4" in 48 hours) precipitation event is projected to *quadruple* in frequency in Manchester under either scenario and in Windham will either increase by 50 percent (low emissions) or double in frequency (high emissions).³ Together, these trends suggest that our region could see more severe storm and flooding-based major disaster declarations in the future. Climate change adaption measures that tackle flooding will be important to mitigate the extra hazards.

Table 3 Major Disaster Declarations for in New Hampshire 2004-2013 (Source: FEMA)

Disaster Number	Date	Incident Description
4139	08/02/2013	Severe Storms, Flooding, and Landslides
4105	03/19/2013	Severe Winter Storm and Snowstorm
4095	11/28/2012	Hurricane Sandy
4065	06/15/2012	Severe Storm and Flooding
4049	12/05/2011	Severe Storm and Snowstorm
4026	09/03/2011	Tropical Storm Irene
4006	07/22/2011	Severe Storms and Flooding
1913	05/12/2010	Severe Storms and Flooding
1892	03/29/2010	Severe Winter Storm
1812	01/02/2009	Severe Winter Storm
1799	10/03/2008	Severe Storms and Flooding
1787	09/05/2008	Severe Storms and Flooding
1782	08/11/2008	Severe Storms, Tornado, and Flooding
1695	04/27/2007	Severe Storms and Flooding
1643	05/25/2006	Severe Storms and Flooding
1610	10/26/2005	Severe Storms and Flooding

Each community in the Southern New Hampshire Region has developed a Natural Hazards Mitigation Plan that is updated and approved by FEMA every five years. These plans identify past and potential hazards and prioritize mitigation strategies to address them. Hazard areas for the Southern New Hampshire Region are illustrated on Map 8-1. It is apparent that we are facing a significant change in the strength, frequency and severity of these hazards and must develop a unified mitigation and adaptation strategy for our communities, our region and our state. Mitigation and preparedness strategies must look to the long-term possibilities of the effects of climate change on our region, making sure our land use and development policies and ordinances are working to ensure the protection of our residents, property and infrastructure. Goals and recommendations for climate change in the Southern New Hampshire region aim to provide guidance on both mitigation and adaptation for the projected climate change impacts we face.



Map # 8 - 1

Granite State Future

Climate Change

SNHPC Regional

Past & Potential

Hazard Areas



- Flooding
- Wildfire
- Wind
- Erosion/Mudslide
- FEMA Floodplains**
 - 100 Year Floodplain
 - 500 Year Floodplain
- Steep Slopes**
 - with a maximum 25% gradient
 - with a maximum 35% gradient
 - with a maximum 60% gradient
- Interstates
- State and US Routes
- Town Boundary
- Rivers
- Lakes

Data Sources:
Granit Digital Data (1:24,000)
NH Department of Transportation
All SNHPC Communities



The individual municipalities represented on this map and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.

This map is prepared for planning purposes only and is not to be used for legal boundary determinations or for regulatory purposes.

Map Produced by GIS Service SNHPC 2014.
Contact: SNHPC, gis@snhpc.org or (603) 669-4664

0 1.25 2.5 5 Miles



“The Task Force recommends... a long-term reduction in greenhouse gas emissions of 80 percent below 1990 levels by 2050. The goal of reducing greenhouse gas emissions by 80 percent by 2050 has been adopted by numerous states, cities and organizations. This goal is based on the reductions that climate scientists believe to be necessary to stabilize greenhouse gases in the atmosphere at or below 450 parts per million CO₂. It has been projected that stabilizing the concentrations of greenhouse gases at this level will avoid the most severe and catastrophic potential impacts of climate change.”¹⁰

– New Hampshire Climate Adaptation Plan (2009)

One comprehensive strategy for reducing greenhouse gas emissions on a state-wide basis that could be implemented in New Hampshire is proposed by climate change action organization 350 Massachusetts. In both New Hampshire and Massachusetts, emission reduction goals of 80 percent by 2050 have been set (via the New Hampshire Climate Action Plan and the 2008 Global Warming Solutions Act in Massachusetts).⁹ These policies are attainable and are readily achievable if we:

- a) Ban the worst – stop coal, fracking, and tar sands
- b) Build only the best – no new fossil fuel infrastructure of any kind, meet energy needs through efficiency and renewables
- c) Begin to price the rest – begin work on setting a price on carbon that operates across all industries⁴³

On the federal level, serious climate legislature is also crucial to achieving a lower emissions scenario and lessened climate change impacts. The New Hampshire Climate Action Plan recommends supporting strong climate action at the federal level, “endors[ing] strong national climate legislation to complement state efforts to reduce greenhouse gas emissions and prepare for the projected impacts of climate change.” Federal legislation could take the form of investment in regional transportation networks or a national cap and trade mechanism for greenhouse gases, for example. The Plan recommends that funds collected through legislative controls on greenhouse gases be returned to the state in order to fund the emission reduction, clean energy, energy efficiency, and adaptation priorities contained in the Climate Action Plan. The Plan also states national legislation should support comprehensive adaptation planning that integrates the enhancement of the state’s significant existing built and natural infrastructure.⁹

Specific adaptation priorities recommended by the Climate Action Plan include protecting natural systems, which provide significant ecosystem services to the state, as well as maintaining and enhancing built infrastructure affected by extreme storm events. Funding is needed to implement these actions and could again be provided by properly structured federal legislation. The Plan notes that funding could “drive the large emissions reductions needed while growing the New Hampshire economy” if it were distributed back to the states and strategically targeted.⁹

Recommended legislative implementation is as follows:

⁴³ 350 Massachusetts, 2014. Climate Legacy Campaign. <http://350ma.org/campaigns/climatelegacy/> (last accessed February 14, 2014)

1. Pass a legislative resolution to support efforts by the New Hampshire congressional delegation to encourage passage of a national climate bill that would complement efforts at the state level and return generated revenue to the states in order to support the implementation of state Climate Action Plans.
2. State level funding resulting from national legislation should be directed toward: tax credits to support residential and business investment in measures consistent with this Plan; state and local government, non-governmental organizations, and privately-administered matching grant and loan funds; direct grants or tax rebates to low-income households least able to adjust to potentially higher energy prices and designed to migrate participants as rapidly as possible to greater energy efficiency; and loans and grants for student and worker green jobs training.⁹

CLIMATE CHANGE ADAPTATION TOOLKIT FOR COMMUNITIES

The New Hampshire Department of Environmental Services (DES) has developed a climate change adaptation toolkit to guide New Hampshire communities through a logical planning process.⁴⁴ It provides a variety of adaptation tools and resources for assessing and planning for climate change impacts. The toolkit allows a community to choose the path to take, starting with where they currently are in assessing and planning.

If a community is starting from the beginning, there is a process that DES recommends they follow:

1. Research and review the state, regional and local plans and assessments for climate change mitigation (decreasing our contribution to greenhouse gas emissions) and adaptation (preparing for the impacts) that already exist.
2. Review messaging around climate change issues (how to talk about this in your community)
3. Engage your community in a conversation around climate change adaptation
4. Perform assessments and evaluations of your community to identify vulnerabilities and opportunities
5. Begin incorporating adaptation recommendations and actions into community plans (Master Plans, Hazard Mitigation Plans, Capital Improvement Plans, etc.) and regulations (Zoning, etc.)
6. Seek funding to implement and draw upon additional resources as necessary State, Regional & Local Plans⁴⁴

The toolkit is also designed to help communities who have already begun their planning process. This includes communities that are prepared to engage their community in a conversation around climate change and adaptation and communities that want to complete an assessment of their community and its vulnerabilities to climate change impacts. Communities that are ready to develop goals and strategies for planning or are currently updating their plans and regulations and want to include climate change adaptation will also find resources that are useful in the toolkit. The toolkit likewise serves communities that are ready to begin planning and communities that are recovering from an extreme storm and want to find available funding.⁴⁵

Municipalities in the region can view the Adaptation Toolkit and begin their planning process here:

⁴⁴ New Hampshire Department of Environmental Services, 2014. The Adaptation Toolkit for NH Communities. Climate Change Program. <http://des.nh.gov/organization/divisions/air/tso/tps/climate/toolkit/adaptation.htm> (last accessed April 18, 2014)

⁴⁵ Godlewski, S. Adaptation Toolkit for NH Communities. NH Coastal Adaptation Workgroup and Upper Valley Adaptation Workgroup. New Hampshire Department of Environmental Services. <http://www.snhpc.org/pdf/ToolKitSNHRPC112613.pdf> (last accessed April 18, 2014)

<http://des.nh.gov/organization/divisions/air/tsb/tps/climate/toolkit/adaptation.htm>

LOCAL CLIMATE CHANGE ADAPTATION PLANS

The City of Keene, NH has developed a climate change adaption plan that can serve as a model for other municipalities in New Hampshire. Keene has a long, steadfast history of climate protection. In April, 2000, the City signed onto the Cities for Climate Protection Campaign® (CCP), administered by Local Governments for Sustainability (ICLEI). Since agreeing to participate in the CCP Campaign, the City of Keene has developed a Local Action Climate Plan to identify ways in which the greater Keene community can assist in lowering greenhouse gas emissions. The City, led by its CCP Committee, has developed processes and implemented projects to ensure they are on track to meet their greenhouse gas emissions reduction goal of 10% below 1995 levels by 2015. Keene reaffirmed this commitment in its Community Goals of 2003.⁴⁶

Keene and ICLEI have identified five key milestones to creating a climate resilient community:

1. Initiate a Climate Resiliency Effort
2. Conduct a Climate Resiliency Study
3. Develop a Climate Resilient Action Plan
4. Implement a Climate Resilient Action Plan
5. Monitor, Motivate, and Re-evaluate⁴⁶

The plan lays the foundation for Keene to move forward with a public process and further refinement of its climate change and overall sustainability goals. Note this plan represents the first time that a community has attempted to undertake the development of an adaptation plan based upon the five milestone process.⁴⁶

The adaptation planning process in Keene importantly intersected with other local planning efforts. Keene was preparing for its comprehensive master plan update, wherein the City, community members, and other local and regional stakeholders played a major role in setting the course for Keene's future. Keene recommended that the Adaptation Plan be utilized in that process and incorporated accordingly into the comprehensive master plan in order to provide the climate lens necessary to coordinate policy, make land use decisions, identify capital improvement projects, and establish funding priorities.⁴⁶

The goals identified by Keene in their adaptation plan address the following opportunities in the built, natural, and social environments: Building and Development, Transportation Infrastructure, Stormwater Systems, Energy Systems, Management, Fauna and Flora, Agriculture, Economy, Public Health, Emergency Services, Promote a Local Climate Appropriate Economy, and Food Security. Examples of various goals are as follows:

- Decrease stormwater runoff and flash flooding.
- Increase the protection of existing and future wetlands to maintain the ability of these systems to naturally recharge aquifers and decrease stormwater run-off.
- Increase Keene's water storage capabilities in the face of drought conditions.
- Integrate into recently published state wildlife action plan.

⁴⁶ City of Keene, NH, 2007. Adapting to Climate Change: Planning a Climate Resilient Community. In Association with ICLEI Local Governments for Sustainability.
http://www.ci.keene.nh.us/sites/default/files/Keene%20Report_ICLEI_FINAL_v2_0.pdf (last accessed April 28, 2014)

- Devise land use regulations to preserve forests.
- Research and identify what crops will be productive in our region with a warmer climate and changing soil composition.
- Increase public awareness about the public health implications of climate change, including risks and the need for emergency preparedness.
- Train and Educate Emergency/Human Services/Public Health officials and workers.
- Support environmentally sustainable businesses and economy.

TRANSPORTATION AND LAND USE PLANNING

Other strategies from the New Hampshire Climate Action Plan focus on transportation and land use planning. Overarching strategies include:

- Reduce vehicle emissions through state actions
- Encourage appropriate land use patterns that reduce vehicle-miles traveled
- Reduce vehicle miles travelled through an integrated multi-modal transportation system
- Protect natural resources (land, water, and wildlife) to maintain the amount of carbon fixed and sequestered

These transportation and land use planning strategies connect to many of the other livability principles that guide *Moving Southern New Hampshire Forward* and are compatible with recommendations included in their respective chapters. See the Transportation, Land Use, and Environment chapters for details on these areas.

Additional inter-related overarching strategies include:

- Lead by example in government operations
- Plan for how to address existing and potential climate change impacts
- Develop and integrated education, outreach, and workforce training program

Keene's climate change adaption plan tackles land use and transportation challenges through the following goals. Building and Development goals include reducing the likelihood of structural damage resulting from predicted increases in severe weather events; creating, adopting, and implementing a City building and energy code that incorporates sustainability, green building materials, and energy conservation principles; making all new development in Keene "green" (i.e. sustainable); lowering the ecological footprint of existing buildings; and reducing sprawl and promoting infill development/ redevelopment. Transportation Infrastructure goals include creating alternative route options for movement of goods and people, designing and reconstructing roadways to handle changes in temperature and precipitation as a result of a change in climate, and providing sustainable transportation mode choices (locally and regionally).⁴⁶

FLUVIAL EROSION HAZARD PROGRAM

Flood and other storm-related damages cost New Hampshire taxpayers \$75.6 million between 2005 and 2007 due to three major storm events. As experienced in these storms, the erosion and collapse of river and stream channels and banks can wash out roads and destroy houses and other buildings, or, in rare cases, change the course of a river.

Fluvial (water flowing in a river) erosion is a natural process most powerful during very high flows and especially during storm events when rivers have more energy to erode stream beds and banks. Damage from fluvial erosion also occurs each day, slowly over time.

As the Existing and Future Conditions section of this chapter explained, climate change is increasing the frequency and strength of severe storm events, making adaptation to fluvial erosion even more important for the present and future.

As a result of the consequences of fluvial erosion and the recent flood disasters New Hampshire has experienced, establishing a statewide Fluvial Erosion Hazard (FEH) program has been a high priority with the New Hampshire State Legislature, the Department of Safety, the Department of Environmental Services, and the New Hampshire Geological Survey. The Federal Emergency Management Association (FEMA) endorses the FEH program, and it has been implemented in other states.

In the Southern New Hampshire Planning Commission Region, The State of New Hampshire (Departments of Safety and Environmental Services) is partnering with the Lamprey River Local Advisory Committee and the Lamprey River Watershed Association to conduct a geomorphic assessment to identify areas in the watershed most at risk to FEH in order to develop a long-term watershed plan. The SNHPC towns of Candia, Deerfield, and Raymond are in the Lamprey Watershed.

Mapping and assessing floodplains and fluvial erosion hazard areas can provide useful information for land use planning and development, as well as resource management and protection. Local governments have the mapping, planning, and zoning tools to minimize the impacts of fluvial erosion hazards, and thus, are recommended as the most appropriate entities to implement appropriate flood hazard planning and mitigation efforts.

STREAM CROSSING VULNERABILITY ASSESSMENT

The Piscataquog River watershed, in south central New Hampshire, is 217.8 square miles in size and includes the following SNHPC communities: Goffstown, New Boston, Weare and portions of the City of Manchester. The goal of this landscape scale assessment project is to evaluate, and rate, each road stream crossing's vulnerability to high water flows during severe storm events. Trout Unlimited (TU), SNHPC, and other state and federal partners are collaborating in the Piscataquog Watershed Stream Crossing Vulnerability Assessment Project to develop a geographic information system (GIS) based hydraulic capacity modeling tool to evaluate whether a particular stream crossing will pass instream water flows during the 2, 25, 50 and 100-year return interval storms.

An estimated 412 stream crossings surveyed in 2012 will be evaluated for stormwater vulnerability. The data collected will be mapped showing the hydraulic capacity rating of each stream crossing to determine existing problem areas. This information could then be used to proactively develop a long-term strategy to reduce community risk associated with undersized, and vulnerable, road crossings. The results from this data analysis will provide municipalities and state agencies with valuable information necessary for implementing new conservation initiatives and conducting detailed safety and hydraulic capacity investigations of hazardous culverts.

With this stream crossing information, municipal road agents and public works staff will be able to prioritize restoration efforts on inadequate crossings whereby reducing the chance of culvert wash-outs during the extreme storm event. In the end, this proactive approach to addressing infrastructure needs across the watershed will help, in both the short and long term, to reduce emergency repair costs

associated with storm damage. These restorations will also serve to protect critical water quality resources as well as improve aquatic habitat frequently associated with stream fragmentation. We believe the key to protecting a community's infrastructure resiliency is to be prepared; and a big part of that preparedness is to understand the vulnerability of road crossings in each community.

COMMUNITY PREPAREDNESS

Keene's climate change adaption plan contains the following emergency preparedness goals: improve the reliability of emergency communications during severe weather events; increase community communication for emergency events; increase the ability of the public to respond/recover from extreme weather events; and continue to train and educate staff and the public regarding current and future diseases and associated vectors.

In the SNHPC Region, similar goals are tackled in the Southern New Hampshire Region Community Preparedness Program (SNHRCPP). SNHRCPP is a regional effort by all of the municipalities in the Southern New Hampshire Planning Commission Region to increase citizen preparedness. Since climate change increases the risk of some types of hazards, preparedness becomes even more important.

The SNHRCPP collaborates with other organizations and agencies working to increase citizen preparedness in the region and promotes the Red Cross message "Get A Kit, Make A Plan, Be Informed". This website is intended as a resource for citizens and municipalities in the Southern New Hampshire Region and for bringing communities together to work towards increasing citizen preparedness in times of emergency and disaster.⁴⁷

This program was developed in two stages, planning and outreach. The Community Preparedness Committee was formed and consists of representatives from emergency management, police, fire and local government from each town in the region. This Committee, with assistance from Southern New Hampshire Planning Commission developed this plan to guide the goals and outreach strategies. The Committee then divided into working groups to develop the outreach program that was implemented.⁴⁷

This program is intended to be a model for other regions in the State for developing their own community preparedness programs and for increasing levels of community preparedness throughout the State of New Hampshire. Natural disasters will continue to threaten our communities and with this plan and program our communities will be better prepared to handle them.⁴⁷

⁴⁷ Lamprey River Local Advisory Committee and Lamprey River Watershed Association, n.d. Fluvial Erosion Hazards and Geomorphic Assessments of the Lamprey River Watershed.

CONCLUSIONS AND RECOMMENDATIONS

In the face of current and future challenges presented by climate change, reducing carbon pollution and adapting to and preparing for changing climates with sustainable development is recommended. As a starting point, it is recommended that municipalities endorse the New Hampshire Climate Action Plan and incorporate its recommendations and strategies into planning efforts, including climate change mitigation. Adaptation emphasis in municipal Master Plans is also key to successful planning for climate change impacts. Grants to support regional efforts to identify and address climate change impacts could help fund this work. Five goals are delineated below, with recommendations organized under each goal.

Goal 1: Increase understanding, education, and training opportunities for adaptation to climate change.

Recommendations:

- Implement an outreach program for town officials, employees, schools, organizations, and businesses.
- The Leadership Team recommended educating NH communities about climate change using the same approach that was used when recycling first began in Manchester. The approach included speaking to the schools and businesses in the area.
- Establish a training program for key municipal employees – Health Department, Department of Public Works, Planning Department, emergency personnel, engineers, transportation officials, and other decision-makers.
- Encourage climate change education programs in public school and higher education, integrate in topics relevant to climate change mitigation and adaption (e.g. in disciplines such as engineering and planning).
- Conduct research and analysis to ensure infrastructure standards reflect current and future climate change impacts (as well as mitigation goals). For example, designing for the current and projected 100-yr flood rather than the outdated, less severe 100-year flood of 50 years ago.
- Increase public awareness about the public health implications of climate change, including risk and the need for emergency preparedness.
- Create support services for people who may lose their jobs as a result of climate change (for example, snowplowing and sugaring).

Goal 2: Reduce greenhouse gas emissions and other environmental impacts in order to lessen the SNHPC region's impact on climate change.

Recommendations:

- Flexible land use and zoning regulations to allow for renewable energy installations, such as wind and solar energy.
 - Require stricter building codes to increase energy efficiency in new buildings and reduce fossil fuel energy use, as well as incorporate other sustainability principles.
 - Support public transportation to lower emissions and improve the environment.
 - Decrease stormwater runoff and flash flooding – consider adopting a Net Zero Runoff site plan requirement.
-

- Increase the protection of existing and future wetlands to maintain the ability of these systems to naturally recharge aquifers and decrease stormwater runoff.
- Align policies with the state wildlife protection plan to protect forests, habitats, and migration routes.
- See Energy Efficiency Chapter, Transportation Chapter, and Environment Chapter for more recommendations.

Goal 3: Work toward climate change impact adaptation; prepare for and mitigate hazards associated with climate change.

Recommendations:

- Include explicit climate change impacts analysis in Master Plans. Climate change impacts analysis is not the same as hazard mitigation; with climate change, there is a need to consider bigger storms, more extreme heat, and other projections beyond current hazards. This recommendation also supports potential future zoning changes related to climate change.
- Encourage and/or require new development to reduce the effects of runoff and associated flooding from bigger, more frequent severe storms (e.g. reduce impervious surfaces).
- Consider using zoning and overlay zones to designate areas vulnerable to impacts and/or to create zones based on adaptation goals, such as protection, accommodation, and preservation.
- Support use of latest Cornell University rainfall intensity numbers based upon latest storm data in stormwater planning and management.
- Build outside of floodplains and strengthen floodplain regulations and building codes to adapt to more severe flood events (e.g. 500-year flood).
- Implement incentives for developers to build and locate subdivisions in suitable areas and set aside vulnerable areas as open space.
- Design and reconstruct roadways to handle changes in temperature and precipitation as a result of climate change.
- Develop a food security plan and integrate it into local policies, and support the local agricultural economy.
- Decrease the ways in which energy supplies could be interrupted.

Goal 4: Increase leadership and cooperation on climate change issues throughout and beyond the region throughout all levels of government.

Recommendations:

- Establish a Climate Change Adaptation Working Group, modeled on the working group for the Upper Valley region, to develop climate change leadership in the region.
- Support studies and efforts to assess the vulnerability of street crossings and pursue funding opportunities to restore and enlarge these crossings to address higher storm flows.
- Support regional level coordination on infrastructure needs and challenges, along with state cooperation.
- Support New England regional cooperation on energy sources.

- Support improved communication between planners and FEMA to mandate climate change adaption considerations in hazard mitigation plans.

Goal 5: Develop and/or identity funding sources or innovation financing tools for climate change mitigation and adaptation.

Recommendations:

- Better align hazard mitigation programs and plans with the Capital Improvement Plan (CIP) so the two processes are more connected.
- Set up acquisition and buyout programs by governments of land vulnerable to flooding with high natural resource value.
- Align conservation easements with hazard mitigation plans and programs.
- Use tax incentives to encourage preferred development: encourage restricted uses on vulnerable properties, relocation or retrofitting in flood-prone areas, and upland infill development.
- Promote mutual sharing and mutual aid for public works.
- Use transfers of development rights to encourage development in upland/ less vulnerable areas.
- Require real estate disclosures of hazards worsened by climate change (e.g. flood and erosion) to prospective buyers.

APPENDIX A: RESOURCES

Climate Change in Southern New Hampshire: Past, Present, and Future

Dr. Cameron Wake, a research associate professor with the Institute for the Study of Earth, Oceans, and Space at the University of New Hampshire, is leading research programs to assess the impact of climate change in New England. This report (*Climate Change in Southern New Hampshire: Past, Present, and Future*, Cameron Wake, et. al., 2014) describes how the climate of southern New Hampshire has changed over the past century and how the future climate of the region will be affected by human activities that are warming the planet.

See SNHPC website at: www.snhpc.org for a copy of this report.

Northeast Climate Impacts Assessment (NECIA)

The *Northeast Climate Impacts Assessment* (NECIA) is a collaboration between the Union of Concerned Scientists (UCS) and a team of [more than fifty independent](#) experts to develop and communicate a new assessment of climate change, impacts on climate-sensitive sectors, and solutions in the northeastern United States. Launched in May, 2005, the goal of the assessment is to combine state-of-the-art analyses with effective outreach to provide policymakers, opinion leaders, and the public with the best available science upon which to base informed choices about climate change mitigation and adaptation.

[Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions](#), released July 11, 2007

<http://www.northeastclimateimpacts.org/>

The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future

The New Hampshire Climate Change Policy Task Force has developed a report prepared by the NH Department of Environmental Services for the state. This report proscribes a long list of climate change specific actions, as well as recommendations, information on adapting to change, economic opportunities, and a strategy for moving the plan forward.

http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf

National Oceanic and Atmospheric Administration

NOAA Climate.gov provides science and information for a climate-smart nation. Americans' health, security, and economic well-being are closely linked to climate and weather. People want and need information to help them make decisions on how to manage climate-related risks and opportunities they face.

www.climate.gov

Skeptical Science

The goal of Skeptical Science is to explain what peer reviewed science has to say about global warming. Skeptical Science is maintained by John Cook, the Climate Communication Fellow for the Global Change Institute at the University of Queensland.

www.skepticalscience.com

RealClimate

RealClimate is a commentary site on climate science by working climate scientists for the interested public and journalists. The current permanent contributors to content on this site are:

- [Gavin Schmidt](#)
- [Michael Mann](#)
- [Caspar Ammann](#)
- [Rasmus Benestad](#)
- [Ray Bradley](#)
- [Stefan Rahmstorf](#)
- [Eric Steig](#)
- [David Archer](#)
- [Ray Pierrehumbert](#)
- [Thibault de Garidel](#)

[William Connolley](#) was a contributor, but has now left academia, although his posts are still online.

www.realclimate.org

APPENDIX B: CLIMATE CHANGE PROJECTIONS IN THE SNHPC REGION

Manchester, NH

Indicators		Historical* 1980-2009	Actual						Change from Historical (+ or -)					
			Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099		Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099	
			Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
Minimum Temperature (°F)														
Annual TMIN		34.5	36.0	36.4	37.1	39.3	38.0	42.8	1.5	1.9	2.6	4.9	3.5	8.3
Winter TMIN		11.8	14.0	14.4	15.2	17.3	16.5	20.8	2.2	2.6	3.4	5.5	4.7	9.0
Spring TMIN		32.1	35.0	33.3	36.5	35.8	37.7	38.8	2.9	1.2	4.4	3.7	5.6	6.7
Summer TMIN		55.1	56.5	57.1	57.6	60.3	58.2	64.1	1.4	2.0	2.5	5.2	3.1	9.0
Fall TMIN		38.4	38.4	40.3	38.7	43.6	39.1	46.9	0.0	1.9	0.3	5.2	0.7	8.5
Maximum Temperature (°F)														
Annual TMAX		58.8	60.5	60.6	61.9	63.8	62.9	67.3	1.7	1.8	3.1	5.0	4.1	8.5
Winter TMAX		33.7	35.3	35.3	36.0	37.2	37.1	39.6	1.6	1.6	2.3	3.5	3.4	5.9
Spring TMAX		56.5	59.4	58.0	62.0	61.3	63.9	65.4	2.9	1.5	5.5	4.8	7.4	8.9
Summer TMAX		81.9	83.7	84.0	85.4	87.8	86.3	91.8	1.8	2.1	3.5	5.9	4.4	9.9
Fall TMAX		62.5	63.3	64.6	63.7	68.4	63.9	72.0	0.8	2.1	1.2	5.9	1.4	9.5
Temperature Extreme (days per year)														
<32°F		160	152	150	147	138	144	122	-8	-10	-13	-22	-16	-38
<0°F		15	11	10	8	5	6	1	-4	-5	-7	-10	-9	-14
>90°F		14	21	21	32	44	38	73	7	7	18	30	24	59
>95°F		3	5	5	10	16	15	39	2	2	7	13	12	36
TMAX on hottest day of year		96.4	99.2	97.8	101.5	101.9	103.6	106.4	2.8	1.4	5.1	5.5	7.2	10.0
TMIN on coldest day of year		-16.2	-12.2	-11.4	-10.0	-5.6	-7.9	1.3	4.0	4.8	6.2	10.6	8.3	17.5
Growing Season (days)		175	186	188	191	202	191	218	11	13	16	27	16	43
Precipitation (in.)														
Annual mean		38.4	42.5	41.5	43.0	43.7	44.8	45.9	4.1	3.2	4.6	5.3	6.4	7.5
Winter mean		8.6	9.8	9.5	10.2	10.0	10.6	11.7	1.2	0.9	1.6	1.4	2.0	3.1
Spring mean		9.4	10.2	10.5	10.2	10.8	10.4	11.4	0.8	1.1	0.8	1.4	1.0	2.0
Summer mean		10.4	12.2	11.1	11.9	12.0	12.9	11.4	1.8	0.7	1.5	1.6	2.5	1.0
Fall mean		9.9	10.4	10.5	10.7	10.8	10.9	11.4	0.5	0.6	0.8	0.9	1.0	1.5
Extreme Precipitation (events per year)														
1" in 24 hrs		8.3	10.2	9.7	10.6	10.9	10.9	12.6	1.9	1.4	2.3	2.6	2.6	4.3
2" in 48 hours		3.4	4.6	4.3	4.9	5.1	5.3	6.0	1.2	0.9	1.5	1.7	1.9	2.6
Extreme Precipitation (events per decade)														
4" in 48 hours		1.8	4.8	2.8	4.7	4.3	7.7	7.7	3.0	1.0	2.9	2.5	5.9	5.9
Snow Covered Days		91	77	77	72	55	62	42	-14	-14	-19	-36	-29	-49

*There were significant gaps in the daily data from some NH sites for the period 1980-2009. Instead, the historical values in these tables were derived from the downscaled GCM model output

(SOURCE: C. WAKE ET. AL., 2014)

Windham, NH

Indicators	Historical* 1980-2009	Actual						Change from Historical (+ or -)					
		Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099		Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099	
		Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
Minimum Temperature (°F)													
Annual TMIN	34.9	36.7	37.1	37.9	40.4	38.8	44.1	1.8	2.2	3.0	5.5	3.9	9.2
Winter TMIN	14.3	16.5	17.0	17.9	20.0	19.2	23.6	2.2	2.7	3.6	5.7	4.9	9.3
Spring TMIN	32.4	35.6	33.8	37.3	36.5	38.5	39.8	3.2	1.4	4.9	4.1	6.1	7.4
Summer TMIN	55.0	56.7	57.4	58.0	61.2	58.8	65.6	1.7	2.4	3.0	6.2	3.8	10.6
Fall TMIN	37.7	37.7	39.9	38.0	43.5	38.5	47.1	0.0	2.2	0.3	5.8	0.8	9.4
Maximum Temperature (°F)													
Annual TMAX	60.1	61.7	61.8	63.0	64.9	64.0	68.3	1.6	1.7	2.9	4.8	3.9	8.2
Winter TMAX	36.6	38.2	38.2	38.9	40.1	40.0	42.5	1.6	1.6	2.3	3.5	3.4	5.9
Spring TMAX	58.3	61.0	59.7	63.3	62.9	65.1	66.9	2.7	1.4	5.0	4.6	6.8	8.6
Summer TMAX	82.0	83.7	83.9	85.2	87.4	86.0	91.4	1.7	1.9	3.2	5.4	4.0	9.4
Fall TMAX	63.0	63.8	65.0	64.2	68.8	64.5	72.1	0.8	2.0	1.2	5.8	1.5	9.1
Temperature Extreme (days per year)													
<32°F	164	155	152	148	137	144	118	-9	-12	-16	-27	-20	-46
<0°F	13	9	8	6	4	5	1	-4	-5	-7	-9	-8	-12
>90°F	11	18	19	28	41	34	72	7	8	17	30	23	61
>95°F	2	4	3	7	12	12	33	2	1	5	10	10	31
TMAX on hottest day of the year	95.3	97.6	96.8	99.0	100.9	100.6	105.8	2.3	1.5	3.7	5.6	5.3	10.5
TMIN on coldest day of the year	-18.8	-13.4	-12.1	-10.6	-5.0	-8.4	2.9	5.4	6.7	8.2	13.8	10.4	21.7
Growing Season (days)	157	168	168	174	187	176	210	11	11	17	30	19	53
Precipitation (in.)													
Annual mean	44.4	48.8	47.9	50.1	50.4	51.4	53.7	4.4	3.5	5.7	6.0	7.0	9.3
Winter mean	10.4	11.6	11.2	11.8	11.6	12.0	13.1	1.2	0.8	1.4	1.2	1.6	2.7
Spring mean	10.7	11.8	12.2	12.4	12.7	12.7	14.0	1.1	1.5	1.7	2.0	2.0	3.3
Summer mean	10.8	12.6	11.9	12.4	12.9	13.1	12.9	1.8	1.1	1.6	2.1	2.3	2.1
Fall mean	12.5	12.9	12.6	13.4	13.1	13.6	13.7	0.4	0.1	0.9	0.6	1.1	1.2
Extreme Precipitation (events per year)													
1" in 24 hrs	9.8	11.4	11.1	11.7	12.6	12.5	14.0	1.6	1.3	1.9	2.8	2.7	4.2
2" in 48 hours	5.0	6.7	6.2	7.2	7.4	7.9	8.8	1.7	1.2	2.2	2.4	2.9	3.8
Extreme Precipitation (events per decade)													
4" in 48 hours	6.6	8.3	7.4	11.3	10.1	10.0	13.7	1.7	0.8	4.7	3.5	3.4	7.1
Snow Covered Days	72	58	57	53	39	45	29	-14	-15	-19	-33	-27	-43

*There were significant gaps in the daily data from some NH sites for the period 1980-2009. Instead, the historical values in these tables were derived from the downscaled GCM model output

Massabesic Lake, NH

Indicators		Historical* 1980-2009	Actual						Change from Historical (+ or -)					
			Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099		Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099	
			Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
Minimum Temperature (°F)														
Annual TMIN	35.4	37.1	37.4	38.3	40.5	39.2	44.2	1.7	2.0	2.9	5.1	3.8	8.8	
Winter TMIN	13.5	15.7	16.0	17.0	18.8	18.2	22.3	2.2	2.5	3.5	5.3	4.7	8.8	
Spring TMIN	33.1	36.0	34.7	37.7	37.4	38.9	40.6	2.9	1.6	4.6	4.3	5.8	7.5	
Summer TMIN	56.1	57.8	58.3	59.0	61.9	59.7	66.1	1.7	2.2	2.9	5.8	3.6	10.0	
Fall TMIN	38.4	38.7	40.2	39.0	43.6	39.5	47.0	0.3	1.8	0.6	5.2	1.1	8.6	
Maximum Temperature (°F)														
Annual TMAX	58.4	60.1	60.1	61.5	63.3	62.4	66.8	1.7	1.7	3.1	4.9	4.0	8.4	
Winter TMAX	35.2	36.9	36.8	37.7	38.7	38.8	41.3	1.7	1.6	2.5	3.5	3.6	6.1	
Spring TMAX	56.3	58.9	58.0	61.3	61.2	63.1	65.2	2.6	1.7	5.0	4.9	6.8	8.9	
Summer TMAX	80.3	82.1	82.4	83.7	86.1	84.6	90.2	1.8	2.1	3.4	5.8	4.3	9.9	
Fall TMAX	61.4	62.4	63.0	62.7	66.6	62.9	69.8	1.0	1.6	1.3	5.2	1.5	8.4	
Temperature Extreme (days per year)														
<32°F	158	149	148	143	134	139	116	-9	-10	-15	-24	-19	-42	
<0°F	13	8	8	6	4	5	1	-5	-5	-7	-9	-8	-12	
>90°F	8	13	15	21	34	27	61	5	7	13	26	19	53	
>95°F	1	2	3	5	10	8	28	1	2	4	9	7	27	
TMAX on hottest day of the year	94.2	96.1	95.5	97.5	99.0	99.5	105.0	1.9	1.3	3.3	4.8	5.3	10.8	
TMIN on coldest day of the year	-14.2	-10.1	-9.8	-7.8	-4.1	-6.0	2.8	4.1	4.4	6.4	10.1	8.2	17.0	
Growing Season (days)	164	178	178	183	194	186	214	14	14	19	30	22	50	
Precipitation (in.)														
Annual mean	41.3	44.9	44.5	46.1	47.0	48.3	50.1	3.6	3.2	4.8	5.7	7.0	8.8	
Winter mean	8.7	9.6	9.6	9.8	9.8	10.3	11.4	0.9	0.9	1.1	1.1	1.6	2.7	
Spring mean	10.2	11.1	11.3	11.6	11.8	12.1	13.2	0.9	1.1	1.4	1.6	1.9	3.0	
Summer mean	11.0	12.7	12.1	12.3	13.0	13.5	12.9	1.7	1.1	1.3	2.0	2.5	1.9	
Fall mean	11.3	11.6	11.5	12.3	12.3	12.4	12.7	0.3	0.2	1.0	1.0	1.1	1.4	
Extreme Precipitation (events per year)														
1" in 24 hrs	9.3	10.5	10.9	11.0	11.9	11.8	13.7	1.2	1.6	1.7	2.6	2.5	4.4	
2" in 48 hours	3.9	5.0	5.1	5.3	5.8	5.9	7.8	1.1	1.2	1.4	1.9	2.0	3.9	
Extreme Precipitation (events per decade)														
4" in 48 hours	5.1	5.8	3.8	7.8	8.3	9.2	10.4	0.7	-1.3	2.7	3.2	4.1	5.3	
Snow Covered Days	85	71	70	67	51	58	38	-14	-15	-18	-34	-27	-47	

*There were significant gaps in the daily data from some NH sites for the period 1980-2009. Instead, the historical values in these tables were derived from the downscaled GCM model output

I

(ENERGY EFFICIENCY)

MOVING SOUTHERN NH FORWARD

VOLUME 2:
Energy Efficiency



2015-2035

Regional Comprehensive Plan 2015



Southern New Hampshire Planning Commission works to make our region better by facilitating cooperative and long term decision making. We believe a promising future can be achieved through fiscally sound and responsible planning and development decisions that improve the economy, efficiency and health of our region.

June 2014

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ENERGY EFFICIENCY

PURPOSE

The purpose of the Energy Efficiency and Green Building Chapter is to provide the public and decision - makers with a strategic analysis and evaluation of our region's energy vision; existing and future energy conditions; key energy issues and needs recognized through the Granite State Future (GSF) public outreach; and the key goals and recommendations of the plan, including the salient background information and data which support this evaluation. This chapter is not meant to serve as a comprehensive energy plan; rather it is a strategic integration and evaluation considering the sustainability and livability principles and themes, as outlined in Volume 1 of the Plan.

In order to have sustainable growth in the Southern New Hampshire Planning Commission region we need affordable and clean energy. Defined in the very technical sense, energy is “the capability to do work, expressed in units of power or capacity over time.” The Southern New Hampshire Planning Commission region and the state of New Hampshire as a whole, needs reliable, affordable energy to expand and strengthen our economy. Energy is used in every facet of our day-to-day lives in our homes, our businesses and for our transportation needs. This important component is critical to our environmental quality and economic vitality, which are both highly regarded here in Southern New Hampshire.

VISION

The Energy Efficiency Chapter is founded upon the following Value Statement:



Energy Efficiency

Residents support renewable energy choices such as solar, wind, and geothermal that are climate-friendly. They support policies for higher energy efficiency standards in new buildings and incentives for home energy efficiency improvements. Many residents are also concerned about various weather-related events.

This Value Statement is also in line with New Hampshire's Livability Principles, which provide:

“Climate Change and Energy Efficiency – identify opportunities to save energy and costs and reduce risks to our communities, businesses and citizens. In recent decades, New Hampshire has seen an increase in extreme storms and flooding coupled with steadily rising fuel and energy prices. How can we reduce dependence on outside sources of energy, construct homes and buildings that are more efficient, and reduce impacts to our communities and infrastructure from extreme storms and flooding?”

PUBLIC INPUT FROM SNHPC OUTREACH

Public input collected via GSF public outreach efforts, such as regional visioning workshops, comments submitted online, and a telephone survey conducted by the University of New Hampshire, demonstrate

widespread public support for community development, environmental protection, energy policies and emergency preparedness.

As captured in SNHPC's Public Outreach Report, Energy Efficiency is highly valued by New Hampshire residents. Residents view energy efficiency and energy choices as the second most important priority for investing public dollars. Residents are largely in favor of all the proposed energy efficiency and renewable energy projects, except for the idea of having public charging stations made for electric vehicles. Most residents also think local governments should at least be somewhat involved in developing policies for renewable energy facilities.

ENERGY POLICIES

Three in four residents (77%) support expanding incentives for home energy efficiency improvements (with 52% who "strongly support"), followed by higher energy efficiency standards in new buildings (74%), and promoting renewable energy sources such as solar, wind and geothermal (73%). Meanwhile, only 34% were in support of public charging stations for electric vehicles.

- Those who work at home are more likely to strongly support expanding incentives for home energy efficient improvements.
- Households earning less than \$40,000 are more likely to strongly support promoting renewable energy sources.

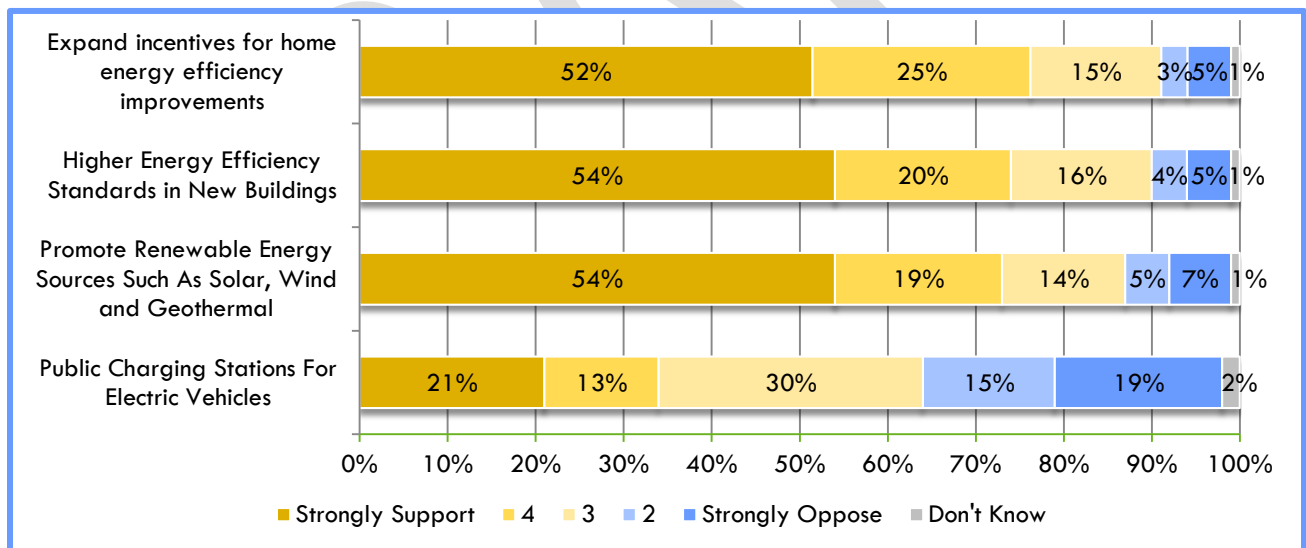


FIGURE 1 SUPPORT/OPOSE ENERGY POLICY CHANGES

Half of residents (49%) think local governments should be very involved in guidelines for renewable energy (such as large wind farms), 38% think they should be somewhat involved, 6% think they shouldn't be very involved, 6% think they should be not at all involved and 1% don't know.

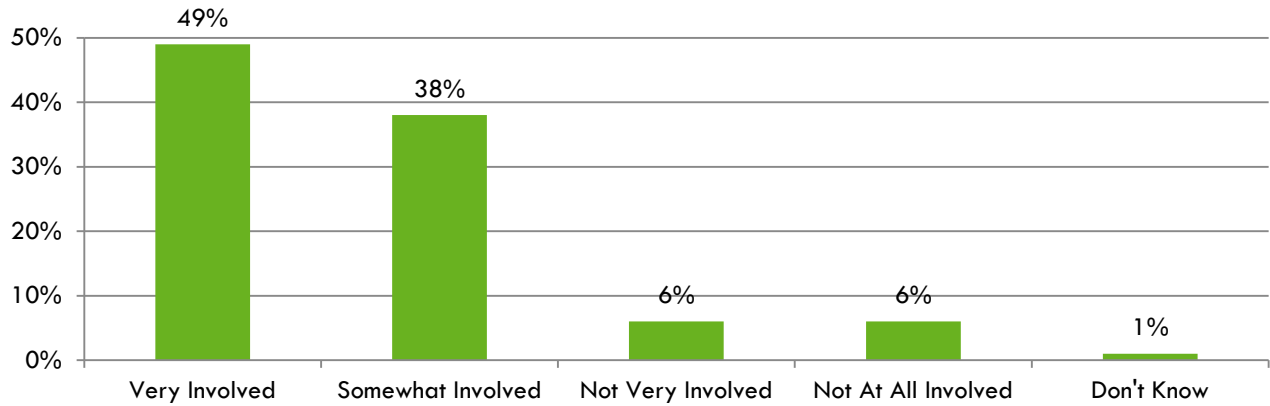


FIGURE 2 HOW INVOLVED SHOULD LOCAL GOVERNMENTS BE IN GUIDELINES FOR RENEWABLE ENERGY?

PRIORITIES FOR INVESTING PUBLIC DOLLARS

Residents' top priority for investing public dollars is environmental protection (24%), followed by energy efficiency (18%), safe and affordable housing (15%), economic development (14%), infrastructure for development (8%), transportation system (7%), preparedness for weather-related or other emergencies (6%), all priorities are equal (6%), something else (3%) and none of the above (1%).

When the top two responses are combined, environmental protection (45%) and energy efficiency (39%) make up the two most cited priorities for investing public dollars.

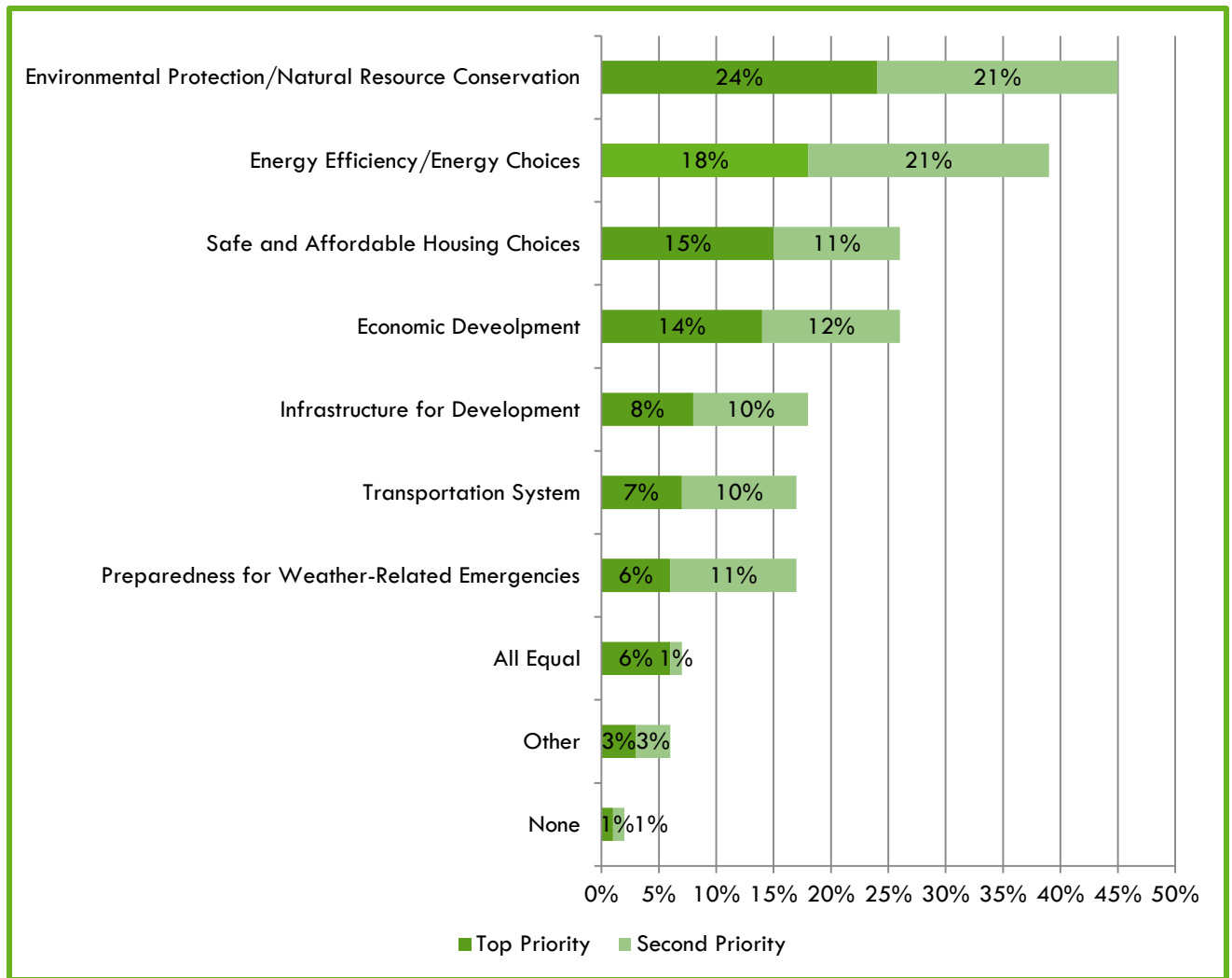


FIGURE 3 PRIORITIES FOR INVESTING PUBLIC DOLLARS

KEY ISSUES & CONCERNS

The Southern New Hampshire Planning Commission has identified several issues that will have an impact on energy production and use in the region in the upcoming years. When addressing energy policy the following should be taken into consideration.

ENERGY EFFICIENT PROJECT FUNDING

Although cost-effective in the long run, energy efficiency projects require significant up-front costs that many businesses and individuals have trouble affording. Funding for energy efficient projects will help with affordability.

COMPLEXITY, INTEREST AND EDUCATION

Many energy efficiency and sustainability programs in New Hampshire are complex and difficult for the general public to understand. For instance, one recent survey showed more than 40 percent of NH residents had little to no idea about where to go for sustainable energy loans, rebates, or grants.¹ Also lack of residential interest and education can present a challenge when trying to make positive changes in a community toward energy efficiency and sustainability.

SPLIT INCENTIVES

In the case of rented buildings, owners pay the costs of initiating energy efficiency programs, but tenants receive the savings from implementing them (or the costs from not implementing them). This leads to a disincentive for landlords to invest in energy efficient projects or renovations. It also leads to a disincentive for renters to invest since investment stays with building.

VOLATILE FUEL PRICES

Develop conservation programs, identify alternative energy resources, examine infrastructure development issues, understand and monitor the impact of market design on operational efficiency and resource development, and propose solutions.

IMPACT OF ELECTRIC INDUSTRY RESTRUCTURING

Monitor energy prices and advise the municipalities on restructuring issues.

CONSOLIDATION OF NORTHEAST ENERGY MARKETS

The federal Energy Regulatory Commission has indicated its preference to combine New England, New York, and Mid-Atlantic electricity markets into a single market, with a single system operator. There are numerous technical and logistical challenges to overcome if a successful Northeast Market is to be developed. Additionally, the financial implications for residents of the Southern New Hampshire region, impacts on system reliability, and ability to influence market design and operations are unknown.

¹ *Independent Study of Policy Issues*: Prepared by the Vermont Investment Corporation, June 2011. A:3.

ENERGY RESOURCE DIVERSITY AS A MEANS TO ENERGY SECURITY

Having a mix of energy supplies can reduce disruptions and mitigate the price volatility of fossil fuels. Indigenous energy resources can improve local energy security. The Southern New Hampshire region will face many decisions related to energy security and will need to assess the pros and cons of government intervention to achieve diversity goals.

THE INTER-RELATIONSHIP OF ENERGY AND ENVIRONMENTAL POLICY

Environmental policy decisions can affect energy choices, prices, and reliability. Energy policy decisions can also affect environmental quality and the region's ability to meet environmental goals. There is a need for close coordination between energy and environmental policy to more effectively achieve common goals and to ensure the respective development and implementation does not inadvertently work at cross purposes.

LAND USE PATTERNS

The Southern New Hampshire Planning Commission recognizes that current zoning regulations and patterns of development are not conducive to reductions in energy consumption. Working with the municipalities in the region to encourage smart growth principles, while educating citizens about best practice in land use patterns that promote sustainable energy use and homebuilding, are essential tools in reducing energy demand.

BUILDING CODES

Building codes can be used to promote sustainable, energy-efficient construction in the built environment. Programs like the U.S. Department of Energy's Building Energy Codes Program (BECP) and certifications such as Leadership in Energy & Environmental Design (LEED) offer guidelines and metrics that can be used to increase a building's energy performance and result in greater energy efficiency and ultimately cost savings.

TRANSPORTATION ALTERNATIVES

The Southern New Hampshire Planning Commission recognizes transportation is an activity that consumes a great deal of fossil fuel. Public transportation options in the Southern New Hampshire region are lacking and the problems that surround this issue are created more so in the region. There are numerous opportunities to create alternatives to the single-occupancy vehicle travel that we are so accustomed to today. Additionally, when the use of alternative fuel in private automobiles becomes more common, accommodations for new fueling infrastructure should be made as needed. Strategies to reduce vehicle miles traveled should include a Complete Streets design approach. Complete Streets are roadways designed and operated to enable safe, attractive and comfortable access and travel for all users, including pedestrians, bicyclists, motorists and public transport users of all ages and abilities.²

² National Complete Streets Coalition (2010). *Economic Development Smart Growth America*. Retrieved from <http://www.smartgrowthamerica.org/complete-streets/complete-streets-fundamentals/factsheets/economic-revitalization> (last accessed 13 January 2014).

NORTHERN PASS

The Northern Pass is transmission infrastructure project that is projected to bring 1,200 megawatts (MW) of clean, low-cost energy from Hydro-Québec's world-class hydroelectric plants in Canada to New Hampshire and New England. This is enough renewable electricity to power one million homes.

The main goal of the Northern Pass is to provide a new connection between New England's energy system and Hydro-Québec's vast hydroelectric resources. Access to this clean, low-cost power will help diversify our region's power supply and keep step with our rising demand for energy.³

DRAFT

³ Project Overview (2014). *The Northern Pass*. Retrieved from: <http://northernpass.us/project-overview.htm> (last accessed 14 January 2014).

EXISTING CONDITIONS

Energy planning has become a key issue to communities, as energy costs continue to increase and concern grows over the environmental and health costs of major forms of energy production. Reducing our dependence on increasingly expensive fossil fuels serves many purposes, such as reducing operating, environmental and health costs; increasing energy options, building comfort, productivity; and keeping more money in the local regional economy.

The connection between global greenhouse gas emissions and our major forms of energy production is becoming increasingly more profound and an extensive analysis of peer-reviewed scientific literature by the Intergovernmental Panel on Climate Change (IPCC) has clearly shown if global greenhouse gas emissions continue to grow at current rates, there will be significant and far-reaching changes in our future climate that will profoundly affect our health, economy, security, and quality of life.⁴

On a regional scale, as outlined in Chapter 8: Climate Change Impacts Assessment, if greenhouse gas emissions continue to increase at current rates, by late in this century New Hampshire's climate will more closely resemble that of North Carolina (Figure 4).⁵

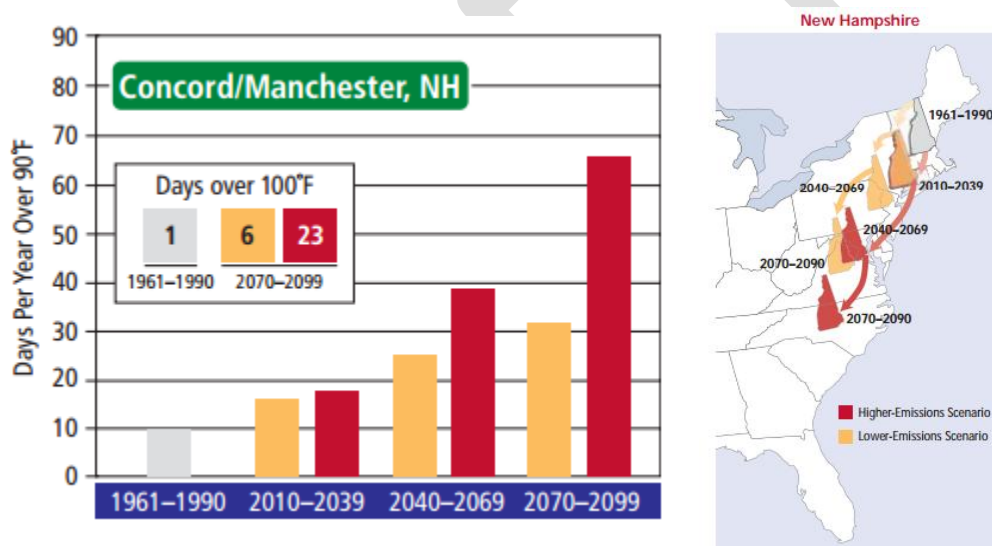


FIGURE 4 TEMPERATURE EFFECTS OF A WARMING CLIMATE

Such a change in New Hampshire's climate presents numerous potential economic impacts including reduced viability of New Hampshire ski areas, change in forest species and extinctions, and increased frequency and severity of extreme weather events and related property damage, and human health impacts. To reduce these negative impacts of climate change, a transition to efficient and renewable sources of energy will be necessary to bring greenhouse gas levels in our atmosphere down to safer levels.

⁴ Gittell, R. and Magnuson, M. (2007). Economic Impact of a New Hampshire Renewable Portfolio Standard. UNH Economic Analysis, 74 pp.

http://des.nh.gov/organization/divisions/air/tsb/tps/climate/documents/unh_rps_report.pdf.

⁵ Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions. Northeast Climate Impacts Assessment Synthesis Team. July 2007. Available at: <http://www.climatechoices.org/assets/documents/climatechoices/confronting-climate-change-in-the-u-s-northeast.pdf>

By considering energy, environmental and economic policies and programs together, we can protect the air, water, and open space in the region. Municipalities, regional planning commissions, and the state can work together to incorporate existing programs and create new ones that will provide a cleaner and healthier environment for all citizens while continuing to have a strong and diverse economy.

ELECTRICITY

As a result of the electric industry undergoing constant restructuring, regional organizations have the ability to play an increasingly larger role in energy planning. It is important for the region to take action in recognizing that New Hampshire is not an energy island, and actions taken outside of New Hampshire affect our energy security, costs and environmental impacts. As privatization and deregulation have become more prevalent in our country, state, and region, it has become a regional responsibility to adopt energy policies that take into consideration the changing global energy economy.

Currently the region is served by Public Service of New Hampshire (PSNH), the State's largest utility. Windham is served by Liberty Utilities and PSNH. A few small areas in the towns of Auburn, Candia, Chester, Deerfield, Raymond and Derry are served by the New Hampshire Electric Cooperative. PSNH serves more than 490,000 homes and businesses throughout New Hampshire and has grown to comprise three fossil fuel-fired generating plants, one wood-burning power plant and nine hydroelectric facilities. As a wholly owned subsidiary of Northeast Utilities, PSNH is an integral part of New England's largest electric system and provides the foundation for continued prosperity and growth in New Hampshire and especially in the Southern New Hampshire Planning Commission Region. (Please refer to the Service Map in the Public Utilities Chapter). PSNH plans to utilize its statewide presence to play a major role in New Hampshire's business development efforts. There are partnerships with state and local organizations to aide in bringing new businesses to New Hampshire and enabling existing businesses to expand. A variety of services are available to companies interested in moving in to New Hampshire.

PSNH facilities are capable of generating more than 1,110 megawatts of electricity. While none of the fossil-fuel fired plants or the wood burning power plant are located within the region, three hydroelectric facilities are found here:

- 1) **Amoskeag Hydro-** Completed in 1924 by the Amoskeag Manufacturing Company and purchased by PSNH in 1936, Amoskeag Hyrdro originally powered the mills in the Manchester Millyard. The original generators and turbines are still in operation and the facility generates 16 MW of power
- 2) **Hooksett Hydro-** Completed in 1927 by PSNH, Hooksett Hydro is located on the Merrimack River and generates 1.6 MW of power. In 1988, a downstream fish passage was installed to allow native fish to move freely downriver. The original generators and turbines are still in operation.
- 3) **Garvins Falls-** Originally built in 1901 by PSNH predecessor Manchester Traction and Light Company; Garvins Falls Hydro is located on the Merrimack River. The plant only had two turbine generators when built; two more were added in 1925. In 1988, the waste gate at the end of the power canal was modified to permit passage of downstream fish. This facility generates 12.1 MW of power.

FOSSIL FUELS

It is clear that fuel oil, kerosene, and other types of fossil fuels are the primary sources of household heating (see **Table 1**). All of the communities in the region have a higher percentage of oil-based heating than the state as a whole. This dependence on oil-based heating is proving to be costly and harder to come by and will continue to do so in upcoming years as oil and natural gas prices increase and the economies of India and China become more oil dependent.

Table 1 SNHPC Household and Heating Type - By Percentage

Municipality	Utility Gas	Bottled, Tank or Liquid Propane	Electricity	Fuel Oil, Kerosene, Etc.	Coal or Coke	Wood	Solar Energy	Other Fuel	No Fuel
Auburn	0.0	18.8	3.7	66.4	0.5	9.4	0.0	1.2	0.0
Bedford	1.4	1.7	3.0	62.0	0.0	2.0	0.0	0.8	0.0
Candia	0.0	17.7	2.3	66.6	0.0	12.1	0.0	1.2	0.0
Chester	1.2	15.9	0.0	75.7	0.5	4.4	0.0	1.7	0.5
Deerfield	1.2	19.0	0.0	62.0	1.4	16.3	0.0	0.0	0.0
Derry	8.8	15.7	16.4	52.3	0.2	2.8	0.1	2.6	0.9
Goffstown	9.2	16.0	5.2	63.4	0.0	4.5	0.0	0.9	0.0
Hooksett	35.6	8.8	4.9	46.2	0.0	3.3	0.0	1.3	0.0
Londonderry	11.8	16.4	9.3	58.6	0.0	2.6	0.0	1.2	0.0
Manchester	49.7	3.2	10.0	34.3	0.06	0.9	0.0	1.0	0.7
New Boston	3.3	31.6	2.2	50.8	0.0	11.5	0.0	0.4	0.0
Raymond	3.5	21.3	3.4	63.6	0.0	5.6	0.0	2.2	0.3
Weare	1.0	20.7	3.3	52.7	0.0	20.2	0.0	2.1	0.0
Windham	3.8	27.6	1.0	62.6	0.0	3.8	0.0	1.3	0.0
State of New Hampshire	19.7	13.4	7.7	50.0	0.1	7.2	0.05	1.2	0.7

SOURCE: 2010 U.S. CENSUS

RENEWABLE ENERGY

While energy demand cannot be eliminated completely, renewable energy can be a valuable complement to energy efficiency and conservation. Energy efficiency and energy conservation can be the most sustainable, cost-effective and least polluting means of reducing our demand for energy. Homeowner and municipal education as well as other initiatives are needed to reduce the demand for energy in the Southern New Hampshire Planning Commission Region.

The Energy Information Administration (EIA) states, "New Hampshire has no fossil fuel reserves but has substantial renewable energy potential. The Appalachian Mountains, which cover much of western New Hampshire, offer wind power potential, and several waterways, including the Connecticut and Merrimack River basins, are hydroelectric power resources. In addition, dense forests in northern and southern New Hampshire offer potential fuel wood for electricity generation."⁶ Among the potential benefits of renewable energy are:

- Diversification of energy sources
- More security because it can be produced close to point of use and it has multiple sources such as hydro, wind, solar, biomass and geothermal
- Efficiency gains due to less energy consumed in transmission or transport
- More energy dollars are retained in local or regional economy, not exported
- Renewable energy installations can create additional local jobs
- Reduced pollution compared with fossil fuels
- Can be greenhouse-gas neutral
- Lifetime cost can be lower than for non-renewable energy sources

⁶ New Hampshire State Energy Profile, http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=NH

- “Wastes” such as manure, sewer gas, landfill gas, landscape trimmings, can become energy sources
- Annual operation costs are low

State law, RSA 72: 61-72 grants municipalities the option to exempt certain renewable energy installations from property taxation. Currently six communities in the region – Bedford, Chester Londonderry, Raymond, Weare and Windham – have elected to exempt at least one type of renewable energy installation incentive. This total is up from three communities in 2003. If more municipalities participated in these programs, there would be more incentive for people to explore different options for home heating and electricity, leading to an improvement in the region’s economic vitality and energy sustainability.

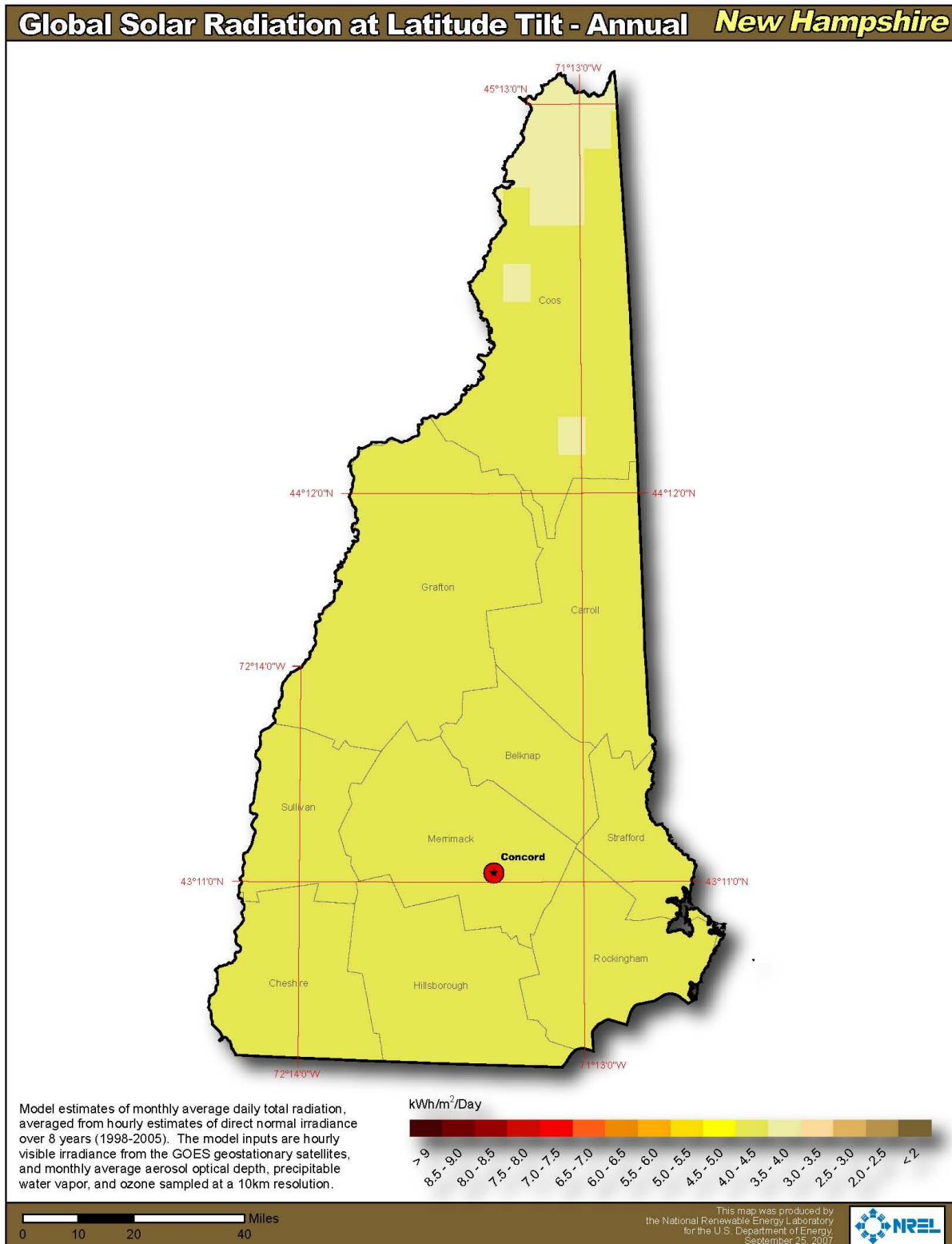
TABLE 2 SNHPC MUNICIPAL PROPERTY TAXATION EXEMPTIONS

Municipality	Solar Energy Exemption	Wind Powered Exemption	Wood heating Energy Exemption
Auburn	NO	NO	NO
Bedford	YES	YES	YES
Candia	YES	NO	NO
Chester	YES	YES	NO
Deerfield	NO	NO	NO
Derry	NO	NO	NO
Goffstown	NO	NO	NO
Hooksett	NO	NO	NO
Londonderry	YES	YES	NO
Manchester	NO	NO	NO
New Boston	NO	NO	NO
Raymond	YES	YES	YES
Weare	YES	NO	NO
Windham	YES	YES	NO

SOURCE: 2013 NEW HAMPSHIRE OFFICE OF ENERGY AND PLANNING

If a municipality has adopted the exemption, the value of the equipment and installation to property may be exempt from taxation.

MAP 9-1 NEW HAMPSHIRE GLOBAL SOLAR RADIATION



In 2012, the average annual electricity consumption for a U.S. residential utility customer was 10,837 kWh, an average of 903 kilowatt-hours (kWh) per month. Louisiana had the highest annual consumption at 15,046 kWh and Maine the lowest at 6,367 kWh. New Hampshire's average electricity price in 2012 was 16.47 cents per kWh, which is the sixth highest in the country. As mentioned previously, renewable energy can be a valuable complement to energy efficiency and reducing electricity consumption as well as overall cost.

The renewable portfolio standard, a regulation that requires the increased production of energy from renewable energy sources, calls for 10.65% of electricity from renewable energy in 2012, including 0.15% from solar and by 2025, 24.8% of electricity is expected to be from renewable energy, 0.3% from solar.⁷

Map 9-1 shows New Hampshire has the potential to average a daily total radiation of 3-5 KWH per Sq. Meter per Day⁸. This means the average household will most likely need to supplement any type of solar installation with other forms of energy. Large-scale solar installations could prove to be an effective means of energy production for large businesses or communities as an alternative energy source though. Net metering, which allows excess generation of energy to be credited towards the following months is one way to receive a return on the investment of solar.

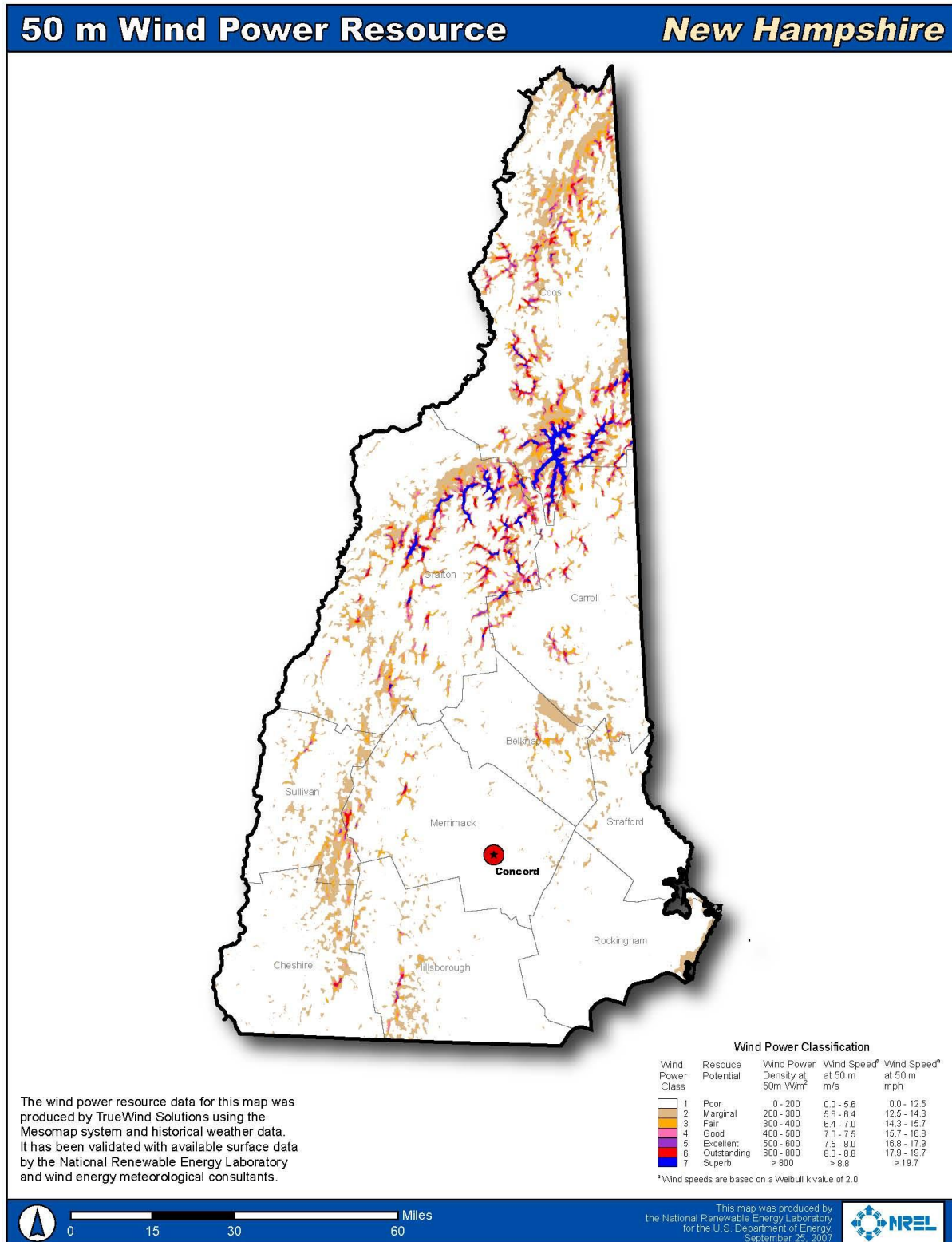
Currently New Hampshire has several solar arrays, the largest is the 525kW solar array installed on the top level of the Manchester Airport parking Garage. Other solar projects include a 51kW solar array PSNH installed on their roof in 2009 and a 50kW array on the roof of the Stonyfield Farm Yogurt Factory installed in 2005.⁹

⁷ New Hampshire Renewable Portfolio Standard, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NH09R

⁸ See **Map 9-1** Global Solar Radiation

⁹ Stonyfield Yogurt Solar, <http://www.nativeenergy.com/stonyield-farm-solar-array.html>; PSNH Solar, <http://www.psnh.com/RenewableEnergy/About-PSNH/Solar-at-Energy-Park.aspx>; Manchester Airport Solar, <http://www.flymanchester.com/newsletters/holiday-2012/solar-project>.

MAP 9-2 NEW HAMPSHIRE WIND POWER



Wind power is another renewable energy resource that is available in New Hampshire. The resource map (**Map 9-2**) shows estimates of wind power density at 50 meters above the ground and depicts the resource that could be used for community – scale wind development using wind turbines at 50-60 meter hub heights.

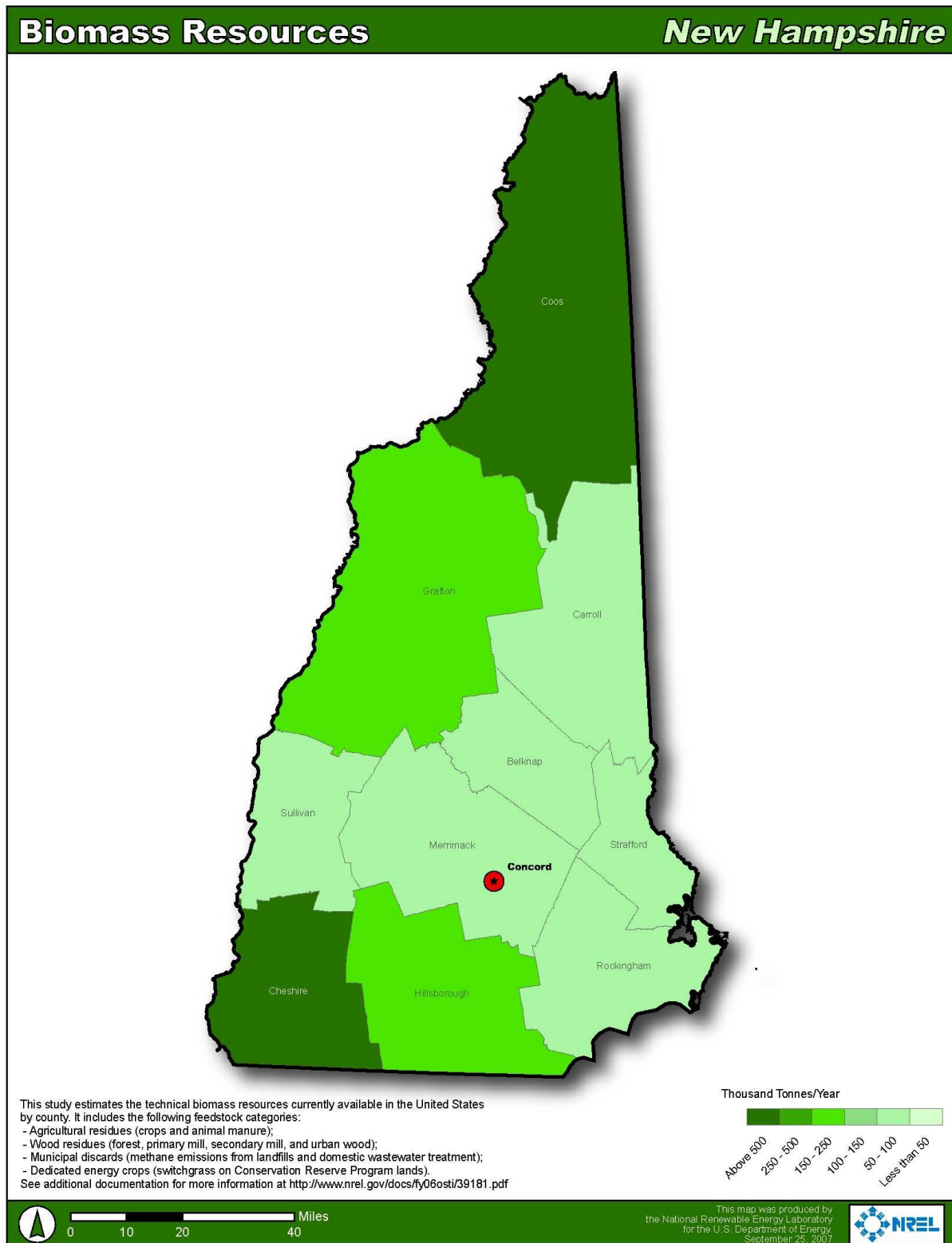
As a renewable resource, wind was classified according to wind power classes which are based on wind speed frequency distributions and air density. These classes ranged from Class 1 (lowest) to Class 7 (highest). In general, at a 50 meter height, wind power Class 4 or higher could have been useful for generating wind power with turbines in the 250 kW to 750 kW rating. Given the advances in technology, resources below Class 4 may now be suitable for the new midsize wind turbines. In recognition of these continuing advancements in wind energy technologies and the ability for the current generation of wind turbines to extract cost competitive wind energy from lower wind speeds the Energy Department has moved away from the wind speeds only.¹⁰

The resource map indicates New Hampshire has wind resources consistent with community – scale production. The excellent wind resource areas in the state are on the ridge crests. The White Mountain region in northern New Hampshire is the most prominent area. Certain ridge crests in the western part of the state can also have excellent wind resource.

Currently there are three operating wind farms in New Hampshire: Lempster Mountain, Granite and Groton Wind located in Sullivan, Coos and Grafton Counties. There are two proposed wind farms as well, Wild Meadows and Alexandria located in Merrimack and Grafton Counties.

¹⁰ U.S. Department of Energy, http://www.windpoweringamerica.gov/maps_template.asp?stateab=nh

MAP 9-3 NEW HAMPSHIRE BIOMASS RESOURCES



As shown in the map (**Map 9-3**), biomass is another renewable resource that is available in New Hampshire. In New Hampshire, biomass generally refers to low value wood from logging. The wood chips are burned by energy plants to make electricity, because biomass plants receive their energy from the sun through photosynthesis, they are cleaner-burning than fossil fuel plants. The map above accounts for agricultural residues, wood residues, municipal discards and dedicated energy crops.

The areas showing the greatest potential for biomass are Coos and Cheshire Counties with the potential for over 500 thousand tons per year, followed by Grafton and Hillsboro Counties with the potential of 150 – 250 thousand tons per year. The remaining counties, Sullivan, Merrimack, Carroll, Belknap, Strafford and Rockingham show potential for 50 – 100 thousand tons per year.

Currently, New Hampshire has seven existing biomass plants in Alexandria, Bethlehem, Bridgewater, Springfield, Portsmouth, Tamworth and Whitefield. These seven active biomass plants can produce 144 MW of electricity, have a capacity of 1.8 million tons of biofuel and have provided 150 direct jobs. There are also two proposed plants for the town of Berlin, Clean Power Development and Laidlaw Berlin-Biopower. These proposed biomass plants could potentially create an additional 100 MW of electricity and 63 direct jobs.¹¹

CURRENT ENERGY EFFICIENCY PROGRAMS

New Hampshire currently has a variety of programs that help homeowners, cities, towns, school districts, businesses and industries, and entire regions to cut their energy use and reduce pollution. Currently the Southern New Hampshire Planning Commission member communities have done little to take advantage of these programs, and it is time for the region to come together and do so.

The New Hampshire Office of Energy and Planning (NHOEP) operates several energy programs in partnership with both private and public entities to promote a sustainable, environmentally sound future for New Hampshire as well as to encourage conservation and renewable energy source. New Hampshire also has two clean transportation programs that seek to reduce emissions by automobiles, trucks and buses and to reduce the state's reliance on foreign oil supply.¹² Additionally, the two major electric utility providers in the region, PSNH and New Hampshire Electric Cooperative, provide many energy conservation incentive programs designed to reduce energy use, save money and protect our environment. The following section briefly discusses some of these programs in greater detail.

NEW HAMPSHIRE GREENHOUSE GAS EMISSIONS REDUCTION FUND (GHGERF)

The Greenhouse Gas Emissions Reduction Fund (GHGERF) is a fund created by New Hampshire legislation in 2008, RSA 125-O: 23. The source of the funding comes from New Hampshire's participation in the Regional Greenhouse Gas Initiative (RGGI). RGGI is the regional cap and trade program aimed at reducing carbon dioxide emissions in the electric power sector across ten participating states in the northeast. Under RGGI, emission amounts are inventoried and a cap is established at a level below current emission levels. New Hampshire emissions allowances are sold at quarterly auctions and the proceeds fund the GHGER program.

The proceeds of these allowance auctions are portioned out among the state participants, and in New Hampshire, the statute directs that the proceeds of each auction flow into the GHGERF. The GHGERF is administered by the Public Utilities Commission (PUC), which is responsible for distributing the funds to

¹¹ New Biomass New Hampshire; <http://www.newbiomassnh.org/issues>

¹² NHOEP maintains a website that serves as a clearinghouse for State sponsored and assisted energy planning programs at <http://www.nh.gov/oep/energy/programs/index.htm>.

programs across the state. These funds support energy efficiency, conservation and demand response programs in order to reduce greenhouse gas emissions generated in New Hampshire.

Ten percent of RGGI funds are set aside to help low-income residential customers reduce their energy use, and the remainder of the funds are distributed through competitive grants or adjudicative proceedings. In 2009 there were 30 awards given, totaling \$17.7 million. Grants were awarded to towns and schools for audits and retrofits, revolving loan funds, large businesses, electric utilities, non-profits, educational institutions, job training programs, and grassroots organizations.

As of June, 2010 the GHGERF has seen revenue of \$24.3 million. During the first reporting year (July 2009 to June 2010), the program was responsible for savings of \$1.5 million in energy costs for New Hampshire residents and a 4,600 metric ton reduction in carbon emissions, which is equal to taking 9000 cars off the road for a year. Projections for the second reporting year of the program (July 2010 to June 2011) forecast an energy cost savings of \$4.2 million and a carbon emissions reduction of 13,200 metric tons.^{13,14}

MUNICIPAL ENERGY REDUCTION FUND (MERF)

As part of the aforementioned GHGERF funding program, the Community Development Finance Authority (CDFA) was awarded \$1.5 million to help finance energy improvements for municipal facilities and activities. The CDFA is a nonprofit group that promotes affordable housing and economic development.

CDFA's Municipal Energy Reduction Fund is available to help municipalities improve the energy efficiency of their municipal buildings, street lighting, water and sewer treatment facilities, and where appropriate, electrical distribution systems. The goal is to reduce energy usage and costs.

Activities will include, but are not limited to:

- Improvements to the buildings envelope including air sealing and insulation in the walls, attics, and foundations;
- Improvements to HVAC equipment inside conditioned space;
- Installation of sealed combustion, high efficiency condensing boilers;
- Installation of alternative energy sources.¹⁵

25 X 25 RENEWABLE ENERGY INITIATIVE

The 25 x 25 Renewable Energy Initiative was announced in August of 2006 and signed into law in May 2007 as the Renewable Energy Act (RSA 362-F); the goal of 25 x 25, a bipartisan national effort, is for New Hampshire to obtain 25% of its energy from clean, renewable sources by the year 2025.

According to the most recent data from the federal Department of Energy, about 14% of New Hampshire's 2011 net electricity generation came from renewable energy.¹⁶ Energy sources include heating fuels, transportation fuels and electricity. Of the electricity consumed in New Hampshire in 2011, 10.6% is from renewable sources.

¹³ NH Greenhouse Gas Emissions Reduction Fund Year 1 (July 2009 – June 2010) Evaluation, published by Carbon Solutions New England

¹⁴ New Hampshire Public Utilities Commission (PUC), <http://www.puc.nh.gov/Sustainable%20Energy/GHGERF.htm> and

¹⁵ New Hampshire Community Development Finance Authority, <http://www.nhcdfa.org/document/ep/2>

¹⁶ U.S. Energy Information Administration <http://www.eia.gov/state/print.cfm?sid=NH>

Achieving 25% renewable energy for New Hampshire might be more easily accomplished as an overall goal, rather than working toward 25% renewable energy in each of the end use categories and economic sectors. It will also be easier to meet the overall goal for renewable energy if demand for energy is reduced by means of energy efficiency and conservation.

The 25 x 25 Plan is being developed jointly, by the New Hampshire Office of Energy and Planning and the Department of Environmental Services in coordination with Innovative Natural Resource Solutions LLC, a New Hampshire-based consulting firm.¹⁷

ENERGY TECHNICAL ASSISTANCE AND PLANNING FOR NEW HAMPSHIRE COMMUNITIES (ETAP)

“As a component of the 2007 Energy Independence and Security Act, the U.S. Department of Energy's Energy Efficiency and Conservation Block Grant (EECBG) Program was established to assist eligible entities in implementing strategies relating to:

- Reduction of fossil fuel emissions
- Reduction of total energy use
- Improved energy efficiency in transportation, building and other areas

The American Recovery and Reinvestment Act 2009 (ARRA) and the Energy Efficiency Conservation Block Grant (EECBG), received its first appropriations of \$3.2 billion nationally in 2010. NH received approximately \$17.3 million. The national funds were distributed using the following formula:

- 68% distributed from the U.S. Department of Energy via a formula to the 10 most populated municipalities and/or counties in each state
- 28% distributed from the U.S. Department of Energy via a formula to the state energy offices in each of the states
 - Out of the portion going to NH Office of Energy and Planning, 60% is required to go to the municipalities which are not chosen as one of the 10 most populated municipalities. The remaining 40% will go into the State Energy Program
- 2% distributed by the U.S. Department of Energy to the Tribes
- 2% distributed by the U.S. Department of Energy via competitive process to municipalities, counties and tribes that are not eligible for the direct formula grant funds”¹⁸

The State Energy Program is called Energy Technical Assistance and Planning for New Hampshire Communities (ETAP).

ETAP was implemented from 2010-2012 as a partnership between NHOEP, CLF Ventures, Peregrine Energy Group, Clean Air Cool Planet and the New Hampshire Regional Planning Commissions. Through this program New Hampshire municipalities were offered energy efficiency technical assistance to reduce energy use, reduce fossil fuel emissions and improve energy efficiency and transportation, building and other areas. This technical assistance took many different forms and was determined on a community by community basis through several preliminary meetings with municipal contacts. The level of assistance was also determined at these meetings.

¹⁷ NHOEP, <http://www.nh.gov/oep/energy/programs/initiatives.htm#renewable>

¹⁸ NHOEP. <http://www.nh.gov/oep/>

GRANITE STATE CLEAN CITIES COALITION

Operated by the New Hampshire Department of Environmental Services and funded by the U.S. Department of Energy, Granite State Clean Cities Coalition (GSCCC) is a partnership of local private and public fleets (including municipal highway department, parks and recreation and emergency vehicles) throughout the state. The project seeks to expand the use of alternative, cleaner burning fuels by private and public fleets and individuals. GSCCC offers training, equipment and vehicle demonstrations, and strategic planning services. Currently within the Southern New Hampshire region, only the City of Manchester is a stakeholder of GSCCC.¹⁹

THE ALTERNATIVE VEHICLES FUEL PROJECT

Operated by the New Hampshire Department of Environmental Services and funded by Congestion Mitigation Air Quality funding from the New Hampshire Department of Transportation and the U.S. Department of Transportation, the project provides funding to help state and municipal fleets purchase alternative fuel vehicles and infrastructure.²⁰

BUILDING ENERGY CONSERVATION INITIATIVE

Established in April 1997, with a second financing package secured by the State Treasurer in 2002, this program analyzes state buildings for energy and resource conservation opportunities. Building Energy Conservation Initiative (BECI) utilizes a "paid from savings" procedure known as "Performance Contracting." This allows agencies to perform energy retrofits and building upgrades that would otherwise not be funded through capital appropriations, providing that energy savings can pay for the project cost, as outlined in RSA 211. NHOEP institutes the study, along with the individual state agencies whose buildings are being evaluated.

BECI is designed specifically for energy improving measures. A sample of those improvements may include lighting upgrades, HVAC upgrades, domestic hot water systems, energy management controls, water conservation measures, building envelope improvements, and miscellaneous projects which an energy service company can prove are feasible within BECI.

Each BECI contract includes instructions on the procedure needed to verify the savings generated by these energy improvements. Since various buildings may include some, but not all, of the suggested measures, a procedure of Measurement and Verification (M & V) is unique to each energy improvement. The most common M & V procedures are "Stipulated Savings," which are calculated upfront, and "Measured Savings" which involve metering and sub metering.²¹

NEW HAMPSHIRE INDUSTRIES OF THE FUTURE

New Hampshire Industries of the Future (NHIOF) is a U.S. Department of Energy sponsored partnership between businesses, the Business and Industry Association's Waste Cap Resource Conservation Network, and the Governor's Office of Energy and Community Services. NHIOF is designed to help energy- and waste-intensive industries use technology and process advancements to improve profitability and competitiveness by cutting energy costs. NHIOF is helping manufacturers in some of the state's largest industry sectors- metals, rubber, plastics, and forest products- to develop strategies to resolve issues of energy efficiency, productivity, waste reduction and environmental conservation. It also seeks to develop a vision of what business people want their respective industries to look like five, ten and twenty years in the future. Businesses are identifying obstacles to achieving that vision - such as energy efficiency, productivity,

¹⁹ Granite State Clean Cities Coalition, <http://www.granitestatecleancities.nh.gov/>

²⁰ NHOEP, <http://www.nh.gov/oep/energy/programs/initiatives.htm#alternative>

²¹ NHOEP, <http://www.nh.gov/oep/energy/programs/initiatives.htm#alternative>

waste reduction and environmental issues - and putting together pragmatic strategies to resolve the problems.²²

RENEWABLE ENERGY PROPERTY TAX EXEMPTION

This incentive, discussed in the previous section, outlined in NH RSA 72:61-72, permits cities and towns to offer exemptions from local property taxes for certain renewable energy installations. These include solar thermal (for example, to heat water), solar photovoltaic (to generate electricity), wind (to generate electricity) and central wood-fired heating systems (not stoves or fireplaces).²³

NEW HAMPSHIRE ENERGY SMART SCHOOLS PROGRAM

This program is open to all K-12 public and private schools in New Hampshire. It is designed to allow schools to pursue energy efficiency initiatives aimed at controlling energy usage and saving money. The program utilizes an energy benchmarking system designed to help schools:

- Understand the energy consumption and cost trends at each of their buildings;
- Learn how their buildings are performing compared to other schools locally and nationally;
- Identify opportunities for improving operations and reducing costs;
- Take advantage of resources to implement efficiency improvements and save money.

To start, the program asks schools to submit their building and energy use data. This data is then used to create a customized analysis for each school that assesses the basic nature of its energy consumption and utility costs. The analysis also compares the school's data against similar schools in New Hampshire and across the country to assess its performance relative to buildings with comparable codes, standards, regulations, size and climate/weather. The analysis also proposes recommendations for making money saving improvements and outlines a list of resources that can help to implement them.

Schools that have participated in energy benchmarking programs have demonstrated an approximate 20 percent decrease in overall energy use. As of early 2014, 209 New Hampshire schools have been benchmarked through the Energy Smart Schools program.²⁴

HIGH PERFORMANCE SCHOOLS

High performance schools offer superior indoor environmental conditions for health and academic performance, are cost-effective and efficient to operate and maintain, and are resource efficient in the areas of energy use, water use, and building material content and durability.

House Bill 129, effective September 9, 2005 gives the Department of Education the ability to award up to three percent more state funding to districts which design, build, and operate school facilities that meet new high performance standards.

Those standards, are modeled after similar criteria established by the Collaborative for High Performance Schools (CHPS) in California and modified for the New England climate and region-specific building codes. Version 2.0 of the Northeast CHPS Criteria has been updated in 2013 and Version 3.0 of the Northeast CHPS Criteria is now available. No New Hampshire school buildings currently qualify as high performance, but a number of districts, design firms, and other advocates are working toward making high performance schools a commonplace occurrence in the state.

²² NHOEP, <http://www.nh.gov/oep/energy/programs/initiatives.htm#alternative>

²³ NHOEP, <http://www.nh.gov/oep/energy/saving-energy/incentives.htm>

²⁴ New Hampshire Energy Smart Schools Program, <http://www.nhschoolbenchmarking.com/Default.aspx>

In New Hampshire there are over 200,000 public school students and 15,000 teachers who spend time in schools with poor indoor air quality, inadequate lighting and drafty rooms. At the same time, administrators, parents and taxpayers must address parent dissatisfaction, increased energy and operation costs and the mitigation of environmental impacts. On average \$165 million is spent annually on school construction in the state, yet despite this investment, the buildings are still lacking in terms of quality and performance.

Over 70 percent of the schools in New Hampshire have been in service for 36 years or more. This gives New Hampshire a tremendous opportunity as many municipalities look to construct new schools and rehab existing spaces. High performance schools utilize proactive, cost-effective and integrated design to result in healthy and efficient school buildings. These schools serve to maximize tax dollars as well as improve the quality of life for students.

The major hurdle is the perceived cost of building a new school or rehabbing an existing one. However with the incentives provided, the long-term benefits outweigh the initial costs.²⁵

CITIES FOR CLIMATE PROTECTION PROGRAM

The Cities for Climate Protection Campaign (CCPC) enlists cities to adopt policies and implement measures to achieve quantifiable reductions in local greenhouse gas emissions, improve air quality, and enhance urban livability and sustainability. As of 2009, 1000 local governments across the country participated in the CCP, integrating climate change mitigation into their decision-making processes.

Communities that participate in the CCP benefit from the actions they take to reduce greenhouse gas emissions through:

- Financial savings in reduced utility and fuel costs to the local government, households, and businesses;
- Improved local air quality, contributing to the general health and well-being of the community;
- Economic development and new local jobs as investments in locally produced energy products and services keep money circulating in the economy.

The City of Keene has been participating in the CCP since 2000. Officials from that city acknowledged local governments play a key role in climate change efforts because they can have direct influence and control of activities that produce such emissions. Decisions about development and land use, energy-efficient buildings, investment in public transit, waste reduction and recycling program all affect local air quality and living standards. They felt the Cities for Climate Protection program was an opportunity for Keene to take practical steps to reduce greenhouse gas emissions and generate other benefits for their communities.

The Cities for Climate Protection Campaign features a five-step process:

- Conduct an energy and emissions inventory and forecast;
- Establish an emissions reduction target;
- Develop and obtain approval from the Local Action Plan;
- Implement policies and measures from Plan;
- Monitor and verify results.

Other towns in the New England region that participate include Burlington, Vermont; Bridgeport, Connecticut; and Springfield, Massachusetts.²⁶

²⁵ New Hampshire Performance for High Performance School, <http://www.neep.org/public-policy/energy-efficient-buildings/high-performance-schools/index>

BIO OIL PROJECT

New Hampshire Office of Energy and Planning and the New Hampshire Department of Resources and Economic Development led a study to determine the economic, environmental and technical feasibility of establishing a bio-oil production and utilization industry in New Hampshire. Other partners in the study team included US and Canadian federal agencies; multiple states' agencies; universities; forest industry, environmental, and biomass energy organizations; economic development organizations; and private individuals. The final report, entitled *Bio-oil Opportunity* and published in September 2004, was intended to provide New Hampshire state government, forest industries, community groups, citizens, bio-oil facility developers and others information on the opportunity that bio-oil production may provide in New Hampshire. This analysis is part of New Hampshire's ongoing effort to secure sustainable and clean energy.

Bio-oil is a renewable, liquid resource that can be obtained from low-grade wood waste by a process known as pyrolysis. This liquid burns cleaner and produces fewer pollutants (e.g., virtually no sulfur emissions) than coal and oil fuels. Bio-oil has potential uses for the production of heat and electricity. Eventually, it may have additional, higher value as a feedstock for a "green" chemicals industry.

Bio-oil production and utilization have several potentially beneficial outcomes including: economic support of sustainable forest management practices; renewable, indigenous, carbon-neutral energy supply; creation of jobs and retention of energy dollars in the regional economy; ability to generate and market electricity at peak demand times; possible spin-off business growth through co-location; combined heat and power applications; derivative products and services.²⁷

STATE HEATING OIL AND PROPANE PROGRAM

The State Heating Oil and Propane Program (SHOPP) monitor residential retail prices for heating oil and propane to determine the average prices for these fuels in New Hampshire. From October through March, SHOPP conducts weekly price surveys and monthly from April to September. Additionally, the state monitors kerosene, electricity, natural gas, gasoline, and diesel fuel prices on a monthly basis.²⁸

WEATHERIZATION PROGRAM

The State of New Hampshire's Weatherization Program is designed to reduce household energy use and costs in low-income households throughout the state by installing energy efficient improvements. The overall goal of the Weatherization Program is to serve those households that are most vulnerable to high-energy costs and may not have the means of making cost-effective energy conservation improvements to their homes.

The New Hampshire Office of Energy and Planning (NHOEP) operates the Weatherization Program with grants from the U.S. Department of Energy (DOE) and the U.S. Department of Health and Human Services. NHOEP subcontracts with New Hampshire's Community Action Agencies (CAAs), which are responsible for operating and delivering weatherization services at the local level. OEP, whenever possible, collaborates with the electric and natural gas utilities' energy efficiency programs to enhance the weatherization services provided to low-income households in New Hampshire. In the Southern New Hampshire region, the following agencies are:²⁹

- Hillsborough County-Southern New Hampshire Services
- Rockingham County-Rockingham Community Action
- Merrimack County-Community Action Program

²⁶ City of Keene, NH, <http://www.ci.keene.nh.us/sustainability/climate-change>

²⁷ NHOEP, <http://www.nh.gov/oep/energy/programs/index.htm>

²⁸ NHOEP, <http://www.nh.gov/oep/energy/programs/index.htm>

²⁹ NHOEP, <http://www.nh.gov/oep/energy/programs/index.htm>

STAY WARM NH

Stay Warm NH is a program offered by the NHOEP that centralizes information and resources pertaining to money and energy saving measures in one location. The Stay Warm NH website provides links to energy resources, weatherization programs and available energy-related funding opportunities. It is an invaluable source of information for residents and businesses looking to reduce energy costs in these difficult financial times.³⁰

BUILD GREEN NH

The Build Green NH Council is comprised of industry professionals dedicated to providing green building guidelines for building and remodeling professionals and environmentally concerned consumers through its certification program.³¹

The Build Green NH Council is recognized as the voice of professional green builders and remodelers in New Hampshire by unifying the industry, promoting a broader understanding of green building, and increasing consumer awareness of Home Owners and Remodelers Association of New Hampshire (HBRANH), Green Builder. The Council is dedicated to providing quality education and awareness to our members and to the public.

Build Green NH encourages builders and consumers to look to the National Green Building Standard for guidance.

INDUSTRIAL ASSESSMENT CENTERS

The Industrial Assessment Center (IAC), funded by the U.S. Department of Energy, enables eligible small and medium-sized manufacturers to have comprehensive industrial assessments performed at no cost. The IAC assessments assist manufacturers to become more economically competitive by helping them reduce energy use, minimize waste, and increase productivity.

The Center for Energy Efficiency and Renewable Energy (CEERE) at the University of Massachusetts in Amherst serves most of New Hampshire. It was established in 1984 and is nationally recognized for its work. Since being established, they have surveyed over 450 plants. More than 1,900 Assessment Recommendation (AR) measures have been identified with average cost savings of \$35,000 per year and an average simple payback of 1.2 years.

An industrial assessment consists of an in-depth assessment of a plant site including its facilities, services and manufacturing operations. The assessment involves a thorough examination of potential savings from:

- Energy efficiency improvements
- Waste minimization and pollution prevention
- Productivity improvement

The assessment begins with the IAC team, consisting of engineering faculty and students, conducting a survey, followed by a one or two day site visit, taking engineering measurements as a basis for assessment recommendations. The team then performs a detailed analysis for specific recommendations with related estimates of costs, performance and payback times.

Within 60 days, a confidential report detailing the analysis, findings and recommendations of the team is sent to the plant. In two to six months, follow-up phone calls are placed to the plant manager to verify recommendations that will be implemented.³²

³⁰ NHOEP, <http://www.nh.gov/oep/energy/programs/index.htm>

³¹ Build Green NH, <http://www.buildgreennh.com/>

PAY AS YOU SAVE (PAYS) ENERGY EFFICIENCY PRODUCTS PILOT PROGRAM

The Pay as You Save (PAYS) pilot program, offered by PSNH and the New Hampshire Electric Cooperative, allows certain customers to finance the purchase of approved efficiency devices, appliances, or services on their electric bill. This innovative pilot program provides eligible customers with a way to purchase efficiency measures while eliminating up-front costs. The costs of installed measures are repaid over time by participating customers from savings on their electric bill. The PAYS program can be used for:

- Weatherization; including air sealing, insulation and recommended through a Home Energy Analysis
- ENERGY STAR lighting, ENERGY STAR products
- Lighting and Lighting control recommended through a Business Energy Analysis³³

CORE ENERGY EFFICIENCY PROGRAMS IN NEW HAMPSHIRE

As part of the Restructuring Act, RSA 374-F:3 X, the electric utilities in the State of New Hampshire have established a set of energy efficiency programs designed for statewide implementation in the service territories of the utilities regulated by the Public Utilities Commission (PUC). A variety of programs exist, serving both residential and commercial and industrial customers. They include programs for new construction, retrofitting existing structures, and rebate programs for selected lighting and appliances. In addition to the statewide programs, individual utilities run specific programs. The electric utility companies involved are PSNH, the New Hampshire Electric Cooperative, Unitil Energy Systems and Liberty Utilities.³⁴

NHSaves

NHSaves is the website formed by New Hampshire's electric utility companies designed to provide New Hampshire residents and businesses with information and support pertaining to the Core Energy Efficiency Programs in New Hampshire. Created in conjunction with the New Hampshire Public Utilities Commission and other interested parties, it serves as a clearinghouse for the programs available through the Core Energy Efficiency Programs. Residential, commercial and industrial electricity customers of PSNH, the New Hampshire Electric Cooperative, Unitil Energy Systems and Liberty Utilities can take advantage of these programs. Utility estimates indicate the programs, when fully implemented, have the potential to reduce electric use in New Hampshire by more than 704.7 megawatt hours, removing 522.8 tons of carbon dioxide, more than three tons of sulfur dioxide, and 1,830 pounds of nitrogen oxides from New Hampshire's air annually. The following is a list of some of the programs currently being offered through NHSaves.

CURRENT ENERGY PROGRAMS FOR BUSINESSES

LARGE BUSINESS RETROFIT PROGRAM

This program seeks to improve the efficiency of a facility through services including installation of variable frequency drives, replacement of motors, installation of energy management systems, air compressors and lighting upgrades. Technical assistance is also offered through the Retrofit Program, including project evaluation, measure identification, equipment monitoring, and energy audits. To help fund these improvements, this program offers perspective and custom rebates to customers who replace equipment at their facility with more energy efficient equipment. Not only will participants save money in the form of rebates, but they will also see long-term savings in their energy bills.

³² NHOEP, <http://www.nh.gov/oep/energy/programs/index.htm>

³³ NHOEP, <http://www.nh.gov/oep/energy/programs/index.htm>

³⁴ State of New Hampshire, <http://www.puc.state.nh.us/Electric/coreenergyefficiencyprograms.htm>

SMALL BUSINESS ENERGY SOLUTIONS PROGRAM

This is another retrofit program designed for business customers with an average monthly demand of less than 100 kilowatts (kW) and operating aging and inefficient equipment. This program will help better the efficiency of the facility through services including lighting upgrades, electric hot water measures, occupancy sensors and installation of programmable thermostats and controls for walk-in coolers. Not only will you see long term savings in the electric bill, but PSNH will help fund a portion of the improvements to the facility.

NET METERING PROGRAM

The Net Metering Program is open to any customer with a generator that has a capacity of 100 kilowatts or less and uses a renewable energy source, such as solar, wind or water, to produce electricity. Under this program, a customer's monthly PSNH bill amount reflects the difference between the power generated and the power used during that month. Net metering allows a meter to run backwards when generation exceeds usage. If generation exceeds use during a billing period, the excess generation creates a credit that is carried forward to the next billing period. When use exceeds generation in a future billing period, the customer uses the credit before buying from their utility provider.

MUNICIPAL SMART START PROGRAM

The Smart START (Savings Through Affordable Retrofit Technologies) Program gives municipal customers an opportunity to install energy saving measures with no upfront costs. Payment for services and products are made over time with the savings obtained from lower energy costs. First, the utility provider applies rebates for all eligible retrofit measures and then finances the remaining costs associated with the purchase and installation of approved measures. A Smart Start Purchase and Installation Charge, calculated to be less than the monthly savings, is then added to the monthly electric bill until all costs are repaid. Over time, the new energy efficient, environmentally friendly equipment that is installed through this program pays for itself.

NEW EQUIPMENT AND CONSTRUCTION PROGRAM

This program offers prescriptive and custom rebates to businesses building new facilities, updating existing ones or looking to replace failed equipment. It helps businesses purchase more energy efficient equipment, such as energy efficient lighting, motors, HVAC systems, chillers, variable frequency drives, and air compressors. In addition to rebates, the New Equipment & Construction Program offers technical assistance to help customers identify and purchase premium energy efficient equipment and measures.

SOLAR POWER PURCHASE AGREEMENTS

A Solar Power Purchase Agreement (SPPA) is a financial arrangement in which a third-party developer owns, operates, and maintains the photovoltaic (PV) system, and a host customer agrees to site the system on its roof or elsewhere on its property and purchases the system's electric output from the solar services provider for a predetermined period. This financial arrangement allows the host customer to receive stable, and sometimes lower cost electricity, while the solar services provider or another party acquires valuable financial benefits such as tax credits and income generated from the sale of electricity to the host customer.³⁵ The customer buys the output (e.g., kWh or pounds of steam) of a distributed generation project, rather than the actual project.³⁶

³⁵ Solar Power Purchase Agreements (2012). *Environmental Protection Agency*. Retrieved from <http://www.epa.gov/greenpower/buygp/solarpower.htm> (last accessed 10 January 2014).

³⁶ ICF International, National Assoc. of Energy Service Companies. Introduction to Energy Performance Contracting. October 2007. http://www.energystar.gov/ia/partners/spp_res/Introduction_to_Performance_Contracting.pdf

COMPETITIVE ELECTRICITY SUPPLY AGGREGATION

Aggregation is the combination of individual electricity buyers (and their loads) into a large pool. Other factors being equal, suppliers prefer dealing with larger groups, which have more purchasing leverage with suppliers competing for their business. This purchasing power can be used to obtain cost savings, a different combination of services, or more favorable service terms. Aggregation also reduces transaction costs for the members of the buyers group and for the suppliers.³⁷

In 1993, the New Hampshire legislature created RSA 21-I: 19-d which allows a municipality to sign a performance contract with an energy service company (ESCO). A performance contract allows costs of energy efficient upgrades to be financed through the ESCO and paid off over time through the energy savings. There is no upfront capital cost associated to the town for such programs. Performance contracts also protect municipalities by requiring the ESCO to meet a certain reduction of energy use. If this level is not reached, the ESCO is required to pay the difference in the energy bill. It is a win-win situation, allowing municipalities to become more energy efficient, reduce their energy costs, and protect it from increase costs.

CURRENT ENERGY PROGRAMS FOR RESIDENT'S

NET METERING

Net Metering or net energy metering, is an electricity policy which allows utility customers to offset some or all of their energy use with self-produced renewable energy. Net metering works by utilizing a meter that is able to spin and record energy flow in both directions. The meter spins forward when a customer is drawing power from the utility grid (i.e., using more energy than they are producing) and spins backward when energy is being sent back to the grid. At the end of a given month, the customer is billed only for the net energy used.³⁸

ENERGY STAR LIGHTING PROGRAM

Residential customers who purchase Energy Star rated light bulbs and fixtures can receive rebate coupons redeemable at participating retailers. Other lighting and select energy savings products will also be made available from a mail order catalog. A typical Energy Star rated compact fluorescent lamp lasts up to 10 times longer than an equivalent incandescent bulb and uses 75 percent less energy.

ENERGY STAR APPLIANCE PROGRAM

Customers will receive a rebate coupon of \$10 to \$30 towards the purchase of Energy Star rated washing machines, dryers, dishwashers, refrigerators, air conditioners, dehumidifiers and air purifiers when purchased at a participating retailer. Energy Star qualified appliances can save 10-50 percent compared with conventional models, and even more compared with older models. Replacing a 10-year-old refrigerator, dishwasher, room air conditioner and clothes washer with Energy Star equipment would save around \$140 each year (calculated using the national average electric rate of 8.5 cents per kWh.)

INCOME QUALIFIED ENERGY EFFICIENCY PROGRAM

This program provides weatherization services and helps income-qualified customers understand their energy use with the goal of lowering energy costs. Qualified customers, who receive an electric bill and live in an apartment or house, either rented or owned can receive up to \$5,000 in services (additional funds may be available to customers that qualify for the NH Weatherization Assistance Program).

³⁷ National Renewable Energy Laboratory. *Customer Aggregation: An Opportunity for Green Power?* February 2001.

³⁸ Calfinder Residential Solar Power. <http://solar.calfinder.com/blog/solar-information/what-is-net-metering/>

HOME ENERGY SOLUTIONS

Under this program, PSNH can help you with your home's energy efficiency through improvements such as insulation, air sealing, thermostat replacement, electric hot water conservation measures, and cost effective appliance and lighting upgrades.

NH ENERGY STAR HOMES PROGRAM

The NH ENERGY STAR homes program encourages customers to take advantage of the benefits of building a new (or complete renovation of an existing) single or multi-family energy efficient home with incentives up to \$2,500. ENERGY STAR construction results in reduced monthly operating costs, improved homeowner comfort and a higher resale value, all while providing greater environmental benefits. The program provides assistance in evaluating your new home plans, air leakage testing, and incentives to install ENERGY STAR appliances and lighting systems.

FUTURE CONDITIONS

There are many sources of alternative energy that are becoming more readily available and have proven to be energy efficient and environmentally sound. The Southern New Hampshire Planning Commission must work with the municipalities in the region to explore these possibilities in addition to increasing efficiency through better planning, engineering and building materials.

ENERGY EFFICIENT DEVELOPMENT

There are a number of ways communities can implement energy efficient development. Implementing energy efficient regulations to minimize the impact of public utilities is one way to do so. For the communities looking for easy and less burdensome ways to implement energy efficiency, they can develop language in the regulations that can be adapted to subdivision or site plan regulations. Towns could also adopt additional building codes that exceed the state energy codes for residential and non-residential construction or adopt performance zoning ordinance encouraging the voluntary implementation of energy efficient practices for new construction in exchange for a set of incentives or bonuses. When all three alternatives are used in combination, the greatest energy savings results will be achieved. For guidance on these practices please refer to the New Hampshire Innovative Land Use Planning Techniques: A Handbook for Sustainable Development, October 2008 developed by NH Department of Environmental Services, NH Association of Regional Planning Commissions, NH Office of Energy and Planning and NH Local Government Center.

In addition to the way buildings are built, the way communities are designed, planned, and built may also influence the amount of energy used, how energy is distributed, and the types of energy sources that will be needed in the future. Energy efficiency can be incorporated into land use planning by adopting mixed-use zoning, which would allow greater accessibility to desired services without requiring greater mobility. Other ways to promote energy efficiency and conservation in land use planning include:

- Encourage livable, walkable land use policies and regulations;³⁹
- Encourage alternative forms of transportation in the planning and design of the community. This includes park & rides, bicycle lanes, pedestrian lanes and crossing and trails;

³⁹ Refer to the 2012 New Hampshire Livable Walkable Communities Toolkit for recommendations and policies. SNHPC. April 2012.

- Encourage energy-efficient development through subdivision and site plan review regulations, zoning ordinance and building codes. Site design techniques that take advantage of sun exposure, differences in microclimate, and landscaping reduce a development's demand for fossil fuel derived energy sources and reduce overall energy consumption;⁴⁰
- Encourage increased reliance on the local food supply in order to:
 - Reduce transportation energy needed to get food to our homes
 - Increase local economic health by keeping money in the community; and
- Encourage organic farming. Local organic farmers do not rely upon the input of petroleum-derived fertilizers and pesticides and thus save energy at the farm.

ENERGY EFFICIENT BUILDING

Almost all existing buildings have the potential to reduce energy use by up to 60% with relatively simple and low cost practices. These include: energy audits, passive solar/daylighting, air sealing, insulation, shades/drapes, upgrades to efficient appliances and controls, etc. Site design opportunities include sun, shade, topography, and integrated landscaping practices to help reduce energy use. The Architecture 2030 Challenge outlines practical steps that all sectors can take to start implementing these demand reduction techniques.⁴¹

Architecture 2030 asks that all firms, organizations and individuals choosing to adopt the 2030 Challenge commit to design all of their projects to meet the targets outlined by the initiative. This requires each new building project or major renovation to be designed to achieve an energy consumption performance standard of 50% of the regional (or country) average for that project's buildings type. For new building projects, this performance standard will increase to 60% of the regional (or country) average in the year of 2010. Every five years the standard will increase by an additional 10%, achieving carbon-neutral buildings in the year 2030. Major renovations are only required to meet the 50% target throughout this timeline, but are encouraged to achieve the increased reductions.⁴²

LEED CERTIFICATION

Leadership in Energy and Environmental Design (LEED) is a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes and neighborhoods. LEED was developed by the U.S. Green Building Council (USGBC), and is intended to help building owners and operators be environmentally responsible as well as use resources efficiently. Proposals to modify the LEED standards are offered and publicly reviewed by USGBC's member organizations, which number almost 20,000.

USGBC's Green Building Certification Institute (GBCI) offers various accreditations to people who demonstrate knowledge of the LEED rating system, including LEED Accredited Professional (LEED AP), LEED Green Associate, and since 2011, LEED Fellows, the highest designation for LEED professionals. GBCI also certifies projects pursuing LEED.

Since they were created in 1998, LEED standards have been applied to more than 7,000 projects in the United States and 30 countries, covering more than 1.5 billion square feet (140 km²) of development area. The Southern New Hampshire Planning Commission's Region currently has 22 LEED projects, shown in **Map 9-4**.

⁴⁰ Model ordinance language can be found in *Innovative Land Use Planning Techniques*. October 2008. Chapter 3.5. Pgs. 371 – 388.

⁴¹ Architecture 2030, a non-profit, non-partisan and independent organization, established in response to the climate change crisis by architect Edward Mazria in 2002.








⁴² Architecture 2030. 2030 Implementation Guidelines.

<http://architecture2030.org/files/2030ImplementationGuidelines.pdf>

Granite State Future



Energy Commercial Solar & LEED Building Projects

-  LEED Building Projects*
-  Commercial Solar Projects
-  Interstates
-  State and US Routes
-  Town Boundary
-  Rivers
-  Lakes

*LEED Building Projects includes new construction that may currently not be finished.

Data Sources:
Granit Digital Data (1:24,000)
USGCB
NH Department of Transportation
All SNHPC Communities

The individual municipalities represented on this map and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.

This map is prepared for planning purposes only and is not to be used for legal boundary determinations or for regulatory purposes.

Map Produced by GIS Service SNHPC 2013.
Contact: SNHPC, gis@snhpc.org or (603) 669-4664

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THIRD – PARTY RATINGS

Third party rating systems provide certification and verification that a building, home or community was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

Examples of third – party rating systems are:

- US Green Building Council Leadership in Energy and Environmental Design (LEED) – includes grounds and neighborhood
- Home Energy Rating System (HERS) – home energy rating program for residential dwellings
- Building Performance Institute (BPI) – a national standards development organization for residential energy efficiency and weatherization retrofit work
- EnergyStar – energy performance rating system for homes and businesses
- ASHRAE's Building Energy Labeling Program – Building Energy Quotient (bEQ) is a building energy labeling program that lets commercial building owners zero in on opportunities to lower building operation cost and make informed decisions to increase value

SELF – ASSESSMENTS

For individuals, a self–assessment can help determine whether there are improvements or behavioral changes that can be made to reduce energy use in their homes. Many homes use more energy than needed to keep individuals comfortable and as fuel prices continue to rise most people cannot afford to be without an energy plan to reign in these expenses. Examples of self – assessment guidelines include:

- My Energy Plan⁴³
- Stepping Up to the 2030 Challenge worksheet⁴⁴

PASSIVE SUSTAINABILITY

Passive sustainability allows buildings to meet occupant needs during power outages and natural disasters. Passive sustainability involves reducing demand and generating energy needed on site as much as possible. For example, passive solar, well air – sealed and insulated structures with high efficiency/low emission wood stoves provide relatively comfortable living conditions for the occupants during times when there may not be power, water, or food available from off –site sources. This is an important adaptation strategy that will create greater community resilience, given the recent extreme weather.

SMALL WIND ELECTRIC SYSTEMS

Small Wind Electric Systems can make a significant contribution to our nation's energy needs. Although wind turbines large enough to provide a significant portion of the electricity needed by the average U.S. home generally require one acre of property or more, approximately 21 million U.S. homes are built on one-acre and larger sites, and 24 percent of the U.S. population lives in rural areas.

In 2008 New Hampshire enacted a small wind energy systems ordinance with RSA 674:62:66, and the purposes outlined in RSA 672:1-III-a. The purpose of this ordinance is to accommodate small wind energy systems in appropriate locations, while protecting the public's health, safety and welfare. In addition, this ordinance provides a permitting process for small wind energy systems to ensure compliance with the

⁴³ <http://myenergyplan.net/>

⁴⁴ <http://architecture2030.org/>

provisions of the requirements and standards established herein.⁴⁵ Several New Hampshire communities have adopted these regulations.

A small wind electric system can work if:

- There is enough wind in the area;
- Tall towers are allowed in the neighborhood or rural area;
- There is enough space;
- The resident can determine how much electricity he or she needs or wants to produce;
- It works economically.

Depending on the wind resource, a small wind energy system can lower an electricity bill by 50 to 90 percent, help avoid the high costs of having utility power lines extended to remote locations, prevent power interruptions, and most importantly, is non-polluting. Moreover, excess energy produced by a turbine can be sold back to the existing electric grid. A small wind electric system might be a practical option for homes or businesses:

- Whose property has a good wind resource;
- Located on at least one acre of land in a rural area;
- Local zoning codes or covenants allow wind turbines;
- Whose average electricity bills are \$150 per month or more;
- Whose property is in a remote location that does not have easy access to utility lines;
- Are comfortable with long-term investments.

Using wind to generate electricity is currently being researched in the state. Alternative energy advocates are currently looking at several New Hampshire communities such as Claremont as possible locations to expand the use of wind power to generate electricity. State officials believe that wind power could someday contribute 10 percent of New Hampshire's power supply. However, there is resistance to creating such wind farms. Some people object to the large turbines and dislike their placement on visible hillsides. Additionally, wildlife organizations have expressed concern regarding bird and bat mortality related to turbines.⁴⁶

BIOMASS

Biomass materials consist of whole-tree wood chips (undried, unprocessed wood chips with bark attached), stumps, brush and smaller low-lying vegetation, low-grade woods, and other plan material unusable in timber or paper production. These materials can result from normal forestry practices such as timber harvesting and fire control measures, or from clearing land for homes, roads and commercial developments. For wood-fired power generation and steam generation for heat (district heating), natural residue from sawmills and other clean wood byproducts can be added to the mix.

A trend to implement such resources has grown in the New England region. **The Northeast Biomass Thermal Working Group** (NEBTWG) is a coalition of biomass thermal advocates committed to working together to advance the use of biomass for heating and CHP (combined heat and power) in the northeastern United States.

⁴⁵ <http://nhrsa.org/law/674-63-municipal-regulations-of-small-wind-energy-systems/>

⁴⁶ Extensive information on small wind electric systems as they apply to New Hampshire can be found in *Small Wind Electric Systems: A New Hampshire Consumer's Guide* at: http://www.windpoweringamerica.gov/filter_detail.asp?itemid=317

Some activities they are working on are⁴⁷:

- Policy and regulatory advocacy at the local, state, and regional levels
- Development, promotion, and distribution of the Heating the Northeast with Renewable Biomass 2025 Vision
- Outreach to allied groups and organizations to expand network of biomass thermal advocates in the Northeast
- Identification and prioritization of key policy, regulatory and public relations issues facing biomass thermal industry
- Information and data collection to assist/influence policy makers and regulators
- Coordination of advocacy to federal delegations on key issues in Washington
- "Best ideas" sharing across region

The Renewable Biomass 2025 Vision could:

- Supply 19 million green tons of sustainable biomass for thermal energy available annually from forest and farm sources
- Achieve 25% of all thermal energy from renewable resources by 2025
- Achieve 75% of thermal renewable energy from biomass by 2025
- Convert 1.38 million households in the seven states to biomass for thermal needs
- Improve air quality, reduce greenhouse gases and build healthier communities
- Reduce 1.14 billion gallons of heating oil annually
- Reinvest \$4.5 billion in resulting economic wealth in the Northeast economy
- Create 140,200 jobs

For small-scale domestic applications of biomass the fuel usually takes the form of wood pellets, wood chips and wood logs.

In New Hampshire the Northern Wood Power Project at the Schiller Station in Portsmouth is the first non-hydro, commercial renewable biomass project in the state. Over 50 MW of coal-fired power generation was replaced by a biomass boiler. This project developed by PSNH burns wood chips and other clean wood products. In addition to creating a market for woodchips from New Hampshire's many logging operations, the facility is now a major regional contributor of renewable energy.

There are two main ways of using biomass to heat a domestic property:

- Stand-alone stoves providing space heating for a room. These can be fuelled by logs or pellets but only pellets are suitable for automatic feed.
- Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW.

SOLAR ELECTRIC (PHOTOVOLTAIC) SYSTEMS

Stonyfield Farms in Londonderry recently added a 5,000 square foot photovoltaic array on top of the roof of their yogurt facility. The integrated array will generate about 50,000 watts of energy on full sun days. This is enough to power 1,600 LCD computer monitors or 500 100W light bulbs. It is comparable to the amount of electricity 10 homes might use on an annual basis.

Hybrid solar lighting collects sunlight and routes it through optical fibers into buildings where it is combined with electric light in "hybrid" light fixtures. Sensors keep the room at a steady lighting level by adjusting

⁴⁷ Northeast Biomass Thermal Working Group <http://www.nebioheat.org/vision.asp>

the electric lights based on the sunlight available. This new generation of solar lighting combines both electric and solar power. Hybrid solar lighting pipes sunlight directly to the light fixture and no energy conversions are necessary, therefore the process is much more efficient.

Until recently, the Stonyfield solar array was the largest in New Hampshire. However, Exeter High School recently added over 350 solar panels that will create over 80,000 watts of electricity initially and up to 100,000 watts in the future. The panels at EHS are expected to produce seven to ten percent of the electricity used by the school and save them \$20,000 per year over the next decade. The first phase of the project, 3,000 watts of production, was completed in December of 2009.

Under the financing agreement with the contractors of the project, several groups working under the title New Hampshire Seacoast Energy Partnership, the Exeter Region Cooperative School District will pay approximately \$150,000 per year for 10 years after which the school district will own the equipment outright.⁴⁸ This project shows that sustainable, renewable energy measures can be taken at the municipal level leading to thousands of dollars in cost savings.



Source: Techno Green Energies,
<http://technogreenenergies.com/>

PSNH also produces a significant amount of solar electricity. Their headquarters in Manchester, located in a reused mill building, is equipped with 183 roof panels that produce over 51,000 watts of electricity, resulting in an estimated reduction of 100,000 pounds of carbon dioxide emissions. The panels, shown in the picture below, will satisfy approximately five percent of the energy needs for PSNH's Energy Park facility.

SOLAR HEATING

Solar heating harnesses the power of the sun to provide heat for hot water, space heating and swimming pools. Solar heating can be either passive, such as simply using large windows to let in more light and warmth, or active, where specially designed mechanical systems increase the heat gained from the sunlight.

SELF-CONTAINED SOLAR UNITS

On a smaller scale, solar energy can be harnessed using self-contained units to power street and crossing lights, parking lots, parks, bus shelters, trails and advertising billboards. These self-contained solar units do not need to be tied into the existing electric grid and do not require difficult underground wiring. They are immune to power outages and offer battery backup for cloudy days. They also are typically easier to maintain than traditionally powered units and reduce ownership costs by eliminating monthly electric bills. Self-contained solar is a good option in places where it may be difficult to run wires or that are especially remote. These relatively inexpensive and easy-to-install units are becoming increasingly popular as a safe, cost effective and efficient way for municipalities to take their first steps toward renewable energy use. The picture below is an example of a self-contained solar powered street light.

HYDRO ELECTRIC

Hydroelectric is an excellent source of clean, renewable power. There are many hydroelectric dams located in New Hampshire that produce about six percent of the state's electricity needs. The Northern Pass transmission project, currently in the planning and permitting stages, is a measure designed to deliver up to 1,200 additional megawatts of low-carbon, renewable energy (predominantly hydropower) from

⁴⁸ Seacoast Online.com, accessed 1/20/11, <http://www.seacoastonline.com/articles/20091009-NEWS-910090323>, and, Revolution Energy, <http://www.rev-en.com/>, and Coolerplanet.com

the Québec to New England's power grid. Currently Hydro-Québec has an available supply of over 42,000 MW of electricity—more power than all of New England's power plants combined.

A study is currently underway to determine the best potential route for Northern Pass infrastructure according to issues of technical and geographical feasibility, rights of way access and potential environmental and social impacts. It has already been decided that a substation in Deerfield is the optimal location for the Northern Pass to connect into the region's alternating current (AC) electric grid. From this terminal location the 1,200 megawatts (MW) of power will be distributed.

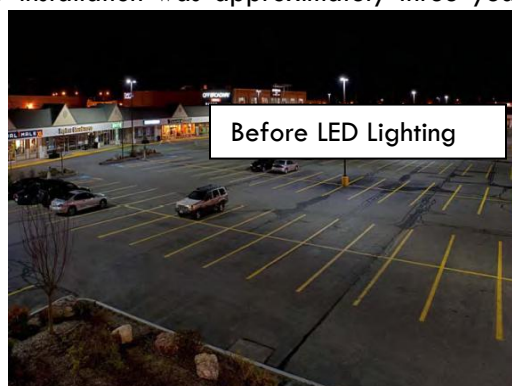
LIGHT EMITTING DIODES

For most applications, LEDs can last up to 20 years and require less maintenance than conventional incandescent bulbs, which often burn out after only a year. Traffic lights using incandescent bulbs may typically use about 150 watts per hour, 24 hours a day. LEDs only require 15 watts, a 90 percent reduction in power consumption. Multiply these savings per every traffic light and it's easy to see that the energy savings are significant. LEDs can be used for:

- Commercial lighting
- Traffic lighting
- Industrial lighting
- Street lighting;
- Flashlights
- Light bulbs for home or office
- Fluorescent replacements

In November and December 2009, the T.J. Maxx Plaza on South Willow Street in Manchester was used as part of a study for the U.S. Department of Energy (DOE) GATEWAY Solid-State Lighting Technology Demonstration Program. This federal program is designed to provide real-world demonstration experience and data on state-of-the-art solid-state lighting (SSL) product performance and cost effectiveness.

The 151,000 square foot parking lot was incurring high maintenance costs from the need for frequent lamp replacements in its 25-year-old luminaries and needed an update. Twenty-five new LED luminaries were placed in the lot, each controlled by an integral occupancy sensor that varies its operation between "high" and "low" light output settings according to the occupancy of the parking lot and the time of day. The study determined the payback period for the LED installation was approximately three years and they provided the parking lot with a 58 percent energy savings. The picture below shows a comparison of the new LED lighting (left) and the old, standard luminaries (right) at the project's midpoint.





Source: Final Report prepared in support of the U.S. DOE Solid-State Lighting Technology Demonstration GATEWAY Program, June 2010

When patrons and employees of the shopping center were surveyed, 79 percent said the replacement lighting system provided more light, 22 percent felt the lighting was about the same as in the original parking lot, and no one who responded felt the lighting had gotten worse.⁴⁹

ALTERNATIVE AUTOMOBILE FUELS

Alternative fuels are becoming increasingly popular with American consumers, who are looking to decrease their carbon footprint and become less dependent on volatile fossil fuel prices and supplies. In response, automakers have been steadily increasing production of plug-in electric vehicles that run completely on electricity, alternative fuel vehicles that run on cleaner combustible fuels, and hybrids that run on a mix of combustible fuel and electric battery power. Governments have promoted the use of alternative fuel vehicles by offering tax incentives and subsidies to consumers.

The Chevrolet Volt is currently the most fuel efficient car on the market in the United States, recently surpassing the Toyota Prius for that distinction. It gets the equivalent of 93 miles per gasoline gallon when running on battery power alone and has the ability to go 25 to 50 miles on battery power, after which can be fueled by a small gasoline powered engine. It can be charged in a standard residential electrical outlet.⁵⁰ Regarding the future of electric vehicles and their benefits, Chevy states, “Put simply, electricity is a cleaner source of power. And as technology improves in the generation of electricity, we will continue to see reduced carbon outputs. Advancements in electricity production along with reduction in emissions from electric-powered driving could help make our world a cleaner place.”

With the popularity, affordability and importance of alternative fueled vehicles rising, the region must remain conscious of new developments in technology and remain equipped with the necessary infrastructure updates to foster growth in this area. This would involve, for instance, the adequate placement of recharging facilities and increased capacity on the grid for electric vehicles and the provision of alternative fuel pumps at filling stations for alternative fuel vehicles.

⁴⁹ U.S. DOE Solid-State Lighting Technology Demonstration GATEWAY Program Report, June 2010, http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_tjmaxx.pdf

⁵⁰ Chevrolet, <http://www.chevrolet.com/volt/features-specs/>

KEY STRATEGIES & PROJECTS

SOLAR AGGREGATION MODEL

The solar aggregation program involves a lead local government or several local governments or a region working together to advertise for and retain a third party solar developer or developers who can coordinate and implement a community/region wide-based volume purchasing campaign. The purpose of this campaign is to lower solar purchase and installation costs for the customers living or operating a business within the community/communities/region who signed up to participate in the program.

Typically, the local governments work together to scope out the basic parameters of the program and the lead local government or host agency issues the RFQ for the solar developer(s). The solar developer(s) are brought on board to develop the details of the program; to coordinate and implement the program; to negotiate and secure reduced rates from a solar provider(s) for the cost of the systems and installation, including the types of systems and quality assurance; and to sign up eligible customers seeking to participate in the bulk purchasing discount rates. The solar developer(s) costs are typically reimbursed at a negotiated rate(s) through the solar provider(s) when a solar system is purchased and installed. Thus, there is very little if any cost to the local government to participate in the program or initiative.

The SNHPC Regional Planning Commission can also lend assistance in program development, coordination as well as program promotion and marketing by seeking grant funds which can be used for developing a program website, customer application forms, and other marketing materials. Grants would need to be pursued through local foundations; private contributors and/or donations.

The services provided by a lead municipality or host agency in the solar aggregation program generally include:

- Assisting in developing initial program parameters and inter-governmental agreement;
- Developing an RFQ and implementing procurement policies and services necessary to obtain a solar developer(s) to run the program;
- Entering into a contract with a solar developer(s) for program deployment;
- Legal counsel to review RFQ process and contracts; and
- Assistance with program marketing and web postings.

An example of a solar aggregation model already in place is Solarize Mass program in the State of Massachusetts.⁵¹ The Solarize Mass program has been very successful not only teaching residents and businesses in these four towns that solar energy is a viable way to manage energy costs and reduce dependence of fossil fuels, but also helping to drive down the costs of solar across the state.

LED LIGHTING PSNH

Public Service New Hampshire has recently expressed interest in converting to efficient LED (light – emitting diode) street lights. The city of Manchester has nearly 9,000 street lights and is by far PSNH's largest municipal customer. The electric bill to PSNH to keep the street lights on is approximately \$1.4 billion annually.⁵² However, under the new proposed conversion to LED lights, the overall estimated reduction of

⁵¹ Solarize Massachusetts Program (2012). *Massachusetts Clean Energy Center*. Retrieved from <http://www.masscec.com/news/masscec-launches-solarize-massachusetts-program-spur-solar-development> (last accessed 15 January 2014)

⁵² PSNH LED Street Lights (2013). *The Union Leader*. Retrieved from <http://www.unionleader.com/article/20131223/NEWS06/131229749> (last accessed 3 January 2014).

costs is about eight percent. Not only would the conversion to LED lighting be cost-effective but the quality and technology of LEDs has been proven to be substantially better than the current lighting in place.

REGIONAL PLAN FOR PLUG-IN ELECTRIC VEHICLE INFRASTRUCTURE

Working to reduce greenhouse gas emissions from the transportation sector and increase the energy efficiency of Southern New Hampshire's motor vehicle fleet is an important factor in realizing energy efficiency improvements and greenhouse gas reductions. Electric Vehicle (EV) technology provides low carbon, highly efficient and cost effective transportation.

Developing a regional plan for Plug-In Electric Vehicle (PEV) infrastructure is would be in the best interest of communities because having a plan will make transitions easier when communities are ready to move forward with implementation.

Examples of current PEV infrastructure plans include:

- VTrans Electric Fueling Infrastructure Plan⁵³
- Plug In Electric Vehicle Readiness Plan for the State of Washington⁵⁴

Currently SNHPC is exploring the possibility of working with PSNH for the initiation of the development of plug-in electric drive vehicles and electric vehicle infrastructure planning.

TRANSPORTATION

The transportation sector is a major contributor to greenhouse gas emissions. EPA names transportation as the second of five major fuel consuming sectors contributing to carbon dioxide (CO₂) emissions from fossil fuel combustion. Energy efficiency and greenhouse gas emissions in transportation are linked to factors such as energy use, traffic flow, and the transport of goods.

Energy conservation in the transportation section is currently being promoted through SNHPC's participation in the CMAQ and Transportation Enhancement (TE) grant programs. Many of the projects eligible for funding under the CMAQ program such as improvements to public transit, bicycle and pedestrian facilities and programs, travel demand management projects and establishments of Transportation Management Associations can also make significant contributions to reductions in energy use. The Transportation Enhancement (TE) program supports community-based projects that expand travel choices and enhance the transportation experience by improving the cultural, historic, aesthetic and environmental aspects of our transportation infrastructure. Eligible projects, which include creation of bicycle and pedestrian facilities, conversion of abandoned railway corridors to trail facilities and streetscape improvements, can also be instrumental in energy savings. SNHPC is also assisting member communities to prepare master plan energy chapters. Transportation-related recommendations from these chapters include incorporating "Complete Streets" principles⁵⁵ into roadway design, encouraging compact and mixed-use developments in village centers and development of facilities for cyclists and pedestrians.

⁵³ VTrans Electric Fueling Infrastructure Plan (2011). *Vermont Energy Investment Corporation*. Retrieved from http://www.veic.org/docs/Transportation/201307_VTrans_EV_Charging_Plan_Final_Report_web.pdf (last accessed 14 January 2014).

⁵⁴ Plug In Electric Vehicle Readiness Plan (2011). *Western Washington Clean Cities Coalition*. Retrieved from http://www.wwcleancities.org/documents/EV_Readiness_Plan_WA.pdf (last accessed 14 January 2014).

⁵⁵ National Complete Streets Coalition (2010). *Economic Development Smart Growth America*. Retrieved from <http://www.smartgrowthamerica.org/complete-streets/complete-streets-fundamentals/factsheets/economic-revitalization> (last accessed 13 January 2014).

OUTREACH AND EDUCATION

Utilize groups and organizations such as New Hampshire Local Energy Solutions, Energy Efficiency and Sustainability Board and the New Hampshire Sustainable Energy Association to establish municipal leadership and develop an integrated education, outreach and workforce training programs for the region. These organizations can help publicize energy efficiency tips, incentives and rebates; hold events with an energy conservation focus; incorporate energy conservation measures into community events and revise municipal energy goals by using their existing outreach and education technology and resources.

ENERGY EFFICIENT MUNICIPAL BUILDINGS

Communities can consider establishing green building ordinances for municipal buildings which incentivize the use of new construction or major renovations of town buildings to meet US Green Building Council LEED standards. Communities can also consider instituting a renewable energy property tax exemption as well as incentivizing more stringent building codes than State codes to increase energy efficiency and decrease energy costs for development in the community.

ENERGY EFFICIENT LAND USE PLANNING

The way communities are designed, planned, and built may influence the amount of energy used, how energy is distributed, and the types of energy sources that will be needed in the future. Energy efficiency can be incorporated into land use planning by adopting mixed – use zoning, which would allow greater accessibility to desired services without requiring greater mobility. Other ways to promote energy efficiency and conservation in land use planning include:

- Encourage livable, walkable land use policies and regulations⁵⁶
- Encourage alternative forms of transportation in the planning and design of the community
- Encourage energy efficient development through subdivision and site plan review regulations, zoning ordinance and building codes. Site design techniques that take advantage of sun exposure, difference in microclimate, and landscaping reduce a development's demand for fossil fuel derived energy sources and reduce overall energy consumption⁵⁷
- Encourage increased reliance on the local food supply in order to:
 - Reduce transportation energy needed to get food to our homes
 - Increase local economic health by keeping money in the community
- Encourage organic farming. Local organic farmers do not rely upon the input of petroleum – derived fertilizers and pesticides and thus save energy at the farm

Deerfield is an example of a community that has already implemented some recognized methods for increasing energy efficiency in land use patterns through the Deerfield Open Space Development Ordinance, the adoption of International Energy Conservation Code (IECC) 2009 and a growing local food movement and farmers market.

⁵⁶ Refer to the 2012 New Hampshire Livable Walkable Communities Toolkit for recommendations and policies. http://www.snhpc.org/pdf/LWCToolkit_FINAL_April2012_NA.pdf. SNHPC. April 2012

⁵⁷ Model ordinance language can be found in *Innovative Land Use Planning Techniques*. October 2008. Chapter 3.5. Pgs. 371 – 388.

CONCLUSIONS & RECOMMENDATIONS

Region-wide energy efficiency can best be implemented when other public policies are taken into consideration. Implementation of energy measures can only work when integrated with programs dealing with other region-wide issues such as land use, air quality, transportation, housing and economic development and other issues that are at the forefront of the Southern New Hampshire Planning Commission's efforts to make our region a healthier and more functional place to live.

The Southern New Hampshire Planning Commission recognizes that a region-wide energy plan needs to be created to ensure municipalities have access to accurate energy information. Current energy challenges require we move forward to achieve adequate, affordable, efficient, and environmentally sound energy supplies in our region and the State of New Hampshire as a whole. It will be important for the Southern New Hampshire Planning Commission and other regional planning commissions in New Hampshire to work together with the state to create awareness on this issue. The education and dissemination of energy efficient programs and alternatives are key pieces to region-wide energy efficiency.

The Southern New Hampshire Planning Commission encourages all of the communities in the region to evaluate the effects of plans, programs, and policies on energy use, and to determine how to reduce energy impacts by making more efficient use of all energy resources.

GOALS

The core goals and recommendations help to define the region's energy efficiency agenda and identify and prioritize projects that can best meet energy efficiency needs as discussed in Key Issues and Concerns. They were developed based on the principles of the Key Projects and Strategies.

The energy efficiency core goals, listed below, are as follows:

1. Affordable renewable energy
2. Increase renewable energy incentives
3. Increase education on energy efficiency issues and alternatives
4. Sustainable funding for energy efficient infrastructure
5. Smart growth and Green infrastructure
6. Increase energy efficiency of existing and future buildings

RECOMMENDATIONS

The recommendations listed below are strategic initiatives intended to demonstrate a commitment to and implementation of the aforementioned core goals and to bring about enhanced energy efficiency for the region. Many of the recommended initiatives are important catalytic projects that will have significant benefits, not only for the SNHPC Region, but statewide. Some of these initiatives are also listed in others chapters of *Moving Southern New Hampshire Forward*. These strategic initiatives include:

- **Develop a Comprehensive Region-wide Sustainability Plan/Energy Plan** – There is currently no comprehensive or long range plan for the region which addresses sustainable growth patterns and renewable and alternative forms of energy and energy conservation.

- **Utilize Smart Growth and Livability Principles** – Adopt land use policies that allow for energy efficient development and opportunities for renewable energy infrastructure as well as alternative transportation options.⁵⁸
- **Coordination between energy and environmental policymakers** – Coordination to more effectively achieve common goals and to ensure their respective decisions do not inadvertently work at cross purposes.
- **Increase small-scale local energy production** – Evaluate opportunities and the feasibility of establishing renewable and alternative energy sources at the local and regional scale (solar, geothermal, wood, biofuels, wind, and hydro); evaluate incentives in zoning and/or regulations to encourage installation of renewable and alternative energy sources in private development (for residential and commercial uses); support Combined Heat and Power systems throughout the region as small-scale local production sites. Continue to participate in SEC process to review proposals for energy facilities and ensure local concerns and resources important to the economy of the region are considered.
- **Increase the energy efficiency of existing and future buildings in the region** – conduct municipal energy audits; adopt and enforce improved building energy codes; establish financial incentives to encourage building energy efficiency improvements and energy retrofits; implement innovative energy financing programs to support energy efficiency; in areas without code officials, use the DOE's Building Energy Code Program methods, tools and procedures to measure and report baseline compliance with the building energy code.
- **Increase regional use of and support for renewable energy** - Ensure renewable energy facilities are properly sited and do not negatively impact natural resources including scenic views and wildlife habitat; establish new or promote existing incentives and financing options for renewables for the residential, commercial, institutional, and municipal sectors; encourage expanded access to renewable energy and its benefits.

⁵⁸Smart Growth and Energy (2012). *State of Washington Department of Commerce*. Retrieved from <http://www.commerce.wa.gov/Documents/GMS-Smart-Growth-Energy.pdf> (last accessed 9 January 2014).