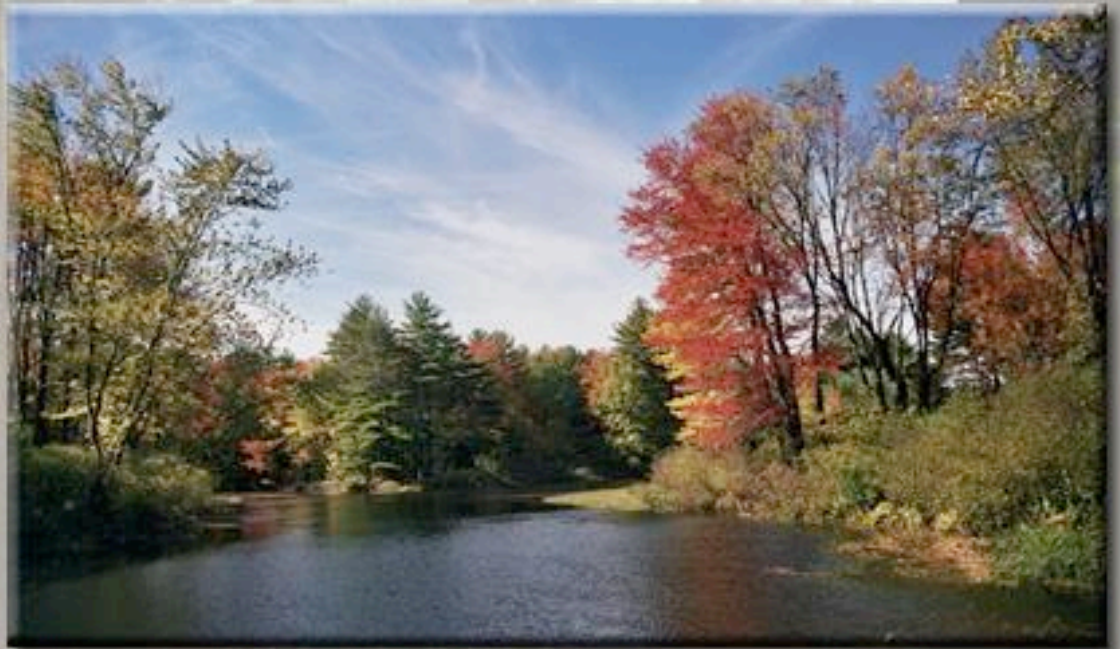


Forest and Water Climate Adaptation:

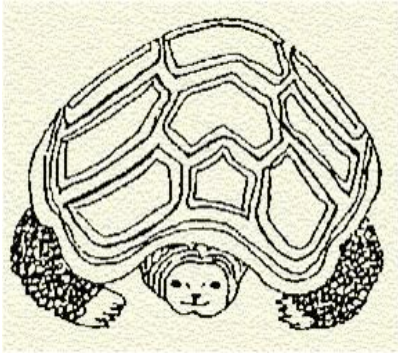
**A Plan for the Ashuelot River
Watershed, New Hampshire**



**The Sustainability Project
Emerson Brook Forest**



**Model Forest Policy Program
Cumberland River Compact**



The Sustainability Project Acknowledgements

This Climate Adaptation Plan would not have been possible without the help, advise, guidance and incredible support of many regional groups, individuals and organizations. Each and every contribution came from a shared vision that by protecting our beautiful watershed, we create a strong base for resiliency to the effects of climate change now and into the future.

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Cover photo insert: The Ashuelot River by Brian Bishoff

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Foreword

In 2010, the Model Forest Policy Program (MFPP), the Cumberland River Compact, and the Sustainability Project came together to create a climate adaptation plan for the community of Keene, New Hampshire and the Ashuelot River Watershed. It came about because MFPP recognized the critical need for increased local community resilience to address the impacts of climate change by conserving forest and water resources. This plan for the Ashuelot River Watershed describes the results of a year of community team effort, deep and broad information gathering, critical analysis, and thoughtful planning. The Sustainability Project took the local leadership role to engage with the Climate Solutions University: Forest and Water Strategies program (CSU) and lead their community toward climate resilience with an adaptation plan that addresses their local climate risks, fits their local conditions and culture, and takes advantage of identified opportunities. This achievement was made possible with the guidance and coaching of the CSU created by the Model Forest Policy Program in partnership with the Cumberland River Compact. The goal of CSU is to empower rural, underserved communities to become leaders in climate resilience using a cost effective, distance-learning program. The result of this collaborative effort is a powerful climate adaptation plan that the community can support and implement in coming years. The outcome will be a community that can better withstand impacts of climate upon their natural resources, economy and social structure in the decades to come.

Further Acknowledgements

Climate Solutions University would not have been possible without the major funding of The Kresge Foundation, which allowed us to develop the in-depth curriculum and provide grants for local community participation. We also gratefully acknowledge the Confidence Foundation for their kind support of program development.

The team that created the CSU program includes Gwen Griffith, Toby Thaler, Will Paddock, Margy Hall, Todd Crossett, Katie Schmitz-Eulitt, Nancy Gilliam, Dan Schmit, and Jeff Morris.

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Introduction and Executive Summary

The Sustainability Project (TSP) began in 1998, when an out-of-state logging company, Haynes Logging of Maine, threatened the Emerson Brook Forest with “liquidation.” Community-raised funds enabled 30 acres of the larger 640-acre tract of the forest to be purchased for preservation and public education. The remaining portion of land was purchased by Bob King and Anne Faulkner who placed it under a limited development conservation easement. The Emerson Brook Forest Center continues to serve the community by promoting the value of preservation and the sustainable use of land. This success was the beginning of community-based efforts to conserve forests and bring conservation education to the southern New Hampshire community.

The Sustainability Project is the lead organization for the formation of the team that received a grant from the Model Forest Policy Program’s Climate Solutions University: Forest and Water Strategies. The grant bolsters The Sustainability Project’s efforts to better protect the forest and water resources of the Ashuelot River Watershed through policy change. The Emerson Brook Forest is a key segment of land that is located in the northern section of the watershed near the Gilsum/Marlow borders. While the Emerson Brook Forest Center has been encouraging sustainable practices for the past twelve years, the Model Forest Policy Program grant structures the approach and broadens the base of support and will extend the geographic scope of climate resiliency initiatives to the entire watershed.

The southwest region of New Hampshire has received national recognition for its leadership in the fields of environmental action and climate change policy. Examples of these actions can be reviewed in the following documents: *City of Keene, NH, Cities for Climate Protection Campaign Local Action Plan (2/19/2004)*; and *Keene, NH, Adapting to Climate Change: Planning a Climate Resilient Community (see appendix with links provided)*. Our partnership with Climate Solutions University has helped to strengthen the potential for improved protective and adaptive strategies not fully addressed or implemented in previous plans.

An ad hoc team of partners is poised to work with The Sustainability Project to enhance and broaden the scope of the existing climate change initiatives, including: the City of Keene, NH, Southwest Region Planning Commission, the State Department of Environmental Services (DES), University of New Hampshire Cooperative Extension, Society for the Protection of NH Forest, the Monadnock Conservancy, the Army Corp of Surry and Otter Brook Dams, The Nature Conservancy, NH Fish and Game, and the Ashuelot River Local Advisory Council.

It is our hope that will be environmental “Champions” through a partnership with the Dartmouth Hitchcock/Cheshire Medical Center’s Vision 2020 initiative. The over arching goal of that initiative is to create the healthiest community in the country by the year 2020. It is our sense that a healthy, intact regional ecosystem is an essential element of community health.

With our action plan, we intend to enhance the many climate change efforts in the region and to serve as an adaptation model for communities around the state. One primary focus is to define

clear achievable goals for protecting our forest ecosystems and water resources. The southwest region of New Hampshire has dealt with several catastrophic weather events over the last ten years, specifically flooding, ice storms, and draughts. The associated social, economic, and environmental costs have forced local and state officials to recognize the importance of climate change adaptation efforts as critical to the region's ecological and economic resiliency.

Our desired outcomes include:

- Increase the protection of forest resources;
- Increase the quality and quantity of water resources;
- Increase local preservation and conservation efforts;
- Improve forest management practices and policies; and
- Provide educational outreach related to climate change.

According to our risk assessment findings the health of the Ashuelot River Watershed is in “good shape.” However, it is highly vulnerable to impacts of climate change and development if not actively protected in coming decades. Our goal is to keep all existing ecosystem services (water, fish and wildlife, recreation, economic benefits) functioning at or above the present levels. The plan concludes with adaptive management provisions, implementation, monitoring, and continued evaluation of the specific plan elements.

Summary of Climate Change Likely in New Hampshire

There is scientific consensus that emissions of greenhouse gases arising from fossil fuel combustion, deforestation and agriculture have contributed to and will continue to cause global and localized climate change. There is a critical need and opportunity for action, both to facilitate mitigation to reduce greenhouse gas emissions and, more immediately, to implement adaptive measures to protect the environment and communities from impacts that cannot be prevented. Current climate models used by the IPCC (Intergovernmental Panel on Climate Change), a group of more than 2,000 scientists, present variations in the impacts of climate change based upon the collective review of several models that show a range of projections. See figure 1.

The range of projections by the IPCC is based upon different emission scenarios and estimates of risk. Even in the scenarios with dramatically reduced greenhouse gas emissions (which assumes a dramatic break from business as usual, “BAU”), the IPCC projects that the Earth will warm by 2 - 6 degrees Fahrenheit by the year 2100 (refer to Figure 1 below). In New England, change of this speed and magnitude will result in significant impacts on natural resources, health, and way of life. Fig. 1 shows the various emission projects from the modeling programs used by the IPCC.

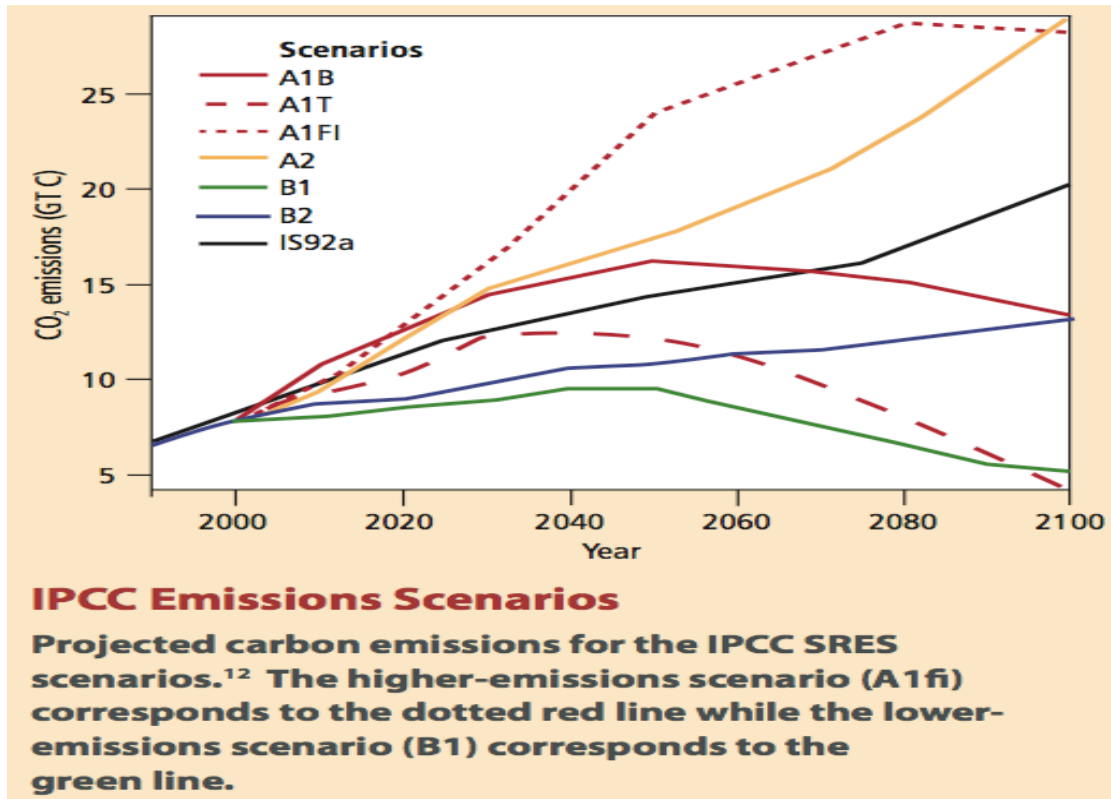


Figure 1. Greenhouse Gas Emission Scenarios. *IPCC*.

While comprising a relatively small geographical area, the Ashuelot River Watershed region is home to a diverse array of communities. It encompasses a variety of ecosystem types and local industries, all of which serve different segments of the region, as well as extra-regional economies, in valuable ways. These include the long-standing traditions of timber management, maple-syrup gathering, and fishing, as well as the economies of skiing, foliage viewing, and other tourism and outdoor recreation activities. All of these industries would be disrupted as a direct result of changes in forest ecosystems caused by global climate change.

Figure 2 is a map depicting the potential climate changes over the next eighty years in New Hampshire as a result of the range of temperature changes that have and most likely will occur under “business as usual” green house gas emissions. Southern New Hampshire’s climate will be similar to the present climate of North Carolina before the end of this century.

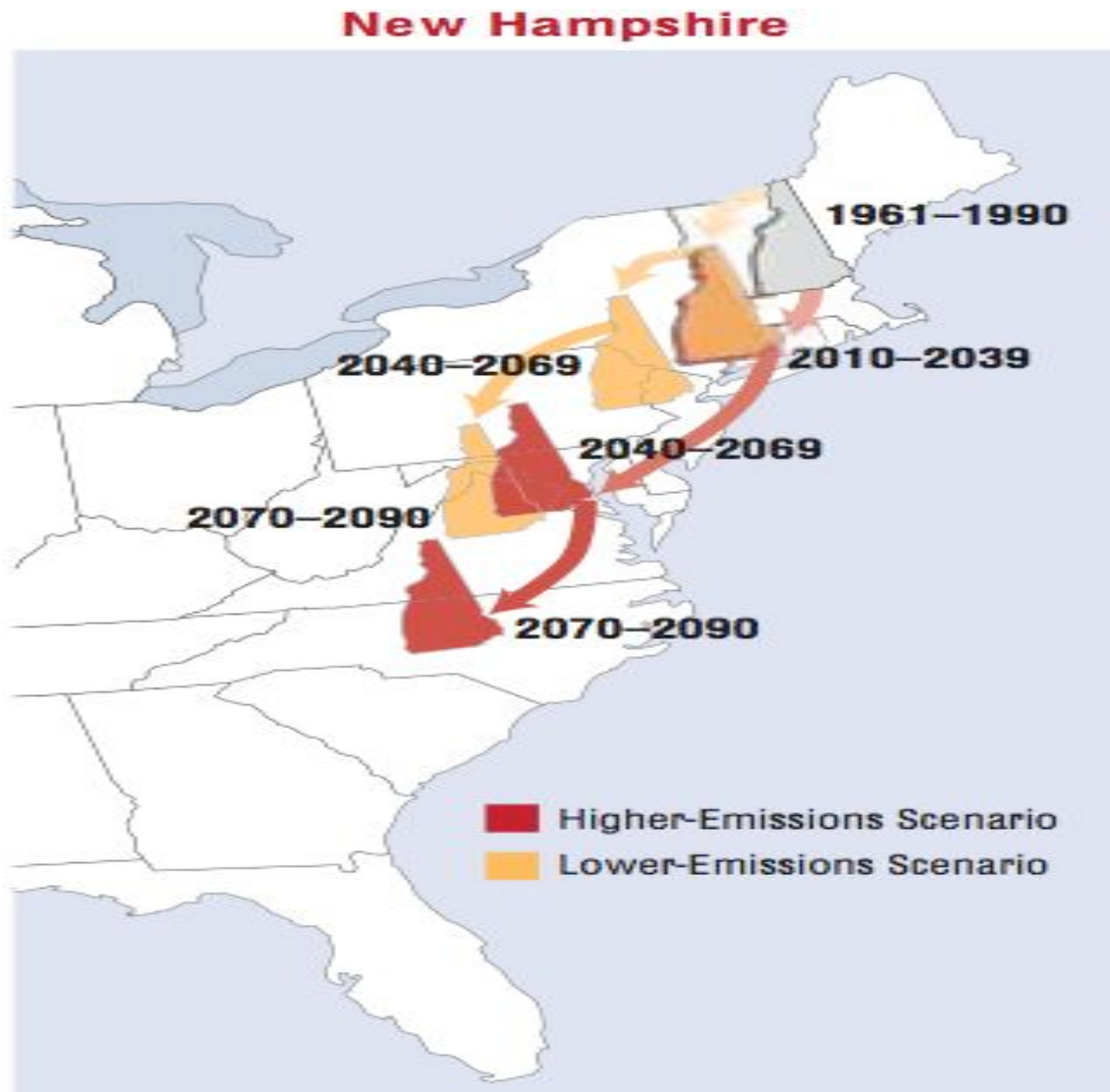


Figure 2. Projected Climate Changes for New Hampshire.

Evidence suggests that the shorter winters, longer and drier summers, increased frequency of flooding, winter thaws, and summer droughts associated with global warming, will occur. These changes can have profound effects on the forest composition, water resources, species composition, snowfall, agricultural growing season, atmospheric visibility, local weather patterns, and ecosystem functions throughout New England.

FIGURE 1: Changes in Regional Average Summer Temperature

The Northeast is already experiencing rising temperatures, with potentially dramatic warming expected later this century, especially if emissions of heat-trapping gases continue along the path of the higher-emissions scenario. These “thermometers” show projected increases in regional average summer temperatures for three time periods: early-, mid-, and late-century.

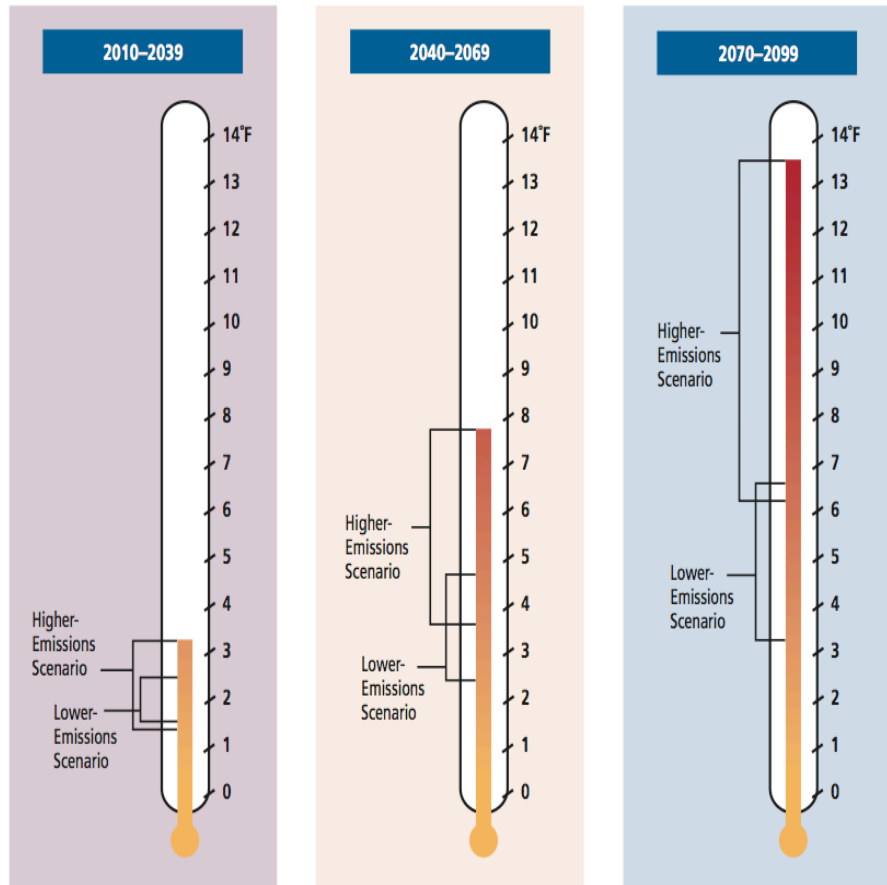


Figure 3. Projected Northeast Temperature Changes.

Impacts already seen:
Since 1970 the N.E. has warmed 0.5 degrees F each decade.
Winter temperatures increased by 1.3 degrees F each decade.
More frequent days above 90 degrees F.
Less winter precipitation as snow and more as rain.
Reduced snow-pack and increased snow density.
Earlier breakup of winter ice on lakes and rivers.
Earlier spring snowmelt, earlier peak river flows.
Increase in forest pests and disease.
Impacts with high GHG emissions (“business as usual”):
Summers could warm 6-14 degrees F, winters by 8-12 degrees F.
Length of winters cut in half in northern sections and by two weeks in south.
Possible 20 days above 100 degrees in summer.
Short-term droughts more frequent.
Hot summers could extend three weeks on each end.

Table 1. Current and Future Changes in New England

FIGURE 4: The Changing Face of Winter

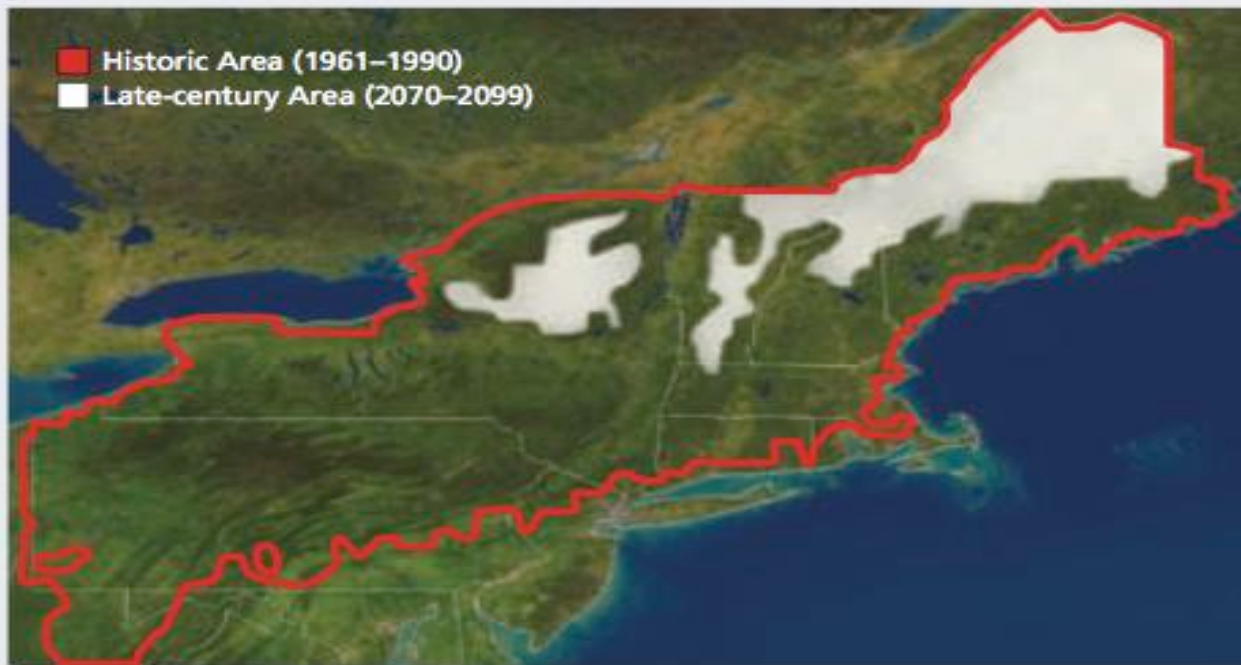


Figure 4. “If higher emissions prevail, a typical snow season may become increasingly rare in much of the Northeast toward the end of the century. The red line in the map captures the area of the northeastern United States that, historically, has had at least a dusting of snow on the ground for at least 30 days in the average year. The white area shows the projected retreat of this snow cover by late-century to higher altitudes and latitudes, suggesting a significant change in the character of a Northeast winter.”

Risk Assessment Findings

Many of the listed impacts, for example shorter winters and increased pest infestation, have already been felt and will only get worse with inaction. While this list includes data and information regarding the entire State of New Hampshire, every impact/economic indicator applies to our watershed region. Reference should also be made to the State Climate Action Plan, the Keene, NH Action Plan and the Keene Adaptation Plan, cited in the appendix. The main points of these documents indicate increased extreme weather events, increased temperatures, and greater ecosystem impacts.

The following list of economic impacts was obtained from the New Hampshire Department of Environmental Services and from the U.S. Forest Service in conjunction with the UNH Cooperative Extension Service. The figures are estimates based upon present calculated losses and projections. Some figures are provided by the Department of Resources and Economic Development (DRED).



Photo from fire tower on Pitcher Mountain, Stoddard, New Hampshire, anonymous.

FOREST RISKS: Projected ecological changes within this century.

- Many tree species will shift northward, 350 miles under low GHG emission scenario and 500 miles under high GHG scenario, translating to potential complete loss of sugar bush in this region (potential large-scale die-offs of sugar maple).
- Projected 70-85 percent loss of Balsam Fir.
- Projected 55-70 percent loss of Red Spruce.
- Spruce and fir decline will put stress on wildlife populations (Hare, Lynx, etc).
- Forest change would greatly affect migratory bird species like the Bicknell's Thrush, greatly affecting tourism from bird watching.
- Hemlock stand will decline from loss of habitat and advance of Hemlock Woolly Adelgid, causing considerable loss in this primary forest product.

ECONOMIC RISKS:

- NH forest industry employees over 8,000 individuals with an annual payroll of nearly \$325 million.
- Changes in forest type could result in loss of \$3.3 Billion in species specific forest products.

- Direct and indirect losses could total \$13 Billion throughout the forest industry.
- 10 extra days of mud-season, \$1.3 Billion in direct loss and \$5.6 Billion in direct and indirect losses based on mud season restrictions on forest practices (BMP)
- 60-day mud season by end of century could result in 20% loss, translating to \$11.5 - \$33.9 Billion in lost revenue.
- Large-scale die-offs of sugar maple could impact a \$3 - \$3.5 million dollar industry.
- New Hampshire foliage travelers on average spend a total of \$292 million annually.

Different Forest Types by Late-Century

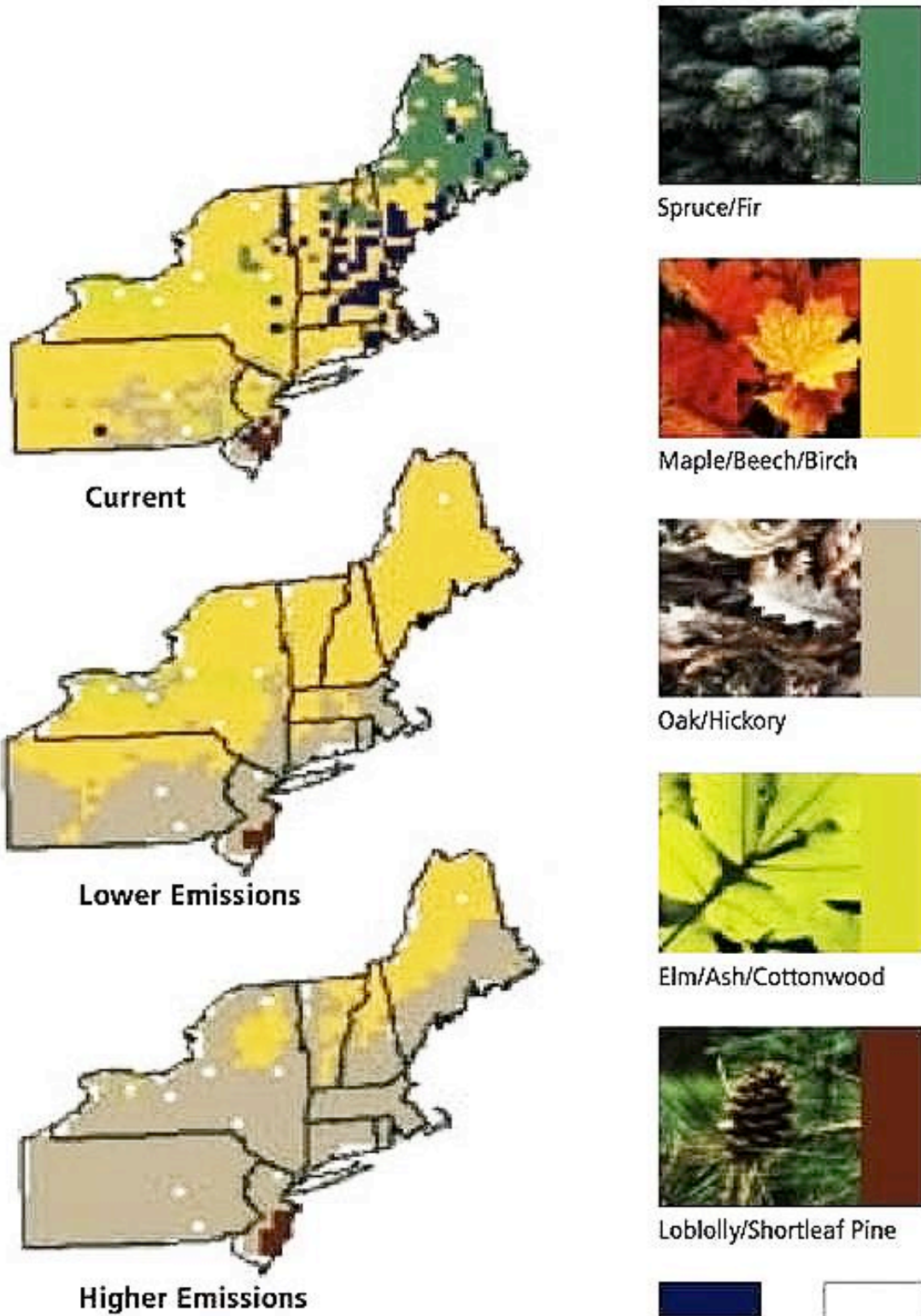


Figure 5. Forest Species Shifts as a Result of Climate Change



WATER RESOURCE AND RELATED ECONOMIC RISKS:

- Altered timing and amount of stream flow could result in regional crop problems.
- Peak spring flow ten days to two weeks earlier.
- Increased risk of winter flooding.
- Winter precipitation 20-30 percent lower.
- Extended low-flow periods in summer one month longer.
- Reduced snowpack ranging from 25-50 percent.
- Increase likelihood and severity of damaging rainstorms.
- Increase in flooding events.

Ski Industry

- New Hampshire's ski industry represents 8.6 percent of total direct visitor spending.
- Loss of 10 - 20 percent of ski season days represents a loss of \$42 - \$84 million in direct and indirect spending in approximately \$190 million. Total ski spending, including indirect spending such as meals, overnight accommodations and the like, totals \$420.7 million.
- Approximately 17,000 New Hampshire residents are employed directly by the New Hampshire ski industry.
- Potential mid-season rain, more freeze-thaw cycles, more icy, granular conditions
- Mid-season rain would necessitate additional snowmaking to restore conditions.
- Water supply will be an issue, to cover one acre of ski trails with one foot of snow takes 150,000 to 180,000 gallons of water

Recreational Fishing Industry

- Fishing is a \$150 million New Hampshire industry.
- Potential loss of cold water fishing: 50 - 100 percent eradication of rainbow, brook, and brown trout

Presidentially Declared Storm-Related Disasters

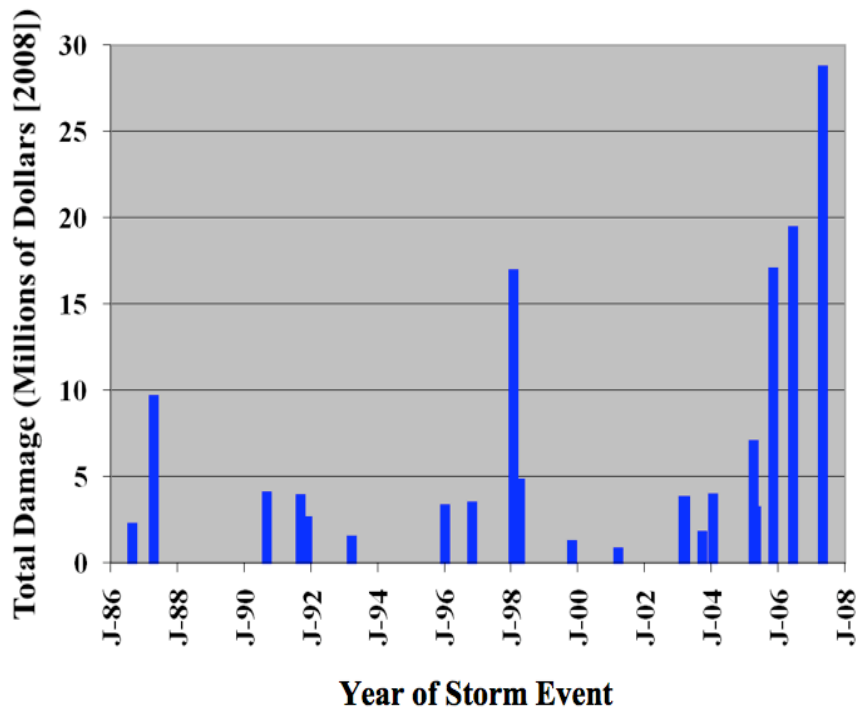


Figure 7. *Source: Sherry Godlewski, Adaptation Coordinator for the State of New Hampshire, Department of Environmental Services.*

Opportunities

There are opportunities for the Ashuelot River watershed that could be created through mindful action and innovative thinking, in partnership with local and state-wide support. Reference should be made to the State Climate Action Plan, Chapter 4, pages 33-37; the City of Keene Local Climate Action Plan, Chapters 4 and 5, pages 40-65, and the Keene NH Adapting to Climate Change Section IV, pages 31-42. One of the primary intents of this document is to supplement the quality works already created, by adding more focused action plans, specific to the protection of forest and water for this region. The documents referenced cover a broad spectrum of economic, social, built and natural aspects of concern and are further supported by the recommendations that follow.

- Avoidance of cost associated with the degradation of the natural environment,

ecosystems and ecosystem services, such as wetlands, floodplain, and riparian zones, and the related decline in natural resources, extractive reserves, tourism and related businesses/industries.

- Job creation associated with a diversification of business models, promotion of local product utilization, and the transportation of such products.
- Educational opportunities in all aspects of state and regional management of resources.
- Education to promote town incentives to follow sustainable models of preservation, conservation and management primarily of forested lands and the related impacts to their health.
- Education regarding the preservation of wildlife and landscape ecology that will ensure their continued success. (See State Wildlife Action Plan)
- Reduce need for increased expenses related to all aspects of water quality and quantity through the conservation of all related ecosystems, wetlands, floodplains, aquifer and surface water/reservoirs.
- Decrease health care cost by supporting all aspects of a healthy environment through clean air and water.
- Structure regional preservation efforts to take advantage of the numerous possibilities related to carbon budgeting and sequestration(credits, tax incentives, etc.).
- Benefits of the pleasures of a beautiful, intact regional landscape now and into the future.

Action/Implementation Plan

The specific goals and objectives for the Ashuelot Watershed Climate Adaptation Plan are outlined below. Also included are an identification of the actions needed to implement the plan, and the identity of the parties who will be responsible for them. The action plan focuses on two broad goals:

- Goal #1: To protect and preserve Ashuelot Watershed forests
- Goal #2: To protect, maintain, and improve water resources in the Ashuelot River Watershed.

The specific objectives involved in accomplishing these goals center around working with many stakeholder partnerships, conducting targeted educational programs, and providing specific data, policy tools, and incentives needed to conserve forest and water resources.

There are two preliminary points to be made regarding implementation. First, the Ashuelot Plan implementation team will be conducting a joint “evaluation” meeting with the Keene Planning Department to strategize where we may be helpful in assisting them with follow up implementation of specific elements of their own adaptation plan.

Second, two of the goals put forward by the team early in the process are already well on the way to being implemented:

- A re-write of the new ten year Ashuelot River Implementation document will incorporate references and recommendations for climate change mitigation/adaptation actions.
- A recommendation that riparian buffers be extended by approximately twenty percent (20%) by the year 2015 is likely to be included in the State’s revision of Best Management Practices for Forest Management. The updated BMP manual that will be coming out early in 2011 is likely to include both the extended riparian zones and also include slope related setbacks/guidelines similar to our team’s recommendations.

ACTION PLAN

Goal #1: To Protect and Preserve Ashuelot Watershed Forest

Objective #1: To create a universal forest extraction system and database.

Strategy: Gain state support to link private, state and federal forest extraction data reporting in a uniform system.

Measure: State protocol and reporting data bank for forest extraction activities (timber harvests).

<u>Actions:</u>

Organize working relationship with key partners including the Division of Forest and Lands (DRED), state of NH, Society for the Protection of New Hampshire Forests (SPNHF), the Forest Industry through UNH Cooperative Extension Service.

Coordinate a process to research forest extraction reporting systems and develop a NH system to recommend for implementation.

Responsible Parties:

Ken Desmarais, Sherry Godlewski, Brian Hotz, Steve Roberge, TSP.

Time: December 2011.

Objective #2: To establish greater use of sustainable forestry practices with a climate change forestry educational/certification program.

Strategy: Engage community and forest resource groups to create and adopt an ongoing educational initiative to connect climate to forest practices.

Measure: The creation and publication of a manual/newsletter to disseminate climate change updates and information.

Actions:

Establish an ad hoc forest advisory group to design educational material and strategies.

Conduct information and training sessions.

Responsible Parties:

SPNHF, UNH Co-op Ext., TSP.

Time: December 2011.

Objective #3: Expand riparian buffer zones by 20%.

Strategy: Work with DES, state adaptation plan to create new guidelines.

Measure: New accepted guidelines.

Actions:

Work with the Ashuelot River Local Advisory Committee (ARLAC).

Responsible Parties:

Barbara Skully, ARLAC; Sherry Godlewski, DES; Rebecca Bullock, Southwest Regional Planning Commission (SWRPC).

Time: December 2011.

Objective #4: To protect standing forest tracts along the Ashuelot River Watershed.

Strategy: To work closely with local land trusts, SPNHF, The Nature Conservancy (TNC) and private landowners to move toward forest conservation.

Measure: Increase tree cover by 10% over the next five years (by 2015).

Actions:

<p>Join land trust boards in an advisory capacity. Provide educational outreach to towns and larger landholders. Create a forest cover “baseline.” Seek funding and incentive mechanisms to support land owner conservation measures.</p>
<p>Responsible Parties: Pete Throop, Monadnock Conservancy; Valerie Piedmont, TSP; Doug Bechtel, TNC.</p>
<p>Time: December 2011.</p>

Goal #2: To protect, maintain, and improve water resources in the Ashuelot River Watershed.

Objective #1: To protect floodplains and wetlands with a no net loss policy.

<p>Strategy: Work with town and regional planning groups to establish wetland and floodplain protection ordinances.</p>
<p>Measure: The creation of a no net loss ordinance.</p>
<p>Actions: Do a wetlands/floodplain inventory. Identify critical wetland areas within the watershed. Build town support for new regulations to protect wetlands and floodplains. Pass town ordinances protecting wetlands.</p>
<p>Responsible parties: Local town officials and the Southwest Regional Planning Commission.</p>
<p>Time: December 2011.</p>

Objective #2: To permanently protect headwater forests of the Ashuelot River Watershed.

<p>Strategy: Work with SPNHF and TNC to develop and implement a headwater protection plan.</p>
<p>Measure: Headwater protection plan implementation.</p>
<p>Actions: Identify and map critical headwater forest cover areas for protection strategies. Communicate and work with SPNHF to develop specific plans for headwater protection actions.</p>
<p>Responsible Parties: TSP, SPNHF (Brian Hotz), TNC</p>
<p>Time: December 2011.</p>

Objective #3: To create “setback” and steep slope policies in areas along the Ashuelot River Watershed with slopes of 15% or greater.

<p>Strategy: Create a GIS reference guide to assist towns in the marking of the boundaries of the</p>
--

setback parcels, for erosion protection.

Measure: Passage of town ordinances creating setback regulations for properties along the ARW.

Actions:

Do a topographical inventory of the watershed identifying areas with slopes greater than 15%.

Make presentations to pertinent towns showing these maps. [New Hampshire's relevant non-regulatory BMPs are at:

http://extension.unh.edu/resources/resource/248/Best_Management_Practices_for_Forestry:_Protecting_NH%27s_Water_Quality]

Responsible Parties:

TSP, Town Officials.

Time: December 2011.

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