SECTION 4: Environmental Inventory and Analysis

This section of the Open Space and Recreation Plan provides a comprehensive inventory of Shelburne's significant natural and cultural resources. The inventory identifies and qualifies geology and soils, special landscape features, water resources, vegetation, fisheries and wildlife, scenic resources and unique environments and scenic landscapes. Finally, environmental challenges in town are described. The Environmental Inventory and Analysis provides the Town with information about existing natural and cultural resources and its relationship to people that is important to understand in order to make informed land use decisions that affect the Town's natural and open areas.

A. GEOLOGY, SOILS, AND TOPOGRAPHY

Good decisions on open space and recreation planning take into consideration the inherent suitability of a site for different uses. Topography, geology, and soils are essential in determining potential sites for future residential, commercial and industrial development as well as for new parks, hiking trails, and open space.

A.1 GEOLOGY

The region around Shelburne as we know it today is the result of millions of years of geologic history: continents moving and colliding, great upheavals of the earth's crust and volcanic activity, and the sculpting power of moving water, ice and wind. This distinctive physical base has determined the distribution of the town's water bodies, its soils and vegetation and its settlement patterns, both prior to and since colonial times.

As continents moved, the pressure of mountain building folded the earth, created faults, and produced the layers of metamorphosed rock typically found in New England. Collision stress melted large areas of rock, which cooled and hardened into the granites that are found in some of the hill towns in Massachusetts today. Preceding the collisions, lines of volcanoes formed, and Franklin County (including Shelburne) shows evidence of this in bands of dark rock, called schist, that metamorphosed from lava flows and volcanic ash, formed 350-500 million years ago.

Approximately two million years ago, accumulated snow and ice in glaciers to the far north began advancing under their own weight. A series of glaciations, or "ice ages," followed, eroding mountains and displacing huge amounts of rock and sediment. The final advance,

known as the Wisconsin Glacial Period, completely covered New England before it began to recede about 13,000 years ago, and left the landforms that are in place today. The areas of Shelburne approximately upland of Route 2 represent sculpted areas of former volcanoes and mountains.

As the glacier receded as it melted, it picked up, mixed, disintegrated, transported and deposited material in its retreat. Material deposited by the ice is known as *glacial till*. Material transported by water, separated by size and deposited in layers is called *stratified drift*. These areas are well drained and are often the location of groundwater aquifers. The glacier left gravel and sand deposits in the lowlands and along stream terraces.

Glacial melting also led to the formation of a large, linear lake around the present Connecticut River, called Lake Hitchcock. In Shelburne at approximately the location of the State Police Barracks and Wilcox Hollow, the land level at Route 2 is about 430 feet above sea level and represents the level of the Deerfield River's delta complex built into Lake Hitchcock. After Lake Hitchcock drained 14,000 years ago, the Deerfield River started to erode through the delta deposits.[1] The parts of Shelburne that lie between this level and the present river level represent floodplain materials.

The Shelburne Falls potholes are river-cut features that formed as the Deerfield River eroded its channel, exposing gneiss. The gneiss is former magma chamber granite that has been metamorphosed, folded, uplifted and eroded.[2] Contrary to local lore, the potholes were not formed by glaciers.

A.2 SOILS

Soils have the following five basic characteristics that make them appropriate or inappropriate for different land uses:

- their depth to bedrock;
- the speed at which they allow water to percolate into the ground;
- their slope;

[1] Personal communication between Tamsin Flanders (FRCOG staff) and Richard Little (Professor Emeritus at Greenfield Community College) dated April 7, 2023.

[2] Little, Richard D. "Dinosaurs, Dunes, and Drifting Continents: The Geology of the Connecticut River Valley," 3rd edition. 2003. Published by Earth View, LLC, Easthampton, MA.

- the amount of surface water that exists in the area;
- and the amount of boulders and stones present on the surface and just below.

Soils are classified and grouped into associations that are commonly found together. The soils of Shelburne are predominantly of the Westminster-Colrain-Buckland association. These soils are generally well-drained and range from fine sandy loams to rocky loams, and are found in the rolling to steep hills and narrow valleys in town. Minor soils in this association are the well-drained Shelburne soils and the poorly drained Cabot soils. The Westminster-Colrain-Buckland soils support dairy farming and apple orchards, as well as the production of maple syrup.

As Shelburne plans for the long-term use of its land, residents can ask:

1. Which soils constrain development given current technologies?
2. Which soils are particularly suited for recreational opportunities and wildlife habitat? and
3. Which soils are best for agriculture?

The answers to these questions help lay a foundation for open space and recreation planning in Shelburne. The following sub-section provides a description of the soils in Shelburne based on their impact on drinking water issues, wastewater issues, recreation opportunities, erosion, wildlife habitat, and agriculture.

A.2.1 SOILS CONSTRAINING DEVELOPMENT GIVEN CURRENT TECHNOLOGIES

The Westminster soils are found on the moderate to steep slopes in Shelburne. They consist of well-drained, shallow, rocky loams, which developed in deposits of glacial material. Depth to bedrock is generally eighteen inches, but can range from bare outcrop to a depth of more than two feet in some places. The Colrain soils can be found on gently sloping to very steep slopes, but are limited in use due to their extreme stoniness. They are well-drained soils that formed in glacial deposits. The Colrain soils have a moderate to high moisture holding capacity. The Buckland soils, which formed in compact glacial deposits, are found in nearly level to moderately steep slopes. They consist of moderately well drained fine sandy loams and have a hard layer at a depth of approximately twenty inches. Although water passes through the surface layer and subsoil of the Buckland soils somewhat readily except when saturated, they are considered wet as water moves slowly through the dense substratum.

In general, wet and shallow soils do not provide for adequate filtration of wastewater pollutants associated with private septic systems, and rarely meet the percolation standards of the Title V regulations. Shallow soils are often associated with steep slopes or hilltops while wet soils are often found along floodplains and wetland systems.

A.2.2 SOILS SUITED FOR RECREATIONAL ACTIVITIES AND/OR WILDLIFE HABITAT AND WOODLANDS

Outside of flat areas for sports fields, the soils best suited for rural recreational purposes are the same as those that provide upland wildlife habitat. Different recreational uses are constrained by different soil and topographical characteristics. Sports fields require well-drained soils and level topography, whereas lands with slopes greater than 25 percent are attractive to mountain biking and hiking enthusiasts.

Erodibility of soils has important implications for the impact of recreational uses. Erodible soils include those that are shallow, wet, sandy, or sloped, or those with a combination of these characteristics. Unless trails are constructed correctly and there is provision to adequately maintain them in the future; hikers, mountain bikers and ATVs can create and exacerbate erosion on steep slopes and in sandy soils.

There is a positive correlation between soils that support wildlife habitat and soils that present the most constraints to development. These soils include the extremely rocky loam type soils of the Westminster and Colrain series found on moderate to steep slopes.

A.2.3 SOILS SUITABLE FOR AGRICULTURE

The Natural Resources Conservation Service (NRCS), is responsible for classification of soils according to their suitability for agriculture. NRCS maintains detailed information on soils and maps of where they are located.

Information on soils presented in this plan is based on 1967 USDA Natural Resource Conservation Service (NRCS) paper mapping for Franklin County. New digital soils data was recently released by NRCS and the Franklin Regional Council of Governments is currently working to integrate it into their database for Franklin County. This 1967 information is useful as a general indicator of town-wide soils. Especially under forest cover, however, mapped soil type over large areas can have inclusions of other types too small to differentiate. Therefore, mapped soils data are inaccurate indicators of potential development limitations.

Designated farmland soils are comprised of three classes of soils that have been identified by the NRCS:

- Prime Farmland
- Unique Farmland, and
- Farmland of statewide or local importance.

What is Prime Farmland?
According to Natural Resources Conservation Service (NRCS), Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if managed with acceptable farming methods.

In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, and few or no rocks. Its soils are permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding.

These soil classes have been identified as contributing to the agricultural productivity of the country and should be protected from conversion to non-agricultural uses. Unique farmland is defined as "land other than prime farmland that is used for production of specific high value food and fiber crops," with such crops defined by the U.S. Secretary of Agriculture. Farmland of statewide or local importance is defined as "farmland, other than prime or unique farmland, that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops." Only soils with the Prime Farmland designation are shown on the maps for this Open Space and Recreation Plan. This data was hand digitized from the 1967 NRCS mapping.

Agricultural soils are a finite resource. If the soil is removed, or the land is converted to another use, the capacity for food and fiber production is lost. Prime farmland soils have contributed to the town's economic stability throughout its history. The more common soils that constitute these prime agricultural lands include the Colrain, Buckland, and Shelburne soils. The Colrain soils are deep and well-drained, and are found in gently sloping to moderately steep areas. The Buckland soils are moderately well-drained, fine sandy loams found in nearly level to moderately steep slopes. Shelburne soils are well-drained stony loams found in gently sloping to steep areas. In Shelburne, prime farmland soils are

located throughout the town where slopes are not too steep.

The characteristics that make prime farmland soils suitable for agricultural also make them easy to develop. Large tracts of level, well-drained farmland are attractive to developers because the cost of installing roads and other infrastructure is relatively low. Residents interested in helping to conserve the town's agricultural landscapes should consider all farmland soils to be rare, valuable, and vulnerable to development.

Placeholder for Soils Map

A.3 TOPOGRAPHY

The topography of the Town of Shelburne consists of steep and rolling hills, high elevation plateau, open fields, numerous streams, and the Deerfield River, which forms the town's western boundary. The Deerfield River enters Shelburne in the northwestern corner of the town and flows southeastward to its eventual confluence with the Connecticut River in the town of Deerfield. Shelburne's highest point is Massaemett Mountain, at 1,588 feet, located in the western section of town.

B. LANDSCAPE CHARACTER

Shelburne's landscape distinguishes it from surrounding communities. The town is one of steep forested hills, open hilltop views, agricultural fields, large active farms, numerous streams, and abundant wildlife. The Deerfield River, which flows southeastward, forms the town's western boundary. To the east of the Deerfield River lies a long, broad ridge line, Massaemett Mountain, with an elevation of 1,588 ft. The ridge extends approximately from Route 2 to Patten Hill. The Patten Hill area, also of significant elevation, is home to many agricultural landscapes including pastures, orchards and cultivated fields. Patten Hill offers magnificent distant views to the north and northeast. Many of the other agricultural lands can be found in the eastern two-thirds of the town and within the floodplains of its streams. The town has two villages, Shelburne Falls located along the Deerfield River and Shelburne Center, located south of the Mohawk Trail. Shelburne Falls is comprised of a mix of residential, business and commercial development within a compact village landscape. The village of Shelburne Falls spans the Deerfield River and joins the towns of Buckland and Shelburne, linked by the Iron Bridge and the iconic Bridge of Flowers. The Town of Shelburne also has a considerable number of retail and service businesses within its commercially zoned area along Route 2, a transportation corridor, which bisects the town. The views from Bardwells Ferry Road from

Shelburne Center to Bardwells Ferry Bridge encompass both intimate glimpses of farm life and vast long-range views of rolling hills and tree-crested hill tops.

B.1. DOCUMENTING AND MAPPING ECOSYSTEMS

Just as the town of Shelburne contains multiple and varied ecosystems, the state of Massachusetts, while relatively small, has many diverse ecosystems and habitats. Documentation and mapping of such ecosystems and habitats – and their contributions to biodiversity and climate change resilience – can be a first step toward protecting and preserving these resources.

Shelburne Town officials and residents can use this Open Space and Recreation Plan as a reference tool when making land use decisions. Ideally, land conservation projects will help protect the town's scenic value and natural resources in the face of potential development, changes in land use, and climate change impacts, while recognizing that people need places to live, learn, work and play. Development—when sited in unsettled areas rather than as infill—can require infrastructure such as roads, power, water, and wastewater systems. These collective needs, in turn, depend upon and affect critical natural systems.

Proactive conservation decisions based on a scientific assessment of conservation value can maximize the value of limited resources. On the statewide level, mapping Core Habitat and Critical Natural Landscapes helps to guide strategic conservation to protect those areas that are most critical to the long-term survival and persistence of rare and other native species and their related habitats and ecosystems. On the local level, Shelburne can use this information to better understand where the Town's ecosystems and habitats fit into the bigger picture. For example, a seemingly insignificant parcel of land could be a key link to two larger, intact ecosystems. Mapping ecosystems and prioritizing areas for land protection is a useful strategy for Shelburne which may have the opportunity to acquire key parcels under the right of first refusal provision of the Chapter 61 Programs (see Section 5 for more information on this program). Shelburne has a policy in place outlining how the Town processes the transfer of a property under the Chapters.[3]

The University of Massachusetts's Center for Agriculture, Food, and the Environment manages a clearinghouse of land conservation information sources and tools developed by a variety of organizations that are available to guide the decision making of Massachusetts land

[3] https://www.townofshelburne.com/files/Chap_61_Review_Procedure.pdf

conservation practitioners. The "Land Conservation Tools" website links to commonly used tools such as BioMap, Audubon's Mapping and Prioritizing Parcels for Resilience, and The Nature Conservancy's Resilient and Connected Landscapes, among others, that help decision-makers identify important criteria for prioritization and filter open space parcels through those criteria. The clearinghouse can be found at https://ag.umass.edu/resources/land-conservation-tools. For the purposes of identifying areas in Shelburne that could be considered for protection during the Open Space & Recreation planning process, a brief analysis was conducted using data from BioMap and the Natural Heritage and Endangered Species Program (NHESP). A summary of findings for each data set follows.

About BioMap

BioMap combines NHESP's 40-plus years of rare species and natural community documentation records with the Division of Fisheries and Wildlife's 2015 State Wildlife Action Plan (SWAP). It also integrates The Nature Conservancy's assessment of ecosystem and habitat connections across the State and incorporates ecosystem resilience in the face of anticipated impacts from climate change.

B.1.1 BIOMAP

In 2022, the Massachusetts Division of Fisheries and Wildlife and The Nature Conservancy launched the newly updated *BioMap: The Future of Conservation in Massachusetts.*[4] This project, produced by the state's Natural Heritage and Endangered Species Program (NHESP), is a comprehensive biodiversity conservation plan for Massachusetts. BioMap3 attempts to protect the state's biodiversity in the context of projected effects of climate change.

BioMap data focus primarily on state-listed rare species and exemplary natural communities. It was developed to guide strategic biodiversity conservation throughout the state by focusing on land protection and stewardship efforts. Core Habitat areas include the most viable habitat for rare plants and rare animals and exemplary natural communities. Critical Natural Landscapes include buffer areas around the Core Habitats, large undeveloped patches of vegetation, large "roadless" areas, and undeveloped watersheds. The Core Habitat areas were identified, through field surveys, as supporting viable populations of rare plant and animal species while the Critical Natural Landscape areas were determined through analyses using Geographic Information Systems (GIS) mapping programs. BioMap Core Habitat and NHESP Priority Habitats for Rare & Endangered Species are shown on the *Plant & Wildlife Habitat* Map.

NHESP BioMap Core Habitat and Critical Natural Landscapes (CNL) in Shelburne can be summarized as follows and are displayed on the *Plant & Wildlife Habitat* map in this section:

[4] https://www.mass.gov/service-details/biomap-the-future-of-conservation-in-massachusetts

- 1,774.4 acres of the land classified as BioMap Core Habitat in Shelburne is protected.
- 2,675.6 acres of the land classified as BioMap Critical Natural Landscape in Shelburne is protected.
- The largest sections of BioMap Core Habitat in Shelburne are located along the entirety of the Deerfield River, with two large patches in the northwestern corner (High Ledges) and the southeastern corner (on Shingle Hill).
- The majority of BioMap Critical Natural Landscape areas are located in overlapping areas of the Core Habitat, along the Deerfield River and its tributaries. BioMap Critical Natural Landscape does not overlap with the two patches mentioned above, however.
- The length of the Deerfield River represents a stretch of Aquatic Core habitat. Smaller patches of Aquatic Core habitat are located in Dragon Brook, Great Brook, and Sluice Brook. Other areas of Aquatic Core habitat overlap with the large section of Core Habitat in the northwestern and southeastern corners of town.

B.1.2 NHESP NATURAL HERITAGE ATLAS

The 15th edition of the NHESP Natural Heritage Atlas (effective August 2021) displays the boundaries of Priority Habitat of Rare Species for the entire Town of Shelburne. A Priority Habitat is an area where plant and animal species that are protected by the Massachusetts Endangered Species Act regulations may occur. [5] According to the 2021 Atlas, NHESP Priority Habitats in Shelburne are located:

- Along much of the extent of the Deerfield River within town boundaries, along Hinsdale and Dragon Brooks
- In High Ledges Wildlife Sanctuary
- Within and around a pond located in the northern section of town between Little Mohawk and Reynolds Road

These areas are shown on the *Plant & Wildlife Habitat* map.

About the NHESP Program

Priority and Estimated Habitats is a program administered by NHESP. Identification and mapping of Priority and Estimated Habitats is based on the known geographical extent of habitat for all state-listed rare or endangered species, both plants and animals, and is codified under the Massachusetts Endangered Species Act (MESA). Habitat alteration within Priority Habitats is subject to regulatory review by the Natural Heritage & Endangered Species Program. Priority Habitat maps are used for determining whether or not a proposed project must be reviewed by the NHESP for MESA compliance.

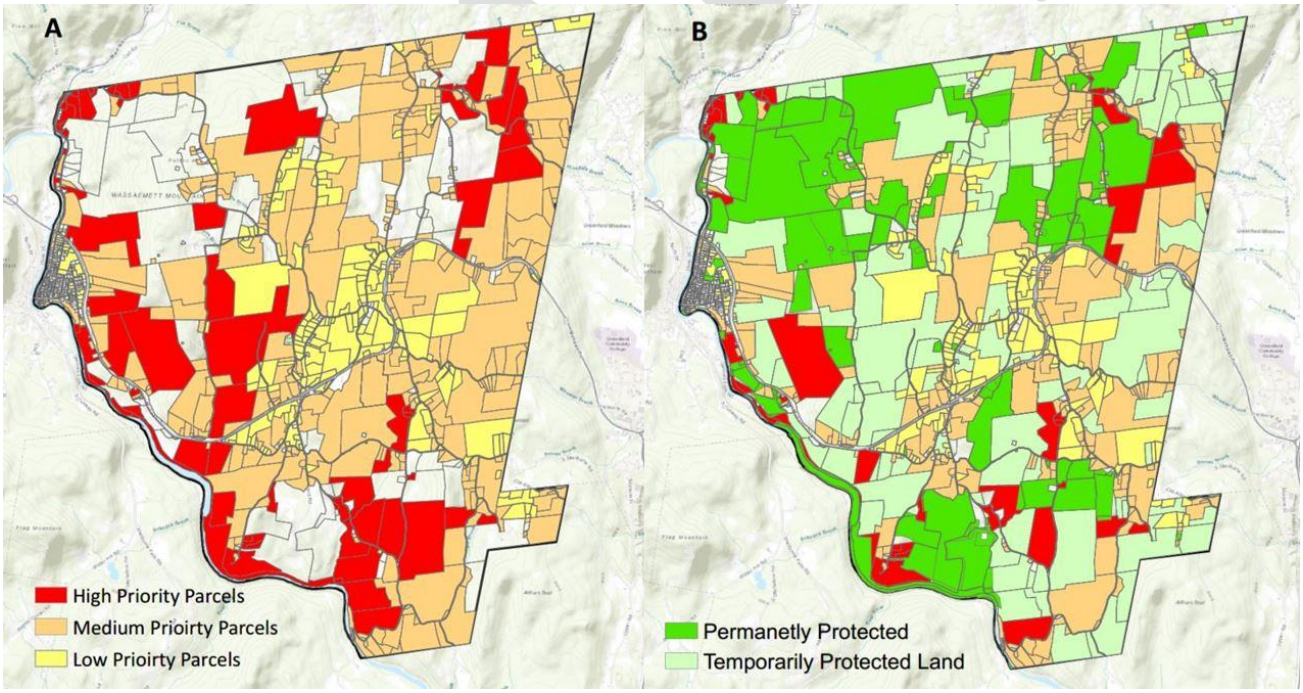
B.1.3 MASS AUDUBON'S MAPPING AND PRIORITIZING PARCELS FOR RESILIENCE (MAPPR)

Mass Audubon, in partnership with The Nature Conservancy and LandVest, developed MAPPR to allow Massachusetts conservationists to rapidly identify specific parcels that, if

[5] https://www.mass.gov/service-details/regulatory-maps-priority-estimated-habitats. Accessed on December 2022.

protected, could contribute the most to achieving land protection goals. MAPPR compiles the previous work of BioMap (Biomap2) and TNC's Resilient Sites, along with other digital parcel information into one online mapping tool.[6] MAPPR allows land conservationists to identify the parcels within an area of interest that are the highest priorities for protection based on habitat quality, climate change resilience, and other metrics such as parcel size and adjacency to existing protected parcels.

In Shelburne, parcels of land identified as a priority for protection are primarily only temporarily protected with tools such as Chapter 61 (Figure 4-3). Areas along the Deerfield River in the southwestern corner of Shelburne and along the Dragon and Allen Brooks were identified as a conservation priority. Some are permanently protected, but some are in temporary protection programs. The majority of the parcels identified as a high or medium priority for conservation have a status of temporarily protected, through one of the Chapter 61 programs. Shelburne Town officials could use the MassAudubon MAPPR data to determine which parcels should be their highest priority for permanently protecting, if one of the parcels is put up for sale.



[6] https://www.massaudubon.org/our-conservation-work/advocacy/shaping-the-future-of-your-community/current-projects/mappr-project. Accessed on April 2023.

Figure 4-3: A) Parcels of land identified as a priority for protection in Shelburne by the Mass Audubon MAPPR analysis.[7] And **B)** Permanently and temporarily protected parcels in Shelburne overlaid on MAPPR data.

Sources: Shelburne Assessor's Office, MassGIS, Mass Audubon.

Placeholder for Plant & Wildlife Habitat Map

C. WATER RESOURCES

Shelburne is rich in water resources, including a river, brooks, streams, vernal pools, wetlands, and aquifers *(See the Water Resources Map)*. Most of the land in Shelburne drains into the Deerfield River mainstem, which forms the western and southern boundaries of Shelburne, and is an important sub-watershed within the Connecticut River watershed. This section focuses on waters within Shelburne, but it is important to keep in mind that improvement in water quality in the Deerfield River and the other brooks and streams in town have impacts beyond town borders.

C.1 WATERSHEDS

As described in Section 3, Shelburne lies entirely within the Deerfield River watershed. The majority of the town lies in the Deerfield River mainstem watershed, and other parts of towns are part of the Green River and North River watersheds, which are tributaries to the Deerfield River. All three are described in further detail below.

C.1.1 DEERFIELD RIVER MAINSTEM WATERSHED

The Deerfield River is a major tributary of the Connecticut River; the Deerfield basin drains approximately 665 square miles of the southern Green Mountains in Vermont and the northern Berkshires in Massachusetts. Three hundred and forty-seven square miles of this land is located in all or part of 20 western Massachusetts towns. From its headwaters at Stratton Mountain in Vermont, the Deerfield River flows southeastward for approximately seventy (70.2) miles through the steep terrain of the Berkshires to its confluence with the Connecticut

[7] The "Balanced Model" was used to develop the maps above. The Balanced Model combines the TNC Resilience, UMass Critical Linkages, BioMap2 Core Habitat, BioMap2 Critical Natural Landscape, Parcel size, Block size, Adjacent to existing protection, and Under-represented settings values together. They are all equally weighted. More information about each of these sources is available on the MAPPR Project website, linked above.

River. The northern portion of the watershed, from Somerset, Vermont to Route 2 in Charlemont, Massachusetts, is primarily forested and steep, and accounts for approximately 78 percent of the total watershed area. Much of the land along the remaining length of the river, from Charlemont to the confluence with the Connecticut River, is open fields and agricultural land.

While the Deerfield River watershed is rural and sparsely developed, decades of natural and human-caused disturbances, such as land clearing and channel modification, have made streams and rivers highly unstable and prone to frequent flooding and erosion. Climate change and continued development in the floodplain also contribute to significant stress on the river systems of the watershed.[8]

In 2017 FRCOG released *The Deerfield River Watershed-Based Plan,*[9] which outlines evidence-based recommendations to protect watershed health, restore impaired water bodies, and increase the watershed's resiliency to climate change. This plan focused on ways that towns can become more resilient by working across municipal boundaries to address shared issues and implement mutually beneficial solutions at watershed scale. The plan outlines a wide range of stewardship and management recommendations for public and privately owned forests and agricultural land. Many of these recommendations are relevant to, and in support of goals and action items identified in this OSRP. They include the following recommendations:

- Update and align land use regulations across the 14 watershed towns, with a focus on mapping and managing the river corridor;
- Identify sediment storage, water quality protection and conservation opportunities in the upland areas of the watersheds; and
- Conduct conservation and restoration projects that protect green infrastructure, improve flood resiliency and reduce sediment inputs to streams and rivers.

The plan also outlines specific landscape scale recommendations for conservation and protection of the river corridor and floodplain. These projects could be implemented throughout the Deerfield River watershed and may involve many towns in the watershed and a variety of stakeholders. The projects are designed to engage and educate watershed residents.

[8] *A Framework for Resilience: Responding to Climate Change in the Deerfield River Watershed.* Franklin Regional Council of Governments, January 2019.

[9] A Watershed-Based Plan to Maintain the Health and Improve the Resiliency of the Deerfield River Watershed, 15-04/319. Franklin Regional Council of Governments. 2017.

C.1.2 GREEN RIVER WATERSHED

The Green River Watershed is located in southern Vermont and northwestern Massachusetts. It has a drainage area of 89.9 square miles, which includes portions of Shelburne, Colrain, Leyden, Bernardston and Greenfield, as well as five communities in Vermont. The total length of the Green River is 28.3 miles, 16.3 miles of which are in Massachusetts. The river itself originates in southeastern Vermont on the south side of the Mt. Olga-Hogback Ridge in the town of Marlboro, Vermont. The Green River enters Massachusetts in the town of Colrain and forms the town's eastern border with the town of Leyden. It flows south and east through a steep, narrow valley for much of its length. As it enters the town of Greenfield the gradient lessens and the floodplain widens. The Green River boasts an undeveloped river corridor, in part due to its steep terrain and geologic features. Most roads in the watershed remain unpaved, with minimal riverside development. Most of the watershed is forested, although along the Massachusetts section, agricultural and open land can be found as well. Only as the river and its tributaries reach the town of Greenfield does it begin to flow through some areas of urban development.

The northeast corner of Shelburne is in the Green River watershed, including the Colrain-Shelburne Road, Peckville Road, and Route 2 east of Colrain-Shelburne Rd.

C.1.3 NORTH RIVER WATERSHED

The North River watershed is located in northwestern Massachusetts and southern Vermont, draining 94.2 square miles. It is formed by the confluence of the East Branch and the West Branch. Below this confluence, the North River is impounded by a dam that diverts water to the Barnhardt water supply (in 2023, this nonwoven cotton mill has closed). The North River flows south and west, paralleling Route 112. Forests predominate the upland slopes of the watershed while the floodplain areas in the valley are mostly agricultural. Residential and industrial development in the watershed is primarily concentrated within the river floodplain. The floodplain narrows as the North River flows toward its confluence with the Deerfield River, just south of North River Road at the Shelburne, Charlemont and Buckland town lines.

Only a small portion of the North River watershed in Shelburne. This area is located near the Buckland/Charlemont border and along parts of lower Patten Road.

C.2 SURFACE WATER

The following inventory describes Shelburne's rivers, streams, and ponds and focuses on water quality issues and the public access and recreational value of these waters. The Massachusetts 2018/2020 Integrated List of Waters prepared by the Department of Environmental Protection (MassDEP), the draft 2022 Integrated List (not yet finalized and approved by EPA, but included here because there were new assessments for the Deerfield watershed) and the BioMap Shelburne Town Report, were used as source documents for all listed surface waters within the Town of Shelburne.[10] Not all water bodies in Shelburne have been assessed by the DEP for water quality impairments.

The Massachusetts Surface Water Quality Standards (SWQS) (314 CMR 4) assign all inland and coastal and marine waters to classes according to the intended beneficial uses of those waters. [11] For example Class A waters are designated as the source of public water supplies and, where compatible with this use, should also be suitable for supporting aquatic life, recreational uses such as swimming and boating, and fish consumption. Class B waters are designated for all uses cited above for Class A, except for drinking water supplies. Class C waters are defined but there are no Class C waters in Massachusetts.

Under the Massachusetts SWQS, a coldwater fishery is defined as waters in which the mean of the maximum daily temperature over a seven day period generally does not exceed 68°F (20°C) and, when other ecological factors are favorable (such as habitat), are capable of supporting a year-round population of cold water-dependent aquatic life, such as brook trout.

When water quality is considered impaired by a pollutant, MassDEP is required to prepare a total maximum daily load (TMDL) for that waterbody. A TMDL is the greatest amount of a pollutant that a water body can accept and still meet water quality standards for protecting public health and maintaining the designated beneficial uses of those waters for drinking, swimming, recreation, and fishing. MassDEP has a TMDL program that identifies the steps and technologies needed to reduce the pollutant or source of impairment for each impaired water body in Massachusetts to reduce pollution from both point and nonpoint sources in order to

[10] Under the Clean Water Act, each state is required by the U.S. Environmental Protection Agency to assess water quality (305b list) and identify water bodies that are not expected to meet surface water quality standards (303d list). Massachusetts does this through a document that integrates both listings, thus the name "Integrated List of Waters." Water bodies may contain other pollutants, but the Integrated List of Waters only includes the results of evaluations upon which MassDEP has performed some measure of quality control.

[11] https://www.mass.gov/regulations/314-CMR-4-the-massachusetts-surface-water-quality-standards

meet water quality standards.[12] No TMDLs have been prepared for any waterbody in the Deerfield River watershed as of early 2023.

Many of Shelburne's surface waters are classified as coldwater fish resources (CFRs) by the Massachusetts Division of Fisheries and Wildlife (MassWildlife). According to MassWildlife, cold water fish resources are particularly sensitive habitats. Changes in land and water use can reduce the ability of these waters to support trout and other kinds of coldwater fish. Identification of CFRs are based on fish samples collected annually by staff biologists and technicians. MassWildlife updates the list of CFRs in the state on an annual basis and maintains an interactive map online.[13] Conservation commissions, planning boards, land trusts, regional planning agencies, and open space committees can refer to the list and map of CFRs to better inform conservation planning.

Coldwater fish resources are particularly vulnerable to warming temperatures and changing precipitation patterns due to climate change, placing increased importance on protecting these resources today. As temperatures rise, species adapted to cool water temperatures will be increasingly stressed. Tree cover in stream riparian areas and around ponds is particularly important for regulating water temperatures. According to MassWildlife's Climate Action Tool, maintaining a forested buffer of at least 100 feet along a stream is ideal, however, even a narrow strip of trees can provide vital shade for coldwater streams. Landowners can help by maintaining forested buffers or planting trees along open stream banks or allowing these areas to return to forest.

According to Massachusetts Division of Fisheries and Wildlife, all streams and rivers in Shelburne are CFRs and should support coldwater habitat.

MassGIS's 2016 land cover data for the Town of Shelburne identified 809.45 acres of surface waters covering 5.4% of the surface area of the Town, consisting of a number of rivers and streams. A number of these waterbodies have habitat for rare and endangered species that are affected by nonpoint source pollution and can be protected through good open space management and acquisition of lands where these species exist.

[12] https://www.mass.gov/total-maximum-daily-loads-tmdls . Accessed on April 2023.

[13] https://www.mass.gov/info-details/coldwater-fish-resources. Accessed on April 2023.

The following table includes listings for waterbodies in the 2018/2020 Integrated List of Waters and the draft 2022 Integrated List. The Integrated List notes that surface waters that have never been assessed do not appear in these tables and are considered Category 3 waters by default. Assessment Unit Categories are defined in the following ways:[14]

- Category 1 – "Waters attaining all designated uses"
- Category 2 – "Attaining some uses; other uses not assessed"
- Category 3 – "No uses assessed"
- Category 4a – "All TMDLs are completed"
- Category 4b – "Impairment controlled by alternative pollution control requirements"
- Category 4c – "Impairment not caused by a pollutant – TMDL not required"
- Category 5 – "Waters requiring one or more TMDL(s)" (i.e., the 303(d) List)
- Category 5a – "303(d)-listed waters for which Alternative Restoration Plans have been completed"

Table 4-1. Assessment Unit Categories for Waterbodies in Shelburne According to the Massachusetts Integrated List of Waters

Waterbody	AU_ID	Description	2018/2020 Assessment Unit Category	Draft 2022 Assessment Unit Category	Impairment
Deerfield River watershed					
Deerfield River	MA33-03	Confluence with North River, Charlemont / Shelburne to confluence with Green River, Greenfield	5	2	Escherichia coli (E. coli) For 2022: new data indicates water quality standard is attained

[14] Page 19 of the Massachusetts 2018/2020 Integrated List of Waters prepared by the Department of Environmental Protection (MassDEP).

Waterbody	AU_ID	Description	2018/2020 Assessment Unit Category	Draft 2022 Assessment Unit Category	Impairment
Dragon Brook	MA33-20	Headwaters, perennial portion north of Patten Rd, Shelburne to confluence with Deerfield River, Shelburne	5	5	Temperature
Great Brook	MA33-54	Headwaters, perennial portion west of Zerah Fiske Rd, Shelburne to confluence with Hawkes Brook Shelburne	--	2	None
Hawkes Brook	MA33-112	Headwaters east of Zerah Fisk Rd, Shelburne to confluence with Dragon Brook, Shelburne	--	2	None
Sheldon Brook	MA33-81	Headwaters, south of Old Albany Rd, Shelburne to confluence with Deerfield River, Deerfield/Greenfield	--	2	None
Shingle Brook	MA33-22	Headwaters north of Guy Manners Rd, Shelburne to confluence with Deerfield River, Deerfield	--	2	None

Waterbody	AU_ID	Description	2018/2020 Assessment Unit Category	Draft 2022 Assessment Unit Category	Impairment
Sluice Brook	MA33-83	Headwaters, north of Tower Road, Shelburne to confluence with Deerfield River, Shelburne	--	2	None
Green River watershed					
Allen Brook	MA33-34	Headwaters, east of Shelburne Colrain Rd/Route 2 intersection to confluence with Green River, Greenfield	Not listed	2	None
Hinsdale Brook	MA33-21	Headwaters east of Fiske Mill Rd, Shelburne to confluence with Punch Brook, Greenfield	5	5	E. coli, Temperature (temperature impairment is new in 2022 listing based on new data)
Punch Brook	MA33-100	Headwaters, perennial portion east of Smead Rd, Shelburne to confluence with Green River, Greenfield	--	2	None

Waterbody	AU_ID	Description	2018/2020 Assessment Unit Category	Draft 2022 Assessment Unit Category	Impairment
Unnamed tributary	MA33-103	Unnamed tributary to Hinsdale Brook, perennial portion east of Little Mohawk Rd, Shelburne to confluence with Hinsdale Brook, Shelburne	--	2	None
Unnamed tributary	MA33-104	Unnamed tributary to an unnamed tributary to Hinsdale Brook from Shearer Pond Dam, Colrain to confluence with unnamed tributary to Hinsdale Brook, Shelburne	--	2	None
North River watershed					
North River	MA33-06	From confluence of east and west branches of the North River, Colrain to confluence with Deerfield River, Shelburne/Colrain	2	5	Lack of a Coldwater Assemblage, Temperature (pollutants impairments added due to new data/assessment)

C.2.1 DEERFIELD RIVER

According to the Massachusetts Surface Water Quality Standards, the Deerfield River from the

confluence with the North River to the confluence with the Connecticut River is a Class B warm water body. MassWildlife classifies the Deerfield to be a *coldwater fish resource*, and therefore it is protected as a coldwater fish resource.[15] Hawkes Brook is listed as a *Class B coldwater waterbody*. No other tributaries to the Deerfield River in Shelburne are specifically listed in Table 8 of 314 CMR 4.06.

As shown above in Table 4-1, most of the streams in the Deerfield watershed are only partially assessed, but are meeting water quality standards. DEP has determined that Dragon Brook not meeting either the temperature or dissolved oxygen (or both) coldwater standards. According to Appendix 9 of the draft 2022 Integrated list, this impairment is due to agricultural practices, including loss of riparian habitat. Reestablishing a forested buffer along the river may help Dragon Brook meet water quality standards for a coldwater fishery. The Deerfield mainstem is currently designated as *impaired* due to bacterial levels. Recent data from the Deerfield River in the vicinity of the town of Deerfield indicates that bacterial counts have dropped, and as a result MassDEP is proposing to eliminate the bacteria impairment for the mainstem Deerfield River.

The Deerfield River Watershed Association (DRWA) has been monitoring the Deerfield River and several of its tributaries in Massachusetts for water quality periodically since 1990. In 2020, DRWA collected samples at "Sunburn Beach, at the confluence of the North River with the Deerfield River at the border of Charlemont and Shelburne. All four samples had low levels of E. coli bacteria in both wet and dry weather conditions. Currently DRWA does not have any water quality monitoring sites in Shelburne.

C.2.2 GREEN RIVER

The Green River, from the Green River water supply intake (near the covered bridge) to the Greenfield wastewater treatment plant's former discharge (near the site of the current wastewater treatment plant), is listed in Table 8 of the Surface Water Quality Standards as a Class B Cold Water fishery with a designation of *High Quality Water*.. This reach of the river includes

[15] According to 314 CMR 4.06(1)(d)(7), "Certain waters not designated as cold water in 314 CMR 4.00 may contain habitat that supports a cold water fish population and, in such cases, the cold water fish population and habitat shall be protected and maintained as existing uses. The Massachusetts Division of Fisheries and Wildlife is responsible for identifying cold water fish populations that meet their protocol, regardless of whether or not the water meets the cold water criteria in 314 CMR 4.00. Where a cold water fish population has been identified by the Division of Fisheries and Wildlife as meeting their protocol, but the water has not been documented to meet the cold water criteria in 314 CMR 4.00, the Department will protect the existing cold water fish population and its habitat as an existing use."

the tributaries that flow through Shelburne on their way to the Green River. Hinsdale Brook, a tributary to the Green River, is listed as a *Class B Cold Water Fishery*.

As shown above in Table 4-1, Hinsdale Brook is considered water quality *impaired* by MassDEP. The impairments are listed as E. coli bacteria and, for the draft 2022 Integrated List, MassDEP is proposing a temperature impairment. Notes in Appendix 9 of the draft 2022 of the Integrated List recommend additional bacteria sampling to determine of the bacteria impairment is still relevant. The temperature impairment was documented in 2012 by MassWildlife fisheries biologists. Improved riparian health and tree shading is recommended for the temperature impairment.

C.2.3 NORTH RIVER

The North River is listed in Table 8 of the State Surface Water Quality Standards as a *Class B Cold Water Fishery* from the treatment works discharge in Colrain (Barnhardt factory) to the confluence with the Deerfield River. This segment is proposed to be listed as *impaired* due to temperature and lack of a coldwater assemblage in the draft 2022 Integrated List of Waters based on biological assessment. Appendix 9 recommends targeted attempts to improve riparian health.

C.3 FLOOD HAZARD AREAS

Water levels in Shelburne's rivers, streams, and wetlands rise and fall seasonally and during high rainfall events. High water levels are typical in spring, due to snowmelt and ground thaw. This is the period when flood hazards are normally expected. Low water levels occur in summer due to high evaporation and plant uptake (transpiration). At any time, heavy rainfall may create conditions that raise water levels in rivers and streams above bank full stage causing them to overflow adjacent lands.

Flooding along rivers is a natural occurrence. Floods happen when the flow in the river exceeds the carrying capacity of the channel. Some areas along rivers flood every year during the spring, other areas flood during years when spring runoff is especially high, or following severe storm events. The term "floodplain" refers to the land affected by flooding from a storm predicted to occur at a particular interval. For example, the "100-year floodplain," is the area predicted to flood as the result of a very severe storm that has a one percent chance of occurring in any given year. Similarly, the 500-year floodplain is the area predicted to flood in a catastrophic storm with a 1 in 500 chance of occurring in any year.

The 100- and 500-year floodplains are mapped by the National Flood Insurance Program (NFIP) after study of waterways. The 100-year floodplain is used for regulatory purposes. According to the NFIP maps effective 1980, 100-year floodplains in Shelburne occur along the following waterbodies:

- The entire length of the Deerfield River in Shelburne;
- From Davenport Pond downstream along the unnamed tributary to the Deerfield River;
- A section of Sluice Brook upstream and downstream of Shelburne Center Road.
- Dragon Brook for a segment that runs parallel to the upper section of Mercy Anderson Road;
- Dragon Brook just downstream of Route 2 and Shelburne Center Road to a point on Bardwells Ferry Road near Bassett Road;
- Great Brook upstream and downstream of South Shelburne Road;
- Hawkes Brook from the intersection with Great Brook to Bardwells Ferry Road;
- Shingle Brook for approximately 2,300 ft. upstream of the Deerfield town line;
- Allen Brook in the wetland complex upstream of North-South Road to a point just downstream of that road.
- Hinsdale Brook from the Colrain town line to the brook's intersection with Brook Road; and
- Hinsdale Brook approximately 4,400 ft upstream of the Greenfield town line to the town line.

The 100-year floodplain is shown on the Natural Resources Inventory Map at the end of this section.
If any of the storage hydropower dams upstream on the Deerfield River, including Somerset Dam, Harriman Dam, Sherman Dam, or Bear Swamp Reservoir, were to fail, the Town of Shelburne would be impacted dramatically, including parts of the densely populated village of Shelburne Falls. Shelburne's 2021 Hazard Mitigation Plan describes inundation scenarios for dam failures at these upstream locations, as well as a description of the Davenport Dam. See Table 4-3 in the 2021 Hazard Mitigation Plan for a prioritized action plan that includes steps to prepare for catastrophic flooding events. An update toFederal Emergency Management Agency (FEMA) floodplain maps are long overdue in Franklin County. Whenever updated maps become available for Shelburne, the hazard mitigation action plan can be finalized

Flood hazard areas include the rivers, streams and adjacent low-lying areas subject to periodic flooding. These flood-prone areas are classified as 100-year 500-year floodplains. The 100-year floodplain has a one percent chance of being flooded in any given year, while areas in the 500-

year floodplain have a .2% chance of being flooded in any given year. Due to the effects of climate change on precipitation patterns, the chances of Shelburne experiencing a 100-year or 500-year flood is higher than previously predicted. The updated FEMA maps will reflect these changes.

The Town of Shelburne's Hazard Mitigation Plan 2021 identifies two streams in Shelburne with the potential to cause localized flooding, including:

- Bardwells Ferry Road at Allen Road - Dragon Brook periodically overruns the road, and does not currently align with existing box culverts.
- Brook Road – Flooding of Hinsdale Brook causes frequent erosion, landslides, slumping, and the road is periodically closed due to these conditions. This is a concern as Brook Road is a designated evacuation route for the northeast section of town.

Shelburne's Hazard Mitigation Plan also recognizes beaver dams as a potential concern in various locations throughout town. The Hazard Mitigation Plan indicates no beaver dams currently pose a threat, and the town has installed beaver deceivers in some locations. They also acknowledge that when a dam is a safety concern, a controlled breach may be needed. Otherwise, beavers provide many ecological benefits at a fraction of the price of contractors, and should be left undisturbed.

The Town's updated Hazard Mitigation Plan fully details past flood events and the extent of the damage incurred. The plan can be referenced here: https://frcog.org/wp-content/uploads/2018/04/Final-Shelburne-2021-HMP_compressed.pdf

C.4 RIVER CORRIDOR MAPPING AND MANAGEMENT

Rivers and streams are dynamic systems in a constant state of change. Fluvial erosion is a natural process of wearing away of soil, vegetation, sediment, and rock through the movement of water in rivers and streams. While erosion is a natural process, the rate of erosion is affected by human alterations of river channels or adjacent land as well as a changing climate. Some buildings and roads are located close to river banks and areas of active river processes, placing them at risk to erosive forces while at the same time increasing the rate of erosion within the river corridor due to loss of flood storage in the floodplain.

In 2019, FRCOG released *The River Corridor Management Toolkit*, which developed and piloted innovative practices for delineating river corridors using a scientifically defensible mapping protocol. The toolkit outlines two management tools to accompany the mapping: a River

Corridor Protection Overlay Zoning District Bylaw and a River Corridor Easement Restriction. The goal of the River Corridor Management Toolkit is to equip communities and landowners with proactive strategies for river restoration and protection, climate resilient land use, and the reduction of harm to land, water, habitat, people and infrastructure caused by increasingly severe and frequent flood events. In Franklin County, the Green River, North River, Sawmill River, Fall River, and South River have mapped river corridors.

Mapping river corridor areas in the Town helps guide planning efforts involving flood resilience and land conservation, which may foster opportunities to meet some of the Town's priority recreational objectives, such as increasing access to waterways.

C.5 AQUIFER RECHARGE AREAS

The Shelburne Falls Fire and Water District supplies drinking water for residents in the Shelburne Falls village. As described in Section 2, the Water District system has two wells located in Colrain, and there is a surface water reservoir that is a backup supply. There is protected land for the water supply in the northwest corner of town, northeast of High Ledges. Residents outside of the village rely on private wells as their water source. Private systems in town include springs and groundwater wells. Groundwater systems collect water underground in layers of sand and gravel called aquifers. Rain permeating through layers of soil can reach groundwater to replace water within an aquifer.

Ideally, wells are placed to take advantage of aquifers. Shelburne's surficial geology has characteristics that support low yield aquifers. A low-yield aquifer provides between 0 and 50 gallons per minute (gpm). MassGIS data indicates a small area of medium-yield aquifer (50-200 gpm) underlies the village area between Bridge Street and Route 2, and between Mechanic and Severence Streets.

C.6 WETLANDS

According to the 2016 MassGIS land use data, 809.45 acres of surface waters covering 5.4% of the surface area of the Town of Shelburne, are classified as wetlands *(see the Water Resources map at the end of this section)*. There are no significant ponds or lakes located within Shelburne.

Wetlands are transitional areas where land-based and water-based ecosystems overlap. Inland wetlands are commonly referred to as swamps, marshes and bogs. Technically, wetlands are

places where the water table is at or near the surface or the land is covered by shallow water. Sometimes, the term wetland is used to refer to any type of surface water.

Wetlands perform a variety of extremely important ecological functions. Wetlands represent unique and special habitats that help to maintain biological diversity and support approximately 43% of the nation's threatened and endangered species (Kinne, 1999). Inland wetlands provide flood storage and control, pollution filtration, and habitat for fish and wildlife. Wetlands have economic significance related to their ecological functions: it is far more cost-effective to maintain wetlands than build treatment facilities to manage stormwater and purify drinking water, and wetlands are essential to supporting lucrative outdoor recreation industries including hunting, fishing and bird-watching. Since they are commonly recharge zones for groundwater sources, it is important that Shelburne identify and protect its wetlands.

In recognition of the ecological and economic importance of wetlands, the Massachusetts Wetlands Protection Act is designed to protect eight "interests" related to their function: public and private water supply, ground water supply, flood control, storm damage prevention, prevention of pollution, land containing shellfish, fisheries, and wildlife habitat. To this end, the law defines and protects "wetland resource areas," including banks of rivers, lakes, ponds and streams, wetlands bordering the banks, land under rivers, lakes and ponds, land subject to flooding, and "riverfront areas" within 200 feet of any stream that runs all year. Local Conservation Commissions are responsible for administering the Wetlands Protection Act and its regulations (310 CMR 10).

The Wetlands Protection Act requires a permit for any alteration of wetland areas or for any landscape disturbance within 100 feet of wetlands bordering a river or stream, or within 100 feet of isolated wetlands larger than one quarter of an acre. Permits are also required for landscape alterations within 200 feet of rivers and perennial streams. The conversion of wetlands is a serious problem with high-priced consequences. Watersheds with degraded or destroyed wetlands experience substantially higher flood peaks. Moreover, wetlands replicated with engineered solutions do not function nearly as well ecologically as undisturbed natural wetland systems, or wetlands created by beavers. The protection of all Shelburne's wetlands is a high priority.[16]

[16] See MassDEP's online wetland viewer at https://maps.massgis.digital.mass.gov/images/dep/omv/wetviewer.htm or the National Wetlands Inventory at https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/

Placeholder for Water Resources Map

D. VEGETATION

D.1 GENERAL INVENTORY

The soils and water resources in Shelburne create ecosystems that support a broad range of types of vegetation. The plants that are a critical component of these ecosystems convert solar energy into food, which supports all animal life. Plants cycle energy through the ecosystem by decaying, by removing carbon from the atmosphere and by shedding oxygen. Plants help moderate temperatures and act as shelter and feeding surfaces for herbivores, omnivores, and carnivores.

Plants and animals together make up *natural communities*, defined as interacting groups of plants and animals that share a common environment and occur together in different places on the landscape. Over the past decade, ecologists and conservationists in Massachusetts have devoted increasing effort to studying and protecting these natural communities, rather than focusing on individual species. This section and the following section will address both natural communities and their component species.

D.2 FOREST

Shelburne is fortunate to have forested open space and conservation lands located throughout the Town. Approximately 74% of Shelburne is forested.[17] According to MassGIS, much of Shelburne is considered Prime Forestland, which is based on potential average timber productivity of white pine and red oak.

D.2.1 FORESTS AND CLIMATE CHANGE

The second highest natural resource goal in the *Franklin County 2035 Regional Plan for Sustainable Development (RPSD)* is to protect forests. Unfragmented forests, old-growth forests, and forests that support rare and endangered plant and animal species are especially ecologically valuable, especially in the face of accelerating climate change impacts. Forests along rivers and streams are also a priority to protect for their important habitat, water recharge functions, shading, and bank stabilization. The plan lists several potential impacts on forests due to climate change, including decline of maple syrup production, the deterioration of the Eastern hemlock, and the spread of invasive insect species.

[17] 2016 MassGIS Land Use Land Cover Data

Forests play a critical role in mitigating future climate change. The Massachusetts Attorney General's Energy and Environment Bureau has been promoting that role, stressing that unfragmented forests play a critical role in protecting our climate and our citizen's public health. The Attorney General's office points to recent research funded by the Harvard Forest that illustrates that allowing forests to remain intact increases carbon sequestration and long-term carbon storage in U.S. Forests.[18] The study, *Intact Forests in the United States: Proforestation Mitigates Climate Change and Serves the Greatest Good*, finds that "Intact forests—largely free from human intervention except primarily for trails and hazard removals—are the most carbon-dense and biodiverse terrestrial ecosystems, with additional benefits to society and the economy."

Intact forests sequester and store carbon in tree roots, stems, branches and leaves, and in forest soils. Trees continue to sequester carbon for as long as they live. Young trees can grow quickly but older trees store more carbon. In Massachusetts, it is estimated that forests sequester 14% of the state's gross annual carbon emissions.[19] According to Mass Audubon, "Keeping forest as forest avoids carbon emissions from land use conversion."

Climate change impacts forests in many ways. A longer growing season and increasing temperatures are shifting habitat conditions for trees northward and to higher elevations. Over time, the birch-beech-maple forests typical of New England will decline while oak-hickory forests more typical in areas south of New England will thrive. An expected increase in periods of drought between intense precipitation events may weaken some trees, leaving them more susceptible to insects and diseases, while it may improve conditions for other trees.

Maintaining healthy forests well into the future will necessitate addressing stressors such as human disturbance, logging, and, invasive plant and insect species in an effort to increase forest resiliency. Forest resiliency is the capacity of a forest to respond to a disturbance by resisting damage or stress and recovering quickly. Depending on the forest type, location, history, and surrounding landscape, forests will have varying degrees of vulnerability and resiliency.

The 2016 publication "Increasing Forest Resiliency for an Uncertain Future" by researchers from UMass Amherst, the University of Vermont, and the U.S. Forest Service focuses on addressing

[18] https://www.frontiersin.org/articles/10.3389/ffgc.2019.00027/full#B58. Accessed on December 2022.
[19] https://www.massaudubon.org/our-conservation-work/ecological-management/habitat-management/capturing-carbon. Accessed on December 2022.

the impacts of various stressors on New England's forests and offers recommendations for foresters, conservation groups, landowners, and municipal officials on how to increase forest resiliency in an uncertain future. [20] The main stressors highlighted in the report include forest conversion, invasive plants, invasive insects and disease, over-browsing from deer, and climate change. These stressors interact with one another to increase their negative impacts, making it all the more important to address them as part of a larger whole.

Landowners who manage their forests for carbon storage can sell a product called "carbon offsets" or carbon credits—one credit is equal to the amount of carbon in one metric ton of carbon dioxide. Mass Audubon and Massachusetts DCR have put together a publication to help municipalities understand and evaluate whether selling carbon offsets make sense.[21]

D.2.2 STREET TREES

Street trees are essential infrastructure, and some of the benefits they provide the town and its residents include the following:[22]

- Air quality improvement
- Water quality improvement (including improved stormwater management)
- Cooler air temperatures
- Carbon storage and sequestration
- Building energy conservation
- Noise reduction
- Wildlife habitat
- Social/psychological benefits
- Human health benefit
- Beautification

Public shade trees are located throughout the town, along its roads, and although not legally public shade trees, the trees on town-owned land, in town cemeteries and in Shelburne Falls, have the perception of being "owned" by the citizens. In a Town as heavily forested as

[20] *Increasing Forest Resiliency for an Uncertain Future*. Catanzaro, Paul, Anthony D'Amato, and Emily Silver Huff. 2016. https://masswoods.org/sites/masswoods.net/files/Forest-Resiliency.pdf. Accessed on December 2022.

[21] Freedberg, W. and S. Smith. 2021. Forest Carbon Market Solutions: A Guide for Massachusetts Municipalities. Massachusetts Audubon Society, In

[22] Rick W. Harper, Ext. Assist. Professor-Urban and Community Forestry, UMass, "Realizing the Benefits of our Urban Trees," *3rd Annual Massachusetts Clean Energy Conference: Helping Communities with Renewables and Efficiency;* 2016. Accessed on December 2022.

Shelburne, preserving public shade trees may seem unnecessary; however, loss of trees along rural roads and in public spaces can significantly change the character of a town. Some methods a town can use to protect shade trees include adopting a Scenic Roads Bylaw, limiting the amount of salt used on roads during the winter, and developing a plan and dedicating funding to the care and replacement of trees in public spaces. Shelburne's Tree Warden is responsible for the town's Public Shade Trees. A Public Hearing must be held (except in certain circumstances), pursuant to state law, before any cutting, trimming, or removal of a Public Shade Tree may take place. Many communities have found that a Tree Committee can work effectively with their Tree Wardens to improve the management, maintenance and public support for Public Shade Trees. For example, a Tree Committee could advocate for measures that mitigate the loss of these trees, which are public assets, such as the town requiring the applicant to plant replacement trees in the affected area at the Tree Warden's direction or requiring the applicant to provide a donation to the Town's tree planting fund.

When planting additional street streets, it is important to choose native species that are adapted to urban growing conditions. Invasive species have the ability to spread rapidly displacing native species and destroying local ecosystems. Planting native street trees along the Town's transportation corridors will promote a more pedestrian-friendly environment as well as create wildlife habitat opportunities for songbirds, moths, butterflies and other species.

In 2018, the Open Space Committee established "A Walking Tour of Shelburne Falls" which included a brochure with "Village Trees of Note" and a map of the tree locations. Each tree has an Identification Tag with information on the type of tree and explaining a bit about that tree species. Walking Tour brochures are available at the Shelburne Falls Visitor Information Center.

D.3 AGRICULTURAL LAND

In 2016, agricultural land use in Shelburne comprised 17 percent of the town's total land area, or 2,500 acres, including pasture land, crop land and orchards (MassGIS; 2016). According to MassGIS, there are 1,329 acres of farmland in Shelburne in the Agricultural Preservation Program. Agricultural Preservation Restrictions (APRs) permanently protect 701 acres within Shelburne, with an additional 2,942 acres temporarily protected by the Chapter 61A program (note that this exceeds the amount determined to be in use as agricultural land in 2016). The amount of land currently in use for agriculture has not changed much since the 1980's.

In 2015, the Franklin Regional Council of Governments (FRCOG) published the *Franklin County Farm and Food System Project* report. The project summarizes the needs of Franklin County

farmers to increase food production, as well as how to make more local food accessible to Franklin County residents, particularly low and moderate-income people. Results of a survey of farmers showed a need for access to more farmland, and that farmland is currently too expensive. The report includes recommendations for increasing farmers' access to land, such as through land matching and leasing as well as by making public-owned land available for farming, where appropriate. Other land recommendations from the report include increasing the amount of farmland under permanent protection, and preventing land from being converted from farming to other uses, in part by offering farmers more technical assistance with farm transition and estate planning. Ensuring that good farmland – and the farm buildings and housing on it – remains available and affordable for farming will help continue to support the growth of this important part of the region's rural economy. These land recommendations are also supportive of open space and recreational planning.

Climate change makes farmland protection even more vital. Locally grown and harvested products allow communities to be more self-sufficient and to contribute to the reduction of pollution and use of fossil fuels associated with industrial agriculture. Purchasing locally grown food and farm products also supports the continued viability of farming and food related jobs in the region, and therefore helps protect farmland from conversion to other uses. Many farmers in Franklin County sell their produce locally, either directly on the farm, through farmers markets and community supported agriculture (CSAs), or through stores that are committed to purchasing from local farms.

D.4 WETLAND VEGETATION

Wetland resources present in Shelburne include open waters, rivers and streams, banks, marshes, wet meadows, forested wetlands, swamps, isolated wetlands, and vernal pools. The majority of the wetland vegetation consists of shrub swamp, marshes, meadows and forested wetlands. Wetlands in Shelburne can be seen on the Plant & Wildlife Habitat map.

D.5 FLOODPLAIN FORESTS

Because flood flows on the Deerfield River are largely attenuated and eliminated by storage hydropower reservoirs upstream, Shelburne has little to no floodplain forests along the Deerfield River.

D.6 RARE, THREATENED, AND ENDANGERED PLANT SPECIES

The Massachusetts Natural Heritage & Endangered Species Program (NHESP) has identified 259 native plant species that are protected under the Massachusetts Endangered Species Act, and a number of rare plants have been documented in the Town of Shelburne. These plants occur in some of the Priority Habitats identified in the *Documenting and Mapping Ecosystems* section of this chapter. Plants (and animals) listed as *endangered* are at risk of extinction (total disappearance) or extirpation (disappearance of a distinct interbreeding population in a particular area). *Threatened* species are likely to become endangered in the foreseeable future. *Species of special concern* have been documented to have suffered a decline that could result in their becoming threatened, or occur in very small numbers and/or have very specialized habitat, the loss of which could result in their becoming threatened (NHESP, 2021). Rare plant species in the Town of Shelburne are listed in Table 4-2.

Table 4-2: Plant Species in Shelburne Listed as Special Concern, Threatened, or Endangered

Scientific Name	Common Name	MESA Status*	Most Recent Observation
Ophioglossum pusillum	Adder's Tongue Fern	T	1980's
Celastrus scandens	American Bittersweet	T	2021
Corallorhiza odontorhiza	Autumn Coral-root	SC	2019
Geum fragarioides	Barren Strawberry	SC	2014
Adlumia fungosa	Climbing Fumitory	SC	2014
Goodyera repens	Dwarf Rattlesnake-plantain	E	1996
Equisetum scirpoides	Dwarf Scouring Rush	SC	2019
Rhododendron maximum	Great Laurel	T	2020
Penstemon hirsutus	Hairy Beard-tongue	E	1931
Platanthera dilatata	Leafy White Orchid	T	1932
Alnus viridis ssp. crispa	Mountain Alder	SC	2017
Mimulus moschatus	Muskflower	T	2012
Trisetum spicatum	Narrow False Oats	E	2010
Platanthera flava var. herbiola	Pale Green Orchid	T	1921
Clematis occidentalis	Purple Clematis	SC	2012
Amelanchier sanguinea	Round-leaved Shadbush	SC	2011
Symphyotrichum tradescantii	Tradescant's Aster	T	2000

*SC – Special Concern; T - Threatened; E – Endangered.

Source: Massachusetts NHESP, Town Species Viewer: https://www.mass.gov/info-details/rare-species-viewer .

Any Massachusetts Endangered Species Act (MESA) listed species with a most recent observation date within the past 25 years is considered to be current. Older dates may be species that have not been recently inventoried, or they may be lost from Shelburne as land use has changed and water quality has changed. Fact Sheets describing many of the MESA listed species and their habitats are available from the state's Natural Heritage and Endangered Species Program (NHESP) website.[23]

E. FISHERIES AND WILDLIFE

Shelburne's upland forests, rivers, wetlands, and open farmland provide habitat for a variety of common and rare wildlife species. This section discusses wildlife species and their habitats from the perspective of natural communities, individual species, and patterns of wildlife distribution and movement across the landscape.

E.1 GENERAL INVENTORY

The combination of the varied and diverse habitats found in Shelburne help promote the numerous wildlife and fisheries populations that live in the area. Shelburne is home to a vast array of wildlife, both permanent and migratory.

The Deerfield River forms the entirety of the southern and western boundaries (with the exception of less than 0.5 mile in the northwestern corner) of the Town of Shelburne. The lower part of the river is habitat for several anadromous fish species (those that are born in fresh water, migrate to salt water where they mature and then return to freshwater to spawn) including sea lamprey and American shad. Shortnose sturgeon, a federally endangered species, spawn and winter over near the confluence of the Connecticut and Deerfield Rivers, and so may make forays into the lower Deerfield. It is unlikely they reach the waters in Shelburne. American eel is a catadromous species, born in the ocean and move to freshwater during their juvenile and adult life stages. Migratory fish species have no means of passing further upstream into Shelburne because of the presence of the Deerfield No. 2 Dam. Resident fish species include walleye, channel catfish, northern pike, small and largemouth bass, and trout. The Deerfield is also the most intensively fished and managed trout fishery in Massachusetts

[23] https://www.mass.gov/service-details/list-of-plants. Accessed on December 2022.

because the river has relatively clean water, is accessible, and there are a variety of fish habitats along its length.

E.2 RARE, THREATENED, AND ENDANGERED WILDLIFE AND FISHERIES SPECIES

The Massachusetts, Natural Heritage & Endangered Species Program (NHESP) has identified 173 species of animals in Massachusetts that are protected under the Massachusetts Endangered Species Act (MESA). Table 4-3 displays MESA-protected species that have been observed in Shelburne, and that may be found in the NHESP Priority Habitat areas identified in the 15th edition of the Natural Heritage Atlas (effective August 1, 2021). Animals listed as *endangered* are at risk of extinction (total disappearance) or extirpation (disappearance of a distinct interbreeding population in a particular area). *Threatened* species are likely to become endangered in the foreseeable future. *Species of special concern* have been documented to have suffered a decline that could result in their becoming threatened, or occur in very small numbers and/or have very specialized habitat, the loss of which could result in their becoming threatened (NHESP, 2021).

Table 4-3: Animal Species in Shelburne Listed as Special Concern, Threatened, or Endangered

Taxonomic Group	Scientific Name	Common Name	MESA Status	Most Recent Observation
Amphibian	*Ambystoma jeffersonianum*	Jefferson Salamander (complex)	SC	2013
Bird	*Bartramia longicauda*	Upland Sandpiper	E	1908
Bird	*Botaurus lentiginosus*	American Bittern	E	2001
Bird	*Ixobrychus exilis*	Least Bittern	E	2001
Bird	*Falco peregrinus*	Peregrine Falcon	T	2019
Crustacean	*Limnadia lenticularis*	American Clam Shrimp	SC	1994
Dragonfly/Damselfly	*Boyeria grafiana*	Ocellated Darner	SC	2004
Dragonfly/Damselfly	*Ophiogomphus carolus*	Riffle Snaketail	T	2004

T= Threatened, SC = Special Concern; E = Endangered.

Source: Massachusetts Natural Heritage and Endangered Species Program, Rare Species by Town Viewer: https://www.mass.gov/info-details/rare-species-viewer

State-listed rare species and Priority Habitat areas are regulated by the Massachusetts Endangered Species Act. Projects resulting in a "take" of state-listed rare species and disturbing two or more acres of Priority Habitat of Rare Species may require the filing of an Environmental Notification Form (ENF) with the State.

Climate change is expected to alter species distributions. As species move to adjust to changing conditions, Federal, state and local agencies and entities involved in land conservation need a way to prioritize strategic land conservation that will conserve the maximum amount of biological diversity despite shifting species distribution patterns.

According to Mass Audubon's *State of the Birds* report, 30% of breeding bird species in Massachusetts are already declining and need conservation action.[24] Climate change will increase stress on many of those species, as well as additional species, and will do so in both predicted and unpredicted ways. For example, increasing temperatures can shift the timing of important events, such as leaf and insect emergence. Those changes in phenology can cause declines in long-distance migrant birds as their arrival on their breeding grounds may miss the periods of peak food abundance. MassAudubon's climate change projections estimate that 43% of the breeding species evaluated as a part of their study are highly vulnerable to climate change by the year 2050. Mass Audubon's full report can be found at the link below for projected impacts on specific species.

E.3 WILDLIFE CORRIDORS

Permanently protected wildlife corridors are particularly critical in a landscape that is experiencing development pressure, and need protection to ensure that animals have the ability to travel across vegetated areas between large blocks of habitat. Connections between bodies of water and sub-watersheds are also important for wildlife and fisheries species. Many species of wildlife in Shelburne have home ranges greater than fifty acres in size. Even those species with smaller home ranges move across the landscape between sources of shelter, water, food and mating areas. Some animals, including white-tailed deer and black bear, seek both interior forest habitat and wetland edges where food sources may be more abundant.

[24] *State of the Birds.* Mass Audubon, September 2019. https://www.massaudubon.org/content/download/21633/304821/file/mass-audubon_state-of-the-birds-2017-report.pdf . Accessed on December 2022.

Natural Heritage and Endangered Species Program considers the riparian areas along the Connecticut and Deerfield Rivers as critical habitats. These rivers play a dual role for the region's wildlife. Riparian corridors often contain a greater degree of species diversity than any other portion of the landscape. The rivers also serve as important regional migration corridors for anadromous fisheries as well as for mammals like the bobcat that may use the riparian forests to move between habitat areas. River corridors are also major migration routes for many species of migratory birds. The Connecticut River is located in the "Atlantic Flyway" where waterfowl migrate north and south each year. Lands along this route provide direction, nesting and feeding areas for this great migration. Some of the more common animals that use river and stream corridors are beaver, muskrat, raccoon, green heron, kingfish, snapping turtle, and many species of ducks, amphibians, and fish. Floodplain forests also provide sheltered riverside corridors for deer and migratory songbirds.

The forested hills in north and northwest Shelburne contain large blocks of contiguous forestland, and provide interior forest habitats for a variety of birds and mammals. The High Ledges Wildlife Sanctuary and surrounding protected land, contain large contiguous forest patches along steep ridges parallel to the Deerfield River floodplain, which biologists believe are used as travel corridors by wildlife. The forest/field interface and the extensive network of hedgerows provides extensive opportunities for both edge species, predatory activity by birds and mammals, as well as travel lanes from one contiguous forest to another. Large expanses of open farmland are important to species such as the Northern Harrier, turkey vultures, hawks, and flocks of migratory birds.

POLLINATOR CORRIDORS

The Commonwealth of Massachusetts has a rich diversity of native wild pollinators, including an estimated 380 species of bees and 120 species of butterflies. In recent decades, however, both managed, agricultural pollinators and wild, native pollinators nationwide have been experiencing significant challenges in their ability to survive and flourish. In the 2017 *Massachusetts Pollinator Protection Plan*, The Massachusetts Department of Agricultural Resources (MDAR) identified the need to evaluate, sustain and enhance pollinator populations in the state.[25] This urgent task is not only important to protect biodiversity and natural resources, it is also linked to the climate resiliency and sustainability of our local farms and food systems. Local agriculture is important to the character and economy of Shelburne and is a key industry sector of Franklin County.

[25] https://www.mass.gov/files/documents/2017/06/zw/pollinator-plan.pdf . Accessed on December 2022.

Waterways, including wetlands, streams, and rivers, are critically important to pollinators. Not only are they home to high concentrations of flowering aquatic plants that feed native specialist and generalist pollinators, waterways are vital corridors the connect entire ecosystems and greater land areas, from uplands to wetlands. Wetland areas typically represent permanently protected open space where human activity is regulated under Massachusetts General Law, Chapter 131: Wetlands Protection Act (WPA).

In 2021, the Franklin Regional Council of Governments prepared a *Regional Pollinator Action Plan for Franklin County*, the first of its kind in Massachusetts. The plan documents specific actions towns can take to support pollinator habitats, and provides an implementation toolkit for interested town officials or residents hoping to expand pollinator habitat on their property. As a part of the planning process, FRCOG supported eight communities with identifying specific areas that already support pollinator habitat, and areas that could be managed to provide suitable habitat and/or provide linkages to habitats in neighboring towns. In 2021, the FRCOG completed a Pollinator Action Plan for the Town of Shelburne. Copies of the *Regional Pollinator Plan for Franklin County*, the *Regional Pollinator Habitat Corridor Implementation Toolkit*, and the Action Plans for the eight participating communities can be found here: https://frcog.org/franklin-county-regional-pollinator-plan/.

E.4 VERNAL POOLS

Vernal pools are temporary bodies of freshwater that provide critical habitat for many vertebrate and invertebrate wildlife species. Vernal pools are found across the landscape; anywhere that small woodland depressions, swales or kettle holes collect spring runoff or intercept seasonally high groundwater tables. Certified Vernal Pools (those that meet the criteria established by the Natural Heritage and Endangered Species Program) are protected to some extent by the Massachusetts Wetlands Protection Act and are protected by additional state and federal regulations. The Town of Shelburne has four certified vernal pools; all are identified on the *Plant & Wildlife Habitat* map.

Shelburne has the potential to have many more pools certified.[26] Vernal pools that are certified have the added protection of Massachusetts law, providing a 100-foot buffer and preventing

[26] According to data from MassGIS, there are 24 potential vernal pools within Shelburne's borders. Mapping resources can be accessed at: https://maps.massgis.digital.mass.gov/MassMapper/MassMapper.html

alterations provided that the vernal pools fall within wetland resource areas as defined by the Massachusetts Wetlands Protection Act.

E.5 ANALYSIS OF SHELBURNE'S WATER RESOURCES, VEGETATION, AND WILDLIFE

From this inventory of Shelburne's water resources, vegetation, and fisheries and wildlife, it is clear that Shelburne contains a diverse array of natural areas that have been utilized in the development of the community and for the enjoyment of its citizens since the Town's establishment. These resources are also all interconnected, and maintaining the health of all the Town's natural areas will help ensure vegetation and wildlife will continue to thrive.

Plants and animals are both critical, inter-related components of the ecosystem in Shelburne. Plants convert solar energy into food. This food supports all animal life. Plants cycle energy through the ecosystem by decaying, by removing carbon, and by shedding oxygen. Plants help moderate temperatures. Plants act as shelter and as food for herbivores, omnivores, and carnivores. Fields, a maintained stage of human-caused vegetation, are important wildlife habitat for many species.

The information provided throughout this section emphasizes the importance of forests in Shelburne:

- they protect aquifers, shade streams, and provide edge and interior habitats as well as movement corridors and food for wildlife;
- they clean the air and cleanse the water; and
- they can provide materials, food, and medicines to support our human community.

Forests also provide habitat for rare, threatened, and endangered plant species that have the potential to disappear with the loss of forestland due to encroaching development, or due to forest succession to the point where a majority of forest land reaches the Climax Forest stage. Forests sequester and store carbon, which is essential to mitigate the effects of climate change.

The greatest threat to forests is the permanent conversion of forest land to development. Habitat is fragmented and migration corridors are broken by the conversion of forest land to buildings, asphalt, noise, people, pets, and traffic.

While old growth timber and reaching the climax forest stage is good for carbon sequestration and certain wildlife species, creating and maintaining a diverse forest can benefit many plant and wildlife species by providing the varying habitat types certain species need during their life

cycle.[27] Many wildlife species, in particular, are dependent on a variety of tree, shrub, and forb species; age classes; and size classes. For example, in Massachusetts, there is a profound lack of early successional stage forest land and the habitat it provides for many species of plants and animals. Responsible forest management is the primary tool for restoring and maintaining a variety of habitat types. Therefore, the multiple values of the forest should be considered in land use decisions with a goal of maintaining a variety of habitat types and as much unbroken and interconnected forestland protected from development, as possible.

The common element between wetlands, streams and brooks, ponds, and groundwater wells is obvious; it is water. Keeping that water clean everywhere in Shelburne is critical to residents. The permanent protection of forests from development and invasive species will do much towards ensuring that brooks and streams will continue to be home to a diverse array of plants and animals and that the associated wetlands will continue to exist to help slow floodwater energy. Shelburne's water bodies also contain special natural communities important to the region's biodiversity and climate resilience.

The spread of invasive plant species is threatening the diversity of Shelburne's plant community. Japanese knotweed, Oriental bittersweet, and multiflora rose are taking over riparian land, forest edge habitat, and to some extent forest land and agricultural fields. Education about spreading invasive species and attempts to pull or kill plants can help minimize the spread.

Warming temperatures and changes in precipitation due to climate change, including heavier precipitation events and more rain in the winter, pose threats to Shelburne's water resources and road infrastructure. Conserving, and in some cases restoring, natural areas is key to maintaining the quantity and quality of Shelburne's water resources and built infrastructure into the future. This may be accomplished through a combination of strategic land conservation and management, resident and landowner education, and revisions to Shelburne's land use regulations appropriate.

The most important areas to protect within Shelburne include those identified on the *Plant & Wildlife Map* as Priority Habitats for Rare & Endangered Species and BioMap Core Habitat. These regions include a broader area than site specific locations where rare, threatened, and

[27] See "Increasing Forest Resiliency for an Uncertain Future" by Paul Catanzaro, Anthony D'Amato, and Emily Silver Huff, 2016. Online at https://masswoods.org/sites/masswoods.net/files/Forest-Resiliency.pdf.

wildlife species have been located, as they are a wider habitat area that supports such species. Any major land use activities should include consideration of the identified locations of these species as well as their surrounding habitat that is crucial to support continued survival.

F. SCENIC RESOURCES AND UNIQUE ENVIRONMENTS

The characteristics that allow a visitor to distinguish Shelburne from other towns in the region may be different than the unique qualities and special places with which residents are familiar. This section identifies the scenic resources and unique environments that most Shelburne residents would agree represent the essence of Shelburne's character. In many ways the history of Shelburne--how people came to settle the land, use its resources, and enjoy its forests, streams, and bodies of water--can be seen in the landscapes that have retained a sense of the past. The unique environments in Shelburne play a very important role in providing residents with a sense of place. Brooks, mountains, wetlands, and villages provide markers on the landscape within which we navigate our lives.

Scenic landscapes often derive their importance from location relative to other landscape features.

Much of Shelburne's landscape is classified as Distinctive or Noteworthy by the Massachusetts Scenic Landscape Inventory report published by the Department of Environmental Management in 1982.[28]

The purpose of inventorying scenic resources and unique natural environments in Shelburne is to provide a basis for setting resource protection priorities. To this end, this section includes information about the different values associated with each scenic resource and natural environment, and indicates areas where multiple values are represented in one landscape (See Table 4-4 and the Scenic Resources & Unique Environments Map). Those landscapes that contain, for example, scenic, wildlife, and cultural values may be given higher priority for protection than a landscape that contains only one value.

[28] The DEM is now the Department of Conservation and Recreation (DCR). The report is available from the Historic Landscape Preservation Initiative program and the mapping is now available from MassGIS. http://www.mass.gov/dcr/ Contact Wendy Pearl wendy.pearl@state.ma.us

Table 4-4: Significant Scenic/Historic/Natural Landscapes/Environments in Shelburne

Feature Number on Map 4-X	Scenic Resources and Unique Environments	Description	Ecological Value	Recreational Value	Historical / Cultural Value
Scenic Landscapes *Note: This table identifies the scenic resources and unique environments that most Shelburne residents would agree represent the essence of Shelburne's character. While Shelburne's parks and open space are described in Section 5, this table summarizes some of these most notable scenic landscapes, and includes areas not otherwise mentioned in this plan.*					
	High Ledges	Off of Patten Rd, MA Audubon's High Ledge Sanctuary offers numerous hiking trails and a panoramic view of the Deerfield River Valley and Mt Greylock.	**X**	**X**	**X**
	Massaemett Mountain Fire Tower Trail	Begin at the culvert at Rt. 2 and Halligan Avenue, just north of the South Maple Street entrance to Shelburne Falls. The strenuous trail climbs 1.25 miles to the stone fire tower at the top of Massaemett Mountain, which is located within the Shelburne State Forest. The fire tower provides 360 degree scenic views of the surrounding landscape.	**X**	**X**	**X**
	The Ridge Trail	Connects Audubon's High Ledges to the Fire Tower and the Fire Tower Trail. Public access allowed on the trail across private property and connects the scenic Shelburne State Forest fire tower with the scenic Audubon property.	**X**	**X**	**X**
	Wilcox Hollow	Located of Route 2, Wilcox Hollow, under the management of two power companies and the State DCR, provides recreational access to the Deerfield River for swimming, angling, hiking, and boating, and scenic views of rock, forest, and water.	**X**	**X**	**X**
	Mohican-Mohawk Trail	Conveniently accessed from Wilcox Hollow and Franklin Land Trust property off Rt. 2, provides enjoyable hiking with dramatic views of the Deerfield River. Note: access to a continuous trail along the river from Deerfield to Shelburne Falls is constrained by private landowners who limit access to their property along the river.	**X**	**X**	**X**
	Shelburne Wooded Loop Trail	Along Old Greenfield Road, this is a privately owned property with three public hiking loops and provides interpretation of forest management practices visible along the hike.	**X**	**X**	**X**

Feature Number on Map 4-X	Scenic Resources and Unique Environments	Description	Ecological Value	Recreational Value	Historical / Cultural Value
	Shelburne State Forest	Also, managed by the Massachusetts Department of Conservation and Recreation (DCR) and considered to comprise a historical recreation/conservation landscape on the top of Massaemett Mountain and within Wilcox Hollow.	**X**	**X**	**X**
	The Patten	The Patten is an area of Shelburne that contains long loops of connecting paved and dirt roads with spectacular views of mountains and farmland. Many people drive to the corner of Little Mohawk and Reynolds Rd where they park and then walk and ride bikes on these scenic country roads.		**X**	**X**
	Bardwell's Ferry Bridge	Bardwell's Ferry Bridge and the surrounding area in Shelburne contain scenic views of surrounding farm landscapes as well as the Deerfield River from the historic lenticular truss bridge, and a number of roads in town that provide scenic views of mostly agricultural landscapes.	**X**	**X**	**X**
	Wells Forest	55-acre parcel owned by the New England Forestry Foundation off Barnard Road.		**X**	
	Agricultural Landscapes	Many agricultural landscapes are not only some of the most scenic areas in town, they are also considered to be of significant historical value. These significant historical agricultural landscapes are found along the following roads: Cooper Lane, Tower Road, Patten Road, Carpenter Road, Reynolds Road, Bardwell's Ferry Road, Williams Road, Fisk Mill Road, Zerah Fiske Road, Old Greenfield Road, and Peckville Road.		**X**	**X**
Archeological, Historic or Cultural Areas *Note: A complete list of properties listed on the National Register of Historic Places is available at www.nps.gov/subjects/nationalregister/index.htm*					
	Shelburne Falls National Historic District	To the north and south of Bridge Street, a historically significant Village Center business district located primarily in Shelburne.		**X**	**X**

Feature Number on Map 4-X	Scenic Resources and Unique Environments	Description	Ecological Value	Recreational Value	Historical / Cultural Value
	Bridge of Flowers	Connecting Water St in Shelburne to State St in Buckland, this abandoned trolley bridge was transformed into a very popular garden walkway across the Deerfield River in 1929.		**X**	**X**
	Salmon Falls	This area is in the same location as the Potholes within the Deerfield River. It was an important indigenous fishing site.	**X**		**X**
Unusual Geologic Features					
	Potholes	Holes in the rock below the falls, located in the Deerfield River. Potholes were formed by river flow after the last ice age. The Deerfield No. 3 Dam sits at the top of the falls.			**X**
Unique Environments					
	Deerfield River	Kayaking and canoeing; fishing; swimming; hiking; BioMap3 Core Habitat, Priority Habitat for Rare & Endangered Species.	**X**	**X**	**X**
	Prime Agricultural Soils	Prime agricultural soils are located throughout Shelburne.	**X**		**X**
	Rich, Mesic Forests	The rich, mesic forest is nutrient-*rich*, moderately moist (*mesic*) variant of the northern hardwood forest. It is found in areas of calcium-rich bedrock and alkaline groundwater. In the Northeast, these forests occur at low to moderate elevations below 2,400 feet and usually on the north or east-facing, concave, middle to lower slopes. Within the Commonwealth of Massachusetts only a limited number of rich, mesic forests can be found. Sugar maple (*Acer saccharum*) and/or basswood (*Tilia americana*) are the dominant species of this forest. White ash (*Fraxinus americana*), yellow birch (*Betula alleghaniensis*), bitternut hickory (*Carya cordiformis*), and sweet birch (*B. lenta*) also occur in small numbers. Autumn Coralroot (*Corallorhiza odontorhiza*) and Barren Strawberry	**X**	**X**	

Feature Number on Map 4-X	Scenic Resources and Unique Environments	Description	Ecological Value	Recreational Value	Historical / Cultural Value
		(*Waldsteinia fragariodes*) are two species of special concern identified by the Natural Heritage and Endangered Species Program (NHESP) that may be found in this forest type in Shelburne.			
	Riverside Rock Outcrop Community	Riverside Rock Outcrop Communities occur on flood scoured bedrock along rivers. The outcrops may be low or steep on the river's edge, or may extend into the river channel. Vegetation is that of sparse, mostly low and scattered herbaceous vegetation limited to crevices where soil accumulates. In Shelburne, the NHESP has identified two rare plants that utilize this outcrop community. Tradescant's aster (*Symphyodtrichum tradescantii*) is a threatened species and Roundleaf Shadbush (*Amelanchier sanguinea*) is a species of special concern.			

Placeholder for Scenic Resources and Unique Environments Map

G. ENVIRONMENTAL CHALLENGES

An overarching environmental challenge for Shelburne's community is climate change, as discussed throughout this section. Temperature changes and precipitation changes are anticipated to impact the Town's water resources, forests, farms, and wildlife in a myriad of ways. In addition to this significant challenge, there are several other environmental challenges identified by the Massachusetts Division of Conservation Services to address in this Open Space and Recreation Plan. These challenges are described in this section along with efforts that the Town either has already implemented or may want to consider in order to address these issues.

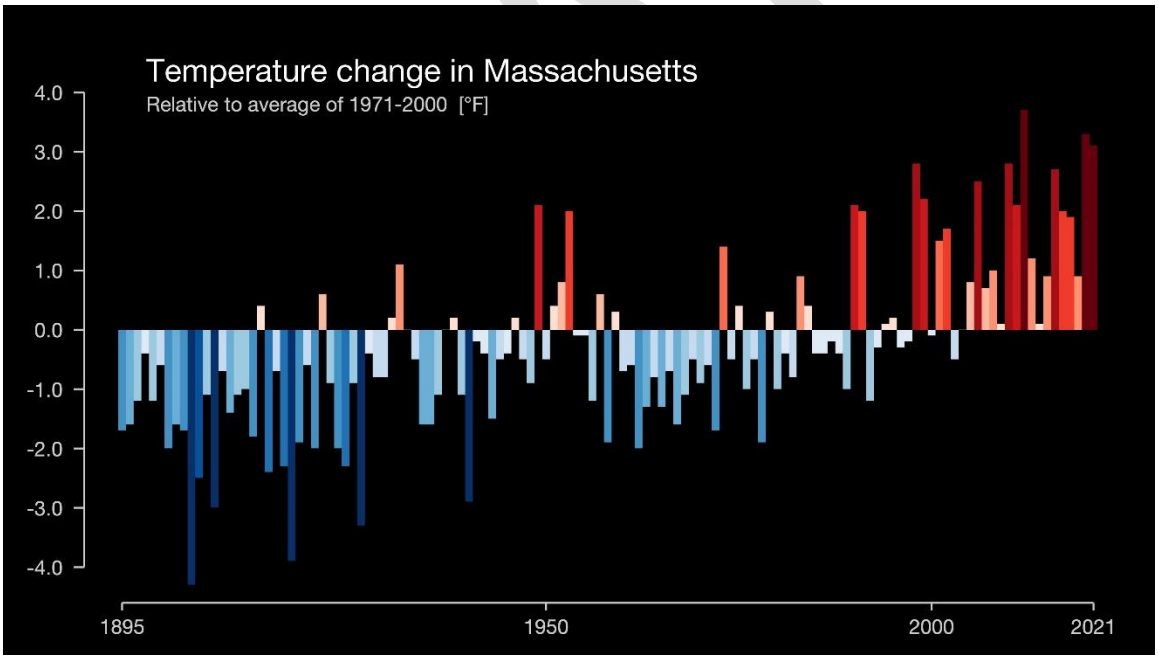
G.1 CLIMATE CHANGE IMPACTS

Natural resources, including water, woodlands, wildlife and habitats, as well as urban forests, are being affected by a changing climate in Massachusetts, and will continue to be impacted as temperatures rise and precipitation amounts and intensity change over the coming decades. According to the Massachusetts Wildlife Climate Action Tool, warming is occurring in all seasons, with the greatest changes in winter, at higher latitudes, and potentially at higher

elevations.[29] Seasonal warming is extending the growing season, particularly with more frost-free days occurring earlier in spring. Precipitation amounts are increasing, especially in winter. Warmer winters are also resulting in more precipitation falling as rain instead of snow, leading to reduced snowpacks - though stronger blizzards may lead to locally higher snowpacks in Massachusetts and New England. In the summer, heavier downpours combined with longer dry periods are expected, increasing the risk of both droughts and floods.

Natural resources play an important role in mitigating future climate change, but are also vulnerable to its impacts. Local decisions about how natural resources are managed and conserved will play an important role in the ability of people, habitats, and wildlife species to cope with future climate changes. This subsection provides an overview of the two major impacts of climate change for Massachusetts and Shelburne -- changes in temperature and precipitation. More information about specific climate change vulnerabilities due to these impacts as well as adaptation strategies are incorporated into each section of the Environmental Inventory and Analysis.

Figure 1. Temperature Change in Massachusetts, 1895-2021



Source: University of Reading, #ShowYourStripes. Online at https://showyourstripes.info/c/northamerica/usa/massachusetts

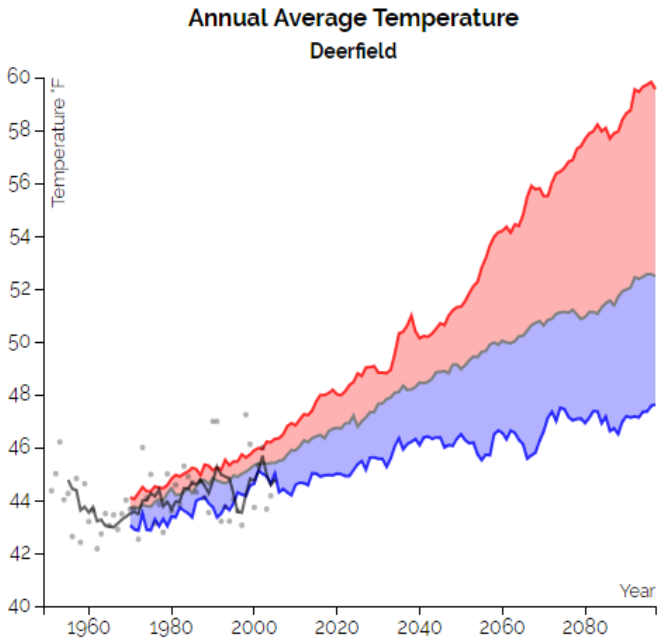
[29] http://climateactiontool.org/content/learning-about-climate-change

G.1.1 TEMPERATURE CHANGES

The northeast United States has experienced an increase in annual temperatures of 1.6°F over the last century, with the greatest warming happening in the winter.[30] Depending on future global greenhouse gas (GHG) emissions scenarios, average annual temperatures in Massachusetts are expected to be 2.8°F to 6.2°F warmer by 2050 than in the past several decades (when the average annual temperature was observed to be 47.5°F). By 2090, the average annual temperature in the state is expected to increase by 3.8°F to 10.8°F, depending on varying emissions scenarios.[31]

In the Deerfield River Watershed, where all of Shelburne lies, annual temperatures in the watershed are expected to increase between 4.5°F and 8.1°F by 2050 depending on future GHG emissions levels (Figure 4-1). By 2090, average annual temperatures in the watershed could increase by 7.2°F to as much as 13.5°F depending on global emissions.[32] In addition to overall warming temperatures, it is expected that an increase in extreme high temperatures will occur. For example, in the Deerfield River Watershed, it is expected that by 2050, there will be anywhere from 16 to 58 more days with temperatures over 90°F. From 1970 to the mid-2000s, the watershed averaged less than 5 days per year when temperatures reached over 90°F.[33] Conversely, the watershed is expected to experience fewer days when temperatures drop below freezing (32°F). Many fruits, such as apples and blueberries, require a minimum number of "chill hours" (hours below 45 degrees) in the winter to produce

Figure 4-1: Observed and Predicted Change in Annual Average Temperature, 1971-2090



Note: The blue line represents the modeled minimum annual average temperature, the grey line represents the modeled median, and the red line represents the modeled maximum. Source: Resilient MA: Climate Change Clearinghouse for the Commonwealth.

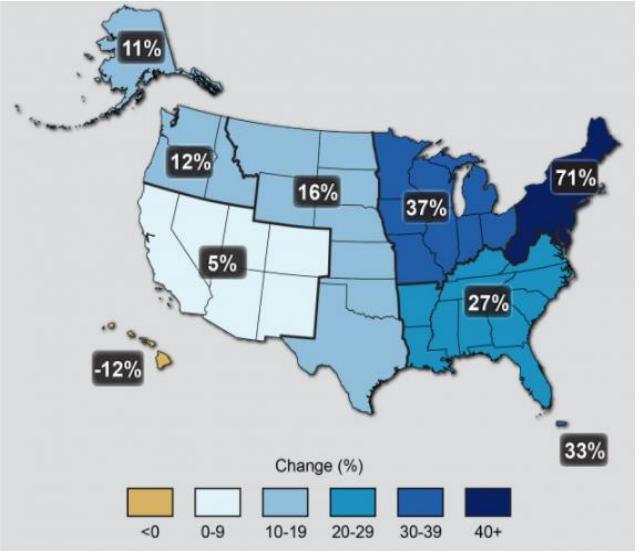
[30] Massachusetts Wildlife Climate Action Tool, http://climateactiontool.org/content/temperature-changes.
[31] Resilient MA: Climate Change Clearinghouse for the Commonwealth, https://resilientma.mass.gov/home.html. Accessed on December 2022.
[32] Ibid.
[33] https://resilientma.org/map/. Accessed on the Climate Dashboard, April, 2023.

optimum fruit. If the number of chill hours is inadequate, bloom and leaf development can be late and erratic.

G.1.2 PRECIPITATION CHANGES

In Massachusetts, annual precipitation amounts have increased at a rate of over 1 inch per decade since the late 1800s, and are projected to continue to increase largely due to more intense precipitation events. The Northeast has experienced a greater increase in extreme precipitation events than the rest of the U.S. in the past several decades (Figure 4-2).

Figure 4-2: Observed Change in Very Heavy Precipitation, 1958-2012



The northeast has seen a greater increase in heavy precipitation events than the rest of the country. Source: updated from Karl et al. 2009, Global Climate Change Impacts in the United States.

Observed annual precipitation in Massachusetts for the last three decades was 47 inches. Total annual precipitation in Massachusetts is expected to increase between 2% to 13% by 2050, or by roughly 1 to 6 inches. In the Deerfield River Watershed, annual precipitation has averaged around 45 inches in recent decades. By 2050, the annual average could remain relatively the same (but occur in more heavy, short intervals) or increase by up to 12 inches a year under a high greenhouse gas emissions scenario. In general, precipitation projections are more uncertain than temperature projections.[34]

Although overall precipitation is only expected to slightly increase, a primary concern is that the Northeast will receive more precipitation during heavy, concentrated events, followed by periods of drought. Changes in precipitation patterns, especially prolonged periods of drought, can negatively affect agriculture, forests, and natural ecosystems. The flash flooding experienced twice in July of 2023, coming on the heels of a drought in 2022, provide a good example of this pattern of disturbance.

G.1.3 EFFECTS OF CLIMATE CHANGE

Climate change is already altering natural habitats and impacting communities in various ways. Ecosystems that are expected to be particularly vulnerable to climate change include coldwater streams and fisheries, spruce-fir forests, hemlock forests, northern hardwood forests, vernal

[34] https://resilientma.org/map/. Accessed December 2022.

pools and street trees in town and city centers. Warming temperatures and changes in precipitation will push plant and animal species northward or to higher elevations. Higher temperatures, along with changes in stream flow, will degrade water quality. Coldwater aquatic fish species will decline, while an increase in stronger storms will lead to more flooding and erosion. A shift to winter rains instead of snow will potentially lead to more runoff, flooding, and greater storm damage along with less spring groundwater recharge.

An increase in extreme weather events, including heavy rains, ice storms, microbursts and hurricanes, will affect natural resources and human communities. Damage to roads, bridges, culverts, buildings, farmland and crops are a few impacts that have already been experienced in the region from increased extreme weather. Sea level rise and more extreme storms on the coast may not directly affect Shelburne, but may begin to push some of the millions of people living along the North Atlantic seaboard to move inland, placing development pressure on rural areas. Climate migration away from extremely hot and/or dry areas will also be a factor affecting land use in Massachusetts.[35]

While climate change will continue to be a major challenge globally, local efforts and decisions have real and lasting impacts on mitigating and adapting to future climate change. One of the most effective and least costly strategies is to preserve existing natural areas and manage them for increased resilience to climate change.

G.2 ENVIRONMENTAL EQUITY & ENVIRONMENTAL JUSTICE

Environmental Justice is based on the principle that all people have a right to be protected from environmental pollution and to live in and enjoy a clean and healthful environment. The Environmental Justice Executive Order No. 552 requires EEA agencies to take action in promoting environmental justice. The Executive Order requires new environmental justice strategies that promote positive impacts in environmental justice communities and focus on several environmental justice initiatives.

EJ communities are defined as being low income, having a high minority population, and/or to have a high rate of English language isolation, based on data derived from the 2016-2020

[35] "The Great Climate Migration, " *New York Times Magazine*, July 23, 2020 and Pro Publica dated September 15, 2020: https://www.propublica.org/article/climate-change-will-force-a-new-american-migration

American Community Survey and based upon demographic data developed by the Massachusetts Executive Office of Energy and Environmental Affairs.[36]

According to the MassGIS Environmental Justice Viewer, Shelburne has one Census block group that is considered an EJ population based on income; Shelburne's EJ community comprises the Shelburne side of the village of Shelburne Falls. Equitable access and use of the Town's open space and recreation facilities for residents of all ages, socioeconomic backgrounds, ethnicities, and physical abilities is an important part of meeting the open space and recreation needs of the community.

In Shelburne, the town's established recreation areas are located primarily in and near the village center in Shelburne Falls. There are several other small neighborhoods in town such as Shelburne Center, but none is big enough to warrant its own recreational facilities like a basketball court or ball fields.

The Recreation Committee continues to be conscious of access issues to its facilities, including access to facilities and programs by special needs groups, such as the elderly and the disabled. Cowell Gym became more accessible with the installation of an elevator in 2004. Programming for children involves no fees, and the basement of the Gym has hosted a food pantry since 2014 and a clothes closet since 2015 or 2016. The Recreation Committee will be addressing the high interest in expanding facilities for additional hiking trails from the village, picnic/park areas, and water access as well as activities such as nature walks, guided hikes, and adult education classes.

Natural open space and recreation areas are distributed throughout town. Residents may hike, hunt, snowmobile, fish, and ride horseback with the permission of private landowners in many areas of town. Although the Town has much open space, much of it is in private ownership, and access to properties can be limited, such as access to the Mohican-Mohawk Trail along the Deerfield River. A concerted effort to work with private landowners to increase availability of land for passive recreation, and funding from Commonwealth and private sources to purchase recreation easements, could increase open space equity in Shelburne.

[36] More information about how EJ Populations are designated is available here: https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts

G.3 FLOODING, EROSION, AND SEDIMENTATION

As previously outlined in the *Flood Hazard Areas* section of this chapter, the Town's 2021 Hazard Mitigation Plan outlines numerous areas where flooding is an issue. The majority of the flooding occurs along the Deerfield River, Dragon Brook, and the Hinsdale Brook. In Shelburne, the 100-year floodplain covers about 333 acres, or approximately 2 percent of the town, including an estimated 8 acres of developed residential land.[37]

Shelburne's 2021 Hazard Mitigation Plan has several flooding-related recommendations. One is to identify and document locations, and calls for hiring a consultant to explore options for mitigating flooding at Bardwells Ferry Road and Allen Road, including implementing an upstream flood mitigation project to keep water within the channel and floodplain. It also recommends expanding and updating the Vulnerability Assessment for properties located within the 100-year floodplain, when new floodplain maps are available from the Federal Emergency Management Agency (FEMA).

Changes in the intensity and frequency of storms due to climate change will also be a challenge for Shelburne, as a "100 year" storm, which once had a 1% chance of occurring in any given year, will likely occur more frequently in the future. Flooding from Tropical Storm Irene in 2011 provided a glimpse of what can happen when a large amount of rain falls on the region within a short period of time. The Town and the entire region will need to work on how to best mitigate damages to existing infrastructure and property from such flooding, and how to allow this flooding to occur naturally without exacerbating it with new development. The fact that this will need to be a regional, watershed-wide effort cannot be understated. What happens upstream of Shelburne can greatly influence the impact of flooding in Shelburne. Looking at a watershed holistically, and ensuring there are outlets for floodwaters upstream, will help minimize the overall impact downstream.

Shelburne's rivers and streams are plentiful throughout town and add considerably to the beauty of the landscape. During storms and spring freshet, they can swell and flood. Because of the nature of the soils, high velocity flow can cause a great deal of erosion. High flow events have undermined roadways or buried roads in gravelly silt. As a result, future development near rivers, streams, and brooks should be carefully evaluated to minimize erosion and sedimentation during construction and ensure that storm water runoff is properly managed. Siltation from eroding banks can compromise habitat for fish and aquatic life, particularly

[37] 2016 MassGIS land use data.

during low flow conditions. Other siltation comes from road sand and loose soil in roadside swales.

G.4 GROUND AND SURFACE WATER POLLUTION

Nonpoint source pollution occurs when pollutants are generated not by a single source like an outflow pipe from a factory, but from multiple or diffuse sources across a landscape. For example, nutrients applied to farm fields or lawns can run off the land during precipitation events to pollute lakes and streams. For example, Long Island Sound has a "dead zone" or anoxic (low oxygen) zone caused by excessive nitrogen inputs from the Long Island Sound watershed. The Connecticut River, of which the Deerfield River is a tributary, is the largest freshwater tributary to Long Island Sound. Nutrient runoff from fields and yards in Shelburne, therefore, can contribute to a pollution problem as far away as Long Island Sound.

Sources of pollution thought to be of greatest concern to residents include the improper use and disposal of hazardous chemicals, heavy use of road salt, siltation of streams from gravel roads and road sand, bacterial contamination in rivers and streams, nitrogen fertilizers and insecticides on lawns, and use of herbicides along utility rights-of-way. Pesticide use on farmland is also a concern, as there are farms in Shelburne that use fertilizers, herbicides, insecticides, and fungicides. These chemicals can migrate to groundwater supplies used for drinking, or to the Deerfield River.

There is a direct link between land use and water quality. Impervious surfaces, such as building roofs and asphalt parking lots, and other forms of development reduce the infiltration of water into the ground. Impervious surfaces often contribute to higher storm water runoff, greater sediment yields, and increased pollutant loads, all of which can degrade water quality. Normally, as a community grows, the amount of impervious surfaces increases. The figure below shows the relationship between percent impervious surface in a watershed and water quality. In a natural system, water infiltrates through the soil, and pollutants are stored in the soil layers. In 2011 and 2012, the USGS, in partnership with multiple agencies in Massachusetts, published two papers that were the technical basis for the Sustainable Watershed Management Initiative.[38] Statistical analyses of fisheries data from across the state demonstrates that as the percent impervious cover and groundwater withdrawals increases, the relative abundance and species richness of fluvial fish decreases.

[38] See https://www.mass.gov/guides/sustainable-water-management-initiative-swmi-technical-resources for more information.

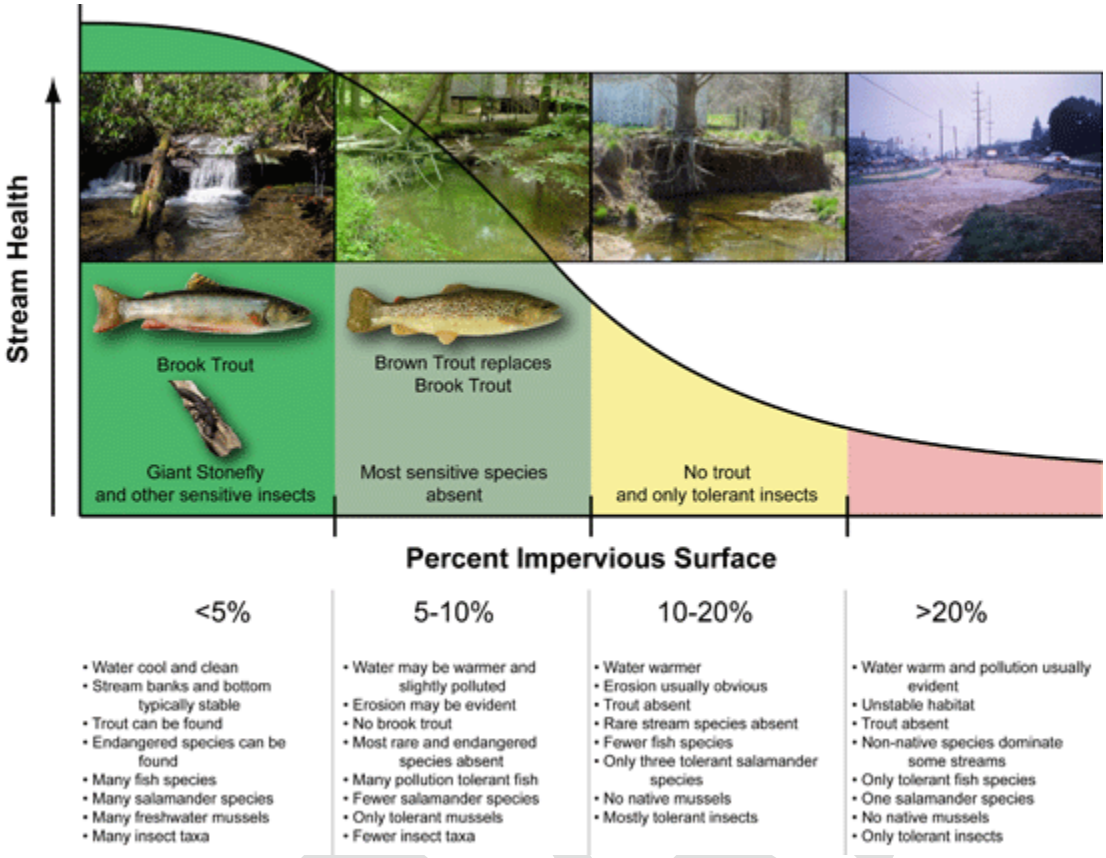


Figure 4-3: The relationship between Percent Impervious Surface and Stream Health. Figure courtesy of Maryland Department of Natural Resources.

As described in previous sections, available water quality data for Shelburne is not extensive. The known impairments in town are from bacteria and elevated temperatures that don't meet the criteria for coldwater streams. The cause of elevated river temperatures is often the lack of shading of streams. Private landowners can help restore coldwater habitat by allowing a buffer of vegetation to grow around any wetland, pond, or stream on their property.

More information about impaired waterbodies in Shelburne can be found in the 2018/2020 Integrated List of Waters published by the Massachusetts Department of Environmental protection, and displayed graphically by pulling up the "DEP 2018 Integrated List Rivers" layer online in MassGIS's online mapping tool.[39,40] The 2022 Integrated List has also been finalized in 2023.

[39] https://www.mass.gov/doc/final-massachusetts-integrated-list-of-waters-for-the-clean-water-act-20182020-reporting-cycle/download. Accessed on December 2022.

[40] https://maps.massgis.digital.mass.gov/MassMapper/MassMapper.html. Accessed on December 2022.

G.5 HAZARDOUS WASTE AND BROWNFIELD SITES

As defined by the U.S. Environmental Protection Agency (EPA), "Brownfields" are properties that the expansion, redevelopment, or reuse of may be complicated by the actual presence or perceived potential presence of a hazardous substance, pollutant, or contaminant. A Phase I Environmental Site Assessment report assesses a site's potential contamination by conducting historical research and reconnaissance of the site. If needed, follow up reports, such as Phase II, will be conducted to assess the impact of potential contamination through sampling and laboratory analysis of soil, groundwater, or building materials. A Phase III report will be conducted if contamination is found in sufficient concentrations such that action should be undertaken. Phase III is a remediation plan that outlines how a clean-up should be conducted.

The Massachusetts Department of Environmental Protection (DEP) maintains a list of brownfield sites where known contamination has occurred. In Shelburne, 16 sites have been reported to the DEP as of December 2022, all of which have been cleaned up or determined to pose no significant risk to public health.[41]

G.6 IMPACTS OF DEVELOPMENT

Development over the last 40 years in Shelburne has included new commercial properties along Route 2, some new single-family detached houses scattered around town, and industrial businesses on Route 112 north of Shelburne Falls. Much of this development has taken place on former farm or forest lands. Agricultural and forested lands contribute to the town's rural character. The future uses of larger tracts of private land should be considered as part of open space planning.

Land disturbance during construction can contribute to nonpoint source. During a storm event, rainwater traveling over land can erode soil if measures are not taken to stabilize or capture sediment. After construction, stormwater runoff from seeded and fertilized soils can load nearby streams and wetlands with excessive nitrogen and phosphorus. In Massachusetts, any land disturbance of one acre of land or greater requires a Notice of Intent with the U.S. Environmental Protection Agency under the Construction General Permit. A Stormwater Pollution Prevention Plan is required as part of the Construction General Permit.[42] Some best management practices (BMPs) during construction including phased grading, seeding of

[41] The full list of sites can be found by searching the DEP database at https://eeaonline.eea.state.ma.us/portal#!/search/wastesite. Accessed on December 2022.

[42] See https://www.epa.gov/npdes-permits/npdes-stormwater-permit-program-new-england#construction.

stockpiles, vegetation of open space, mulching, silt fencing and waddles, cross-grading, and sediment detention swales and basins; these can help to reduce runoff and improve water quality. After construction, other BMPs can help to deter stormwater runoff using features such as pervious driveway surfaces, landscape plantings, reduced roadway widths, roadside swales, detention swales and a cul-de-sac detention basin. The Massachusetts DEP provides ample erosion and sediment control guidelines via their website.[43]

G.7 LANDFILLS

According to the Mass DEP Bureau of Waste Prevention, Shelburne has four inactive landfills, two of which have been capped and require no environmental monitoring. The Shelburne Landfill on Shelburne Falls Road in Conway is an unlined landfill that was capped in 1979. The Shelburne Stump Dump on Little Mohawk Road in Shelburne is closed and was capped in 1987. There are two dump sites on private property located on Bardwell's Ferry Road whose closure status is Incomplete, according to the MassDEP's *Inactive/Closed Landfills & Dumping Grounds List, June 2013*.[44]

Although the information available from the DEP website indicates that there are no environmental problems associated with these landfills, the status of the closure of the construction and demolition dumping sites on private property should be further investigated by the Board of Health.

G.8 WASTEWATER TREATMENT

Over the past 50 years, municipal wastewater treatment in the region has helped to reduce the level of pollution in many rivers. Where private septic systems are in use, the concern for the impacts of failing septic systems is a driving force behind maintaining large minimum lot sizes in areas without access to public sewer, especially in soils that constrain proper treatment of on-site wastewater. It is important for the Town to support the Board of Health (BOH) in its enforcement of percolation (perc) tests and in its siting of new homes in only those areas that have passed a perc test. In addition, the BOH should continue to identify on-site septic systems needing upgrades. The main motivation for this level of inspection is to ensure that groundwater, wetlands, surface waters, and drinking water supplies are free from

[43] http://www.state.ma.us/dep/brp/stormwtr/files/esfull.pdf
[44] https://www.mass.gov/doc/list-of-inactiveclosed-landfills-dumping-grounds-in-massachusetts-june-2023/download. Accessed on July 2023.

contamination by untreated wastewater and, that homeowners do not become needlessly over-burdened by failing on-site septic systems.

G.9 INVASIVE SPECIES

Invasive species, or exotics, are plants that are 'non-native' to our local ecosystem. These plants have the ability to spread rapidly and displace native species. In some cases they can cause extinction but generally they decrease biodiversity of native species, alter habitats, and limit resources. Once they invade an ecosystem, it creates the need for time consuming and expensive weed management.

Climate models project rising temperatures and increased precipitation in the Northeastern United States in coming years, which is likely to impact local forests as well other vegetation and public health partially as a result of related impacts on pests, pathogens, and nuisance species. Periods of rapid climate change, such as we are presently experiencing, are especially favorable for rapidly reproducing species such as insects and diseases and promote conditions that can enhance the spread of problematic species. By contrast species with longer life cycles, such as trees, are inherently less well equipped to adapt to rapid climate change.

The following is a list of invasive species that are widespread across Franklin County:

- Aegopodium podagraria L. (Bishop's goutweed; bishop's weed; goutweed)
- Alliaria petiolata (Bieb.) Cavara & Grande (Garlic mustard)
- Berberis thunbergii DC. (Japanese barberry)
- *Celastrus orbiculatus* Thunb. (Oriental bittersweet; Asian or Asiatic bittersweet)
- Elaeagnus umbellata Thunb. (Autumn olive)
- Euonymus alatus (Thunb.) Sieb. (Winged euonymus; Burning bush)
- Frangula alnus P. Mill. (European buckthorn; glossy buckthorn)
- Iris pseudacorus L. (Yellow iris)
- *Lonicera spp.* (several non-native honeysuckle species)
- *Lythrum salicaria* L. (Purple loosestrife)
- *Polygonum cuspidatum* Sieb. & Zucc. (Japanese knotweed; Japanese or Mexican Bamboo)
- *Rhamnus cathartica* L. (Common buckthorn)
- *Robinia pseudoacacia* L. (Black locust)
- *Rosa multiflora* Thunb. (Multiflora rose)

All of these species can be troublesome and difficult to control once planted or they invade an area. Along Interstate 91 and Route 2, Oriental bittersweet vines are visibly taking over the forested edge along the roadway. Species such as bittersweet are not allowed to be sold and the Town should ensure that nobody sells ornamental wreaths with bittersweet, as this spreads the seeds and causes new problem areas.[45] Japanese knotweed has invaded much of the areas along the river's edge of the Deerfield River, which impacts riparian habitat and crowds out native floodplain vegetation.

Invasive pests such as the hemlock wooly adelgid, beech bark disease, and the emerald ash borer also pose a threat to Shelburne's forests. Die-offs due to these species have already been reported in towns in Franklin County. The emerald ash borer is likely to eliminate ashes as major forest trees from Massachusetts in the next few decades.[46]

Shelburne's Hazard Mitigation Plan recommends several action items related to invasive plant species. The Town would be wise to take a proactive approach to environmental problems related to the spread of invasive species, and stay abreast of the latest information about related problems that may impact local vegetation, agriculture, forestry wildlife, and public health, as well as related strategies for sustainable management. Such efforts will require cooperation with state and regional efforts and may involve several town boards and departments including the Open Space Committee, the Board of Health, and the Conservation Commission, as well.

[45] The MA Department of Agriculture publishes and updates a Prohibited Plant List of plant species that can't be sold in Massachusetts. See https://www.mass.gov/massachusetts-prohibited-plant-list

[46] https://www.mass.gov/guides/emerald-ash-borer-in-massachusetts