

# CHAPTER 4

## **ENVIRONMENTAL INVENTORY AND ANALYSIS**

Before one can begin to understand the potential impacts of land use choices on natural resources in the watershed, one must first identify the environmental values at risk from development. Wetlands, for example, are ecosystems consisting of the interaction of plants and animals, water, and soil, sun and air. Wetland vegetation grows where soils are saturated by water for at least several weeks a year. This vegetation provides shade, food and habitat for a wide variety of insects, birds, mammals, amphibians, reptiles and fish. Wetlands trap and remove sediments, nutrients and toxic substances from surface water. They store floodwaters during and after storms, preventing damage to public and private property, and recharge water to the ground and retain it during droughts. These functions are vulnerable to the impacts of land development. Construction in and around wetlands not only displaces the animals that depend on these ecosystems, it may also result in increased flooding, storm damage, and a reduction in the quality and quantity of ground and surface waters. This chapter summarizes information on the biological and physical components of the watershed's environments: Topography, Geology, and Soils; Landscape Character; Water Resources; Vegetation; and, Fisheries and Wildlife, Scenic Resources and, Environmental Challenges. The information provided in this section comes from existing open space and recreation plans in the Deerfield River Watershed as well as the Final Draft Deerfield River Watershed Assessment (April 2004) by Gomez and Sullivan.

### **A. Topography, Geology and Soils**

Decisions about land use must take into consideration the inherent suitability of a site for different kinds of development. Knowledge of the local and regional geological, soils, and topographical characteristics are essential in determining potential sites for future residential, commercial and industrial development and for new parks, hiking trails and open space.

#### ***Topography***

Elevations range from about 4,000 feet above sea level in Vermont's mountains to 120 feet above sea level in the Connecticut River Valley in Deerfield. The river gradient through Vermont and upper Massachusetts is steep and averages 28.4 feet/mile from the Massachusetts border to West Deerfield (33 river miles). The steep gradient makes the river ideal for power generation and there are 11 hydroelectric facilities along the main stem that effectively control the river flow. The steep gradient and cool mountainous source waters also make the river ideal for kayaking and cold-water fish species like trout and salmon. The river's floodplain varies in width along its length in Massachusetts providing for a gentler gradient through Charlemont to Buckland, and near the Stillwater region in Deerfield to its confluence with the Connecticut

River. The floodplain in the watershed contains transportation corridors (e.g. Rte. 2 and the railroad), farmland, village-level density, and a concentration of commercial and industrial land uses.

## ***Geology***

The *surficial geology* of the Deerfield River Watershed is primarily till and bedrock. There are some sand and gravel deposits located within the river and stream valleys and along the eastern Deerfield watershed lowlands. Some floodplain alluvium also exists towards the Connecticut River Valley.

The Deerfield watershed is the result of millions of years of *geologic history*: Hundreds of millions of years ago, a great continent, known as Pangaea, formed through the collisions of plates. Pangaea began to break apart almost 200 million years ago, and continues to do so as the continents drift away from each other today. The Connecticut Valley was one of many smaller rifts to develop. Streams flowing into the river from higher areas to the east brought alluvium, including gravels, sand and silt. At the time, the area that is now the Deerfield River Watershed was located south of the equator. By the close of the Dinosaur age, the entire eastern United States was part of a large featureless plain, known as the peneplain. It was leveled through erosion, with the exception of a few higher, resistant areas. Today, these granite mountaintops, called monadnocks, are still the high points in this region. Local examples include Mt. Greylock and Mt. Monadnock in New Hampshire.

As the peneplain eroded, the less resistant rock eroded to form low-lying areas, while bands of schist remained to form upland ridges. By this time, the Connecticut Valley had been filled with sediment, while streams that would become the Deerfield, Westfield and Farmington Rivers continued to meander eastward.

As the Rocky Mountains were forming in the west, eight million years ago, the eastern peneplain shifted upward a thousand feet. As a result of the new, steeper topography, stream flow accelerated, carving deep valleys into the plain. Today, the visible remnants of the peneplain are the area's schist-bearing hilltops, all at about the same 1,000-foot elevation.

Glaciers shaped the remaining peneplain into its current topography. Approximately two million years ago a series of glaciations or “ice ages” eroded mountains and displaced 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. This last glacier scoured and polished the land into its final form, leaving layers of debris and landforms that are still distinguishable.

The glaciers picked up, mixed, disintegrated, transported and deposited material in their 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* (NRCS; 1976). The glacier left gravel and sand deposits in the lowlands and along stream terraces.

## ***Soils***

Soil is the layer of minerals and organic material that covers the rock of the earth's crust. All soils have characteristics that make them more or less appropriate for different land uses. Without getting into specific soil associations in the Deerfield River Watershed, one can still correlate types of soils and soil characteristics to land use and thus to open space and recreation planning. For example, there are at least three questions that reflect why people should care about soils when planning for open space and recreation:

*Which types of soils constrain development given current technologies?* Soils that constrain development include those that are wet, or excessively drained, have steep slopes, or that are extremely rocky. Both wet and shallow soils do not provide for adequate filtration of wastewater effluent associated with private septic systems. Shallow soils are often associated with steep slopes or hilltops while wet soils are often found along floodplains and around wetland systems.

*Which soils are particularly suited for recreational opportunities and wildlife habitat?* Outside of flat areas for sports fields, the soils best suited for rural recreational purposes are the same as those that provide for dry, upland wildlife habitat. Sports fields require well-drained soils and level topography, whereas lands with slopes greater than 25 percent are more attractive to trail enthusiasts. Erodability of soils has important implications for the impact of recreational uses. Erodable soils include those that are shallow, wet, sandy, or sloped, or those with a combination of these characteristics. Hikers, mountain bikers and ATVs can create and exacerbate erosion on steep slopes and in sandy soils. In a developing landscape, there is a correlation between soils that support wildlife habitat and soils that present the most constraints to development.

*Which soils are best for agriculture?* The Natural Resources Conservation Service (NRCS) defines prime farmland as the land with the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and that is available for these uses (NRCS; 2001). Prime soils produce the highest yields with the fewest inputs, and farming in these areas results in the least damage to the environment. Prime farmland soils are also 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 conserving these lands can consider all farmland soils to be rare, valuable, and vulnerable to development.

## **B. Landscape Character**

In Massachusetts, the Deerfield River Watershed is one of steep hills blanketed in deciduous forests, agricultural lands along floodplains, plateaus and hilltops, numerous streams, and abundant wildlife. The Deerfield River, a focal point within the watershed, flows southeastward

from Vermont passing through narrow and broad floodplains. Many of the agricultural lands are found within the Deerfield River floodplain, within the floodplains of other tributaries, and along the hilltop plateaus of Heath, Shelburne, Conway, Colrain and Leyden. The towns' village centers often contain historic buildings and blocks, a mix of residential and commercial uses, a cross roads and / or main street, and sometimes access to nearby transportation resources including major rivers and railroad (*see the Scenic and Cultural Resources Map*).

## **C. Water Resources**

This section focuses on water resources in the watershed and on the idea that improvements and threats to water quality have impacts beyond town borders.

### ***Deerfield River (sub-watershed of the Connecticut)***

The Deerfield River Watershed is a sub-watershed of the Connecticut River Watershed that 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 twenty (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 River.

The northern portion of the watershed from Somerset to Route 2 in Massachusetts is primarily forested and steep, accounting for approximately 78 percent of the total watershed area. Much of the land along the remaining length of the river is open and agricultural land.

According to the Mass. Department of Environmental Protection, the Deerfield River from the Vermont-Massachusetts State Line to its confluence with the Connecticut River is given a Class B water quality designation. Given a Class B designation, a water body is considered suitable habitat for fish, other aquatic life and wildlife. It is also safe for primary and secondary contact recreation and has overall consistent aesthetic quality.

The Deerfield River, from the confluence of the Cold River in the Town of Charlemont to its confluence with the North River at the Charlemont/Shelburne Falls line is one of the water bodies in the state that the Massachusetts Department of Environmental Protection (DEP) has placed on its Section 303(d) List of Waters (Segments Needing Confirmation List). A report of the DEP, Final Massachusetts Section 303(d) List of Waters, 1998, states that the "Section 303(d) of the Federal Clean Water Act requires states to identify those water bodies that are not expected to meet surface water quality standards after the implementation of technology –based controls and, as such, require the development of total maximum daily loads (TMDL)." 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. TMDL's also describe a report

prepared by DEP for each impaired water body that identifies the steps and technologies needed to reduce the pollutant or source of impairment to meet water quality standards. The TMDL reports reflect DEP's strategy for cleanup of all of the water bodies in Massachusetts.

The Deerfield River Watershed Association (DRWA) has been monitoring the Deerfield River and several of its tributaries in Massachusetts for water quality since 1990. The results of its 2002 Volunteer Monitoring Program note that the alkalinity levels in the watershed are low which can stress the native trout fishery. Dissolved oxygen levels have been historically high and were found to continue to be so. After five years of collecting bacteria data, the DRWA has concluded that dry spells in the watershed do not pose a bacterial threat to the Deerfield River and the tributaries it monitors and thus, these waters are safe for contact recreation during times of drought. Conversely, it was found that runoff, as a result of storms, does pose a bacterial threat at several of the monitored sites, making them unsafe for swimming at those times.

### Sub-watersheds of the Deerfield River Watershed

The water quality and sub-basin land use information provided in this section come from the draft Deerfield River Watershed Assessment (April 2004) by Gomez and Sullivan.

#### *Pelham Brook Sub-watershed*

The total drainage area of the sub-watershed is 13.7 square miles. Pelham Brook begins at the outlet of Pelham Lake in Rowe, Massachusetts, and flows southwest for approximately 4.9 miles through a narrow and steep valley before entering the mainstem Deerfield River in Charlemont, Massachusetts. Land use is comprised primarily of forest (87.1%), agricultural (4.0%), and residential (3.9%) (Massachusetts DEP; 2003).

There are two historic landfills affecting Pelham Brook. The Rowe Brush Dump is over twenty-five years old and is not lined and not capped. It received demolition debris and lies within 100 feet of Pelham Brook. The Rowe landfill received municipal waste and is also over twenty-five years old. It is not lined or capped and is within 100 feet of Pelham Brook. Screening level sampling was conducted in 2003 in a down gradient groundwater seep and no adverse water quality impacts were detected.

#### *Cold River Sub-watershed*

The Cold River originates in the Hoosac Range in the town of Florida. It flows fourteen miles southeastward. The Cold River drains an area of 31.7 square miles and lies on the western border of the Deerfield River Watershed and flows south through Florida, Massachusetts then east through Savoy and Charlemont, Massachusetts before entering the mainstem Deerfield River. Most of its 14 river miles are characterized by a steep gradient flowing through a narrow river valley. For a portion of its length, the Cold River runs through Mohawk Trail State Forest, where it is enjoyed for swimming and whitewater boating, in season. Land use in the sub-watershed is primarily forest (93%) with a small number of farms (2%) and residential properties (2%) (Massachusetts DEP; 2003).

### *Chickley River Sub-watershed*

The Chickley River flows 8.7 miles northeasterly before entering the Deerfield River in Charlemont approximately 2 miles downstream of the Cold River confluence, and is classified as a Class B cold water fishery. The Chickley River originates in Savoy State Forest in the town of Savoy in Berkshire County. It flows eastward, then northward to its confluence with the Deerfield River, near Route 8A on the southern shore of the River. The Chickley River, from its confluence with Tilton and Horsefords Brooks in Savoy to the River's confluence with the Deerfield River, is on the 1998 Massachusetts Section 303 (d) List of Impaired Waters (Segments Needing Confirmation List), for pathogens. Much of the 27.4 square mile sub-watershed is forested (93%) with some farmland located on floodplains in Hawley, Massachusetts (2% agriculture) (Massachusetts DEP; 2003).

### *Mill Brook Sub-watershed*

Davis Mine Brook is a sub-tributary and begins in Rowe before flowing into Mill Brook in Charlemont. This brook has been severely impacted by the now defunct Davis Mine in Rowe, and assigned a Non-Support status for aquatic life and aesthetic uses (MDEP; 2003). The Davis Mine was a sulfur mine containing pyrite and was active from 1882 to 1910 when it collapsed and groundwater filled the shafts. Since that time, extremely acidic water (pH < 2) has been entering the Davis Mine Brook and has led to the disappearance of fish and many macroinvertebrates. Acid Mine Drainage is evident in the streambed near the mine as the water is brightly colored due to the colonization of acidophilic microbes. Mill Brook has some potential water quality issues and was placed on Alert Status for aquatic life uses (MDEP; 2003), as it may be affected by Davis Mine Brook's acidic water, or by junkyards/landfills in its watershed. The total drainage area of the sub-watershed is approximately 15 square miles. Land use is primarily forest (90%), agricultural (6%), and residential (3%) (Massachusetts DEP; 2003).

### *Clesson Brook Sub-watershed*

Clesson Brook in Hawley and Buckland met State water quality standards for a cold water fishery, but fish sampling conducted by DEP revealed that there were no salmonids (trout, salmon) present and only one of the fish species collected was considered to be intolerant of pollution. Therefore, it was placed on Alert Status for aquatic life use. Water quality samples were collected from Clesson Brook during the summer of 2000. The brook has some channelized sections and its watershed includes the Buckland Landfill that holds municipal waste, sludge from the Shelburne wastewater treatment plant, industrial and demolition waste, and bottom ash. The landfill has been closed and capped, but not lined.

### *North River Subwatershed*

The North River and its West Branches flow south from their headwaters in Halifax and Whitingham, Vermont through Colrain and Heath, Massachusetts. The total drainage area of the North River Sub-watershed is 92.9 square miles; most of this area is very hilly terrain, which results in very flashy streamflows. Fifty-two percent (48.4 square miles) of the watershed lies in Massachusetts with land use totaling 83 percent forest, 9 percent agriculture, and 3 percent residential (Massachusetts DEP; 2003).

The North River and its tributaries are classified as Class B cold water fisheries and have generally good water quality with the exception of erosion, sedimentation, landfill seepage, and wastewater discharge concerns. Parts of the North River and some of its tributaries have been experiencing significant erosion in localized areas. These erosion sites, combined with upstream road crossing and agricultural runoff, have potential impacts on productivity and nutrient loading. Significant turbidity in the North River and its tributaries has been observed during wet weather conditions.

In the upper reaches of the North River, the Colrain Brush Landfill/Former Town Dump received demolition waste, industrial waste, and municipal solid waste. The site was closed in 1976 and lies within 50 feet of the North River. The landfill is not capped or lined. A study conducted by Fuss and O'Neill (2003) ranked the site as being "high" for the potential to impact the environment. Subsequent testing of a down-gradient groundwater seep on the bank of the North River found high levels of iron, manganese, and cadmium.

The lower 3.3 miles of the North River (before it enters the Deerfield River) support the water quality standards for a Class B cold water fishery; however, there appears to be pollution issues involving arsenic, fecal coliform below the BBA Nonwovens facility, a 1999 acid spill, and three historic landfills (Gomez and Sullivan; 2004).

### *South River Subwatershed*

The South River begins at the outlet of Ashfield Pond in Ashfield, Massachusetts and flows east then north through Conway, Massachusetts to its confluence with the mainstem Deerfield River approximately four miles downstream of the Station No. 2 Dam. Agriculture and residential properties dominate the floodplains in the lower seven miles of river where the valley widens. Overall, land use in the 26.3 square miles sub-watershed is 77 percent forest, 13 percent agriculture, 6 percent residential, and 2 percent open land (Massachusetts DEP; 2003). The water quality is generally good although it was put on the 1998 303d list of impaired waters for unknown causes/habitat alteration and pathogens.

### *Green River Sub-watershed*

The Green River begins in Marlboro, Vermont and flows east through Halifax, Vermont into Guilford, Vermont where it turns south toward Massachusetts for a total of 13 river miles in Vermont. Once in Massachusetts, the Green River flows approximately 20 miles south through Leyden and Greenfield, Massachusetts to its confluence with the Deerfield River. The total drainage area of the Green River sub-watershed is 89.8 square miles. Land use in the Massachusetts portion of the sub-watershed (52.6 square miles) is primarily forest (65%) and a nearly equal amount of agricultural and residential land (13% and 11% respectively) with the majority of the residential properties in the Town of Greenfield (Massachusetts DEP; 2003).

The northern portion of the river down to the Greenfield Water Supply Dam in Greenfield (8.3 miles north of the confluence) is classified as a Class A public water supply cold water fishery; water quality is good. The river does, however, have some aesthetic and ecologic quality issues in this northern section. There is a dumping area present along the river in Colrain that contains household appliances, household trash, construction debris, paint cans, and furniture. The area is cleaned up by volunteers on an annual basis. There is also a junkyard located in Guilford, Vermont and the Greenfield Department of Public Works along with the town of Guilford have addressed concerns about vehicles in the floodplain and stormwater best management practices.

The health of the final 3.7-mile reach (to the confluence with the Deerfield River) is compromised by high fecal coliform counts, limited riparian zones, and one dam in disrepair. Fecal coliform counts are high both in the Green River and in its tributary streams near the confluence with the Deerfield. The high counts occurred during wet weather events in the fall of 2000 and were attributed to neighboring cattle fields, sewage leakage in Greenfield, and other unknown sources. Turbidity and trash along some areas of the riverbank in Greenfield and a petroleum odor from the sediment have been noted (DEP; 2003).

### ***Wetlands and Vernal Pools***

***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 “wetlands” is used to refer to surface water as well.

Historically, wetlands have been viewed as unproductive wastelands, to be drained, filled and “improved” for more productive uses. Over the past several decades, scientists have recognized that wetlands perform a variety of extremely important ecological functions. They absorb runoff and prevent flooding. Wetland vegetation stabilizes stream banks, preventing erosion, and trap sediments that are transported by runoff. Wetland plants absorb nutrients, such as nitrogen and phosphorus, which would be harmful if they entered lakes, ponds, rivers and streams. They also absorb heavy metals and other pollution. Finally, wetlands are extremely productive, providing food and habitat for fish and wildlife. Many plants, invertebrates, amphibians, reptiles and fish depend on wetlands to survive. 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.

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 two hundred feet of any stream that runs all year. Local Conservation Commissions are responsible for administering the Wetlands Protection Act; some towns also have their own, local wetlands regulations.

There are several wetlands in the Vermont portion of the watershed mostly located on the plateau east of the Green Mountain peaks. These include a 70-acre emergent marsh around Billings Pond in Searsburg, a 100-acre marsh around Red Mill Pond in Woodford, the 250-acre Beaver Meadows wetland complex in Woodford, the 200-acre Camp Meadows wetland complex in Woodford, the 50-acre Castle Meadows wetland complex in Glastonbury, and a number of 30-40 acre wetlands in the remaining parts of the watershed. Despite the apparent abundance of wetlands in Vermont, wetland habitat has been significantly reduced since the 19<sup>th</sup> century due to logging and agricultural land clearing. It is estimated that Vermont and Massachusetts have lost approximately 35 percent and 28 percent, respectively, of their wetlands in the last 200 years. Land use practices have changed. Since 1880, over 1.7 million acres of farmland in Vermont have reverted back to forest but wetland loss in Vermont continues at an estimated rate of 120 acres annually (FERC; 1997).

*Vernal pools* are temporary bodies of fresh water that provide critical breeding habitat for many vertebrate and invertebrate wildlife species. They are defined as “basin depressions where water is confined and persists for at least two months during the spring and early summer of most years, and where reproducing populations of fish do not survive”. Vernal pools may be very shallow, holding only 5 or 6 inches of water, or they may be quite deep. They range in size from fewer than 100 square feet to several acres (NHESP; 2001). Vernal pools are found across the landscape, anywhere that small woodland depressions, swales or kettle holes collect spring runoff or intercept seasonal high groundwater, and along rivers in the floodplain. Many species of amphibians and vertebrates are completely dependent on vernal pools to reproduce. Loss of vernal pools can endanger entire populations of these species.

The state’s Natural Heritage and Endangered Species Program (NHESP) has predicted the location of vernal pools statewide based on interpretation of aerial photographs. NHESP believes that its method correctly predicts the existence of vernal pools in 80 to 90 percent of cases. They acknowledge, however, that the method probably misses smaller pools.

In addition to identifying potential vernal pools, NHESP certifies the existence of actual vernal pools when evidence is submitted to document their location and the presence of breeding amphibians that depend on vernal pools to survive. Certified vernal pools are protected by the Massachusetts Wetlands Protection Act and by additional state and federal regulations.

According to MassGIS data, there are eleven certified vernal pools (*see Natural Resources Map*) in the Massachusetts portion of the Deerfield River Watershed. These vernal pools were certified by the Natural Heritage & Endangered Species Program (NHESP) according to the Guidelines for Certification of Vernal Pool Habitat (5/88, MDFW). In most cases, certified vernal pools are offered protections under the state wetlands protection act regulations, as well as the state water quality certification, state Title 5, and forest cutting practices act regulations. In addition, NHESP staff identified locations of over 450 potential vernal pools by aerial photograph interpretation.

### ***Aquifers and Recharge Areas***

Aquifers are composed of water-bearing soil and minerals, which may be either unconsolidated (soil-like) deposits or consolidated rocks. Consolidated rocks, also known as bedrock, consist of rock and mineral particles that have been welded together by heat and pressure or chemical reaction. Water flows through fractures, pores and other openings. Unconsolidated deposits consist of material from the disintegrated consolidated rocks. Water flows through openings between particles.

As water travels through the cracks and openings in rock and soil, it passes through a region called the “unsaturated zone,” which is characterized by the presence of both air and water in the spaces between soil particles. Water in this zone cannot be pumped. Below this layer, water fills all spaces in the “saturated zone.” The water in this layer is referred to as “groundwater.” The upper surface of the groundwater is called the “water table” (Masters; 1998).

The route groundwater takes and the rate at which it moves through an aquifer is determined by the properties of the aquifer materials and the aquifer’s width and depth. This information helps determine how best to extract the water for use, as well as determine how contaminants, which originate on the surface, will permeate soil and flow within the aquifer.

Aquifers are generally classified as either unconfined or confined (EPA and Purdue U.; 1998). The top of an unconfined aquifer is identified by the water table. Above the water table, in the unsaturated zone, interconnected pore spaces are open to the atmosphere. Precipitation recharges the groundwater by soaking into the ground and percolating down to the water table. Confined aquifers are sandwiched between two impermeable layers (Masters; 1998). Almost all the public wells in Massachusetts and many private wells tap unconfined aquifers (Mass. Audubon Society; 1985). Wells that rely on confined aquifers are referred to as “artesian wells.”

According to MassGIS and US Geological Survey (USGS) documents, the Massachusetts portion of the watershed contains several high-yield aquifers, defined as an aquifer with the potential to provide a pumping volume 50 to 200 gallons per minute. These high yield aquifers are found in the following locations:

- Greenfield;
- Deerfield;

- West Charlemont associated with the Deerfield River (west of Rte. 8A);
- Shelburne Falls Village; and,
- Two areas along the North River in Colrain

## **D. Vegetation**

Plants are a critical component of ecosystems in the Deerfield Watershed. Plants convert solar energy into food, which supports terrestrial and aquatic 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 (NHESP; 2001). 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.

Vegetation comprises about 89 percent of the Massachusetts part of the watershed's land area. Forests make up 79 percent and all agricultural lands combined use another 10 percent. The rest is used by residential development (5%), commercial/industrial and institutional uses (2%), transmission lines (2%), water (1%), and wetlands (1%).

### ***Agricultural Land***

Agricultural land in the watershed includes land growing feed crops to support dairy and beef farms, pasture for grazing, fruit tree orchard plantings, and sugar maple stands that are tapped to produce maple syrup. Within the watershed, agricultural fields are most prevalent along the Deerfield River, Clesson Brook, and North River floodplains, in the Greenfield and Deerfield lowland meadows areas, and in the uplands of Shelburne, Conway, Leyden, and Heath. The relative amount of agricultural land in the watershed can be shown by ranking towns by the relative share of each town's farmland acreage to total land area:

- Monroe, Florida, Savoy, Hawley, and Rowe have five percent or less of their land in agriculture;
- Ashfield, Conway, Buckland, Charlemont, and Heath have between 9 and 11 percent of their land in agriculture; and,
- Colrain, Shelburne, Greenfield, Deerfield, and Leyden have between 12 and 23 percent of their land in agriculture.

In the western portion of the watershed, towns with few remaining farms contain agricultural fields that are generally used in the cultivation of hay or, silage for local livestock. Farms and agricultural fields that enhance the rural character and provide scenic views are becoming rare within towns like Savoy, Florida, and Hawley. Residents would like to see full retention of these remaining farms and the prime agricultural soil. Farm fields are lost to two processes: development and abandonment. Development's impacts on farm fields are discussed in Chapter 3.

When fields are abandoned, the still open land undergoes the process of secondary succession. This land has not been tilled for many years or may have been mowed occasionally, but the woody, perennial species like birches, aspens, dogwood, elderberry, and multiflora rose and larger herbaceous vegetation such as thistle, goldenrod and ragweed take over.

### ***Forest***

The dominant forest type in the watershed is the northern hardwoods forest (DeGraaf, R.M et.al; 1992). This forest type commonly occurs up to an elevation of 2,500 ft. above sea level and prefers fertile, loamy soils and good moisture conditions. In New England, the northern hardwoods can be found in Massachusetts in the glacial till soils west of the Connecticut River and in small portions of Maine and Connecticut, as well as most of the forested areas in New Hampshire and Vermont. The predominant species of the northern hardwoods are sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), and yellow birch (*Betula alleghaniensis*). Associated species include red maple (*Acer rubrum*), white ash (*Fraxinus americana*), eastern hemlock (*Tsuga canadensis*), paper birch (*Betula papyrifera*), quaking and big tooth aspen (*Populus tremuloides* and *P. grandidentata*), eastern white pine (*Pinus strobus*), red spruce (*Picea rubens*) and red oak (*Quercus rubra*).

#### Northern Hardwood – Hemlock – White Pine Forest

According to the Massachusetts Natural Heritage and Endangered Species Program (NHESP), the watershed is home to old growth northern hardwoods-hemlock-white pine forests, a good example of which is located in the Mohawk Trail State Forest (NHESP; 2002). The northern hardwoods-hemlock-white pine forest is a variant of the northern hardwood forest, which occurs in dry to moderately moist and acidic conditions on north facing slopes and ravines. This community varies from pure stands of hemlock to deciduous forests scattered with hemlocks. Various combinations of hemlock, sugar maple, yellow birch, black cherry (*Prunus serotina*), red oak, and white pine are common. Scattered throughout this forest type one can also find paper birch, aspen, red maple, and yellow birch.

To the west, in Savoy, a spruce-fir-northern hardwood forest is a community of variable dominance: red spruce may be dominant or co-dominant with sugar maple and beech, with abundant yellow birch and smaller amounts of red spruce and/or balsam fir. Eastern hemlock can be abundant or scattered along with paper birch.

### High-Terrace Floodplain Forest

High-terrace floodplain forests can also be found in the watershed. Typically, they occur on raised banks adjacent to rivers and streams, on steep banks along high gradient rivers, on high alluvial terraces and on raised areas within major-river and small-river floodplain forests. The high-terrace floodplain forest is not subjected to annual spring flooding as it is above the flood zone.

The high-terrace floodplain forest in Massachusetts has a mixture of hardwoods generally associated with floodplains. These include red and silver maple (*Acer rubrum* and *saccharinum*) as well as sugar maple (*Acer saccharum*), shagbark hickory (*Carya ovata*), black cherry (*Prunus serotina*), American elm (*Ulmus americana*), and basswood (*Tilia americana*). Ironwood (*Carpinus caroliniana*) is present in the sub-canopy and is a good indicator of this community. Within the shrub layer one can find arrowwood (*Viburnum dentatum*), nannyberry (*Viburnum lentago*) and winterberry (*Ilex verticillata*). The herbaceous layer is a mixture of forest ferns and upland herbs characteristic of floodplain forests.

### ***Unusual Natural Communities***

The Natural Heritage and Endangered Species Program (NHESP) has noted the Deerfield Watershed as having a number of uncommon ecologically significant natural communities within its borders, which support a number of the state-listed rare and endangered species (NHESP correspondence, 2002). These communities include:

#### 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 and/or basswood are the dominant species of this forest. White ash, yellow birch, butternut-hickory (*Carya cordiformis*), and sweet birch (*Betula lenta*) also occur in small numbers.

#### Rocky Summit/Rock Outcrop Community

The Rocky Summit/Rock Outcrop community is found on the rocky summits of hills and mountains where bedrock is exposed or on rock outcrops of upper to mid-slope areas. Most of these communities are small in size, usually less than one-quarter acre. Grasses, sedges, herbaceous plants and shrubs dominate them.

#### High-Energy Riverbank

High-energy riverbank communities are rare in Massachusetts, however they are found in steep gradient, and high flood areas on fast-flowing rivers. They typically occur on riverbeds and the upstream ends of islands. These communities are created by cobbles, sand and silt being deposited during spring floods. Plants associated with this community vary depending upon the composition of the substrate and the severity of annual flooding. On open cobbles, false dragonhead (*Physostegia virginiana*), cocklebur (*Xanthium strumarium*), beggar's ticks (*Bidens* spp.) and lady's thumb (*Polygonum persicaria*) are dominant. As the amount of sand increases, water horsetail (*Equisetum fluviatile*) and clasping dogbane (*Apocynum sibiricum*) occur. There is also definitive band of switchgrass (*Panicum virgatum*). In the sandiest environments, mixed grasses of switchgrass, big and little bluestem (*Andropogon gerardii* and *Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*) and goldenrods (*Solidago* spp.) are found. Due to the intense flooding, trees and/or tall shrubs are not able to establish themselves in the high-energy riverbank environment. However, short shrubs such as shadbush (*Amelanchier sanguinea*), silky dogwood (*Cornus amomum*), sandbar willow (*Salix exigua*) and sandbar cherry (*Prunus pumila* var. *depressa*) can be found on the sandiest sections, which typically border floodplain forests.

### Riverside Seep

Riverside seeps occur at the base of steep riverbanks where groundwater seeps out of the bottom of the slope. These seepages are usually mineral rich leading to great plant diversity. Periodic flooding helps to prevent woody shrubs from establishing themselves. The riverside seeps known to occur along the Deerfield River are not calcareous (limey), which is common with the seeps along the Connecticut River in Vermont and New Hampshire. Riverside seeps are often associated with riverside outcrop communities and high-energy riverbanks.

Vegetation is that of a mixed herbaceous community with the wettest spots being mossy with a mixture of herbs and sedges. The muskflower (*Mimulus moschatus*), a threatened species, utilizes riverside seeps as habitat.

### Bat Hibernaculum

According to the NHESP, the watershed is home to bat hibernaculum(s). Several bat species in the United States spend winter hibernating in caves or abandoned mines (bat hibernaculums). Cave bats return yearly to the same hibernaculum and often to the same location within the hibernaculum (U.S. Fish and Wildlife Service, website; 2003).

## **E. Wildlife**

The Deerfield River Watershed'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. A more complete description of the fisheries and wildlife species found in the watershed is included in the Appendix, which was borrowed from the Deerfield River Watershed Natural Resources Assessment (April 2004),

which was prepared by Gomez and Sullivan.

Common loons have been observed on Somerset Reservoir in Vermont since 1977. During the period 1977 to 1994, common loons nested on Somerset Reservoir during 13 of the 17 years and were successful (young survived through August 31) in seven years accounting for 6 percent of the known common loon production in Vermont. Common loons set up breeding territories on large lakes. The common loon has reduced mobility on land and, therefore, its nest building is restricted to the waters edge. Due to its nest location and lack of mobility on land, common loon nesting success is sensitive to water level fluctuation and human disturbance. As this is the southernmost location of breeding loon pairs in Vermont, it represents a value of special significance to agencies, non-governmental organizations and to the general public. The water level management plan within Somerset Reservoir, adopted as part of the 1997 re-licensing, will allow loons to more successfully nest on natural sites and enhance shoreline feeding habitat.

Big game species occurring within the watershed include wild turkey, white-tailed deer, moose, and black bear. White-tailed deer are the only species requiring special winter habitats known as “deer yards.” Studies in Vermont identified approximately eleven deer yards along the Deerfield River and various tributaries in the mid-1990s, while similar studies have not been completed in Massachusetts, it is believed that steep south and west facing slopes may hold deer in the winter.

White-tailed deer and black bear populations in the Massachusetts portion of the watershed are quite extensive. The watershed typically ranks among the highest in terms of annual bear harvest in Massachusetts. Moose are known to inhabit the Green Mountain region of the upper watershed. In addition, there have been anecdotal sightings of moose in the eastern part of the Massachusetts portion of the watershed.

Fur bearing species common in the watershed include beaver, mink, muskrat, and otter with eastern coyote and bobcat are present in the upland areas. There have been anecdotal reports of fisher sightings in the Green River sub-watershed.

Other mammals observed in the watershed are the red and gray fox, marten, river otter, meadow jumping mouse, woodland jumping mouse, and various moles. Bird species inhabiting the watershed include common loon, great blue heron, Canada goose, black duck, wood duck, mergansers, rails, flycatchers, swallows, warblers, sparrows, black-capped chickadees, tufted titmice, starlet tanagers, American robins, song sparrows, and common grackles. Green frogs, bullfrogs, tree frogs, and American toads are the most common amphibians. A more complete list of likely wildlife in the watershed is in the Appendix.

Recent studies (DRWA; 2003a) were conducted by inventorying calling amphibians and marshbirds in the Massachusetts portion of the Deerfield River watershed. The three most common and widely-distributed species of calling amphibians in the watershed were the spring peeper, green frog, and gray tree frog, which were found in a variety of wetland habitats. Intermediate in occurrence and distribution were the bullfrog and wood frog. Bullfrogs were only observed in wetlands with areas of open water, while wood frogs were found predominantly in seasonally flooded areas. The occurrence of wood frogs was positively associated with the amount of tree cover at a given site. The least frequently encountered amphibians were the

American toad, pickerel frog, and Northern leopard frog. Habitat preferences for these species could not be determined by the study. Fowler's toad and the spadefoot toad were not observed during the study. The Fowler's toad is more common in eastern Massachusetts, and spadefoot toad is listed as threatened by the Natural Heritage & Endangered Species Program (NHESP). The study concluded that on-road vehicle kills are probably a major cause of mortality to amphibian populations. In addition, preservation of wetlands diversity and prevention of habitat fragmentation were deemed as being critical components of the long-term health of amphibian populations.

Four of the eight target species of marshbirds were documented during the study. Three of the four species were never observed, Pied-billed grebe, common moorhen, and sedge wren, rarely breed in Massachusetts. The fourth species, the king rail, is at the northernmost edge of its breeding range in Massachusetts.

American bitterns were identified at seven (29%) of the wetlands inventoried and five of the seven sites range in size from 15 to 23 acres. The least bittern was the most rare marshbird of the four target species observed, occurring at only one wetland. Species scarcity was attributed to their tendency to avoid high altitude-freshwater wetlands and unstable water regimes. Virginia rails were identified at 46% of wetlands surveyed, which made it the most frequently observed marshbird. This species was found in wetlands ranging from 8 to 33 acres.

Soras were rarely detected, as they were found at 13 percent of the wetlands surveyed. Soras typically occur at sites with greater amounts of cattails and increasing edge between aquatic bed/open water and emergent vegetation. Several wetlands appeared to contain appropriate habitat for breeding soras; however, no birds were detected at these sites. The study recommended that similar inventories be conducted in the future to determine whether changes have occurred in marshbird distribution and abundance.

### ***Rare and Protected Species and Habitats***

In 1994, the United States Fish and Wildlife Service (USFWS) reported that there were no populations of federally listed or proposed endangered wildlife species in the Deerfield River watershed with the exception of occasional transient individuals. Bald eagles and peregrine falcons (both on the federal endangered species list) are known to occasionally use habitats in the Deerfield watershed but are not known to permanently reside. The federally endangered shortnose sturgeon from the Connecticut River have been known to utilize the lower 2 mile reach of the Deerfield as an apparent refuge area to escape high spring flows in the Connecticut on their way to upstream spawning grounds; however, overall use is very limited and sporadic.

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) has also identified locations of estimated habitats of rare wildlife and uses the information to assist in the enforcement of wetlands, endangered species, and forest management regulations. In the Massachusetts portion of the Deerfield River watershed, more than 38 estimated habitats have been identified by the NHESP. Current data indicates that at least 7 invertebrates, 57 plants, and 17 vertebrates of special concern occur in the watershed (NHESP; 2003).

As a companion to the estimated habitats of rare wildlife information, NHESP also identified locations of priority habitats of rare species. This information consists of habitats for rare plant and animal populations that are protected under the Massachusetts Endangered Species Act regulations. There is typically substantial overlap between locations of estimated and priority habitats, there are also significant differences as well. In the Massachusetts portion of the Deerfield River watershed, more than eighty priority habitats have been identified.

The Living Waters Project and the BioMap Project of the NHESP has identified areas throughout the state that are critical to supporting the maximum number of terrestrial and wetland plant and animal species and natural communities. The goal of the Living Waters project is to promote the protection of freshwater biodiversity in Massachusetts. Water flow manipulations and water quality degradation can threaten freshwater species and their habitat; therefore, NHESP developed the Living Waters project to identify the most critical areas for freshwater biodiversity in the state.

The results of the Living Waters project were the delineation of Core Habitats and critical supporting watersheds. Core Habitats represent the lakes, ponds, rivers, and streams that provide habitat for rare freshwater species, or that are known to be exemplary aquatic habitats in Massachusetts. The critical supporting watershed identifies the more immediate portion of a core habitat's watershed where conservation efforts should be targeted (NHESP; 2003).

Several Living Waters Core Habitat areas were identified within the Deerfield River watershed, including several mainstem reaches and tributaries. Significant portions of the Cold River, Pelham Brook, Chickley River, Clesson Brook, North, South, and Green Rivers and their sub-tributaries were identified as core habitats. In addition, significant portions of the main stem of the Deerfield between the Fife Brook and Station No. 4 dams were delineated as Core Habitats, as well as portions of the Deerfield below Station No. 2 Dam, and its mouth. Roads and agriculture were considered the greatest potential threats to the Core Habitats within the Deerfield watershed (NHESP; 2003).

The BioMap uses Estimated Habitat and other records to identify the areas most in need of protection to safeguard the native biodiversity of the Commonwealth. It focuses primarily on state-listed rare species and exemplary natural communities and was developed to promote strategic land protection. The BioMap divides the state into thirteen distinct ecological regions based on geology, soils and plant and animal communities. Within each region, scientists have designated Core Habitats and Supporting Natural Landscapes. Core Habitat areas include the most viable habitat for rare plants and animals and exemplary natural communities. Supporting Natural Landscape includes buffer areas around Core Habitat, large undeveloped patches of vegetation, large areas without roads and undeveloped watersheds. Core Habitat areas are an important focal point for the watershed in part because state agencies prioritize them for protection over other areas without them. They are also important because protecting core habitats from development will help ensure the biodiversity of the region is retained over time. Sometimes Core Habitats are located in areas that are characterized as having constraints for development. These constraints can include wetlands, areas within the first 100 feet of the Rivers Protection Act buffer, already developed lands, protected lands, and areas with slopes

over 25 percent. In the Deerfield Watershed, every town contains at least one Core Habitat (*see the Natural Resources Map*):

- **Monroe/Rowe (1 square mile)**-A core area is located on both sides of the Deerfield, south of Monroe Bridge. Very steep slopes and a portion of the Monroe State Forest help constrain development there. In Rowe there are three potential vernal pools within the Core Habitat area.
- **Monroe (ten acres)**-Monroe State Forest contains several small Core Habitat areas.
- **Rowe ( $\leq 1$  sq. mile)**-Rowe contains three other areas of Core Habitat. On the south-facing slope of Negus Mountain a Core Habitat area contains three potential vernal pools and surrounds tributaries flowing into the Deerfield River. A second smaller Core Habitat area contains two potential vernal pools and is located on the south-facing slope of Adams Mountain, south of Pelham Lake Park and surrounds a tributary of Maxwell Brook. Much of the land within these Core Habitats is constrained from development.
- **Florida/Savoy (4-5 sq. miles)**-These two towns share a 4-5 square mile Core Habitat area with Charlemont. The habitat lies north of Chickley River in Charlemont and contains that portion of the Mohawk Trail State Forest. In Savoy and Florida the Core Habitat surrounds the Chickley River and much of the Savoy Mountain State Forest and the rest of the Mohawk Trail State Forest. In Florida, the Core Habitat area contains agricultural lands six potential vernal pools and two public water supplies rural residential ANR development. In Savoy, there are five potential vernal pools, scattered farm fields, and very light residential development, of approximately ten lots.
- **Charlemont (1 sq. mile)**- A Core Habitat complex contains up to five separate areas (and five potential vernal pools), most of which appear to be part of the 4-5 square mile Core Habitat area in southern Florida and northern Savoy. A second Core Habitat area lies in eastern Charlemont on the south-facing slopes west of Avery Brook and north of Route 2. Approximately half of this core area appears to be developable and the area rests atop portions of a high yield aquifer. A third Core Habitat area straddles a tributary of the Deerfield River that drains the southern slopes of the Catamount Hills in Colrain, itself an estimated 2 square mile Core Habitat area.
- **Hawley (4 sq. miles)**- One large, 4-square mile Core Habitat area is located along the southern boundary of the watershed and includes drainage basins of Chickley River and Clesson Brook. About one third of the Core Habitat appears to occur on buildable land, while the other two-thirds are found to be within the Kenneth Dubuque State Forest or on steep slopes. The portion of the Core Habitat within the watershed contains twenty-five potential vernal pools and an estimated seven certified vernal pools. Portions of the Core Habitat area are also located in Plainfield.
- **Ashfield (1 sq. mile)**- A Core Habitat occurs surrounding Bear Swamp in northwestern Ashfield. The Core Habitat contains three potential vernal pools and about three quarters of it is already protected from development. Just south of the

Core Habitat is an Outstanding Resource Water and several public water supplies. Ashfield shares a 1.5 square mile Core Habitat area with Conway.

- **Conway (3 sq. miles)**- Conway contains three separate Core Habitat areas each being an estimated 1+ square miles in size. A Core Habitat is in the west, within the drainage of South River, north and south of Route 116. It contains steep slopes, agricultural fields, and low yield aquifers. A second Core Habitat contains tributaries of Poland and Johnny Bean Brooks southwest of the center of town. About half of this core area is developable. A third Core Habitat lies on the Deerfield River, south of the Bear River, and north of a power line easement. This northern core area contains the South River State Forest, wetlands, and NHESP lands. About one third of this area appears to be developable.
- **Heath (300 ± acres)**- Heath has a small Core Habitat area that occurs south of the West Branch of the North River on north-facing slopes of Stone Mountain, on the towns border with Colrain. Most of the area is constrained from development due to steep slopes.
- **Colrain (3.5 sq. mile)**- Colrain contains three Core Habitat areas. Catamount State Forest encompasses most of one Core Habitat in southwestern Colrain. It lies northwest of the North River and is contiguous to the Deerfield River in Charlemont via a riparian corridor Core Habitat in the eastern portion of that town. The Core Habitat areas straddle Houghton and Meadow Brooks, which drain the southern slopes of Catamount Hills. It contains thirteen potential vernal pools and a set of farm fields off Catamount hill Road. The second Core Habitat area, about one square mile or 600+ acres in size lies to the west of the Green River and contains a portion of the drainage area of Workman's Brook, in southeastern Colrain. Most of this land appears to be developable. The third area occurs east of New County Road, north of Stewartsville, which is a part of a 2-square mile Core Habitat in northwestern Leyden.
- **Buckland (4 sq. miles)**-There are two Core Habitat areas in Buckland. One area is located on the towns border with Hawley and surrounds the headwaters of Clesson Brook. One potential vernal pool is in this area as well as a potential low yield aquifer. The larger Core Habitat area is about four square miles in size. It is located in the eastern half of town, southeast of Route 116 and just west of Shelburne Falls Village area. The Core Habitat contains portions of Johnson, Goodnow, Moonshine, and Mary Lyons Hills, Hog Hollow, and tributaries to Clark Brook, which drains into Clesson Brook. The area contains four potential vernal pools, a pond, and more than a dozen agricultural fields. An estimated three fourths of the area appears to be developable.
- **Shelburne (2 sq. miles)**-Shelburne has one Core Habitat area located on the western and northern slopes of Massaemett Mountain and Patten Hill, northeast of Shelburne Falls. Most of the land is constrained from development via steep slopes and protected lands. It contains three potential vernal pools and NHESP areas. Another Core Habitat area occurs along the Deerfield River, which is part of the Bear River Core Habitat area in Conway.
- **Leyden (2 sq. miles)**-Leyden has two Core Habitat areas. One Core Habitat area in the northwestern corner of town spreads west from the ridgeline of Gates Hill

beyond the Green River and into Colrain near Stewartsville. This area contains farm fields, two potential vernal pools, drainage areas of Thorne and Hibbard Brooks, and is mostly developable. The other area is located on the western-facing slopes of Kately Hill and abutting the Green River.

- **Greenfield (300+acres)**-There are three separate Core Habitats in the town, all of which are located along the Green River. Two are northwest of Interstate 91 and one is part of a larger Core Habitat area surrounding the floodplain forests and fields of the Deerfield River in the town of Deerfield.
- **Deerfield (1.5 sq. miles)**-Deerfield's Core Habitats straddle the Deerfield River from the South River State Forest to the river's confluence with the Green River. Much of the Core Habitat areas north, south, and west of Old Deerfield is in agricultural uses.

### ***Conserving the Deerfield River Watershed's Biodiversity***

The theory of Island Biogeography is based on observations that biodiversity is greater on large islands than on small ones, and greater on islands that are close to the mainland. The concept of islands surrounded by water has been applied to the idea of "islands" of protected open space surrounded by developed areas. Based on this theory, ecologists predict that increasing the size of a protected area increases its biodiversity (MacArthur and Wilson; 1967). Therefore, connecting two protected areas via a protected corridor to create one large area should also increase natural biodiversity (Wilson and Willis; 1975).

How will the watershed communities determine the most appropriate conservation strategies for wildlife habitat? There are three general paths to follow in conserving the health of wildlife populations. One is to protect the habitat of rare species. A second path is to conserve landscape-level resources such as contiguous forests or riparian areas. This helps to protect the habitats of a large number of species, but it might not meet the needs of all rare species. The third method is a combination of the first two. Maintaining the biodiversity of the watershed over the long term will likely require the protection of both unique habitats for specific species as well as networks of habitats across the landscape. Conservation strategies to consider include monitoring of species locations, numbers, and movements; the protection of Core Habitat areas as identified by the NHESP BioMap and Living Waters (*see Open Space Map*); the continued protection and linkage of large blocks of contiguous forestland; the retention and maintenance of early successional habitats like fields and grasslands; and the protection of vernal pools, wetlands, and riparian corridors that sustain the greatest diversity of life in the Deerfield River Watershed.

## **F. Scenic Resources and Unique Environments**

Each town within the Deerfield River Watershed has unique places that have special meaning for residents. Many of these sites, buildings, and landscapes may remind natives and long time

residents of events and customs and the ways things once were. Tourists traveling through a town might not even notice some of the more meaningful sites in each community.

There are other places in the watershed including scenic hills, waterfalls, farm landscapes, and long-range mountain views that any person would find memorable. Often, town Open Space and Recreation Plans attempt to inventory and describe both types of scenic resources. The following themes are common among municipal plans. Each could be an important element of the watershed landscape to protect. Their intersection, the places where multiple scenic resources are contained, might also be a target for conservation planning. In most cases, areas that are scenic have ecological, economic, recreational, and historic values as well.

The challenges for the watershed communities lay in the need to not only conserve what each town has in the way of cultural landscapes, but to do so in a way that celebrates the connections and patterns shared by many communities in the basin so that the essential scenic and historical characteristics of village and rural landscapes within the Deerfield Watershed are conserved over time. Watershed residents can conserve the rural character of their basin by sustaining working farms and forests and small local businesses, by monitoring and resolving environmental quality issues, by inventorying and promoting the richness and heritage of historic structures, sites, and landscapes, and by seeking to conserve large areas of contiguous forest and riparian buffers.

### ***Watershed-wide Scenic Resource Themes***

From a watershed-wide perspective, several scenic themes link parts of the watershed together:

- **Large River Floodplain Views:** Large river floodplain views bridge forested valley sides, town village areas, floodplain farmland, and river-associated wetlands.
- **Historic Village Districts:** Historic village districts may or may not have a national or local designation but they often share common elements: a public way or a crossroads, small lots with little or no setback, groupings of historical commercial, residential and institutional buildings, town commons or greens, sidewalks, memorials, and churches. For many communities these areas are what watershed residents consider to be their town centers. The village area may represent the first or second civic or commercial center in a town's history. Village areas in the watershed are often the focus of community events. Village areas are often buffered by the more dense residential neighborhoods of a community. Both local businesses and town officials in the watershed seek to focus commercial-based economic development in the village area. Trends such as encouraging housing to develop over first floor commercial uses, also called mixed-use development, could be designed in accord with local historic architectural styles.
- **Farmland along Scenic Roads:** Most farm fields abut roads, and some run parallel to them. Whether roads are designated as scenic or not, many in the watershed link large and small farms to town centers. Rte. 2 bisects the watershed, with a fair share of its length along the Deerfield River. Roads that parallel floodplain farm fields

bridge historic agricultural landscapes from Shelburne to West Charlemont and from the watershed's boundaries to the main stem of the Deerfield.

- **Distinctive Landscapes:** The Massachusetts Landscape Inventory, published by the Department of Conservation and Recreation (DCR) in 1982, identifies distinctive and noteworthy landscapes. Distinctive landscapes are characterized as having “openness, low population density, high relative relief, historical structures and features, and lack of contemporary development.” Noteworthy landscapes have similar but fewer elements. The DCR considers the presence of distinctive landscapes as an important criterion in their land conservation programs (*see the Scenic and Cultural Resources Map*).
- **Wetlands, lakes, ponds, waterfalls, and rivers:** In the Deerfield Watershed, surface waters of all types provide a visual break from forest, the dominant vegetative cover in the basin. They can offer long-range views in the case of the Deerfield and North Rivers, and shorter-range views, as are provided by the Green, Cold, South and Chickley Rivers. Ponds, waterfalls, and lakes are also destinations for residents and tourists and as such, represent scenic resources that serve as a base of activities and, as a place from which to enjoy views of surrounding landscapes.
- **Hills and Ridgelines of Contiguous Forests:** Hills and ridgelines are visible throughout the watershed and often form the backdrop to life in the basin. Perhaps most visible from mountaintops and from river valleys, hillsides are often taken for granted by a community until development or its proposal occurs.
- **Long-range Scenic Views that Encompass all of the Above:** In each community there are places from which one can see a far distance. Often these views are gained from private property. They often encompass forest and farms, rivers, and villages, sounds and smells. Long-range views can be marred by development that contrasts greatly from surrounding landscape by its size, height, color, or reflectivity.

### *Unique Environments*

Often towns view unique environments to mean the important natural communities within their town boundaries. These are areas identified on the GIS Theme maps as rare species habitats. The Massachusetts Natural Heritage and Endangered Species Program (NHESP) provides towns with detailed descriptions of these natural communities some of which are described on pages 10-12. NHESP does not give detailed descriptions of the locations of these special environments to help protect against illegal takings and poaching.

## **G. Environmental Problems**

According to the municipal Open Space and Recreation Plans and the Deerfield Natural Resources Assessment and Action Plan (by Gomez and Sullivan), the main environmental problem is considered to be non-point source pollution and other impacts to the ecological integrity of the watershed's plant and animal communities. Non-point source pollution occurs when pollutants are generated not by a single source like an outflow pipe from a factory but from improper land use across landscapes both suburban and rural. For example, watershed residents can unknowingly contaminate groundwater by failing to update their private septic systems to limit untreated effluent leaching into rivers and streams and by improperly disposing of household hazardous materials like petroleum products, wood preservatives, and pesticides. Non-point source pollution can result in the contamination of both surface and groundwater and involve other types of pollution. Sources of pollution thought to be of greatest concern to residents include the improper use and disposal of hazardous chemicals, road salt, siltation from new construction, gravel roads, and the use of herbicides along utility right-of-ways. Sources of non-point source pollution and actions that reduce ecological integrity in the Deerfield Watershed include:

- Salt runoff from road salt and sand use in winter.
- Floodplain development and any associated failing septic systems that can pollute ground and/or surface water.
- Uncapped landfills, old farm and residential dumps, and car graveyards.
- Stream bank erosion. Erosion is a water shed-wide type of non-point source pollution that may be impacted by local land use decisions.
- Early spring manure spreading on fields without vegetative buffers along streams. The result may be pathogens in surface waters downstream.
- Gravel operations can have negative impacts on groundwater when permitted to harvest materials too close to the groundwater table.
- Dirt roads. Dirt roads often experience higher traffic volumes than they were designed for and can be maintained to reduce erosion.
- Logging operations can also contribute to erosion problems in the woodlands if Best Management Practices are not followed.
- Herbicide use along easements and rights-of-way.

Other threats to the Deerfield River watershed's ecological integrity:

- Guilford Transportation Systems, Inc., which has experienced several chemical spills along the Deerfield River.

- Acid Mine Drainage from the Davis Mine in Rowe.
- Invasive non-native species. Japanese Knotweed, for example, is a threat to native vegetation because it often forms dense patches, which shade out all other plants. It is a particular threat in riparian areas where it can survive floods and quickly colonize scoured streambanks. Japanese knotweed is difficult to eradicate once it has become established.
- Flow peaking problems caused by the use of the Deerfield River to generate hydroelectric power. Rapid changes in flow caused by hydroelectric power generation create unstable habitats that can reduce the abundance and diversity of riverine fish. Changes in water levels displace shallow shoreline zones, forcing fish in those areas to relocate, stranding fish, or exposing trapped fish to predation. Flow fluctuations can also degrade the quality of shoreline habitat by altering macro invertebrate communities, aquatic and riparian vegetation, and availability of structure such as woody debris.
- Wildlife habitat fragmentation. If and when subdivisions become the dominant form of development in the watershed, any remaining backland habitat not protected from development would become further fragmented. Large blocks of forest, riparian corridors, wetlands, and fields are four types of wildlife habitat that can become fragmented through unplanned development.

