

II. NATURAL HERITAGE

A. Introduction

Natural heritage refers to all the natural resources Cabot residents and visitors value; including forests, clean waters, clean air, healthy wildlife populations, rare species, significant natural communities¹, scenic vistas, and a working landscape – all of which provide us the opportunity to hike, fish, trap, bird watch, and work the land in a sustainable manner.

To sustain our rural character, fish, wildlife and overall natural heritage for future generations, it is imperative that conservation be one of our priorities in town planning. This means protecting our fish, wildlife, plants, natural communities, prime agricultural soils and the ecological processes and landscapes that allow them to co-exist with our human activities.

Understanding and planning for the protection and sustainable use of Cabot's natural resources requires understanding the physical landscape. The configuration of its mountains, valleys, wetlands, lakes, and rivers is crucial in determining the distribution of natural communities, habitats, and native species.

The following broad environmental factors influence the distribution of species, habitats and natural communities: climate, bedrock and surficial geology, topography, hydrology, and land use history.

B. Existing Conditions

Geology – Topography

Except for the irregular boundary at Joe's Pond, Cabot is square in shape, six miles on each side, a total of 22,325 acres. Cabot lies in the geographic region known as the Piedmont, in the foothills of the Green Mountains.

There are three distinct rock types in Cabot: (1) metamorphosed limestones of the Waits River formation (northwest and southeast); (2) mica-rich quartzites of the Gile Mountain Formation (central); and (3) New Hampshire Series Granites (southeast). The Waits River and Gile Mountain Formation rocks were originally deposited as sediments in an ancient sea and were later transformed into rock, folded, and uplifted into mountains during the continent-continent collision of the Acadian Orogeny (mountain building event) that occurred 350-400 million years ago.

The highest point in Cabot is Danville Hill (2,246 feet), followed by Joe's Hill (2,198 feet), Burbank Hill (1,980 feet) and Thistle Hill (1,909 feet). The lowest part of town is 880 feet at the point where the Winooski River exits the town at the Marshfield border.

¹ Natural communities can be defined as the interacting assemblages of organisms, their physical environment, and the natural processes that affect them.

Most of Cabot lies within the Winooski River drainage basin, and Coits Pond is considered to be the headwaters of the Winooski. A small portion of the eastern section of town drains to Joe's Pond, a part of the Connecticut River drainage basin.

Soil is the layer of earth that lies directly over the bedrock. It is the layer through which rain and nutrients filter, upon which crops and trees grow, and where wildlife and humans create their lives and homes. The type of soil that develops in an area is dependent on its parent material (bedrock and glacial deposits), vegetation, topography, climate, and time. Understanding the characteristics and capabilities of these soils is important for planning the types, locations, and intensities of future land uses. Soils information can be an important guide for reviewing individual development proposals.

Because of Cabot's location in the upland drainage region, it lacks the abundance of rich bottomland soils found in towns that are lower in the drainage basins of the Winooski and Connecticut Rivers. Nevertheless, Cabot has significant areas of prime agricultural soils which have been mapped (See Map 2b: Natural Resources).

The Natural Resources Conservation Service of the US Dept. of Agriculture has mapped the soils in Cabot. A soils interpretation sheet is available for each soil type which describes the soil and evaluates its capability for certain uses. Information on slope, texture, density, permeability, depth to bedrock, flood hazard, seasonal high water table, and other characteristics is available. Soils are evaluated for their suitability for construction, septic systems, water supply, recreation, farming, woodland management, and wildlife and resource material uses. In general, unfavorable soil types for development typically contain excessive slopes, shallow depth to bedrock, wet soils, excessively drained soils, unstable soils, and erodible soils.

NRCS has classified Vermont's soils into twelve categories, called Agricultural Value Groups, according to their limitations, management requirements, and potential for crop production. Soil map units in Group 1 have the most potential for crop production, while units in Groups 11 and 12 have the least potential. Soils in Groups 1 and 3 are rated prime, and those in Groups 2 and 4-7 are rated as statewide important. Designations of prime and statewide important soils are used both in a regulatory context (i.e., as a potential trigger for Vermont's statewide land use law, Act 250, criterion 9(b), and as a key criteria in determining which farmland should be permanently protected. There are 725 acres of prime agricultural soils and 6,757 acres of statewide soils in Cabot, representing about 30% of the town's total land area.

NRCS has rated most soils in Cabot for their forest productivity. Given the desire of the Town to conserve forest land, soils with good forestry potential should be considered in development proposals. However, NRCS ratings only reflect physical and chemical compositions of the soils and do not consider location, current land use, parcel size or other relevant factors. A geographic information system (GIS) study could include other criteria for determining the conservation potential of important forest land in the Town such as potential natural community and erosion potential. When prime forest lands are thus identified, the Town could take steps to ensure the land remains productive. If large

parcels of forest are fragmented through subdivision, the natural and economic value of the forest decreases.

Soils in the uplands of Cabot are of the Glover-Calais and Calais-Buckland associations that are generally well drained and have moderate amounts of calcium carbonate (buffering capacity). Although these soils are usually suitable for residential and agricultural uses, there are areas where considerable limitations exist because of steep topography, wetness, shallow depth to bedrock, and unfavorable soil textures. Many areas containing these soil types are unsuitable for septic tank leach fields. Subordinate soils found in depressions in upland areas are very poorly drained loamy soils of the Muck and Peat Peacham Association that are not suitable for any use.

Soils found in the upper Winooski River valley are of the Windsor, gravelly Windsor, and Hartland-Belgrade associations. Windsor-gravelly Windsor-sandy-gravelly soils are found on terraces along streams and creeks in central Cabot, whereas Hartland-Belgrade silty soils are found in the Winooski River valley in southern parts of Cabot. Windsor and gravelly Windsor are generally suitable for all uses; however, some Hartland-Belgrade soils have severe limitations for many uses.

Sand and gravel resource areas in town are very limited. Two areas mapped for sand and gravel resources are both along the South Walden Road, one in the vicinity of Houston Hill Road and the other in the vicinity of Cross Road. The granites of Cabot intruded into the Waits River and Gile Mountain rocks during the waning stages of the Acadian Orogeny. Such granites are frequently quarried as dimension stone. Although no such active granite quarries exist today in Cabot, quarrying was conducted in the northwest corner of town from 1904 into the 1930's. In nearby Woodbury a significant quarry exists that can be seen from higher vantage points to the east of town.

Climate

Climate and weather patterns are important planning and design considerations because of their effect on such things as soil erosion, plant growth, air quality, storm water runoff and flooding, groundwater supplies, road maintenance, energy demand for cooling and heating, access to alternative energy sources and recreational activities, such as snow sports.

Vermont's northern climate is dominated in winter months by cold, dry Canadian air and in summer by warm, moist air from the Gulf of Mexico. Weather patterns vary locally with topography and relief and Cabot has many microclimates because of this. Cabot's average annual rainfall is approximately 44 inches, snowfall is 112 inches (actual statistics are for Danville, VT).

Global climate change predictions and scientific models suggest temperature changes in the next 50-100 years, an increase as high as 5 to 9 degrees Fahrenheit. Northeast average annual temperature has increased by 2 degrees Fahrenheit since 1970. Such an increase would reduce the number of months with average low temperatures below

freezing from the current six to four, and increase the number of months with average highs above 80 degrees from two to three or four.

Warming has resulted in many other climate related changes including more frequent very hot days, a longer growing season, an increase in heavy downpours, less winter precipitation falling as snow and more as rain, reduced snowpack, earlier spring runoff resulting in earlier peak river flows.

While some of us human residents may not miss the extra months of winter, the plants and animals around us will. Climate change will alter the town's natural environment by changing the plant species that can thrive in Cabot, the migrating patterns of birds, the temperature of rivers and ponds, and many other changes through throughout the interconnected web of life. The variability and severity of weather is likely to increase and adversely impact the human and natural environments.

If climate change proceeds as currently anticipated, the climate and natural environment in Vermont will resemble that of the mid-Atlantic region by the end of the 21st century. Agricultural production, including dairy, fruit, and maple syrup may be impacted. Climate conditions suitable for maple/beech/birch forests are projected to shift dramatically northward. This may leave a smaller portion of the Northeast with a maple sugar industry and the colorful fall foliage displays which residents and visitors to the area are accustomed to. The projected reduction in snow cover may impact winter recreation and the industries that rely on it. At the same time, warmer and longer growing seasons could bring some positive impacts; for example, increased farm productivity, reduced dependency on heating fuels, and greater opportunity for warm weather recreational activities.

Cabot should anticipate that a changing climate will bring social, economic, and environmental change locally. Climate change has the potential to affect the local economy in numerous ways, pointing to a need for both diversification of the local economy and action to limit future emissions of climate changing air pollutants.

Air Quality

Cabot has various microclimates, causing significant variation in temperature, precipitation, and frost dates. Cabot Village and Lower Cabot are in valleys subject to temperature inversions especially during the winter months. Perhaps Cabot's greatest air quality concerns lie within these areas, when smoke from wood furnaces and wood stoves and other heating sources become trapped in these locations.

Illegal residential burning of trash, including agricultural plastics, can be a significant source of toxic air pollutants and exposure in any part of town, but especially in higher density areas, and in areas where temperature inversions occur. Young children and the elderly can be particularly sensitive to air pollutants, including particulates and airborne toxic materials. In recent years, restrictions against trash burning have been enforced by the Cabot Health Officer as a public health hazard and public nuisance.

Like most of Vermont, Cabot is fortunate to have exceptional air quality. Nonetheless, we are impacted by air pollution generated far from Vermont. Coal burning power plants in the Midwest are a main cause of airborne air pollutants (nitrous and sulfur oxides) that can impact the health of forest and pond ecosystems as well as human health. This air pollution, as well as that which contributes greenhouse gases to the atmosphere, are some of the largest environmental challenges facing Cabot in the next few decades.

Hydrology

Water and its movement have a profound influence on animals, plants, and natural communities, as well as human activities. Lakes, ponds, rivers and streams provide habitat for a diversity of fish, aquatic plants, aquatic invertebrates, and other organisms. Wetlands that form in waterlogged soils, along with riparian areas, provide a variety of habitat functions for wildlife along with other biodiversity values.

Cabot's ground and surface water resources are connected to the Lake Champlain watershed via the Winooski and Lamoille rivers and to the Connecticut River watershed via the Passumpsic River. Wetlands, ponds, and streams in the northwest quadrant form the headwaters of the Winooski River, which winds its way through Cabot and is closely paralleled by Route 215. In Lower Cabot, Jug Brook feeds into the Winooski. Waterways in the northeastern corner of Cabot flow into Joe's Pond and eventually the Connecticut River.

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Lakes and Ponds

Five significant lakes and ponds lie at least partially within Cabot's borders:

Molly's Pond: A scenic, productive pond with a large diversity of aquatic plants (including rare species) and outstanding wildlife value. Molly's Pond is a natural, public lake of nearly forty acres, with a maximum depth of twenty-eight feet. Its outlet and shoreline are in Cabot, with the watershed extending into Peacham. There are no public lands adjacent to the pond, although the Vermont Land Trust holds easements on large tracts of land bordering the pond. The Vermont Department of Fish and Wildlife reported fair water quality and good recreational fishing, although nutrient levels are most likely high due to runoff from surrounding agricultural land uses.

West Hill Pond: An artificial, privately-owned lake covering about forty-eight acres, with a maximum depth of thirteen feet. Its outlet and shoreline are in Cabot, with the watershed extending into Woodbury. Shoreline includes a fifty-foot municipal beach and state boating access. Fishing and swimming are allowed, motorized boating is not. Due to draining or lowering of the water level, the pond is not always fishable. There is a high percentage of farmland within the watershed.

Molly's Falls Reservoir (Marshfield Reservoir): An artificial, mesotrophic lake (medium productivity and nutrient levels), rich in wildlife (including loons and migratory birds),

covers about 400 acres, with a maximum depth of thirty-five feet. Its outlet and shoreline are in Cabot, with the watershed extending into Marshfield and Peacham. Ninety-eight percent of the land within its watershed is undeveloped. The reservoir is a power supply source operated by Green Mountain Power, which also owns a significant proportion of the shoreline. Warm water and cold water fishing are permitted, albeit impaired due to water level fluctuations (between one and six feet in summer and ten to twelve feet in the winter) and turbidity. The State owns some public land around the reservoir with no developed access, and the Vermont Land Trust holds easements over a tract of land to the southwest of the reservoir. There is a state boating access; gas motors and jet skis are allowed.

Joe's Pond: A natural lake with artificial control is a public water that covers about 396 acres, has a watershed area of 18,445 acres, a maximum depth of 78 feet, and a mean depth of 21 feet. Tremendous diversity of plant life exists on the lake and adjoining wetland, which is large and significant. The pond has a heavy concentration of development along its shorelines in both Cabot and Danville. The outlet is in Danville and the watershed also includes Peacham, Stannard and Walden. Joe's Pond is noted for both warm and cold water fish species including yellow perch, smallmouth bass, pickerel, bullhead, and brown and rainbow trout. Other popular recreational activities include boating and swimming. Green Mountain Power regulates lake levels for hydroelectric generation. There is a state boating access and municipal swimming and picnic areas in Danville. The water quality is rated as fair to good, although many pressures exist: a high level of development; close proximity to roads leading to increased runoff potential; fluctuations in the water level; and the size of the watershed in proportion to the lake indicates that the "pond may reach a critical mass of nutrient/sediment loading beyond which water quality degradation may become apparent." (1990 *Lake Assessment*, Vermont Department of Environmental Conservation).

Coits Pond: A shallow, public lake in the northwestern corner of Cabot, with shoreland in Cabot and Woodbury. The State of Vermont owns a 27+ acre tract on the southwest shore of this pond. Current uses include warm water fishing and carry-in boating; motorized watercraft are not allowed. Public access has recently been improved with a small parking area.

Several issues of concern were noted in the 2003 plan concerning Cabot's lakes and ponds, and these issues remain relevant today. They include:

- A 1994 State of Vermont Water Quality Summary noted high levels of eutrophication and acceleration of rates of eutrophication at West Hill Pond, Joe's Pond, and Molly's Pond.
- Rare, threatened or endangered species have been identified on all of these bodies of water. Most notably, loons are present on Molly's Falls Reservoir and Joe's Pond.
- Public access to Cabot's lakes and ponds is very limited.

- Cabot's lakes and ponds are threatened by close proximity to other bodies of water that are infested with Eurasian milfoil, a nuisance aquatic plant. Eurasian milfoil has been reported in Marshfield Reservoir. At Molly's Pond, nutrient levels are high; periphyton and plant growth have been noted adjacent to unbuffered farmland (*1990 Lake Assessment*, Vermont, Dept. of Environmental Conservation)
- Due to development density Joe's Pond is considered to be vulnerable to water quality degradation.
- Molly's Falls Reservoir has a largely undeveloped shoreline which is owned by Green Mountain Power Corporation. In the future, there may be development pressures on the shoreline that have not been anticipated or assessed.

Wetlands

Wetlands are land areas that are saturated or inundated by water and support plant and animal life adapted to saturated soil conditions. Such areas include marshes, swamps, bogs, fens, wet meadows, ponds and vernal pools. Wetlands were traditionally thought of as undesirable places - swamps and wasted land that was either drained or filled and put to use, usually for agriculture. In fact, Cabot Village and Lower Cabot were part of a northern white cedar swamp bordering the Winooski River that was drained and developed. Under today's wetland protection laws, Cabot Village would not have been able to develop in its current location. The mucky soils and high water table characteristic of wetlands makes for poor septic system suitability.

Wetlands are now known to perform important functions such as reducing flooding, filtering sediment and pollutants before reaching surface waters, supporting numerous wildlife species, and providing open space and scenic beauty. Although poorly designed and sited development in or near wetlands can impair their functions, in most cases, development can be accommodated in the vicinity of wetlands when properly planned.

Most significant wetlands greater than an acre in size in Cabot appear on National Wetland Inventory maps. Cabot contains numerous small wetlands, totaling approximately 670 acres or 2.7 percent of the land area. Many of these wetlands were initially designated by the Vermont Water Resources Board as Class Two wetlands. Class Two wetlands have an initial buffer of 50 feet. Class I wetlands have an initial 100 foot buffer. Class III wetlands are those that are either not significant or have not yet been evaluated and are not protected under the Vermont Wetland Rules. Allowed uses include most farming and forestry activities; recreational activities, and repair and maintenance of utility lines and poles. Vermont's Wetland Rules indicate that local planning commissions are responsible for undertaking studies, making recommendations on wetland protection, and indicating those areas for wetland protection in the land use plans, including undesignated wetlands. No municipality may grant a zoning permit for the development of a wetland prior to the expiration of a period of 30 days following the

submission of a report to the Agency of Natural Resources describing the proposed use, the location requested, and an evaluation of the effect of such proposed use on the Town Plan and Regional Plan. The present zoning ordinance does not designate or protect these areas.

There is one large wetland complex in East Cabot that is greater than forty acres in size. This complex consists mainly of forested wetland, with smaller areas of scrub-shrub and emergent zones. The remainder is small wetlands from one to ten acres in size, scattered along the Winooski River and to the west. The most common wetland type is forested wetland, followed by scrub-shrub and emergent, and a small amount of aquatic bed wetlands. Perhaps the richest, most diverse wetlands occur in association with several ponds, including Coits, Joe's, Molly's and West Hill.

Many wetlands in town have not received study or characterization for significant values. There has not been a study of so-called Class III wetlands. Any kind of comprehensive wetland evaluation in Cabot is likely to take a significant amount of time and resources. From the standpoint of wildlife significance, the wetlands adjacent to and bordering the ponds in town should be studied first, especially in identifying significant wildlife habitat in the town.

Rivers and Streams

Cabot has over 40 miles of upland streams and rivers. Most streams are small but some of the larger streams support recreational trout fishing. Little information is available on upland streams in Cabot. Some water quality information is available on the Winooski River. Until recently the Winooski was affected by failed and discharging septic systems and occasional straight pipes to the river in the village. With the construction of a community wastewater treatment facility, water quality should improve significantly for recreational uses such as fishing and swimming. Vegetative buffer strips along farmland adjacent to the river are sparse or non-existent.

In 2006, the Cabot Conservation Committee completed a geomorphic assessment of the main stem of the Winooski River and a few tributaries with funding obtained through the Vermont Agency of Natural Resources. A River Corridor Management Plan was developed to identify and prioritize areas of significant stream bank instability. Many problem areas were identified, particularly along the main stem of the Winooski River. Non-vegetated, eroding stream banks degrade fish habitat, increase water temperature, and add excessive silt and nutrients that degrade water quality. The towns of Cabot, Marshfield, and Plainfield have formed the Winooski Headwaters Community Project, and with funding and assistance from various groups, including Cabot Creamery, Friends of the Winooski, and the Winooski Natural Resources Conservation District, several restoration projects are underway. Several riverfront properties have been assessed for stream bank stabilization projects, and four sites have undergone extensive tree plantings to stabilize banks. The Project has also continues to do extensive water quality monitoring for physical, chemical, and bacteriological parameters to assess water quality health. Effort to improve rivers and streams are a long-term project that requires

adequate funding for research, technical studies, and project implementation; landowner education and cooperation; and committed volunteers. The geomorphic assessment work and the formation of the Winooski Headwaters Community Project are the foundation for moving forward and improving river and stream water quality and habitat for fish and wildlife.

Floodplains, Flood Hazards and Fluvial Erosion

Floodplains are low lying areas of land adjacent to a streams and rivers that are frequently inundated by water. While these places serve important ecological functions, including floodwater storage, sediment trapping, nutrient filtering and aquifer recharge, they can be hazardous locations for people and property. Flooding (and flood related events), arising from a variety of causes including: heavy rain, melting snow, ice jams, poor drainage and dam breaks, it is the most frequent, damaging and costly type of natural disaster experienced in the State and Region. In fact, over the last 50 years flood recovery costs have averaged \$14 million per year (not adjusted for inflation) statewide. Unfortunately, it appears that Vermont can anticipate more frequent flooding occurrences in the years ahead as climate change models predict wetter summers with more intense rainfall events.

High water causes damage in two distinct, but related, ways. *Inundation* can fill structures with water and cause property damage and drowning. It is a great concern for those living in or near Flood Hazard Zones (the area inundated by water during a flood with a statistical probability of occurring once every 100 years – i.e., the “One Hundred Year Flood”). Surprisingly, however, erosion from flash flooding (i.e. *fluvial erosion*) actually causes greater damage. Within the area of a stream or river’s active channel movement, known as the Fluvial Erosion Hazard Zone (or FEH), bank failures and changes in river channel courses during floods can undermine buildings, roads, farm fields, and utility infrastructure.

Cabot is not immune to either of these hazards. Over the years the Town has experienced several damaging floods and high water events. Like the rest of Vermont, Cabot witnessed severe flooding in November of 1927. More recently, a flood in June of 1998 took Cabot by surprise, with upland streams jumping their beds, carving out new channels, and filling Main Street with silt. The recent storm events in May and June 2011 caused severe erosion along roads and tributaries to the Winooski River as well as the mainstem of the Winooski in Cabot

Unfortunately, our society’s historical response to floods and fluvial erosion has been to treat the symptoms as opposed to the causes – repairing damage rather than preventing it. Furthermore, some of the traditional “cures”, such as rip-rapping, dredging and land-filling, actually exacerbate the problem they attempt to fix by accelerating currents, raising base flood levels and shifting problems downstream. The disaster response paradigm is changing, however, as more communities are taking a proactive role in both inundation and fluvial erosion hazard mitigation and avoidance, as opposed to the traditional reactive stance.

Perhaps the best known mitigation program is the National Flood Insurance Program (NFIP). This program, administered through the Federal Emergency Management Agency (FEMA), identifies areas within the Flood Hazard Zone and prescribes development review standards and procedures for lands within regulated areas. Municipalities that comply with Federal standards can qualify their residents for flood insurance through the program at rates far below what would be available on the private market. It is essential, therefore, that Cabot maintain its eligibility for this program. It is important to note that under this program, reduced insurance rates are available town-wide – not just to those located within the Flood Hazard Zones.

Washington County recently underwent a FEMA-directed “map modernization process” and the Town was provided with draft updated digital maps of Cabot’s Flood Hazard Zones. (Note: Finalized maps for Washington County are expected in late 2012 or early 2013.) Because the new maps use ortho-photographs as a base, they may be more accurate and easier to interpret. In 2009, the Cabot Selectboard adopted a Flood Hazard Ordinance consistent with federal standards, and has since readopted the ordinance twice as an interim bylaw.

While the FEMA Flood Hazard Zones are important maps for town planning and for mortgage lenders in deciding which properties need flood insurance protection, they do not address fluvial erosion hazards. Accordingly, the Department of Environmental Conservation and many Regional Planning Commissions have been busy conducting fluvial erosion hazard assessments for many river and stream segments statewide. Cabot has been a beneficiary of this effort. Using field surveys and GIS technology, CVRPC has completed (or will soon complete) erosion hazard maps for sections of the main stem of the Winooski River. Cabot can use this information to help avoid future life and property damage by allowing rivers and streams the area they need to maintain or re-establish their natural “equilibrium” (or stability) thereby avoiding the need for costly, and potentially environmentally damaging stream channelization and bank stabilization measures. While Flood Hazard and Fluvial Erosion Hazard (FEH) Zones typically have large areas of coincidence, they are seldom, if ever, identical.

Even if Cabot were to restrict new development from flood hazard and FEH zones, it would not solve every problem. Historically, the Town has also witnessed damage from upland streams that have not been mapped by either of the above programs. Mountainous or hilly areas tend to have narrow, confined channels through which flood water move rapidly and travel downstream more quickly than in flat areas. Even though a building is not located in a valley where a rising river could overflow its banks and inundate the structure, it is not necessarily safe from flood damage. Cabot’s zoning regulations have not historically identified upland stream corridors as areas needing protective setbacks for development. That may need to change. By establishing setbacks in its zoning regulations, the Town can prevent people from building structures too close to rivers, such that the structures could be flooded or swept away by strong currents in a storm.

Finally, it is important to consider how land use within a watershed impacts flooding. Impervious surfaces, such as roads, driveways, parking areas and buildings prevent water from soaking into the ground, increasing runoff and erosion potential. Any disturbance of the soil or any change in topography may increase erosion potential. Building development and soil tillage are two primary causes of soil disturbance in Cabot. Logging is another. Excessive logging can leave hillsides open to erosion, removing the forest canopy that would have absorbed and retained much of the water. Improperly constructed logging roads may lead to increased erosion, particularly on poorly drained soils. Private driveway culverts are often undersized, causing washouts and road damage during intense storms.

Driveways which are improperly graded and ditched can direct water onto the main road, increasing highway maintenance costs. Improper maintenance of Town roads and roadway culverts can lead to washouts. Soil and vegetation allowed to build up on the edges of roads will prevent water from running into ditches. Clogged culverts restrict water flow. Inadequate municipal infrastructure can result in problems such as undersized (or too few) culverts, inadequate ditches, or the lack of headwalls on culverts.

Land Use History

A critical factor in determining the distribution of plants, animals and natural communities is the history of land use. For instance, the degree and type of forest cover have a great influence on the species that inhabit an area. Cabot has much more forest than it had in the mid-1800s, when forests were cleared and rivers were choked with silt. Fish and wildlife populations were decimated largely due to habitat destruction and alteration as well as unregulated fishing and hunting. In this period, even some common species such as beaver and deer disappeared. When railroads and other transportation access opened the Midwest in the mid 1800s, Vermonters left in droves, and the hills began to return to forest. With the return of the forest and the recolonization and reintroduction of animal species, the beaver, deer, wild turkey, fisher, bobcat, moose, and others have returned in great numbers. Many species of fauna and flora, however, have not recovered their populations and may never do so. For instance, the passenger pigeon is extinct, and mountain lions and wolves, once top predators in Vermont, no longer roam the land.

Wildlife Resources

Wildlife Natural Heritage Elements

The elements of our natural heritage – all of the things that are important to consider when planning for conservation – range from individual species and their particular habitat needs to large landscapes and the many species and ecological functions they support. We have a reasonable knowledge of the habitat needs of some species, like black bear and peregrine falcon, but for most species there are major gaps in our knowledge.

Conserving our natural communities is one way to ensure that we retain most of our native wildlife species. But conserving natural communities in isolation is not enough. To ensure the proper functioning of these communities and to provide habitat for wide-ranging and reclusive species, we must conserve and foster the stewardship of larger landscapes and areas of undeveloped land, with all of their component species, habitats, and natural communities.

The following discussion addresses the three conservation levels important in conserving our wildlife natural heritage; landscape level, community level and species level.

Landscape Level: Contiguous Forests and Connecting Land

Contiguous forest habitat is an area of forested land with either no roads or low densities of Class III or IV roads and little or no human development. Contiguous forest areas may have various age classes or forest cover and may be composed of other habitat types such as wetlands or old meadows that are part of the overall contiguous habitat complex. Ideally, these areas are connected with other similar areas so the animals that use them can move freely to other forested areas and habitats. It is important to keep in mind that there is no minimum or maximum number of acres to define contiguous habitat; rather it is important to consider the size of the contiguous forest habitat and associated species of plants and animals within the context of the level of fragmentation in the region/area. In addition, the configuration of the habitat is also an important consideration for identifying contiguous forests. For instance, an area of forest habitat that is highly irregular in shape, with a high degree of forest edge may be less functional than a similar size area of regular shape. Contiguous forest is important because it:

- Supports the biological requirements of many plants and animals, including those species like bobcats and black bears, that require large areas;
- Serves as habitat for source populations of dispersing animals for recolonization of nearby habitats that may have lost their original populations of those species;
- Supports public access to and appreciation of the forested landscape;
- Provides forest management opportunities for sustainable extraction of forest resources; and
- Provides forest management opportunities to yield a mixture of young, intermediate, and older forest habitat.

Connecting lands or habitat is land that links larger patches of habitat within a landscape. These connections are essential to keep habitat patches (genetic reservoirs) from becoming isolated; if cut off from the local and regional movement of wildlife, populations can die out. Many of the smaller wetland or wooded areas in town retain their wildlife populations only because they are connected to larger, less disturbed areas. These connection or linkages are disappearing, mostly due to housing development. There are few large and unbroken tracts of wetland or forest left in town. Cabot is part of a high priority habitat linkage area referred to as the Worcester Range – Northeast Kingdom linkage area as identified by the State and conservation organizations.

Connecting habitat is important because it does the following:

- Allows animals to move freely across their range;
- Allows plants and animals to colonize new habitat as climate change, succession, or other ecological processes force them to migrate;
- Reduces the risk of population isolation and provides for the exchange of genetic information among populations;
- Allows seasonal movements (migrations) to essential range or habitat; and
- Allows young adult animals to access new range.

Community Level: Natural Communities

A natural community is an interacting assemblage of plants and animals, their physical environment, and the natural processes that affect them. As these assemblages of plants and animals repeat across the landscape wherever similar environmental conditions exist, it is possible to describe these repeating assemblages as natural communities.

Identifying natural communities is a powerful tool for developing effective land management plans, determining conservation priorities, and increasing our understanding of Cabot's natural heritage. The Vermont Fish & Wildlife Department currently recognizes 80 upland and wetland natural community types in Vermont. Some examples of upland natural communities are Northern Hardwood Forest and Temperate Calcareous Cliff, while examples of wetland natural communities are Red Maple – Black Ash Swamp, Cattail Marsh, and Northern White Cedar Swamp. Each community type is assigned a state rank that describes the rarity of the community on a statewide level. In Vermont, inventories for significant natural communities have only taken place at the county and watershed levels. Identification of significant natural communities at the town level can help focus efforts on those areas in need of conservation and management attention.

Several types of natural communities are deserving of particular attention. These include:

- Wetlands – that provide fish and wildlife habitat, flood and erosion protection, nutrient and pollution filtration, groundwater recharge, and aesthetic diversity;
- Riparian and aquatic habitats – that have a wide variety of plant and animal communities with an interconnected food web that includes reptiles, amphibians, plants, waterfowl, songbirds, bats, mink, and otter. Healthy riparian ecosystems give life to all the species that inhabit them, including those species that use bodies of water only at certain times during their life cycle, such as during breeding or migration.

Species Level: Rare, Threatened and Endangered Species; Deer Winter Habitat; Mast Stands; Important Turtle Habitat; Grassland and Bird Habitat; Early Successional Forest and Scrub Habitats

The Vermont Fish & Wildlife Department recommends that town conservation planning processes consider the following additional species level elements because they are not necessarily protected or properly represented through either landscape level or natural community level conservation.

- Rare, threatened and endangered species – Rare species such as the loon, which is found in Cabot, are important conservation challenges of our time and will serve as indicators of whether we can create sustainable economies and lifestyles, locally and beyond.
- Deer Winter Habitat – Deer yards can vary in size from a few acres to hundreds of acres, consisting of mature or maturing softwood cover that provides protection from deep snow, cold temperatures, and wind. A variety of other wildlife species also benefit from dense softwood stands, including snowshoe hare, coyote, fox, fisher, bobcats, crows, ravens, and many others. Logging can be either beneficial or detrimental to the habitat depending on harvest method, and education on management practices is important. Cabot’s mapped deer yards can be found on Map 2a. About 24% of Cabot’s land area is considered deer winter habitat.
- Mast Stands – The seeds of shrubs and trees serve as important wildlife food for numerous species including mammals, birds, amphibians and reptiles. Beech and oak stands are absolutely essential for the survival of black bears in Vermont. Mapping significant mast stands and encouraging their protection through education will protect wildlife diversity.
- Important Turtle Habitats – Turtles are a long-lived group of animals that face many threats from human activities. Seven species occur in Vermont and nearly all spend most of their time in aquatic environments. The greatest challenge facing turtles is their ability to produce young by finding suitable nesting habitat where young hatchlings safely make it to an aquatic environment.
- Grassland and Bird Habitat – There are several birds, including rare and endangered species that rely on grassland habitat for their survival in Vermont. Populations of grassland birds have declined due to loss of habitat. Although Cabot has limited grassland habitat that would allow for reproductive success, there are management opportunities, such as mowing practices that could increase the amount of grassland habitat.
- Early Successional Forest and Shrub Habitat – Many species of wildlife require early successional forest and shrub habitat, including ruffed grouse, American

woodcock, New England cottontail rabbit, and songbirds such as the golden-winged warbler. It appears that Cabot and the Northern Piedmont region of the state as a whole have an adequate amount of this habitat type.

Wildlife Data for Cabot

Species-level data for Cabot is documented to various degrees through state and regional surveys, such the Breeding Bird Atlas, Small Mammal Atlas, Herptile Atlas (reptiles and amphibians) as well as harvest data from hunting which is compiled by the Vermont Department of Fish and Wildlife. Harvest data from hunting shows that the following species are regularly harvested in relatively small numbers: black bear, bobcat, fisher, otter, mink, raccoon, muskrat, skunk, weasel, coyote, red fox, and beaver. Turkey hunting became legal in Cabot in 1997, and the harvest ranged from a low of one in 1997 to a high of 90 in 2008. In 2008, Cabot had the fifth highest total of turkey for the spring hunting season. Deer harvest over the last 20 years has totaled 701 bucks and 1,580 total deer. There are 5,400 acres mapped as deeryard in Cabot, totaling 24% of Cabot's land area. Although there have been no legal harvests of moose in Cabot, moose are abundant near the periphery of town, which is more forested and less developed than the center of town. Ten incidental mortality reports for moose were filed from 1997-2008 in the vicinity of Route 2, most of which were road kills. Moose have been legally harvested in adjacent towns, including Woodbury, Walden, Marshfield, and Peacham. Fish & Wildlife's Natural Heritage Program maintains information on rare and endangered plants and animals. Cabot has five mapped vernal pools – small temporary wetlands typically found in upland forests over a relatively impermeable substrate layer.

Fisheries data from the Agency of Natural Resources show abundant wild brook trout populations on the main stem of the Winooski River from Cabot Village upstream. Temperature and habitat conditions deteriorate downstream. Jug Brook has wild brook trout populations; Kidder (Hooker) Brook has wild brook and brown trout; and Molly's Brook has wild brook and brown trout above Marshfield Reservoir, but extreme flow reductions due to hydroelectric bypass and unregulated minimum flow limits wild trout populations downstream of the dam, in part due to higher water temperatures.

The Agency of Natural Resources has documented the following fish species to be common in occurrence lakes and ponds in Cabot:

- Joe's Pond – brown and rainbow trout, smallmouth bass, yellow perch, chain pickerel, brown bullhead, rock bass, and pumpkinseed.
- Coits Pond – chain pickerel, yellow perch, and brown bullhead.
- West Hill Pond – largemouth bass, chain pickerel, yellow perch, and brown bullhead.
- Molly's Falls Pond (Marshfield Reservoir) – northern pike, smallmouth bass, yellow perch, rainbow trout (stocked), brown trout (stocked), and brown bullhead.

Late fall, early winter water drawdown impacts littoral (shoreline) productivity and may affect spawning tributary access.

- Peacham Pond – brown trout (stocked), yellow perch, and rainbow smelt. Late fall, early winter water drawdown impacts littoral (shoreline) productivity and may affect spawning tributary access.
- Molly’s Pond – chain pickerel, yellow perch.

C. Planning and Land Use Considerations

To better plan for natural heritage conservation, it is important to understand the effects of development. The following discussion explains seven major mechanisms by which current development patterns degrade Vermont’s natural heritage:

- Direct loss of diversity;
- Destruction of habitat;
- Habitat fragmentation;
- Disruption of movement, migration, and behavior;
- Introduction of invasive exotic species;
- Degradation of water quality and aquatic habitat; and
- Loss of public appreciation for the environment.

Direct Loss of Diversity

As development alters natural habitats and ecological functions, the types and number of species change. Human activities, most notably land conversion and development have contributed to the listing of over 150 plant species and over 40 animal species in Vermont as threatened or endangered. Like plant and animal species, whole natural communities can be lost to or negatively affected by human development. Vermont has over 80 types of upland and wetland natural communities. Some are rare and highly sensitive to human disturbance. More common communities, such as Northern Hardwood Forests, may be abundant, but reduction in their size and loss of connectivity between them still threatens their function as habitat for fish and wildlife.

Destruction of Habitat

As buildings, parking lots, roads, and lawns replace the natural vegetation, we lose significant wildlife habitats including deer winter habitats, riparian habitats, feeding and denning habitats for black bears, and habitat for threatened and endangered species. Loss of habitat from development is almost always permanent.

Habitat Fragmentation

One consequence of human settlement of the landscape is fragmentation of habitat into smaller and smaller areas. The creation of gaps in the forest and barriers to wildlife movement such as housing and commercial development, roads, and power lines results in the direct loss or inaccessibility of important habitat. The reduction in size of forest patches can render the forests and other habitats unsuitable for certain species of native plants and animals. The smaller the habitat patch, the smaller the number of species that can occupy the habitat. Fragmentation of a forested area affects species composition, favoring species like raccoons that are more tolerant of human activities and more general in their habitat requirements. Furthermore, these tolerant species may out-compete native species for the same resources, like food, leading to further native species decline. Fragmentation disrupts connections between habitats that are essential for movement, and ultimately the survival, of many species of large, wide-ranging carnivores such as black bears, bobcats, and fishers.

Disruption of Movement, Migration, and Behavior

Roads are a good example of disruption to wildlife movement, migration, and behavior. Roads not only lead to motor vehicle collisions with wildlife, but fragment habitat and affect movement of wildlife ranging from salamanders to black bears. Roads can isolate populations, limit reproduction, and reduce genetic diversity of a population. Small, inadequate, or poorly placed culverts can create barriers to fish migration in streams.

Introduction of Invasive Species

Exotic species are those introduced, either deliberately or accidentally where they do not naturally occur. Examples include Eurasian milfoil, purple loosestrife, Japanese knotweed, goutweed, buckthorn, and honeysuckle. Invasive exotic species are ones that proliferate, aggressively displace other species, and even alter natural communities. It can take over an entire area it invades. Invasive parasites and diseases are altering the composition of our forests, killing off elms, beeches, hemlocks and ash trees.

Degradation of Water Quality and Aquatic Habitat

Soil erosion from a tilled field, construction site, gravel road or severely eroding stream bank has a negative impact on water quality and aquatic habitats. Siltation of stream bottoms can destroy the habitats of stream invertebrates, an important part of the aquatic food web and suffocate incubating eggs and young of many fish species. Increased silt loads in streams can also absorb more solar radiation, increasing stream temperatures, which reduce oxygen level in the water, thereby reducing habitat quality for cold-water species such as brook trout.

Development affects the hydrology of a watershed in many ways. Roads built along riverbanks can effectively confine the river in its current channel, preventing its natural meandering and causing it to cut a deeper channel, and losing its access to the flood plain,

where the energy of moving water is dissipated and can be deposited. Land clearing and development, including paved surfaces, can change the quality, quantity and time or water running from the land into our lakes, rivers, and streams, thereby exacerbating erosion.

An ammonia spill and discharge at the Cabot Creamery in 2005 resulted in a complete fish kill (all species/life stages) for 5.5 miles downstream. Much of the fishery has now recovered.

Loss of Public Appreciation for the Natural Environment

As communities become more suburban and urban, people tend to have fewer positive experiences with wildlife. Animals are seen more as a nuisance than an integral part of our quality of life. As people become more accepting of a human-developed landscape, they can lose their connection with the land and their appreciation for wildlife and its importance.

D. Goals and Implementation Strategies

Goal	Implementation Strategy	Key Implementer(s)	Future Measures of Progress
<p>II.1 Conserve and provide stewardship for existing patches of forest and connecting habitat (corridors) and minimize subdivision and parcelization of this habitat.</p>	<p>II.1 (a) Develop a map of contiguous forest patches in Cabot and their potential connecting habitat.</p> <p>II.1 (b) Identify benchmark acreage of contiguous forest in consultation with VT Agency of Natural Resources and other conservation organizations.</p> <p>II.1 (c) Minimize the subdivision of large forested areas by encouraging cluster development and tools such as Planned Unit Developments (PUD).</p> <p>II.1 (d) Provide landowner education on the importance of contiguous forests and connecting habitat and promote voluntary methods to protect these.</p> <p>II.1 (e) Consider establishment of a <i>conservation reserve fund</i> for acquisition and perpetual protection of critical agricultural, forest and open land, including wildlife migration corridors, wetlands, and riparian buffers. Consider tax incentives for conservation easements.</p>	<p>Conservation Committee</p> <p>Conservation Committee</p> <p>Planning Commission</p> <p>Conservation Committee / Planning Commission</p> <p>Conservation Committee / Planning Commission</p>	<p>Map created</p> <p>Benchmarks identified</p> <p>Subdivision regulations in place and increased use of cluster development</p> <p>Education materials developed and distributed</p> <p>Conservation fund proposal developed</p>
<p>II.2 Encourage the conservation and/or proper stewardship of significant natural communities and species including deer wintering areas, mast stands, turtle nesting sites, and grass lands and other critical wildlife habitat.</p>	<p>II.2 (a) Conduct a natural community mapping project and map areas with extensive invasive plant species.</p> <p>II.2 (b) Develop a significant natural community overlay district and provisions in the zoning regulations that will conserve them.</p> <p>II.2 (c) Provide public and landowner education on significant natural communities.</p>	<p>Conservation Committee/Naturalist</p> <p>Planning Commission</p> <p>Conservation Committee / Planning Commission</p>	<p>Natural Community Map developed</p> <p>Overlay district identified and zoning regulation adopted</p> <p>Education materials produced distributed</p>

