Conservation Commission: Drafts of Natural Resource Section for New Town Plan

Pursuant to a meeting last July with Clare Rock and Mark Fausel, The Richmond Conservation Commission (CC) has begun work on an update for the Natural Resources of the Richmond Town Plan. Accordingly, the CC has drafted an Inventory and from this a set of Observations, Objectives and Implementation. These are provided below. A series of Natural Resource Maps also is posted on the CC page.

The CC would be most interested in your thoughts and suggestions of this work in progress. These can be emailed to Bob Low (bob.low@uvm.edu).

Preamble

At its July meeting, the Conservation Committee (CC) discussed the upcoming revisions to the Town Plan with Clare Rock. The CC offered to undertake revisions to the Natural Resources (NR) section of the current Town Plan. Since that time, the CC has been hard at work.

There were several reasons the CC thought work needed to be done. Among them: 1/ The 2012 Plan, being built to a significant degree on text created several years before that, simply is out of date in terms of the inventories (and also Key Findings, Objectives and Implementation). 2/ There is a large amount of new information available regarding our natural resources (two examples: the State Agency of Natural Resources web site; Science to Action). 3/ The interest in including additional topics (e.g. Ridgelines, Climate, Invasive Species). 4/ The need to provide actionable specifics to Objectives and Implementation. 5/ To provide a scientific basis for town planning as a matter of principle and as required by law.

The CC thus far has come up with the following attached DRAFT. This is in no way complete, requiring corrections for commissions, omissions, syntax and like issues to say nothing of community dialogue.

Though the CC used the current Town Plan as an organizational framework, the Commission fully understands that the format of the new Plan may be substantially different. Accordingly, the goal was to provide the knowledge base required to construct the new Plan.

NATURAL RESOURCES: INVENTORY AND TRENDS

Richmond is possessed of a rich variety of natural resources that include diverse wildlife habitats, assemblies of flora, fauna and natural communities. The Town's location in the eastern uplands of Chittenden County places it in an area noted for some of the richest habitat diversity in all of Vermont. Their co-existence with working farms and forests, unique shoreline environments and outstanding vistas have created a sense of place precious to our community, as well as opportunities for recreation and education.

Testimony to the importance of the Town's natural resources to its citizens has been surveys indicating the high importance of rural landscapes, natural resources themselves, open land and scenery to the quality of life in Richmond; and of encouraging ways to protect these values. Richmond voters approved the creation of a conservation reserve fund in 2005, to be funded by town taxpayers for five years. That fund has been used to support a number of conservation projects, recently having been voted to be renewed for the third time by the largest margin ever.

Scientific study and resultant data bases (e.g. Vermont Center for Geographic Information (VGIS) the State Agency of Natural Resources (ANR, including BioFinder, Science to Action) have provided a sound basis for understanding these resources (see Appendix – Introduction). The opportunity has been provided to understand the impact of current and proposed land uses to guide policies that will maintain, even enhance, their integrity.

Certain features are beyond human control such as bedrock and surficial geology, elevation, land form, topography, slopes and general hydrology. Indeed, nature has imposed a land use plan that identifies areas unsuitable for most if not all forms of modified land use, such as is the case for example with steep slopes.

Other features are critical to appreciate in terms of the integrity of natural communities. Among these are included natural communities such as upland forest, wetlands, aquatic, open, woodland, riparian, each of which possess important key attributes such as size, scale rarity, species biodiversity and rarity. Derivative features include Ecological Land Units (ECUs) contiguous and connecting habitat, wildlife corridors and the like. It is essential that planning be based on appreciation of the importance of each feature's contributions, as well as build on policies that preserve the freedom to preserve priority natural resources and to use them wisely.

Drainage Basins

Richmond is located within three watersheds, the Winooski River watershed, the Huntington River watershed and the LaPlatte River watershed. The Winooski watershed (excluding the Huntington River portion) encompasses roughly two-thirds of the town and receives drainage from those areas of town generally north of Bryant Hill (above Cochran's Ski Area) and Owls Heed collects water from uplands surrounding the Huntington River, and the LaPlatte River watershed contains a small portion of Richmond in the vicinity of Lake Iroquois.

The Huntington River is noted for its natural beauty, fisheries and wildlife habitat, natural resources, ecologic integrity, and recreational values. It is a tributary of the Winooski River. Its drainage basin includes the towns of Huntington, Hinesburg, Starksboro, Fayston, Duxbury, Bolton, Richmond and Buels Gore, as such reaching three counties within the State of Vermont - Chittenden, Addison and Washington.

Surface Waters

Two of Vermont's major rivers, The Winooski and Huntington, flow through Richmond. Gillett Pond, Richmond Pond as well as a portion of Lake Iroquois are in the Town. Other prominent surface waters include Donohue Brook, Johnnie Brook, Snipe Ireland Brook and Mill Brook, there being a number of additional ponds, streams, brooks and unnamed tributaries.

The Winooski River courses through Richmond generally following the Route 2 corridor. It is a major recreational resource from swimming, to boating, to fishing. In addition to providing for aquatic plants and wildlife, the river as well serves as an important wildlife corridor.

The main branch of the Huntington River is approximately 18 miles long, from its headwaters in Buels Gore to its mouth at the Winooski River in the village of Jonesville (Richmond), Vermont. Approximately 10 miles of the river are located within the town of Huntington with another 5 miles within the town of Richmond. The Huntington River is designated by the State of Vermont as Class B water. According to the Vermont Water Quality Standards (effective July 10, 2000) Class B waters should be suitable for, among other uses; aquatic habitat, boating, swimming and public water supply with filtration and disinfection.

The quality of these waters is essential to Richmond. They serve as a source of recreation, providing visual amenities that enhance the rural character of the town, and support a wide variety of fish, wildlife and plant species that contribute greatly to the natural diversity so valued by Richmond citizens. For these reasons, State professionals have identified a number of significant shorelines in Richmond that warrant a higher degree of protection. Protection of the riparian areas surrounding these waters and streams remains an important priority (see ***Riparian Areas***).

The Shoreline Protection Act passed by the Vermont General Assembly in May 2014, describes standards that protect shore lands yet allow lake-friendly development. The Act defines when permits are required as compared with registration for alterations within areas up to 250 feet of mean water level for alterations such as clearing, creating impervious areas, vegetation removal and paths. Grandfathering covers existing non-conforming uses. The Act pertains to Lake Iroquois, Gillett Pond and Richmond Pond.

The Huntington Conservation Commission began regular water quality testing at a number of sites along the Huntington River in Huntington, beginning in 2004, with funding by a Vermont Dept. of Environmental Conservation Larosa Grant. Richmond joined the study in 2006. Continuing to this day, results from these studies have identified the role of runoff as compared to spot sources as the major contributor to *E. coli* contamination. An initial look at potential animal sources of contamination was undertaken with help from a grant from the Vermont Department of Environmental Conservation and the U.S. Geological Survey. Public outreach efforts have been undertaken to educate residents in the Huntington River Watershed of potential threats to the watershed and positive steps they could take to address these threats.

An important step towards understanding the disequilibrium that exists for a given river or stream is to undertake a geomorphic analysis. Accordingly, the Huntington Conservation Commission as part of a project funded by the Vermont Department of Environmental Conservation River Corridor grant Program sponsored a geomorphic analysis of the Huntington

River by Arrowwood, one that includes the entire corridor including the Richmond segment. Destabilizing events such as Tropical Storm Irene, the July, 2013 and June 2015 storms that significantly damaged Dugway and other town roads underscore the importance of stabilizing rivers and riverbanks.

The watershed is comprised of a combination of agricultural, forest and residential landscapes. Man-made channel alterations are described such as straightening, armoring, dredging and berming are noted as resulting in areas of bed and bank erosion. Though streams naturally exhibit erosion, deposition and like processes, certain regions of the Huntington are not in equilibrium, resulting in sedimentation and degradation of aquatic habitat. Geomorphic instabilities have resulted in unnatural redistribution of sediment loads. Hydrologic and sediment stressors are specified for of the Richmond segment. These mostly are found in the reaches closest to the Winooski River as well as those as the river leaves Huntington. Issues specific for this segment of the River include decreased boundary resistance due to loss of floodplain, generally poor buffers, and increased armoring.

These findings inform the development of a river corridor plan for which a number of tools might be considered such as easements, minimizing storm water runoff, removal of invasive species, stream bank stabilization by planting vegetation, stream bed stabilization and like strategies.

Recently passed State Act 64 has as its goal improving the quality of State waters, more broadly aimed at maintaining and improving the quality of air, water, wildlife, and land resources. The Act 64 addresses a number of issues that pertain to point non-point sources of water contamination, for example dealing with Agricultural and storm runoff, forestry practice and road construction. A Vermont Clean Water Fund was established within the Act as a mechanism for covering costs related to improving water quality. The goals presented in Act 64 must be embraced in the clean water objectives and implementation presented in this Town Plan.

Floodplains (THIS NEEDS UPDATE IN TERMS OF NEW FEMA MAPS AND GUIDELINES)

A floodplain is the area bordering a lake or river that is subject to flooding. Floodplain borders are usually determined by the 100- or 500-year flood levels. A 100-year flood has a 1 in 100 chance of occurring in any given year. Floodplain boundaries are determined by the Federal Emergency Management Agency (FEMA), and are determined based on topography and estimated flood flows. Severe flooding can also have long term effects on stream banks. In 2006, Richmond began identifying waterways susceptible to erosion through a Fluvial Geomorphology study conducted by the Chittenden County Regional Planning Commission.

Floodplains not only protect property and life by reducing the severity of flooding but also provide wildlife habitat and serve as corridors for animal movement. They also represent some of the richest and most viable agricultural land in Richmond because of a concentration of alluvial deposits left by past floods.

Richmond's Flood plains have been compromised by recent high-intensity storms including Hurricane Irene, the July 2013 and the August 2015 storms. The recent and predicted increases in storm intensity force careful reconsideration of how floodplains need to be understood in terms of permissible uses (see ***Climate Change, Riparian Areas***).

Riparian Areas

Riparian areas are defined as those along the banks of rivers and streams, from the base of the water table to the top of the vegetation canopy within. They are vital contributors to the complete Hydrologic System of which they are a part, also including rivers, lakes wetlands and floodplains – all the land directly affected by surface waters. It is essential to consider the hydrologic system as a whole if one is to understand its dynamics, as well to understand how changes / disruption in any one part of the System will have effects elsewhere. This especially is true of riparian areas.

Trees, shrubs and other vegetation growing in riparian areas serve a vital function in maintaining water quality and protecting soils, as well as contribute vitally to the natural communities found within them. Acting as buffers, riparian areas effectively treat silt, fertilizers, pesticides and animal wastes before these pollutants reach surface waters. Roots in the banks bind the soil, reduce erosion and protect human property. Riparian areas also give floodwaters room to spread out, slowing down their flow, dissipation of energy, thereby reducing erosion and property damage. Shade provided by a forested canopy keeps stream water temperatures cool during hot summer months, important in terms of maintain oxygen levels and temperatures required by trout and other aquatic organisms. Leaf litter and insects falling from overhanging vegetation are major sources of food and form the base of the food chain in many stream systems. Trees and branches which enter the water are important habitat components for fish and aquatic organisms, as are undercut banks maintained by root systems. Naturally vegetated riparian areas provide important habitat and travel corridors for a wide variety of birds, mammals, amphibians and other terrestrial flora and fauna. Bird species ranging in the 40s and 50s can be observed during summer months, and riparian areas are home to a number of State-defined endangered species.

To maintain these protective functions, riparian areas must be vegetated for an adequate width, which varies depending on the physical and biological nature of the surface water and surrounding land. Recommendations from the Vermont Agency of Natural Resource call for protecting various widths as measured from the top of the bank or slope. The importance of shoreline protection is further emphasized in recent shoreline protection legislation (see ***Surface Waters.***

Vermont's own John Perkins Marsh provided one of the first and best descriptions of the importance of maintaining riparian areas in his landmark book Man and Nature: Physical Geography as Modified by Human Action. (1864). The Friends of the Winooski have provided important detail important detail as it pertains to the Winooski River, as well as guidance regarding how to protect it. Its "Living in Harmony with Streams" provides explanation of the processes of erosion and deposition, aka aggradation and degradation, giving illustrated examples. (Insert picture(s) of recent 2015 erosion damage?) Methods that exist are described to assess the "sensitivity" of rivers and streams to creation of imbalances in the natural equilibrium between them and their surroundings. Soil erodibility, flow volume, runoff dynamics and degree of confinement are variables that go into the equation.

Protection of water quality

Site soils and slope indicate low risk of erosion; proximity of project to receiving water and amount of resulting impervious cover indicate low potential for overland flow of pollutants. Site characteristics indicate increased risk of erosion and/or potential for overland flow of pollutants (Vermont Agency of Natural Resources, Riparian Buffer Guidance, December 9, 2005).

Studies of the Huntington River indicate the main source of fecal contamination, measured as *E. coli*, is runoff and of animal rather than human origin (See ***Surface Waters***). Point sources such as failed septic systems do not appear to play a significant role though need to be monitored. Studies of phosphate contamination have begun to study the impact of fertilizers: data are insufficient as of 2015to assess the issue.

Wetlands and Vernal Pools

Wetlands are areas that are inundated by surface or ground water with a frequency sufficient to support vegetation or aquatic life that depend on saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands perform several important ecological functions: they contribute to protection of surface and ground water quality, recharge ground water aquifers, and control erosion by binding and stabilizing soil. In addition, wetlands provide necessary fish and wildlife habitat, can contain rare and endangered flora and/or fauna, can represent a rare or outstanding wetland community type, and can provide opportunities for recreation, education, research, and aesthetic enjoyment. Vernal pools are small, open-water wetlands that are filled by rain and snowmelt in spring or fall and are typically dry during the summer months. Vernal pools are usually contained within a small forested basin with no permanent inlet or outlet, and supporting no fish that prey on other species. Years of filling and drying result in a unique set of conditions that support a variety of wildlife specialized to take advantage of these conditions. Vernal pools are known as important breeding habitats for amphibians such as several salamander species and wood frogs. In Vermont, information regarding the distribution of vernal pools is limited and further study is needed to better understand this natural resource. The Vermont Water Resources Panel uses a three-tier system to classify wetlands for protection. Class One and Class Two wetlands are considered “significant” as determined by the degree to which they carry out the above described functions, and are protected by the Vermont Wetlands Rules. Class Three wetlands are those wetlands that have not yet been evaluated or those not considered significant under the Vermont Wetland Rules. Although the most comprehensive source of information on wetlands is the NWI, this information should be used with caution. The maps were prepared using aerial photography rather than field inventory, so wetlands that are hard to see on aerial photos are not mapped. Many forested wetlands, for example, are not on NWI maps. Understanding the functions and values of each wetland requires field inventory and assessment by a natural resource professional.

Groundwater

Clean and plentiful groundwater is a critical resource for the health and well-being of Richmond’s residents. Statewide, 66% of Vermonters depend on groundwater for their primary water supply. This number is significantly higher in Richmond, where nearly all residents obtain their water from public and private wells and springs. The most significant quantities of groundwater are found in aquifers, which are geologic formations that have the capability to

store, transmit and yield useful quantities of water to a well or spring. Land through which water percolates to become groundwater is called a recharge area. Recharge areas and the groundwater they supply can become contaminated by many sources, including failing septic systems, animal waste, leaking underground storage tanks, improper disposal of household and industrial waste, inappropriate use of pesticides and fertilizers, and excessive road salting. Groundwater can also be contaminated by naturally occurring substances including radioactivity in deep layers of bedrock and decaying plant and animal matter in areas closer to or on the surface. Similarly, over-development can deplete groundwater resources by increasing the amount of impervious cover and preventing infiltration of water underground. In Richmond, the importance of groundwater to the health of Town residents, present and future, makes protection of groundwater resources a top priority. Higher quality water is also less expensive to treat. The Vermont Department of Environmental Conservation (DEC) has published a groundwater protection handbook, which is an excellent source of information about groundwater resources, threats to groundwater and tools local governments can use to protect groundwater. The DEC also has a model Groundwater Protection Ordinance that can be used as a guide for regulations protecting groundwater.

The State's Agency of Natural Resources has mapped all Source Protection Areas, which are the recharge areas for public community water supplies (those serving 25 or more full-time users). There are five public water systems active in Richmond at this time: **[Needs to be updated]**

- One well comprising the Richmond Municipal System serving the village
- Two wells comprising the Riverview Commons System serving the mobile home park located off River Road
- The Larned System serving portions of Jonesville; the well is actually located in Bolton
- Fire District #1 serving the Robbins Mountain development located off Wes White Hill
- Two wells comprising the system serving the Orchard Lane Development off Dugway Road.

In 1996, the Town adopted a Water Supply Source Protection Ordinance setting forth protective regulations for the municipal water supply.

Soils

Soils in Richmond are comprised of two general types: 1/ Those formed from water-deposited material in the Champlain valley; 2/ Those formed in the Green Mountains and the foothills.

Soil Characteristics of General Soil Units Soil Associations Suitability for Development (Source: US Dept. of Agriculture, Natural Resources Conservation Service, 1988)

- Munson Raynham-Scantic Association Limited due to seasonal high water table
- Hartland-Belgrade Association Limited due to seasonal high water table, steepness, and poor permeability Limerick-Hadley-Winooski Association Limited due to high water table and flooding
- Adams-Windsor Association Suitable except in areas limited by slope Colton-Stetson Association Suitable except in areas limited by slope

- Lyman-Marlow Association Unsuitable due to steepness, shallowness to bedrock and poor permeability
- Peru-Marlow Association Limited due to steepness and poor permeability
- Peru-Cabot Association Unsuitable due to excessive wetness

Steep Slopes

Richmond's geological features, including hills and ridgelines, are an important part of the town's heritage and provide recreational and aesthetic enjoyment, educational and research opportunities. It is beneficial to public good and welfare to protect the ridgelines of Richmond in ways that preserve their aesthetic value, yet allow development in a fair and consistent manner.

A significant effort took place in 2002 to map ridgeline viewpoints throughout Richmond, laying the groundwork for identifying priorities and laying the groundwork for future discussion.

Many soils along ridgelines are characterized as being thin layers of soil over rock and/or having steep slopes, and thus very vulnerable to damage and erosion. In addition, these areas contain environmentally sensitive areas in terms of unique vegetation communities and wildlife habitats including for endangered species. Protection of water supplies, preservation of unique landforms that promote recreation and tourism, otherwise contributing to sense of place / community. Development needs to be sensitive to issues of protection of biodiversity, steep slope storm runoff and preserving existing vegetation including trees that reduce erosion by stabilizing soils (see ***Riparian Buffers***). Public safety as well as costs to the Town need to be considered in terms of overly steep roads and emergency service access.

A particular more recent issue is the location of communication towers, electric power generators and like structures. The location of communication towers in Richmond recently created extensive commentary and concern, as did their potential placement. Lack of guidance in the current Town Plan left the Town little leverage in the decision-making process. The issue deserves further attention as town planning proceeds.

Working Farms and Forests **(<u>Little done to this section other than some rearranging</u>)**

As stewards of their land, generations of Richmond farmers, foresters and loggers have provided and protected the open space that, for many, defines our town's rural landscape. Today, their hard work continues to provide fresh foods, local employment, revenues for other local businesses and a safeguard against sprawl. Meanwhile, farms and forestland have little impact on the cost of Town services. Managed properly, farms and timberlands help safeguard streams and water quality, often producing less pollution per acre than developed land. Farms can serve as important buffers between developed areas and wildlife habitat, and forests provide key habitat to many species and protection of clean water supplies. Richmond farms serve as a source for fresh, local foods. Currently, most acreage is devoted to growing corn and hay for local dairy farms. Other farms in town supply local customers with fresh vegetables, fruit, beef, pork, lamb, poultry, maple syrup and other foods. The town is home to at least two horse-riding schools and one tree nursery. A thriving Farmers Market is held at Volunteers Green throughout the warmer months, serving as a popular weekly gathering place for the community as well. Through the State's voluntary Current Use Program, owners of farm and forest land can reduce their property taxes as long as they keep their land in production.

Economically healthy, environmentally responsible farms and forests have benefited Richmond residents since our town was founded. Farms remain a vital resource for our community, helping us become more self-sufficient in producing food, fuel and construction materials, providing customers for local businesses and protecting many critical natural resources, including prime agricultural soils and wildlife habitat that are disappearing elsewhere. Trends in transportation costs and fuel prices could make Richmond's farms and forests even more valuable, as more people turn to local sources for food, and more homes and businesses switch to burning wood to save on heating costs.

Despite all efforts, however, economic pressures and other factors continue to cause farmers to sell off parts of their land to development. Trends in our global economy make it more difficult than ever for small farms and forestry operations to make a profit. Reversing these trends will take not only innovative public initiatives but also the conscious effort of residents to buy locally produced foods whenever possible.

Sand and Gravel Deposits

Sand and gravel deposits are important natural resources. Utilization of these resources is often hindered by land use regulations and by public attitudes toward sand and gravel extraction. Identification of the highest quality sand and gravel deposits as part of the town planning process should help to avoid conflicts in the utilization of these resources in the future. Extraction of sand and gravel can pollute surface and groundwater resources while also having adverse effects on other resources and adjoining land use. Erosion and runoff controls combined with restoration of sites after operations can minimize the damage that is caused. A preliminary inventory of the town's sand and gravel deposits was performed as part of the report "Geology for Environmental Planning in the Burlington-Middlebury Region, Vermont", by David Stewart, 1973. Contacting local and state sources such as landowners, engineers, geologists and site contractors may further refine this inventory. Field reconnaissance should also be used when possible to verify information.

Scenic Views

Two major features dominate Richmond's landscape: the foothills of the Green Mountains and the Winooski River Valley. Much of Richmond's rural character and appeal results from the scenic vistas that can be observed in many parts of the town and that include an interplay of villages, mountains, forested hills, unbroken ridgelines, farms, fields, rivers, streams, ponds and woodlands. Richmond is also fortunate to have many tree-lined streets in its village and along its outlying roads. Trees provide shade, beauty and habitat; can serve as food sources, and reduce air and noise pollution. Properly sited street trees can also have important traffic calming effects and improve pedestrian safety. In addition to these benefits, street trees can improve neighborhood property values.

Ridgelines are an important part of the mix providing recreational and aesthetic enjoyment, educational experiences and research opportunities. They need to be approached in ways that preserve these features, yet allow development in a fair and consistent manner.

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environmentally sensitive areas in terms of unique vegetation communities and wildlife habitats including for endangered species. Protection of water supplies, preservation of unique landforms that promote recreation and tourism, otherwise contributing to sense of place / community. Development needs to be sensitive to issues of protection of biodiversity, steep slope storm runoff and preserving existing vegetation including trees that reduce erosion by stabilizing soils (see ***Riparian Buffers***). Public safety needs to be considered in terms of overly steep roads and emergency service access.

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Air Quality **(<u>needs update)</u>**

Air pollution can cause a number of serious illnesses such as chronic bronchitis, asthma, emphysema, cancer or damage to the kidneys, liver and central nervous system. There are a number of significant sources of air pollution in Vermont, the largest being the automobile. Each year motor vehicles in Vermont emit about 1,000 tons of toxic and carcinogenic compounds into the air. Various steps have been taken over the last several decades to improve the emissions from automobiles nationwide. However, while the controls have reduced the amount of pollution from each vehicle, the number of vehicles on Vermont roads and the number of miles they travel have increased dramatically. Motor vehicles now travel over 6 billion miles annually in Vermont, double the amount traveled in 1972. Fuel-efficient vehicles are in popular use. The increase in vehicles and road miles is a trend that is expected to continue into the foreseeable future.

Another source of air pollution once common in Vermont is trash burning. Thankfully, as air pollution has become better understood, fewer and fewer people are burning trash. Unfortunately, some still believe burning trash is a viable alternative to paying for land filling. Household burn barrels produce low temperature fires which release many toxic chemicals close to the ground. Agency of Natural Resources, Air Pollution Control Division flyer, *Air Pollution from Motor Vehicles in Vermont*, 1998.

The US Environmental Protection Agency has required each state to measure its ambient air for six “criteria” pollutants since 1970. Ambient air refers to air that is not directly at the source of pollution, but the air we breathe in neighborhoods, on farms and in the marketplace. These six pollutants are particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone and lead. These pollutants are by no means the only harmful ones. In fact the Vermont Air Pollution Control Division monitors the ambient air for several hundred pollutants, but the six “criteria” pollutants are considered the most common. With energy costs increasing, many people are returning to heating their homes with wood. While wood is a cost effective, renewable resource, older wood stoves may actually emit more pollutants, particularly particulate matter, than the sources they replace. Since 1988, the US Environmental Protection Agency has required all new stoves to be equipped with catalytic converters or other technologies which reduce air

pollution emissions by 50% to 60%. Newer woodstoves are also more efficient, requiring a third less wood to produce the same amount of heat. However, as with automobile travel, increases in usage may offset the improvements in the technologies. Another concern is the growing popularity of outdoor, wood-fired boilers, which, unlike wood stoves, are not required to have pollution controls and which often must burn wood year-round to provide hot water to the home. A study in 2006 by the northeastern states notes that wood-fired boilers "emit significantly more particulate matter than other residential wood burning devices and short term particulate matter spikes can be extremely high."

Natural Areas

Introduction

Natural areas can be described as those that provide habitat for a rich ecological and biological diversity for plant and wildlife alike. They are areas of land or water that are or contain unique resources. They include wetlands, ponds, critical wildlife habitat, rare or vanishing flora and fauna, outstanding natural communities, and geological formations. In addition, these areas must be considered for their value as a resource for outdoor recreation and for providing educational opportunities for exploration of the natural world.

Natural areas are irreplaceable sites with their own special character, permanence, vulnerability and management considerations. Their importance requires close attention to threats towards their existence. Those that have been identified include:

- Degradation / destruction of habitat, caused by lack of attention to preservation of natural features, inappropriate / imbalanced appropriation for human use, cumulative human actions both local (inappropriate use as working landscape) and global (climate change) any of which can creep in effect over time if not regularly assessed.
- Habitat fragmentation that disrupts the needs of plant and wildlife.
- Disruption of wildlife movement caused by reduced connectivity within and around natural areas.
- Degradation of critical resources such as quality ground and surface waters.
- Reduced diversity due to human intervention, introduction of invasive species and like factors.
- Lessened appreciation of the core values natural resources provide.
- Loss of property value due to degradation of natural resources.
- Loss of property value due to ecological imbalance.
- Stability of riparian habitat.

These natural area functions can be maintained along with their additional functions as a working landscape; andbuilding effective inter-relationships between natural areas and the built environment. It is from the integration of these functions that are provided the core principles behind defining natural areas in Richmond as well as their appropriate use.

The health of natural areas depends on understanding the relationships that exist between the landscape itself, the plant and wildlife communities that it supports and the relationships that build between those communities. Building and maintaining inter-relationships with our region's natural and land use systems is an essential goal. Doing so can increase human benefits from natural services and decrease town costs (see steep slopes section for example). Simply

defining what natural areas are and can be is necessary but not sufficient for their well-being: attention must be made to developing policies that will assure their value. Hence the need for municipal planning that encompasses their protection and enhancement, policies on which the capacity of natural areas to provide these functions depends

Policies with regard to natural areas must be mindful of the opportunities they bring.

- Natural areas enable a variety and diversity of ecosystems and wildlife that reinforce if they are not mutually dependent on one another, necessary both for their long-term viability but also the richness with which they can be appreciated by people: resident and non-resident alike.

- Natural areas promote the health not only of wildlife but also people. They provide the opportunity for appropriate use of the resources they provide, such as clean water, in turn providing the opportunity for development in appropriate inter-relationship.

- Natural areas provide a critical component to our scenic resources, contributing to quality of life and community enrichment.

- Natural areas can provide important natural resources, working landscapes with appropriate attention to the qualities and features essential for their well-being.

- Preserve property values if quality / integrity of natural resources is maintained / fostered.

Inventories now exist through ANR, STA, VFW and like sources defining natural areas and communities of importance to Richmond and providing a basis for future planning. These include areas of statewide as well as local significance. More recently, the high quality of wildlife habitats, working timberland and other resources in the northeastern part of Richmond and beyond led to that part of Town being included in the Chittenden County Uplands Conservation Project. This public and private initiative has been aimed at working with willing landowners to conserve ecologically significant areas and productive timberlands linking Mount Mansfield State Forest with Camels Hump State Park.

Natural areas are characterized by the natural communities they contain, in terms of forest communities, habitat blocks, uncommon species and rare-threatened-endangered species, and travel corridors for game animals. All have been mapped and rated in terms of importance and threat.

Wildlife Habitat, Flora, Fauna, Natural Communities

It is the natural resources features of our landscape that provide the nature and diversity of our wildlife populations. They define key bear habitat and deer wintering areas among other critical features. They define natural communities and their contents, allowing prioritization depending on the variety and nature of the content of each.

Of particular importance are longitudinal studies of wildlife populations. One such is provided by The Second Atlas of Breeding Birds of Vermont (University Press of New England) where a comparison is made between 1985 and 2013. Richmond provides a rich habitat for birds of many species, some 80 identified by annual one-day Vermont Audubon birdathons, annual

species identification invariably reaching the 90s in the Wes White Hill area alone. The Atlas reports State-wide gains and losses by land classification such as grasslands, forest type, open wetlands and developed. This has demonstrated how changes in land use is disproportionately associated with species losses in comparison with gains, informing the overall picture of gains and losses. While acreage devoted to haying has remained quite stable, there has been a significant drop in pastureland. Presently endangered species that can be found in Richmond include Whip-poor-will and Eagle (VFW). Species once present with regularity are now seldom observed, such as Bobolink and Eastern Towhee. The primary threats to our avian population are habitat loss, change or fragmentation; introduction of exotic plants, insects and plant pathogens; and of course climate.

These natural communities must not only be considered as individual communities but in terms of contribution to those around each. Critical here is mapping and understanding the importance in particular to wildlife of connectivity, contiguous habitat, road crossings and travel corridors. Indeed, tiered priorities have been established and located as a guide for project review.

Climate

Climate change has been in the news for some time. Its history does not need to be retold. Its impact is on virtually every aspect of town planning.

The 2014 Intergovernmental Panel on Climate Change Final and Synthesis Report summarizes the views of hundreds of scientists from dozens of countries who came together in this international effort, concluding “definitively” that human interference is a key cause. Conclusions are supported from many different sources. Effects have been on all continents and oceans, from tropics to poles. Conclusions regarding consequences continue to be reinforced in terms of extreme weather events, persistent droughts, species distribution and the like, with a reminder that more “surprises” undoubtedly remain before us.

Noteworthy is IPPC’s latest conclusion with greater than 95% certainty that humans have been the dominant cause of the changes that are occurring. The need for immediate actions on prevention, remediation and adaptation are described and options put on the table. The data supporting these conclusions are included.

Important locally is the comprehensive report on climate change in Vermont which was issued by the Rubenstein School at the University of Vermont. This first state-wide climate assessment in the country categorizes the impacts of climate change including on human activities, temperature, precipitation, weather extremes, community development, energy, water resources, forests, wildlife habitat, agriculture, public health, transportation and housing. The list goes on. Impacts are assessed on industries such as dairy, fruit and maple syrup production. The prediction is made with a high level of scientifically-based certainty that most winter precipitation will fall as rain rather than snow within 30-40 years, with disastrous effects on the ski industry, yet positive impact on summer tourism and recreation. Temperatures have increased some 2 degrees F in Burlington since 1980 according to the NOAA, reflected in the progressive delays in ice out in Joe’s Pond. July 2015 was the hottest month ever recorded world-wider. Follow-up studies comparing Thoreau’s natural world while he was living at Walden Pond to the present a longitudinal regional assessment.

The following map illustrates the issue with regard to forest types, representative of several different models that have been used. Note the loss of signature trees in Vermont, such as the sugar maple; and changes to our boreal forests, home to several endangered species.

A major additional strength of the Rubenstein Report is that it lays out opportunities to build resistance, to adapt, to accommodate; this is a must read as part of the planning process. Strategies are laid out for ecosystems, agriculture, dealing with increased runoff / severity of storms and the built environment, among other recommendations.

The Vermont Legislature recently passed Act 56 with the goal of establishing a renewable energy standard. Goals include reducing greenhouse gas emissions to 25% of 1990 levels by 2050 and increasing the ratio of renewable energy sales to 25% by 2032, and development of a renewable energy portfolio addressing transportation and heating. Also affecting ***air quality***, these State-wide goals need to be recognized in town planning.

Climate education will be essential. One can again turn locally to the Rubenstein School, as well as University of Vermont Satellites, Weather and Climate (SWAC) Teachers Summer Institute which is providing the tools to our educators, as are companion articles on climate education in the K-12 classroom.

Invasive Species

Invasive species are a growing problem throughout Vermont and in Richmond, threating our environment, health, safety and economy. Invasive species degrade high quality wildlife habitat, reduce the productivity of agricultural lands and working forests, decrease property values, damage public infrastructure, reduce the scenic quality of roadsides, and they pose health risks to people. Invasive species are globally the second most serious threat to biological diversity following habitat loss.

Invasive species (plants and animals) are those that have been introduced, either accidentally or intentionally, from outside of their native range and have the potential to negatively impact humans, animals and/or ecosystems. Due to the lack of natural controls these species can quickly become widespread and cause myriad problems. Japanese knotweed undermines riverbanks and can damage road and bridge infrastructure. Others, including Wild Chervil and Wild (Poison) Parsnip , which are often found along Vermont roadsides, and giant hogweed, produce sap that in combination with sunlight can cause severe burns to the skin and eye. Japanese barberry infestations have been linked to increased Lyme disease (mice and other rodents—the primary vector for Lyme bearing ticks—are protected from predators by the barberry's thorns allowing rodent and Lyme ticks to multiply).

One of the more common ways in which invasive species spread to new locations is when seeds or root segments are transported on vehicles, especially construction and logging machinery and mowers. Best management practices have been identified for reducing the accidental spread of invasives, including avoiding using fill from invaded sites, washing of equipment before leaving infected sites, stabilization of disturbed sites and mowing roadsides before plants go to seed.

While the state provides some coordination and support for invasive control and manages VTInvasives.org (an information clearinghouse to help people map, assess and combat the

introduction and spread of invasives) the bulk of the work is left to landowners and municipalities to shoulder. As a result, the health and vitality of Richmond's natural environment, working lands and scenic beauty increasingly depends on the ability of landowners and the town to develop and implement control measures of invasive species and to restore native communities.

Since 2008 the Great Richmond Root Out!, a partnership of the Town's Conservation Commission and Trails Committee, the Richmond Land Trust, The Nature Conservancy, the Vermont Youth Conservation Corps and some private landowners have been collaborating to map infestations, control invasive plants and restore native species to the floodplain forests along the Winooski River in the area between the Jonesville and Bridge Street bridges. Root Out! efforts have been guided by the Richmond Floodplain Forest Invasive Plant Management Plan (2010-2015) covering lands owned by the Town, Richmond Land Trust and The Nature Conservancy. This plan is due for updating and renewal in 2016.

School groups, business groups and individuals have contributed hundreds of hours of volunteer time yearly through the Great Richmond Root Out! cutting Japanese Knotweed, Japanese Barberry, and Honeysuckles and digging Garlic Mustard, from the rivershore. Professionals have also been hired to treat significant infestations with herbicide. Infestations in this area have been reduced by as much as 95% but will likely never be fully eradicated because of new introductions from upstream and neighboring lands.

Elsewhere in Richmond, some individual landowners, forest managers, sugarbush operators and farmers perform some control measures on their properties, but there is no overarching organized effort to identify, map, prevent or control infestations.

OBSERVATIONS

- Richmond is blessed with natural resources central to its sense of place and that contribute significantly to drawing people and businesses, recreational opportunities, health and well-being, and education regarding the natural world around us.

- A wealth of recent studies have provided for scientific evaluation of the nature and integrity of these resources. This allows assessment of threats and opportunities that inform sound town planning.

- Strategies are now available that exploit opportunities to develop win-win interfaces between human endeavor and our natural resources.

- There is the continuing need to match Zoning Bylaws with the goals and objectives of the Town Plan.

Natural Resources
Appendices

Introduction

Key Resources

Vermont Center for Geographic Information (VGIS)
http://vcgi.vermont.gov/

Vermont Natural Resources Council (VNRC) Community Planning Toolbox
http://vnrc.org/resources/community-planning-toolbox/

Science To Action (STA)
http://www.richmondvt.gov/wp-content/uploads/2014/03/2014-Science-to-Action-Natural-Resource-Report.pdf
http://www.arrowwoodvt.com/STA/

Vermont Agency of Natural Resources (ANR)
http://anrmaps.vermont.gov/websites/anra/

BioFinder
http://biofinder.vermont.gov/

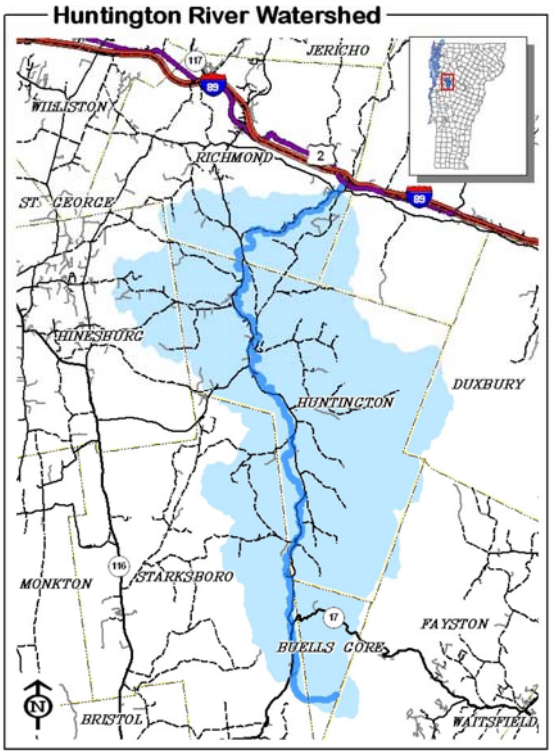
VT Fish and Wildlife (VFW): Endangered/Threatened Species
http://www.vtfishandwildlife.com/learn_more/critter_cirriculum/endangered_and_threatened_species

MAPS

Land Forms-1 (VGIS-Map-1)
Land Features (VGIS-Map-2)

Drainage Basins

Add General Map



Surface Waters

Shoreline Protection Act:

http://www.anr.state.vt.us/dec/waterq/lakes/docs/shoreland/lp_ACT172_Shoreland%20Protection%20Law.pdf).

Larosa Grant

http://www.huntingtonriver.org/)

Huntington River Geomorphic Analysis

http://www.vtwaterquality.org/rivers/docs/FinalReports/rv_P1_Huntington.pdf

MAPS

ANR-Habitats (see Natural Resources maps)
ANR-Natural Areas (see Natural Resources maps)
ANR-Endangered Species. (See Natural Resources Maps)
Huntington River Geomorphic Assessment. (Map)

Floodplains

Needs new FEMA maps

Riparian Areas

http://www.anr.state.vt.us/site/html/buff/buffer-tech-final.pdf)

Act-172

http://www.anr.state.vt.us/dec/waterq/lakes/docs/shoreland/lp_ACT172_Shoreland%20Protection%20Law.pdf).

Friends of the Winooski Report

http://www.winooskiriver.org

http://www.winooskiriver.org/images/userfiles/files/Stream%20Guide%201-25-2012%20FINAL.pdf

Insert recent 2015 pictures of damage?

Protection of Water Quality

No Items

Wetlands / Vernal Pools

National Wetlands Inventory: Add Map(s)

Ground Water

Conserving Vermont's Natural Heritage (Waterbury: Vermont Fish and Wildlife Department and Agency of Natural Resources, 2004), pp.74-75.

For information on NWI maps contact the ANR or see http://www.usgsquads.com/prod_nwi_data.htm.

Conserving Vermont's Natural Heritage (Waterbury: Vermont Fish and Wildlife Department and Agency of Natural Resources, 2004), p.64.

Reported by Larry Becker, State Geologist, to the U. S. Senate Committee on Energy & Natural Resources, Water and Power Subcommittee Hearing, 3/30/2006.

An Ounce of Prevention, a Groundwater Protection Handbook for Local Officials, September 2005, http://www.anr.state.vt.us/dec/watersup/GWPRS/VTOuncePrevention2005.pdf.

http://www.anr.state.vt.us/dec/watersup/GWPRS/GroundwaterProtectionModelOrdance.doc.

Soils

For more detailed information, the reader is referred to *The Soil Survey of Chittenden County, Vermont*, which contains maps that show the extent and location of the different soil types.

Steep Slopes

No entries

Working Farms and Forests

No Entries

Sand and Gravel Deposits

No Entries

Scenic Views

No Entries

Air Quality

No Entries

Natural Areas

Map: Natural Areas Rated (CCRPC-Map-1)

Wildlife Habitat, Flora, Fauna, Natural Communities

Maps:

Deer winter
Bear habitat
Significant Natural Communities (ANR-Map-1)
Habitat Blocks Rated (ANR-Map-2)
Uncommon Species (ANR-Map-3)
Anchor Blocks-Connecting lands-Road Crossings (Biofinder-Map-6-Anchor, Connecting-Crossing)
STA-Contiguous habitat Units –Road Crossings (STA-Map-1-CHU-Corridor-Travel)
BioFinder-Tiered Importance (BioFinder-Map-1-Master)
ANR-Tiered Priorities (Hilke-Map-1-Tiered priorities)

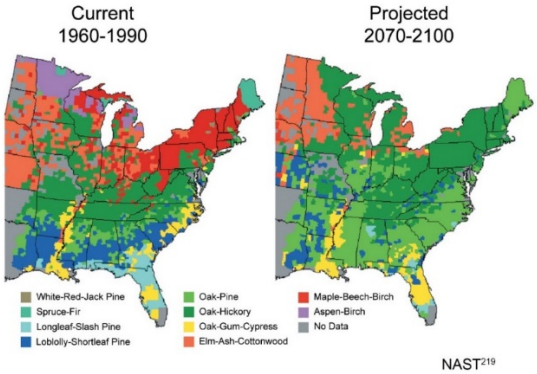
Climate

Intergovernmental Panel on Climate Change (IPCC: http://ipcc.ch/)

http://www.epa.gov/climatechange/impacts-adaptation/forests.html;
http://www.globalchange.gov/ncadac

Rubenstein School at the University of Vermont (vtclimate.org)

(Primack, BioScience, 2012, 62:170ff)



The maps show current and projected forest types. Major changes are projected for many regions. For example, in the Northeast, under a mid-range warming scenario, the currently dominant maple-beech-birch forest type is projected to be completely displaced by other forest types in a warmer future.[244]

Act 56: http://legislature.vermont.gov/assets/Documents/2016/Docs/ACTS/ACT056/ACT056%20As%20Enacted.pdf

Dupigny-Giroux, 2010, Geography Compass, 4/9, pp. 1203-1217.

Invasive Species

Some of the invasive plant species currently found in Richmond

- Japanese knotweed *Polygonum cuspidatum*
- Phragmites (Common Reed) *Phragmites australis*
- Buckthorn (Common and Glossy) *Rhamnus cathartica* and *Frangula alnus*
- Wild Chervil *Anthriscus sylvestris*
- Wild (Poison) Parsnip *Pastinaca sativa*
- Japanese Barberry *Berberis thunbergii*
- Garlic Mustard *Alliaria petiolate*
- Shrub Honeysuckles *Lonicera spp*.
- Giant Hogweed *Heracleum mantegazzianum*
- Yellow Flag Iris *Iris pseudacorus*

Invasive forest pests not yet found in Richmond

- Asian Longhorn Beetle *Anoplophora glabripennis*
- Emerald Ash Borer *Agrilus planipennis*
- Hemlock Wooly Adelgid *Adelges tsugae*

Post Management Plan at Town Web Site.