Ridgefield Natural Resource Inventory

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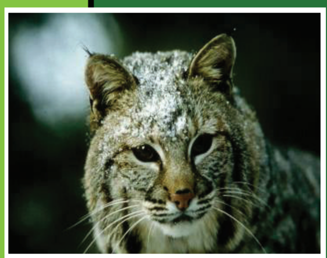
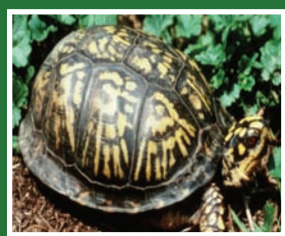
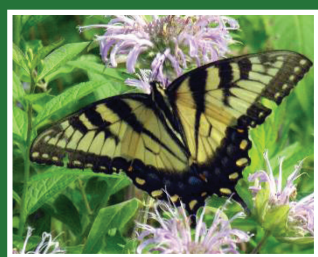
Prepared for the
Ridgefield Conservation
Commission







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Materials referenced in the NRI that are available at the Ridgefield Conservation Commission Office

Natural Resource Inventory Vernal Pool Study Data, 2010*
Natural Resource Inventory Forest Study Site Data, 2010*
Photographs of Ridgefield's Natural Resources, 2010*
Land Conservancy of Ridgefield Property Descriptions, 2009
Forest Stewardship Plan, Connwood Foresters, Inc., 2011
Norwalk River Watershed Water Quality Report, 2008
Guilford CT Natural Resource Inventory, 2002
Bennetts Pond Evaluation, Stearns & Wheeler, 1998-2001
Weir Farm National Historic Site Amphibian & Reptile Inventory, 2000*
Washington, CT Natural Resource Inventory, 2000
Norwalk River Watershed Impairment Inventory, USDA Natural Resources Conservation Service, 1999
Norwalk River Watershed Report, USDA Natural Resources Conservation Service, 1997
Bennetts Pond Stewardship Study, IBM, 1993
Route 7 Natural History Inventory, 1991*
Pierrepont State Park Natural History, Teresa Clark Gallagher, 1991
Norwalk River Benthic Macro Invertebrate Study, Raymond J. Pupedis, 1985
Hemlock Hills - Pine Mountain; A Natural Resource Inventory, Jonathan Kusel and Kent Wommack, 1982
Spring Wildflowers Historical Record, Jack Sanders

An asterisk (*) following a title indicates that the material is available electronically. Contact conservation@ridgefieldct.org.

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1.0 INTRODUCTION

Ridgefield lies at a biological crossroads, with its abundant natural diversity influenced by both coastal and highland ecoregions, as well as its diversity of bedrock and surficial geologies (Dowhan and Craig, 1976). Despite its proximity to the coastline, the rocky upland terrain attains some of the highest elevations in southwestern Connecticut and serves as headwaters for streams and rivers that drain into the Hudson and Housatonic Rivers, as well as the Norwalk and Saugatuck Rivers that empty directly into Long Island Sound.

Ridgefield was settled by English colonists from Norwalk and Milford in 1708 and incorporated under a royal charter in 1709. Ridgefield has a land-use history typical of much of southern New England, which includes clearing of the virgin forest for agriculture and pasturage. This began to decline in the early nineteenth century with the availability of more productive lands in the midwestern United States. This was followed by a period of reforestation, which reached an apogee in the first half of the twentieth century, followed by a period of rapid suburban growth. Ridgefield's population grew from 6,703 in 1950 to 24,638 in 2010.

The natural diversity of Ridgefield has been strongly influenced by centuries of human development. Stone walls lace the landscape, evidence of past attempts to tame and manage the stony soils for cropland and pasture. Small dams are found on many of the streams and rivers, creating impoundments that provided water power for industry as exemplified by the dam and old millhouse at the intersection of Florida Hill Road and Route 7. These impoundments created different still water (lentic) aquatic habitats, when compared to the flowing (lotic) habitats below each dam. The railroad spur from Branchville to Ridgefield's village center has been abandoned, now serving as the much-loved rail trail. A walk along the rail trail provides a quick tutorial on how the construction of the elevated rail bed and the embankments and culverts created distinctive wetland habitats on each side of the elevated walking path. The dry embankments serve as habitat for many creatures, including basking and nesting areas for turtles and snakes.

In 2010 the Ridgefield Conservation Commission partnered with the Metropolitan Conservation Alliance, a program of the Cary Institute of Ecosystem Studies, to create the first-ever comprehensive Natural Resource Inventory (NRI) of the town of Ridgefield. This NRI is a living document—while it catalogs what we know, both past and present, it also recognizes that these are merely snapshots of what is an ever-evolving pattern of change. The reader is particularly directed to the appendices which contain the species-specific information derived from the field surveys done for this document. They are intended to be seen as a work in progress to be added to by future observers of the flora and fauna of Ridgefield. Like so many of its neighboring towns, Ridgefield faces the challenge of maintaining the rich diversity of species and habitats that occur within its thirty-four square miles. While many may argue that "progress" dictates that we continue to lose species, habitats, and diversity, there is an alternative scenario. That scenario simply states that through knowledge and more informed land-use decisions, we will be able to maintain sufficient interconnected areas of natural habitat to allow for the evolution and adaptation of Ridgefield's remarkable biological heritage. This NRI, taken in tandem with the Town's Plan of Conservation and Development (POCD) provides a blueprint for charting a more sustainable future for Ridgefield.

1.1 *Acknowledgments*

This study would not have been possible without the support, encouragement, and assistance of the members of the Ridgefield Conservation Commission: Susan Baker, Carroll Brewster, David Cronin, George Orlan, Alan Pilch, Patricia Sesto, Kitsey Snow and Beth Yanity.

The 2010 NRI field inventory required many hours of slogging through wetlands, climbing mountains, and patiently observing. This work could not have been done without the more than 20 hardy people who made up the NRI volunteers.

Special recognition for the field inventory goes first to David Cronin, whose knowledge of maps and GPS and ability to organize data were instrumental to our success. Without Dave, we would never have known where to go or where we went. And that only begins to account for his hours of help and myriad contributions to our overall efforts.

The following are recognized for their special help:

Jim Tobin generously shared his knowledge about trees and our town; Mike Carpenter's and Allen Welby's keen ears and sharp eyes were essential to the success of the breeding bird survey; Jean Linville used her expertise to guide our photographing of the field work; Kitsey Snow consistently participated in all facets of the fieldwork; Nelson Gelfman is recognized for his ability to locate and his knowledge of turtles and his high level of overall participation; Sandy Toich and Kari Lonning contributed pictures; Donna Roscoe spent countless hours investigating vernal pools; Cheryl Cook for her many contributions, early support, help with meetings and extensive field work; Jack Sanders supplied a historical list of Ridgefield's wildflowers and edited the place names on the maps; Vic DeMasi lent his expertise on butterflies; Michael Beauchene of the Connecticut Department of Environmental Protection taught and led the aquatic macroinvertebrate surveys; Greg Waters and Linda Cook of Weir Farm for their contributions and support; Henryk Taraskiewicz, Executive Director of Woodcock Nature Center for his help; Theodora Pinou, PhD, associate professor with a specialty in herpetology at WestConn, for choosing Ridgefield as a laboratory for her students; Betty Brosius and Aimee Pardee of the Ridgefield Town Planning Department for their input and support; Jacob Muller, Assistant Engineer, Town of Ridgefield, for his contributions to mapping, the Ridgefield Historical Society for historic photographs.

We recognize the technical support that the NRI received from the Highstead Arboretum (Redding, CT). Ed Faison designed the forest study. Bill Labich joined us to work on the Spring Valley survey as did intern Ali Lones. Intern Kari Amick created the Spring Valley maps used in this report.

We thank the Spring Valley neighborhood for allowing us access to their properties and recognize the leadership of Philip and Christine Lodewick, who helped organize the neighborhood volunteers.

Special thanks go to Nancy McDaniel, the Conservation Commission's administrative assistant, who without complaint made endless revisions to various drafts and compiled the species lists and data in the NRI's appendices. Most important, she cheered Ben Oko on throughout the entire project.

Thanks also go to Susan Baker for her extraordinary help in bringing her editorial expertise to the final version of this document.

The funding for this project came from a variety of sources. More than 200 individuals contributed to the Open Space Fund's 2009 special appeal to support the creation of this NRI. The Bay and Paul Foundation generously supported a portion of the work conducted by the Cary Institute, specifically covering a significant portion of the time that Dr. Klemens spent on this two-year project. Additional support came from a donation restricted to the support of Ridgefield's environment authorized by the Department of Planning and Zoning. The Wadsworth Lewis Fund provided multi-year grant support for our efforts spanning 2010-2011.

2.0 SOILS AND GEOLOGY

The word "soil" refers to the first few feet of material below the ground's surface that is subject to weathering and decomposition. Soil is a complex of mineral (weathered rock) and organic material (bacteria, fungi and microorganisms).

Soils provide five important social and biological functions: (1) soils provide a medium for plant growth including agricultural crops; (2) soil properties are the principal factor controlling the hydrologic cycle; (3) soil functions as nature's recycling system, assimilating waste and decomposing materials for reuse; (4) soils provide habitat for a wide variety of organisms; and (5) soil serves as an engineering medium, providing the foundation for every road and dwelling we build (Brady and Weil, 1999).

2.1 *Soil Types*

The soils of Ridgefield consist of those types typical of a Connecticut landscape consisting of rolling hills, ridgelines and stream valleys. Soils of glaciofluvial[1] and alluvial[2] origins dominate the valleys, while soils originating from glacial till[3] dominate the uplands. The ridgelines of Ridgefield are characterized by soils that are shallow to bedrock, interspersed with pronounced bedrock outcroppings.

Soil series occurring in Ridgefield are listed in Appendix 1. A soil series, sometimes called a "soil type," refers to soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. Appendix Table 1 also lists Ridgefield's soil types based on categories including wetland soils, organic wetland soils, limestone-derived soils, floodplain soils and shallow-to-bedrock soils.

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[1] Material deposited by glacial meltwater

[2] Sediment deposited by flooding of rivers and streams

[3] Non-stratified sediment carried or deposited by a glacier

2.1a *Wetland Soils*

Wetland soils are those soils in which the water table is at or near the soil surface for a prolonged period during the growing season. Wetland soils fall within the "poorly drained" and "very poorly drained" drainage class categories as defined by the United States Department of Agriculture (USDA)[4]. Seven drainage classes have been defined, from very-poorly drained (occurring in lowlands) to excessively drained (occurring in uplands) occurring along what is referred to as a "toposequence." Changes in landscape position create different soil drainage conditions, with poorly drained and very poorly drained soils occurring in the low-lying areas of the drainage basin.

Ridgefield's wetland soils are illustrated on Map 1. The most common wetland soil in Ridgefield is the Ridgebury-Leicester-Whitman soil complex. These soil types are so intermingled that they have been grouped as a single soil complex. The mapping unit consists of two poorly drained (Ridgebury and Leicester) and one very poorly drained (Whitman) soil developed on glacial till in depressions and drainageways in uplands and valleys. The Ridgebury and Leicester series have a seasonal high water table at or near the surface (0-6") from fall through spring. The Whitman soil has a high water table for much of the year and may frequently be ponded. The majority of smaller, sloping wetlands in Ridgefield consist of this soil complex.

The Timakwa-Natchaug and Catden-Freetown soil complexes dominate Ridgefield's most depressed lowlands and swamps. These are organic soils consisting of peat and muck material. These soils are very poorly drained, and are typically ponded throughout the year. These soil types dominate Ridgefield's two largest swamp systems, Great Swamp, and Pumping Station Swamp.

2.1b *Floodplain Soils*

Ridgefield's floodplain soils are illustrated on Map 2. Floodplain soils are those soils that are actively inundated by streams and rivers. They consist of fine-textured mineral material deposited by floodwaters referred to as alluvium. Drainage class ranges across the spectrum, from very poorly drained to excessively drained. These soils include the Pootatuck, Rippowam and Saco soil series, in addition to soils classified as fluvaquents-udifluvents, which are young, undeveloped alluvial soils.

2.1c *Shallow-to-Bedrock Soils*

Shallow-to-bedrock soils are soils in which the depth to bedrock ranges from approximately 20 to 40 inches below the soil surface (see Map 4). These soils commonly have outcroppings of bedrock or "ledge." The most common shallow-to-bedrock soil is the Hollis-Chatfield-Rock Outcrop complex, which is common on Ridgefield's mountains and ridgelines including Ned's Mountain, Pine Mountain, Ridgebury Mountain, and West Mountain.

Shallow-to-bedrock soils have moderate to severe development limitations, often necessitating extensive site preparation for the placement of foundations and other construction associated

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[4] The CT Inland Wetlands and Watercourses Act (P.A. 155) defines wetlands as areas of poorly drained, very poorly drained, floodplain, and alluvial soils, as delineated by a soil scientist.

with development. Frequently, these soils have limited capabilities for onsite septic systems without significant landscape modifications such as raised and engineered leaching fields. Filtration capacity is diminished in these soils, which results in a higher risk for groundwater pollution. This is caused by the rapidly permeable substratum that does not adequately filter effluent, or the shallowness of soils that lack the depth to completely filter infiltrated effluent. In addition, shallow-to-bedrock soils occur on moderate to steep slopes, limiting suitability for roads and driveways and increasing the likelihood of erosion when disturbed. The use of low impact development practices (LID), such as infiltration, is also limited due to insufficient soil thickness.

2.1d *Prime Farmland Soils*

The USDA's Natural Resource Conservation Service (NRCS, 2008) has identified soil types that support "prime farmland." Prime farmland is defined as:

> land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban land or built-up land or water areas.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slopes are gentle, ranging primarily from zero to six percent (NRCS, 2008). Prime farmland soils occur predominately on glaciofluvial and alluvial deposits on Ridgefield's valleys and gently-sloping hills and include the Pootatuck, Agawam, Haven and Enfield soil series (see Map 11).

Although there is considerable "prime farmland" in Ridgefield, it has been substantially developed. A clear example of this is that most of the town center is prime farmland. Because of this, the NRI chose to map fields, not farmland, on Map 11.

2.1e *Limestone-Derived Soils*

Limestone-derived soils refer to those soils that have developed from alkaline-rich marble parent material (see Map 5). These include the Fredon, Georgia, Amenia, Farmington, Halsey and Nellis soil series. Fens, a rare wetland type in the Northeast, develop within limestone-derived soils. Rich calcareous fens (pH above 6.0) support rare plants known as calcicoles, as well as rare wildlife, such as the bog turtle (*Clemmys muhlenbergii*). The majority of fens in Ridgefield have been altered or lost due to development. Although there are no fens, trees and other flora do show the influence of limestone soils.

2.2 *Geology*

Geology is the foundation upon which wildlife habitat is built, driving the hydrology and vegetation that develops upon the landscape. Geology can be described in two parts, surficial and bedrock geology. Bedrock refers to the layer of solid rock located below the soil and glacial deposits. Ridgefield's bedrock consists of gneiss, schist and marble. Surficial geology refers to the unconsolidated material overlying bedrock and underlying soil. In Connecticut, this material can range from a few feet to several hundred feet in thickness. Most of the unconsolidated materials are deposits of continental glaciers that repeatedly covered all of New England during the Pleistocene glaciations. These glacial deposits are divided into three broad categories, glacial ice-laid deposits (tills), glacial meltwater deposits (stratified drifts) and postglacial deposits (alluvial and swamp deposits).

2.2a *Surficial Geology*

Ridgefield's surficial geology is illustrated on Map 3 and described in Table 1. Most widespread is the glacial deposit known as till that was laid down directly by glacial ice. Till is characterized by a non-sorted matrix of sand, silt, and clay with variable amounts of stones and large boulders. Glacial meltwater deposits are concentrated in both small and large valleys and were laid down by glacial meltwater in streams and lakes in front of the retreating ice margin during deglaciation. These deposits are characterized by layers of well-sorted to poorly sorted gravel, sand, silt, and clay. Postglacial sediments, primarily floodplain alluvium and swamp deposits, make up a lesser proportion of the unconsolidated materials found in Connecticut. Alluvium is glacial materials reworked during stream and river flooding, and therefore has similar physical characteristics of its glacial parent material. Swamp deposits refer to muck and peat that contain minor amounts of sand, silt, and clay, accumulated in poorly drained areas. Most swamp deposits are less than ten feet in depth and are underlain by either glacial deposits or bedrock.

Table 1: Surficial geology deposits of Ridgefield (see Map 3)

KEY TO SURFICIAL DEPOSIT GROUPS

Glacial ice-laid deposits | Glacial meltwater deposits

Deposit	Extent	Location / Notes
Glacial Meltwater Deposits		
Alluvium overlying sand & gravel	Rare	Very limited in extent in valleys, generally under swamp deposits
Artificial fill	Rare	Developed areas; two small deposits bordering Great Swamp
Gravel	Rare	Two small deposits bordering Candees Pond, the Norwalk River & Miller's Pond
Sand	Rare	Three deposits bordering the Titicus River, Ridgefield Brook & East Branch Silvermine River
Sand & gravel	Uncommon	Pumping Station Swamp, Silver Spring Brook, Norwalk River, Miller's Pond, Titicus River, Little Pond Brook
Sand overlying fines	Rare	Great Swamp
Swamp	Common	Swamps and stream valleys throughout Ridgefield
Swamp overlying fines	Rare	One deposit bordering Ridgefield Brook
Swamp overlying sand overlying fines	Rare	Underlies the majority of Great Swamp
Swamp overlying sand & gravel	Rare	Limited in extent along Ridgefield Brook

Glacial Ice-Laid Deposits		
Thin till	Most common	Uplands
Thick till	Common	Throughout Ridgefield predominately on ridgetops and highlands

DEPOSIT DESCRIPTION OF MAP UNITS

Floodplain Alluvium (overlying sand & gravel) - Sand, gravel, silt, and some organic material, on the floodplains of modern streams. The texture of alluvium commonly varies over short distances both laterally and vertically, and is often similar to the texture of adjacent glacial deposits. Along smaller streams, alluvium is commonly less than 5 ft thick. Alluvium typically overlies thicker glacial stratified deposits, the general texture of which is indicated by the stacked unit.

Artificial fill - Earth materials and manmade materials that have been artificially emplaced. Artificial fill is common throughout the map area but has been shown on this map only where extensive areas of “made land” occur.

Gravel - Composed mainly of gravel-sized particles; cobbles and boulders predominate; minor amounts of sand within gravel beds, and sand comprises few separate layers. Gravel layers generally are poorly sorted and bedding commonly is distorted and faulted due to post-depositional collapse related to melting of ice. Gravel deposits are shown only where observed in the field; additional gravel deposits may be expected, principally in areas mapped as unit sg (proximal fluvial deposits or delta-topset beds).

Sand & gravel - Composed of mixtures of gravel and sand within individual layers and as alternating layers. Sand and gravel layers generally range from 25 to 50 percent gravel particles and from 50 to 75 percent sand particles. Layers are well to poorly sorted; bedding may be distorted and faulted due to postdepositional collapse.

Sand - Composed mainly of very coarse to fine sand, commonly in well-sorted layers. Coarser layers may contain up to 25 percent gravel particles, generally granules and pebbles; finer layers may contain some very fine sand, silt, and clay (delta-foreset beds, very distal fluvial deposits, or wind-blown sediment).

Sand overlying fines - Sand is of variable thickness, commonly in inclined foreset beds and overlies thinly bedded fines of variable thickness (distal deltaic deposits overlying lake-bottom sediment).

Swamp deposits - Muck and peat that contain minor amounts of sand, silt, and clay, accumulated in poorly drained areas. Most swamp deposits are less than about 10 ft thick. Swamp deposits are underlain by glacial deposits or bedrock. They are often underlain by glacial till even where they occur within glacial meltwater deposits. Where swamp deposits are known or inferred to be underlain by sand and/or fines, they are shown on the map by the stacked unit.

Thin till - areas where till is generally less than 10-15 ft thick and including areas of bedrock outcrop where till is absent. Predominantly upper till; loose to moderately compact, generally sandy, commonly stony. Two facies are present in some places; a looser, coarser-grained ablation facies, melted out from supraglacial position; and a more compact finer-grained lodgement facies deposited subglacially.

Thick till - areas where till is greater than 10-15 ft thick and including drumlins in which till thickness commonly exceeds 100 ft (maximum recorded thickness is about 200 ft). Although upper till is the surface deposit, the lower till constitutes the bulk of the material in these areas. Lower till is moderately to very compact, and is commonly finer-grained and less stony than upper till. An oxidized zone, the lower part of a soil profile formed during a period of interglacial weathering, is generally present in the upper part of the lower till. This zone commonly shows closely spaced joints that are stained with iron and manganese oxides.

2.2b *Bedrock Geology*

Ridgefield’s bedrock geology is illustrated on Map 4. Ridgefield is located within a region known as Connecticut’s Western Uplands. The western uplands contains two major landscape regions known as the Northwest Highlands and the Southwest Hills. These regions are divided along a line that runs roughly from the town of Canton to Ridgefield (Bell, 1985). The northwest portion of Ridgefield, approximately north of Route 35, is located within the Northwest Highlands region. The southern portion of town (approximately south of Route 35) is located within the Southwest Hills region. The Southwest Hills region is characterized by metamorphic rock aligned predominately north-south. The Northwest Highlands region is an extension of the Hudson Highlands Plateau, formed by erosion-resistant schists and gneisses. Valleys within the Northwest Highlands Region consist of highly erodible marble.

2.2c *Marble Valleys*

Ridgefield is part of the Southern Marble Valley described by Bell (1985), dominated by dolomitic and schistose marble. Marble is derived from metamorphic limestone, a sedimentary rock composed mostly of carbonate mud and the shell fragments of marine fossils. These materials weather easily, resulting in a highly erodible landform. Over time, the slightly acidic rainwater has eroded wide, deep lowlands between the region's ridgelines. Areas of Ridgefield dominated by marble bedrock are illustrated on Map 5. They are found in both the highlands and the southwest hills.

Ridgefield's marble valleys contain many of the town's largest lakes and ponds, including Lake Windwing, Rainbow Lake, Fox Hill Lake, Mamanasco Lake, and Pierrepont Lake. Pumping Station Swamp and Great Swamp also occur within marble valleys.

2.2d *Ledge and Talus Slopes*

Ridgefield's rugged topography gives rise to various habitats associated with bedrock outcroppings and steep slopes. As one approaches the summit of many of the larger hills such as Pine Mountain the forest gives way to more open areas dominated by bedrock. These dry mountaintop "balds" are important habitat for a variety of plants as well as invertebrate and vertebrate species. Ridgetops are important travel corridors for area-sensitive carnivores such as the bobcat. Ledge habitat occurs when steep slopes intersect bedrock outcroppings. A good example of this type of formation can be found above the junction of Ridgebury and Mopus Bridge Roads, in the area of Ledges Road. These areas are important for snakes as well as a variety of wildflowers that are protected from deer browse by the steepness of the slope. Talus slopes occur below ledges and bedrock outcroppings (Figure 1), where the broken rock jumble is interspersed with leaf material and soil to form a rich habitat for many small mammals, amphibians, and invertebrates.

2.2e *Mountains and Ridgelines*

Ridgefield's name derives from the ridgelines and hills that define the rugged topographic relief of the town. These ridges and their corresponding valleys determine the drainage patterns and settlement patterns, as well as the location of the major transportation infrastructure within the town.

Ridgefield's land surface area of 34 square miles is a two-dimensional measurement taken as if the town were flat. It does not take into account the three-dimensional qualities of the rugged topography, which actually results in the area available to plants, animals, and humans being larger than the town's square miles. Temperature gradients between the ridges and valleys are quite noticeable and can vary several degrees (F) in areas in close proximity at any given time, in turn giving rise to a variety of micro-climates. While these phenomena are not unique to Ridge-

Figure 1: Ledge outcrop with talus on Pine Mountain

field, they play an important role in biodiversity because of the sheer number of ridges and corresponding valleys within the town. The town's highest elevation of 1,012 feet occurs at the summit of Pine Mountain. The topographic relief of Ridgefield is illustrated on Map 6. This map uses shaded relief to illustrate Ridgefield's abundance of ridges and valleys. Ridgefield's prominent hills, some of which are high enough to be referred to as mountains, are listed in Table 2/Figure 2.

3.0 WATER RESOURCES AND AQUATIC HABITATS

3.1 *Watersheds*

A watershed, or drainage basin, is an extent of land where water from rain and snowmelt drains downhill into a body of water, such as a stream, river or lake. The drainage basin includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those watercourses. The drainage basin acts like a funnel, collecting all the water within the area covered by the basin and channeling it into a waterway. Each drainage basin is separated topographically from adjacent basins by a geographical barrier such as a ridge, hill or mountain, known as a *drainage divide*.

Ridgefield's unique geographical position in tandem with its high ridges and deep valleys give rise to five regional drainage basins that feed two major rivers (Hudson and Housatonic) and the Long Island Sound estuary. These regional drainage basins are: the Croton River which in-

Table 2: Mountains, ridgelines and hills of Ridgefield, CT

Mountain / Hill	***Max Elevation***	***Dominant Aspect(s)***
Pine Mountain	1,021	South
Barlow Mountain	972	East
West Mountain	958	Northeast, southwest
Ned's Mountain	956	Variable
Ridgebury Mountain	920	South
Ivy Hill	768	Southwest, northeast
Cains Hill	756	Variable
Nod Hill	650	North
Florida Hill	610	Variable

Table includes named geographic features according to USGS topographic maps and locally used nomenclature. Elevations taken from UCONN 2ft contour LIDAR-derived data

Figure 2: View from Pine Mountain

cludes the Waccabuc and Titicus subregional basins, the Housatonic River which includes the Still River and Miry Brook subregional basins, the Southwest Western Complex which includes the Mill River subregional basin, the Saugatuck River which includes the Saugatuck River subregional basin, and the Norwalk River which includes the Norwalk River subregional basin (see Map 7). Watercourses and their tributaries located within these five basins are illustrated on Figure 3.

Generally speaking, the northern portion of Ridgefield drains towards the Housatonic River, the western portion towards the Hudson River, and the southern and eastern portions towards the coastline via the Saugatuck and Norwalk Rivers. The ridgelines of Ned's Mountain, Pine Mountain, Ridgebury Mountain, and Barlow Mountain form some of the drainage divides between these regional basins.

3.2 *Rivers, Streams and Floodplains*

The size of watercourses and their relative position within a watershed are described by a system known as stream order, which defines the sequence in which small streams flow into larger ones, and the hierarchy of the various tributaries of larger rivers. Figure 3 illustrates this watershed hierarchy within Ridgefield. A first-order stream is so small that it does not have any tributaries that can be mapped. Typically, first-order streams are less than a mile long, with small watersheds, narrow channels and limited flow rates. Second-order streams have only first-order streams as their tributaries. A third-order stream can have first or second-order tributaries. First, second and third-order streams are considered headwaters; their principle function is to collect runoff. First, second and

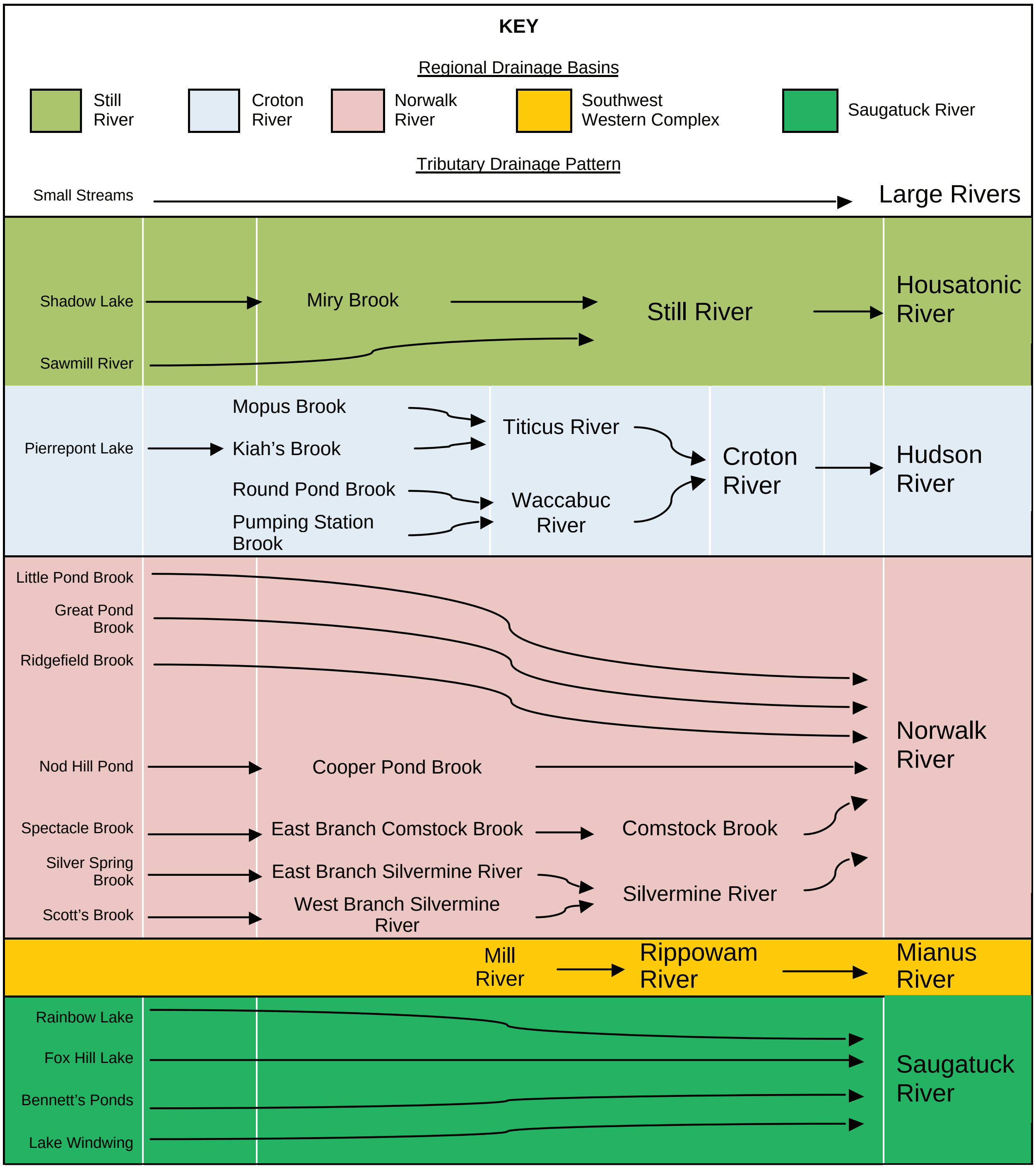


Figure 3: Stream and river drainage patterns, Ridgefield, CT. The regional drainage basins are indicated by the colors noted. Flow path is indicated by arrows, with font size increasing with stream order.

third-order streams typically do not have floodplains and they seldom support fish larger than minnows and dace and are too small for most aquatic recreational activities (MacBroom 1998).

Many first and second order streams occur in Ridgefield, originating as groundwater springs on the ridgelines of Ned's Mountain, Pine Mountain, Ridgebury Mountain, and Barlow Mountain.

Figure 4 illustrates the complete drainage basin of the Mopus Brook, which is part of the Titicus-Croton system.

3.2a *Non-Alluvial Stream Channels*

In most cases, higher order streams consist of steeply-sloping, well-defined watercourses with non-alluvial channels. Non-alluvial channels refers to watercourses that have banks and channels that are resistant to erosion due to the presence of compact glacial till or shallow bedrock. Higher-order streams draining from the hills, mountains and ridgelines consist of non-alluvial stream channels.

Bedrock stream channels are those non-alluvial channels in which the stream substrate is dominated by bedrock. Those streams that occur within soil types such as the Hollis and Chatfield soil series, where depth to non-erodible gneiss and schist bedrock is commonly less than three feet, are examples of bedrock-channel headwater streams.

3.2b *Headwater Stream Ecology*

Headwater and other low order streams are considered to be detritus-based ecosystems (Figure 5). These streams are usually less than 15 feet wide and in undisturbed areas generally have a closed tree canopy (when occurring in undisturbed habitats) that limits sunlight. These streams typically have high levels of dissolved oxygen due to inputs from groundwater (e.g., springs and seeps), high-velocity flow due to steep slopes and shading, which keeps water temperatures cool. Coarse debris such as leaves, twigs and other woody debris are the primary energy source for such streams. Aquatic insects, bacteria and fungi convert this coarse organic material to fine particulate matter that is then exported downstream (MacBroom, 1998).

Fish are sometimes present in small streams, including several species of minnows, suckers, darters, trout (primarily brook trout) and sculpins. But generally speaking, fish habitat is limited in these small streams due to periods of low flow that create intermittent flows (i.e., pools of water separated by areas of dry streambed) and decreased levels of dissolved oxygen.

Inputs of detritus from riparian vegetation is an important source of organic load for headwater streams and associated downstream river ecosystems; therefore, activities that remove streamside vegetation (e.g., development, land clearing) or alter stream ecology (e.g., pond/dam construction) can affect the production of fine particulate matter, which in turn can disrupt downstream ecology.

3.2c *Ecology of Small Rivers*

As headwater streams flow into large streams, brooks and small rivers, the ecology changes from that of a detritus-based food chain to a photosynthesis-based system. These intermediate-sized streams generally have a channel width greater than 15 feet. These wider stream channels receive greater amounts of sunlight due to decreased shading, resulting in warmer water temperatures and increased photosynthesis by algae, mosses and vascular plants attached to stream banks (MacBroom 1998). These small rivers (sometimes referred to as mid-sized streams) receive inputs of fine particulate organic matter from headwater streams as well as direct deposition of coarse organic matter such as leaves and twigs. These streams support a wide diversity of aquatic

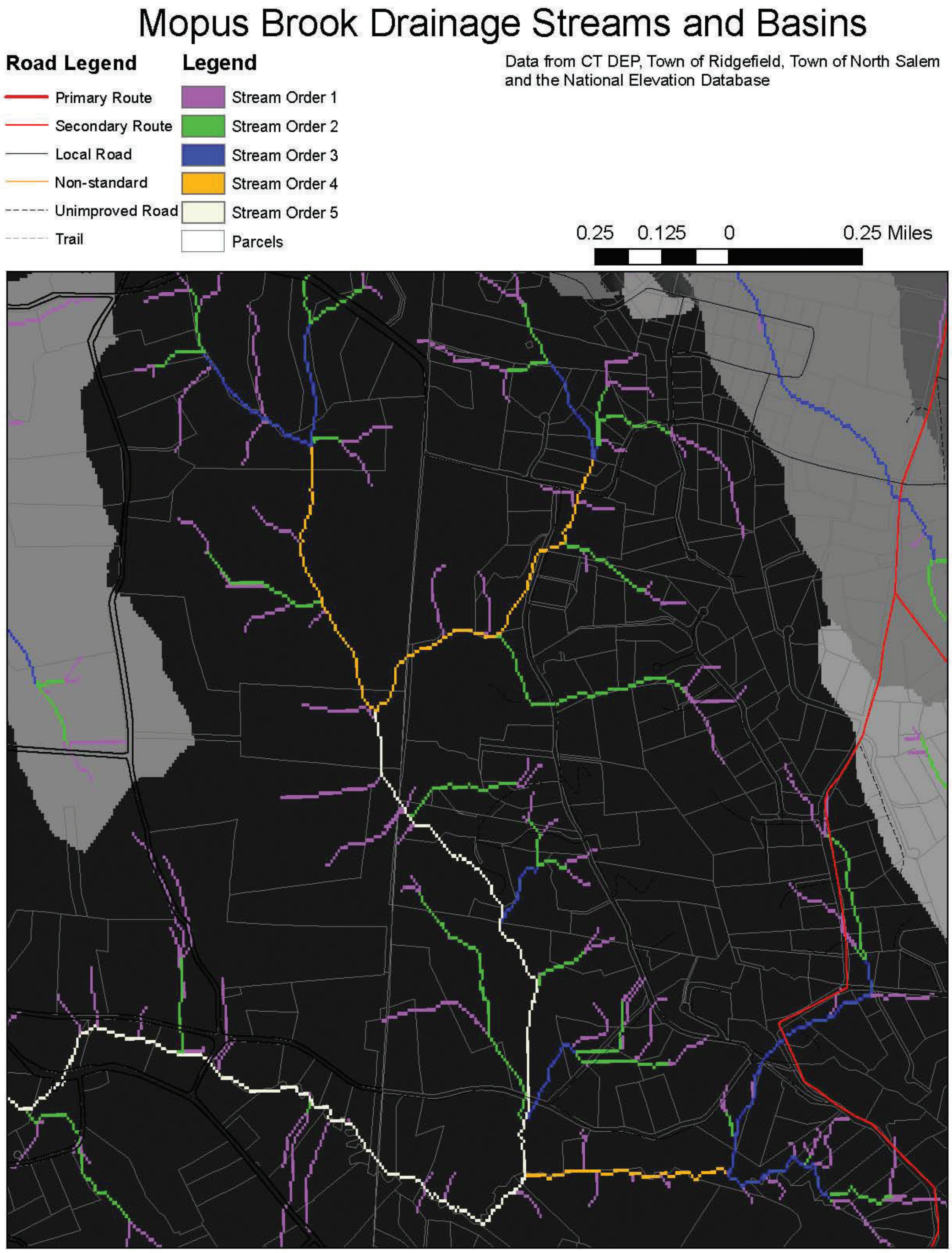
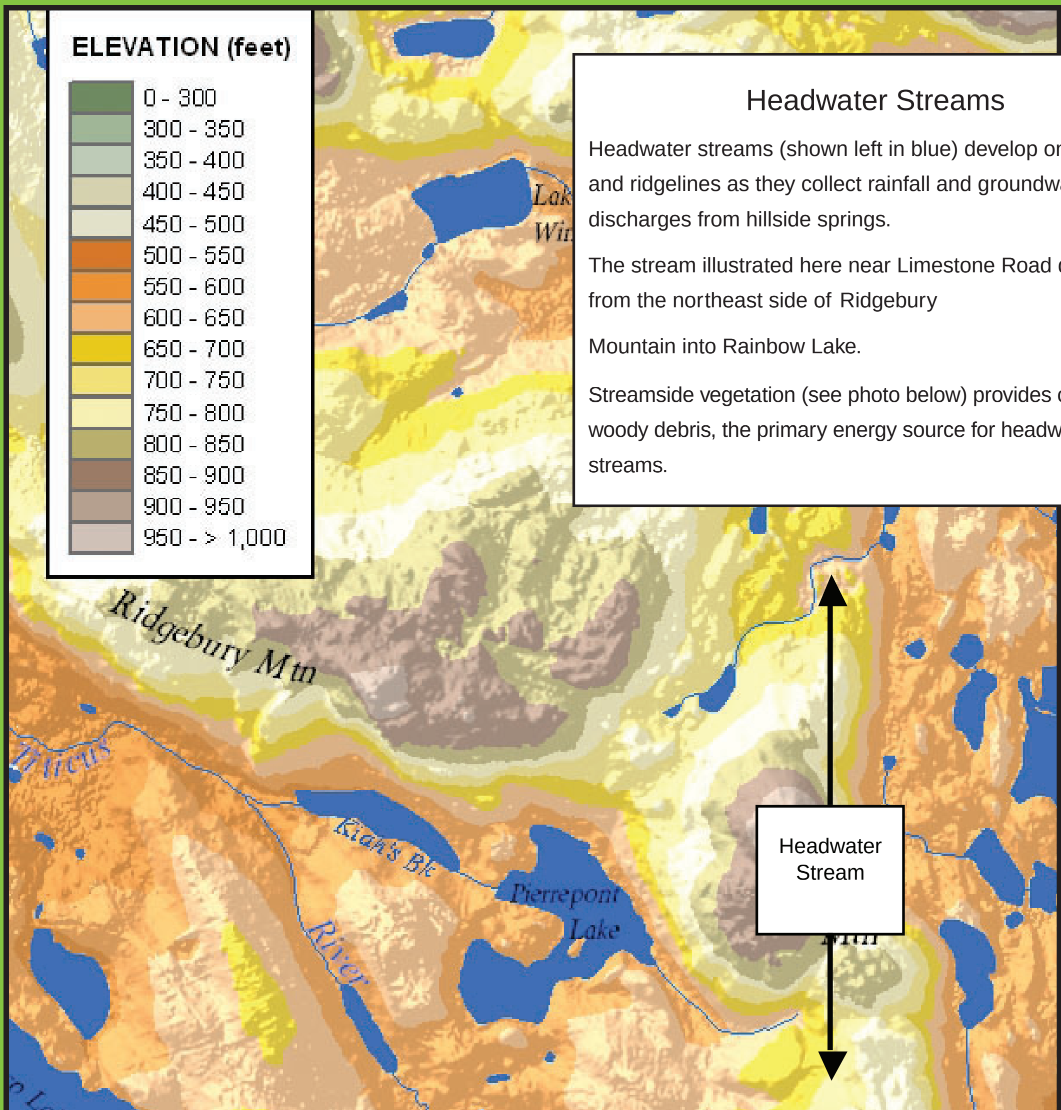


Figure 4: Stream drainage network, Mopus Brook. The shades in the background illustrate different drainage basins; only water from areas that are dark gray flows into Mopus Brook. The colors used for the brook and its tributaries represent stream order. Higher stream order indicates more tributaries. This map was created as a model, based on a digital elevation model (DEM) obtained from the National Elevation Database (prep. K. Amick).

Figure 5: Hillshade model illustrating headwater stream flowing from Ridgebury Mountain



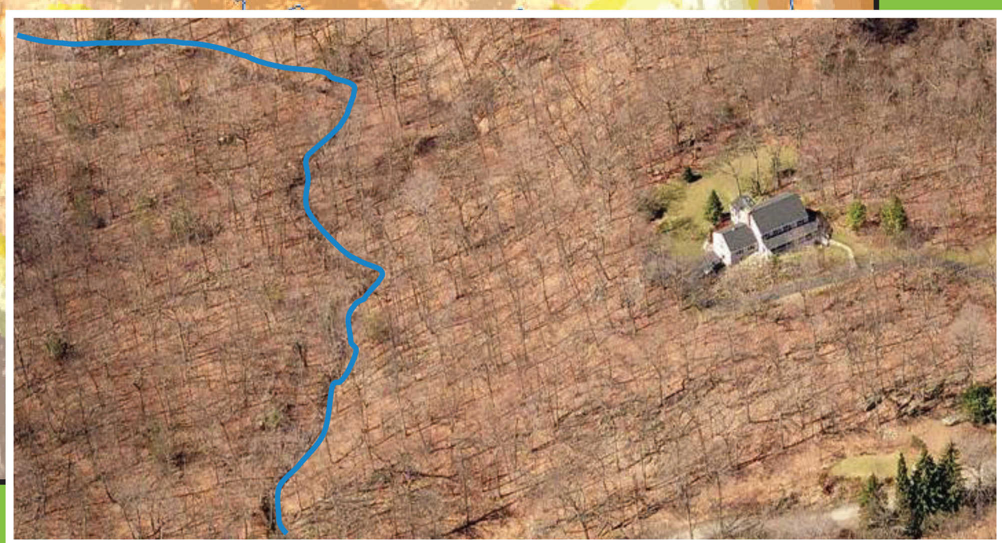
Headwater Streams

Headwater streams (shown left in blue) develop on hills and ridgelines as they collect rainfall and groundwater discharges from hillside springs.

The stream illustrated here near Limestone Road drains from the northeast side of Ridgebury

Mountain into Rainbow Lake.

Streamside vegetation (see photo below) provides course woody debris, the primary energy source for headwater streams.



life from benthic macro-invertebrates (bottom-dwelling aquatic insects) to numerous fish species. Aquatic turtles such as the snapping turtle (*Chelydra serpentina*) and wood turtle [*Clemmys (=Glyptemys) insculpta*] also utilize these mid-sized streams. Examples of small rivers in Ridgefield include the Norwalk, Saugatuck, and Titicus Rivers.

3.2d *Floodplains*

A floodplain is flat to gently sloping land adjacent to a watercourse that experiences occasional or periodic flooding from a river or stream. Floodplains contain deep fine sediment deposited by floodwaters. Historically, floodplains have been prized as agricultural land, as they contain nutrient-rich sediment and are largely free of stones. Floodplains provide numerous ecological functions and services. These include storage and the slow release of ponded floodwater, a process referred to as desynchronization, wildlife habitat, sediment storage, nutrient storage and uptake as well as sequestering of pollutants within sediments, a process referred to as attenuation.

Floodplains border many of Ridgefield's rivers and larger streams. Table 3 lists the watercourses in Ridgefield that have adjacent mapped floodplain soils. Floodplains are common along the gently sloping streams and rivers that flow within the town's marble valleys, such as the Titicus River. The most expansive floodplain borders the Titicus River throughout much of its course.

Floodplain soils occurring in Ridgefield include the Saco, Rippowam, Pootatuck and Fluvaquents-Udifluvents complex soil series. The Saco series consists of very deep, very poorly drained soils formed in silty alluvial deposits. They are nearly level soils on flood plains subject to frequent flooding. In places water is ponded on the surface from late fall through early spring. These soils flood in the spring and after periods of heavy rainfall.

The Rippowam series consists of very deep, poorly drained loamy soils formed in alluvial sediments. They are nearly level soils on flood plains subject to frequent flooding. Slope ranges from 0 to 3 percent. Permeability is moderate or moderately rapid in the loamy layers and rapid or very rapid in the underlying sandy materials.

The Pootatuck series consists of very deep, moderately well drained loamy soils formed in alluvial sediments. They are nearly level soils on floodplains subject to common flooding. Slope ranges from 0 to 3 percent. Permeability is moderate or moderately rapid in the loamy upper horizons and rapid or very rapid in the sandy substratum layers.

Fluvaquents-Udifluvents consist primarily of poorly and very poorly drained alluvial soils. These very deep soils are formed in alluvial sediments on floodplains. Fluvaquents have a seasonal water table at a depth of 0 to 1.5 feet.

Table 3: Floodplains along Ridgefield's streams and rivers

Watercourse (s)	**Floodplain Acreage**	**Soil Type**
Titicus River (includes Kiah's Brook)	187	Pootatuck, Saco, Fluvaquents-Udifluvents complex
Miry Brook and tributaries	180	Saco
Norwalk River and tributaries	88	Saco
Mopus Brook	76	Saco, Fluvaquents-Udifluvents complex
East Branch Silvermine River	56	Rippowam, Saco
Bennett's Farm Brook	52	Saco, Rippowam
Saugatuck River and tributaries	48	Saco
Ridgefield Brook	38	Saco
Mill River	21	Rippowam, Saco
Cooper Pond Brook	12	Saco
Pumping Station Swamp	4	Rippowam
Unnamed tributary to Round Pond Brook	4	Rippowam
Unnamed tributary to West Branch Silvermine River	4	Fluvaquents-Udifluvents complex

Floodplain Soil Type	**Lithology (origin)**	**Textural Group**	**USDA Drainage Class**
Fluvaquents-Udifluvents Complex	Young soils, variable parent material	Variable	PD-VPD
Pootutuck	Derived from gneiss, schist, granite and quartzite	Loamy	MWD
Rippowam	Derived from gneiss, schist, granite and quartzite	Loamy	PD
Saco	Derived from mixed crystalline & sedimentary rock	Silty	VPD

SOURCE: NRCS digital soil survey; Soil Catenas of Connecticut, 2006

Key to USDA Drainage Class

VPD – very poorly drained

MWD – moderately well drained

PD – poorly drained

3.3 *Lakes and Ponds*

A total of 16 named lakes and ponds occur in Ridgefield (see Table 4 and Map 8). These include headwater impoundments as well as impoundments within streams and rivers. The majority of water bodies consist of small, privately owned ponds less than 10 acres in size. Ridgefield's largest water body is Mamanasco Lake, with other large water bodies including Pierrepont Lake, Fox Hill Lake and Rainbow Lake.

Mamanasco Lake is long, narrow and shallow in depth, attaining an approximate maximum depth of nine feet (see Figure 6). The lake is located within a large marble valley located south of Route 116 (North Salem Road). The lake maintains a surface water connection to the Titicus River, and is bordered predominately by residential development.

Table 4: Locally named lakes and ponds of Ridgefield

Waterbody	***Acreage***
Bennett's Pond	9.26
Candee's Pond	6.44
Fox Hill Lake and Upper Pond	29.73
Great Pond	22.46
John's Pond	6.90
Lake Windwing	13.62
Little Pond	5.90
Mallory's Pond	5.98
Mamanasco Lake	85.89
Miller's Pond	2.18
Nod Hill Pond	3.28
Pierrepont Lake	37.70
Rainbow Lake	40.99
Round Pond	33.46
Spectacle Brook Pond	0.90
Turtle Pond	8.67

3.4 *Wetlands*

Wetlands are areas where the presence of water for extended periods exerts a controlling influence on the plant community, soil properties, and animals living in or using them. From a

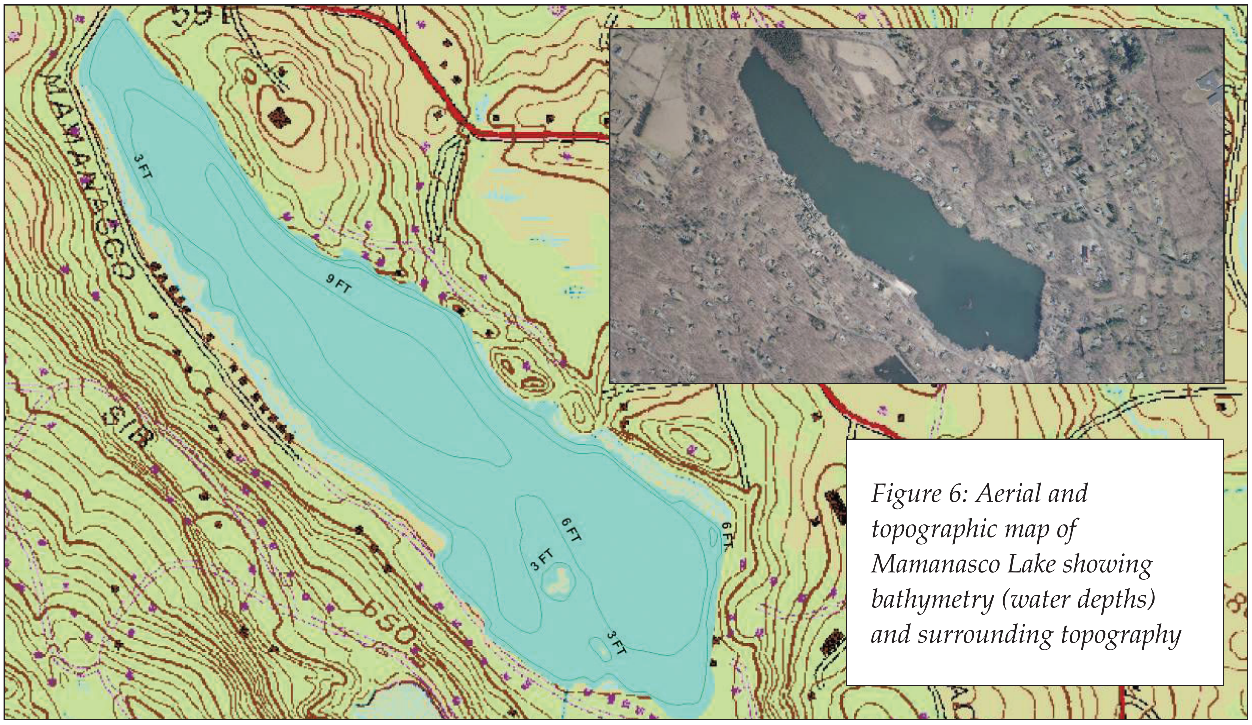


Figure 6: Aerial and topographic map of Mamanasco Lake showing bathymetry (water depths) and surrounding topography

regulatory perspective, the state of Connecticut defines wetlands by soil type. Wetland soils are those soils in which the water table is at or near the soil surface for a prolonged period during the growing season. Wetland soils are those soils that fall within the "poorly drained" and "very poorly drained" drainage class categories as defined by the U.S. Department of Agriculture.[5]

Wetland systems occurring in Ridgefield include riverine (i.e., watercourses), lacustrine (i.e., lakes and ponds, see Figure 7) and palustrine (i.e., forested) systems (Cowardin et al., 1979). The most common wetland types are palustrine. Palustrine wetlands or wooded swamps (as they are more commonly referred to) are wetlands that have a vegetational community characterized by a forest canopy at least 20 feet (6 m) tall.

Calcareous fens have a pH above 6.0 and contain calcium-loving plant species (a.k.a. calciphiles). Fens are wet throughout the year but are not submerged with water. Fens are not forested, but rather are dominated by herbaceous and shrub species, including sedges, sphagnum moss, narrowleaf cattail, pitcher plant, sundew, bog birch, swamp azalea, leatherleaf, large cranberry, highbush blueberry and buttonbush (Hammerson, 2004). Fens are ephemeral habitats that depend upon natural disturbances such as wind storms, periodic inundation by beaver activity, herbivore grazing and especially fire (Hammerson, 2004). Without periodic disturbance, fens and other open-canopy wetlands will eventually revert to forest. As previously described, there are no records of extant calcareous fens within Ridgefield. However, fens occur as small, fringing areas of larger wetland systems and therefore can easily escape detection. Given the extensive distribution of limestone valleys within Ridgefield as well as the historical presence of bog turtles, it is reasonable to assume that patches of fen habitat may still remain in Ridgefield. Moreover, fens can be restored by the removal of woody vegetation where groundwater fed seepage hydrology

[5] The CT Inland Wetlands and Watercourses Act (P.A. 155) defines wetlands as areas of poorly drained, very poorly drained, floodplain, and alluvial soils, as delineated by a soil scientist.

Figure 7: Lacustrine wetland as illustrated by Bennett's Pond

occurs on slopes underlain by limestone bedrock. In fact, it is quite probable that many of Ridgefield's fens have succeeded into red maple-dominated swamps.

3.5 *Vernal Pools*

Vernal pools are seasonal waterbodies that attain maximum depths in the spring and fall and lack permanent surface water connections with other wetlands and waterbodies (see Figure 8). Pools fill with snowmelt and runoff in the spring, although some may be primarily fed by groundwater. The duration of surface ponding, known as hydroperiod, varies depending upon the pool and the year; vernal pool hydroperiods range along a continuum from less than 30 days to almost a year. Vernal pools are generally small in size (less than 2 acres), with the extent of vegetation varying widely. They lack established fish populations, usually as a result of periodic drying, and support communities dominated by animals adapted to living in temporary, fishless pools. In the region, they provide essential breeding habitat for one or more wildlife species including Ambystomid salamanders (*Ambystoma* sp., often referred to as "mole salamanders" because they live in subterranean shrew and rodent tunnels) wood frog (*Rana sylvatica*), and fairy shrimp (*Eubranchipus* sp.). Pools that hold water for more than a year, but dry out intermittently, are referred to as semi-permanent pools, and are also used by amphibians for breeding.

Vernal pools and their adjacent upland habitats contribute a vast amount of biodiversity to landscapes of the northeastern United States. Vernal pools produce a large biomass of frogs that serve as the base of the food chain, and for their small size they provide a variety of critical functions including flood water detention, aquifer recharge, nutrient cycling, and denitrification. However, due to their small size and seasonality, these wetlands are often overlooked or discounted and are disproportionately impacted by development, especially suburban sprawl.

Figure 8: One of Ridgefield's many vernal pools studied during the 2010 NRI survey

A vernal pool survey was conducted by volunteers during the spring of 2010. The data collected during that survey effort is compiled in Appendix 2.1. The survey focused on documenting species from egg masses found in the pool. This was less intrusive than using traps and has comparable accuracy.

Vernal pools and vernal pool conservation zones are illustrated on Maps 9 and 10. These include 69 pools confirmed by field work in 2010 or by other studies (Bogart and Klemens, 2008; Klemens *unpublished data*) to serve as breeding habitats for vernal pool obligate species. Seven pools initially identified through aerial photographs and topographic maps were found to be lacking obligate species during the 2010 NRI inventory (Appendix 2.1), and 16 potential pools, also identified via aerial photographs and topographic maps, were not inventoried in 2010. It is also expected that as-of-yet undiscovered vernal pools occur within Ridgefield. The majority of vernal pools in Ridgefield were identified by the presence of wood frogs (*Rana sylvatica*) and/or spotted salamanders (*Ambystoma maculatum*). A smaller number of pools also contained the much less common, long-hydroperiod marbled salamander (*Ambystoma opacum*) and the State-listed Jefferson salamander (*Ambystoma jeffersonianum*) (Figure 9) found at two widely separated upland sites in Ridgefield.

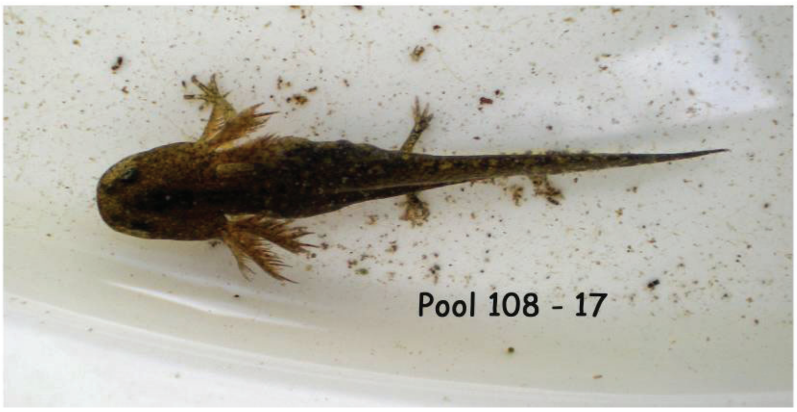


Figure 9: Marbled salamander larvae were documented at several vernal pools during the 2010 NRI survey

Vernal pools are defined, assessed, and ranked by criteria (*see* Calhoun and Klemens, 2002: 9) that include the presence of obligate species, the presence of State-listed species, the number of egg masses, and the condition of the landscape surrounding the pools. One of the issues contributing to the increasing scarcity of functioning vernal pools is that in order to remain functional, pools require extensive areas of forested habitat surrounding them (at least 750 feet). Ridgefield's protected areas, including Hemlock Hills, Wooster Mountain, and Woodcock Nature Center contain some of the most extensive vernal pool habitats (Figure 10). An examination of Map 9 illustrates that vernal pools often occur in clusters, their critical upland habitat zones (750 feet from the high water mark of the pool) often overlap, indicating that these pools have a meta-population function. This means that there is migration between pools resulting in genetic exchange and higher levels of overall population viability than single isolated pools.

Vernal pools are under threat in many of the developed portions of Ridgefield.

3.6 *Groundwater Aquifers and Recharge Zones*

An aquifer is a geologic formation (permeable rock or stratified drift) that yields drinking water. Ridgefield has one State-designated aquifer as well as eight locally designated aquifers.

3.6a *State-Designated Aquifer Protection Area (APA)*

The Connecticut Department of Energy and Environmental Protection (CT DEEP) manages a cooperative program partnering with municipalities and local water companies to delineate, designate, and protect water supply wells or well fields located in sand and gravel aquifers that serve more than 1,000 people (i.e., stratified drift deposits). These are colloquially referred to as

Figure 10: Example of vernal pools visible on birds eye aerial photography

wellhead protection areas. Ridgefield adopted the DEEP's land use regulations for APAs on April 25, 2010, protecting the town's single state-designated aquifer, the Oscaleta Well Field, centered below Mountain and Oscaleta Roads and Pumping Station Swamp (Figure 11). This well field lies completely within the town's boundaries.

The CT DEEP APA regulations are designed to minimize the risks of contamination to well fields by restricting certain types of land uses that store, handle or dispose of potentially hazardous materials as well as requiring pre-existing, non-conforming land uses to be registered. The Aquifer Protection Area Program responsibilities are jointly shared between the CT DEEP, the municipalities and the water companies using the aquifer. The CT DEEP is responsible for overall program administration, establishing state land-use regulations and standards, approving aquifer protection area maps and local regulations, and developing guidance materials.

Municipalities in the program are responsible for appointing an aquifer protection agency, inventorying land-uses within the aquifer protection area, designating the aquifer protection area boundary, and adopting and implementing local land use regulations. The agency regulates land-use activities within the aquifer protection area by:

- Registering existing regulated activities
- Issuing permits for new regulated activities
- Overseeing regulated facilities
- Educating their citizens on ground water protection

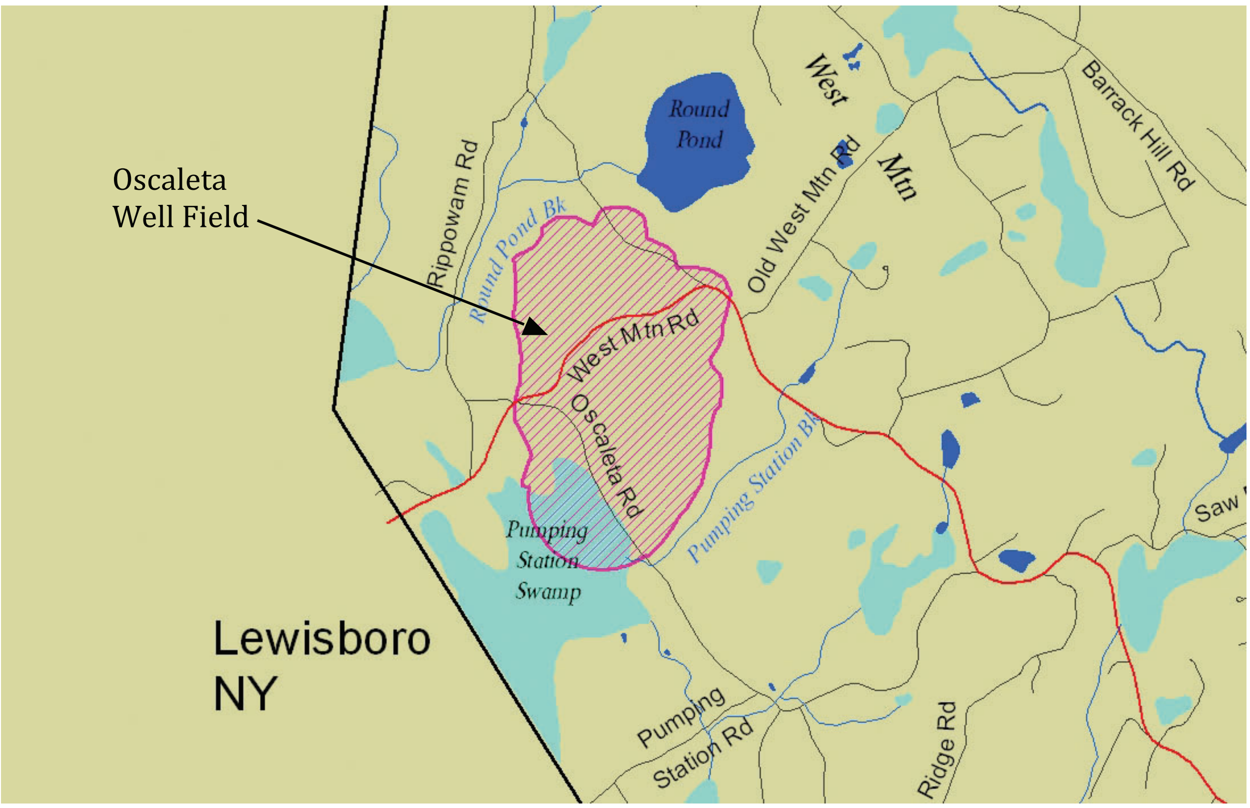


Figure 11: Map showing the location of the Oscaleta well field Aquifer Protection Area

Water companies are required to map, using methods specified in state mapping regulations, the critical recharge areas of the aquifer that provide water to the well fields. This preliminary mapping is refined by the water companies using extensive, site-specific data and groundwater modeling to determine the final mapping area. The final mapping defines the regulatory boundaries for land use regulations. In addition to mapping, the water companies:

- Assist towns with their protection programs and oversight of the aquifer protection area
- Conduct well field monitoring to warn of contamination
- Conduct well field monitoring to detect contamination
- Plan for land acquisition and protection around well fields

A final (adopted) APA, the Lake Kenosia well field (A72), occurs immediately north of the Ridgefield town line in Danbury. A small area of land within Ridgefield drains to this APA (CT DEP local basin #6601-01), including a small unnamed stream draining from Shadow Lake located north of Shadow Lake Road.

3.6b *Locally Designated Aquifer Protection Zones*

In 1990 Ridgefield identified eight stratified drift aquifers of local significance. These lie below certain sections of the Titicus, Norwalk, and Saugatuck river drainages, as well as below several of the town's largest swamps (i.e., Great Swamp, Pumping Station Swamp, and New Purchase Swamp). Authority to manage land uses to protect these aquifers from pollution was assigned to the Planning and Zoning Commission. Figure 12 from Ridgefield's Plan of Conservation and Development (POCD, 2010) illustrates both the Oscaleta Well Field, the eight locally designated aquifers, as well as two documented areas of ground-water contamination.

4.0 TERRESTRIAL HABITATS

A habitat is the physical and biological environment used by an individual or a population of a species. Habitat loss is the conversion of one habitat type to another such that the new type no longer supports a given species (Johnson and Klemens, 2005). "Terrestrial habitat" refers to upland or non-wetland habitat types. Terrestrial habitats can generally be divided into two categories, forested and non-forested. Forested refers to areas dominated by deciduous, coniferous or a mixture of deciduous and coniferous tree species.

Non-forested habitats, often referred to as "successional habitats," are habitats dominated by shrubs, small trees and herbaceous vegetation. "Succession" refers to the process by which non-forested habitats such as fields will naturally revert to forest over time. These non-forested habitats require regular disturbance to prevent succession into forest. Disturbances can include natural disturbance, such as fire or tree-throw resulting from windstorms, but is most often of anthropogenic origin, such as mowing or tree-harvesting. Successional habitats in Ridgefield are post-agricultural lands such as fields and meadows.

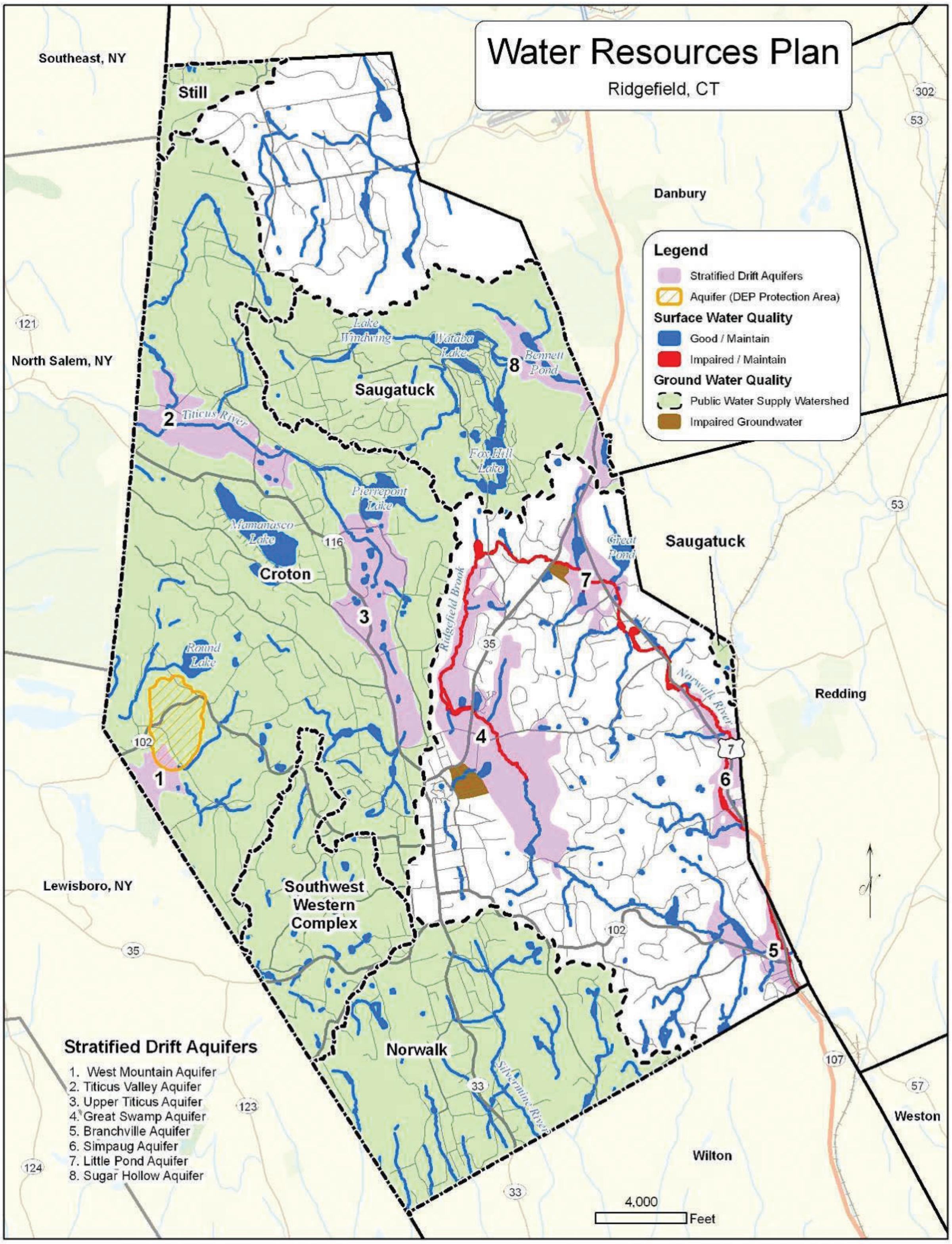


Figure 12: Water Resource Plan taken from the Ridgefield POCD showing locally-designated aquifers

4.1 *Forest*

Currently, the State of Connecticut is approximately 60 percent forested (CT DEEP, Division of Forestry). According to land cover data from the University of Connecticut's *Center for Land Use Education and Research* (CLEAR), Ridgefield's land cover parallels that statewide trend, with a total 59.8 percent forest cover according to CLEAR's 2006 land use/land cover data derived from satellite imagery. Ridgefield covers approximately 22,300 acres of land, with 13,339 acres in deciduous, coniferous or wetland forest cover types (see Figure 13A). In an effort to assess the ecological value of this forest cover, CLEAR conducted a second analysis of this land cover data in order to identify interior or "core" forest habitat, defined as forest located greater than 300 feet from any non-forested land cover type. Over the past few decades, numerous studies have identified "edge effects" resulting from forest fragmentation – the breaking up of large contiguous forest tracts into smaller tracts or "fragments", as having a significant negative impact on forest-dwelling flora and fauna. This CLEAR study, called the *Forest Fragmentation Analysis Project*, analyzed its satellite-derived forest cover data to distinguish areas of fragmented forest from areas of core, or high-value, forest habitat. The project identified the following forest categories:

<u>CLEAR's forest fragmentation analysis categories (See Figure 13B)</u>

Patch Forest Forest pixels[6] that comprise a small forested area surrounded by non-forested land cover.

Edge Forest Forest pixels that define the boundary between core forest and large non-forested land cover features.

Perforated Forest Forest pixels that define the boundary between core forest and relatively small clearings (perforations) within the forested landscape.

Core Forest - Forest pixels that are relatively far from the forest – non-forest boundary. Essentially these are forested areas surrounded by more forested areas. Core forest is divided into three classes. Small core consists of those forest patches that are smaller than 250 acres. Medium core forest patches are between 250 and 500 acres and large core forest patches are greater than 500 acres.

This forest fragmentation data reveals that, although 59.9 percent of Ridgefield's land is covered in forest, only 27 percent of that forest, or 3,613 of 13,339 acres, is considered core forest, with only 1,443 acres considered to be "large core" forest in excess of 500 acres.

The preservation of this large intact forested tract within Ridgefield, the Bennett's Pond–Hemlock Hills–Pine Mountain complex occurred serendipitously. The Hemlock Hills–Pine Mountain tract was slated for development. However, when the owner Otto Lippolt died, his widow did not pursue subdivision and in 1967, the town bought the property. The Bennett's Pond tract, owned by IBM but never developed, was contiguous with these town-owned lands. In the late 1990s, it was sold by IBM to a private developer. In 2005, the town, in partnership with the State of Connecticut, acquired 450 acres of the former IBM property through eminent domain, resulting in 1,200 acres of un-fragmented forest.

The core blocks greater than 100 acres in size were mapped (see Map 11). A total of 15 separate forest blocks were identified (see Table 5). Forest blocks were mapped by analysis of color ortho-

[6] The CLEAR program uses a 30 x 30 meter pixel size for analysis.

Figure 13A: Forest types as a percentage of total land cover (total forest cover 59.9 percent)

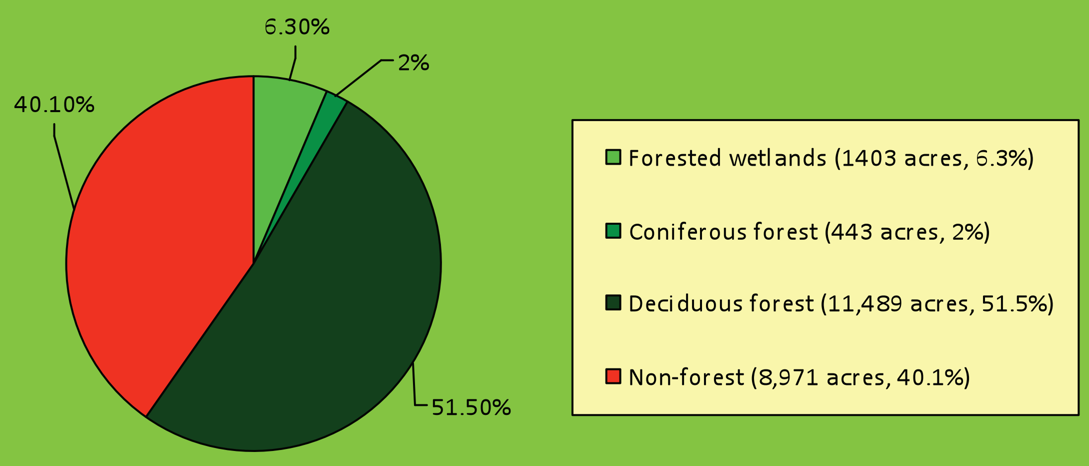


Figure 13B: Percentage of Ridgefield's total land cover by forest fragmentation analysis categories

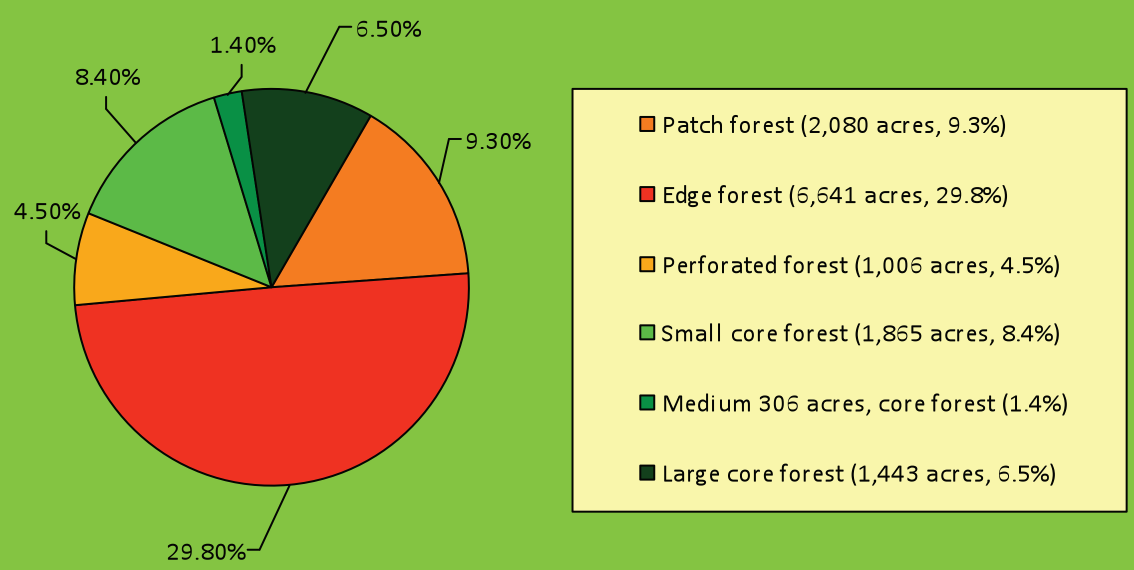


Table 5: Forest blocks greater than 100 acres in size

Block	Block Name	Acres	Location / Characteristics
1*	Keeler Drive	28	Uplands and wetlands south of Keeler Drive and contiguous with forest in North Salem, NY
2*	Oroneca Road	41	Uplands west of Oroneca Road contiguous with forest in North Salem, NY
3*	Rippowam Road	52	Steep slopes, drainage ways and wetlands west of Rippowam Road along the North Salem, NY Line
4*	Great Pond Brook	72	Ridgetop and wetlands bordering Great Pond Brook contiguous with forest in Redding
5*	Pumping Station Swamp	86	Pumping Station Swamp west of Oscaleta Road; forest is contiguous with land in adjacent Lewisboro, NY
6	Farmingville Road	93	Predominately forested wetlands north of Farmingville Road
7	Maplewood Road	126	Ridge top forest located south of Maplewood Road and Route 35
8	Tanton Hill Road	128	Forested wetlands surrounding Ridgefield Brook
9*	Sleepy Hollow Road	133	Uplands and wetlands west of Sleepy Hollow Road and north of Round Pond contiguous with forestland in North Salem, NY
10	Mopus Bridge Road	137	Forested floodplains and wetlands bordering the Titicus River south of Mopus Bridge Road
11	Silver Spring Road	141	Slopes and headwater wetlands along the Lewisboro, NY line and west of Silver Spring Road
12*	Spectacle Brook	173	Uplands and forested wetlands bordering Spectacle Brook; forestland is contiguous with forest in adjacent Wilton
13	Great Swamp	271	Great Swamp forested wetlands
14	Pierrepont State Park	386	Predominately uplands and ridgeline located on Barlow and Ridgebury Mountains
15*	Bennett's Pond/Hem-lockHills/ Pine Mtn/Wooster Mtn	1318	Upland and ridgeline forest located on Pine Mountain, Ned's Mountain, Wooster Mtn (Danbury) and south of Bennett's Pond
*Indicates forest blocks larger than 100 acres that include lands in contiguous towns			

photography (2008, both "leaf on" and "leaf off" sources were analyzed) where development and roadways are easily discernable from forest cover. Note that mapped forest blocks do not include land within 100 feet of developed areas (e.g., roads, subdivision) or non-forested areas (e.g., clearings, fields) in order to account for the minimum "edge effect."

Examples of Ridgefield's wildlife that are dependent upon large intact forest blocks include Jefferson salamander, slimy salamander, scarlet tanager, ovenbird, wood thrush and eastern wood pewee. Large blocks of forest are critical to these noted species because they provide what is referred to as “forest-interior” habitat. Forest-interior habitat is forest located away (approximately 100-300ft) from the forest edge (i.e., the boundary between forest and another habitat or development). This edge forest is often degraded and in a transitional state. Forest edges have a higher rate of brood parasitism, and predatory species such as the raccoon or cowbird occur at higher densities along the forest edge. As large forest blocks are fragmented by development, this increases the amount of edge forest habitat and decreases the amount of forest-interior habitat (see Section 4.3). This edge forest is typically not utilized by forest-interior bird species such as the scarlet tanager or wood thrush.

4.1a *Forest Composition*

Three data sources were used to examine the forest composition of Ridgefield: (1) a formal study of forest plots by the 2010 NRI volunteers under the guidance of Edward Faison of Highstead (see Figure 14); (2) A study conducted by Connwood Foresters (2011) on the town-owned lands that fall within the New York City watershed, i.e., the Titicus drainage; and (3) an informal inventory of the trees found on Land Conservancy property. Information regarding these studies is included in Appendixes 2.2 and 2.3.

The three studies show the makeup of Ridgefield’s forest to be a combination of sugar maple dominated sites, red maple dominated sites and oak dominated sites (Figure 15). Each has its own significance: sugar maples grow well where the soil is less acidic, and therefore are common in Ridgefield’s limestone valleys; red maples are the dominant species in wet soils, where they predominate in forested wetlands. Oaks are found on dryer ground, such as the slopes and peaks of Ridgefield’s ridges and hilly terrain. Hemlocks are the predominant evergreen tree found in Ridgefield. They are located primarily, but not exclusively, in the Hemlock Hills area.

The distribution of the tree species found in the NRI study is shown on Figure 16.

Forest surveys also confirmed the presence of several diseases. Hemlock Wooly Adelgid was found in many areas, with impacts ranging from severe infestation and stand deterioration to minor infestations. Ash was often found dead from “ash decline,” a term used to define the loss of ash trees typically resulting from multiple environmental stressors. Some older sugar maples also showed evidence of decline.

The forest understory (i.e., shrubs and tree seedlings) was also examined during these surveys and revealed a lack of plant species diversity. Oak and hemlock seedlings were uncommon or absent at many sites. Beech seedlings were more common as they are less susceptible to deer browse due to the fact that they produce new growth via root suckering. In wetter areas, the understory consisted of spicebush, witch-hazel, highbush blueberry, and winterberry. The predominant plant found throughout the forest floor was barberry, a non-native invasive plant. Vines of bittersweet, another non-native invasive plant, were also commonly noted.

The paucity of a diverse native shrub layer can have a negative effect on biodiversity, as many species require a structurally diverse forest understory. The lack of diversity in the forest understory can be attributed to a combination of factors including deer browse, acidic soils, older forests with limited light availability, and the negative impact of non-native earthworms on soil composition.

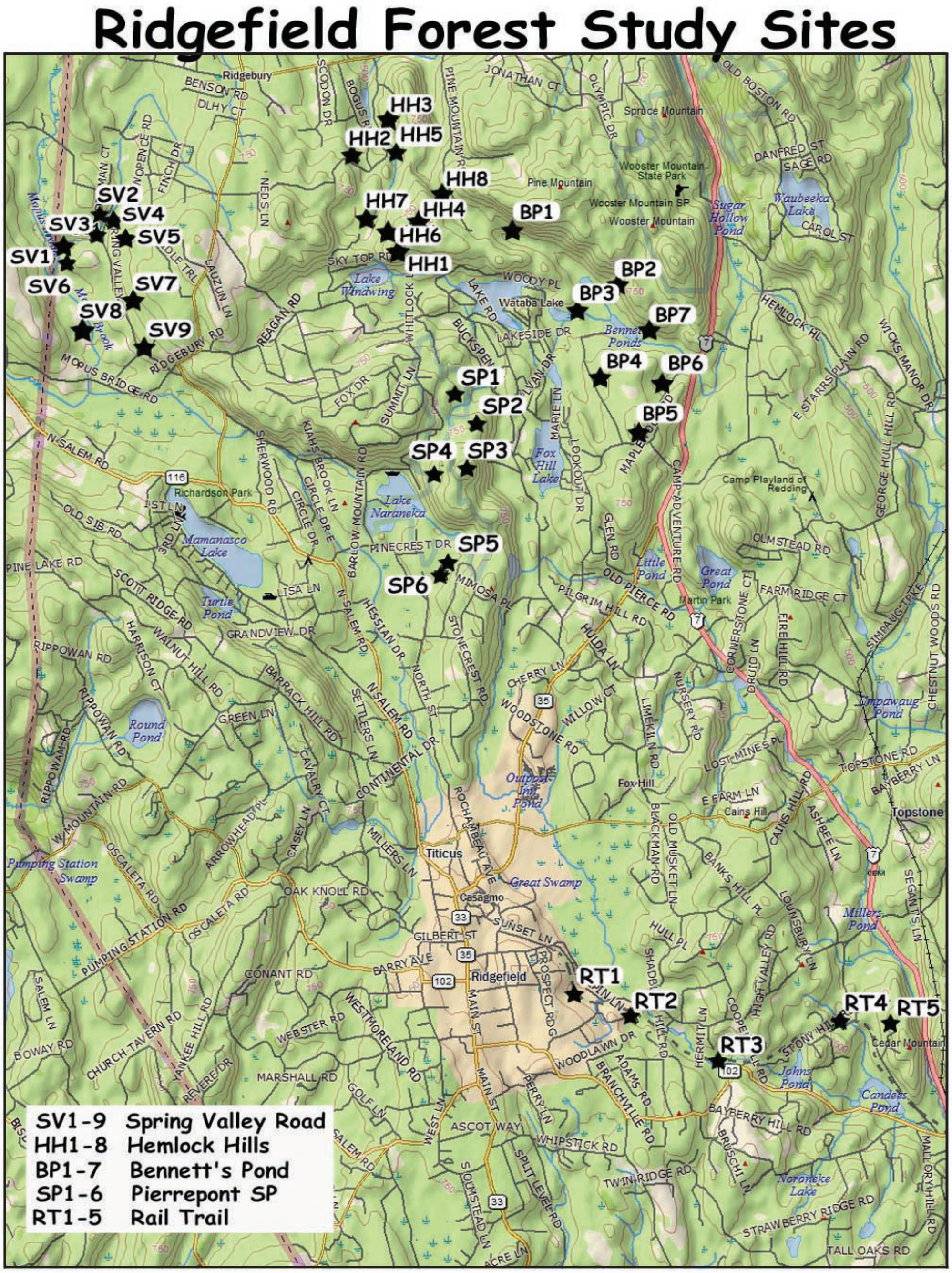
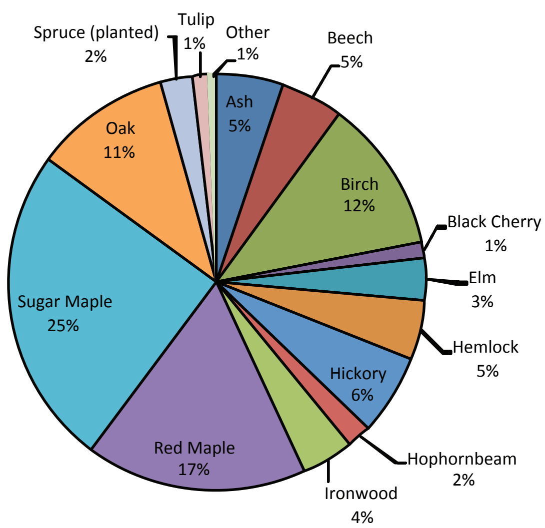


Figure 14: 2010 NRI forest study sites

As part of the 2010 NRI survey work, forest mensuration plots were established using a protocol developed by Edward Faison, a forest ecologist based at the Highstead in Redding, CT. All the sites surveyed were in five areas of concentration. Each site measured 20 x 20 meters. All woody material was identified and measured.

Figure 15: Ridgefield's mixed deciduous forest

Figure 16: Percent composition of 960 trees surveyed in 2010, by species



The age of Ridgefield's forests is highly variable and dependent upon current and past land-use practices. None are thought to be older than 200 years due to the almost complete absence of forest in 1808 (Bedini, 1958). The age of several large trees was established by core boring as part of a study done by Edward Faison for the Highstead. The oldest tree found was 155 years old, a white oak 46 inches in diameter. As farmland was abandoned, a process that started in the late 1800s, the forests were reestablished. This process of land abandonment and reforestation lasted through the 1940s. Looking at the change in forest cover in Spring Valley (Figure 21, Section 6.1), one gets a clear picture of how much land went from field to forest after 1934. By the 1960s, abandoned fields were no longer returning to forest but were being converted to residential development.

4.2 *Early-Successional Habitats*

As discussed in Section 4.0, early-successional habitats are non-forested habitats dominated by a mixture of shrubs, herbaceous vegetation and young trees. Common habitat types include grasslands, old fields, shrublands and young forest. These habitat types occur most commonly in agricultural landscapes, as they generally develop on cropland or pastureland that has been left fallow (see Figure 17).

Figure 17: Successional habitat near Lake Windwing illustrating the gradient from herbaceous field to shrubland to young forest

Grassland is a broad term that applies to many open land habitats. Typically we think of grassy areas with no shrubs or trees and no agriculture. Pasture and hayfields can be managed to provide habitat for grassland species like bobolink. They need to be of sufficient size, greater than 20 acres, and then not mowed until the middle of July. Ridgefield has no hayfields of this size and only has pastures that are being managed for grazing so are not being used for hay.

Old fields differ from grasslands in that they contain a mix of grasses and herbaceous plants along with shrubs and some tree seedlings and saplings. Old fields vary from upland meadows dominated by herbaceous plants such as goldenrod and meadowsweet to successional openings containing a large component of shrubs. The later stages of old fields are commonly referred to as ***shrubland***. Old fields and shrublands vary greatly in structure and composition of herbaceous and woody vegetation, depending on the soils, moisture, and time since last disturbance (see Figure 18). As time passes, these old forests become treed through a lengthy process of first being populated by "pioneer" species like red cedar and cherry. This is followed by the shade-tolerant hardwoods—oak, beech, maple, hickory, and hemlock, which form the permanent woodlands of Ridgefield.

Absent anthropogenic or natural disturbances such as grazing, mowing or burning, grassland will revert to meadow, then to old field, then to new forest and eventually to climax forest.
This process is referred to as succession, and collectively, these habitat types are referred to as early-successional habitats.

Early-successional habitats are scarce in Ridgefield, occupying approximately 238 acres of land. The majority of this acreage, approximately 195 acres, is occupied by small annually-mowed fields. The remaining 43 acres can best be classified as old field habitat. Two additional agricultural land-use classes occur in Ridgefield, pasture (69 acres) and orchard (13 acres); however, these areas are more intensively managed and therefore are unlikely to provide significant habitat for early-successional wildlife species.

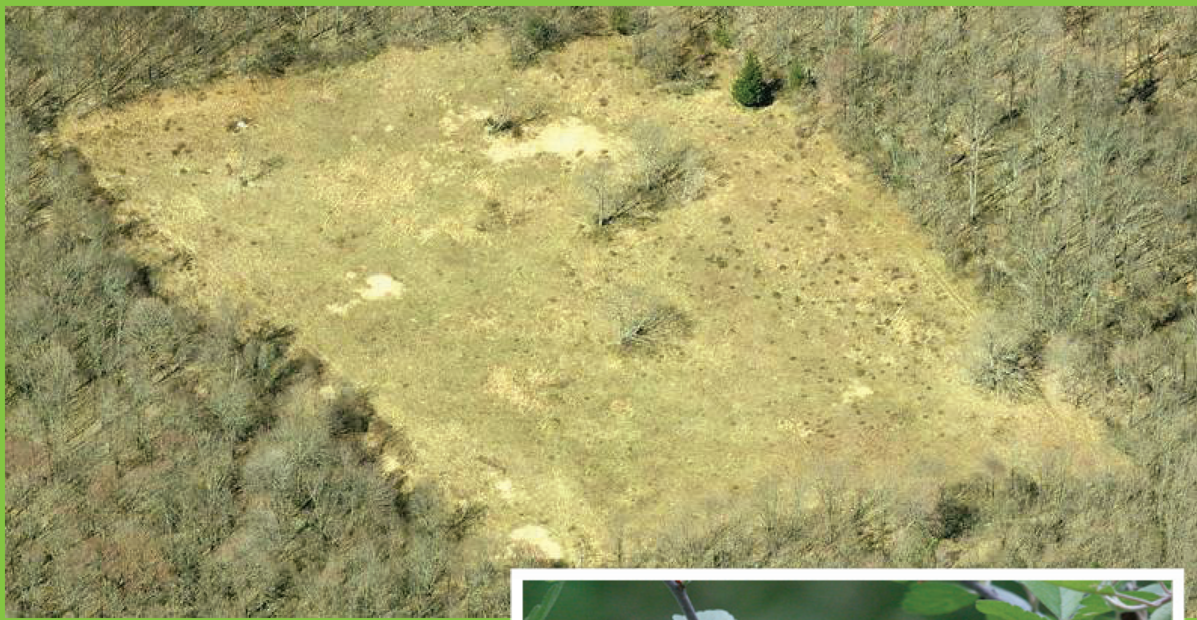


Figure 18: Old field habitat

Birdseye view of old field habitat near Bennett's Farm Road. This field supports the blue-winged warbler, a declining shrubland species.

4.3 *Fragmented Suburban and Urbanized Habitats*

Habitat fragmentation occurs when large contiguous habitat areas are broken into smaller pieces, either through natural or man-made processes. These habitat "fragments" are subsequently surrounded by non-suitable habitat for a given species. The most common cause of habitat fragmentation is residential development resulting from sprawl.

Populations of some wildlife species increase in response to suburbanization. These species, referred to as "development-tolerant" focal species, are usually habitat generalists, having non-specific habitat requirements (see Section 5.1). Human alterations to landscapes favor, or "subsidize" these generalists, which tend to be found in areas that have already been degraded or along edges, such as highway right-of-ways (Mitchell and Klemens, 2000). Examples of such species include corvids (crows and jays), Canada geese (*Branta canadensis*), bullfrog (*Rana catesbiena*), raccoon (*Procyon lotor*) and white-tailed deer (*Odocoileus virginiana*). As suburbanization proceeds, development-sensitive species are out-competed by the more development-tolerant species. In this manner, the biomass of development-tolerant species tends to increase, while the overall biodiversity of development-sensitive species declines.

Much of Ridgefield is dominated by medium to large-lot residential development, characterized by large homes surrounded by mature trees and extensive lawns interspersed with small woodlots (Figure 19). These areas are not devoid of wildlife, but are mostly suitable for development-tolerant or "backyard" wildlife. Typical birds include the American robin, northern cardinal, catbird and blue jay. Typical mammals include squirrel, eastern chipmunk and white-footed mouse. While these residential areas can give the appearance of being forested, they are incapable of supporting less common forest-specialists including the spotted salamander or scarlet tanager (*Piranga olivacea*).

These fragmented habitats also create a host of other ecological problems including degraded water quality and stream flashiness due to increased stormwater runoff, disruption of phenological (cycles of flowering) patterns due to light pollution, increased nocturnal species activity, increased predation due to dogs and cats, and noise pollution which interferes with species such as birds and frogs that depend upon audial cues for breeding and territorial defense.

5.0 WILDLIFE

Since the beginning of civilization, humans have been intrigued with and fascinated by animals, seeing in them reflections of themselves. The boundaries between human and animal are blurred in many ancient societies, including the deification of certain species, and attribution of human qualities to others. Our interest in animals continues to the present day, indeed it is that component of the natural world that is most readily accessible and of interest to humans. Whether it be the new-found presence of black bears, the fear of rattlesnakes, or the concern with over-abundant

Figure 19: Large-lot residential development can often give "the illusion of green," but in fact these areas only support the most adaptable wildlife. This suburban forest habitat is incapable of supporting rare or unique species associated with unbroken forest blocks. Note the wetland visible on the left side of the photo. This type of land-use pattern makes it difficult for wildlife to effectively move between wetland and upland habitats.

deer, wildlife figure prominently into public discourse. Bird watching, vernal pool exploration, and wildlife rehabilitation are all parts of our enduring bond with the animal kingdom. Wildlife can also provide us with important lessons and information that guide our own survival on this planet. Many species serve as the proverbial canary in the mine shaft; as they decline and disappear because of environmental deterioration, so in turn is our very own existence threatened.

5.1 *The Focal Species Approach*

The process of evaluating focal species, and its implications for ecosystem health and land use is termed the "Focal Species Approach," or simply "FoSA." The results of FoSA analysis can enhance planning efforts by assessing the importance of individual sites for conservation. For example, development should be discouraged or clustered within areas that support healthy populations of development-sensitive focal species, and redirected toward sites that are already degraded (i.e., those that are dominated by development-associated species).

In our approach to analyzing biological information for Ridgefield's NRI, we used the FoSA methodology. FoSA prioritizes land-use planning efforts on wildlife species that respond specifically to development impacts including habitat loss and habitat fragmentation. Such species are termed "focal species," and can be further divided into two broad categories. Many focal species experience population declines as a result of land development and suburbanization. These species, referred to as "development-sensitive" focal species (DS FoSA species), are usually habitat specialists, with relatively narrow ecological requirements and/or complex life-history requirements that involve use of multiple, interconnected habitat types. The specialized habitats and interconnections between habitats required for DS FoSA species are often compromised by development. Examples of DS FoSA species that are often impacted in this manner include neotropical migrant bird species, vernal pool-breeding amphibians, and long-lived species such as Eastern box turtles. Such species tend to disappear from the landscape as their habitats are altered or fragmented. Populations of other focal species increase in response to suburbanization. These species, referred to as "development-tolerant" focal species, are usually habitat generalists, with much less specific habitat requirements.

Many FoSA species require large tracts of interconnected habitat that at minimum approach 1,000 acres in size to support long-term population viability. This does not mean that these large tracts are devoid of human settlement, but rather that these settlements are arranged upon the landscape to allow wildlife dispersal around developed areas. When habitat fragmentation impedes the movement of wildlife across the landscape, populations of long-lived species such as the Eastern box turtle are now isolated from one another. This results in reduced long-term viability of certain species due to their small population sizes and the inability of certain terrestrial species to disperse between sub-populations. Examples of FoSA species that are especially at risk in this manner are spotted, wood and box turtle, and Jefferson salamander (see Table 6).

Table 6: Development-sensitive FoSA species reported (currently or historically) for Ridgefield

Common Name	Scientific Name	Connecticut State Status	Audubon Watch-list Designation*	Partners in Flight Designation*
BIRDS				
American Redstart	*Setophaga ruticilla*	GCN species		
Baltimore Oriole	*Icterus galbula*			PIF-IA
Blue-winged Warbler	*Vermivora pinus*	GCN species	Yellow	PIF-IA
Chimney Swift	*Chaetura pelagica*			PIF-IIA
Eastern Wood Pewee	*Contopus virens*	GCN species		PIF-IIA
Great-crested Fly-catcher	*Myiarchus crinitus*	GCN species		
Indigo Bunting	*Passerina cyanea*	GCN species		
Hooded Warbler	*Wilsonia citrine*	GCN species		
Ovenbird	*Seiurus aurocapillus*	GCN species		
Red-shouldered Hawk	*Buteo lineatus*	GCN species		
Rufous-sided Towhee	*Pipilo erythrophthalmus*	GCN species		PIF-IIA
Scarlet Tanager	*Piranga olivacea*	GCN species		PIF-IA
Veery	*Catharus fuscescens*	GCN species		
Virginia Rail	*Rallus limicola*	GCN species		
Warbling Vireo	*Vireo gilvus*	GCN species		
Wood Thrush	*Hylocichla mustelina*	GCN species	Yellow	PIF-IA
AMPHIBIANS & REPTILES				
Common Name	**Scientific Name**	**Connecticut State Status**	**Status in Klemens 2000**	
Blue-spotted Salamander complex	*Ambystoma laterale*	Special concern, GCN species	Special concern	
Bog Turtle	*Clemmys muhlenbergii*	Endangered (federally -T), GCN species	Endangered	
Eastern Box Turtle	*Terrapene Carolina*	Special concern, GCN species	Special concern	
Four-toed Salamander	*Hemidactylium scutatum*	GCN species	Secure	
Fowler's Toad	*Bufo fowleri*	GCN species	Secure	
Jefferson Salamander complex	*Ambystoma jeffersonia-num*	Special concern, GCN species	Special concern	
Musk Turtle	*Sternotherus odoratus*		Secure	
Marbled Salamander	*Ambystoma opacum*	GCN species	Declining	
Northern Slimy Salamander	*Plethodon glutinosus*	Threatened, GCN species	Threatened	

(continued)

Table 6: Continued

AMPHIBIANS & REPTILES				
Common Name	***Scientific Name***	***Connecticut State Status***	***Status in Klemens 2000***	
Northern Copperhad	*Agkistrodon contortrix mokasen*	GCN species	Declining	
Spotted Salamander	*Ambystoma maculatum*	GCN species	Declining	
Spotted Turtle	*Clemmys guttata*	GCN species	Declining	
Wood Frog	*Rana sylvatica*	GCN species	Declining	
Wood Turtle	*Clemmys insculpta*	Special concern, GCN species	Special concern	
Worm Snake	*Carphophis amoenus*		Secure	
MAMMALS				
Common Name	***Scientific Name***	***Connecticut State Status***		
Long-tailed Weasel	*Mustela frenata*	GCN species		
Silver-haired Bat	*Lasionycteris noctiva-gans*	Special concern, GCN species		

KEY

* Applicable to birds only

Connecticut State Status

Species listed as special concern, threatened, or endangered by the CT Department of Environmental Protection OR species listed as "Greatest Conservation Need" (GCN) as described in the CT State CWCS.

Audubon Watchlist Designation

Red: species in this category are declining rapidly and/or have very small populations or limited ranges, and face major conservation threats. These typically are species of global conservation concern.

Yellow: this category includes species that are either declining or rare. These typically are species of national conservation concern. Visit http://web1.audubon.org/science/species/watchlist/index.php for additional information.

Partners in Flight Designation (Area 09)

Tier I High Continental Priority

Species that are typically of conservation concern throughout their range. These are species showing high vulnerability in a number of factors, expressed as any combination of high parameter scores leading to an average score > 3 (the midpoint); total of 7 parameter scores will be 22, with AI 2 (so that species without manageable populations in the region are omitted).

Tier I A *High Continental Priority-High Regional Responsibility* - Species for which this region shares in major conservation responsibility; i.e., conservation in this region is critical to the overall health of this species. Species with AI of 3 - 5, or a high percent population (above threshold in II B).

Tier II High Regional Priority
Species that are of moderate continental priority, but are important to consider for conservation within a region because of various combinations of high parameter scores, as defined below; total of 7 parameter scores = 19-21.

Tier II A *High Regional Concern*. Species that are experiencing declines in the core of their range and that require short-term conservation action to reverse or stabilize trends. These are species with a combination of high area importance and declining (or unknown) population trend; total of 7 parameters = 19-21, with AI + PT 8.

Tier IIC. *High Regional Threats*. Species of moderate continental priority that are uncommon in a region and whose remaining populations are threatened, usually because of extreme threats to sensitive habitats. These are species with high breeding threats scores within the region (or in combination with high non-breeding threats outside the region).

Visit http://www.partnersinflight.org/bcps/pl_09sum.htm for additional information.

Status in Klemens 2000
Reptile and amphibian species listed as "declining" in Klemens, M.W. 2000, pp. 80-84. Note that all state-listed species are, by definition, also declining.

FoSA represents an innovative departure from traditional conservation efforts. By expanding the scope of investigation beyond federal or state listed threatened and endangered species, we are able to more proactively conserve natural resources. There are many species, currently unlisted and unprotected, whose populations are declining in response to sprawl. Rather than waiting until they are on the brink of extinction (when recovery efforts are not only dangerously uncertain, but also very expensive), it is wiser to attempt to address their habitat requirements and to stabilize their populations now. In addition, ecosystems contain complex interactions among many species. FoSA evaluates systems more reliably by considering a much broader suite of species and their relative abundances, as opposed to basing land use recommendations on a single threatened or endangered species. FoSA methods are not intended to replace the existing and necessary efforts to conserve threatened and endangered species; instead, they complement ongoing conservation and land use planning efforts.

FoSA studies often focus on avifauna (birds) and herpetofauna (amphibians and reptiles). Being good indicators of the ecosystem effects of fragmentation most often the result of development, the presence or absence of these species can be rapidly assessed in a relatively cost-efficient manner using established field techniques. These two groups (avifauna and herpetofauna) exhibit differing responses to scales of fragmentation. Because of poor dispersal abilities, herpetofauna are initially more affected by fragmentation than avifauna (LaBruna *et. al*. 2006). When used in tandem, these two groups provide a robust evaluation of ecosystem integrity.

5.1a *Ridgefield's Focal Species*

The data used to identify Ridgefield's FoSA species (Map 12) was not gathered in a systematic manner. The field work done by the volunteers under the guidance of the Conservation Commission varied from specie to specie. A detailed description of the various methods used is found in the appendix along with the complete lists of species found in Ridgefield. These lists include not only species found during the NRI but also ones found through earlier surveys and by observation of various contributors.

BIRDS

Based on the breeding bird survey conducted in 2010, a total of 16 FoSA bird species were observed in Ridgefield (see Table 6). Ridgefield's FoSA bird species include forest-dwelling species, such as the scarlet tanager, wood thrush, eastern wood pewee and ovenbird. These species require large, un-fragmented tracts of deciduous forest habitat to thrive (see Sections 4.1a and 4.3). These forest birds occur at sites such as Bennett's Pond, Hemlock Hills and Barlow Mountain, where large forest blocks provide ample forest-interior habitat.

Other FoSA species include those that occur in open fields (i.e., non-forested habitats) such as the blue-winged warbler, indigo bunting and warbling vireo. Most notable of these is the blue-winged warbler. The blue-winged warbler is a regionally declining species that inhabits successional habitats dominated by deciduous vegetation, including second-growth forests with understory saplings or shrubs, shrubby abandoned farm fields, open edges of streams, rivers and marshes and openings in mature deciduous forest (Bevier, 1994). The blue-winged warbler was observed at four locations during the 2010 breeding bird survey in successional habitat near Lake Windwing, Bennetts Pond, Shadow Lake and along the Norwalk River. Suitable habitat for field-nesting species such as the blue-winged warbler are limited in extent, as these habitats require regular management (i.e., mowing, cutting) for them to remain suitable for such species (see "old field" habitat distribution, Map 11).

Approximately 150 species of birds are identified as breeding in Connecticut (Hammerson, 2004). In total, 75 species of birds have been identified as potentially breeding in Ridgefield based on information collected during 2010 breeding bird surveys with additions of birds known to be present in Ridgefield during their breeding seasons (Map 13 and Appendix 2.4). Note that presence of a species does not equate with breeding. That can be confirmed only by the presence of nests, eggs and young.

It is interesting to see how the composition of Ridgefield's bird population has changed over the years. From 1953 until 1969, Louse Peck and Anna Grace Woodford kept a daily checklist of birds seen on their property on North Salem Road which consists of a six-acre field bordered by woods. Among other matters of interest, there were consistent records of eastern meadowlark, brown thrasher and northern bobwhite being present throughout the breeding season. None of these birds are now present in Ridgefield in 2010. Although the field still exists in a natural state and is mowed in late fall, it is not of sufficient size in itself to supply the habitat that these birds of fields and edge habitat require. Habitat of sufficient size to support breeding populations of these birds has disappeared in Ridgefield. It is, in fact, in short supply throughout the entire state, resulting in a sharp decline of these species statewide.

While some birds have declined in numbers, others have become more common. For example, the northern cardinal, now one of the most common winter resident birds, was not seen until 1955. Tufted titmouse were not observed until 1960 and red-bellied woodpecker and turkey vultures were observed infrequently. These birds are tolerant of fragmented habitat and have spread upward from their southern population centers.

The original of the Peck and Woodford record is available at the Ridgefield Historical Society. An electronic version is available from the Ridgefield Conservation Commission.

AMPHIBIANS

The data on Ridgefield's amphibians (see Appendix 2.5) are more comprehensive than most other groups of organisms because the NRI data is supplemented by the studies conducted by Klemens (1993) and subsequent surveys of Ambystomid (or mole) salamanders (Bogart and Klemens, 1997, 2008).

Jefferson Salamander ***(Ambystoma jeffersonianum)***

Ridgefield populations of Jefferson salamanders include polyploid hybrid females that are associated with diploid, bisexual populations of this species. Jefferson salamanders are true upland species, and are found in two widely separated areas of Ridgefield that encompass significant tracts of high-quality habitat; steeply graded, forested ledge and talus habitat, punctuated by deep, shrub dominated (buttonbush and red-osier dogwood) vernal pools. Jefferson salamanders are found only west of the Connecticut River, and are undergoing a long-term, non-cyclical decline in suburbanized areas of the state. They require large areas of intact forest for their survival.

Blue-spotted Salamander ***(Ambystoma laterale)***

A single population of blue-spotted salamanders occurred in northwestern Ridgefield along the Danbury town line in the Still River watershed (Bogart and Klemens, 1997). There are a number of populations of this particular lineage of blue-spotted salamander in Danbury and New Fairfield (Bogart and Klemens, 1997) and more recently reported from the vicinity of Haines Pond just west of Danbury in New York (Davison and Klemens, 2009a). Blue-spotted salamanders utilize red-maple swamps and marshes for breeding, usually associated with a riparian system. Like other Ambystomid salamanders, they require upland habitats associated with these wetland systems for the non-breeding portion of their life cycle. Recent development in this section of Ridgefield and Danbury has placed Ridgefield's sole population of blue-spotted salamanders at risk. Although not recently reported from this section of Town, ample habitat still remains to support this cryptic species. Various areas of open space, including the open space associated with the Turner Hill subdivision, are extremely important for the persistence of this species within Ridgefield.

Spotted Salamander ***(Ambystoma maculatum)***

This is the most widespread of the mole salamanders within Ridgefield and occurs not only within vernal pools, but also within deeper pooled areas of swamps termed "cryptic vernal pools," as well as some man-made ponds. The mole salamander gets its name because it lives underground using the subterranean tunnels made by small mammals like shrews and moles. Many populations of this salamander have declined in the more developed portions of town because of the loss of upland habitats associated with development.

Marbled Salamander ***(Ambystoma opacum)***

This is the only mole salamander that breeds in the autumn, where eggs are deposited in dry vernal pool basins and subsequently hatch and develop over the winter, spring and in the early summer. Because of the extended development period, marbled salamanders require pools that have a long hydroperiod. These pools are often imbedded in larger swamp systems that ensure a more steady supply of water. Marbled salamanders were found in a series of pools in Hemlock Hills, and an adult was found dead on Florida Hill Road near a series of pools and wetlands associated with the Rail Trail (Klemens, *unpublished data*).

Four-toed Salamander *(Hemidactylium scutatum)*

Once considered rare, this diminutive swamp-dwelling species is secretive and frequently overlooked. It breeds in swamps that have sphagnum tussocks, where eggs are deposited and brooded, hatching and falling into the water followed by an abbreviated aquatic larval stage. This unique salamander is a member of the woodland salamander group (Plethodontidae) which are characterized by direct development within terrestrially deposited eggs. The four-toed salamander can be considered intermediate in its life history strategy between the Ambystomid salamanders that have totally aquatic larvae, and the salamanders of the genus *Plethodon,* which totally develop within the egg on land. The NRI field work in 2010 substantially increased the number of documented locations for this species within Ridgefield, where it occurs at scattered sites town-wide.

Slimy Salamander *(Plethodon glutinosus)*

The slimy salamander is known from a single site within Ridgefield, documented as part of Klemen's state-wide survey in preparation for his book (Klemens, 1993) on the state's herpetofauna. This is a state-listed threatened species. Slimy salamanders are known from a handful of towns in extreme western Connecticut, where they favor old growth hemlock and deciduous forest that is located on moist, talus strewn slopes with a thick duff layer and ample supply of rotting logs and crevices. This species is especially susceptible to clearing activities, and to the loss of habitat through fragmentation and development. Fragmentation of forest blocks brings edge effects deep into the forest, as illustrated by Figure 21 (Section 6.1), rendering them unsuitable for many amphibian species and especially for slimy salamanders.

Fowler's Toad (*Bufo fowleri*)

Fowler's toad is an uncommon species, restricted to areas of the state dominated by dry sandy surface soils. These are often found in association with low-lying areas and river valleys, though this species has also been found in open, dry bald areas on ridgetops. Fowler's toads are known from a single area in Ridgefield, along the Wilton town line in the vicinity of Weir Farm.

Wood Frog (*Rana sylvatica*)

Along with the spotted salamander, this is one of the most widespread vernal pool species in Ridgefield, breeding in a variety of seasonally inundated wetlands. Unlike the mole salamanders, it has a very quick generation time, which is measured in a few years. Therefore, it is not usual to see fluctuations in occurrence and abundance of this species over a relatively short time span. Wood frogs require extensive tracts of moist woodland adjacent to their natal wetland, and easily move 1000-1500 feet from their breeding sites for foraging and dispersal purposes. The biomass of young wood frogs in the deciduous forest is a major food source for many other species. Wood frog tadpoles feed on fallen leaves in vernal pools, transferring the energy locked up in those leaves into their bodies and then out into the terrestrial ecosystem in the form of metamorphosed froglets. As such, they form an important part of the nutrient and energy cycling within the deciduous forest biome.

REPTILES

Spotted Turtle (*Clemmys guttata*)

The spotted turtle has complex landscape habitat use, moving between a variety of different wetland habitats on a seasonal basis. This rotational use of wetlands necessitates extensive overland migration of spotted turtles through terrestrial habitats where road mortality and other factors result in loss of long-lived adults. Spotted turtles were once much more widespread within Ridgefield (Nelson Gelfman, *pers. comm*) when the landscape was characterized by more open space, wet meadows, as well as fewer roads, less development, and less traffic. Although no spotted turtles were documented during the 2010 NRI survey, we have mapped two records from 2008 and 2009 (Nelson Gelfman, *pers. comm.*), a record from 1999 from Bennett's Pond (*Anon*, 2001), as well as two records from the Ridgefield/Wilton town line at Weir Farm (Klemens, 1993; Brotherton, *et.al.* 2005).

Wood Turtle (*Clemmys insculpta*)

The wood turtle is a long-lived species that is declining throughout the state and is listed as Special Concern. Like the spotted turtle, it uses a variety of habitats throughout its annual cycle. Wood turtles hibernate in streams and rivers, and then move into adjacent floodplains, forest, and fields during the summer months, returning once again to hibernate. Because their movements are from a river into adjacent habitat, they may be less vulnerable to road mortality than spotted turtles that are moving between disjunct wetland habitats. Recent Ridgefield mapped records of wood turtles have been documented by Nelson Gelfman along the Titicus River and by Klemens (*unpublished data*) at the southern end of the Great Swamp and along the Rail Trail. The 2010 NRI survey documented several wood turtles in the Mopus Brook wetlands that flow into North Salem in the Spring Valley Road area of Ridgefield. A record from 1993 at the outflow of Bennett's Pond near Route 7 is also mapped (*Anon,* 2001).

Bog Turtle (*Clemmys muhlenbergii*)

Historically Ridgefield was one of the few towns within Connecticut that had documented populations of this rare turtle species. Bog turtles are protected both by the federal government as a Threatened Species (Endangered Species Act) as well the State of Connecticut as a State Endangered Species. Klemens (1993) details the distribution of bog turtles in Connecticut, considering the species restricted to five towns in western Connecticut: Bethel, Danbury, Ridgefield, Salisbury, and Sharon. All documented bog turtle populations are in open canopy wetlands lying within the calcareous valleys of western Connecticut. Map 14 illustrates the polygons where bog turtles have been documented within Ridgefield, and is derived from data supplied by the DEP Natural Diversity Data Base and from the collections and field notes of Dr. Michael W. Klemens, Research Associate in Herpetology, American Museum of Natural History. Although the USFWS (2001) still lists Fairfield County (and adjacent Westchester County NY) as within the bog turtle's range, it is assumed by most turtle biologists that populations in both these counties are at or near localized extinction (i.e., they are extirpated). Habitat loss and fragmentation, wetland loss, conversion, and succession to wooded swamp, as well as collection, have all been implicated in the decline of bog turtle populations within Connecticut. Nonetheless, USFWS regulations require that a Phase 1 assessment, as per the recovery plan, be conducted at any sites formerly known to support bog turtle as mapped by the CT DEP's Natural Diversity Database program.

Eastern Box Turtle (*Terrapene carolina carolina*)

The box turtle is a very long-lived terrestrial species that prefers the lower-lying areas of Connecticut below 500 feet elevation (Klemens, 1993: 191). Ridgefield may never have been optimal habitat for this species, and populations may never have been as widespread and abundant as in other parts of the state. This turtle is undergoing a long-term non-cyclical decline, and many populations that remain have little if any recruitment. This turtle is a Connecticut Special Concern Species. There are widely scattered records of this turtle from Ridgefield, but there is no information on the viability of those populations or other sites within Ridgefield (Anon, 2001; Brotherton *et.al.* 2005). Habitat loss, fragmentation, road mortality, and collection are all threats to this long lived gentle species. Box turtles favor a mosaic of habitats, with edge areas for sunning, wetlands for hydration, and forested areas for hibernation and protection from summer heat.

Musk Turtle (*Sternotherus odoratus*)

The musk turtle is a highly aquatic species that is distributed in the river and stream systems of Ridgefield. They reach high densities in impoundments that are part of a riparian system. Musk turtles have been documented in Little Pond Brook, which is a tributary to the Norwalk River and were documented during the 2010 NRI in Lake Windwing, which is an impoundment within the Saugatuck River drainage. However, it is assumed that musk turtles are much more widespread within Ridgefield than these data indicate. Klemens (1993, *unpublished data*) has documented this species in the Mill, Still, Titicus, and Waccabuc drainage basins in adjacent towns in Connecticut and New York. There is no reason to assume that this species does not occur in suitable habitat within these drainage basins in Ridgefield. Musk turtles are small, extremely secretive, primarily nocturnal and live on the bottom of streams and impoundments, frequently obscured by turbid waters. They can on occasion be seen basking; terrestrial activity is limited to nesting, which often occurs very close to their aquatic habitats. This combination of life history traits makes systematic sampling of musk turtles very difficult unless rivers and impoundments are sampled using baited hoop nets to capture live turtles.

Worm Snake (*Carphophis amoenus*)

This is one of Connecticut's smallest snakes, totally adapted for subterranean life. Its hard, smooth body allows it to move through loose, sandy soil aided by its wedge-shaped head. Worm snakes are very difficult to sample in any predictable manner. During heavy rains they are occasionally flooded out of their waterlogged habitats. There are scattered locations for this species across Connecticut (Klemens, 1993: 214) including nearby records from Redding (CT) and just over the state line in Vista (NY). The single documented locality for this species within Ridgefield is southwest of Branchville, just north of the Wilton town line.

Black Rat Snake (*Elaphe o. obsoleta*)

This large arboreal black snake may be increasing due to the reforestation of southwestern Connecticut. However, it is still an uncommon species within Ridgefield. The 2010 NRI survey sighted a large Black Rat Snake near Lake Windwing on several occasions and it is assumed that this species is more widespread along Ridgefield's forested ridgelines. The species is vulnerable to road mortality and collection.

Copperhead (*Agkistrodon contortrix mokasen*)

The single record from Ridgefield is a specimen collected on Pine Mountain (Klemens, 1993:269). There are no recent reports from Ridgefield, and copperheads have been declining dramatically in Fairfield County over the last fifty years. In contrast to central Connecticut, where copperheads occur in significant numbers associated with trap rock ridges, copperhead distribution in southwestern Connecticut and adjacent sections of Westchester County, NY has always been in small, localized populations associated with bedrock outcropping in deciduous forest. The nocturnal and secretive nature of this snake also may help it survive undetected. The non-venomous water and milk snakes are often mistaken for the venomous copperhead, which is one of two pit viper species that occur within Connecticut.

MAMMALS

FoSA mammals observed during the 2010 NRI survey work include area-sensitive carnivores as well as various Mustelids (mink and long-tailed weasel). These species were documented in non-systematic manner by sightings and road kills noted in Appendix 2.6 and locations illustrated in Map 12.

Notable mammals observed in Ridgefield include area-sensitive carnivores such as the bobcat and fisher, as well as various Mustelids, indicative of high quality, prey-rich habitats. The bobcat is sparsely distributed in less-developed portions of Connecticut (Hammerson, 2004). Bobcats inhabit forest and various types of successional habitats, feeding on a variety of small vertebrates. While they hunt in field and forest, they require rocky ledges for denning. Ridgefield's abundant ledges and rocky outcrops may account for the persistence of this species in an increasingly suburbanized setting. Bobcat were observed in several locations during 2011.

Fisher occur in large tracts of forest, feeding on a variety of small mammals. Once extirpated from Connecticut as a result of forest clearing, the fisher has re-colonized in eastern Connecticut from northern New England, benefitting from the large tracts of second-growth forest which now cloak Connecticut. Fisher found here are likely the result of a DEEP program that reintroduced them to western Connecticut.

5.2 *State and Federally Listed Species Occurring in Ridgefield*

Listed in Table 7 are those state-listed species known to occur in Ridgfield based on all historical data, data collected during the 2010 NRI survey work and records from the Department of Environmental Protection's Natural Diversity Database (NDDB).

Table 7: State-listed species known to occur (currently or historically) in Ridgefield

Common Name	***Scientific Name***	***Required Habitat***
Insects		
Appalachian Blue (T)	*Celastrina neglectamajor*	Moist woods edges near host plant Black Cohosh (*Cimicifuga racemosa*)
Borer Beetle (SC)	*Bembidion pseudocautum*	Under rocks, logs or other debris on ground
Borer Beetle (SC)	*Bembidion semicinctum*	Under rocks, logs or other debris on ground
Bronze Copper (SC)	*Lycaena hyllus*	Low wet areas including bogs, marshes, wet meadows and ponds
Ground Beetle (SC)	*Badister transverses*	Under rocks, logs or other debris on ground
Newman's Brocade (SC)	*Meropleon ambifuscum*	Meadows, forest openings, emergent wetlands
Sedge Skipper (T)	*Euphyes dion*	Open wet fields, meadows, woods edges, pond edges
Spongillafly (SC)	*Sisyra fuscata*	Highly-specialized predator of freshwater sponges utilizing aquatic habitats and riparian areas
Amphibians & Reptiles		
Blue-spotted Salamander complex (SC)	*Ambystoma laterale*	Breeds in floodplain wetlands, vernal pools, pond/ lake margins and wooded swamps, with forested uplands used for terrestrial habitat
Bog Turtle (E, fed-T)	*Clemmys muhlenbergii*	Calcareous wet meadows and fens
Eastern Box Turtle (SC)	*Terrapene Carolina*	Old fields and deciduous forest ecotones
Jefferson Salamander complex (SC)	*Ambystoma jeffersonianum*	Breeding occurs in vernal pools; deciduous or coniferous forests are used as terrestrial habitat
Northern Slimy Salamander (T)	*Plethodon glutinosus*	Deciduous or hemlock forest on moist, rocky slopes covered with thick duff and rotten logs
Wood Turtle (SC)	*Clemmys insculpta*	Streams, rivers, riparian areas
Birds		
Red-headed Woodpecker (E)	*Melanerpes erythrocephalus*	Open woodlands along the margins of fields or swamps
Aquatic Invertebrates		
Lymnaeid Snail (SC)	*Fossaria rustica*	Aquatic snail found on rocks, woody debris, aquatic plants as well as soft, silty substrates
Plants		
Smooth Black-haw (SC)	*Viburnum prunifolium*	Forests to field edges; full sun to partial shade
Water Lily (SC)	*Nymphaea odorata var. tuberose*	Shallow, slow-moving aquatic habitats
Water Marigold (T)	*Megalodonta beckii*	Lakeshores, ponds and slow-flowing streams

Mammals		
Silver-haired Bat	*Lasionycteris noctivagans*	Woodland areas bordering lakes and streams
SC – species of special concern *T – threatened species* *E – endangered species* *Fed-T – federally threatened species*		

6.0 LAND USE PATTERNS

6.1 *Land Use Changes Over Time*

Connecticut's landscape has undergone sequential alterations since its settlement in the early 1600s. During the 17th and 18th centuries, essentially all the virgin old growth forest was converted to farmland or used in the production of charcoal. Bedini (1958) describes Ridgefield's tax list of 1808. Particularly instructive is the account of land uses and conditions at that time two centuries ago. These included 3,807.5 acres of "plough land"; 4,498.5 acres of "upland mowing and clear pastures"; as well as 405.5 acres of "boggy land-mowed"; 5,259 acres of "bushy land"; 1,257.5 acres of "other lands" in addition to "numerous acres of unenclosed land".

During the 19th and 20th centuries, the Connecticut landscape began to reforest as people moved west in search of better farmland and the industrial era began. Statewide aerial photography in Connecticut began in 1934 at a period when second growth reforestation of the state was largely complete. A review of these historic photos allows us to observe significant changes in land-use patterns over a nearly eighty-year period, from the mid-1930s to the present day (Figure 20). Particularly striking is the abundance of farmland present in several areas of Ridgefield during the 1930s, particularly within the village of Ridgebury, bordering Route 116 between Ridgebury and the town's center and surrounding the town's center and near the confluence of Route 35 and Route 7. Also notable is the presence of a large intact forest block surrounding Pine Mountain, a forest block still present today. Due to its rugged terrain it has been spared from land clearing and development. An example of land-use change over time is illustrated in Figure 21, which shows the change in forest cover in the Spring Valley area of Ridgefield between 1934 and 2008.

Aside from such anecdotal observations of land cover changes over time, the Center for Land Use Education and Research (CLEAR)'s program, *Connecticut's Changing Landscape* provides a statewide analysis of land cover changes for the period from 1985 to 2006 (see Figure 22 and Table 8). This data provides some fairly predictable results of land-use changes in Ridgefield over this 21 year period. Most notable are the land cover changes for two key categories, "agricultural land" and "developed land." CLEAR defines these land use categories as follows:

- <u>Agricultural Land</u> – defined as "areas that are under agricultural uses such as crop production and/or active pasture. Also likely to include some abandoned agricultural areas that have not undergone conversion to woody vegetation." Total acres of agricultural land decreased from 555 acres to 323 acres, a loss of 232 acres or 41.8 percent

- <u>Developed Land</u> – defined as "high-density built-up areas typically associated with commercial, industrial and residential activities and transportation routes. These areas can be expected to

Figure 20: Ridgefield's past agricultural heritage is remembered both in historical photographs as well as place names.

Top: Lee Farm, Ridgebury 1942

Center: Walnut Grove Farm, Farmingville, 1930s

Bottom: Wickop Farm, Peaceable and High Ridge, 1940s

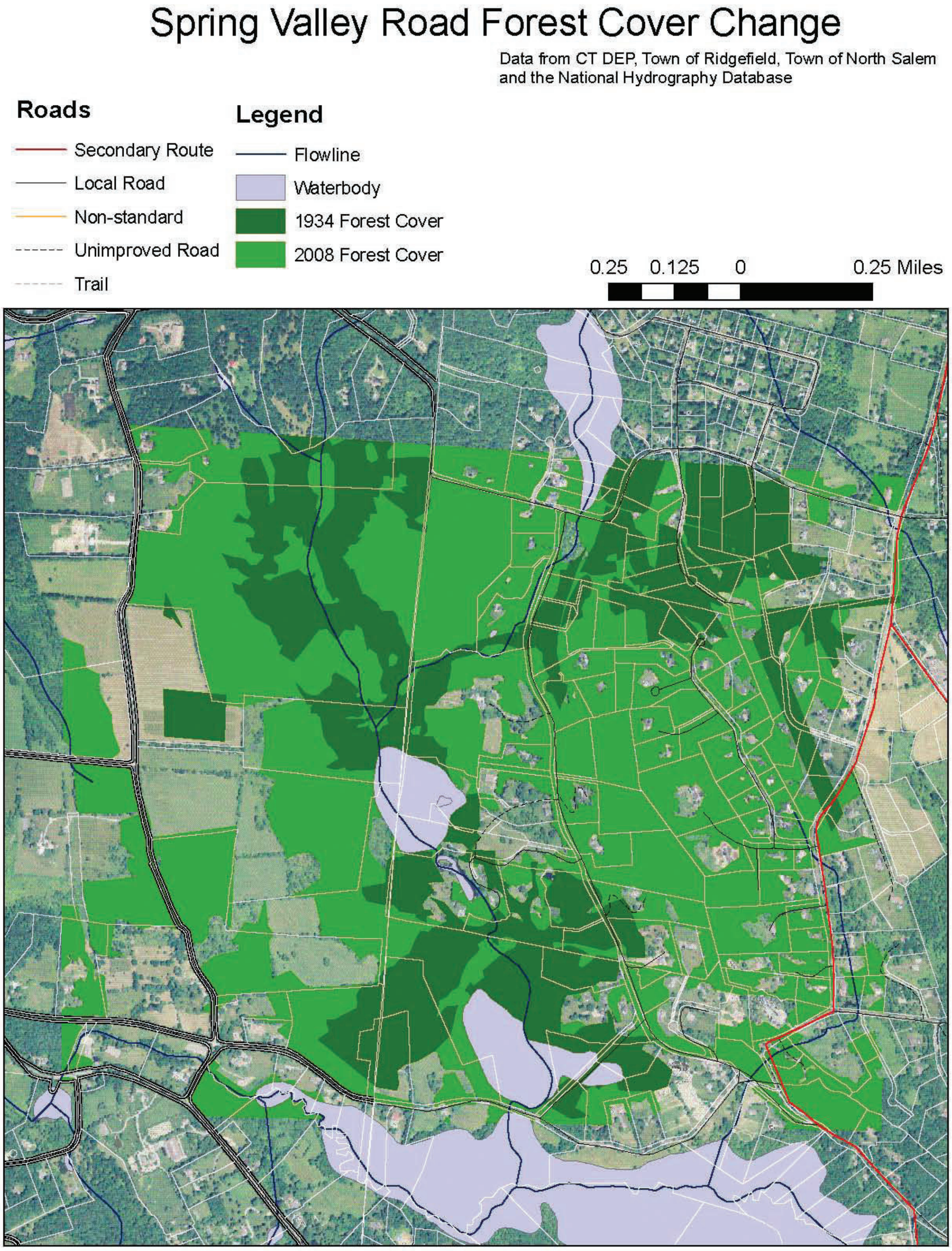
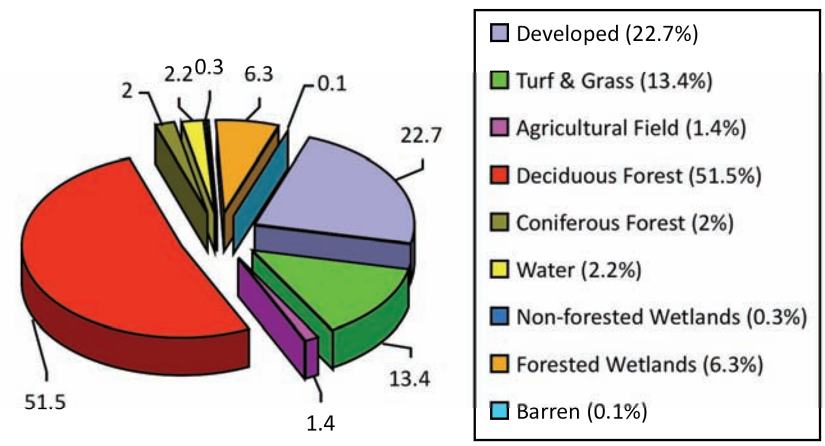


Figure 21: Forest cover change, Spring Valley, 1934 to 2008 (prep. K. Amick)

This figure uses aerial photographs from the University of Connecticut Map and Geographic Information Center (UConn MAGIC). Aerial photographs from 1934 and 2008 were used to determine forest coverage for the area around Spring Valley Road in both years. By translating the photographs into map layers, the forest coverage change from 1934 to 2008 can be compared on one map.

Figure 22: Ridgefield 2006 Land Cover Data



Data Source: UCONN Center for Land Use Research & Education
(note that forest cover types may include light residential development)

Table 8: Land cover changes 1985-2006, taken from CLEAR's Connecticut's Changing Landscape Project

Year	1985	1990		1995		2002		2006		Change		
Cover Type	acres	% of town	acres	% of town	acres	% of town	acres	% of town	acres	% of town	acres	% change
Developed	4533	20.3%	4763	21.4%	4853	21.8%	5026	22.5%	5074	22.7%	541.4	11.9%
Turf & Grass	2447	11%	2459	11%	2559	11.5%	2612	11.7%	2740	12.3%	292.3	11.9%
Other Grasses	197	0.9%	207	0.9%	237	1.1%	209	0.9%	238	1.1%	40.4	20.4%
Agricultural Field	555	2.5%	489	2.2%	388	1.7%	349	1.6%	323	1.4%	-232.2	-41.8%
Deciduous Forest	12033	53.9%	11888	53.3%	11775	52.8%	11660	52.3%	11489	51.5%	-544	-4.5%
Coniferous Forest	456	2%	456	2%	454	2%	449	2%	443	2%	-12.5	-2.7%
Water	533	2.4%	525	2.4%	514	2.3%	502	2.3%	497	2.2%	-36	-6.8%
Non-forested Wetland	68	0.3%	71	0.3%	70	0.3%	70	0.3%	70	0.3%	2.1	3.1%
Forested Wetland	1468	6.6%	1437	6.4%	1422	6.4%	1406	6.3%	1403	6.3%	-65.3	-4.4%
Barren	15	0.1%	8	0%	31	0.1%	19	0.1%	28	0.1%	12.6	84.6%
Utility (Forest)	5	0%	6	0%	6	0%	7	0%	6	0%	1.2	23.4%

contain a significant amount of impervious surfaces, roofs, roads, and other concrete and asphalt surfaces." Developed land increased from 4533 acres to 5074 acres, an increase of 541 acres or 11 percent. Additionally, a land use category directly associated with development and urbanization, "turf and grass," increased 292 acres (11.9 percent) over that time period.

6.2 *Agricultural Land*

As described in Section 6.1 and Table 8, CLEAR's *Connecticut's Changing Landscape* program's land cover data provides a rough estimate of land in active agricultural use based on interpretation of 2006 satellite imagery data. This data concluded that in 2006, approximately 320 acres of land were in active agriculture.

In order to refine the CLEAR analysis, existing agricultural land was mapped at a finer scale using recent aerial imagery (see Map 11). Agricultural lands were divided into four categories: (1) mowed field, (2) pasture, (3) old field and (4) cropland (see Table 9).

Two aerial image data sources were used to map agricultural lands: (1) 2008 high-resolution orthoimagery for Bridgeport, New Haven and Hartford, CT urban areas created by the US Geologic Survey and (2) 2009 Pictometry International Corp. birdseye-angle aerial images viewed on www.bing.com.

Much of Ridgefield's former agricultural land has been developed. What remains consists of small fragments of annually mowed fields dominated by cool-season grasses. Ecologically, these fields are not unlike hayfields managed for the production of livestock feed. However, the majority of these fields appear to be maintained for aesthetic purposes rather than for the production of livestock feed, a one-acre field bordering a large estate for example. The largest contiguous area of annually mowed field is located at the town-owned McKeon Farm, totaling 37 acres.

The second largest agricultural land-use category is pasture, totaling 69 acres. The majority of Ridgefield's pastureland is devoted to horses. There are five large horse farms in Ridgefield, with the largest single pasture totaling 29 acres.

The category "old field" consists of non-forested, late-successional habitats dominated by herbaceous vegetation, shrubs and small trees which typically develop on fallow agricultural lands. A total of 43 acres of old field were mapped in Ridgefield. With respect to wildlife, old field is the most valuable of the agricultural land-use types mapped, as many species of conservation importance favor old field habitats (e.g., blue-winged warbler, see Figure 18).

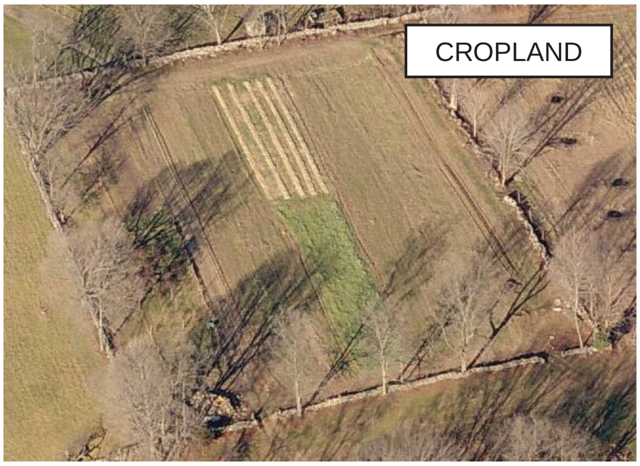
Ridgefield's cropland is very limited in extent, totaling approximately 25 acres, with the largest single field located at The Hickories (Figure 23), totaling 20 acres.

Figure 23:
The Hickories

Table 9: Agricultural land by type (see Map 11)

Type	***Total Acreage***	***Mean Field Size***	***Max Field Size***
Cropland	25	N/A	20
Mowed Field (annual)	195	7	37
Old Field	43	4	9
Pasture	69	7	29

Agricultural land types were mapped as follows: ***Annually Mowed Field*** – visible as mottled green and brown tall grass with tractor cut lines visible; ***Pasture*** – distinguished from hayfield by the presence of scarified soil or lack of grass due to heavy livestock activity; these areas may include riding rings, fencing or feeding stations; ***Old Field*** – areas that appear as a complex of shrubs, small trees and grasses. Old fields are generally fallow agricultural fields (not illustrated below – see Figure 17); ***Cropland*** – *includes those areas known to actively be planted with crops. These areas were not mapped remotely.*



6.3 *Existing Dedicated Open Space*

The protection and maintenance of Ridgefield's abundant natural diversity is directly dependent upon the network of dedicated open spaces that are located throughout the town (Table 10). The larger parcels serve as critical reservoirs for biodiversity. Examination of Map 12 (FoSA Species) illustrates that the majority of the declining and development-sensitive species recorded in Ridgefield are on or adjacent to the larger areas of contiguous, interconnected protected open space. The protection and management of these areas is essential for the survival of these species and the diversity of Ridgefield's natural systems. The large tracts of open space that surround Bennett's Pond, Pine Mountain, Hemlock Hills and Lake Windwing all represent significant habitat mosaics that contain a rich abundance of habitat types, wetlands, and a diversity of plants and animals. Certain tracts of dedicated open space also contribute to regional biological connectivity, transcending town and state boundaries (Figure 24).

The numerous, scattered smaller parcels of open space, while biologically less significant, are important to the overall character of the town. These smaller isolated patches provide welcome green space and visual buffers between residential developments and are inhabited by species that co-exist in human-dominated landscapes (e.g., raccoons, skunks, blue jays, crows, and white-tailed deer). In terms of FoSA analysis, these are classified as development-associated species. Development-associated species thrive in human altered habitats, often at the expense of more specialized development-sensitive species.

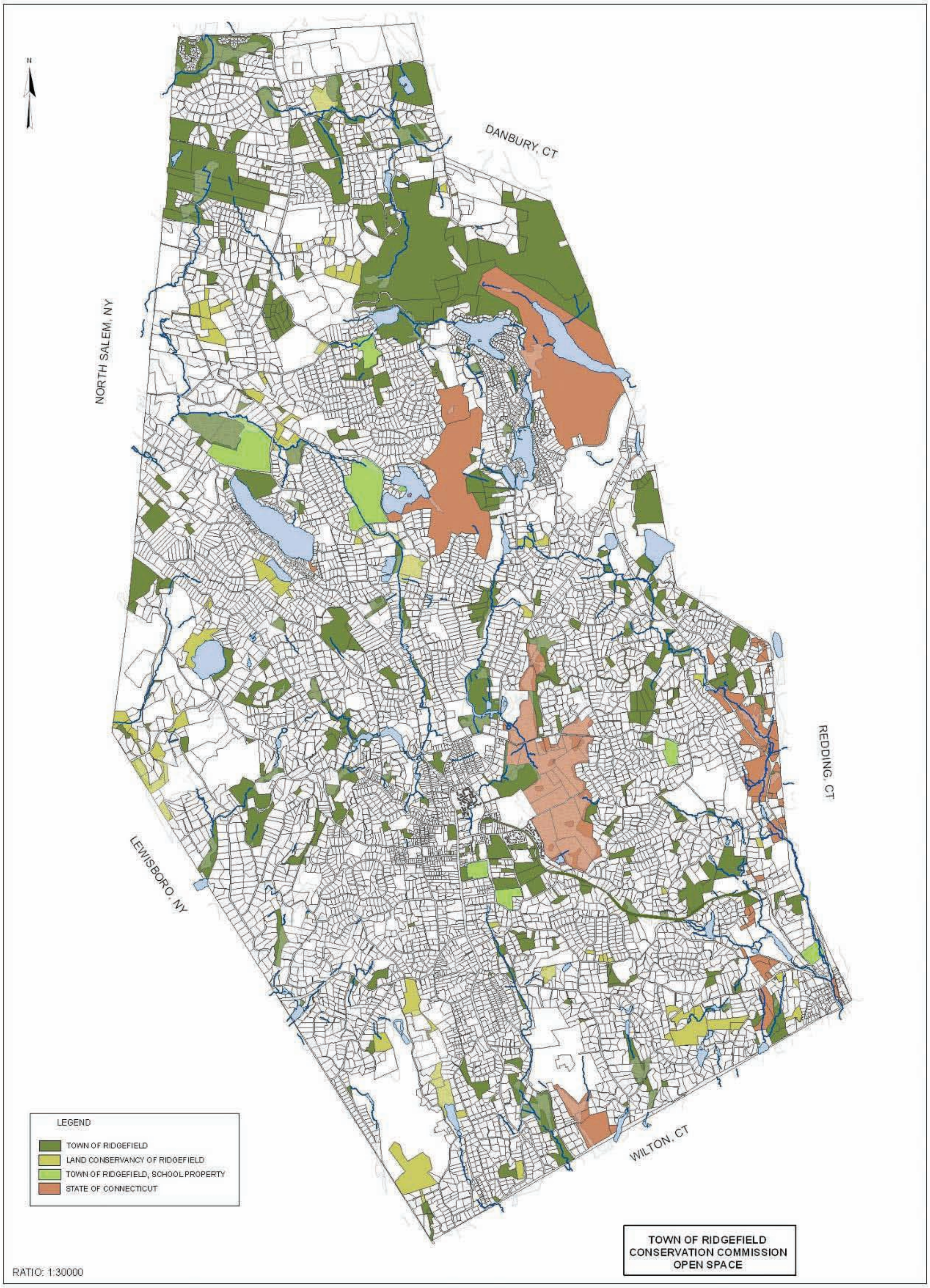
These open space parcels were accumulated from three sources: purchase, donation and land obtained from subdivision regulations, requiring that 10 percent of the subdivided parcel remain as open space. The town's Plan of Conservation and Development has a goal of 30 percent of the town being protected. Of the town's total of 22,335 acres, about 5500 acres, or 25 percent, are permanently protected from development. This land is a mixture of town, state and land conservancy-owned properties. It also includes lands that are protected through conservation easements held by the town or the Land Conservancy of Ridgefield. Five hundred acres is the number assigned as protected through easements. These easements are not mapped so their connections to the mapped parcels are not clear.

The number of undeveloped parcels that could still be protected either through purchase or easement is quite small. If one tallies the acreage represented on Figure 25 that shows parcels of six

Table 10: Ridgefield open space calculations (as of 12/8/08)

Category	Total Acreage
Conservation Commission deeded land or town undeeded open space	2,942.13
Town parks, golf courses, etc.	555
Land Conservancy	506.16
State of Connecticut	1,554.22
Boy Scouts of America	54
Homeowner's Associations (estimated conservatively)	167

Figure 24: Map showing existing open space as of December 8, 2008



acres and larger that have only one house site, the total is about 2,500 acres. Certainly a higher priority should assigned to those parcels that directly abut, and thereby add value through additional acreage to, existing protected areas.

There are some possibilities of trans-boundary ecological connectivity to open space in neighboring towns. These are primarily on the western boundary of Ridgefield, in the Spring Valley Road and Pumping Station Swamp area. Both these areas link to the Eastern Westchester Biotic Corridor (Miller and Klemens, 2002), an extensive area of interconnected habitats that exceeds 25,000 acres (see Figure 29 in Section 7.2b).

The role that open space will play in providing protection for natural resources and biodiversity will remain relatively static; however, strategic acquisitions could yield ecological value and resiliency through linkages both within Ridgefield and into neighboring towns.

7.0 IMPACTS OF DEVELOPMENT ON NATURAL RESOURCES

7.1 *Water Quantity and Quality*

7.1a Impacts of Development on Water Quantity and Quality

Activities associated with land development, in particular the conversion of natural vegetation to impervious surfaces[7], result in alterations to the movement of water through the environment. As soil infiltration is reduced and precipitation is converted to overland flow (i.e., stormwater), these modifications affect not only the characteristics of the developed site but also the watershed in which the development is located. Stormwater has been identified as one of the leading sources of pollution for all water body types in the United States (US EPA 2007).

Development can alter water quantity and reduce water quality. Water quantity impacts include (CT DEP 2004):

- Increased runoff (increases in total volume of runoff)
- Increased peak discharges (increases in the maximum discharge volume)
- Decreased runoff travel time (runoff moves more quickly through the watershed)
- Reduced groundwater recharge (less rainwater is infiltrated into the ground)
- Reduced stream baseflow (reduced low flow stream volumes resulting in stream drying)
- Increased frequency of bankfull and overbank floods
- Increased flow velocities during storms
- Increased frequency and duration of high stream flow

These effects on water quantity, or flow, have a significant negative effect on aquatic habitats by altering stream hydrology and riparian vegetation and disrupting the natural stream substrate—all of which affect the habitat of aquatic species across the food chain, from macroinvertebrates to fish.

[7] Surfaces that cannot infiltrate rainfall, including rooftops, pavement, sidewalks, and driveways.

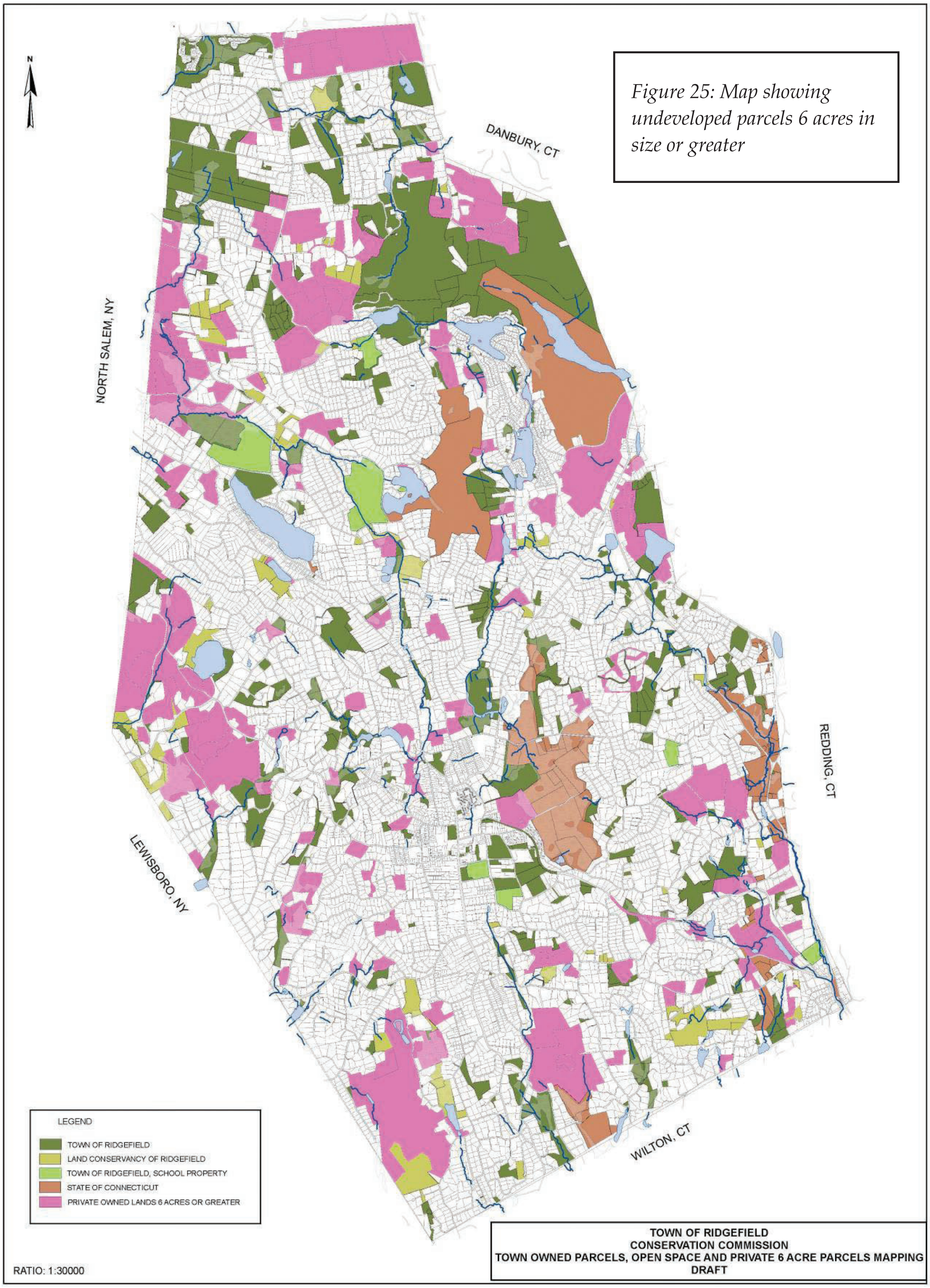


Figure 25: Map showing undeveloped parcels 6 acres in size or greater

In the past, hydrology studies for proposed development focused on not increasing the peak discharge of stormwater, meaning the highest volume generated at one point in time would not exceed predevelopment conditions. The development might increase the amount of stormwater generated, it would just be detained and released more slowly. This in turn meant streams ran at elevated levels for longer periods of time to accommodate the additional volume. Consequences of prolonged bank-full flow are bank erosion with the associated loss of vegetation, down cutting of the streambed, widening of the stream bed, splitting the main channel into multiple streams, called braiding, and sediment deposition. Each of these conditions contributes to the degradation of a watercourse.

Diversion of stormwater to watercourses as opposed to facilitating infiltration also reduces groundwater recharge. In low flow periods, streams and rivers depend on groundwater to maintain their baseflow volume and cooler water temperatures.

In addition to impacts on water quantity, stormwater runoff can have a significant negative impact on water quality, particularly in urbanized watersheds. As rainwater washes across impervious surfaces as well as lawns, it can pick up spilled oil, detergents, solvents, de-icing salt, pesticides, fertilizer, and bacteria from pet waste. Storm water drainage systems (e.g., catch basins) do not typically direct water to treatment facilities, but carry runoff directly into streams, rivers, and wetlands. Carried untreated into streams and waterways, these materials become what are referred to as "non-point source pollutants." Non-point source pollutants negatively affect water quality by increasing algae content, increasing water temperatures and reducing dissolved oxygen; all of which can result in impacts to aquatic life as well as recreational water uses and public drinking water supplies. The majority of surface pollutants are collected during small storm events, with the first inch of rainfall. This is the period when the majority of pathogens, sediment, waste, and debris are picked up by flow across lawns and roadways.

7.1b *Existing Water Quality Data for Ridgefield*

Several data sources were available to assess the current condition of some of Ridgefield's rivers, streams and lakes, these are:

1. Data collected as required under the Federal Clean Water Act (Section 305b)
2. Benthic macroinvertebrate sampling data collected by Ridgefield NRI volunteers in 2010
3. Data collected in the Norwalk River Watershed
4. Data collected at Mamanasco Lake

<u>Clean Water Act (305b) Data</u>
Section 305b of the Federal Clean Water Act requires states to monitor, assess and report on the quality of its waters relative to designated uses established by the state's Water Quality Standards. This report, entitled *Integrated Water Quality Report to Congress*, documents whether a water body is "fully supporting" or "not supporting" with respect to certain use categories including recreation, habitat for fish and other aquatic life and wildlife, fish consumption and drinking water.

Depending on the waterbody and data available, any one or combination of the following information sources were used to make water quality assessments: benthic macro-invertebrate and fish community analysis, ambient physical/chemical data, indicator bacteria monitoring and beach closures, intensive surveys, toxicity tests, sediment and tissue analyses.

The most recent 305b data (CT DEP GIS, 2008) contains assessments for those watercourses and waterbodies in Ridgefield listed in Table 11.

Table 11: Water quality of assessed surface waters, 305b data 2008

Water body / Watercourse	***Aquatic Life***	***Recreation***	***Fish Consumption***	***Drinking Water Supply***	***Cause of Impairment***
Miry Brook	Not assessed	Not supporting	Fully supporting	Not classified	*E. coli*
Saugatuck River	Not assessed	Not assessed	Fully supporting	Not assessed	None
Titicus River	Fully supporting	Not supporting	Fully supporting	Not assessed	*E. coli*
Mamanasco Lake	Not supporting	Not supporting	Fully supporting	Not assessed	Non-native aquatic plants & excessive algae growth
Ridgefield Brook	Not supporting	Not supporting	Fully supporting	Not classified	*E. coli*
Norwalk River	Not assessed	Not supporting	Fully supporting	Not classified	*E. coli*
Cooper Pond Brook	Not assessed	Not assessed	Fully supporting	Not classified	None
Not classified – waters not classified as drinking water supply source					

According to the 305b data, the primary impairment of the assessed waters in Ridgefield is *Escherichia coli* bacteria. *E. coli* is a type of fecal coliform bacteria that comes from human and animal waste.[8] The CT DEP and US Environmental Protection Agency uses *E. coli* measurements to determine whether water is safe for recreation. Disease-causing bacteria, viruses and protozoans may be present in water that has elevated levels of *E. coli*. Levels of *E. coli* can increase during flooding. In the cases of *E. coli* contamination noted above, the sources of contamination have not been identified.

Common sources of *E. coli* include agricultural runoff, urban stormwater runoff and sewage overflows. In Ridgefield, stormwater runoff is a likely source of *E. coli* contamination. Throughout Connecticut, stormwater is a major contributor of both bacterial and chemical non-point source pollution of surface waters. Impervious surfaces associated with urban and suburban areas are capable of generating more polluted storm water runoff than land covered in natural vegetation. *E. coli* levels in urban stormwater can reach as high as 100,000 CFU (colony forming unit)/ 100mL. Improperly designed or malfunctioning septic systems can also be a source of contamination.

[8] *E. coli* is measured in number of colony forming units. The EPA water quality standard for *E. coli* bacteria is 394 colony forming units per 100 mL.

Benthic Macro-invertebrate Data

The second water quality data source available was benthic macroinvertebrate data, which was collected at four locations by Ridgefield volunteers in the fall of 2010 as part of the CT DEP's *Rapid Bioassessment in Wadeable Streams and Rivers by Volunteer Monitors Program* (a.k.a. RBV program, see Map 8). The results of those surveys are summarized in Table 12 and available in the Ridgefield Conservation Commission office. Sampling of benthic macroinvertebrates has been widely used in the United States to assess aquatic health for the following reasons (Barbour *et.al.* 2002):

- Macroinvertebrate assemblages are good indicators of localized conditions. Because many benthic species have limited migration patterns or a sessile mode of life, they are particularly well suited for assessing site-specific impacts (upstream-downstream studies).
- Macroinvertebrates integrate the effects of short-term environmental variations. Most species have a complex life cycle of approximately one year or more. Sensitive life stages will respond quickly to stress; the overall community will respond more slowly.
- Degraded conditions can often be detected by an experienced biologist with only a cursory examination of the benthic macroinvertebrate assemblage. Macro-invertebrates are relatively easy to identify by family; many "intolerant" taxa can be identified to lower taxonomic levels with ease.
- Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects.

Table 12: 2010 RBV survey results

Stream / River Sample Locations	***Most Wanted***	***Moderately Wanted***	***Least Wanted***
Cooper Pond Brook	2	5	4
Norwalk River	3	4	2
Titicus River	4	6	1
Mopus Brook	3	5	0

KEY

(*source CT DEP RBV http://www.ct.gov/dep/lib/dep/water/volunteer_monitoring/rbvcards.pdf*)

Most Wanted - In general these organisms require a narrow range of environmental conditions. When found in abundance one can infer non-impaired stream condition.

Moderately Wanted – these organisms can be found in a variety of water quality conditions. When found in abundance further information about the upstream watershed may be necessary to infer water quality

Least Wanted - these organisms tend to be very tolerant of a wide range of environmental conditions. As a result when these organisms comprise the majority of a sample, one can infer some level of water quality impairment.

- Sampling is relatively easy, requires few people and inexpensive gear, and has minimal detrimental effect on the resident biota.
- Benthic macroinvertebrates serve as a primary food source for fish, including many recreationally and commercially important species.
- Benthic macroinvertebrates are abundant in most streams. Many small streams (1st and 2nd order), which naturally support a diverse macroinvertebrate fauna, only support a limited fish fauna.
- Most state water quality agencies that routinely collect biosurvey data focus on macroinvertebrates. Many states already have background macroinvertebrate data. Most state water quality agencies have more expertise with invertebrates than fish.

The CT DEP RBV program samples macroinvertebrates and divides them into three categories: (1) “most wanted”; (2) “moderately wanted” and (3) “least wanted.” The “most wanted” are those species that are highly sensitive to decreases in water quality while the “least wanted” are those species that can tolerate a wide range of water quality, from pristine to highly disturbed. The “moderately wanted” are those species that fall in the middle of this pollution-tolerance spectrum.

The mere presence of “least wanted” species does not indicate an impaired stream; however, if these species make up the greatest proportion of species present it is generally inferred that some type of water quality impairment is present. Most telling is the diversity of “most wanted” species within a stream, as these species can only thrive within a narrow range of water quality conditions. When four or more “most wanted” species are present, this indicates high water quality that is fully supporting of aquatic life. The Titicus River, one of the four waterways sampled in 2010, had four of these highly-sensitive species present. Mopus Brook and the Norwalk River sites also had a relatively high diversity of these high-sensitivity indicator species present (three species each). The most impaired of the four sample sites was Cooper Pond Brook, with only two “most wanted” species present and a higher proportion of “moderately wanted” and “least wanted” species. This impairment may be the result of stormwater draining from dense commercial development near the sample site, which was located near the intersection of Route 102 and Route 7 (see Map 8). Copies of the DEP historic benthic data surveys from Ridgefield streams are filed at the Ridgefield Conservation Commission office.

<u>Norwalk River Watershed Data</u>

Water quality data has been collected annually at twelve sites in the Norwalk River and some of its tributaries by Harbor Watch/River Watch since 1998 (Harris *et.al.* 2009). Data collection was focused on *E. coli* bacteria as an indicator of aquatic health. This data reveals that *E. coli* contamination continues to be an issue within the watershed, despite the fact that the point source discharges have been eliminated. The report attributes the elevated levels of *E. coli* to increases in non-point source discharges such as those generated from impervious surfaces. This measure is not inconsistent with the data from the macro-invertebrates, as they measure different aspects of water quality.

<u>Mamanasco Lake Data</u>

Monitoring of *E. coli* bacteria levels is conducted each summer at Mamanasco Lake’s public beach. When public health levels are exceeded, the beach area is closed until levels drop. This monitoring reveals that in most summers, the beach is closed at least once due to elevated bacteria levels. These elevated levels are typically associated with rain events which discharge polluted runoff into the lake.

7.1c Mitigating Impacts to Water Quantity and Quality

There are a number of ways in which impacts to water quantity and quality can be mitigated during the development process or redevelopment process as well as the management of residential landscapes. These include the employment of Low Impact Development Practices (LID practices) including stormwater retrofitting.

LID Practices for Residential Stormwater Management

The primary method for reducing impacts to water quantity and quality during new development or the retrofitting of existing development is through the use of LID techniques. LID techniques strive to allow natural infiltration to occur as close as possible to the original area of rainfall, thereby maintaining runoff volumes and patterns. The primary goal of LID development techniques is to preserve the pre-development hydrology. LID practices, as espoused by a variety of sources, follow key site design principles, including:

(1) ***Designing the Development to fit the Terrain -*** Soil disturbance is reduced when a development is designed to fit into the existing terrain. Placement of roads parallel to contours makes the installation of natural drainage ways easier. Development of steep slopes greater than 25 percent should be avoided to protect drainage basins.

(2) ***Limiting Land Disturbance Activities-*** By limiting land disturbance only to those areas absolutely necessary for construction, the intact natural systems can be preserved. This is more difficult and less practical on smaller lots in more urbanized areas.

(3) ***Reducing or Disconnecting Impervious Areas -*** Impervious surfaces are a necessary component of development, however there are options to reduce "connectedness" of these surfaces to the stormwater system.

(4) ***Preserving and Utilizing Natural Drainage Systems -*** Traditional stormwater design seeks to collect, concentrate and convey stormwater offsite. The LID approach advocates the use of vegetated systems, both existing and newly constructed, to keep runoff on the site.

(5) ***Providing Setbacks and Vegetated Buffers -*** Buffers help to reduce pollutant transport to surface water bodies both during and after construction. They also provide benefits to wildlife.

LID Informational Resources:

- UCONN's NEMO program at: http://nemo.uconn.edu/tools/stormwater/concepts.htm
- *Low-Impact Development Design Strategies, An Integrated Design Approach*, prepared by Prince George's County Maryland, Department of Environmental Resources, 1999: http://nemo.uconn.edu/tools/stormwater/pdf/LIDManual.pdf
- The Connecticut Department of Environmental Protection's 2004 Stormwater Quality Manual: http://ct.gov/dep/cwp/view.asp?a=2721&q=325704
- The U.S. Environmental Protection Agency's LID website: http://www.epa.gov/nps/lid/

Below: *pervious paving provides infiltration and reduces runof*

(6) ***Minimizing the Use of Steep Slopes* -** Disturbance of vegetation on steep slopes creates a high potential for erosion, and pollutant transport to surface waters. Slopes greater than 25 percent generally should be stabilized or avoided.

(7) ***Maintaining Pre-Development Vegetation* -** Intact vegetation helps to infiltrate and evapotranspire rainfall, which reduces the potential for runoff from the site. Erosion potential is also reduced.

These principles can be achieved through proper site selection and design, as well as the use of structural best management practices such as rain gardens, grass-lined swales and pervious pavers. The use of LID techniques can minimize the impacts of development on water quality and quantity. Some examples that can readily be implemented in existing residential developments within Ridgefield include:

- Consider installing rain gardens to promote infiltration of water from gutters and roof leaders into the ground.
- Collect roof runoff in rain barrels and use to supplement garden irrigation.
- Instead of repaving a decaying blacktop driveway consider the environmental and aesthetic benefits of replacement with a compacted gravel driveway or semi-permeable surface.
- Replace sunny areas of lawn with native grasses, creating habitat for insects and birds, using less water, and providing aesthetic interest in the winter.
- Replace failing shaded areas of lawn with fern glades and other shade-loving native plants and spring ephemerals. This creates habitat for small mammals and amphibians.
- Remove curbing along driveways.
- Do not allow manicured lawns to intersect with wetland margins. Instead restore a 10-15 foot strip of native herbaceous and low shrubby vegetation alongside streams and ponds. This creates a natural filter and provides habitat for many creatures.
- Do not allow grass clippings and leaves to be blown into wetlands and watercourses as it overloads these sensitive areas with nutrients.
- Do not convert ecologically complex and valuable wooded and shrub swamps into ornamental ponds (see Figure 26).

<u>Stormwater Retrofitting</u>

Site redevelopments offer an excellent opportunity to reduce stormwater runoff and lessen impacts on water quantity and quality. Older commercial and residential developments were typically constructed with significant amounts of impervious surface and little in the way of stormwater management measures. These developments were constructed before there was an understanding of the connection between stormwater runoff and water quality. The typical method for managing stormwater on older develop-

Figure 26: Complex wetland converted to ornamental pond

ments was to collect and pipe runoff from paved surfaces and directly discharge this water to the nearest stream or wetland. These older developments offer an opportunity to install or "retrofit" the site with stormwater management measures that will reduce the runoff volumes. These retrofitting practices can apply to large scale redevelopments or be scaled down to improve the management of an existing individual house site.

Stormwater retrofits are structural stormwater management measures for suburban watersheds designed to help minimize accelerated channel erosion, reduce pollutant loads, promote conditions for improved aquatic habitat and correct past mistakes. They are inserted into landscapes where little or no prior stormwater controls existed (Center for Watershed Protection). Stormwater retrofits can often occur when older developed sites are redeveloped. Stormwater retrofits help restore watersheds by providing stormwater treatment in locations where practices previously did not exist or were ineffective (Schueler *et. al.* 2007). Numerous retrofit opportunities exist in densely developed watersheds, particularly on sites that were constructed without stormwater quality or quantity mitigation measures. Many of these sites were developed prior to the 1970s and the institution of the CT Inland Wetlands and Watercourses Act (P.A. 155) and the Federal Clean Water Act (see Figure 27).

Examples of stormwater retrofit projects could include modifications that improve water quality and mitigate the impacts of stormwater quantity, such as the creation of disconnected impervious surfaces using rain gardens and infiltration trenches in developments containing large parking areas, or including water-quality basins (i.e. wet basins) on sites lacking such measures in order to improve water-quality renovation and reduce peak flows.

Another common retrofit practice is the conversion of existing simple detention basins into more complex treatment practices that polish (i.e., clean) stormwater. Older basins were typically designed to accommodate stormwater volume, but did not address water-quality renovation. These older basins can be converted into vegetated artificial wetlands or "wet ponds." These vegetated artificial wetlands provide nutrient and pollutant removal. This is perhaps the easiest retrofit option for many sites since stormwater is already collected at a designated lo-

Stormwater
Retrofit Resources:

- Center for Watershed Protection at: http://www.cwp.org/
- UCONN's NEMO program at: http://nemo.uconn.edu/tools/stormwater/concepts.htm
- The Connecticut Department of Environmental Protection's 2004 Stormwater Quality Manual: http://ct.gov/dep/cwp/view.asp?a=2721&q=325704

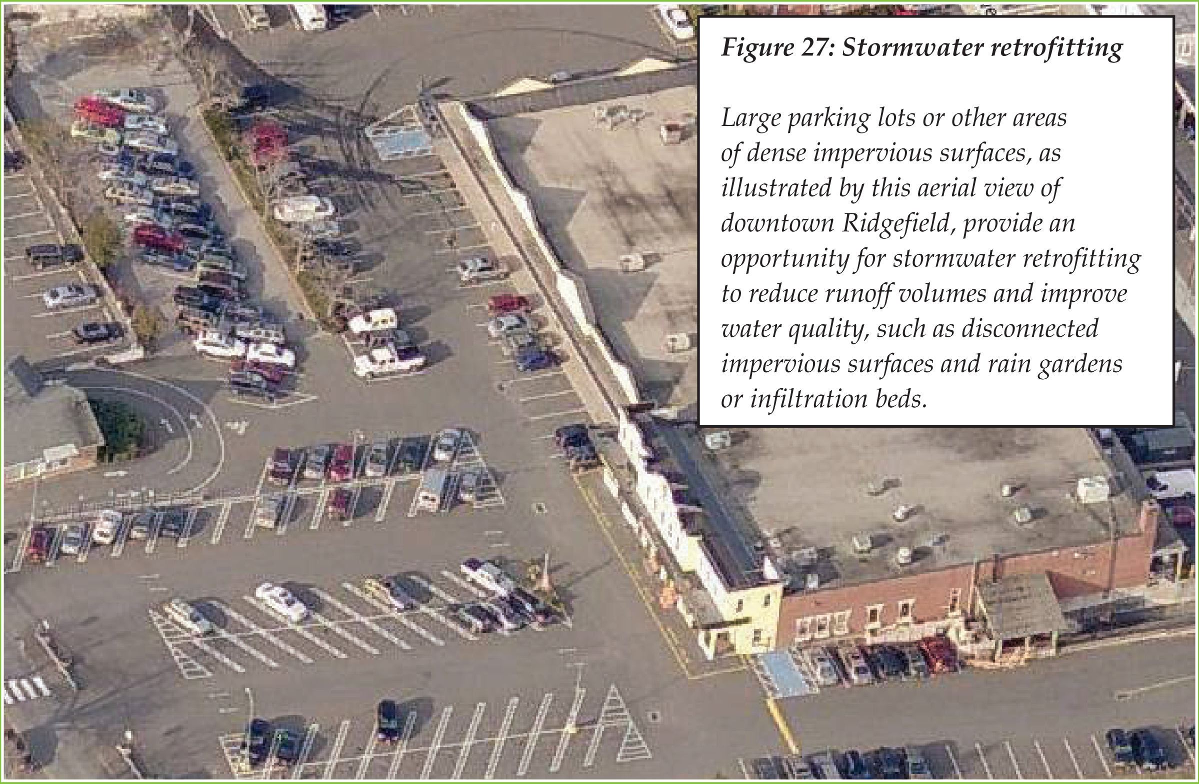


Figure 27: Stormwater retrofitting

Large parking lots or other areas of dense impervious surfaces, as illustrated by this aerial view of downtown Ridgefield, provide an opportunity for stormwater retrofitting to reduce runoff volumes and improve water quality, such as disconnected impervious surfaces and rain gardens or infiltration beds.

Stormwater retrofitting can accomplish the following objectives:

1. Repair past mistakes and maintenance problems – improve stormwater infrastructure including upgrading undersized culverts or repairing areas of chronic erosion.
2. Solve chronic flooding problems – this could include installation of supplemental upstream flood storage in flood prone areas.
3. Stormwater demonstration and education – demonstration of new stormwater practices to promote stormwater education and stewardship.
4. Trap trash and floatables – modifications or additions of structures in order to capture and remove trash and floatables and keep them from receiving waters.
5. Reduce runoff volumes to combined sewers – reduce flows to sewer systems in order to reduce the size and frequency of sewage overflows.
6. Renovate the stream & wetland corridor – including re-vegetating stream and wetland buffers, naturalization of channelized streams.
7. Reduce pollutants of concern – the goal of stormwater retrofit can be reduction of pollutants or bacteria (such as E. coli), sediment or nutrients
8. Systematically reduce downstream channel erosion – this type of work generally occurs in more intensively urbanized watersheds where chronic channel erosion is a problem.
9. Support stream restoration – activities can include flood storage modifications to regulate the frequency, volume, or peak discharge of stormflow installation in order to create a more predictable hydrologic regime; they may also incorporate water-quality and habitat improvement measures.

cation. Another benefit of retrofitting these existing basins is that new impacts to undeveloped portions of the site will not occur.

7.2 *Impacts of Development on Biodiversity and Ecosystems*

7.2a *Habitat Loss, Fragmentation and Connectivity*

The major factor in the reduction and loss of Ridgefield's biodiversity (i.e., plants, animals, and habitat types) is fragmentation of habitat units into smaller, isolated sub-units. This is a national phenomenon, which is discussed in detail by Johnson and Klemens (2005) in their book *Nature in Fragments: The Legacy of Sprawl.* The major driver of habitat fragmentation and its accompanying environmental degradation and impoverishment is a pattern of suburban development that now dominates large portions of Ridgefield. Klemens (1990, 1993) identifies a landscape-scale signature that indicates a tipping point for many of Connecticut's wildlife species. That tipping point is reached with the transition from compact development nodes (villages and hamlets) to dispersed development patterns, where individual houses are situated on lots of an acre or more. Examining USGS 7.5 minute quadrangles, Klemens identifies an abrupt shift in species richness and ecological integrity with progressive changes in road patterns. This occurs when the dominant road network pattern shifts from collector roads that move people between concentrated development nodes to road networks that solely function to disperse people to and within residential development.

Fragmentation creates myriad ecological challenges. Some are immediately apparent, such as deforestation and erosion, while others are measured in decades such as the reduction and loss of long-lived species as exemplified by several species of land and freshwater turtles that are at or near localized extinction (i.e., extirpation) within Ridgefield. Certain species respond to fragmentation in different ways. Amphibians and reptiles, because of their low dispersal abilities, are vertebrates that almost immediately exhibit declines of certain key species in fragmented habitats, when contrasted with birds that have greater dispersal capabilities between patches of optimal habitat (LaBruna et. al., 2006). Other species are able to dramatically increase their numbers in habitats dominated by humans. These species are termed by Mitchell and Klemens (2000) as "subsidized species," owing their success to a subsidy provided by humans. That subsidy could include introduction, elimination of competition, or human-created sources of food such as garbage or suburban gardens. Subsidized species is an umbrella for plants and animals that have been referred to as either over-abundant, invasive, exotic, or nuisance species. The term subsidized species is preferred because it correctly attributes the causality of the problem to its source, human actions, rather than to some intrinsic negative attribution of the worth of any individual species of plant or animal.

Understanding the mechanisms of how fragmentation affects species and ecosystems is very important. If we understand the stepwise progression leading toward this deterioration, we can begin to proactively avoid future damage and in some instances, reverse the loss of biodiversity and species richness of affecting approximately 75 percent of our native flora and fauna. When land is cleared and roads and houses are constructed, there are several immediate impacts. Deforestation immediately changes the very nature of the habitat, and often leads to high levels of erosion, despite attempts to minimize and control stormwater runoff and sediment erosion. The recent clearing also creates a new forest edge and the effects of that edge penetrate deeply into the remaining forest, altering its ecology.

This new edge is characterized by increased dryness of the ground, light spillage, and wind. The survival of many of the trees previously deeply situated within the forest, now exposed to sun and wind, is compromised. The pencil-like trees that often remain in new developments lack lower branches and are very susceptible to wind throw and other factors, and they often perish. These newly cleared habitats are well suited to the establishment of subsidized species, especially a variety of plants that establish themselves on the scraped and disturbed soils. The loss of water absorption ability, both by trees and shrubs, as well as the duff layer of the forest, results in rapid runoff. This is turn causes flashiness in small streams, as well as thermal spikes and sedimentation. These amplified oscillations with stream flows create deeply incised, scoured channels that are inhospitable to a variety of invertebrates as well as vertebrates. For example, the dusky salamander has all but disappeared in southwestern Connecticut because of the changes in headwater streams caused by habitat fragmentation. In streams where historically both the dusky and two-lined salamander occurred, only the two-lined remains, as it is able to tolerate and survive in degraded and flashy streams with minimal organic material (Klemens, 1993:54).

Figure 28 illustrates the penetration of “edge affects” into forest fragments within the Spring Valley area. While this area appears heavily forested, its value to forest-interior wildlife is very limited when this edge affect is accounted for.

Networks of roads and development fragment the habitat at differing layers of porosity. While white-tailed deer can easily move through a patchwork of roads, development, and manicured lawns, these are all but insurmountable barriers to amphibians and reptiles and many invertebrates. Over time, these habitat fragments suffer from lack of gene flow between ever-increasingly isolated species of plants and small animals, and are vulnerable to the chance effects of disease or other environmental catastrophes such as fire and adverse weather conditions (Lack, 1976). Over time, these habitat blocks lose many of their ecologically specialized and long-lived species, those referred to as “development-sensitive” in the FoSA analyses previously described, and what remain are those species characterized as “development-tolerant.” Multiply this pattern of loss at a town-wide and then regional landscape scale, and it becomes readily apparent why so large a proportion of Ridgefield’s biodiversity and that of its neighboring towns is in a long-term non-cyclical decline.

Several maps in this NRI illustrate the impact of development on biodiversity. For example, map 11 illustrates forest blocks within Ridgefield that are 100 acres or larger, the minimum size to sustain certain development-sensitive species based on our FoSA methodology.

Connections between undeveloped lands can help mitigate the full impact of fragmentation. The majority of significant terrestrial ecological connections exist on an east-west axis through the remaining forested upland areas and their associated wetlands. River corridors such as the Norwalk and Saugatuck provide some constricted movement corridors for certain terrestrial species, as well as north-south connectivity for aquatic species.

Figures 25 & 29 illustrate connectivity. Figure 25 (see Section 6.3), prepared by the Town of Ridgefield’s mapping department, shows the parcels of 6 acres or larger that have no more than one house per parcel. It also shows preserved open space and town–owned land. Although these six-acre-plus parcels are presently in private hands and have no restrictions in regard to future development, they have some potential as permanent connectors through future purchases or

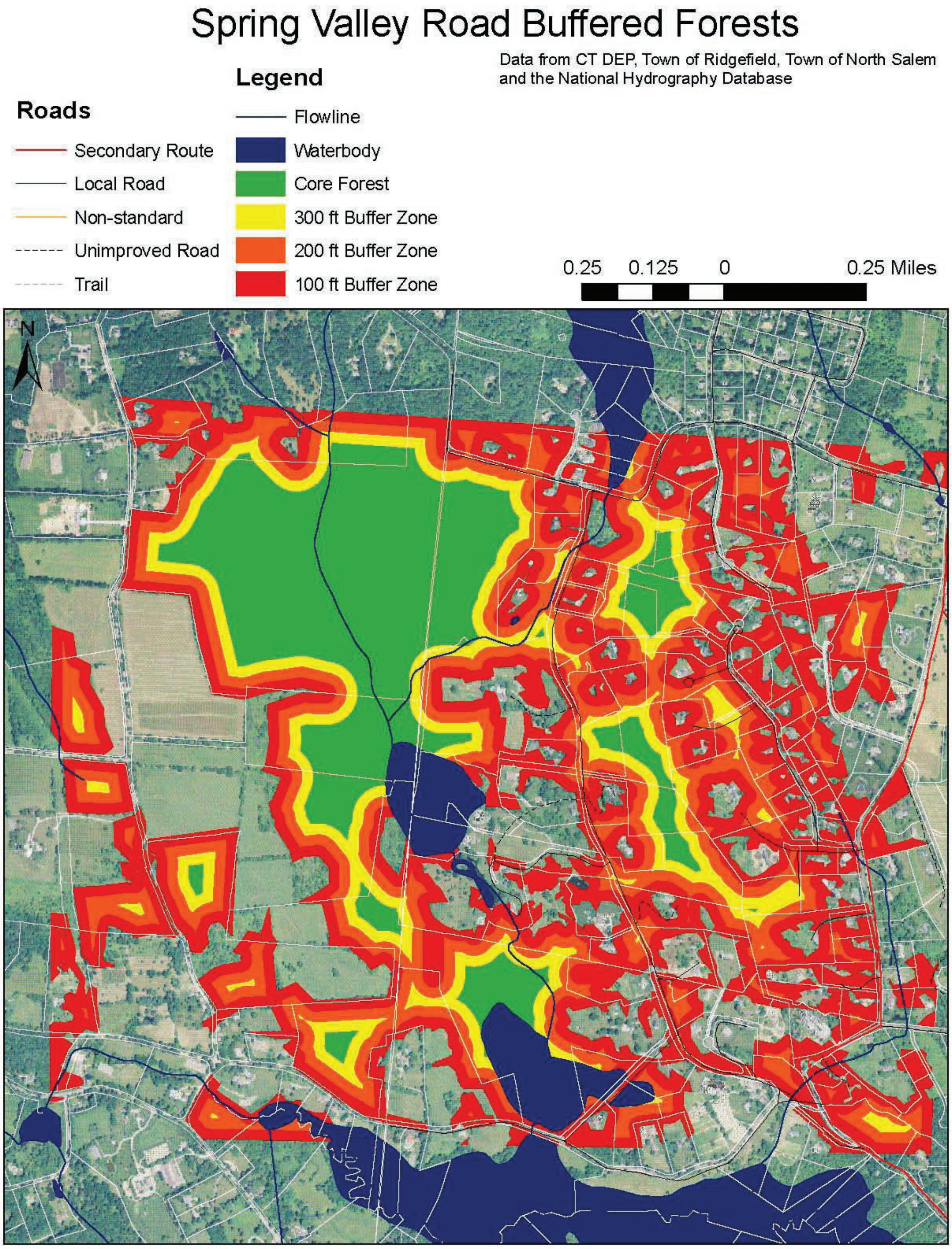


Figure 28: The impact of "edge affect" on core or interior forest habitat (map prep. K. Amick).

This map was created using 2008 forest coverage data. The forest was buffered inward to illustrate the fragmentation of the forest blocks. Each shift in color represents 100 feet further into the forest; the core forest in green has a total buffer zone of 300 feet. The green blocks range in size from 134 acres to 0.02; the largest four blocks are 134, 17, 7 and 7 acres, moving clockwise from the northwest (the 17 acre block is eclipsed by a water body on the map).

easements. If one looks at the presently preserved open space, one sees large and small parcels. While many of these smaller parcels do not contribute significantly to Ridgefield's biodiversity, they provide important visual screening of development and may serve as migratory stopover sites for birds on a limited basis. In many instances, these smaller parcels serve as reservoirs for subsidized species, while the large parcels contribute to the overall ecological connectivity discussed below.

Figure 29, mapped by Highstead using a variety of data sources, illustrates forest block sizes on a regional scale. Most importantly, all these data show that the northern sections of Ridgefield are connected eastward to large areas of intact forest that stretch from Bennett's Ponds and Wooster Mountain eastward through Danbury and Bethel and southward into Redding. A second area of ecological significance stretches from the extreme western portion of Ridgefield in the Spring Valley Road area into North Salem and another area from Pumping Station Swamp westward into Lewisboro and North Salem, NY. These western sections of Ridgefield are ecologically continuous with the Eastern Westchester Biotic Corridor (Miller and Klemens, 2002; Davison and Klemens, 2009b; Davison and Klemens, 2010).

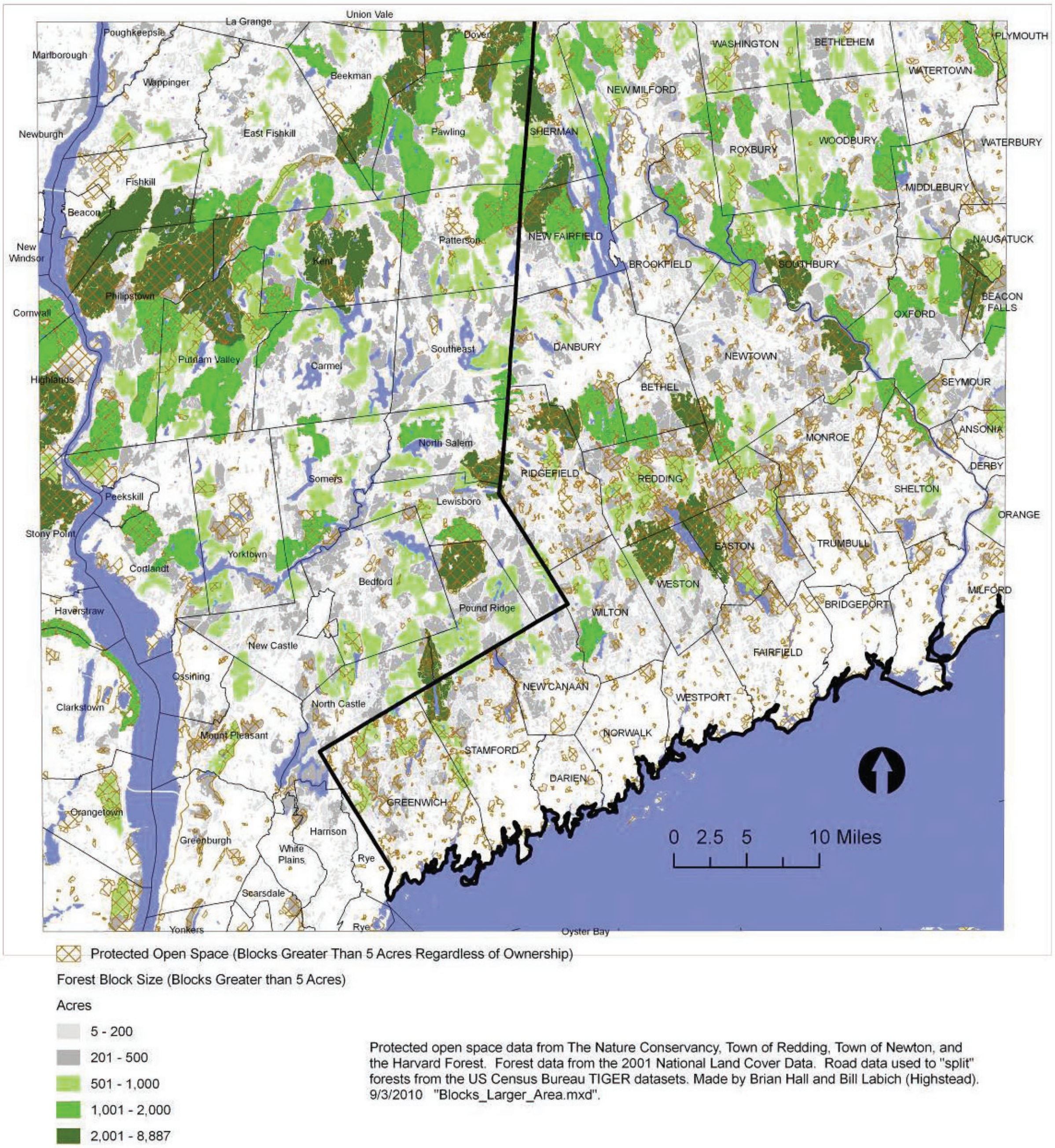
7.2b *Integrating Biodiversity and Ecosystems into the Land-Use Decision Making Process*

The challenge that Ridgefield faces moving forward is how to achieve a better balance between prudent economic growth and thoughtful stewardship of its natural resources. Too often, a healthy functioning environment is considered to be in opposition to economic growth and human quality of life. In fact, this is a false dichotomy. Without abundant clean water, clean air, and the myriad ecosystem services that are provided by natural systems, human survival and quality of life is impaired. If one can discard the oppositional model that pits the environment against human progress, we can begin to have a broader discussion about how to achieve both.

There are many tools available to achieve better patterns of development. These include:

- Conservation clustering that leaves 50-75 percent of the parcel as open space in its natural state. Conservation lands should not only include steep slopes and wetlands, but also developable land that connects these constrained features.
- A requirement that mandates that conserved open space on one development parcel connect to the open space on another parcel when possible.
- Improved (expanded) wetland buffers, especially in steeply graded areas.
- Limitations to the amount of site clearing.
- Conservation overlay district(s) in portions of the town that have exemplary natural values as defined by documented science-based criteria. The overlay district will leave the underlying zoning intact but allow for additional requirements and additional incentives to manage development in a more sustainable manner.
- Protection of exemplary vernal pools using the criteria of Calhoun and Klemens (2002).
- Make LID (Low Impact Development) practices the requirement for any development. Allow conventional techniques if an applicant demonstrates inability to employ LID.

Figure 29: Map showing regional forest blocks



LID techniques include, but are not limited to, curb-free roads, swales, rain gardens and other infiltration devices that treat run-off not as a waste product but life water to nurture the ecosystem.

- Require the environmentally protective standard as the development requirement rather than allowing it to be used at the discretion of the applicant. This provides higher levels of protection and more certainty to the applicant.

- Adopt enabling language in the subdivision, zoning regulations, site plan, and special permit regulations giving the P and Z the authority to consider state-listed species, ecological connectivity, exemplary natural communities, and unique features such as vernal pools and bedrock outcrops.
- Increase ecological connectivity through the re-development process.

8.0 RECOMMENDATIONS

Regulatory Opportunities / Reform

1. Prioritize protection of large parcels that contain forest-interior habitat through mechanisms such as outright purchase or easements. Easement language should specify protection of forest-interior habitat. Core habit is generally +/-300 feet from roads or other edge habitats. Easements and management should protect function of the core forest and maintain connectivity between forest blocks.

2. Separate the Inland Wetlands Commission (IWWC) from the Planning and Zoning Commission (P & Z). The current arrangement of having the P & Z serve as the IWWC is an outdated model that remains only in a handful of towns within Connecticut. P & Z and IWWC act as a check and balance upon one another, ensuring that development adequately factors in wetland avoidance and impacts. Combined agencies, such as in Ridgefield, often result in inadequate wetland protection. A review of this issue (CACIWC, Position Paper No. 3., www.caciwc.org; CCEQ, 2008) determined that combined commissions gave insufficient attention to their respective functions, required different expertise, resulted in attempts to streamline the regulatory process to the detriment of both component functions, often resulting in pre-judgment, and overwhelmed a single set of volunteer commissioners to their own and the public's detriment.

3. Investigate opportunities to reduce impervious surfaces of roads through changes to the subdivision regulations, driveways by promoting the use of pervious surfaces and parking areas by reviewing the parking requirements of land uses to determine if they are excessive. Opportunities also exist to reduce roadway width during major road maintenance operations, such as repaving and resurfacing. The requirement to provide curbs also reduces opportunities to promote infiltration of runoff within the adjacent right of way.

4. Ridgefield's Planning and Zoning regulations need to be more explicit and prescriptive concerning conservation opportunities within the development process. The town's subdivision regulations have not been recently updated and are vague in terms of protection-based language. Terms such as "preserve existing features" or "mitigate runoff" are unsupported by any specifics or guidance. This may be remedied by a joint task force of the Planning and Zoning and Conservation Commissions meeting to find ways to draft more explicit language for incorporation into the regulations. This will benefit all parties, providing clearer guidance to both the regulators, town staff, and the applicants. The more explicit guidelines will allow for money in lieu of open space to be used by the developers when open space does not meet established criteria.

5. Minimize loss of core forest by clustering development. Ridgefield's current cluster provision (Section 4:1-Planned Residential Development) is restricted to parcels of 75 acres or more that are served by public sewer and water. This high acreage threshold results in missed opportunities to cluster developments on smaller parcels served by wells and septic systems. A more flexible and innovative approach to cluster is required in order to protect important natural features and core forest habitat.

6. Planting plans approved by the P & Z whether part of subdivision or site plan approval should encourage the use of native plants or non-invasive non-native plants. This is especially important on properties that border upon riparian systems where floodwaters can easily spread plants throughout a downstream drainage basin.

7. Downward directed lighting and shielded lighting should be employed where a site abuts a natural area, wetland, or watercourse. This will reduce the impacts of light spillage into natural areas, which has a variety of deleterious effects to wildlife and plants. Landscape lighting should be restricted to areas that immediately surround houses, and should not be allowed in natural areas. Uplighting of trees should be actively discouraged.

8. Ridgefield should consider establishing a regional collaborative with neighboring towns to protect resources which cross town boundaries. Such efforts at shared dialogue ultimately help maintain home rule by providing a platform to discuss potential developments that lie on or near the municipal boundary.

9. Promote the incorporation of Low Impact Development (LID) and other stormwater management techniques in new developments as well as redevelopments. LID techniques have been proven effective at reducing the impacts of development on water quality and quantity. Applicants should be required to utilize LID techniques whenever possible as opposed to conventional stormwater measures.

10. Development applications that include swimming pools should be required to install wildlife exclusion fencing.

11. Consider a conservation/forest overlay district that would examine impacts to forest-interior habitat or forest blocks during review of development applications. Such an overlay district leaves the underlying zoning intact, but provides additional flexibility through incentives and standards for development to proceed within the district. One example may be the allowance of small scale clustering within the district to protect core forest function.

12. Consider establishment of a transfer-of-development-rights or other local mitigation banking program to offset habitat loss and fragmentation. Much of the open space that remains post-development has limited conservation values. In certain instances, it may have superior long-term natural resource benefits to more fully develop a parcel in exchange for open space set-asides that can be transferred toward the acquisition of a large, ecologically important area.

13. Leave UV disinfecting lights on year-round on all sewage treatment plants to reduce bacteria levels in the Norwalk River.

Residential / Landowner Stewardship and Public Education

1. Promote the use of native plant species in Ridgefield. Review of development proposals should include the promotion of native plantings in landscaping plans. Continue public education on invasive species through garden clubs and other civic groups.

2. Support the work of watershed coalition groups aimed at improving the quality and management of our streams and rivers.

3. Improve habitat diversity through land management. Reducing lawns, mowing of fields, planting of field edges, and creating small forest openings all provide opportunities for increasing biodiversity on small as well as large parcels.

4. Encourage reduced fertilizer, pesticide and herbicide use on town property as well as private residential lawns.

5. Establish neighborhood ecological associations whose primary purpose will be to raise ecological literacy and awareness among the general populace, developing a constituency for open space and natural resource stewardship and serving as environmental "watchdogs" for Ridgefield's natural resources.

6. The Conservation Commission should establish a small grants program for neighborhood associations to encourage projects that enhance or protect Ridgefield's natural resources. These grants would encourage stewardship while providing press and media coverage of efforts to protect natural resources. These annual grant awards could generate interest among civic groups resulting in greater overall ecological awareness.

7. Improve the condition and protection of riparian areas through education. An education program geared toward the importance of natural stream buffers and their restoration has an important place in Ridgefield due to the presence of many headwater stream systems. Riparian restoration projects would be excellent candidates for the small grants program previously described.

8. Support the Deer Committee's efforts for deer management to reduce the impact of deer browse on the forest understory.

<u>Research and Monitoring</u>

1. Update the NRI 2010 Surveys as new species are observed.

2. Conduct additional biological surveys to add to the knowledge of Ridgefield's biota.

3. Continue vernal pool assessments with a focus on those pools that are located on private lands.

4. Continue the benthic-macro-invertebrate stream sampling initiated under this NRI. Streams should be surveyed annually each fall.

5. Continue forest monitoring initiated under this NRI. Surveys should be conducted every ten years.

9.0 REFERENCES

Anon. 2001. An Evaluation of Existing Environmental Conditions on the Bennett's Pond Property, November 1998-June 2001. Stearns & Wheler, Inc. (*on file in Ridgefield Conservation Commission office, paper only*).

Anon. 2010. Ridgefield: 2010 Plan of Conservation and Development. Compiled by Planimetrics.

Barbour, M. T., Gerritsen, J., Snyder, B. D., and Stribling, J. 2002. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. U.S. Environmental Protection Agency.

Bedini, S. A. 1958. Ridgefield in Review.

Bell, M. 1985. The Face of Connecticut, people, geology and the land. State Geological and Natural History Survey of Connecticut. CT Department of Environmental Protection, bulletin 110.

Bevier, L. R. 1994. The Atlas of Breeding Birds of Connecticut. Department of Environmental Protection, bulletin 113.

Bogart, J. P., and Klemens, M. W. 1997. Hybrids and genetic interactions of mole salamanders (*Ambystoma jeffersonianum* and *A. laterale*) (Amphibia: Caudata) in New York and New England. American Museum Novitates 3218, 78 pp., 8 figs., 16 tabs.

Bogart, J. P., and Klemens, M. W. 2008. Additional distributional records of *Ambystoma laterale*, *A. jeffersonianum* (Amphibia: Caudata) and Their Unisexual Kleptogens in Northeastern North America. American Museum of Natural History Novitates: 3627: 58 pp., 8 figures, 7 tables.

Brady, N. C., and Weil, R. R. 1999. The Nature and Properties of Soils, twelfth edition. Prentice Hall Inc., NJ.

Brotherton, D. K., Cook, R. P. , and Behler, J. L. November 2005. Weir Farm National Historic Site Amphibian and Reptile Inventory March–September 2000. Technical Report NPS/NER/NRTR—2005/029. National Park Service. Boston, MA.

Calhoun, A. J. K. and Klemens, M. W. 2002. Best Development Practices (BDPs) for Conserving Pool-breeding Amphibians in Residential and Commercial Developments. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, NY.

Connecticut Association of Conservation and Inland Wetlands Commissions, Inc. 2006. Position Statement: Inland Wetlands and Watercourses Commissions: Separate Versus Combined with Planning and Zoning Commissions. Position Paper No. 3.

CCEQ (Connecticut Council on Environmental Quality), 2008. Swamped: Cities, Towns, the CT DEP and the Conservation of Inland Wetlands. Pp. 1-17 plus supporting documentation pp.1-10.

Connwood Foresters, Inc. 2011. Forest Stewardship Plan: Town of Ridgefield Properties, 324 Forest Acres 2011-2026 (*on file in Ridgefield Conservation Commission office*).

Connecticut Department of Environmental Protection website, www.ct.gov/dep.

Connecticut Department of Environmental Protection. 2004. Connecticut Stormwater Quality Manual.

Connecticut Department of Environmental Protection. 2010. Rapid Bioassessment in Wadeable Streams and Rivers by Volunteer Monitors, annual summary report #12, 2010.

Connecticut Department of Environmental Protection and Natural Resource Conservation Service. 2006. Soil Catenas of Connecticut.

Cowardin, L. M., Carter, V., Golet, F. C., and LaRoe, E. T. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington, DC. 103 pp.

Davison, E. R., and Klemens M. W. 2009a. Haines Pond Biodiversity Study. MCA Technical Paper No. 15. Metropolitan Conservation Alliance.

Davison, E. R., and Klemens, M.W. 2009b. Eastern Westchester Biotic Corridor: North Salem, Titicus Reservoir Addendum. MCA Technical Paper No. 4B, Metropolitan Conservation Alliance, Cary Institute of Ecosystem Studies, Millbrook, NY.

Davison, E. R., and Klemens, M. W. 2010. Eastern Westchester Biotic Corridor: Northern Terminus Addendum, North Salem–Southeast, New York. MCA Technical Paper No. 4C

DeMasi, V.O. (compiler). 1991. New Route 7 Expressway Natural History Inventory (*on file at the Ridgefield Conservation Commission office*).

Dowhan, J. J. and Craig, R. J. 1976. Rare and Endangered Species of Connecticut and Their Habitats. State Geol. and Nat. Hist. Surv. Of Connecticut, Rep. of Investigations 6:i-v,1-137.

Hammerson, G. A. 2004. Connecticut Wildlife, biodiversity, natural history and conservation. University Press of New England.

Harris, R., Fraboni, P. and Sroka, E. 2009. Water Quality Data Report for the Norwalk River Watershed, May 2009 through September 2009.

Johnson, E.A, and Klemens, M.W., editors. 2005. Nature in Fragments, the Legacy of Sprawl. Columbia University Press.

Klemens, M. W. 2000. Amphibians and Reptiles in Connecticut: A Checklist with Notes on Conservation Status and Distribution. Connecticut Department of Environmental Protection. Bulletin 32:1-90.

Klemens, M. W. 1993. The Amphibians and Reptiles of Connecticut and Adjacent Regions. Conn. Geol. Nat. Hist. Surv. Bulletin 112:1-318 + 32 plates.

Klemens, M. W. 1990. The Herpetofauna of Southwestern New England. Doctoral Dissertation/Ecology/Conservation Biology, University of Kent at Canterbury, U.K.

LaBruna, D. T., Klemens, M. W., Avery J. D., and Ryan, K. J. 2006. Pocantico Hills Biodiversity Plan, Rockefeller State Park Preserve and Associated Private Lands: A Public-Private Land Stewardship Initiative. MCA Technical Paper No. 12, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

Lack, D. 1976. Island Biology. Blackwell Scientific Publications, Osney Mead, Oxford.

MacArthur, R. H., and Wilson E. O. 1967. The Theory of Island Biogeography. Princeton University Press.

MacBroom, J. G. 1998. The River Book: The Nature and Management of Streams in Glaciated Terrains. CT DEP Natural Resource Center.

Miller, N. A. and Klemens, M. W. 2002. Eastern Westchester Biotic Corridor. MCA Technical Paper No. 4, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

Mitchell, J. C., and Klemens, M. W. 2000. Primary and Secondary Effects of Habitat Alteration, in Michael W. Klemens (ed.). Turtle Conservation. Smithsonian Institution Press, Washington, D.C. Pp. 5-32

Natural Resource Conservation Service (NRCS) 2008. Soil Survey of the State of Connecticut.

Oehler, J. D., Covell, D. F., Capel, S., and Long, B. 2006. Managing Grasslands, Shrublands and Young Forest Habitats for Wildlife, A Guide for the Northeast. The Northeast Upland Habitat Technical Committee, Massachusetts Division of Fisheries and Wildlife.

Schueler, T., Hirschman, D., Novotney, M., and Zielinski, J. 2007. Urban Subwatershed Restoration Manual No. 3, Urban Stormwater Retrofit Practices, Version 1.0. Center for Watershed Protection, Ellicott City, MD

United States Environmental Protection Agency. 2007. Reducing stormwater costs through low-impact development (LID) strategies and practices. Non-point Source Control Branch, Washington, DC

USFWS 2001 (M.W. Klemens, compiler). Bog Turtle (*Clemmys muhlenbergii*)—Northern Population Recovery Plan. U.S. Fish and Wildlife Service, Northeast Region.

MAPS

APPENDICES

APPENDIX 1: Soil Types of Ridgefield

Table 1: Soil types occurring in Ridgefield

KEY TO SOIL CATEGORIES

Wetland Soils | Floodplain Soils | Organic Wetland Soils | Shallow to Bedrock Soils | Limestone Soils | Other Non-Wetland Soils

Soil Type	***Glacial Deposit***	***USDA Drainage Class***	***Farmland Soil***	***Landform***
Wetland Soils – soils in which the water table is at or near the soil surface for extended periods during the growing season				
Fredon	Glaciofluvial	PD	Statewide importance	Nearly level drainageways, depressions and terraces on outwash plains
Leicester	Glacial till	PD	Statewide importance	Nearly level to gently sloping depressions and drainageways in uplands
Raypol	Glaciofluvial	PD	Statewide importance	Nearly level depressions and drainageways on outwash plains
Ridgebury	Glacial till	PD	Statewide importance	Nearly level to gently sloping depressions and drainageways in uplands
Ridgebury, Leicester & Whitman	Glacial till	PD-VPD	No	Nearly level to gently sloping depressions and drainageways in uplands
Rippowam	Alluvial	PD	Statewide importance	Nearly level on floodplains
Saco	Alluvial	VPD	No	Nearly level on floodplains
Fluvaquents-Udifluvents complex	Alluvial	PD-VPD	No	Nearly level on floodplains
Timakwa & Natchaug	Glaciofluvial	VPD	No	Depressions
Catden & Freetown	Organic	VPD	No	Depressions

Soil Type	***Glacial Deposit***	***USDA Drainage Class***	***Farmland Soil***	***Landform***
Fredon	Glaciofluvial	PD	Statewide importance	Depressions and drainageways on outwash plains and terraces
Halsey	Glaciofluvial	VPD	No	Nearly level terraces, depressions and drainageways on outwash plains
Walpole	Glaciofluvial	PD	Statewide importance	Nearly level drainageways and depressions on outwash plains
Floodplain Soils – soils subject to flooding by streams and rivers				
Fluvaquents-Udifluvents complex	Alluvial	PD-VPD	No	Nearly level on floodplains
Pootatuck	Alluvial	MWD	Prime	Nearly level on floodplains
Rippowam	Alluvial	PD	Statewide importance	Nearly level on floodplains
Saco	Alluvial	VPD	No	Nearly level on floodplains
Organic (muck) Wetland Soils – peat and muck soils subject to prolonged flooding				
Timakwa & Natchaug	Glaciofluvial	VPD	No	Depressions
Catden & Freetown	Organic	VPD	No	Depressions
Shallow-to-Bedrock Soils – soils with shallow depth to bedrock as well as bedrock (ledge) outcroppings				
Hollis-Chatfield-Rock Outcrop complex	Glacial till	WD-SED	No	Bedrock controlled hills and ridges
Rock Outcrop-Hollis complex	Glacial till	SED	No	Bedrock controlled hills and ridges
Chesire-Holyoke complex	Glacial till	SED-WD	No	Gently to strongly sloping on hills and till plains in uplands
Farmington-Nellis complex*	Glacial till	SED-WD	No	Gently sloping to steep on bedrock controlled hills and ridg-es in uplands
Limestone Soils – soils derived from marble geology				
Fredon	Glaciofluvial	PD	Statewide importance	Nearly level depressions and drainageways on outwash plains and terraces
Georgia-Urban Land com-plex	Glacial till	MWD	No	Anthropogenically altered; nearly level to gently sloping on hills in uplands
Georgia & Amenia	Glacial till	MWD	No	Nearly level to strongly sloping on hills and uplands

Soil Type	***Glacial Deposit***	***USDA Drainage Class***	***Farmland Soil***	***Landform***
Halsey	Glaciofluvial	VPD	No	Nearly level on terraces, depressions and drainageways on outwash plains
Nellis	Glacial till	WD	No	Gently sloping to moderately steep on hills and uplands
Farmington-Nellis complex	Glacial till	SED-WD	No	Gently sloping to steep on bedrock controlled hills and ridg-es in uplands
Other Non-Wetland Soils – Non-wetland soils not included in other categories				
Ninigret & Tisbury	Glaciofluvial	MWD	Prime	Nearly level to gently sloping on terraces and outwash plains in valleys
Gloucester	Glacial till	SED	No	Gently sloping to moderately steep hills on uplands
Hinckley-Urban Land com-plex	Glacial till	ED	No	Anthropogenically altered; gently sloping to strongly sloping kames, terraces, eskers and outwash plains in valleys
Hinckley	Glaciofluvial	ED	Statewide im-portance	Nearly level to steep on terraces, eskers, kames & outwash plains on valleys
Bernarndston	Glacial till	WD	Statewide im-portance	Gently sloping to moderately steep on uplands and hills
Charlton-Chatfield complex	Glacial till	SED-WD	No	Gently sloping to steep on bedrock controlled hills in uplands
Canton & Charlton	Glacial till	WD	No	Gently sloping to steep on hills and uplands
Agawam	Glaciofluvial	WD	Prime	Nearly level to strongly sloping on terraces and outwash plains in valleys
Charlton-Urban Land com-plex	Glacial till	WD	No	Anthropogenically altered; s trongly sloping in hills in uplands
Haven & Enfield	Glaciofluvial	WD	Prime	Nearly level to gently sloping outwash plains and terraces in valleys
Paxton-Urban Land complex	Glacial till	WD	No	Anthropogenically altered; strong-ly sloping on drumlins, hills and till plains in uplands

Soil Type	***Glacial Deposit***	***USDA Drainage Class***	***Farmland Soil***	***Landform***
Paxton & Montauk	Glacial till	WD	Prime (3-8% slopes only)	Gently sloping to moderately steep on hills, till plains and drumlins in uplands
Stockbridge-Urban Land complex	Glacial till	WD	No	Anthropogenically altered; gently to strongly sloping on hills in uplands
Stockbridge	Glacial till	ED	No	Gently sloping to moderately steep on hills in uplands
Sutton	Glacial till	MWD	Prime (3-8% slopes, non-stony only)	Nearly level to strongly sloping on drainageways and depressions in uplands
Udorthents-Pits complex, gravelly	Gravelly out-wash	MWD	No	Anthropogenically altered; Nearly level to steep sand and gravel pits
Udorthents-Urban Land complex	Drift	WD	No	Anthropogenically altered; Nearly level to moderately steep
Urban Land - Charlton-Chatfield complex	Glaciofluvial	WD	No	Anthropogenically altered; gently sloping to strongly sloping
Woodbridge-Urban Land	Glacial till	MWD	No	Anthropogenically altered; nearly level to gently sloping
Woodbridge	Glacial till	MWD	Prime (0-8% slopes only) statewide importance (8-15% slopes)	Nearly level to strongly sloping on drumlins and hills in uplands

Farmland Soils

Prime farmland- land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban land or built-up land or water areas.

Additional farmland of statewide importance – includes those areas that are nearly prime farmland that economically produce high yields of crops when treated and managed according to modern farming practices.

"Udorthents" and "Urban Land"

Refer to soil map units that have been anthropogenically altered or are developed

USDA Drainage Classes

VPD – very poorly drained (wetland soil)

PD – poorly drained (wetland soil)

SPD – somewhat poorly drained

MWD – moderately well drained

WD – well drained

SED – somewhat excessively drained

ED – excessively drained

**Depth to bedrock varies in the Farmington-Nellis soil complex from shallow to deep*

APPENDIX 2: NRI FIELD STUDIES

INTRODUCTION

Ridgefield has never had a comprehensive survey done of its flora and fauna. It is the intention of this document to ***START*** this process. It is the hope of the Conservation Commission that this inventory will be added to as new species are found. If you, the reader, come upon anything not in this document, please submit your finding to the Ridgefield Conservation Commission, *conservation@ridgefieldct.org*. Please include a careful description including location and, if at all possible, a photograph.
And now to the surveys.

When the inventory was conceived of, a decision was made that the underlying conditions that constitute Ridgefield's natural resources, its soils, waters, geology, landscape and habitats would be compiled by Dr. Michael Klemens, assisted by Eric Davison, working under the umbrella of the Cary Institute of Ecosystem Studies. It was left to Ridgefield's Conservation Commission to supply information about the biological/biotic communities that constitute Ridgefield.

It was clear from the outset that the Conservation Commission would have to limit its goals; that it would be impossible to inventory and catalogue everything that lived within Ridgefield. Discrete limits were imposed by the timetable of one year, the number of available volunteers and experts, and the limited access to private properties.

The time limit of one year was the first constraint. Even with a full team of experts, it is impossible to detect all species within a single year. Therefore the survey is incomplete and should be considered a work in progress, continued into the future as determined by available interest and expertise.

Within the NRI 2010 inventory framework, a decision was made to limit inquiries to a discrete group of taxa and habitats. Vernal pools, trees, wildflowers, amphibians, reptiles, butterflies, birds, and mammals were selected. Water quality was also added. The surveys were focused in five discrete areas of Ridgefield. These were Bennett's Pond State Park, Hemlock Hills Open Space, Pierrepont State Park, the Rail Trail, and Spring Valley Road. The first three are some of Ridgefield's largest protected properties and as such were thought likely to yield the richest amount of biodiversity. The Rail Trail provided a linear transect in the southern part of town, and Spring Valley allowed the inclusion of private properties in a lightly developed area.

Having selected what to study and where, the "how" was in turn determined by the availability of expertise, the number of interested volunteers and the time available within the one year framework. Details on how each study was conducted are outlined within each section.

A2.1 VERNAL POOLS

Survey Method
The protocol for vernal pools was developed with the author of this report, Michael Klemens. Prior to the survey, pools were identified by surveying aerial maps and by reports received by the Conservation Commission. Once in the field, pools were added as found (see Map 9). After

the survey was completed it was decided to add previously explored pools in the Weir Farm and Bennett's Pond areas.

Volunteers were recruited. They were trained at a session held at the Cary Institute and then again in the field by Dr. Klemens. The protocol for the survey was to visit each pool twice. On each visit the pool was examined for the presence of egg masses and tadpoles or larvae of the indicator species, i.e., species that depend on vernal pools for replication. The findings were documented with data sheets and photographs. The photographs were reviewed by Dr. Klemens to evaluate whether any of the salamander egg masses were those of the Jefferson Salamander, rather than the much more common spotted salamander. In addition other species when observed were recorded.

The following table shows the findings of the 2010 NRI survey and the other data gathered by previous surveys. When available it includes the geographic coordinates of the pools. Complete data on the findings is available at the Ridgefield Conservation Commission office in paper and electronic format, including maps of each location.

Table 1: Vernal pools

Location	New	Geographic		Source	Results	Notes
Casey Lane	23	41.2956	73.5183	NRI 2010	<25	
	22	41.2957	73.5163	NRI 2010	0	
Pine Mountain	59	41.3546	73.4851	NRI 2010	>25	
	13	41.3527	73.4882	NRI 2010	>25	
	60	41.3512	73.4838	NRI 2010	>25	Marbled, fairy shrimp
	61	41.3487	73.4842	NRI 2010	0	
	14	41.3506	73.4875	NRI 2010	>25	
	58	41.3565	73.4897	NRI 2010	>25	
	62	41.3498	73.4862	NRI 2010	PPNS	Marbled
	57	41.3434	73.4786	NRI 2010	NS	2011 Jefferson egg masses 20
	25	41.3446	73.4794	NRI 2010	NS	
Boy Scouts	71	41.3585	73.4937	NRI 2010	PPNS	
Hemlock Hills	69	41.3463	73.5005	NRI 2010	>25	
	70	41.3461	73.5027	NRI 2010	>25	
	67	41.3471	73.4976	NRI 2010	>25	
	68	41.3482	73.4975	NRI 2010	>25	Marbled
	18	41.3552	73.5052	NRI 2010	>25	
	21	41.3442	73.5045	NRI 2010	>25	Four-toed (2)
	32	41.3487	73.5035	NRI 2010	0	
	20	41.3479	73.5045	NRI 2010	>25	
	19	41.3510	73.5068	NRI 2010	>25	
	17	41.3614	73.5139	NRI 2010	>25	
Canterbury La	66	41.3652	73.5426	NRI 2010	>25	
	30	41.3637	73.5392	NRI 2010	0	
	29	41.3639	73.5335	NRI 2010	>25	

Location	New	Geographic		Source	Results	Notes
Woodcock Ntr	53	41.2502	73.4774	NRI 2010	>25	
	54	41.2504	73.4778	NRI 2010	0	
	5	41.2510	73.4785	NRI 2010	>25	
	55	41.2508	73.4767	NRI 2010	>25	
	52	41.2496	73.4770	NRI 2010	0	
Eureka IV	48	41.3234	73.4811	NRI 2010	PPNS	
	49	41.3224	73.4804	NRI 2010	PPNS	
	50	41.3237	73.4816	NRI 2010	PPNS	
	51	41.3250	73.4823	NRI 2010	PPNS	
Pierrepont SP	64	41.3346	73.4978	NRI 2010	PPNS	
	65	41.3325	73.5004	NRI 2010	<25	
	31	41.3198	73.4946	NRI 2010	0	
Peaceable Rdg	38	41.2806	73.5240	NRI 2010	>25	
	36	41.2804	73.5236	NRI 2010	<25	
	37	41.2805	73.5292	NRI 2010	>25	
	39	41.2825	73.5300	NRI 2010	>25	Northern two-lined
	35	41.2854	73.5246	NRI 2010	PPNS	
Sarah Bishop	56	41.3563	73.5433	NRI 2010	>25	Fairy shrimp
	12	41.3574	73.5436	NRI 2010	>25	
	11	41.3571	73.5425	NRI 2010	>25	Four-toed
	10	41.3545	73.5421	NRI 2010	>25	
	9	41.3542	73.5427	NRI 2010	>25	
	8	41.3545	73.5405	NRI 2010	>25	
Round Pond area	34	41.3103	73.5431	NRI 2010	PPNS	
	45	41.3087	73.5388	NRI 2010	PPNS	
	33	41.2907	73.5334	NRI 2010	PPNS	
Old Sib Road	15	41.3211	73.5423	NRI 2010	>25	
Silver Spring	76	41.2481	73.5091	NRI 2010	>25	Four-toed
	75	41.2464	73.5042	NRI 2010	>25	
	74	41.2468	73.5056	NRI 2010	>25	
	63	41.2452	73.5072	NRI 2010	>25	
	7	41.2493	73.5042	NRI 2010	>25	
Rail Trail	40	41.2778	73.4785	NRI 2010	0	
Florida Refuge	47	41.2772	73.4633	NRI 2010	0	
	46	41.2779	73.4603	NRI 2010	0	
	44	41.2801	73.4588	NRI 2010	0	
	43	41.2786	73.4583	NRI 2010	PPNS	
Weir Farm	42	41.2630	73.4519	NRI 2010	ND	
	41	41.2649	73.4497	NRI 2010	ND	

Location	New	Geographic		Source	Results	Notes
Ledges Road	16	41.3296	73.5262	NRI 2010	0	
Spire View	6	41.3319	73.5202	NRI 2010	>25	
Weir Farm	1	ND	-	NPS 2005	24	Spotted Salamander, Wood Frog also present, egg masses not counted
	2	ND	-	NPS 2005	6	Spotted Salamander; Wood Frog also present, egg masses not counted
	3	ND	-	NPS 2005	ND	Spotted Salamander, Wood Frog
	4	ND	-	NPS 2005	ND	Spotted Salamander, Wood Frog
Bennetts Pond	24	ND	-	Stearns & Wheler study	ND	Spotted Salamander, Wood Frog
	25	ND	-	Stearns & Wheler study	ND	Spotted Salamander, Marbled Salamander, Wood Frog
	26	ND	-	Stearns & Wheler study	ND	Spotted Salamander, Wood Frog
	27	ND	-	Stearns & Wheler study	ND	Spotted Salamander, Wood Frog
	28	ND	-	Stearns & Wheler study	ND	Spotted Salamander, Wood Frog

<u>KEY</u>

PPNS - Private Property Not Surveyed

“< >” - Refers to number of obligate egg masses found

ND – no data recorded

A2.2 FOREST INVENTORY DATA

Forest Plot Survey Method

The protocol for the forest plot surveys was developed by Edward Faison, a forest ecologist based at the Highstead in Redding, CT. All the sites surveyed were in the five areas of concentration. The sites were picked for their variety of habitat using mapping programs. This method proved largely accurate in the field. When not accurate, the site was altered. Also, sites were altered if access was very difficult. See Figure 14 in Section 4.1a.

Each site measured 20 meters by 20 meters. In the field, the locations of sites was found using G.P.S. Two corners were marked with plastic pipe and a marker with the site number on it was nailed to a tree. All woody material was identified and measured. The participants had varying degrees of skill from excellent to adequate, so occasional species may have been misidentified, but the general level of accuracy was high.

The complete data including GPS locations, descriptions of site, and data for each tree measured including type and diameter is available at the Ridgefield Conservation Commission office in paper and electronic form.

Table 2: Tree species observed during 2010 NRI forest survey

Common name	Scientific name
American Elm	*Ulmus americana*
Ash	*Fraxinus americana*
Basswood	*Tilia americana*
Beech	*Fagus grandifolia*
Birch, black	*Betula lenta*
Birch, yellow	*Betula alleghaniensis*
Cherry, black	*Prunus serotina*
Dogwood, flowering	*Cornus florida*
Gum, black	*Nyssa sylvatica*
Hawthorn	*Crataegus sp.*
Hemlock	*Tsuga canadensis*
Hickory, mockernut	*Carya tomentosa*
Hickory, pignut	*Carya glabra*
Hickory, shagbark	*Carya ovata*
Hophornbeam	*Ostrya virginiana*
Ironwood (hornbeam)	*Carpinus caroliniana*
Maple, red	*Acer rubrum*
Maple, sugar	*Acer saccharum*
Oak, black	*Quercus velutina*
Oak, chestnut	*Quercus prinus*
Oak, red	*Quercus rubra*
Oak, scarlet	*Quercus coccinea*
Oak, white	*Quercus alba*
Sassafras	*Sassafras albidum*
Spruce, Norway	*Picea abies*
Tulip	*Liriodendron tulipifera*

Table 3: Forest plot survey results by survey site location, 2010 NRI

	USDA	Dominant	Secondary	Other	Cover	Seedlings
Hemlock Hills						
HH1	8	Red maple, sugar maple	Shagbark hornbeam, red/chestnut oak		None	Striped maple (7), hornbeam (2)
HH2	1	Hemlock	Black birch	Yellow birch	None	None
HH3	8	Beech	Red maple	Red oak, white oak	None	Beech (16), striped maple (2)
HH4	1	Hemlock	Yellow birch	Ash	None	Striped maple
HH5	3	Red oak	Beech, red maple, yellow birch	Hemlock	Spice bush #3, witch hazel #1	Beech (18)
HH6	10	Black birch	Sugar maple	Yellow birch, red maple	Ferns #3	None
HH7	1	Hemlock	White oak	Red oak	Witch hazel #3, summer sweet	Ironwood (1)
HH8X	10	Sugar maple	Yellow birch	Tulip	None	Striped maple (8)
Seth Low Pierrepont points						
SP1	9	Red maple	Ash, yellow birch	Elm	Winterberry #1, spice bush #1	None
SP2	11	Sugar maple	Ironwood	Red maple mixed	None	Sugar maple (3)
SP3	5	Sugar maple	Black oak	Chestnut oak	None	Sugar maple (1)
SP4	3	Red oak	Black birch, sugar maple	Pignut hickory	Spice bush #1	Sugar maple (5)
SP5	5	Black oak	Red maple, oak, cherry, black birch		Barberry #1, Blueberry #1	Cherry (2)
SP6		Not surveyed				
Rail Trail points						
RT1	9	Red maple	Elm	Ironwood	None	None
RT2X	8	Red maple, beech	Black oak	Mixed hardwoods	Witch hazel #2	Yellow birch (1)
RT3X	9	Red maple	Yellow birch, iron-wood	Elm, black birch	Mixed shrubs #3	Red maple (1), hickory (1)
RT4	9	Red maple	Ironwood	Black birch, elm, hickory	Barberry #3, witch hazel (1), winterberry #2	None
RT5X	3	Sugar maple	Black birch	Red oak, mixed	None	None

	USDA	Dominant	Secondary	Other	Cover	Seedlings
Bennett's Pond						
BP1	11	Sugar maple	Ash, black oak		Witch hazel #1	Striped maple (1)
BP2	5	Chestnut, oak	Sugar maple, black birch	Hop hornbeam	Witch hazel #1	Hickory (2)
BP3	4	Black oak, white oak	Black birch, iron-wood	Tulip, Beech	Blueberry #1	Black birch (10), Ironwood (2)
BP4	12	Ash, elm	Red maple, sugar maple	Black birch	Privet #1	Sugar maple (2)
BP5	X	Hemlock (nonnative)	Linden, magnolia	Red pine, white pine	Wineberries #1	Sugar maple (1)
BP6	9	Hickory	Red maple, yellow birch	Tulip, black oak	Winterberry #2, Serviceberry #1	Hickory (6)
BP7	3	Mixed includ-ing:	Basswood, sugar maple, red/chestnut oak, tulip, beech, shagbark		Witch hazel #1	Beech (7)
Spring Valley Road						
SV1	11	Sugar maple		Ash	Barberry #3	None
SV2	3	Red oak	Hickory, red maple, black oak	Scarlet oak	Blueberry #1	Beech (8)
SV3	11	Sugar maple	Elm, ash		Barberry #1	None
SV4	11	Sugar maple	Ash, elm	Red maple	Mixed #2	None
SV5	12	Red maple	Sugar maple, ash	Black cherry, black birch	Spicebush and other #1	None
SV6	11	Sugar maple	Red oak, red maple	Ash, hickory	Barberry #2	None
SV7	9	Red maple	Sugar maple	Elm, ash	Mixed #2	None
SV8	9	Red maple	Ironwood	(Black ash nearby)	Barberry #4, vibernum #1	None
SV9	X	Norway spruce	Pignut hickory		Barberry #1	Bitternut hickory (8)

Key to USDA types:

1. eastern hemlock
2. white oak-red oak-hickory
3. red oak
4. tulip tree-white oak-red oak
5. chestnut oak- scarlet oak-black oak
6. cherry-white ash-tulip tree
7. elm-ash-black locust
8. red maple-oak
9. red maple swamp
10. sugar maple-beech-yellow birch
11. sugar maple-basswood
12. mixes hardwoods

X plantation

Key to cover scale for shrub species:

#1 1%
#2 1-4%
#3 5-25%
#4 25-50%
#5 51-74%
#6 >75%

A2.3 ADDITIONAL FOREST STUDIES
(on file at Conservation Commission office)

<u>Forest Study of New York City Watershed</u>
A professional forester, David Beers, did a forest survey aimed at forest management. This was funded by the Watershed Agricultural Council as part of their effort to preserve forests in the New York City watershed. Approximately 1/3 of Ridgefield lies in the watershed.

The survey was of town-owned land. Preserved open space and municipal properties were included; 343 acres in total were surveyed.

The study looked at the composition and conditions of the tree stands. It concluded with recommendations for stewardship. The only area of the NRI forest study that fell within the watershed was the Spring Valley study of private properties, so there was little overlap.

The survey confirms the history of Ridgefield's forests as returning after the agricultural use of fields ended. The youngest forests are 60 to 70 years old, the oldest 150 years old. In the younger fields, occasional red cedar, one of the first trees to grow in post-agricultural fields, are found. In addition, stone walls lace the surveyed lands. The tree stands showed more oak-dominated sites than were found in the NRI survey. Sugar maple stands were common as were red maple swamps.

The complete study, titled *Forest Stewardship Plan*, is available electronically and in paper form in the Ridgefield Conservation Commission office.

<u>Land Conservancy Forest Study Methodology</u>
The Land Conservancy of Ridgefield owns approximately 500 acres of land and holds conservation easements on 200 more acres. A yearly inspection of these properties is carried out. With the NRI in mind, the 2009 inspection included a description of the properties that included a number of variables:

1) How much was upland versus wetland
2) How much was forested
3) What species of trees were found
4) Whether or not they exceeded 12 inches in diameter
5) Shrub coverage
6) Presence of invasive species

The observers were asked to respond with impressions rather than actual measurements. The reports varied in terms of completeness but do give impressions as to the properties under management. There was great variety in the land held. Some of the properties exceeded 20 acres; some were less than two acres. The largest single holding was a 99-acre easement. The properties were all donated starting in the late 1960s. Many of the holdings were described by surveyors as "wild and wonderful," which seemed to correlate with the forested areas containing many mature trees.

Surveys were returned on 505 of the 700 acres. About 60 percent of the land held is upland, and 85 percent of the land upland or wetland was forested. The trees varied with the terrain. Properties that included steep ledge slopes contained the largest and oldest trees because they were never suitable for agriculture, neither crops nor grazing. Because of the informal nature of the survey, one cannot make any generalizations about the species mix of the properties or the presence of invasives. The data sheets are available in the Conservation Commission office in paper form.

A2.4 BIRDS

Breeding Birds

The goal of the breeding bird survey was to investigate which bird species breed in Ridgefield. The documentation of breeding is considered to be of higher conservation interest than birds that are merely migrating through Ridgefield.

Method:

The surveys took place between May 28, 2010 and June 24, 2010, encompassing the optimal period for the detection of most breeding birds. Two visits, separated by at least a week, were conducted at each pre-determined site. At each visit, two ten-minute long counts were conducted, one immediately after the other, for a total of twenty minutes per site. All birds heard or seen were counted in each period. The number of individuals heard/observed was not recorded.

Sites were chosen in each of the NRI inventory's five areas of concentration. These sites were supplemented by two other locations, Shadow Lake and Norwalk River. None of these sites were randomized, but were picked as potentially productive. See Map 13.

The data were collected by surveyors experienced in recognizing the distinct audial cues (i.e., song patterns) of the various species. A conservative approach was employed, if the surveyor was unable to make a positive detection, the species was not added to the survey list.

As the goal of the inventory was an assessment of the birds that breed in Ridgefield, the survey was supplemented by species known to breed by repeated observations in past years, but not found during the survey. This was considered to be valid as the 2010 survey did not systematically cover the entire town and excluded early-season breeding species. Site specific data is available at the Ridgefield Conservation Commission in electronic form.

Table 4: Breeding birds survey, 2010 NRI

Common Name	Scientific Name	Source
American crow	*Corvus brachyrhynchos*	NRI 2010
American goldfinch	*Spinus tristis*	NRI 2010
American redstart	*Septophaga ruticilla*	NRI 2010
American robin	*Turdus migratorius*	NRI 2010
American woodcock	*Scolopax minor*	Known to breed
Baltimore oriole	*Icterus galbula*	NRI 2010
Barn swallow	*Hirundo rustica*	NRI 2010
Barred owl	*Strix varia*	NRI 2010
Belted kingfisher	*Megaceryle alcyon*	Known to breed
Black and white warbler	*Mniotilta varia*	NRI 2010
Blackburnian warbler	*Dendroica fusca*	NRI 2010

Common Name	Scientific Name	Source
Black-capped chickadee	*Poecile atricapillus*	NRI 2010
Blue-gray gnatcatcher	*Polioptila cairulea*	NRI 2010
Blue jay	*Cyanocitta cristata*	NRI 2010
Blue-winged warbler	*Vermivora cyanoptera*	NRI 2010
Brown-headed cowbird	*Molothrus ater*	NRI 2010
Canada goose	*Branta canadensis*	NRI 2010
Carolina wren	*Thryothorus ludovicianus*	NRI 2010
Cedar waxwing	*Bombycilla cedrorum*	NRI 2010
Chestnut-sided warbler	*Dendroica pensylvanica*	NRI 2010
Chimney swift	*Chaetura pelagica*	NRI 2010
Chipping sparrow	*Spizella passerina*	NRI 2010
Common grackle	*Quiscalus quiscula*	NRI 2010
Common yellowthroat	*Geothlypis trichas*	NRI 2010
Cooper's hawk	*Accipiter cooperii*	Known to breed
Downy woodpecker	*Picoides pubescens*	NRI 2010
Eastern bluebird	*Sialia sialis*	NRI 2010
Eastern kingbird	*Tyrannus tyrannus*	NRI 2010
Eastern phoebe	*Sayornis phoebe*	NRI 2010
Eastern screech owl	*Megascops asio*	Known to breed
Eastern towhee	*Pipilo erythrophthalmus*	NRI 2010
Eastern wood pewee	*Contopus virens*	NRI 2010
European starling	*Sturnus vulgaris*	NRI 2010
Gray catbird	*Dumetella carolinensis*	NRI 2010
Great blue heron	*Ardea herodias*	NRI 2010
Great crested flycatcher	*Myiarchus crinitus*	NRI 2010
Great horned owl	*Bubo virginianus*	Known to breed
Green heron	*Butorides virescens*	Known to breed
Hairy woodpecker	*Picoides villosus*	NRI 2010
Hooded warbler	*Wilsonia citrina*	NRI 2010
House finch	*Carpodacus mexicanus*	Known to breed
House sparrow	*Passer domesticus*	Known to breed
House wren	*Troglodytes aedon*	NRI 2010
Indigo bunting	*Passerina cyanea*	NRI 2010
Mallard	*Anas platyrhynchos*	NRI 2010
Mourning dove	*Zenaida macroura*	NRI 2010

Common Name	Scientific Name	Source
Mute swan	*Cygnus olor*	NRI 2010
Northern cardinal	*Cardinalis cardinalis)*	NRI 2010
Northern flicker	*Colaptes auratus*	NRI 2010
Northern mockingbird	*Mimus polyglottos*	Known to breed
Northern rough-winged swallow	*Stelgidopteryx serripennis*	NRI 2010
Ovenbird	*Seiurus aurocapillus*	NRI 2010
Pileated woodpecker	*Dryocopus pileatus*	NRI 2010
Red-bellied woodpecker	*Melanerpes carolinus*	NRI 2010
Red-eyed vireo	*Vireo olivaceus*	NRI 2010
Red-shouldered hawk	*Buteo lineatus*	NRI 2010
Red-tailed hawk	*Buteo jamaicensis*	NRI 2010
Red-winged blackbird	*Agelaius phoeniceus*	NRI 2010
Ring-necked pheasant	*Phasianus colchicus*	NRI 2010
Rough-winged swallow	*Stelgidopteryx serripennis*	NRI 2010
Scarlet tanager	*Piranga olivacea*	NRI 2010
Song sparrow	*Melospiza melodia*	NRI 2010
Swainson's thrush	*Catharus ustulatus*	NRI 2010
Tree swallow	*Tachycineta bicolor*	NRI 2010
Tufted titmouse	*Baeolophus bicolor*	NRI 2010
Turkey vulture	*Cathartes aura*	NRI 2010
Veery	*Catharus fuscescens*	NRI 2010
Virginia rail	*Rallus limicola*	NRI 2010
Warbling vireo	*Vireo gilvus*	NRI 2010
White-breasted nuthatch	*Sitta carolinensis*	NRI 2010
Wild turkey	*Meleagris gallopavo*	Known to breed
Wood duck	*Aix sponsa*	NRI 2010
Wood thrush	*Hylocichla mustelina*	NRI 2010
Yellow warbler	*Dendroica petechia*	NRI 2010
Yellow-throated vireo	*Vireo flavifrons*	NRI 2010

Birds Observed

Method

A list of birds seen in Ridgefield between 2005 and 2010 was compiled from checklists of Jamie Meyers (ctredbird@comcast.net) and Allen Welby supplemented by observations by Ben Oko and others.

Table 5: All birds seen in Ridgefield, 2000 –2010

Goose, Snow
Goose, Canada
Swan, Mute
Duck, Wood
Mallard
Duck, Ring-necked
Merganser, Hooded
Duck, Ruddy
Pheasant, Ring-necked
Grouse, Ruffed
Turkey, Wild
Grebe, Pied-billed
Cormorant, Double-crested
Heron, Great Blue
Egret, Great
Heron, Green
Vulture, Black
Vulture, Turkey
Osprey
Hawk, Sharp-shinned
Hawk, Cooper’s
Hawk, Red-shouldered
Hawk, Broad-winged
Hawk, Red-tailed
Kestrel, American
Rail, Virginia
Killdeer
Sandpiper, Solitary
Sandpiper, Spotted
Woodcock, American
Gull, Ring-billed
Gull, Herring
Pigeon, Rock
Dove, Mourning
Owl, Eastern Screech
Owl, Great Horned
Owl, Barred
Nighthawk, Common
Swift, Chimney
Hummingbird, Ruby-throated
Kingfisher, Belted
Woodpecker, Red-headed
Woodpecker, Red-bellied
Sapsucker, Yellow-bellied
Woodpecker, Downy
Woodpecker, Hairy
Flicker, Northern
Woodpecker, Pileated
Wood-Pewee, Eastern
Flycatcher, Alder
Flycatcher, Least
Phoebe, Eastern
Flycatcher, Great-crested
Kingbird, Eastern
Vireo, Yellow-throated
Vireo, Blue-headed
Vireo, Warbling
Vireo, Philadelphia
Vireo, Red-eyed
Jay, Blue
Crow, American
Crow, Fish
Raven, Common
Swallow, Tree
Swallow, Northern Rough-winged
Swallow, Bank
Swallow, Barn
Chickadee, Black-capped
Titmouse, Tufted
Nuthatch, Red-breasted
Nuthatch, White-breasted
Creeper, Brown
Wren, Carolina
Wren, House
Wren, Winter
Kinglet, Golden-crowned
Kinglet, Ruby-crowned
Gnatcatcher, Blue-gray
Bluebird, Eastern
Veery
Thrush, Swainson’s
Thrush, Wood
Robin, American
Catbird, Gray
Mockingbird, Northern
Starling, European
Waxwing, Cedar
Warbler, Blue-winged
Warbler, Tennessee
Parula, Northern

Warbler, Yellow

Warbler, Chestnut-sided

Warbler, Magnolia

Warbler, Black-throated Blue

Warbler, Yellow-rumped

Warbler, Black-throated Green

Warbler, Blackburnian

Warbler, Yellow-throated

Warbler, Pine

Warbler, Palm

Warbler, Bay-breasted

Warbler, Blackpoll

Warbler, Black and White

Redstart, American

Ovenbird

Waterthrush, Louisiana

Yellowthroat, Common

Warbler, Hooded

Warbler, Canada

Tanager, Scarlet

Towhee, Eastern

Sparrow, Chipping

Sparrow, Field

Sparrow, Song

Sparrow, Swamp

Sparrow, White-throated

Junco, Dark-eyed

Cardinal, Northern

Grosbeak, Rose-breasted

Bunting, Indigo

Blackbird, Red-winged

Grackle, Common

Cowbird, Brown-headed

Oriole, Baltimore

Finch, Purple

Finch, House

Redpoll, Common

Siskin, Pine

Goldfinch, American

Sparrow, House

(Note: listing follows the A.O.U. Checklist of the Birds of North America (7th ed. 1998 and supplements to the 49th, July 2008).

A2.5 AMPHIBIANS AND REPTILES

The amphibians and reptiles survey has as a baseline the historical information from Michael Klemens' survey of amphibians and reptiles done for his work "The Amphibians and Reptiles of Connecticut and Adjacent Regions, 1993." The data from the NRI includes the vernal pool survey and species seen in casual field observations. No formal reptile survey was done.

Table 6: Amphibians and reptiles known to occur in Ridgefield

Common Name	Scientific Name	Source	Source
Jefferson salamander	*Ambystoma jeffersonianum*	Klemens 1993	***
Blue-spotted salamander	*Ambystoma laterale*	Klemens 1993	
Spotted salamander	*Ambystoma maculatum*	Klemens 1993	NRI 2010
Marbled salamander	*Ambystoma opacum*	Klemens 1993	NRI 2010
Northern two-lined salamander	*Eurycea b. bislineata*	Klemens 1993	NRI 2010
Four-toed salamander	*Hemidactylium scutatum*	Klemens 1993	NRI 2010
Redback salamander	*Plethodon cinereus*	Klemens 1993	NRI 2010
Slimy salamander	*Plethodon glutinosus*	Klemens 1993	
Red-spotted newt	*Notophthalmus v. viridescens*	Klemens 1993	NRI 2010
Eastern American toad	*Bufo a. americanus*	Klemens 1993	NRI 2010
Fowler's toad	*Bufo fowleri*	Klemens 1993	
Gray treefrog	*Hyla versicolor*	Klemens 1993	NRI 2010
Northern spring peeper	*Pseudacris c. crucifer*	Klemens 1993	NRI 2010

Common Name	Scientific Name	Source	Source
Bullfrog	*Rana catesbeiana*	Klemens 1993	NRI 2010
Green frog	*Rana clamitans melanota*	Klemens 1993	NRI 2010
Pickerel frog	*Rana palustris*	Klemens 1993	NRI 2010
Wood frog	*Rana sylvatica*	Klemens 1993	NRI 2010
Common snapping turtle	*Chelydra s. serpentina*	Klemens 1993	NRI 2010
Painted turtle	*Chrysemys picta*	Klemens 1993	NRI 2010
Spotted turtle	*Clemmys guttata*	Klemens 1993	***
Wood turtle	*Clemmys insculpta*	Klemens 1993	NRI 2010
Bog turtle	*Clemmys muhlenbergii*	Klemens 1993	
Eastern box turtle	*Terrapene c. carolina*	Klemens 1993	***
Common musk turtle	*Sternotherus odoratus*	Klemens 1993	NRI 2010
Eastern worm snake	*Carphophis a. amoenus*	Klemens 1993	
Northern ringneck snake	*Diadophis p. edwardsii*	Klemens (*unpublished data*)	
Black rat snake	*Elaphe o. obsoleta*	Klemens 1993	NRI 2010
Northern water snake	*Nerodia s. sipedon*	Klemens (*unpublished data*)	
Eastern garter snake	*Thamnophis s. sirtalis*	Klemens (*unpublished data*)	
Northern copperhead	*Agkistrodon contortrix mo-kasen*	Klemens 1993	
**** species confirmed by NRI in 2011; records collected after 2010 are not included on maps accompanying this document*			

A2.6 MAMMALS

<u>Survey Method</u>
Mammals are anecdotally known to be present by casual, non-systematic sighting or recent reported roadkill. A few roadkills were photographed during the inventory. When a specific location is noted, this indicates a photographic record either of roadkill or the animal. The absence of a mammal from the list does not imply its absence from Ridgefield, but rather the non-systematic nature of the data collection.

Table 7: Mammals observed, NRI 2010

Common Name	Scientific Name	Observed	Location
Beaver	Castor canadensis	Frequent	Multiple
Black bear	Ursus americanus	NRI 2010	Parley Lane
Bobcat	Lynx rufus	2011	West Lane
Coyote	Canis latrans	Frequent	Multiple
Eastern chipmunk	Tamias striatis	Frequent	Multiple

Common Name	Scientific Name	Observed	Location
Fisher cat	Martes pennanti	NRI 2010	Rt. 116
Grey squirrel	Sciurus carolinensis	Frequent	Multiple
Groundhog	Marmota monax	Frequent	Multiple
Long-tailed weasel	Mustela frenata	NRI 2010	Mopus Bridge
Meadow vole	Microtus pennsylvanicus	Frequent	Multiple
Mink	Neovison vison	NRI 2010	Spring Valley
Muskrat	Ondatra zibethicus	Frequent	Multiple
Opossum	Didelphis virginiana	Frequent	Multiple
Otter	Lontra canadensis	Occasional	Multiple
Raccoon	Procyon lotor	Frequent	Multiple
Red fox	Vulpes vulpes	Frequent	Multiple
Red squirrel	Sciurus vulgaris	Frequent	Multiple
Striped skunk	Mephitis mephitis	Frequent	Multiple
White-footed mouse	Peromyscus leucopus	Frequent	Multiple
White-tailed deer	Odocoileus virginianus	Frequent	Multiple

A2.7 BUTTERFLIES

The NRI did not undertake formal, comprehensive surveys of butterflies in Ridgefield. Therefore the following table is by definition an incomplete catalogue of the Lepidopteran fauna of Ridgefield. Anecdotal information was collected from a variety of sources and verified by Victor DeMasi. These tables include data from both 2009 and 2010. Invertebrate data from the parts of Ridgefield that were included in the annual Redding bird count are included as are data from field trips conducted at randomly selected sites picked for their potential for high productivity. These sites include fields at Bennett's Pond and Lake Windwing which are managed by mowing, resulting in flowering plants, most importantly wild bergamot, being available for butterfly nectaring.

The casual nature of this survey is well illustrated if it is contrasted to the work done 1955-59 for the Connecticut Butterfly Atlas project. This resulted in 55 species being identified compared to the 25 found for the NRI. The data from the Atlas project is available at the Ridgefield Conservation Commission in electronic form.

Table 8: Butterflies observed in Ridgefield

Common Name	Scientific Name	Location	Source*
American copper	*Lycaena phlaeus*	ST	NRI 2010
American lady	*Vanessa virginiensis*	ST	NRI 2010
Appalachian brown	*Satyrodes appalachia*	BF	NRI 2010
Black dash	*Euphyes conspicua*	LW	NRI 2010
Broad-winged skipper	*Poanes viator*	LW	NRI 2010
Cabbage white	*Pieris rapae*	BF LW ST WF	NRI 2010
Clouded sulphur	*Colias philodice*	BF ST WF	NRI 2010
Common buckeye	*Junonia coenia*	LW	NRI 2010
Common wood nymph	*Cercyonis pegala*	BF ST	NRI 2010
Dun skipper	*Euphyes vestris*	BF LW ST	NRI 2010
European skipper	*Thymelicus lineola*	BF LW ST	NRI 2010
Great spangled fritillary	*Speyeria cybele*	BF ST WF	NRI 2010
Hobomok skipper	*Poanes hobomok*	ST	NRI 2010
Little glassywing	*Pompeius verna*	BF WF	NRI 2010
Monarch	*Danaus plexippus*	BF LW ST WF	NRI 2010
Northern broken-dash skipper	*Wallengrenia egeremet*	ST	NRI 2010
Pearl crescent	*Phycoides tharos*	BF LW ST	NRI 2010
Question mark	*Polygonia interrogationis*	ST	NRI 2010
Silver-spotted skipper	*Epargyreus clarus*	BF LW ST	NRI 2010
Spicebush swallowtail	*Papilio troilus*	BF LW	NRI 2010
Summer azure	*Celastrina ladon*	BF ST	NRI 2010
Tailed blue	*Everes comyntas*	ST	NRI 2010
Tawny-edged skipper	*Polites themistocles*	BF ST	NRI 2010
Tiger swallowtail	*Papilio glaucus*	BF LW ST WF	NRI 2010
Wild indigo duskywing	*Erynnis baptisiae*	LW	NRI 2010

Location Key: BF, Bennetts Farm; LW, Lake Windwing; ST, Simpaug Turnpike; WF, Weir Farm
*Butterflies inventoried in 2009 are included in the NRI 2010 data.

A2.8 WILDFLOWERS

The 2010 wildflower survey was conducted by several of the NRI volunteers who had both interest and expertise in floral identification. This was a non-systematic incidental survey. Both spring and summer wildflowers are listed.

The inventory used historical data for spring wildflowers collected by Jack Sanders. Much of these data were Sanders' personal observations, augmented by information provided to him by other by other Ridgefielders. This data set was primarily collected in the 1970s, supplemented with some later additions.

The original Sanders inventory contained specific locations where the flowers were found. Many of these areas have been lost to subsequent development, and other areas have been severely impacted by deer browse, a major threat to wildflowers in Ridgefield. Table 9 does not attempt to confirm spring flowers by location. It compares the presence of flowers found in 2010 with the Sanders' inventory. It is not intended to be complete. Some of flowers found by Sanders may still be present in Ridgefield, despite not being recorded during the 2010 NRI. The original inventory is available in the Ridgefield Conservation Commission office in paper and electronic form.

The Sanders inventory did not include summer or autumn wildflowers. The 2010 NRI (Table 9) documented summer wildflowers, again in a non-systematic manner. Ridgefield also has important autumn wildflowers, including a variety of asters, and the fringed gentian (*Gentiana crinita*) documented by Michael Klemens in the Great Swamp in 2005.

Table 9: Spring wildflowers observed in Ridgefield

Common Name	Scientific Name	Source	Source
Anemone, Rue	*Annemonella thalictroides*	Jack Sanders	NRI 2010
Anemone, Wood	*Anemone cinquefolia*	Jack Sanders	NRI 2010
Avens, Yellow	*Geum aleppicum/strictum*		NRI 2010
Baneberry, White	*Actea pachypoda*	Jack Sanders	NRI 2010
Bellwort, Perfoliate	*Uvularia perfoliata*		NRI 2010
Bittercress, Pennsylvania	*Cardamine pensylvanica*	Jack Sanders	
Bloodroot	*Sanguinaria Canadensis*	Jack Sanders	NRI 2010
Bluets	*Houstonia caerula*	Jack Sanders	NRI 2010
Buttercup, Hispid	*Ranunculus hispidus*	Jack Sanders	
Buttercup, Kidney	*Ranunculus aborvitus*	Jack Sanders	NRI 2010
Buttercup, Swamp	*Ranunculus septentrionalis*	Jack Sanders	
Calla, Wild	*Calla palustris*	Jack Sanders	
Celandine	*Chelidonium majus*	Jack Sanders	NRI 2010
Cohosh, Blue	*Caulophyllum thalictriodes*		NRI 2010
Coltsfoot	*Tussilago fargara*	Jack Sanders	NRI 2010
Columbine, American	*Aquilegia Canadensis*	Jack Sanders	
Cress, Smooth Rock	*Arabis laevigata*		NRI 2010
Cress, Spring	*Cardamine bulbosa*	Jack Sanders	
Cress, Winter	*Barbarea vulgaris*	Jack Sanders	
Cuckoo Flower	*Cardamine pratensis*	Jack Sanders	
Dutchman's Breeches	*Dicentra cucullaria*	Jack Sanders	NRI 2010
False Solomon's Seal	*Smilacina racemosa*	Jack Sanders	

Common Name	Scientific Name	Source	Source
Fleabane, Philadelphia	*Eregeron philadelphicus*	Jack Sanders	NRI 2010
Geranium, Wild	*Geranium maculatum*	Jack Sanders	NRI 2010
Gill-over-the-ground	*Glechoma hederacea*	Jack Sanders	NRI 2010
Ginger, Wild	*Asarum Canadense*	Jack Sanders	
Ginseng, Dwarf	*Panax trifolius*		NRI 2010
Golden Alexanders	*Zizia aurea*	Jack Sanders	
Hellibore, False	*Veratrum viride*		NRI 2010
Hepatica, Round-lobed	*Hepatica Americana*	Jack Sanders	NRI 2010
Jack-in-the-Pulpit	*Arisaema atrorubens*	Jack Sanders	NRI 2010
Lady's Slipper, Pink	*Cypripedium acaule*	Jack Sanders	NRI 2010
Lady's Slipper, Yellow	*Cypripedium calceolus*	Jack Sanders	
Leek, Wild	*Allium tricoccum*		NRI 2010
Lily, Bullhead	*Nuphar variegatum*	Jack Sanders	
Lily, Trout	*Erythronium Americana*	Jack Sanders	NRI 2010
Marigold, Marsh	*Caltha palustris*	Jack Sanders	NRI 2010
May Apple (Mandrake)	*Podophyllum peltatum*	Jack Sanders	NRI 2010
Mayflower, Canada	*Maianthemum canadense*	Jack Sanders	NRI 2010
Mertensia (Virginia Cowslip)	*Mertensia virginica*	Jack Sanders	NRI 2010
Miterwort	*Mitella diphylla*	Jack Sanders	NRI 2010
Mustard, Garlic	*Alliaria officininalis*	Jack Sanders	NRI 2010
Orchis, Showy	*Orchis spectabilis*	Jack Sanders	
Parsnip, Meadow	*Thaspium trifoliatum*	Jack Sanders	
Partridgeberry	*Mitchella repens*		NRI 2010
Plantain, Downy Rattlesnake	*Goodyera pubescens*		NRI 2010
Pussytoes	*Antennaria neglecta*	Jack Sanders	NRI 2010
Ragged-Robin	*Lychnis flos-cuculi*		NRI 2010
Ragwort, Golden	*Senecio aurens*	Jack Sanders	NRI 2010
Robin-Plantain	*Erigeron pulchellus*		NRI 2010
Rue, Early Meadow	*Thalictrum dioicum*	Jack Sanders	
Sarsaparilla	*Aralia nudicaulus*	Jack Sanders	NRI 2010
Saxifrage, Early	*Saxifraga virginiensis*	Jack Sanders	NRI 2010
Skunk Cabbage	*Symplocarpus foetidus*	Jack Sanders	NRI 2010
Solomon's Seal, False	*Smilacina racemosa*		NRI 2010
Solomon's Seal, Great	*Polygonatum canaliculatum*	Jack Sanders	NRI 2010
Solomon's Seal, Smooth	*Polygonatum biflorum*	Jack Sanders	NRI 2010

Common Name	Scientific Name	Source	Source
Speedwell, Corn	*Veronica arvensis*	Jack Sanders	
Speedwell, Slender	*Veronica filiformis*	Jack Sanders	
Spurge, Cypress	*Euphorbia cyparissias*	Jack Sanders	NRI 2010
Star Flower	*Trientalis borealis*	Jack Sanders	NRI 2010
Stargrass	*Hypoxis hirsuta*	Jack Sanders	
Stonecrop, Wild	*Sedum ternatum*	Jack Sanders	
Strawberry, Common (wild)	*Fragaria virginiana*	Jack Sanders	
Toothwort	*Dentaria diphylla*	Jack Sanders	NRI 2010
Toothwort, Cutleaf	*Dentaria lacinata*	Jack Sanders	
Trillium, Dwarf	*Trillium narvale*	Jack Sanders	
Trillium, Red	*Trillium erectum*	Jack Sanders	NRI 2010
Trillium, White	*Trillium grandiflorum*	Jack Sanders	
Violet, Common Blue	*Viola papilionacea*	Jack Sanders	NRI 2010
Violet, Dog	*Viola conspersa*	Jack Sanders	
Violet, Early Blue	*Viola palmata*	Jack Sanders	
Violet, Lance-leaved	*Viola lanceolata*	Jack Sanders	
Violet, Long-spurred	*Viola rostrata*		NRI 2010
Violet, Marsh Blue	*Viola cucullata*	Jack Sanders	
Violet, Northern White	*Viola pallens*	Jack Sanders	NRI 2010
Violet, Smooth Yellow	*Viola pensylvanica*	Jack Sanders	NRI 2010
Violet, Sweet White	*Viola blanda*	Jack Sanders	
Violet, Triangle-leaf	*Viola emarginata*	Jack Sanders	
Wintergreen, Spotted	*Chimiphila maculata*		NRI 2010
Wood Betony, Lousewort	*Pedicularis Canadensis*	Jack Sanders	

Table 10: Summer wildflowers observed in Ridgefield

Common Name	Scientific Name	Source
Arrowhead, Broadleaf	*Sagittaria latifolia*	NRI 2010
Bartonia	*Bartonia virginica*	NRI 2010
Batchelor’s Buttons	*Centaurea cyanus*	NRI 2010
Black-eyed Susan	*Rudbeckia hirta*	NRI 2010
Butter and Eggs	*Linaria vulgaris*	NRI 2010
Buttercup	*Ranunculus acris*	NRI 2010
Campion, Bladder	*Silene cucubalis*	NRI 2010
Cattails	*Typha latifolia*	NRI 2010

Common Name	Scientific Name	Source
Cinquefoil, Common	*Pontentilla simplex*	NRI 2010
Cinquefoil, Rough-fruited	*Potentilla simplex*	NRI 2010
Clover, Least Hop	*rifolium dubium*	NRI 2010
Clover, Red	*Trifolium pratense*	NRI 2010
Clover, White Sweet	*Melilotus alba*	NRI 2010
Daisy, Ox-eye	*Chrysanthemum leucanthemum*	NRI 2010
Dames Rocket	*Hesperis matronalis*	NRI 2010
Dogbane, Intermediate	*Apocynum medium*	NRI 2010
Fleabane, Common	*Eregeron philadelphicus*	NRI 2010
Fleabane, Daisy	*Eregeron annuus*	NRI 2010
Garlic, Field	*Allium vineale*	NRI 2010
Herb-Robert	*Geranium robertianum*	NRI 2010
Lily, Day	*Hemerocallis fulva*	NRI 2010
Madder, Wild	*Galium mollugo*	NRI 2010
Milkweed	*Asclepias syriaca*	NRI 2010
Milkweed, Purple	*Asclepias purpuascens*	NRI 2010
Motherwort	*Leonurus cardiaca*	NRI 2010
Mountain-Mint, Virginia	*Pycnanthemum virginianum*	NRI 2010
MT.-Mint, Narrow-leaved	*Pycnanthemum tenuifolium*	NRI 2010
Mullen, Common	*Verbascum thapsus*	NRI 2010
Nettle, Horse	*Solanum carolinense*	NRI 2010
Pink, Deptford	*Dianthus armeria*	NRI 2010
Ragweed	*Ambrosia artemisiifolia*	NRI 2010
Raspberry, Black	*Rubus occidentalis*	NRI 2010
Raspberry, Purple-flowering	*Rubus odoratus*	NRI 2010
Sorrel, Yellow Wood	*Oxalis stricta*	NRI 2010
St. Johnswort, Common	*Hypericum perforatum*	NRI 2010
St. Johnswort, Shrubby	*Hypericum spathulatum*	NRI 2010
Thistle, Canada	*Cirsium discolor*	NRI 2010
Trefoil, Birdfoot	*Lotus corniculatus*	NRI 2010
Vetch, Crown	*Coronilla varia*	NRI 2010
Vetch, Purple	*Vicia americana*	NRI 2010
Water-Lilly, Fragrant	*Nymphae odorata*	NRI 2010
Wineberry	*Rubus phoenicolasius*	NRI 2010
Yarrow	*Achillea millefolium*	NRI 2010

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