The Farmington Valley Biodiversity Project

A Model for Intermunicipal Biodiversity Planning in Connecticut

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The Farmington Valley Biodiversity Project: A Model for Intermunicipal Biodiversity Planning in Connecticut

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Introduction

The Farmington Valley Biodiversity Project (FVBP) is an intermunicipal collaboration involving seven contiguous towns located within the Farmington River Valley of Connecticut: Avon, Canton, East Granby, Farmington, Granby, Simsbury and Suffield. The primary objectives of the project are to:

1) Collect and map comprehensive data on the biological resources within the seven-town area.

2) Identify and map priority conservation areas for incorporation within each town's Plan of Conservation and Development to help guide municipal planning and decision making regarding land use.

3) Promote awareness of the region's unique ecological communities, the importance of biodiversity, threats to biodiversity, and the role that various municipal commissions can take towards the conservation of biodiversity.

The project is coordinated by the Metropolitan Conservation Alliance, a program of the Wildlife Conservation Society (WCS/MCA), and the Farmington River Watershed Association (FRWA). The FVBP is an extension of several other conservation initiatives undertaken by the WCS/MCA in the tri-state region of Connecticut, New York and New Jersey including the *Eastern Westchester Biotic Corridor* (Miller & Klemens 2002), the *Croton-to-Highlands Biodiversity Plan* (Miller & Klemens 2004), and the *Southern Wallkill Biodiversity Plan* (Miller et al. 2005). Planning models such as these strategically link contiguous towns and provide the mechanism for individual municipalities to address their local conservation needs in a manner that also fosters regional conservation planning. The model also provides a significant scale of economic efficiency. By spreading costs among a group of towns, the cost for any single town to accomplish the same work is much reduced. Intermunicipal partnerships are also attractive to potential donors because they are both local and regional in scope.

A formal FVBP working group was created to assist in administering and communicating locally about the project. The working group consists of representatives from each of the participating towns including town planning staff and commission members, land trust officials, environmental attorneys, professional ecologists, and WCS/MCA and FRWA staff.

The project was officially launched in November 2001 with a workshop that brought together a broad array of experts including town planners and commission members from the seven participating towns, biologists from the Connecticut Department of Environmental Protection, WCS/MCA, The Nature Conservancy, and the Connecticut Museum of Natural History, an environmental attorney, land use managers from the McLean Game Refuge, the Metropolitan District Commission (MDC), and the FRWA. This working session focused on obtaining input on the following areas to guide project staff in development and implementation of the project:

- Knowledge of existing and available sources of biological data for the Farmington Valley that could be incorporated into the project.

- Strategies for managing the biological data set, including guidelines for sharing and distributing the data, as well as developing GIS data layers.

- Approaches and methods to undertaking the field research component of the project.

The Importance of Conserving Biodiversity

Although small in land area, the Connecticut landscape is diverse for its size, featuring an impressive range of distinct ecological regions and within them, a rich diversity of animals and plants. Even within the seven-town area of the Farmington River valley covered by the FVBP this is evident. Biodiversity encompasses the richness of life at all levels, from the genetic level to the species and population, natural community, and ecoregion levels. All of these levels of diversity are represented within the Farmington River Valley and are important for future conservation planning. Table 1 provides an example of the different levels of diversity occurring within the Farmington River Valley.

Table 1: Biological diversity at multiple scales within the Farmington River Valley.

Genetic-population Level	Species Level	Community Level	Ecoregion Level
Genome diversity among hybrid populations of the blue-spotted/Jefferson salamander complex.	Nineteen species of salamanders and other amphibians.	Vernal pool breeding community of amphibians, and associated reptiles, invertebrates, and plants.	Traprock ridges and the mosaic of vernal pools and forest habitat communities and their associated animal and plant species.

Biologists are frequently asked the question, "Why does biodiversity matter?" Maintaining the native biodiversity of a region has many benefits and values. Biologically diverse ecosystems are healthy ecosystems, sustaining important natural processes such as soil creation, pollination, decomposition of organic matter, and filtration of water. There are also enormous recreational benefits associated with biodiversity which often translate to economic benefits because of strong interest among the public in observing wildlife. A recent study conducted in Dutchess County, New York provided an illustration of the relationship between local biodiversity and Lyme disease risk. The study found that smaller (<2 ha.), fragmented forests supported a higher density of infected deer tick nymphs. Consequently these forest fragments present a much greater Lyme disease risk than larger forest areas (Allan et al. 2003). The authors attributed the increase in density of nymphal ticks and the prevalence of nymphal infection to the loss of vertebrate species resulting from forest fragmentation. Many of these vertebrates are competitors or predators of the white-footed mouse, the primary natural reservoir for the Lyme bacterium (Allan et al. 2003). White-footed mouse populations are not diminished by forest fragmentation and, in fact, can increase in density under such conditions. Clearly, as our understanding of ecosystem functions grows, our understanding of the importance of biologically diverse systems and their impact on human populations grows as well.

Land Use Change and Biodiversity

As with all of New England, the Farmington River Valley has undergone significant changes in land use since colonial settlement. Originally the area was predominantly mature forest with openings created by beaver activity and other natural processes including wildfire. By the late 1800s, extensive clearing of forests for agriculture and timber resulted in the deforestation of more than three-quarters of the landscape. During the agricultural period, areas unsuitable for farming (e.g., steep ridges and large wetlands) served as "refugia" for wildlife, especially forest-dependent species. Although current development pressures impinge on such areas, they remain some of our most biologically rich habitats. In the early 1900s, as farming gradually waned with the advent of manufacturing resulting from industrial development, reforestation of the landscape began in earnest and continued throughout the 1900s. As the forests gradually returned, wildlife was able to re-colonize the landscape and their populations rebounded.

The key elements in the example above are resiliency and connectivity. As land uses changed over time, many species of wildlife and natural communities were able to adapt to these changes. For example, certain grassland-dependent birds, such as the bobolink (*Dolichonyx oryzivorus*) and eastern meadowlark (*Sturnella magna*), make use of hayfields as surrogate habitat for their native grassland breeding habitats (Miller & Klemens 2002).

Today's land use patterns are entirely different from those of historic times. A resilient reaction to sprawl in not possible for most species. In the current wave of sprawl, permanent structures are erected. Highways, parking lots, subdivisions, and commercial developments fragment remaining tracts into smaller pieces, and isolate them from other tracts. The impervious surfaces created through such development degrade the last parcels of habitat by drastically altering hydrologic conditions, impacting water quality and introducing "edge effects" that degrade the remaining terrestrial habitat. Although careful planning can mitigate some of the adverse impacts of such development, most planning occurs on a site-specific scale, and does not consider the much larger landscape-scale picture. Ironically, the land review process currently practiced by most municipalities may actually foster fragmentation by considering too small an area in the review process. The transitions that are occurring within our landscape today are much more permanent than past changes, and they do not accommodate our native biodiversity. The few wildlife species that have adapted to such changes are opportunistic and/or invasive species, which thrive at the expense of a more diverse and balanced biological community (Miller & Klemens 2002).

Approximately a quarter of a million people reside within the Farmington River Valley. During the period 1950 through 2000 population in the seven FVBP towns grew by 363% from 27,547 to 100,191 (U.S. Census 2000). However, population growth is not the primary factor driving land use issues; rather it is a shift in population from the cities to the surrounding rural areas and suburbs, coupled with the current pattern of development spreading across the landscape. This pattern of landscape development is typically referred to as "sprawl" (see Johnson & Klemens 2005).

For example, a recent report on the Capitol Region, in which the FVBP seven-town study area is situated, found that during the period 1950-2000, the region's population residing in rural and suburban communities more than doubled, increasing from 18% to 38%. Conversely, the share

of the region's population residing in fully suburban and urban communities declined from 82% to 62% (Capitol Region Council of Governments 2003).

The sprawling pattern of housing development over the past several decades also reflects the shift in the region's population from the city to the suburbs. Using census data as a measure of how much undeveloped land in the region was converted to residential use during the period 1990-2000, the report found that there were 5,800 fewer acres of undeveloped land in 2000 than in 1990. For the most part, this land was converted to low-density residential use, typical of subdivision development, on one- to two-acre lots. If this trend continues, the analysis estimated that nearly 9,000 acres of rural, undeveloped area would be converted to new subdivisions by 2015 (Capitol Region Council of Governments 2003).

Further evidence of the extent of this problem was reflected in a recent Connecticut study that found that between 1970 and 2000, Connecticut's population grew by a modest 12%; however, the amount of developed land grew by more than 100% during this same period (Orfield 2003).

Planning at the Landscape Level

As sprawl proceeds, large tracts of habitat within our landscape are fragmented into ever-smaller components. To maintain biodiversity, we must ensure that remaining habitats are of sufficient size and quality to support viable populations, and that they are arranged in such a way that allows dispersal of plants and animals across the landscape. Klemens and others have described this as creating or maintaining a "permeable landscape." The following paragraphs define those landscape components, and discuss how ecological function can be maintained through better planning.

All too often, land use decisions are made at the municipal level without the benefit of baseline biological information, or without mechanisms to integrate such information into planning processes. This occurs despite significant efforts of concerned citizens and municipal officials. The gap between information providers (scientists) and information users (local decision-makers) creates a major obstacle. WCS/MCA has identified three fundamental challenges that lead to this situation (Miller & Klemens 2002):

1) *Baseline data are generally not available*: Without data, it is impossible to plan for economic growth while simultaneously ensuring environmental integrity. Baseline ecological data can be used to identify areas of biological significance worthy of protection, and to identify areas of lesser significance.

2) *Even where data are readily available, mechanisms rarely exist to translate the data into policy*: To address this problem WCS/MCA has been developing a set of publications to serve as "conservation tools" and identifying similar tools that will aid planners and other decision-makers in the application of biological data. These tools are targeted at a broad constituency, to address land use issues within Connecticut, New York and New Jersey. WCS/MCA and FRWA will work closely with project towns to incorporate these conservation tools into local strategies for biodiversity conservation. For more information on these tools, the reader can refer to MCA Technical Paper Series: No. 10

entitled "From Planning to Action: Biodiversity Conservation in Connecticut Towns" (Klemens et al. 2006).

3) *Biological data and conservation tools are ineffective unless they are accepted as part of a community's goals and integrated into land use practices*: WCS/MCA and the FRWA strive to raise awareness and understanding of biodiversity concerns among municipal officials, land trust personnel, the general public and others who influence the patterns of development upon our landscapes. This is accomplished by serving in an advisory capacity to planning commissions and other entities, raising awareness of biodiversity by conducting informative presentations and field trips, and promoting intermunicipal, cooperative efforts to plan for biodiversity.

For development to occur in a manner that is compatible with biodiversity, the "porosity" of the landscape must be maintained with regard to wildlife habitat, allowing animals to move around development nodes. In order to create a porous landscape, we must understand and accommodate core wildlife habitat areas, or "hubs," and the connections between them. In general, habitat hubs are better able to support healthy, viable populations than smaller areas. The connections between hubs are of paramount importance; although they may not be as pristine as the hubs they connect, they enable dispersal of plants and animals among the hubs, maintaining gene pools and preventing local extinctions. Ecologically-friendly development is a porous landscape consisting of compact development nodes with multiple, broad swaths of habitat connections extending around them, linking habitat hubs. In addition, great attention is paid to designing roads and infrastructure that have a low ecological impact. *Thus, ecologically-friendly development should be envisioned as compact development nodes in a surrounding matrix of wildlife habitat rather than fragments of wildlife habitat within a matrix of development.*

Because we are making permanent changes to our landscape, it is imperative to carefully identify where the matrix of wildlife habitats and corridors occurs. It is not sufficient to randomly protect small parcels or "island" habitats across the region in the hope that they will provide viable wildlife habitat. Instead, we must discover where species and natural communities already occur (i.e., priority habitats), and use the results of those inquiries as a template for making future land use decisions. If we apply this conceptual template to guide development patterns, it may be possible to maintain biodiversity and ecological health. Without this template to guide us, loss of biodiversity is certain (Miller & Klemens 2002).

The Farmington River Valley

The Farmington River Watershed covers an area of 609 square miles encompassing over 30 towns in Connecticut and Massachusetts. While predominantly rural in character with large tracts of forest remaining in the headwaters, extensive ridges and numerous wetland systems, the Farmington River valley supports a mosaic of land use including urban centers, suburban residential and commercial development, light industrial and agriculture. The Farmington River flows through the center of it all and is a multi-use resource, providing drinking water, recreation, hydropower, fish and wildlife, and economic opportunities to the communities of the watershed (Farmington River Watershed Association 1999). In 1994, Congress designated the upper reach of the Farmington River stretching from Canton to Colebrook as a Wild and Scenic River.

The Farmington River Valley includes five distinct ecological regions, or "ecoregions." Figure 1 illustrates the distribution of these ecological regions within the seven-town study area. The ecological regions are described below:

1) The **traprock ridge ecoregion** extends up through the river valley and includes the Metacomet ridge system that runs along the eastern edge of the river valley and the intrusive ridge system that runs along the western edge of the valley. These unique geological features composed of erosion resistant basalt from ancient lava flows harbor a wide range of important natural communities such as talus slopes and cliffs, bald rocky summits, perched vernal pools and large tracts of contiguous forest. These habitats contribute significantly towards the region's biodiversity. Wildlife species such as the five-lined skink (*Eumeces fasciatus*), Connecticut's only lizard, and the northern copperhead (*Agkistrodon contortrix mokasen*), are restricted to traprock ridge habitats in this region. These ridge systems also function as natural corridors and refugia for migratory birds and large mammals such as the bobcat (*Lynx rufus*) and black bear (*Ursus americanus*). Many rare plants are located within traprock ridge communities. For example, the only Connecticut occurrences of the long-leaved bluet (*Houstonia longifolia*) are found here.

2) The **alluvial floodplain ecoregion** associated primarily with the Farmington River and some of its larger tributaries support an array of natural communities ranging from wet meadows and marshes to floodplain forests and forest levees. Species such as the northern leopard frog (*Rana pipiens*), wild rice (*Zizania palustris*), the purple giant hyssop (*Agastache scrophulariifolia*), starry campion (*Silene stellata*) and a variety of wetland-dependent birds including the American bittern (*Botaurus lentiginosus*) reside within these habitats. These riparian corridors also serve as important dispersal routes and linkages for wildlife.

3) **The sandplain ecoregion** is restricted to a number of small pockets scattered throughout the low-lying central portions of the Farmington River Valley. Although highly vulnerable to development, a number of the core habitats in these areas are on managed lands. These ecosystems support a specialized community of plants and animals including many rare moths, tiger beetles (*Cicindela* sp.) and other invertebrates as well as breeding populations of warm season grassland birds such as the grasshopper sparrow (*Ammodramus savannarum*).

4) The **western highlands ecoregion** extends throughout much of the western portions of the river valley. This region is characterized by a shift in topography from the low-lying valley to the steeper elevations of the surrounding uplands, and a shift in geology to granite and gneiss. Large tracts of contiguous forest transitioning from central to more northern hardwood species support robust communities of breeding forest-interior birds including the cerulean warbler (*Dendroica cerulea*). Headwater streams and seeps support populations of native brook trout (*Salvelinus fontinalis*), the slimy sculpin (*Cottus cognatus*) and the northern spring salamander (*Gyrinophilus p. porphyriticus*). Many large mammals including black bear, river otter (*Lutra canadensis*), bobcat and fisher

(*Martes pennanti*) are well established here and the moose (*Alces alces*) is currently expanding its range into this area of the Farmington River Valley.

5) The **glacial lake plain ecoregion** lies within the extreme northeastern section of the Farmington River Valley, primarily within the town of Suffield. This region is more typically associated with northern sections of the Connecticut River Valley. This region is characterized by geology that features fine clays and sediments deposited by a glacial lake that covered the area more than 10,000 years ago. Because of the high degree of impermeability of these sediments, a large number of wetland systems have developed across the landscape, including dense clusters of small vernal pools and extensive red maple swamps. The fertile sediments deposited by the lake also promoted the expansion of agriculture in this region, a land use that has also contributed significantly to the biodiversity of the valley by maintaining some of the largest contiguous grasslands in the region. These habitats support grassland bird communities including bobolink and eastern meadowlark.

In order to effectively preserve the full biodiversity compliment of the Farmington River Valley, land use planners must consider the unique ecoregions described above and the natural communities and habitats associated with them.

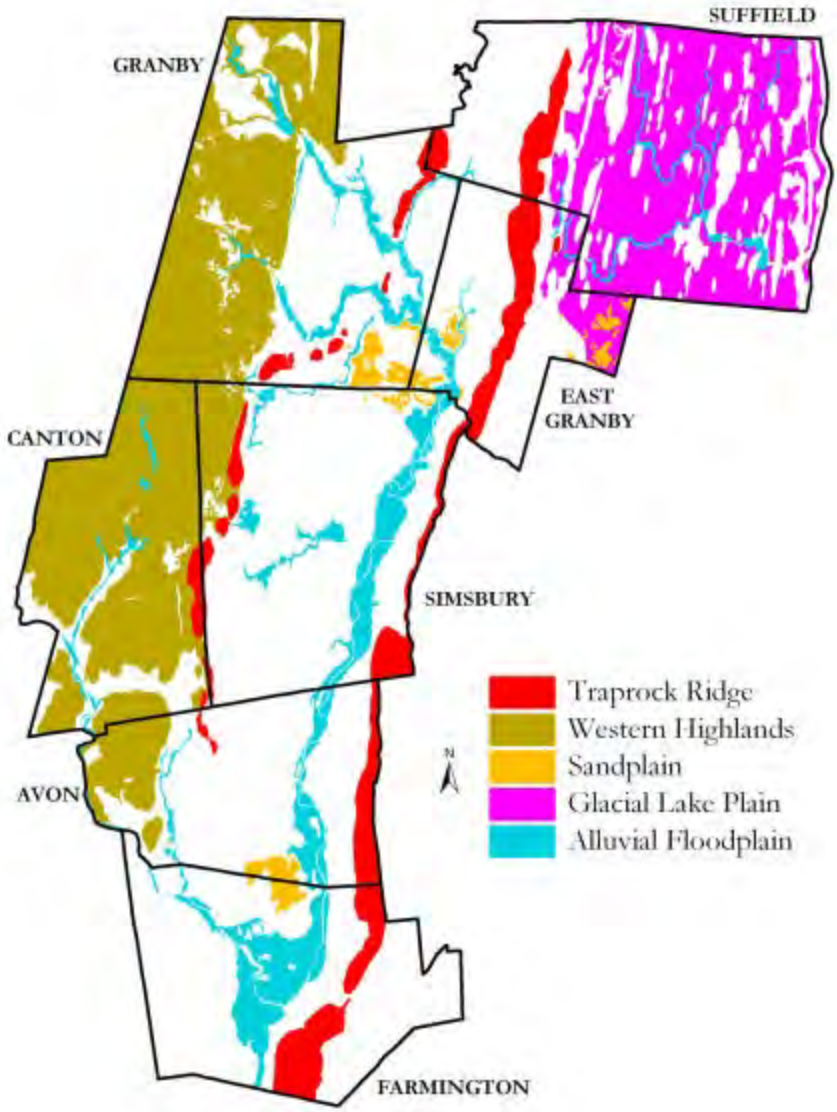


Figure 1: Ecoregions of the Farmington River Valley

Building Awareness and Community Involvement

Throughout all phases of the project, which took place between December 2001 and October 2004, project staff worked closely with representatives from the steering committee to schedule a series of outreach activities within each of the seven communities. Outreach focused on providing regular updates to municipal Conservation Commissions and in some cases Inland Wetland and Planning and Zoning Commissions. The presentations were scheduled at key junctures as follows:

1) Initial presentation focusing on the objectives of the project, an explanation of the biological datasets to be used and the landscape/habitat mapping process to be used.

2) A second meeting to review the results of the preliminary mapping and present plans for the field surveys. This meeting was also used to obtain assistance from Commission members in obtaining landowner permission for priority sites identified for survey work.

3) A third meeting to review the results of the field surveys.

4) A final meeting was held to present the biodiversity conservation area overlay and discuss implementation.

A total of 25 formal presentations were made to municipal commissions.

In addition, project staff maintained regular communication via telephone and email with town planners, participating commission members, and several land trust managers active in the project. These meetings focused on reviewing town Plans of Conservation and Development (POCD) and various regulations, providing input on applications for specific projects within conservation areas mapped by the project, and discussing implementation plans for the project. A total of 46 meetings were held with municipal representatives. To date, FVBP data 1) has been incorporated into POCDs of four towns (Avon, Canton, East Granby, & Granby), 2) is in draft POCDs in two towns (Farmington and Simsbury), and 3) is expected to be considered in Suffield in a few years when its POCD is scheduled for updating.

During the course of the project, participating municipal officials expressed a strong desire to provide opportunities for greater public engagement. Thus, a series of four events were developed and presented. These included informational presentations on various aspects of biodiversity and conservation at a nature center, Audubon facility, and land trusts within the region. In addition, a "Farmington River Valley Ecotour" was created as a unique means of showcasing the region's ecological diversity. During this tour for commission members and members of the general public, a school bus was rented for a day and project biologists provided short walks at select stops within each of the ecoregions.

Finally, through the vernal pool survey collaboration with the University of Maine, the project was able to effectively engage a number of adult volunteers in a meaningful citizen science program that increased awareness of vernal pool resources and contributed data to the project. Two training sessions were held as a part of this outreach effort.

Methods

Phase I: Identifying Biological Data Sets

The FVBP collected and analyzed data and mapped the distribution of plants, animals and natural communities in three primary categories: "state-listed species," "conservation focal species," and "significant natural communities of conservation concern."

State-listed Species
Plants and animals listed by the CTDEP as "endangered species," "threatened species" or "species of special concern" as defined under the Connecticut Endangered Species Act (Connecticut General Statutes 26-303). This listing includes Federal "endangered" and "threatened" species. Historic and current records of state-listed species documented within the seven-town study area were provided to the FVBP by the CTDEP-Natural Diversity Data Base (NDDB) through a cooperative agreement. The NDDB dataset included a total of 98 records. Additional datasets for state-listed species were obtained from Roaring Brook Nature Center (28 records), the field notes of Henry Gruner (17 records), the collections of the American Museum of Natural History (14 records) (see Klemens 1993), and the University of Connecticut (9 records). Table 2 provides a list of state-listed species of plants and animals of the Farmington River Valley.

Conservation Focal Species (non-State-listed)
There are a number of non-listed wildlife species or species assemblages that are recognized as being of conservation concern among biologists. These species are under-going non-cyclical, long-term population declines throughout the northeast and are vulnerable to land use practices resulting in habitat loss and fragmentation. Such species are termed "focal taxa," and can be further divided into two broad categories. Category I focal species are usually habitat specialists with very specific habitat requirements. Populations of these species tend to decline in response to development. Examples of Category I species include many of the neotropical migrant bird species and vernal pool-breeding amphibians.

Populations of other focal taxa increase in response to development. These species, referred to as Category II focal species, are usually habitat generalists, with much less-specific habitat requirements. Often, human alterations to landscapes favor, or subsidize, these generalists. Avian examples of Category II species include blue jays (*Cyanocitta cristata*) and crows (*Corvus brachyrhynchos*); an amphibian example is the bullfrog (*Rana catesbeiana*). As urbanization proceeds, such taxa tend to replace Category I species, resulting in an overall loss of regional biodiversity (i.e., species richness).

Both of these focal taxa categories provide valuable information about ecosystem health. It is the relative proportion, or "mix" of these two categories that reveals the most about the ecological integrity of any given site. WCS/MCA refers to the process of evaluating this mix, and its implications for ecosystem health and land use, as a "Focal Species Analysis," or "FoSA." The results of a FoSA can enhance planning efforts and assess the importance of

individual sites for conservation. The FoSA approach represents an innovative departure from traditional conservation efforts (Miller & Klemens 2002).

By expanding the scope of investigation beyond State or Federally listed endangered and threatened species, the FVBP is able to highlight a more proactive view toward species and habitat conservation. There are many species, currently unlisted and unprotected, whose populations are declining in response to sprawl. At the current pace of sprawl development, these species are likely to be candidates for official listing in the near future. 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. The FoSA approach evaluates systems more reliably by considering a broad range of species and their relative abundance, as opposed to basing land use recommendations on a single threatened or endangered species. The FoSA approach does not replace efforts to conserve endangered and threatened species; instead, it adds value to on-going conservation efforts (Miller & Klemens 2002).

In selecting Category I focal species for the biogeographic area encompassed by the FVBP, we used multiple sources. We identified focal bird species for each priority habitat-species suite listed by the Partners in Flight Bird Conservation plans for the Northern New England Physiographic Area (Hodgman & Rosenberg 2000) and Southern New England Physiographic Area (Dettmers & Rosenberg 2000), and refined this selection through a comprehensive review of the current literature including Askins (1993) and Askins and Philbrook (1987). For amphibians, we selected key indicator species and assemblages identified by the Amphibian Index of Biotic Integrity (AmphIBI) for wetlands (Micacchion 2002), and refined this listing through a comprehensive review of the current literature including Klemens (2000) and Gibbs (1998). For reptiles, species listed in Wildlife Species of Regional Conservation Concern in the Northeastern United States (Northeast Endangered Species and Wildlife Diversity Technical Committee 1996) were chosen and refined through a comprehensive review of the current literature including Klemens (2000). Finally, for fish, the focal species list was selected through consultation with the CTDEP Division of Inland Fisheries.

Focal species lists were reviewed and refined in consultation with independent biologists with research experience regarding landscape scale correlations and species distributions in Connecticut. A complete list of references used in species review is available upon request. Datasets for focal species were obtained from the CTDEP Fisheries Division stream survey (46 records), Roaring Brook Nature Center (11 records), the field notes of Henry Gruner (79 records), AMNH (see Klemens 1993) and University of Connecticut collections (21 records). Table 3 provides a list of Category I focal species developed for the Farmington River Valley.

Significant Natural Communities of Conservation Concern

Natural communities are assemblages of plants and animals that occur together and have adapted to specific abiotic conditions on the landscape. For example, sandplain grasslands are a natural community characterized by dry, sandy soil deposits that support a unique vegetative community dominated by grasses and other low vegetation, as well as a distinct invertebrate and vertebrate animal community including various species of grassland breeding birds and tiger beetles. Other

examples of natural communities include floodplain forests, red maple swamps and traprock ridge talus slopes.

Natural communities selected for mapping were based on the Connecticut Natural Community Classification (Metzler 1990) and Thirteen of Connecticut's Most Imperiled Ecosystems (Metzler & Wagner 1998). For the purposes of this survey, a natural community was designated as "significant" only if (1) there was reason to believe that it, as a community entity was rare, uncommon, or restricted, either by virtue of its type or its condition, in a state, regional, or global context; and/or (2) it provided critical habitat, actual or potential, for rare and uncommon plants or animals (Moorhead 2002). Data sets for natural communities were obtained from the CTDEP NDDB (19 records for plant communities and 26 records for bogs), and from vernal pool mapping that occurred within three towns. Table 4 provides a list of significant natural communities that were mapped and recorded in the study area.

The above-described datasets were used in the preliminary mapping phase of the project as an aid in stratifying site selection and follow-up field survey work, as well as in identifying gaps in current knowledge of species distributions in the region.

Other potential biological datasets that might be applied in future biodiversity conservation and planning projects include a database of public reports of mesocarnivores (black bear, fisher and bobcat) maintained by the CTDEP Wildlife Division, the Connecticut Butterfly Atlas, and several on-going or planned statewide or regional surveys including a study on distribution of the New England cottontail (*Sylvilagus floridanus*), wetland bird call-back surveys, and several invertebrate surveys, including Odonates (damsel/dragonflies) and freshwater mussels. New datasets will develop over time and should be investigated for their potential application in biodiversity conservation planning.

Table 2: State-listed Vertebrate, Invertebrate and Plant Species used in FVBP Data Analysis[1]

Reptiles
Eastern Box Turtle (sc)
Eastern hognose snake (sc)
Eastern ribbon snake (sc)
Five-lined skink (t)
Wood turtle (sc)

Amphibians
Blue-spotted salamander (sc)
Jefferson salamander (sc)
Northern leopard frog (sc)
Northern spring salamander (t)

Mammals
Eastern cougar (sc historic)

Birds
Alder flycatcher (sc)
American bittern (e)
American kestrel (sc)
Bald eagle (e)
Brown thrasher (sc)
Common loon (sc)
Common nighthawk (t)
Common raven (sc)
Cooper's hawk (t)
Eastern meadowlark (sc)
Golden-winged warbler (t)
Grasshopper sparrow (e)
Horned lark (t)
Northern harrier (e)
Northern parula (sc)
Olive-sided flycatcher (sc)
Peregrine falcon (sc historic)
Purple martin (sc)
Red-headed woodpecker (e)
Red-shouldered hawk (sc)
Savannah sparrow (sc)
Sedge wren (sc)
Sharp-shinned hawk (e)
Upland sandpiper (e)
Vesper sparrow (e)
Whip-poor-will (sc)
Yellow-breasted chat (e)

Insects
Big sand tiger beetle (sc)
New Jersey tea inchworm (e)
Superb jewelwing (e)

Freshwater Mussels
Brook floater (sc)
Dwarf wedge mussel (t)
Eastern pearlshell (sc)
Eastern Pond Mussel (sc)

Plants
3-leaf false solomon seal (sc)
American ginseng (sc)
Basil mountain mint (e)
Beaked corn salad (sc historic)
Bog rosemary (t)
Bog willow (e)
Climbing fern (sc)
Cyperus-like sedge (e)
Davis' sedge (e)
Dillen's tickfoil (sc)
Dwarf bulrush (e)
False hop sedge (e)
False pennyroyal (sc historic)
Goldie's fern (sc historic)
Hare's tail (e)
Labrador tea (sc historic)
Long-leaved bald rush (e)
Long-leaved bluet (e)
Low frostweed (e)
Naiad (sc)
Narrow-leaved glade fern (sc)
Narrow-leaved horse gentian (sc)
New England grape (sc)
Northern stitchwort (sc)
Northern yellow-eyed grass (e)
Nutrush (sc historic)
One flower wintergreen (sc)
Pod grass (e)
Purple giant hyssop (e)
Purple milkweed (sc)
Puttyroot (sc historic)
Ragwort (e)
Ram's toothcup (sc)
Sandbar willow (t)
Sandplain gerardia (e)
Sedge, *Carex bushi* (sc)
Sedge, *Carex hirsutella* (sc)
Sedge, *Carex limosa* (e)
Sedge, *Carex oligocarpa* (sc)
Sedge, *Carex squarrosa* (sc)
Skunk currant (e)
Slender mountain ricegrass (sc)
Slender wheatgrass (sc)
Slender willow (sc)
Small-flowered agrimony (sc)
Spiked false oats (sc)
Starry campion (sc)
Tall cinquefoil (sc)
Threadfoot (sc)
Torrey bulrush (t)
Violet wood sorrel (sc)
Virginia copperleaf (sc historic)
Virginia waterleaf (sc)
Weigand's wild rice (sc)
White mandarin (t)
Winged monkey flower (sc)

Note: e=endangered, t=threatened, sc=special concern

[1] Based on species designations from the 1998 State of Connecticut Department of Environmental Protection's list of Connecticut's Endangered, Threatened, and Special Concern Species. Proposed changes to some species designations were made in 2003.

Table 3: Category I Conservation Focal Species (non-state-listed) used in FVBP Data Analysis

Amphibians	Fish	Reptiles
Dusky salamander	Brook trout	Spotted turtle
Four-toed salamander	Slimy sculpin	
Gray treefrog		
Marbled salamander		
Red-spotted newt		
Spotted salamander		
Wood frog		

Birds	
Barred owl	Hermit thrush
American woodcock	Louisiana waterthrush
Bicknell's thrush	Northern goshawk
Blackburnian warbler	Prairie warbler
Black-throated blue warbler	Rufous-sided towhee
Black-throated green warbler	Sora rail
Blue-winged warbler	Virginia rail
Bobolink	Wood thrush
Canada warbler	Worm-eating warbler
Cerulean warbler	Yellow-throated vireo
Chestnut-sided warbler	

Table 4: List of Significant Natural Communities of Conservation Concern used in FVBP Data Analysis

Natural Community Type	
Acidic cliff	Mesic acid forest
Acidic hemlock basin swamp	Poor fen
Acidic pond shore	Riverbank beach/shore
Acidic rocky summit/outcrop	Riverside levee prairie
Acidic seepage swamp	Sand barren
Acidic talus forest	Sandy seasonal flooded acid fen
Alluvial marsh	Seepage forest
Alluvial wet meadow	Steam gorge/drip cliff
Basin marsh	Subacidic cliff
Cove forest	Subacidic riverside ledges
Dry acidic forest	Subacidic rocky summit/outcrop
Dry subacidic forest	Subacidic talus
Floodplain forest	Subacidic talus forest
Harsh low seasonal saturated meadow	Swamp white-oak-pin oak drawdown swamp
Large shaded shale/siltstone outcrop	Vernal pool
Medium fen	

Phase II: Mapping Core Habitats and Assessing Landscape Fragmentation

The Farmington Valley Biodiversity Study was completed using ESRI ArcView 3.2 Geographic Information System software. Data used in the study was gathered from many public sources, or was created when necessary (in the case of the ecoregion map and a map of potential vernal pools). One of the primary objectives of the project was to utilize readily available GIS data layers to facilitate application of the process for towns throughout Connecticut. Much of the baseline digital data of natural features and human infrastructure were available from state and federal agencies and public data libraries. Several key pieces of information were available from municipal offices. Examples of these sets of data are: tax parcels, detailed assessor-based land use, open space, zoning, high-quality aerial photographs, and assessor's grand tax list.

The first step in the mapping process began by selecting general land cover types: grassland, scrub/shrub, and forest. These were selected from 1998 LANDSAT Land Use/Land Cover data.[1] To develop broad land cover layers, each of the separate habitat layers that fell within a specific cover type were combined into a single coverage. For example, forest habitat types such as deciduous, coniferous, etc., included within the LANDSAT data were combined into a single forest cover layer. This process resulted in a land cover map for the project area (see Figure 2).

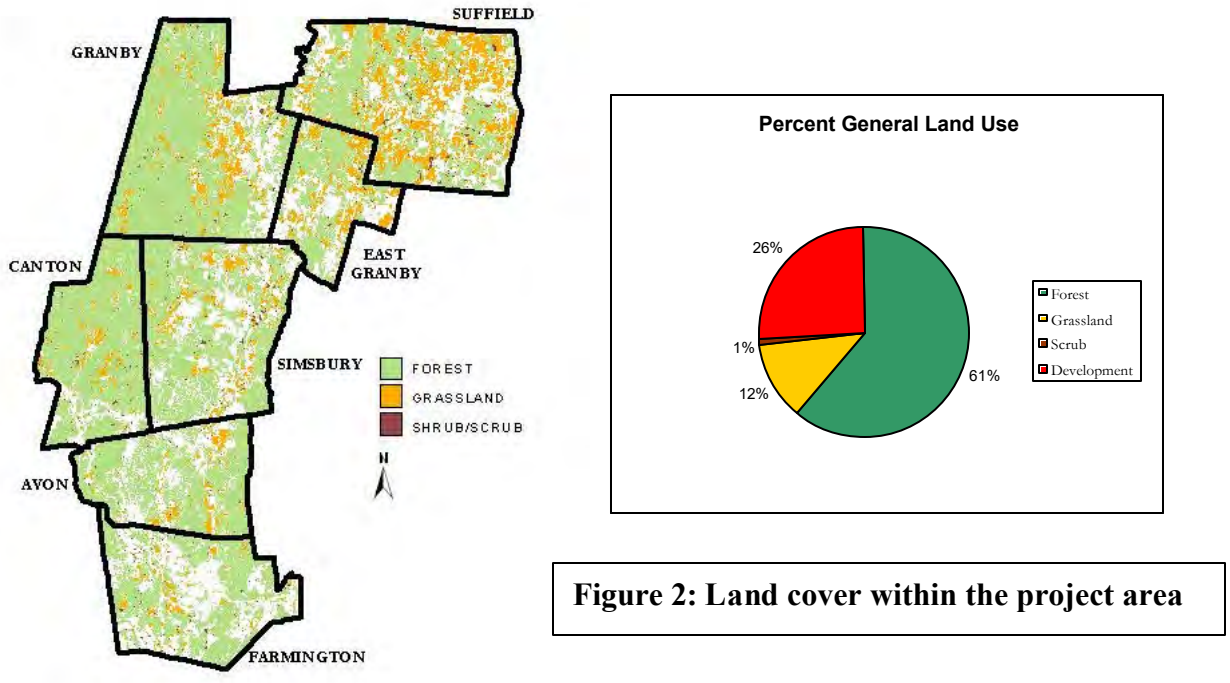


Figure 2: Land cover within the project area

[1] GIS polygon layer developed by UCONN & NASA.

The second step entailed intersecting these broad habitat polygons with roads to determine the level of habitat fragmentation. Current research shows that fragmentation of the landscape, most often by roads, reduces the ability of habitats to respond and adapt to changes, and can directly affect the long-term viability of many habitats. After examining the level of fragmentation across the landscape of the Farmington Valley, unfragmented polygons were chosen as potential core conservation areas for field study based on size criteria.

To be considered as a possible site for field study, an area had to be greater than 125 acres of forest, 25 acres of grassland, 5 acres of shrub/scrub, or some combination of two or more. Although these thresholds are somewhat subjective, they were based on patch size requirements necessary to support various species assemblages such as forest interior bird communities, grassland bird communities and vernal pool-breeding amphibian communities. In selecting our area thresholds we also considered the size range of unfragmented patches available within the seven-town area. Appropriate area thresholds should be developed for specific geographic areas based on conservation objectives as well as the current level of landscape fragmentation. For example, forest fragments of 10 acres or less might be critical in more urbanized areas.

The resulting map delineates those areas within the seven-town study area that could be potential conservation areas. This total area was roughly 50% of the total seven-town area (see Figure 3).

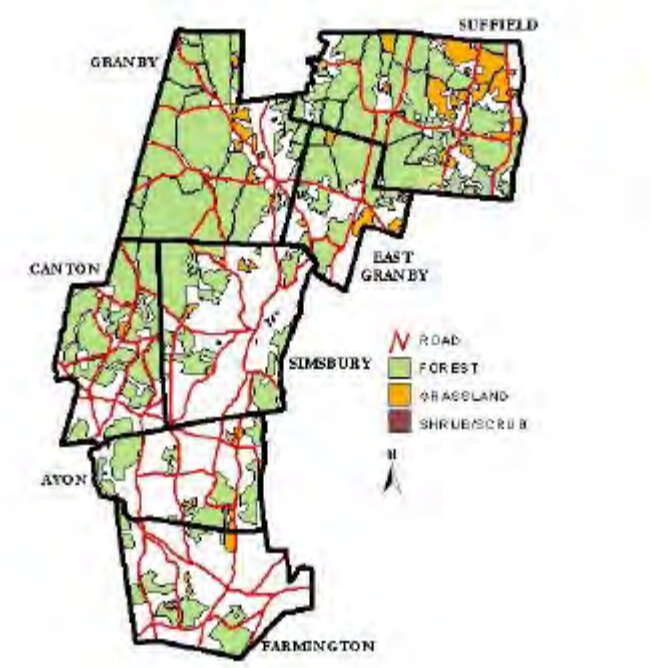


Figure 3: Fragmentation of the landscape

Phase III: Integrating Available Natural Resource Data to Refine and Prioritize Areas for Surveys

The broad range of potential core study areas were then analyzed in greater detail using GIS to overlay a variety of additional, readily available biological and natural resource data and maps. Wetland maps were used to analyze the extent and diversity of wetland habitat within the areas. Topographic and geological maps were used to identify ledge systems and rocky outcrops, kettle holes, and other habitat features. Aerial photographs were used to determine variation in forest cover, grassland habitat and wetland habitat types. Aerial photo interpretation also helped refine the fragmentation analysis revealing new developments and roads within the potential study areas. Finally, existing biological data layers were used to identify areas previously documented as supporting conservation-sensitive animal and plant populations. These data sets were described in detail earlier in the document. Refer to Figures 4 and 5 below for examples of these mapping exercises.

Although the majority of data layers used in our analysis have state-wide coverage, other municipal or regional natural resource layers might be available depending upon the particular geographic areas. For example, towns that have completed natural resource inventories or vernal pool mapping projects should have these data sets available for use.

Figure 4: Integrating biological data

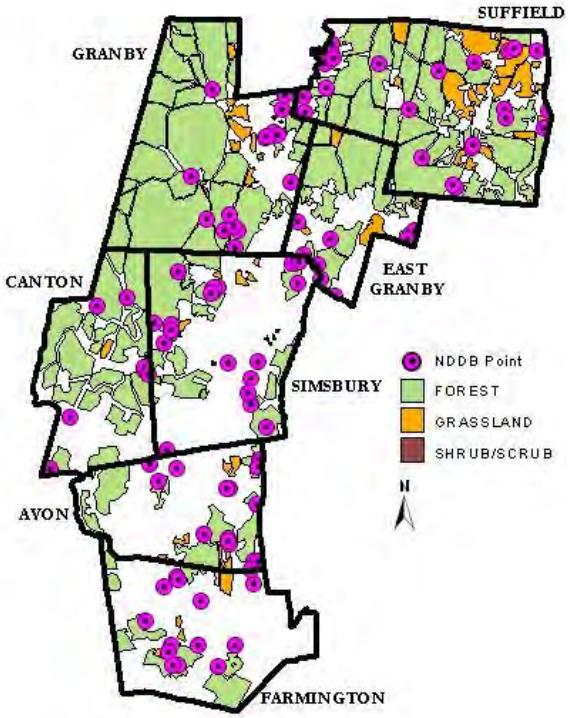
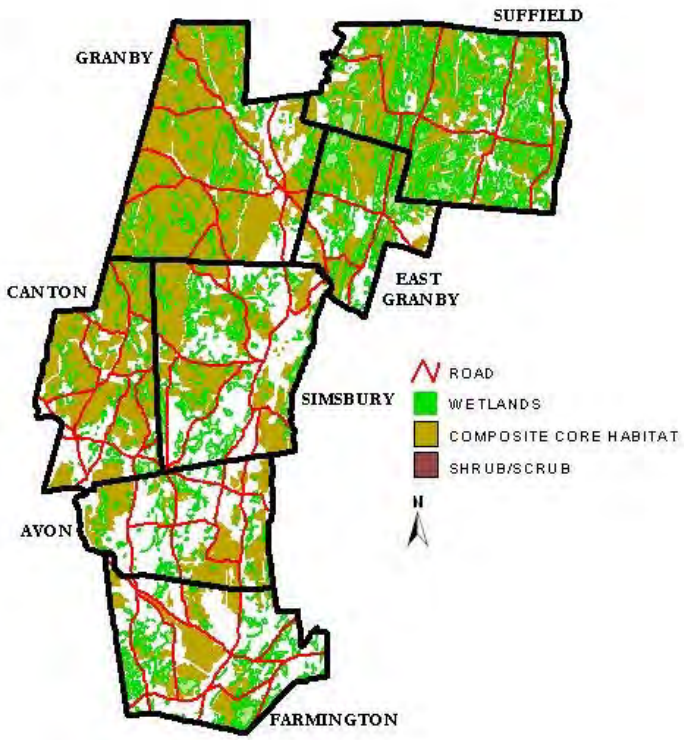


Figure 5: Integrating wetland mapping



Natural resource data layers were used to prioritize areas for field survey work. From this detailed analysis the study sites were ranked as *primary, secondary and tertiary*.

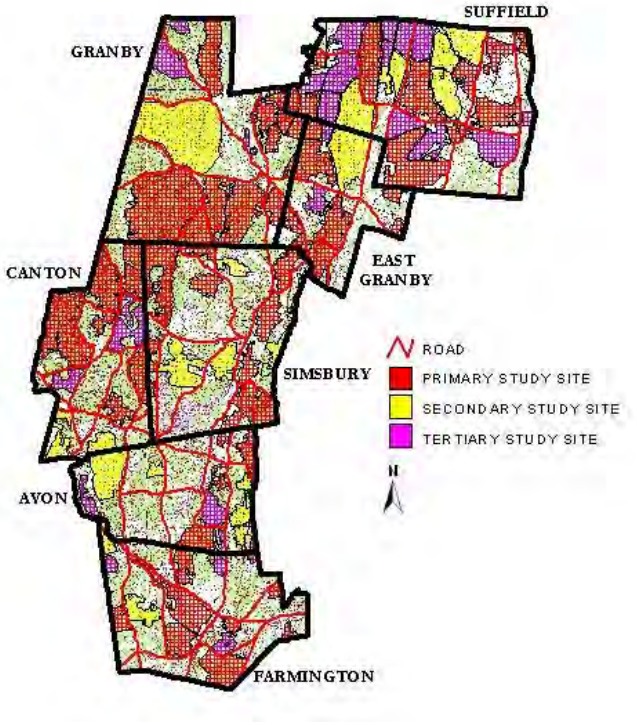
Primary sites were those that met the minimum size criteria of 125 acres of forest, 25 acres of grassland or 5 or shrub/scrub (or a combination of these) **and** were documented as supporting populations of state-listed plants and animals.

Secondary sites were those that met the minimum size criteria as described above **and,** based on GIS analysis, featured a high diversity of habitat types such as wetlands, talus slopes, etc., that suggested the potential for supporting a rich biodiversity. These sites had no existing records of state-listed species, however.

Tertiary sites were those that met the minimum size criteria, however, GIS analysis did not identify a significant diversity of habitat types, nor were there records of state-listed species documented at these locations.

Analysis yielded 43 primary study sites covering over 40,000 acres, 19 secondary study sites covering nearly 20,000 acres, and 27 tertiary study sites covering over 10,000 acres. Figure 6 illustrates the distribution of these sites within the seven-town area.

Figure 6: Prioritization of study sites



Phase IV: Completing Field Surveys and Vernal Pool Mapping

Field surveys focused on the primary and secondary core habitat areas as identified during the habitat-mapping and site selection phase of the project. The objective of the field surveys was to collect additional data on the distribution of state-listed plants and animals, non-listed conservation focal species, and natural communities of conservation concern. Complete taxonomic surveys were not undertaken at all sites. With a large area to cover in a single field season, biologists prioritized survey effort based on the preliminary site selection process (which provided geological data, habitat data, and existing biological evidence) in order to assess the probability that specific sites support various animal and plant communities. In some cases the FVBP was unable to obtain landowner permission for access to key parcels within selected core habitat areas, thus surveys within these areas are incomplete.

Breeding Bird Surveys

Data on breeding bird populations was collected during the late spring and early summer (mid-May through mid-July) of 2002. A total of 92 ornithological surveys were conducted. To facilitate complete coverage of the target habitats, a team of three ornithologists was assigned specific survey areas. All birds seen or heard were recorded during transect surveys and general site visits. A minimum of two surveys were conducted at each of the target areas; a late spring and an early summer survey. Surveys were scheduled for early morning hours, during peak activity periods, and under appropriate weather conditions. Although complete species lists were developed for each target area, only the locations of state-listed and focal bird species were mapped on USGS 7.5-minute topographic maps by the surveyors. These data points were later

digitized for application in GIS mapping. Surveys recorded 77 observations of 18 species of state-listed birds and 333 observations of 18 Category I focal species. A total of 153 different species of birds were recorded with an estimated 131 species breeding within the seven-town area.

Amphibian and Reptile Surveys

Data on amphibians and reptiles was collected during the early spring through early fall (April through October) of 2002. A total of 122 herpetological surveys were conducted. Survey techniques included extensive visual and cover searching among appropriate habitats, dip-netting for larval amphibians, visual searching of wetlands for amphibian egg masses, night road surveys for migrating amphibians, frog call surveys along wetlands, and minnow trapping for breeding *Ambystomid* salamanders. To facilitate coverage of the target areas, two herpetologists were assigned specific survey areas. A minimum of four surveys were conducted at each of the target areas. Although complete species lists were developed for each target area, only the locations of state-listed and focal amphibian and reptile species were mapped on USGS 7.5-minute topographic maps by the surveyors. These data points were later digitized for mapping in GIS. For amphibians, surveys recorded 10 observations of 4 state-listed species and 108 observations of 8 Category I focal species. For reptiles, surveys recorded 19 observations of 3 state-listed species and 8 observations of 1 category I focal species. A total of 19 species of amphibians and 13 species of reptiles were documented. The vernal pool surveys also yielded 12 records of state-listed amphibians and 1 record of a state-listed reptile.

Rare Plant and Significant Natural Community Surveys

Data on state-listed plants of conservation concern and natural communities of conservation concern were collected during the spring through late fall (April through November) of 2002. A total of 221 botanical surveys were conducted. The survey was guided by data on 41 recently observed and 64 historic rare species occurrences in the study area compiled by the Connecticut Geological and Natural History Survey/Natural Diversity Data Base (CTDEP-NDDB). Additional data on historic occurrences was extracted from published reports of field trips conducted by the Connecticut Botanical Society in the study area from 1928-present, and herbarium research provided by the New England Wild Flower Society. Existing data on priority natural communities was provided in the form of landscape-level GIS map units developed by the CTDEP-NDDB in cooperation with the FVBP. The method of identifying and naming the ecological/natural communities follows the methodology of the draft *Natural Communities of Connecticut* (Metzler 1990), which is the system currently used by the CTDEP-NDDB.

Locations of all listed species of plants observed were mapped on aerial photographs (Aerographics 2000 flight line, 1":1,000') (Moorhead 2002). These data points were later digitized for application in GIS mapping. Locations of all natural communities of conservation concern were mapped as polygons on aerial photographs (Aerographics 2000 flight line, 1":1,000'). These data points were later digitized for application in GIS mapping. Standard field forms for all plant locations and ecological communities were completed by the project botanist and are on file at the Connecticut Department of Environmental Protection's Natural Diversity Data Base.

Because of the strong correlation between the occurrence of rare plants and rare/uncommon natural communities, survey for and documentation of natural communities was conducted simultaneously with the survey for rare plant species. Surveys recorded 141 observations of 41 state-listed species of plants and 159 observations of 34 different significant natural communities. Approximately 34 rare plant species known historically from the study area were not reconfirmed during the survey. Three of these species, although observed since 1980, may no longer be extant as a result of habitat destruction and alteration. These are three-leaved false Solomon's seal (*Smilacina trifolia*), climbing fern (*Lygodium palmatum*), and tooth-cup (*Rotala ramosior*).

Four species - white mandarin (*Streptopus amplexifolius* var. *americanus*), spiked false oats (*Trisetum spicatum var. molle*), and purple giant hyssop known historically from the area were rediscovered, each with one occurrence and small populations, placing them at risk of extirpation. An historic species, Narrow-leaved horse gentian (*Triosteum angustifolium*), last observed in 1947, was rediscovered during the survey. This population represents the only occurrence of this species in New England. The abundance of three species - long-leaved bluet, starry campion, and Davis' sedge (*Carex davisii*), indicates that the study area is a Connecticut/New England stronghold for these species.

The survey documented 3 species that have not previously been recognized as established outside of cultivation in Connecticut – Siebold crabapple (*Malus sieboldii*), forked threeawn (*Aristida basiramea*), and slimpod rush (*Juncus diffusissmus*). Several of these as well as Northern catalpa (*Catalpa speciosa*) and orange mullein (*Verbascum phlomoides*), both non-native species, bear consideration as potential invasive species as they were encountered frequently within the study area. Finally, a wormwood (*Artemisia* c.f. *campestris* spp.) observed during the survey appears to be a taxonomic and phytogeographic mystery. The typical form of this species is the only wormwood native to Connecticut; it is biennial, and grows on sand flats and dunes along the coast. The form observed here is distinctly unlike the typical coastal plants in several characteristics; principal among them is that it is perennial. These characteristics make it appear intermediate between A. *campestris* ssp. *caudata* and A. *campestris* ssp. *borealis*, a rare perennial in New England that has not been documented in Connecticut (Moorhead 2002).

Incidental Records

Incidental observations of other state-listed vertebrate and invertebrate species were recorded by project biologists and mapped on USGS 7.5-minute topographic maps. These data points were later digitized for application in GIS mapping. Observations of the tiger beetle, *Cicindella formosa,* were recorded at 3 sites.

Vernal Pool Mapping and Biological/Habitat Assessment

A wetland scientist was contracted to map potential vernal pools within the seven-town area using aerial photographic interpretation (Aerographics 2000 flight line, 1":1,000') (Pawlak 2003). The black and white, stereo pair photographs were viewed under a mirror stereoscope. Potential vernal pools were identified based upon dark signatures (which often indicate surface water), canopy breaks, landscape position and surrounding land use. Potential pools were marked on copies of the aerial photographs and individually numbered. Each potential vernal pool was assigned to a category based upon the likelihood that it was in fact a vernal pool on a

scale ranging from1=high, 2=moderate, 3=low. Potential vernal pool mapping was completed in February 2003. A total of 1,240 potential vernal pools were identified across the 7 FVBP towns. These data points were later digitized and mapped using GIS.

In the spring of 2003, the FVBP, in cooperation with the University of Maine and MCA/WCS, implemented a volunteer-based field survey of potential vernal pools in three of the seven towns (Farmington, Simsbury and Suffield). The goal of this project was to verify their status and collect biological and habitat data on the pools for application with the *Best Development Practices: Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States* (Calhoun & Klemens 2002) planning tool to prioritize the pools for conservation. Thirty-seven volunteers were recruited and trained by project staff. The volunteers surveyed 286 of the 898 mapped potential vernal pools falling within the three-town area. Data collected by the volunteers was analyzed by project staff and each pool was assigned a "Tier" ranking based on Calhoun and Klemens (2002). Thirty-five percent of the pools were Tier I, 2% were Tier II and 28% Tier III. The remaining 35% of the potential pools surveyed were determined not to be functioning vernal pool ecosystems. This volunteer-based project proved to be an effective means of collecting accurate data (Oscarson & Calhoun, *in press*).

Phase V: Integrating Survey Data with Habitat Mapping

All biological records collected during the field survey efforts were digitized from 7.5' minute USGS topographic quad maps or aerial photographs (1":1,000') for application in GIS. Table 1.6 provides a summary of the biological data sets and numbers of records mapped for use in the analysis.

Table 5: Summary of biological datasets used in FVBP data analysis

Biological Dataset	State-listed Species Records	Category I Focal Species Records	Critical Natural Community Records	Totals
Taxonomic Group				
Amphibian	31	197	-	228
Bird	80	358	-	438
Fish	-	46	-	46
Insect	6	-	-	6
Mammal	2		-	2
Mollusk	2	-	-	2
Plant	193	-	-	193
Reptile	70	19	-	89
Ecological Communities				
Bog	-	-	26	26
Plant community	-	-	242	242
Vernal pool	-	-	1,240	1,240
Totals	384	620	1,508	2,512

Once complete, the comprehensive biological datasets were integrated with the previously created potential conservation area maps. Using GIS, these integrated maps were analyzed to

further prioritize areas for biodiversity conservation based on their potential to function as major habitat hubs and on their ability to serve as ecological connectors across the landscape. Those areas designated as "*Primary Conservation Areas*" are considered to be important sites featuring a high diversity of habitat types, including some limited in distribution throughout the Farmington River Valley. These sites also support a high diversity of animal and plant species of conservation priority. Those designated as "*Secondary Conservation Areas*" are relatively unfragmented sites that, because of their size and location on the landscape in regards to the primary conservation areas, likely function as important core habitats and ecological corridors. A total of 71 conservation areas were identified, 48 primary areas and 23 secondary areas. Figure 7 illustrates these areas.

The next step was to map a broad "biodiversity overlay" encompassing the entire seven-town study area. The overlay connects the primary and secondary conservation areas across the larger regional landscape, providing a corridor to support long-term ecological functions. In mapping this overlay we considered the land use and habitat types adjacent to the primary and secondary core areas. Figure 7 illustrates this biodiversity overlay.

A final step in the process was integrating a data layer of protected parcels of land on to the biodiversity overlay as a means of identifying those areas with potential vulnerability for habitat loss and fragmentation. Figure 8 highlights these areas.

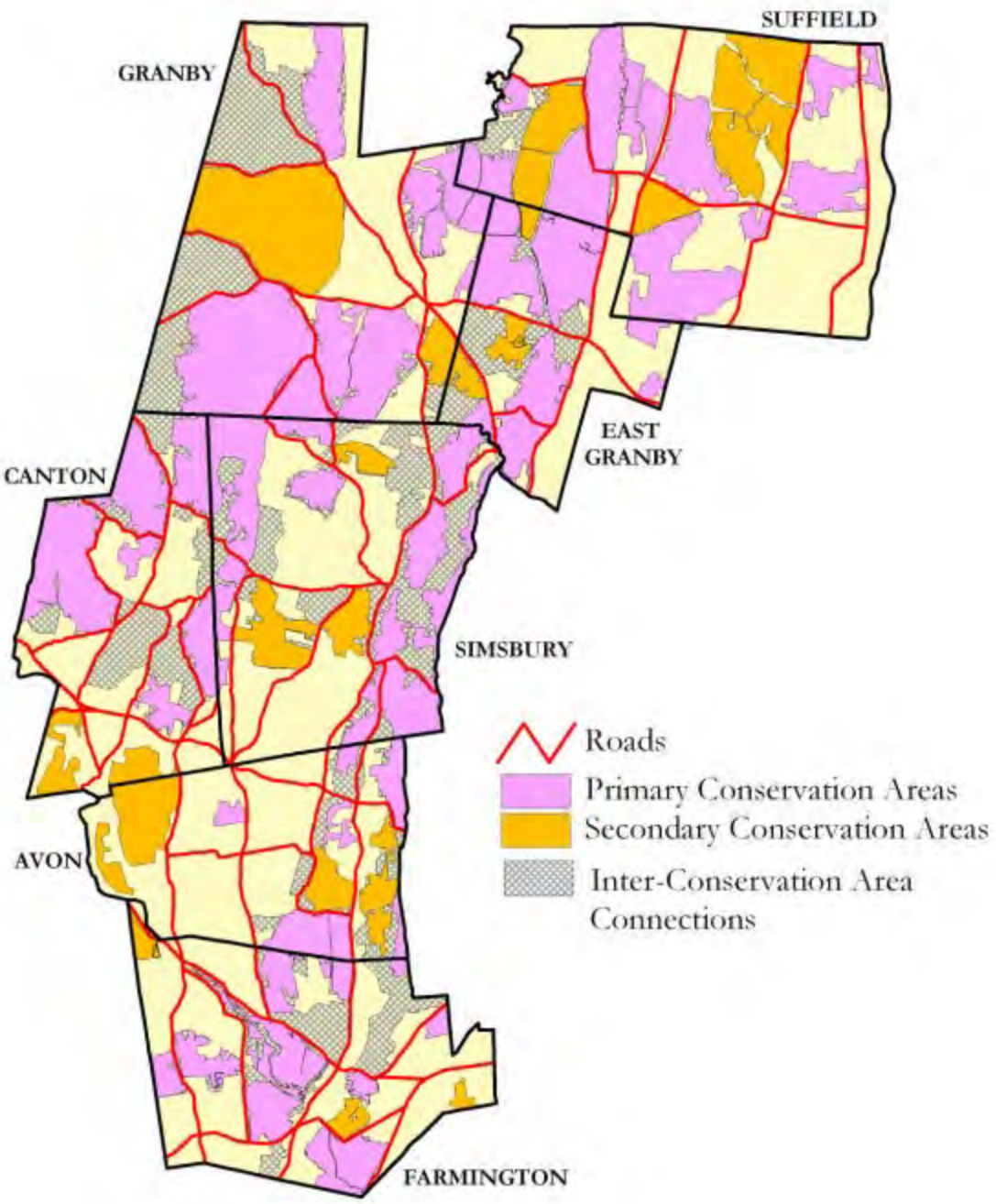


Figure 7: Biodiversity conservation area overlay

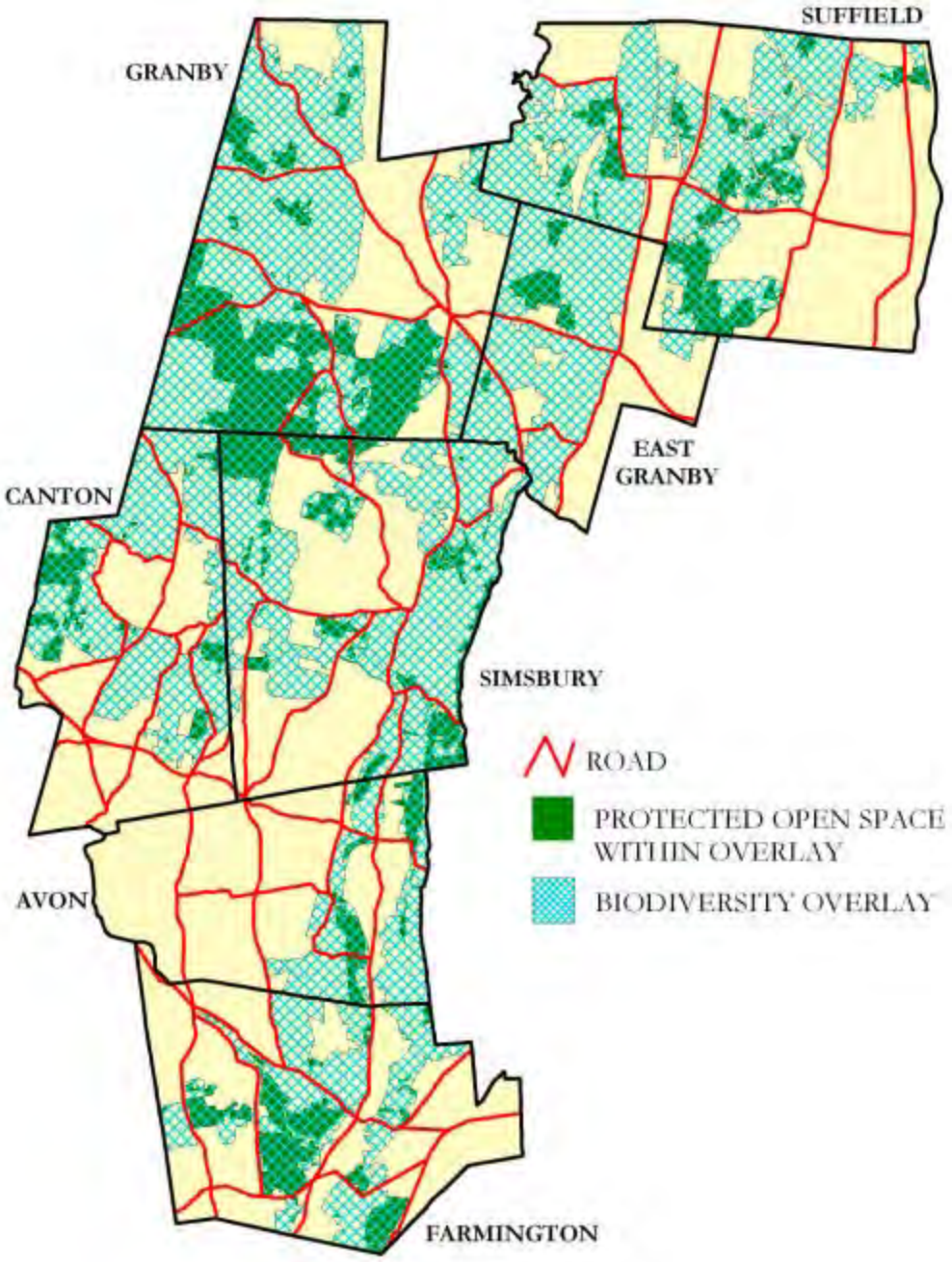


Figure 8: Protected parcels within the biodiversity conservation area overlay

Town Conservation Profiles

The following section presents a summary analysis of the core conservation areas identified within each of the participating towns and includes a discussion of significant natural communities and elements of biodiversity. Conservation area maps are included at the end of each town's profile. Town land use classes (i.e. rural, suburban etc.) follow those used in the Capitol Region Council of Governments Plan of Conservation and Development for the Capitol Region and are: "rural," less than 500 persons per square mile; "suburban," 500-1,250 persons per square mile; "fully suburban," 1,251-3,000 persons per square mile, and "urban," greater than 3,000 persons per square mile (CROG 2003).

Avon

The town of Avon is categorized as "suburban" and covers an area of 23.5 square miles within the Farmington River watershed. The town has experienced significant growth and development over the past few decades, growing from a population of 3,171 in 1950 to a population of 15,832 in 2000. The FVBP identified seven primary and four secondary core areas for biodiversity.

Primary Conservation Areas

Area Designation	Ecoregion
Fishers Meadows	River Floodplain
Lake Erie	River Floodplain
Nod Brook	River Floodplain
Walton Pond	River Floodplain
Talcott Mt. North	Traprock Ridge
Hartford Reservoir	Traprock Ridge
Secret Lake	Traprock Ridge/Wetland

Secondary Conservation Areas

Area Designation	Ecoregion
Avon Old Farms	River Floodplain
Huckleberry Hill	Western Highlands
Talcott Mt. South	Traprock Ridge
Farmington River	River Floodplain

Primary Conservation Areas

Three areas, "Walton Pond" including the "Fisher Meadows area," "Lake Erie," and "Nod Brook" are located within, or ecologically associated with, the alluvial floodplain ecoregion along the Farmington River. These sites support a high diversity of significant natural communities including sand barrens, floodplain forests, and wet meadows. Consequently, a number of rare plants were documented among these sites. One species on the brink of extirpation, the purple giant hyssop, was located during the field surveys. Volunteers were able to collect seeds from this small population for banking in the New England Wild Flower Society's seed bank. This seed bank of native genotypic material can be used in the event that reintroduction or population augmentation is required (Moorhead 2002). FVBP biologists along with biologists from the CTDEP NDDB worked with town staff to develop and initiate a management plan for this site to prevent accidental destruction of the plants and to control the spread of invasive plant species. These sites also encompass the largest New England occurrence for the rare Davis' sedge. These alluvial sites and natural communities also support a diversity of animals including grassland bird communities, with breeding savannah sparrow (*Passerculus sandwichensis*) and meadowlark; scrub-shrub bird communities with breeding brown thrasher (*Toxostoma rufum*), blue-winged warblers (*Vermivora pinus*) and chestnut-sided warblers (*Dendroica pensylvanica*) among others, and wetlands supporting northern leopard frog populations.

Thompson Brook, a tributary to the Farmington River flowing through the Walton Pond site, contains a diversity of fish and benthic macroinvertebrates, which indicates high water quality. Several of the sand barren communities have the potential to support a rich diversity of insects and warrant further investigation. Although insect surveys were not included as a part of the field survey effort for the FVBP, several incidental records were documented for species of conservation concern, including one record of a tiger beetle associated with the Walton Pond site.

Two areas, "Talcott Mountain North" and "Hartford Reservoir" are associated with the Metacomet traprock ridge ecoregion. The Talcott Mountain and Hartford Reservoir sites are contiguous with large, unfragmented forests located in West Hartford that are maintained by the Metropolitan District Commission (MDC) as public watershed land. These sites support an array of natural communities, including perched vernal pools, extensive red maple and shrub swamp systems, and various traprock ledge communities. These include robust vernal pool-breeding amphibian populations such as Jefferson (*Ambystoma jeffersonianum*), marbled (*Ambystoma opacum*) and spotted (*Ambystoma maculatum*) salamanders and wood frogs (*Rana sylvatica*), and breeding populations of forest-interior dependant bird species such as black-throated blue (*Dendroica caerulescens*) and worm-eating warblers (*Helmitheros vermivorum*), and hermit thrush (*Catharus guttatus*).

The "Secret Lake" area is located at the southern terminus of an intrusive traprock ridge system that extends along the western edge of the Farmington River valley. Because of the high diversity of natural communities present at this site including a large wetland system, talus rockslides with open ledge, and high quality forest, the site appears to support a high diversity of wildlife including box turtles (*Terrapene c. carolina*), northern copperheads; a high number of vernal pool-breeding salamanders (a good indicator of wetland and forest quality); and a breeding bird community dominated by a high percentage of forest-interior dependent species (another indicator of forest quality). Although this site might appear somewhat isolated in the landscape due to lack of connectivity to the ridge system to the north and surrounding development, the high quality of habitat present lends support to the site's role as a habitat hub on the larger landscape.

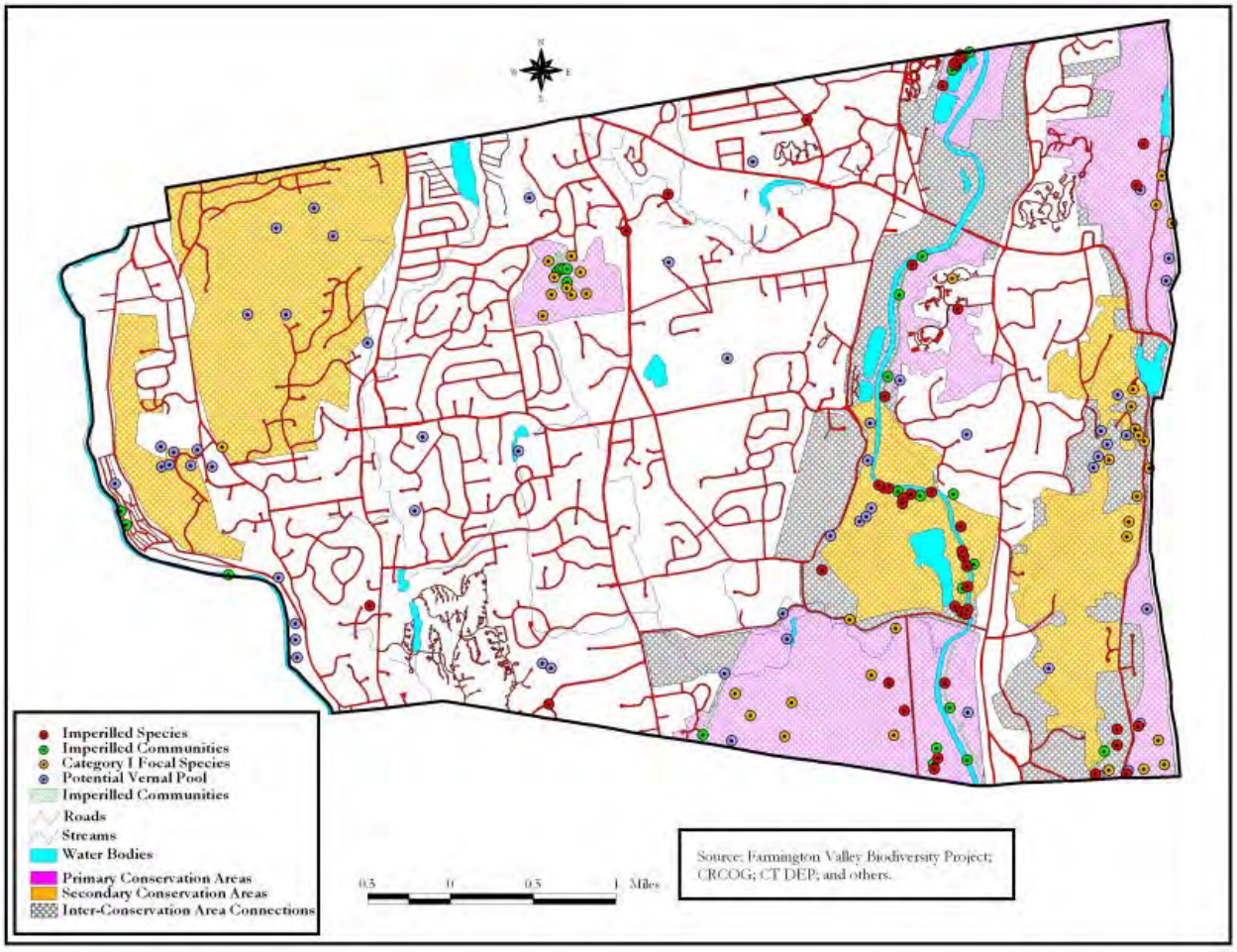
Secondary Conservation Areas

"Avon Old Farms" located north of the Walton Pond site on the west side of the Farmington River was identified as an important ecological connector along the alluvial floodplain ecoregion connecting the Walton Pond/Fisher Meadows and Lake Erie primary sites along the River.

"Talcott Mountain South" was identified as an important ecological connector along the traprock ridge ecoregion in this area.

Two secondary areas located in the western section of Avon included the large, unfragmented "Huckleberry Hill" site which is located within the western highlands ecoregion. This site includes extensive tracts of contiguous forest that support forest-interior breeding bird communities and high quality streams. The "Farmington River" area includes a fairly narrow, strip of contiguous land primarily in private ownership, immediately adjacent to the river north of Unionville. This site contains populations of several rare plant communities.

Figure 9: Avon biodiversity map



Canton

The town of Canton is categorized as "rural" and covers an area of 25 square miles within the Farmington River watershed. While northern and western sections of the town remain primarily rural with large, unfragmented tracts of forest, the southern section of town, especially south of Route 44, have undergone significant residential and commercial development. The FVBP identified five primary and two secondary core areas for biodiversity.

Primary Conservation Areas

Area Designation	Ecoregion
Ratlum Mt. North	Western Highlands
Ratlum Mt. South	Western Highlands
West Mountain	Western Highlands/Traprock
Onion Mountain	Traprock Ridge
Mt. Horr	Traprock Ridge

Secondary Conservation Areas

Area Designation	Ecoregion
Sweetheart Mountain	Western Highlands
Huckleberry Hill	Western Highlands

Primary Conservation Areas

Three of the primary areas are located in the north and northwestern section of the town and fall within the northwest highlands ecoregion. These include "Ratlum Mountain North," "Ratlum Mountain South," and "West Mountain." Each of these three sites represents areas of large, unfragmented forest. The Ratlum Mountain North and South sites are contiguous with large forested parcels in neighboring Barkhamsted. The West Mountain site is contiguous with large forested tracts of land to the east in Simsbury and to the north in Granby. This "tri-town" West Mountain area is the largest unfragmented landscape within the seven-town area and ecologically bridges the western highlands and western traprock ridge ecoregions. These sites support robust populations of forest-interior dependent breeding birds as well as other species of conservation concern including the whip-poor-will (*Caprimulgus vociferus*), one of the few areas in the study where this species was documented. Numerous small streams and seeps scattered throughout the forests supporting populations of fish and amphibians such as native brook trout and dusky salamanders (*Desmognathus fuscus*) that are dependent upon high water quality.

"Onion Mountain" lies within the intrusive traprock ridge ecoregion that extends along the western edge of the Farmington River valley. This site is contiguous with a smaller section of the mountain that extends north into Simsbury. Onion Mountain has been well-documented as a biodiversity "hotspot" and the FVBP survey efforts confirm this. The site contains numerous significant natural communities including a cluster of high quality wetlands and vernal pools that support a rich amphibian fauna, extensive talus rock slides, and open ridgetop glades (home to a variety of rare plants), and high quality forest with a breeding bird community dominated by forest-interior dependent species. Onion Mountain and other intrusive traprock ridge sites extending to the north in Granby and Simsbury support the only known Connecticut occurrences of the long-leaved bluet.

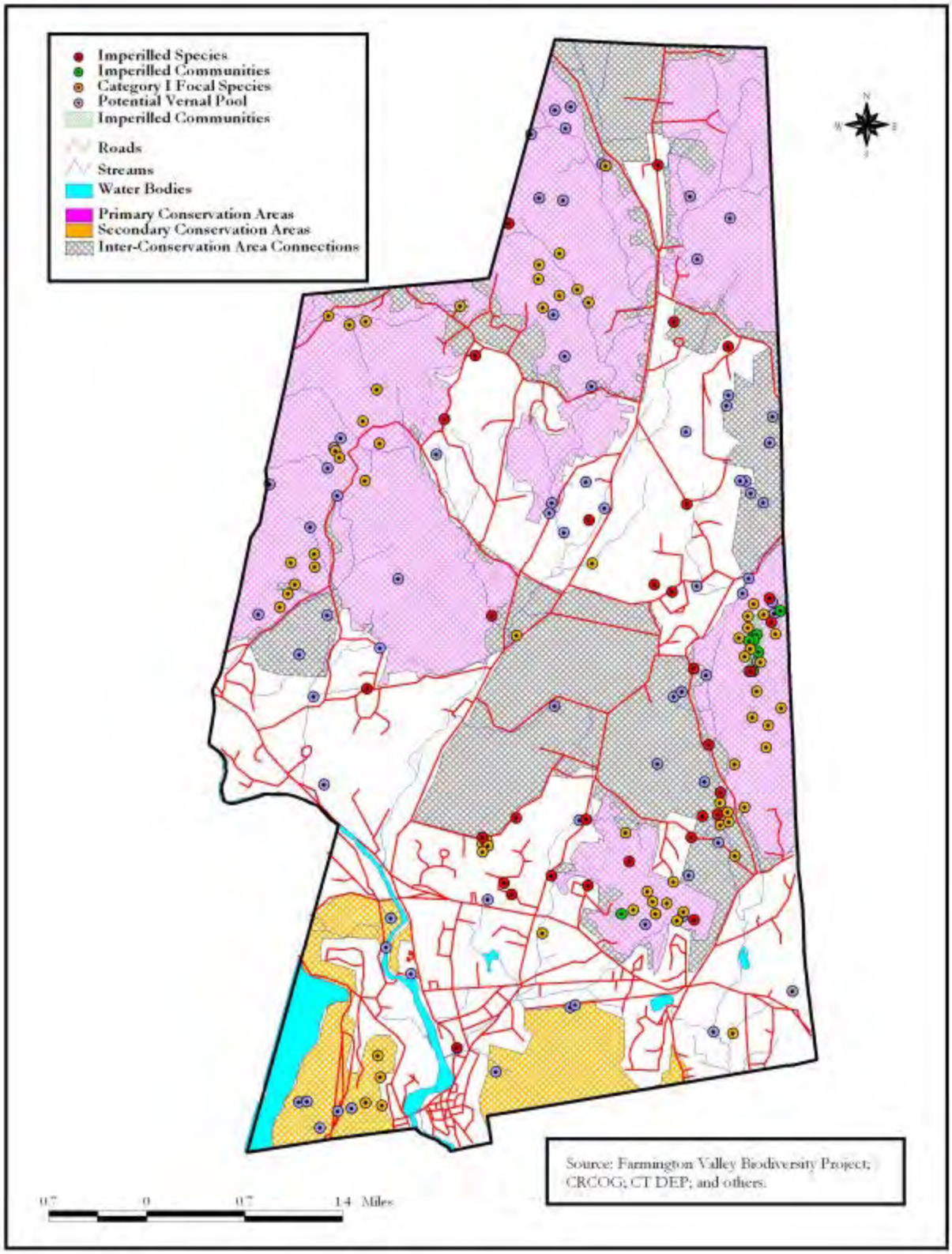
The final primary area, "Mt. Horr," although similar in appearance to the traprock ridge systems, is actually different geologically, being composed of amphibolite rock versus the dolerite of the traprock systems. However, the site supports some similar natural communities including dry ridgetop forests and talus rockslides. A breeding bird community dominated by forest-interior

dependent species is indication of the quality of forest habitat present. FVBP biologists had only limited access to this site, thus biodiversity data are incomplete.

Secondary Conservation Areas

Two secondary areas within the western highlands ecoregion were identified based on the extent of contiguous, unfragmented forest contained within them. These are "Sweetheart Mountain," which is located on the western side of the Farmington River contiguous with the Nepaug Reservoir, a large tract of forested land and open water maintained by the MDC, and "Huckleberry Hill," a large, forest tract that is contiguous with a similar large forest tract to the south in Avon. Both of these secondary sites support high quality stream systems and important habitat for forest-interior dependent birds.

Figure 10: Canton biodiversity map



East Granby

The town of East Granby is categorized as "rural" and covers an area of 17.4 square miles within the Farmington River watershed. The FVP identified eight primary and three secondary core areas for biodiversity.

Primary Conservation Areas

Area Designation	Ecoregion
Tariffville Gorge	Traprock Ridge
Hatchett Hill	Traprock Ridge
Peak Mountain	Traprock Ridge
Great Marsh	Grassland/Wetland
Beaverdam Marsh	Grassland/Wetland
Bradley Airport South	Grassland
Bradley Airport North	Grassland
Pickerel Cove	River Floodplain

Secondary Conservation Areas

Area Designation	Ecoregion
Holcomb Brook	Corridor
Salmon Brook	Corridor
Newgate Swamp	Corridor

Primary Conservation Areas

Three of the primary areas are located within the metacomet traprock ridge ecoregion. These include "Tariffville Gorge," "Hatchett Hill," and "Peak Mountain." The Hatchett Hill site features a number of significant natural communities including wetland fen and marsh habitats supporting rare plants, blue-spotted salamanders (*Ambystoma laterale*), and wetland dependent breeding birds such as the Virginia rail (*Rallus limicola*). The extent and quality of the forested habitat along this ridge support good populations of breeding forest-interior dependent birds. The Tariffville Gorge natural communities include a unique riverside ledge system that support rare plants, including one species, spiked false oats, on the verge of extirpation in the study area. Volunteers were able to collect seeds from this small population for banking in the New England Wild Flower Society's seed bank. This seed bank of native genotypic material can be used in the event that reintroduction or population augmentation is required to conserve the population (Moorhead 2002).

Other communities include ridgetop, shrub swamps and vernal pools that support a rich amphibian community as demonstrated by a high number of vernal pool-breeding salamanders, a strong indicator of high wetland and forest quality. The Peak Mountain site is an extensive forested ridge, extending north well into Suffield and contiguous with West Suffield Mountain. Numerous high quality wetland systems, talus rockslides and traprock ridgetop natural communities are contained within this site.

"Great Marsh" and "Beaverdam Marsh" are two primary areas located in the northwest corner of town that are dominated by extensive and highly diverse wetland habitat complexes situated among a mosaic of forest and open agricultural and post-agricultural habitats. Consequently, these sites were among the most biologically rich areas encountered during the survey. Great Marsh is contiguous with land tracts to the west in Granby and Beaverdam Marsh is contiguous with a large tract of land to the north in Suffield. The complex of forests and wetlands at these sites support a high number of vernal pool-breeding salamanders including blue-spotted, four-toed (*Hemidactylium scutatum*) and spotted salamanders, as well as high densities of ribbon snakes (*Thamnophis sauritus*), strong indicators of high quality wetland and forest habitat.

Wetland dependent birds such as sora (*Porzana carolina*) and Virginia rail, forest-interior dependent birds such as black-throated green warblers (*Dendroica virens*) and wood thrush (*Hylocichla mustelina*), and grassland dependent birds such as bobolink and American kestrel (*Falco sparverius*) are well represented within the mosaic of intact habitats among these sites. A high number of raptor species were recorded at the Beaverdam Marsh site.

The "Bradley Airport" and "Bradley Airport South" areas located in the eastern section of the town encompass well-documented and regionally significant natural communities situated within the sandplain and glacial lake plain ecoregions. The Bradley Airport South site supports a regionally (New England) significant grassland breeding bird population including upland sandpiper (*Bartramia longicauda*), grasshopper sparrow, savannah sparrow, eastern meadowlark and American kestrel, among others. This site is monitored by the CTDEP in cooperation with the Airport operations managed for grassland birds. The Bradley Airport site is located just to the north and includes property owned by the Airport that is contiguous with a large tract of unfragmented land extending into Suffield. This large tract features a high density of small vernal pools supporting a forest amphibian community including spotted salamanders and wood frogs, while small pockets of wet meadow and more open canopied wetlands on the periphery of the forest support breeding gray treefrogs (*Hyla versicolor*) and Fowler's toads (*Bufo fowleri*). Both of these sites harbor good sand barren habitat that support rare plants, hognose snakes (*Heterodon platirhinos*) and possibly rare insect communities.

The final primary area, "Pickerel Cove" is situated along the Farmington River within the alluvial floodplain ecoregion. A small section of this larger contiguous site that extends south into Simsbury falls within East Granby (refer to the Simsbury town profile for a description of this site).

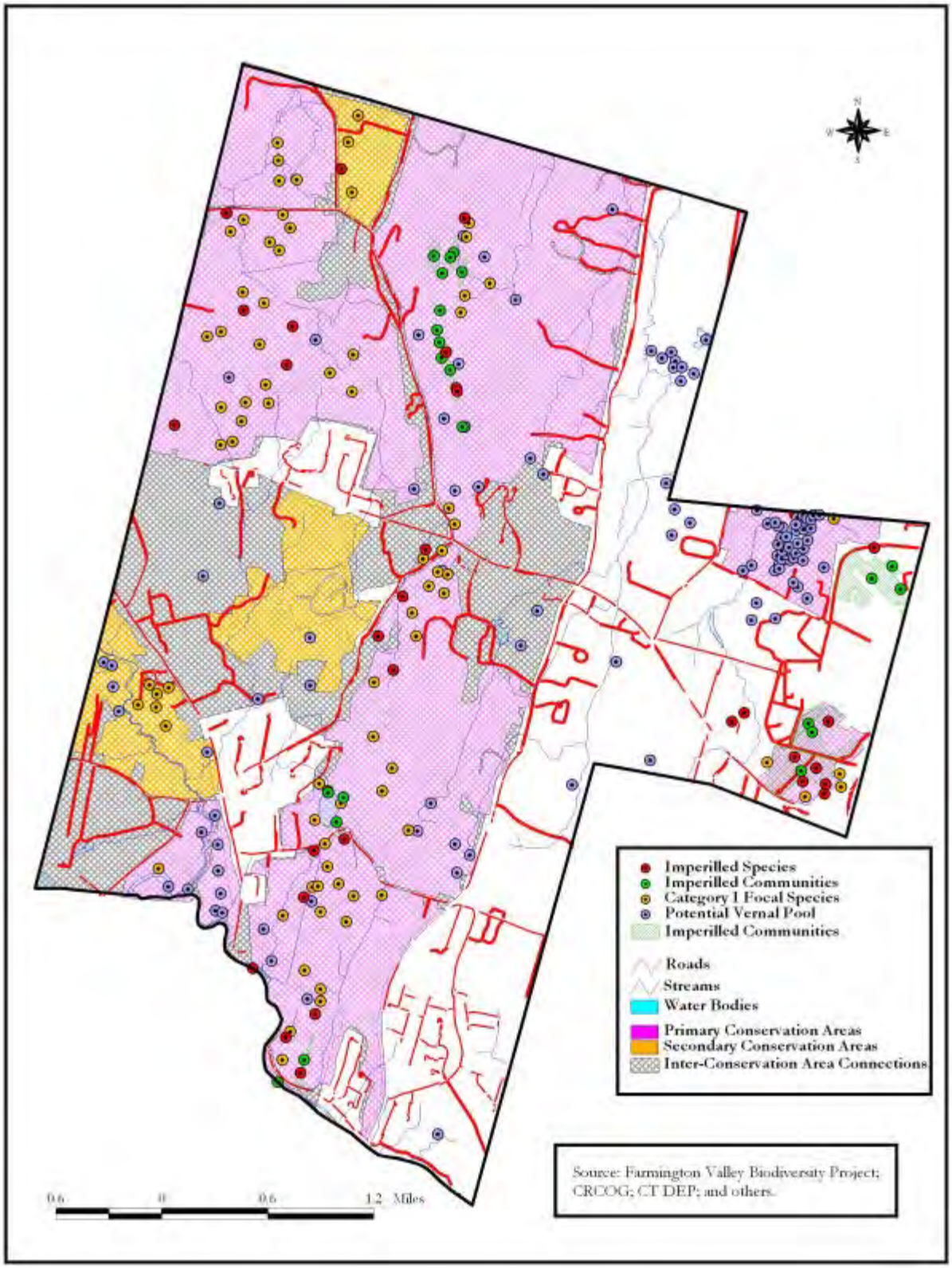
Secondary Conservation Areas

"Holcomb Brook" was identified as an important ecological corridor between the Great Marsh/Beaverdam Marsh complex and other core primary habitat sites to the south.

"Salmon Brook" located in the southwest section of town was identified as an ecological connector between the northwest highlands and western traprock ridge ecoregions and the Farmington River. This site is contiguous with land tracts in neighboring Granby.

"Newgate Swamp" is an important large habitat parcel in proximity to the Newgate Wildlife Management Area.

Figure 11: East Granby biodiversity map



Farmington

The town of Farmington is categorized as suburban and covers an area of 28.7 square miles within the Farmington River watershed. The town has experienced significant growth over the past few decades, with a current population of more than 23,000. The FVP identified eight primary and three secondary core areas for biodiversity.

Primary Conservation Areas

Area Designation	Ecoregion
Shade Swamp	River Floodplain
Community Garden	River Floodplain
Walton Pond	River Floodplain
Scott Swamp	Wetland
Town Forest	Forest
Hartford Reservoir	Traprock Ridge
Hillstead	Traprock Ridge
Deadwood Swamp	Traprock Ridge

Secondary Conservation Areas

Area Designation	Ecoregion
Burnt Hill	Forest
Taine Mountain	Western Highlands
Batterson Park Pond	Forest

Primary Conservation Areas

Three of East Granby's primary conservation areas are located along the Farmington River situated within the alluvial floodplain ecoregion. These sites are: "Shade Swamp," "Community Garden," and "Walton Pond." Shade Swamp is located along the Pequabuck River just south of its confluence with the Farmington River. The site includes an extensive and diverse wetland system situated within a mosaic of forest and agricultural habitat. Consequently, the site supports a high diversity of wildlife including a rich amphibian community with northern leopard frog and blue-spotted salamanders, and both grassland-dependent and wetland-dependent breeding bird communities. The Community Garden site is located along the west side of the Farmington River just north of Shade Swamp. The site is predominantly composed of open habitats including active sand/gravel operations, with several of these habitats supporting grassland breeding birds such as the savannah sparrow. A number of significant natural communities are associated with alluvial habitats here including alluvial marsh, wet meadow, floodplain forest, and riverbank beach/shore communities. The only known riverine community of the dwarf bulrush (*Fimbristylis autumnalis*) was documented here during the survey. This species is typically associated with pond and lake shores. The Walton Pond site is contiguous with large tracts of land to the north in Avon and is discussed in the Avon town profile.

Three of the primary areas are associated with the traprock ridge ecoregion. These sites are: "Hartford Reservoir," "Hillstead," and "Deadwood Swamp." Deadwood Swamp is located along the Rattlesnake Mountain section of the traprock ridge and is part of a large contiguous tract that extends south into New Britain and Plainville. Several active and inactive quarry operations are located within the site. Deadwood Swamp is a large wetland system located along the eastern slope of the ridge and is under State ownership. Other natural communities include talus rockslides, cliffs and ridgetop glades. Biodiversity documented during the survey includes a rich vernal pool-breeding salamander community including marbled and four-toed salamanders and red-spotted newts (*Notophthalmus viridescens*). Because of the urban development immediately adjacent to the south and east, the site serves as an important refuge for wildlife in the area. The Hillstead site is located along the Farmington Mountain section of the traprock ridge and is

associated with the Hillstead Museum. The mix of forest and managed open land at this site supports some breeding grassland birds and rare plants. The Hartford Reservoir site includes a small section in the northeast corner of town that is contiguous with a larger tract of land extending north into Avon and West Hartford along the Talcott Mountain section of the traprock ridge ecoregion. This site is discussed in the Avon town profile.

The final two primary habitat areas are located in the western section of town. "Scott Swamp" is a large, diverse wetland complex that includes both forested and open canopy wetlands. The site is contiguous with a large tract of forest habitat to the west in the towns of Bristol and Burlington. The site supports spotted and wood turtle (*Clemmys insculpta*) populations, hognose snakes and a variety of shrub/scrub-dependent breeding bird species. Just east of Scott Swamp, the "Town Forest" site is primarily protected town land with private land holdings on the periphery. The site is forested with several wetland habitats including vernal pools. The site supports box turtles and a variety of other wildlife species.

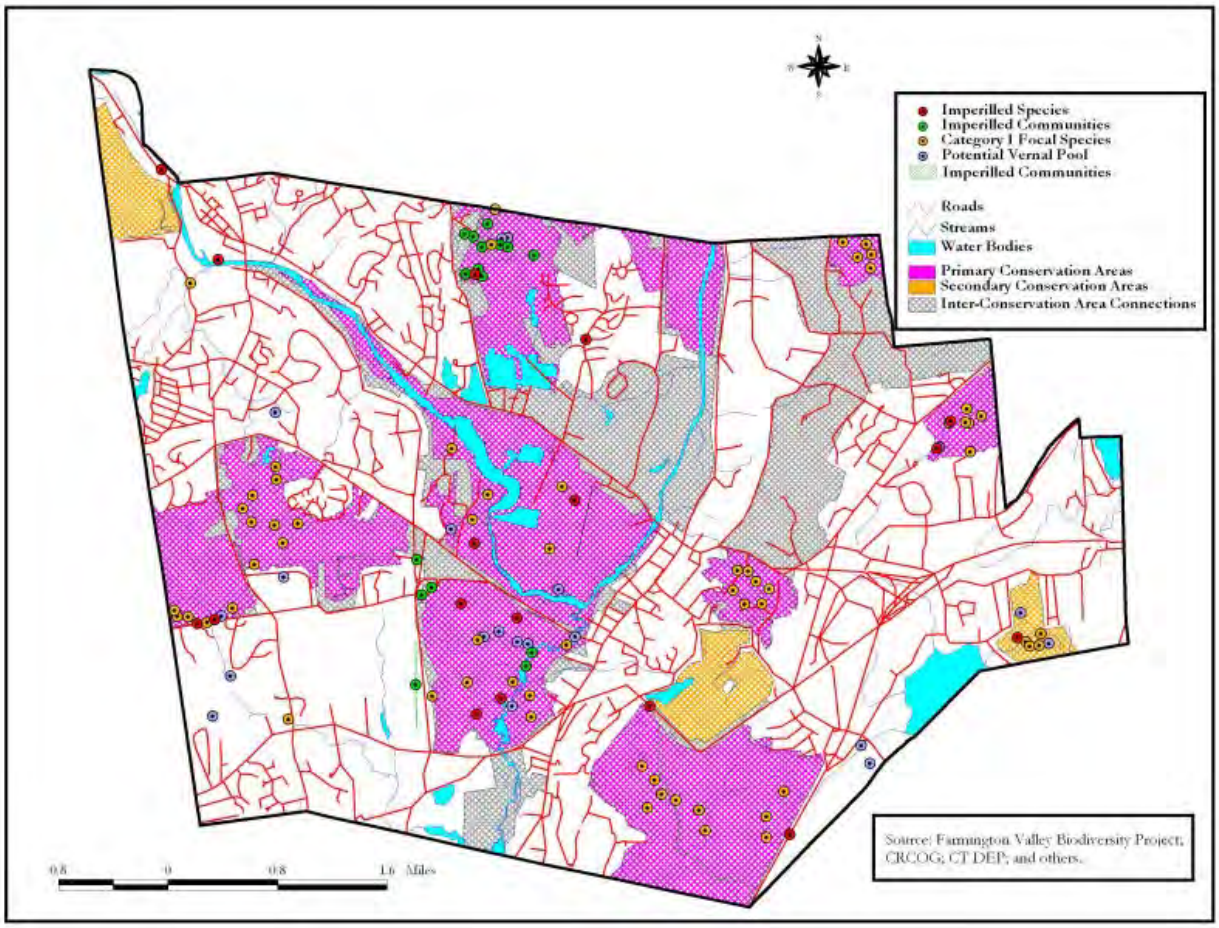
Secondary Conservation Areas

The "Burnt Hill" area is a disjunct site located just east of the Talcott Mountain traprock ridge ecoregion. The site is situated at the edge of urban development to the south and east. The range of habitats present, including vernal pools, wetlands, shrub-scrub power line right-of-ways, and forest, support a diversity of wildlife, from blue-spotted salamanders and wood frogs to box turtles and hognose snakes. Because of its location, this site serves as an important refuge for wildlife.

The "Batterson Park Pond" area is located just east of the Batterson Park recreational park in the eastern section of town. The site is an island amid urban development. A range of habitats, including vernal pools, wetlands, a seepage stream, a shrub/scrub power line right-of-way, and forest, support a diversity of wildlife, including spotted and dusky salamanders, wood frogs, and box turtles. Because of its location, this site serves as an important refuge for wildlife.

The "Taine Mountain" area includes several large tracts of privately owned forest located along the west side of the Farmington River within the western highlands ecoregion. These sites are small sections of a much larger contiguous tract of land extending west through Burlington. Little survey work was conducted by the FVBP here so further biodiversity data here is needed. The section of river along this site supports several rare plant species.

Figure 12: Farmington biodiversity map



Granby

The town of Granby is categorized as rural and covers an area of 41.3 square miles within the Farmington River watershed. While the southern and western sections of town remain rural in character and feature extensive, unfragmented tracts of forest, the eastern section of town along the route 10/202 corridor has undergone significant development. The FVP identified eight primary and two secondary core areas for biodiversity.

Primary Conservation Areas

Area Designation	Ecoregion
The Knolls	Traprock Ridge
Barndoor Hills East	Traprock Ridge
Barndoor Hills West	Traprock Ridge
Manitook Mt. North	Traprock Ridge
Manitook Mt. South	Traprock Ridge
Manitook Lake	Traprock Ridge/Bog
West Mountain	Western Highlands
Crag Mountain	Western Highlands

Secondary Conservation Areas

Area Designation	Ecoregion
Salmon Brook	Corridor
W. Branch Salmon Brook	Western Highlands

Primary Conservation Areas

Six of the primary habitat areas are associated with the intrusive traprock ridge ecoregion that extends along the western edge of the Farmington River valley. "The Knolls," "Barndoor Hills West," and "Barndoor Hills East" are three clustered traprock knolls located in the southern section of town. Large sections of these areas are owned and managed by the McLean Game Refuge. All three of these sites are extensively forested and a high percentage of the breeding bird community associated with these sites is composed of forest-interior dependent species. A number of raptor species including the northern goshawk (*Accipiter gentilis*) reside within these sites. All three sites also feature a diversity of significant natural communities associated with traprock ridges including talus slopes, rocky outcrops and summits, and cliffs. These, in turn, host an array of rare plants. These sites along with other intrusive traprock ridge sites extending to the south in Simsbury and Canton support the only known Connecticut occurrences of the long-leaved bluet. A diversity of wetland habitats also is common to these sites including many glacial kettle ponds. A number of high streams such as Bissell Brook support fish, amphibian and benthic macroinvertebrate communities requiring high water quality conditions. Barndoor Hills East also has a number of fens and bogs within it, providing habitat for additional rare plant species. The Knolls support a noteworthy diversity of vernal pool-breeding amphibians including Jefferson salamanders. Although the FVBP did not survey for mammals, biologists recorded a number of black bear sightings within these sites.

"Manitook Mountain North," "Manitook Mountain South," and "Manitook Lake" are three primary areas located along the intrusive traprock ridge ecoregion extending along the western edge of the Farmington River Valley, and located in the northeast section of town. Biodiversity data for these three sites is limited due to the inability of the FVBP to obtain access to much of the key habitats within these sites for survey work.

The Manitook Mountain North and South sites include a number of natural communities associated with traprock ridge systems including talus slopes, cliffs and ledge, acidic forest, and

open summits that support a variety of rare plants. The only extant occurrence in New England of the narrow-leaved horse gentian was documented among these sites during the survey. The Manitook Lake site includes a series of bogs that support populations of rare plants as well as spotted turtles (*Clemmys guttata*), and a diversity of amphibians and insects.

The "West Mountain" site is part of the largest contiguous forest tract in the seven-town study area. The site is situated within the western highlands ecoregion and is located in the southwestern section of town. It is contiguous with large forest tracts extending south into Simsbury. Numerous small, high-quality streams and seeps support populations of brook trout and northern spring salamanders. The large intact forest habitat support robust breeding populations of forest-interior dependent birds. This is one of the few locations in the study area that has breeding cerulean warblers, among the most area-sensitive species of the forest-dependent breeding birds. The West Mountain site also serves as an ecological bridge between the western highlands and the intrusive traprock ridge ecoregion.

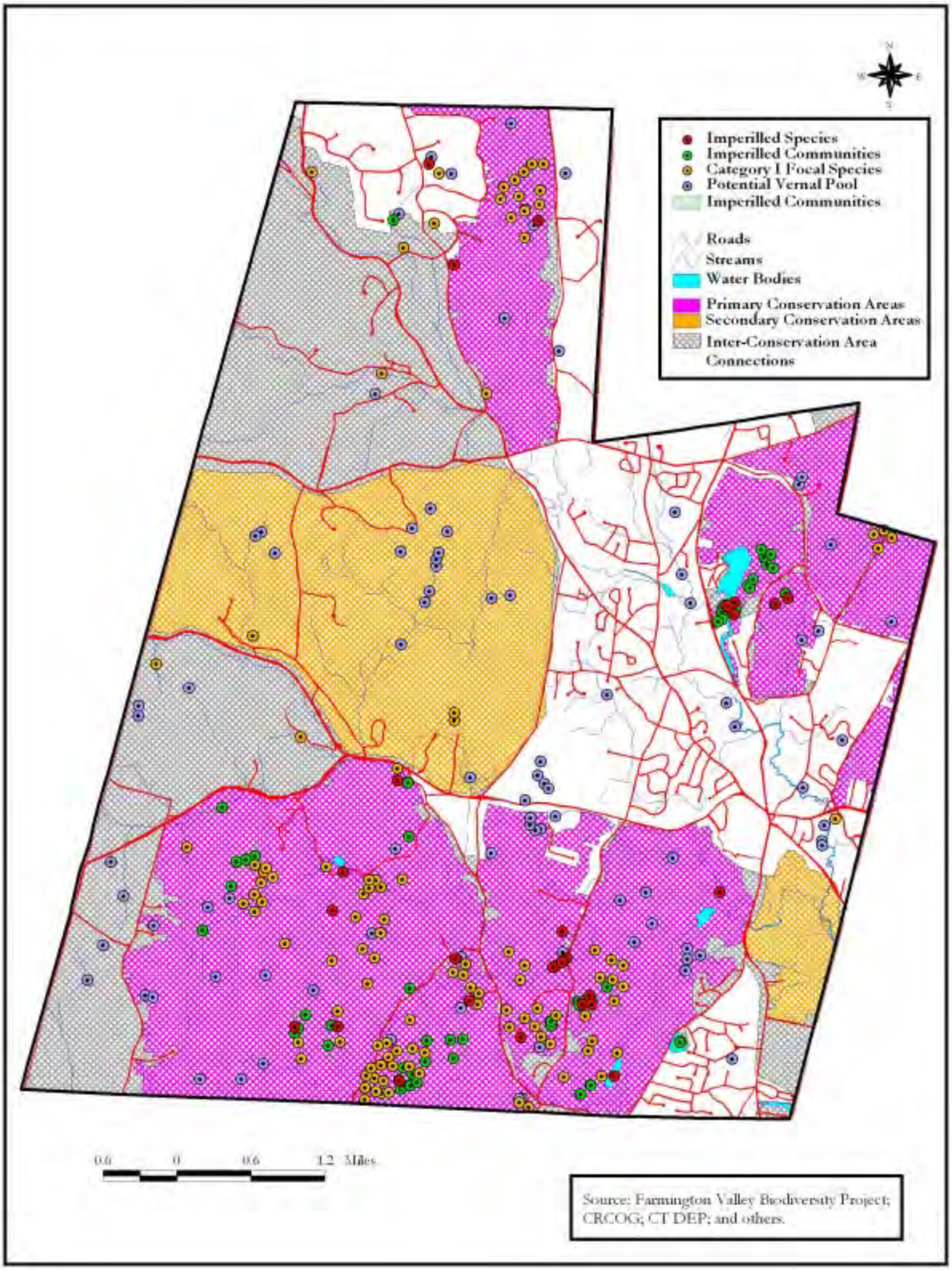
The final primary habitat area, "Crag Mountain," is an extensive and primarily privately owned forested ridge system located within the western highlands ecoregion and located in north Granby. The site features a number of extensive wetland complexes, high-quality streams, and large, unfragmented forest habitat with a breeding bird community dominated by forest-interior dependent species. Only limited survey effort was undertaken at this site due to time constraints.

Secondary Conservation Areas

"Salmon Brook," located in the southeast section of town, was identified as an ecological connector between the northwest highlands and western traprock ridge ecoregions and the Farmington River. This site is contiguous with land tracts in neighboring East Granby and has small open space holdings but is primarily privately owned.

A large, unfragmented forested land tract "West Branch Salmon Brook," located north of West Mountain, was identified as a secondary conservation area because it serves as an ecological connector within the western highlands ecoregion. Little survey work was conducted in this site during the FVBP and further investigation of biodiversity in this area is warranted.

Figure 13: Granby biodiversity map



Simsbury

The town of Simsbury is categorized as "suburban" and covers an area of 34.5 square miles within the Farmington River watershed. The town's population has grown significantly in recent years from approximately 5,000 to more than 23,000 during the period 1950-2000. The FVP identified eleven primary and three secondary core areas for biodiversity.

Primary Conservation Areas

Area Designation	Ecoregion
Nod Brook	River Floodplain
Weatogue	River Floodplain
Terry's Plain	River Floodplain
Pickerel Cove	River Floodplain
Onion Mountain	Traprock Ridge
Sugarloaf Mountain	Traprock Ridge
The Knolls	Traprock Ridge
Talcott Mt. North	Traprock Ridge
Penwood	Traprock Ridge
West Mountain	Traprock Ridge/Western Highlands
Great Pond	Wetland

Secondary Conservation Areas

Area Designation	Ecoregion
Meadowwood	Corridor
Powder Forest	Corridor
Ethyl Walker	Corridor

Primary Conservation Areas

Four of the primary habitat areas are located along the Farmington River and fall within the alluvial floodplain ecoregion. These are, "Nod Brook," "Weatogue," "Terry's Plain," and "Pickerel Cove." These sites support a high diversity of significant natural communities including sand barrens, various floodplain forests, wet meadows and extensive marshes. Consequently, a number of rare plants were documented among these sites. These sites, along with alluvial sites further to the south in Avon, encompass the largest New England occurrence for the rare sedge, *Carex davisii.* The extensive marsh and wet meadow communities within these sites support populations of the northern leopard frog among other amphibians, various wetland dependent birds including the American bittern, and wood turtles. The floodplain forests support rookeries of great blue heron (*Ardea herodias*), and the floodplain forest levee communities in this area are the New England stronghold for the starry campion plant. The Pickerel Cove site includes a significant sand barren community that supports populations of a number of rare insects including the big sand tiger beetle (*Cicindela formosa*) and the rapids clubtail (*Gomphus quadricolor*) (M. Thomas, pers. comm.). Ongoing surveys at this and other sand barren communities along the Farmington River are likely to greatly increase our understanding of the biodiversity of these areas.

Four primary sites, "Onion Mountain," "West Mountain," "Sugarloaf Mountain," and "The Knolls" are part of the intrusive traprock ridge ecoregion that extends along the western edge of the Farmington River Valley. These sites are located in West Simsbury. Only a small section of the Onion Mountain site, which is contiguous with a larger tract of ridge in neighboring Canton, is located in Simsbury. The Onion Mountain site is discussed in the Avon town profile. Similarly, only a small section of "The Knolls" is located in Simsbury. This site is contiguous with a much larger tract to the north in Granby and is discussed in the Granby town profile.

The West Mountain site is part of the largest contiguous tract of land within the seven-town study area. This Simsbury section of this tract includes Hedgehog Mountain and is contiguous with large tracts located to the east in Canton and the north in Granby. The West Mountain area of Simsbury however, falls primarily within the intrusive traprock ridge ecoregion. West Mountain tracts in Canton and Granby are associated with the western highlands ecoregion. Significant natural traprock communities associated with the West Mountain and "Sugarloaf Mountain" sites include rocky outcrops and summits, talus slopes, and acidic forests. These sites along with other intrusive traprock ridge sites extending to the north in Granby and to the south in Canton support the only known Connecticut occurrences of the longleaf bluet, among a diversity of other rare plants. The only extant occurrence of New England's only lizard, the five-lined skink, within the entire traprock ridge ecoregion in Connecticut and Massachusetts is located within the West Mountain section of Simsbury. The large, intact forests associated with these ridges support robust populations of forest-interior dependent breeding birds. Other wildlife of this ridge system includes eastern box turtle, northern copperhead, bobcat, and fisher.

Two primary habitat areas, "Talcott Mountain North," and "Penwood" are situated along the Metacomet traprock ridge ecoregion that extends north along the eastern edge of the Farmington River valley. The Talcott Mountain North site includes the King Philip Mountain section of this ridge and is contiguous with large unfragmented forest tracts located to the east in neighboring Bloomfield including properties maintained by the MDC as public watershed land. The Penwood site located north of King Philip Mountain is contiguous with the Penwood State Park. This site is also contiguous with the extensive Griffith Brook wetland complex located to the east in Bloomfield. The King Philip Mountain section of the ridge is one of the few areas where the ridge system is contiguous with the alluvial floodplain. These ridge sites support an array of natural communities including perched vernal pools and various traprock ledge communities including talus slopes and rocky outcrops/summits, that host an array of rare plants. These ridge systems support robust vernal pool-breeding amphibian populations such as Jefferson, marbled and spotted salamanders and wood frogs, and breeding populations of forest-interior dependant bird species such as black-throated blue and worm-eating warblers, and hermit thrush among others.

The final primary habitat area is "Great Pond" a large, hydrologically variable isolated pond located in north-central Simsbury. Based on previously documented species occurrences and the fieldwork conducted for this study, it was found that this site supports a high level of biodiversity. The pond shore and fen communities at the site are home to a number of rare plants. Other indicators of high wetland quality include a large breeding population of wood frogs and the presence of ribbon snakes. The pond sits within a large intact forest that supports a high percentage of forest-interior dependent breeding birds.

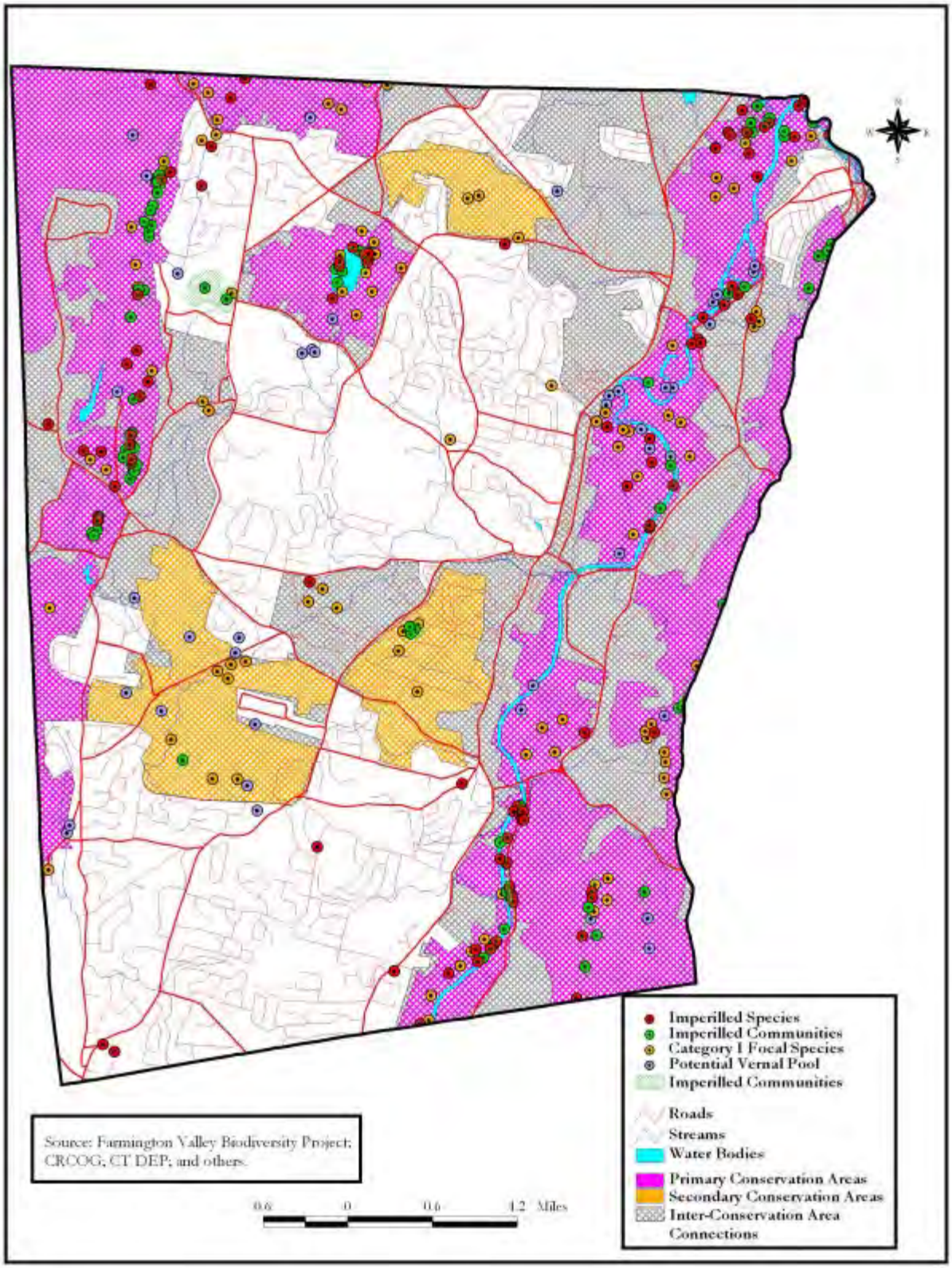
Secondary Conservation Areas

"Meadowwood" a large, relatively unfragmented tract of land located to the northeast of Great Pond, was identified as an important ecological corridor. This site supports a mix of open and forest habitat with several wetland systems including vernal pools.

Several large tracts of intact forest lands that contain a diversity of wetland communities were identified as secondary habitat areas, serving as ecological connectors across the landscape.

These include the Powder Forest and Ethel Walker sites. Minimal survey effort was conducted within these areas due to time constraints and, in one case, inability to obtain landowner permission. Further investigation of these sites to determine elements of biodiversity is warranted.

Figure 14: Simsbury biodiversity map



Suffield

The town of Suffield is categorized as "rural" and covers an area of 43.1 square miles. However, only a small portion of this falls within the Farmington River watershed. The majority of the area is within the Connecticut River watershed. The town is experiencing significant growth with a current population of around 13,500. The many large, remaining land tracts surrounded by development present an interesting challenge for future planning. The FVBP identified thirteen primary and seven secondary biodiversity conservation areas.

Primary Conservation Areas

Area Designation	Ecoregion
Peak Mountain	Traprock Ridge
West Suffield Mountain	Traprock Ridge
Manitook Mt. North	Traprock Ridge
Beaverdam Marsh	Grassland/Wetland
Congamond Lake	Bog
Bradley Airport	Grassland/Sandplain
Rocky Gutter Brook	Wetland
Rattlesnake Swamp	Wetland
Muddy Brook	Glacial Lake Plain/Wetland
Stony Brook	Glacial Lake Plain/Wetland
Rawlins Brook	Glacial Lake Plain/Wetland
Four Mile Brook	Grassland
Connecticut River	Grassland/River upland

Secondary Conservation Areas

Area Designation	Ecoregion
Newgate Swamp	Corridor
Mountain Brook Swamp	Corridor
Spaulding School	Corridor
Buck Hill	Corridor
Philo Brook	Corridor
Stockwell Swamp	Corridor
Onion Brook	Corridor

Primary Conservation Areas

Two primary habitat areas are located along the Metacomet traprock ridge ecoregion. These are, "Peak Mountain" and "West Suffield Mountain." The Peak Mountain site is an extensive forested ridge that extends south into East Granby and is contiguous with a section of West Suffield Mountain to the north. West Suffield Mountain is an extensive forested ridge that extends north into Massachusetts, where the traprock ridge continues northward to Provin Mountain.

These ridges feature numerous high-quality wetland systems including perched vernal pools along the ridgetops and extensive red maple and shrub swamps along the eastern and western bases of the ridge. These wetlands support a rich diversity of vernal pool-breeding amphibians including marbled, spotted and four-toed salamanders among others. Other significant natural communities present include talus and seepage forests. The large, intact forest habitat along these ridges supports forest-interior breeding bird community.

"Manitook Mountain North" is located along the intrusive traprock ridge ecoregion that extends along the western edge of the Farmington River valley. The northern tip of this traprock ridge is located in the southwest corner of Suffield and is contiguous with the remainder of the Manitook site that extends south into Granby. Survey data is limited for this site due to access issues. For a discussion of this site, see the Granby town profile.

"Beaverdam Marsh" is part of an extensive and highly diverse wetland complex situated among a mosaic of forest, open agricultural, and post-agricultural habitats. Consequently, these sites are among the most biologically rich areas encountered during the survey. The section of this site located within Suffield is primarily agricultural. The site, including the majority of the wetland, extends south into East Granby. The FVBP documented a regionally (New England) significant grassland breeding bird community within the Suffield section of this site. Twelve singing male grasshopper sparrows, one of the largest populations in the state, along with other grassland species including the savannah sparrow, American kestrel and bobolink, were recorded here. The proximity of this grassland habitat to the Bradley Airport and Northwest Park (Windsor) sites, both of which support breeding grasshopper sparrows, is an important landscape-scale factor. For further discussion of the biodiversity of this site refer to the East Granby town profile.

The "Bradley Airport" primary habitat area is located in the south-central section of Suffield and is contiguous with a smaller section of the site that extends south into East Granby. The site lies within the glacial lake plain and sandplain ecoregions. This large tract features a high density of small vernal pools supporting a forest amphibian community including spotted salamanders and wood frogs, while small pockets of wet meadow and more open-canopied wetlands on the periphery of the forest support breeding gray treefrogs and Fowler's toads. Sand barren communities within the site support rare plants, hognose snakes and possibly rare insect communities.

Two primary conservation areas adjacent to the Connecticut River were identified as important grassland communities. These are the "Four-Mile Brook" and "Connecticut River" sites. Both sites include large, unfragmented, post- and active-agriculture grassland communities that support grassland breeding bird populations including the American kestrel, bobolink and eastern meadowlark, among others. The Four-Mile Brook site also supports populations of several rare sedges. The sites are a mix of private and agricultural holdings.

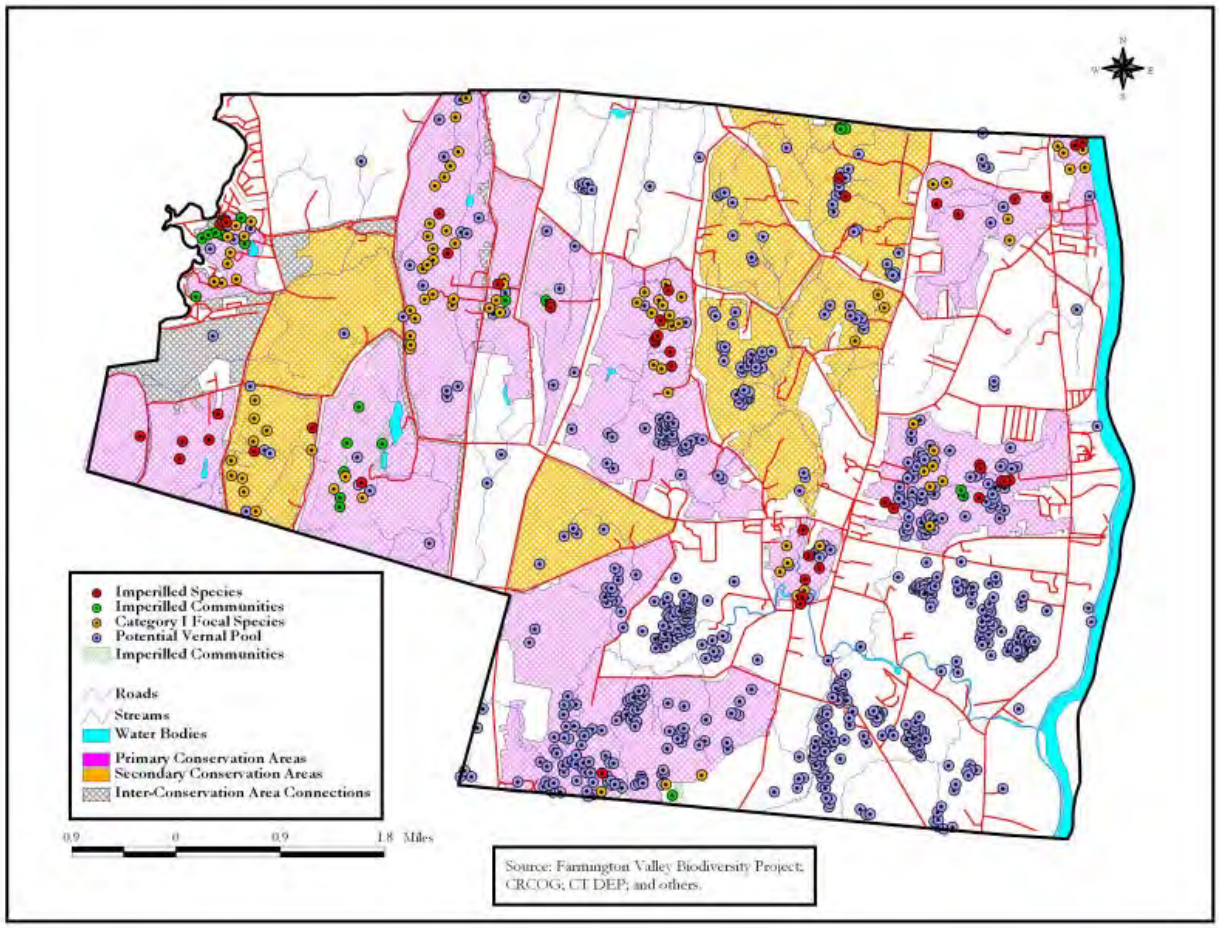
The "Congamond Lake" primary habitat area is situated on the eastern shores of the Congamond Lakes that are in Massachusetts. This site includes a complex of fens and bogs that support a diversity of rare plants. A sand barren community is also associated with the site. Other biodiversity elements associated with the site include spotted turtles, black bear and a variety of amphibians and reptiles. Because of the natural communities present the site warrants further investigation for significant insect populations.

Five large, unfragmented tracts of land were identified as primary conservation areas. Each features a mosaic of land use and/or a diversity of natural communities, including extensive forested swamps and clusters of small vernal pools, sections of upland forest and large tracts of grassland. They include "Rocky Gutter Brook," "Rattlesnake Swamp," "Muddy Brook," "Stony Brook," and "Rawlins Brook." All of these sites are located within the glacial lake plain ecoregion. Several of these sites, Muddy Brook and Rawlins Brook support high quality forest streams with populations of dusky salamanders, and diverse benthic macroinvertebrate communities. The Rawlins Brook site includes several natural communities only found here in the study area; they include a swamp white oak-pin oak drawdown swamp and a shale/siltstone outcrop. All of these sites included a diversity of wetlands with some, such as Rawlins Brook,

featuring dense clusters of small vernal pools. Breeding bird communities were diverse, and due to the mosaic of habitat types, primarily consisted of habitat generalists with the exception of Rawlins Brook which had a high percentage of forest interior-dependent species. The Muddy Brook site includes the Lewis Farms Audubon land.

Secondary Conservation Areas

Several large, relatively unfragmented tracts of land were identified as important habitat and ecological corridors. These include, "Newgate Swamp," "Mountain Brook Swamp," "Spaulding School," "Stockwell Swamp," "Onion Brook," "Philo Brook," and "Buck Hill." All of these sites are within the glacial lake plain ecoregion. Although there was minimal survey effort at these sites, they include a diversity of wetland communities and mosaics of grassland and forest communities. Further field investigations to assess elements of biodiversity within these sites are warranted.


Imperilled Species
Imperilled Communities
Category I Focal Species
Potential Vernal Pool
Imperilled Communities
Roads
Streams
Water Bodies
Primary Conservation Areas
Secondary Conservation Areas
Inter-Conservation Area Connections
0.9 0 0.9 1.8 Miles
Source: Farmington Valley Biodiversity Project; CRCOG; CT DEP; and others.

Utilizing the Maps and Data

Incorporation within the Municipal Plan of Conservation and Development

Collecting and mapping data on the distribution of species and their habitats is an important first step in planning for the conservation of these resources. The critical next step, necessary to facilitate conservation planning, is to integrate this information into the municipal Plan of Conservation and Development (POCD). A POCD is the "master plan" that maps the most appropriate locations for various land uses such as residential, commercial, industrial, and recreational development, as well as designating important natural resource areas that might have limitations on development. Additionally, the POCD outlines goals, standards and policies associated with these land uses. The most important goal for utilization of the conservation area data and maps is to guide *where* and *how* future development activities occur within these areas.

The two core objectives are:

1) Maintain overall habitat quality and landscape/ecological connectivity.

2) Protect specific habitat types (vernal pools, bogs, open ledge, etc.) and natural communities that occur within the conservation areas and that are critical to animals and plants of conservation concern.

For more detailed information on POCD functions refer to Zizka (2004) and Klemens et al. (2006). During the implementation phase of the FVBP, staff worked closely with several town planners and members of Conservation and Inland Wetland Commissions to promote integration of the biodiversity conservation overlay maps within POCDs that were under development at the time. It is recommended that a town's Conservation Commission take the lead role in promoting and advancing the incorporation of the conservation area maps and associated goals, policies and standards within the POCD. An excellent example of language used by a Connecticut town can be found on the Town of Simsbury's website at: http://simsburyct.virtualtownhall.net/Public_Documents/SimsburyCT_POCD/Individual/03%20Natural%20Resources.pdf.

Moving from the POCD to Action

It is likely that by the end of 2007, FVBP maps and recommendations will be incorporated into six of the seven towns participating in the project, but hopefully the story will not end there. There are a number of steps that are recommended to position municipal land use planners and decision-makers to better accomplish conservation objectives. Vital to these are reviewing the town's Planning and Zoning, Subdivision, and Inland Wetlands regulations to ensure that they align with the goals, policies, and standards that are incorporated into the POCD. For example, will the Subdivision regulations allow for "cluster" or "conservation" designs within the conservation areas as a means to reduce fragmentation? Others include adopting a pre-application process for projects proposed within conservation areas, establishing standards for biological reviews, and providing adequate training for commission members, etc. Klemens et al. (2006) discuss the scientific, planning, and legal perspectives surrounding many of these steps and present a "biodiversity conservation checklist" for municipalities to consider in moving towards proactive biodiversity protection.

The maps and data within this report can be a valuable tool for use by Conservation and Inland Wetland Commissions because it provides a large-scale ecological context for reviewing design plans for regulated projects proposed for parcels within the conservation areas. Having this information upfront, especially as part of a pre-application phase, can be an efficient and effective means for guiding discussions towards avoiding impacts to a site's natural resources. *However, these maps and data are not a substitute for site-specific surveys and data collection required for individual development proposals.*

The Role of Best Management and Development Practices

The application of "best development practices" (BDP) or "best management practices" (BMP) can be an effective tool for use by municipal planners as well as land trusts and private landowners within conservation areas. During the course of the project, several BDP/BMPs were identified as potential conservation tools for use in the Farmington River Valley based on the natural communities and habitats present within the area. These include the following:

Grassland Bird Communities

Conserving Grassland Birds - provides an overview of grassland bird species and management in addition to management and restoration recommendations for small grasslands, large grasslands, and agricultural grasslands.
Available at: http://www.massaudubon.org/birds&beyond/grasslandbirds/index.

Forest Interior Bird Communities

A Land Manager's Guide to Improving Habitat for Scarlet Tanagers and other Forest-interior Birds.
Available at: Cornell Lab of Ornithology.

Vernal Pool Communities

Best Development Practices: Conserving Pool-breeding Amphibians in Residential and Commercial Developments in the Northeastern United States.
MCA Technical Paper Series No. 5
Available at: Metropolitan Conservation Alliance/Wildlife Conservation Society
www.wcs.org/mca.

Forestry Habitat Management Guidelines for Vernal Pool Wildlife. MCA Technical Paper Series No. 6
Available at: Metropolitan Conservation Alliance/Wildlife Conservation Society
www.wcs.org/mca.

Ridgeline Communities

Shawangunk Ridge Conservation and Design Guidebook
Available at: The Catskill Center for Conservation and Development.

Conservation Design

Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks.
Available at: Island Press.

Amphibians and Reptiles
Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States. Technical Publication HMG-3.
Available at: Partners in Amphibian and Reptile Conservation.

Rivers and Streams
The Practice of Watershed Protection, editors Thomas R. Schueler and Heather K. Holland.
Available at: The Center for Watershed Protection, Ellicott City, MD.

Integrated Watershed Management: Principles and Practice. Isobel Heathcote, 1998.
Available at: John Wiley & Sons, Inc. Press.

Prioritizing Areas for Open Space Acquisition
The biodiversity conservation overlay provides a data layer that can be used in concert with municipal natural resource, recreation, and other maps to help guide prioritization for open space acquisitions. The maps and data within this report could also be shared with local land trusts to assist their efforts to strategically protect key parcels within the community. A proposed ranking scheme (strictly from a biodiversity viewpoint) might be as follows:

Priority 1 - Parcel in primary conservation area, **and** featuring an important natural community, wetland habitat or a population of conservation focus animals or plants, **and** contiguous with other currently protected parcels within the conservation area.

Priority 2 - Parcel in primary conservation area**, and** featuring an important natural community, wetland habitat or a population of conservation focus animals or plants, **but** disjunct from other protected parcels within the conservation area.

Priority 3 - Parcel in secondary conservation area, **and** featuring an important natural community, wetland habitat or a population of conservation focus animals or plants, **and** contiguous with other currently protected parcels within the conservation area.

Priority 4- Parcel in secondary conservation area**, and** featuring an important natural community, wetland habitat or a population of conservation focus animals or plants, **but** disjunct from other protected parcels within the conservation area.

Priority 5 - Parcel in primary conservation area

Priority 6 - Parcel in secondary conservation area

Summary

The FVBP provides a model for Connecticut towns to enter into intermunicipal collaborations and partner with local and regional conservation organizations to proactively plan for the protection of their biological resources. By employing readily available GIS technology and data layers, towns can prioritize areas for natural resource surveys, work with biologists to collect additional resource data, and integrate this information into a comprehensive biodiversity conservation area overlay. Once integrated within participating towns' Plans of Conservation and Development, the conservation area overlay informs both landscape-scale planning as well as site-specific parcel reviews. The FVBP model also provides a template for engaging the community and promoting awareness of local ecoregions, biodiversity, and conservation issues.

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