The Natural History of the Broad Brook Greenway

and Fitzgerald Lake

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Other Sources
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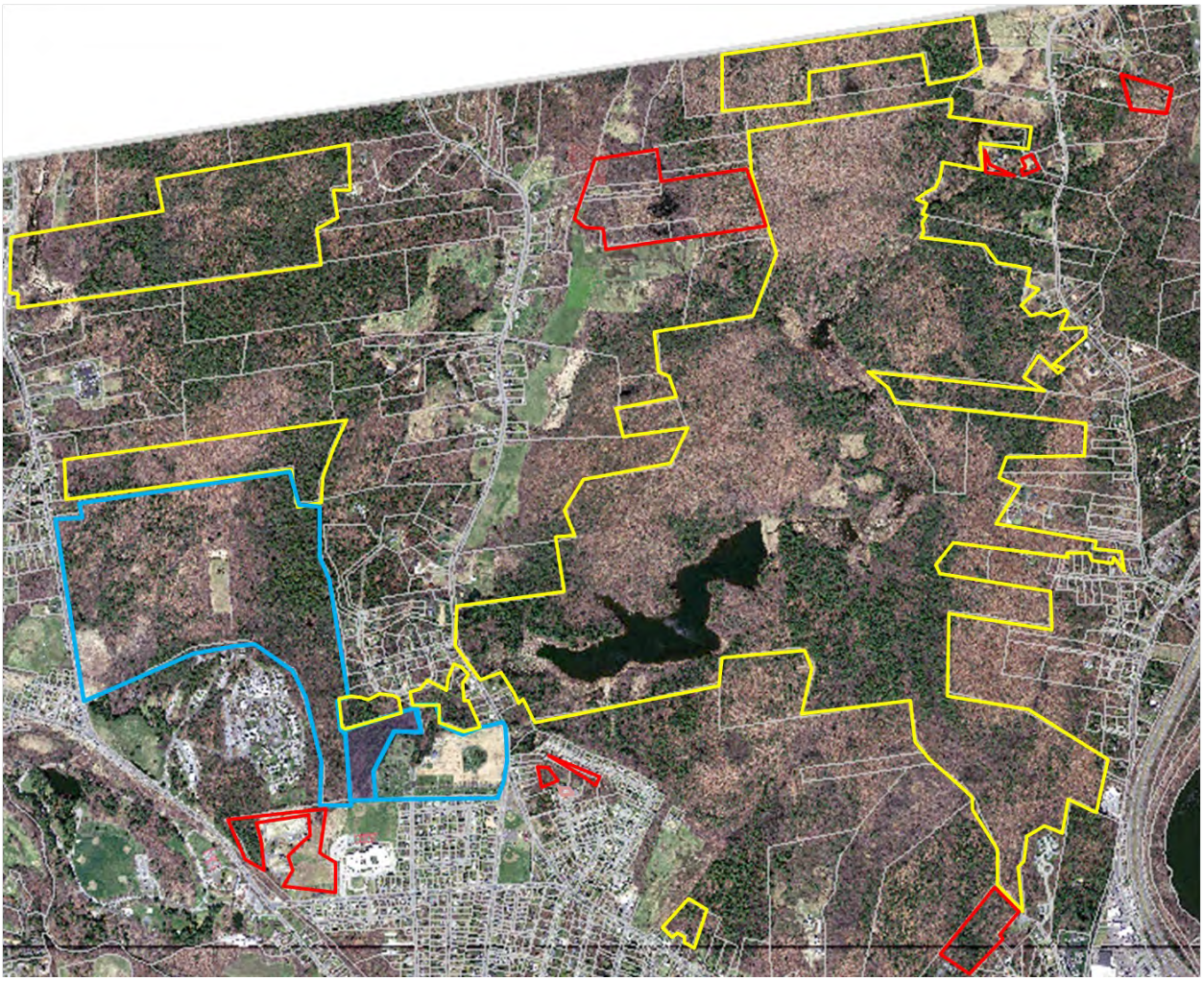
About the Author:
Laurie Sanders, M.S. is a field biologist, radio journalist and natural history tour leader. She has lived in the Connecticut River Valley for nearly thirty years. A graduate of UVM's Field Naturalist Program and Smith College, she prepared *Rediscovering Northampton* in 1993. At the time, it was the first comprehensive ecological assessment of the city's conservation lands, which included only 13 parcels that collectively totaled about 800 acres.

Photographs
Unless otherwise noted, all photographs by Laurie Sanders.

The Natural History of the Broad Brook Greenway and Fitzgerald Lake

Overview

With more than 900 acres, the Broad Brook/Fitzgerald Lake Greenway is the largest conservation area in Northampton, and, thanks to a long-standing partnership between the City's Conservation Commission and the Broad Brook Coalition (BBC), it is the best managed. Since 1990, the two groups have jointly managed this expanding area, with most of the funding for large capital expenses provided by the



The protected properties in the Broad Brook Greenway and Fitzgerald Lake Conservation Area that are owned in fee are outlined in yellow, while those held under private conservation restriction are outlined in bright red.. Other nearby municipally-owned land (Smith Vocational, JFK Middle School's forested land, and Spring Grove Cemetery) are outlined in bright blue. When all of the permanently protected land in this area is combined, it totals more than 900 acres.

City (through grants, CPA funds, and budget allocations) and the bulk of the labor provided—free of charge—by BBC volunteers. During that time, an impressive number of tasks have been completed—from repairing the dam and restoring Cooke's pasture to trail maintenance and invasive species control.

For the last ten years, the decisions about what projects to tackle next within the Fitzgerald Lake Conservation Area (FLCA) have been guided by a management plan that was written not by an outside consultant, but by BBC's Board. Although initially prepared for just 2005 -2010, the original management plan was so well done that it continues to be the primary document guiding the property's future management and stewardship activities. More recently, the highlights of the plan have been incorporated into the City's latest Open Space & Recreation Plan for FLCA.

One consequence of such a great plan and such committed volunteers is that, in spite of the large size of this conservation area, I have relatively few recommendations to add. My suggestions (Table 1) pertain either to new and neighboring properties or in a few cases, simply reiterate and reinforce some of the action items that have been previ-

This aerial photo from the 1950s shows a portion of what is now the Fitzgerald Lake Conservation Area before the dam and pond were built. The pond now covers what were cleared fields and pasture near the center of this image. Due west is Spring Grove Cemetery and southeast of the future lake is Harold K. Fitzgerald's Cloverdale subdivision, a portion of which is being cleared for new homes along Rick Drive. Fitzgerald had the pond built in 1965. The places in this photo that were open fields then and are now forested are also the areas where invasive plants, especially multiflora rose and Asiatic bittersweet, have taken off.

BBC volunteers remove water chestnut in 2007 from Fitzgerald Lake. *Photo courtesy Bill Williams.*

Table 1: Recommendations for Broad Brook/Fitzgerald Lake Greenway

- Continue to follow the recommendations of the Management Plan (2005-2010), including invasive species control, especially in more unusual habitats (e.g. wetland areas).

- Work with Smith Vocational to:
  (a) protect their land,
  (b) provide access to the "Girl Scout" trails,
  (c) develop a forest management plan that protects the old trees in the Broad Brook Valley, and
  (d) inventory the old trees on the Smith Vocational land and adjacent "Girl Scout" conservation area.

- Notify and work with the VA to:
  (a) correct a drainage problem that is causing erosion and damaging the Sullivan property and wetlands near Broad Brook,
  (b) provide access and parking to trails behind the VA, and
  (c) address invasive species issues on their property.

- Work with the City DPW to
  (a) control the spread of Japanese knotweed near the Burke Conservation Area, and
  (b) address other invasive plant problems within the grasslands in the cemetery (i.e. knapweed, swallowwort) and manage this special habitat, which supports at least three state-listed and/or uncommon plants and animals (bees, butterflies), and
  (c) restore one of the natural springs below Spring Grove cemetery, which was filled in to control an erosion problem in the early 1990s.

- Work with the Lathrop Community to address invasive species problems along Pine Brook (barberry, Japanese knotweed, etc.)

- Work with abutting private landowners to control invasive species.

- Try to secure public access from the Cloverdale Subdivision.

- Inventory all of the plants and animals within the Broad Brook/Fitzgerald Lake Conservation Area.

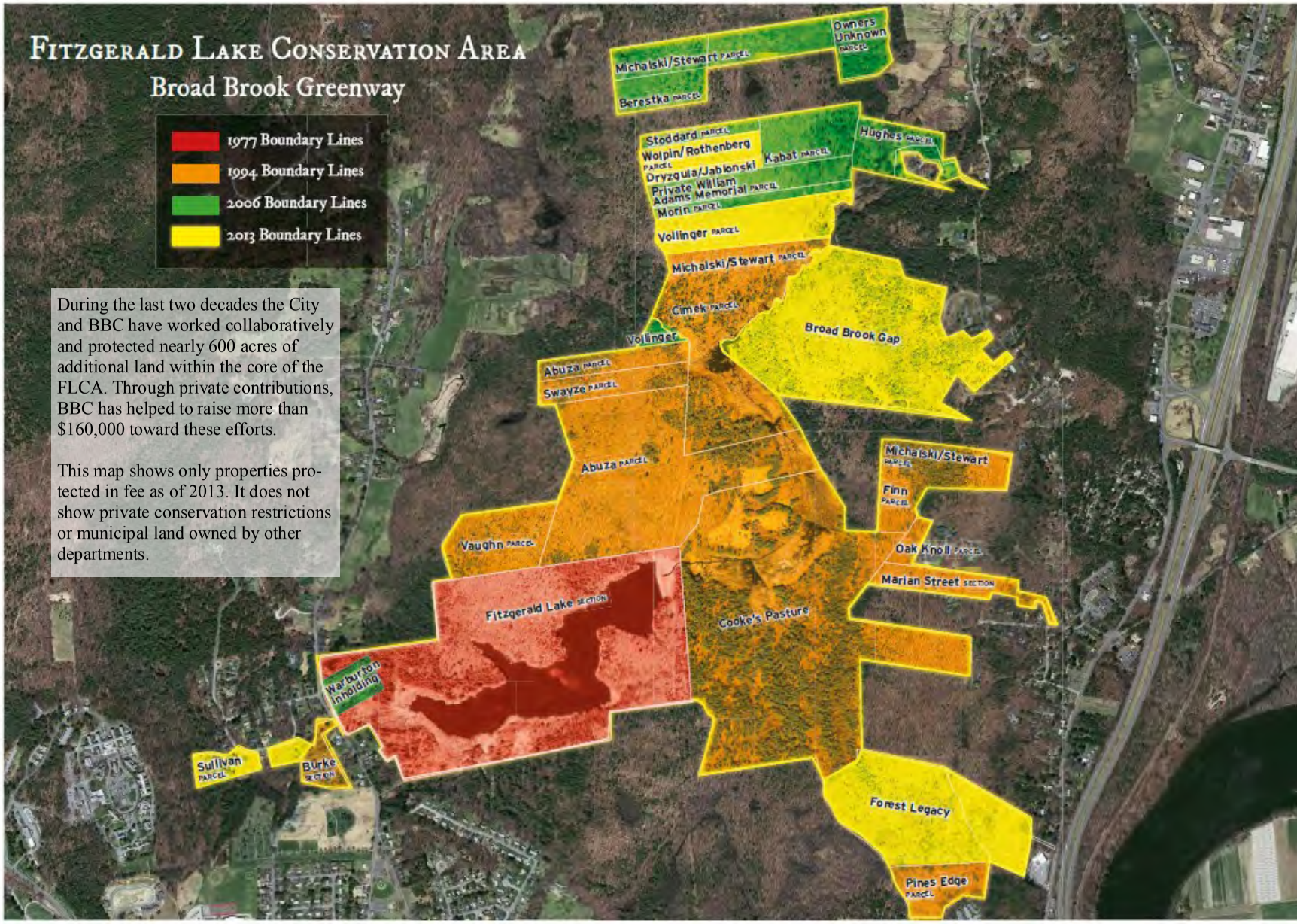
- Re-construct the boardwalk and canoe launch.

- Continue land acquisition efforts, in particular in the Horse Mountain Area, and in collaboration with Williamsburg and Hatfield.

- Gain permission from abutting landowners to access existing trails in the conservation areas in the upper Broad Brook drainage (i.e. Girl Scout property, Beaver Brook/Broad Brook, Sullivan, Burke).

ously identified, but either remain undone (e.g. inventory of the plants and animals) or are on-going (e.g. control of invasive plants). And of all of my recommendations, invasive plant control remains the most nettlesome, requiring constant monitoring and attention.

The good news is that the situation within this large greenway is much better than in most of the City's conservation areas. It turns out that this quiet corner of the City is mostly free of invasive plant species. What's more, where invasive plants do occur, they are often in relatively low numbers and they are found fairly consistently in three main areas: (1) along trails and roadside edges, (2) within sections of


Fitzgerald Lake Conservation Area
Broad Brook Greenway
1977 Boundary Lines
1994 Boundary Lines
2006 Boundary Lines
2013 Boundary Lines
During the last two decades the City and BBC have worked collaboratively and protected nearly 600 acres of additional land within the core of the FLCA. Through private contributions, BBC has helped to raise more than $160,000 toward these efforts.
This map shows only properties protected in fee as of 2013. It does not show private conservation restrictions or municipal land owned by other departments.
Michalski/Stewart PARCEL
Owners Unknown PARCEL
Berestka PARCEL
Stoddard PARCEL
Wolpin/Rothenberg PARCEL
Dryzgula/Jablonski
Private William Adams Memorial PARCEL
Morin PARCEL
Kabat PARCEL
Hughes PARCEL
Vollinger PARCEL
Michalski/Stewart PARCEL
Cimek PARCEL
Vollinger
Broad Brook Gap
Abuza PARCEL
Swayze PARCEL
Abuza PARCEL
Michalski/Stewart PARCEL
Finn PARCEL
Vaughn PARCEL
Oak Knoll PARCEL
Marian Street SECTION
Fitzgerald Lake SECTION
Cooke's Pasture
Warburton Inholding
Sullivan PARCEL
Burke SECTION
Forest Legacy
Pines Edge PARCEL

past disturbance (i.e. pastures, old wood roads), and (3) along the margins as well as within wetlands.

These generalized locations are already well-known to BBC, which has been working on the control of invasive plants since the mid-1990s. During that time, they have worked on knocking back spotted and black knapweed, *Phragmites*, multiflora rose, glossy buckthorn, autumn olive, Asiatic bittersweet, Japanese knotweed, Morrow's honeysuckle, swallowwort, lesser celandine, garlic mustard and since its discovery in 2005, water chestnut. In some cases, the group has hired professional licensed applicators to spot-control the most problematic and worrisome species (*Phragmites*, knapweed, glossy buckthorn, and Japanese knotweed), but in others they have relied on volunteer labor (e.g. water chestnut, swallowwort, lesser celandine, etc.). As part of a comprehensive effort, BBC volunteers created a preliminary base map of invasive species locations in 2006, and in 2012 the stewardship committee invited botanist Matt Hinckler to survey the lake and he confirmed that water chestnut was the only invasive aquatic species in the pond. So far, it is free of Eurasian milfoil and other unwanted plant pests.

That said, in spite of these efforts, the Fitzgerald Lake Conservation Area has some potentially serious invasive species problems. Young stems of Asiatic bittersweet are common (especially near the wildlife blind) and winged euonymus is spreading along the main entrance trail. Glossy buckthorn has taken off during the last two decades and is now commonly encountered bordering the pond and marshes below Cooke's Pasture.

In addition, all of the conservation properties within the Broad Brook drainage have invasive plants—some extensive—and several abutting private properties have sizeable and/or worrisome invasions of non-native plants, a few of which threaten the conservation area's more sensitive habitats. For instance, two of the Greenway's more unusual wetlands (Burke, Sullivan & Kubosiak) are at risk from the spread of Japanese knotweed from nearby yard waste/stump dumps. In addition, the former pasture areas behind Rick Drive are loaded with multiflora rose, Asiatic bittersweet, and autumn olive, and the western portion of the Boggy Meadow Road wetland (now a beaver pond) includes impressive patches of multiflora rose. The forest/former pasture adjacent to this wetland also includes lots of multiflora rose below a stand of large catalpa.

Wood anemone (*Anemone quinquefolia*) is a common spring wildflower in the FLCA.

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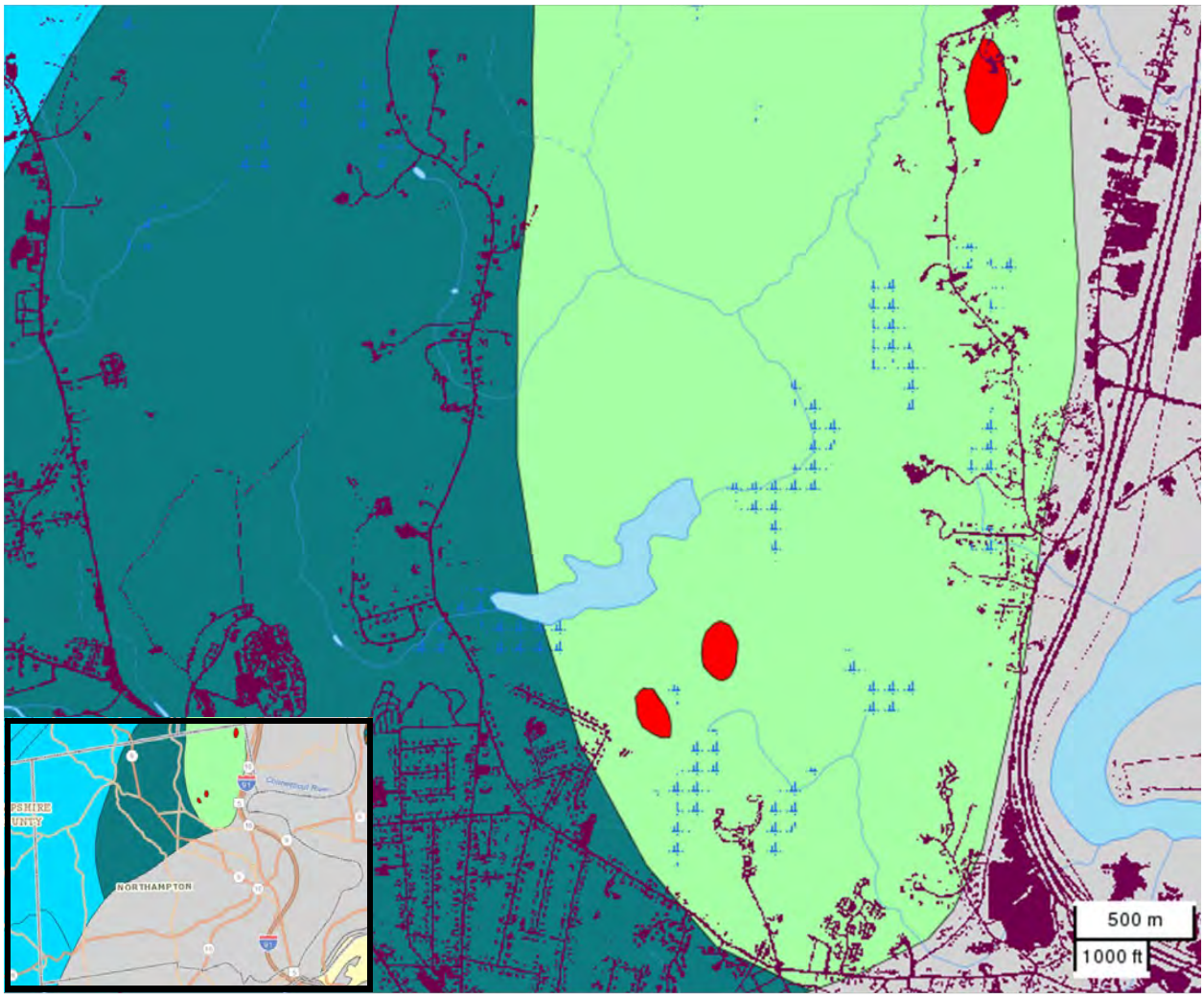
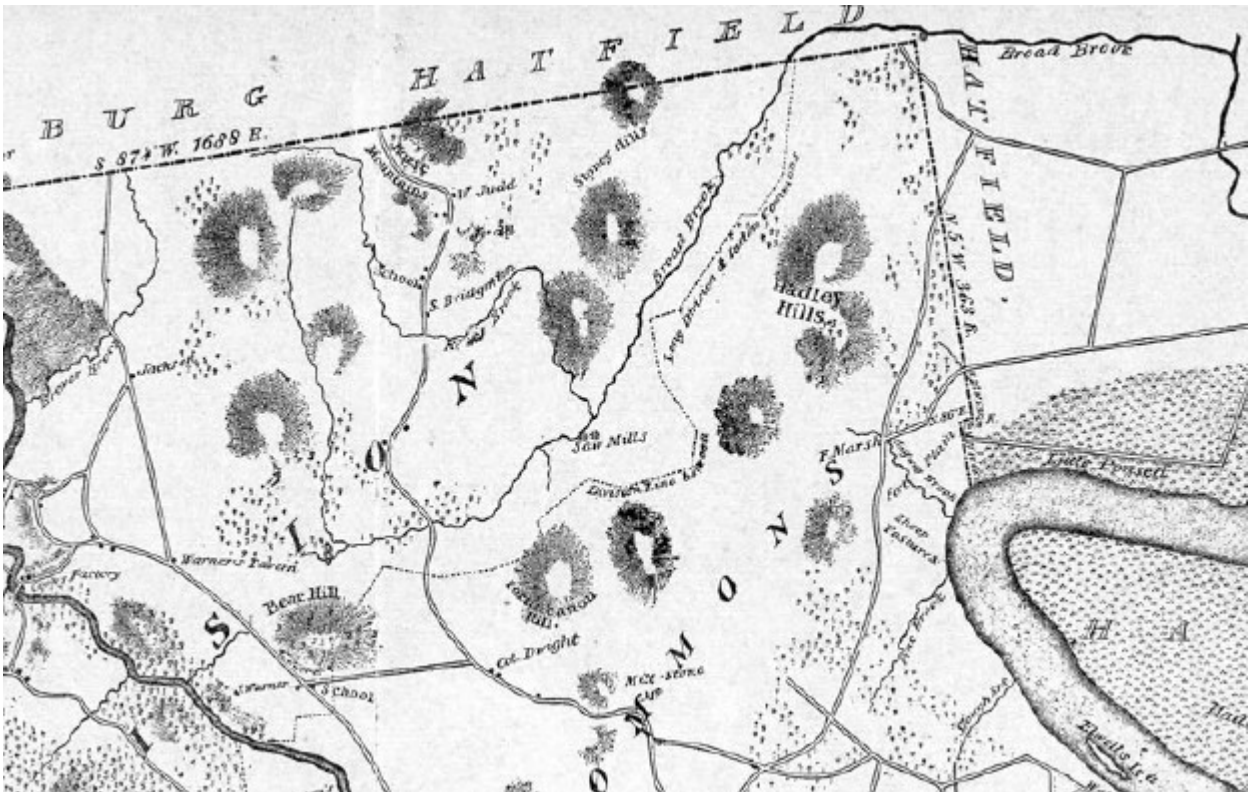


Bedrock Geology

The Broad Brook Greenway and Fitzgerald Lake Conservation Area are underlain by two different kinds of bedrock. Moving from west to east, the bedrock below the Broad Brook Greenway is a band of ancient metamorphic rock (*teal*), which formed when an island arc crushed against the margin of a proto-North American continent some 460 million years ago. It is composed of schist, gneiss and quartzite.

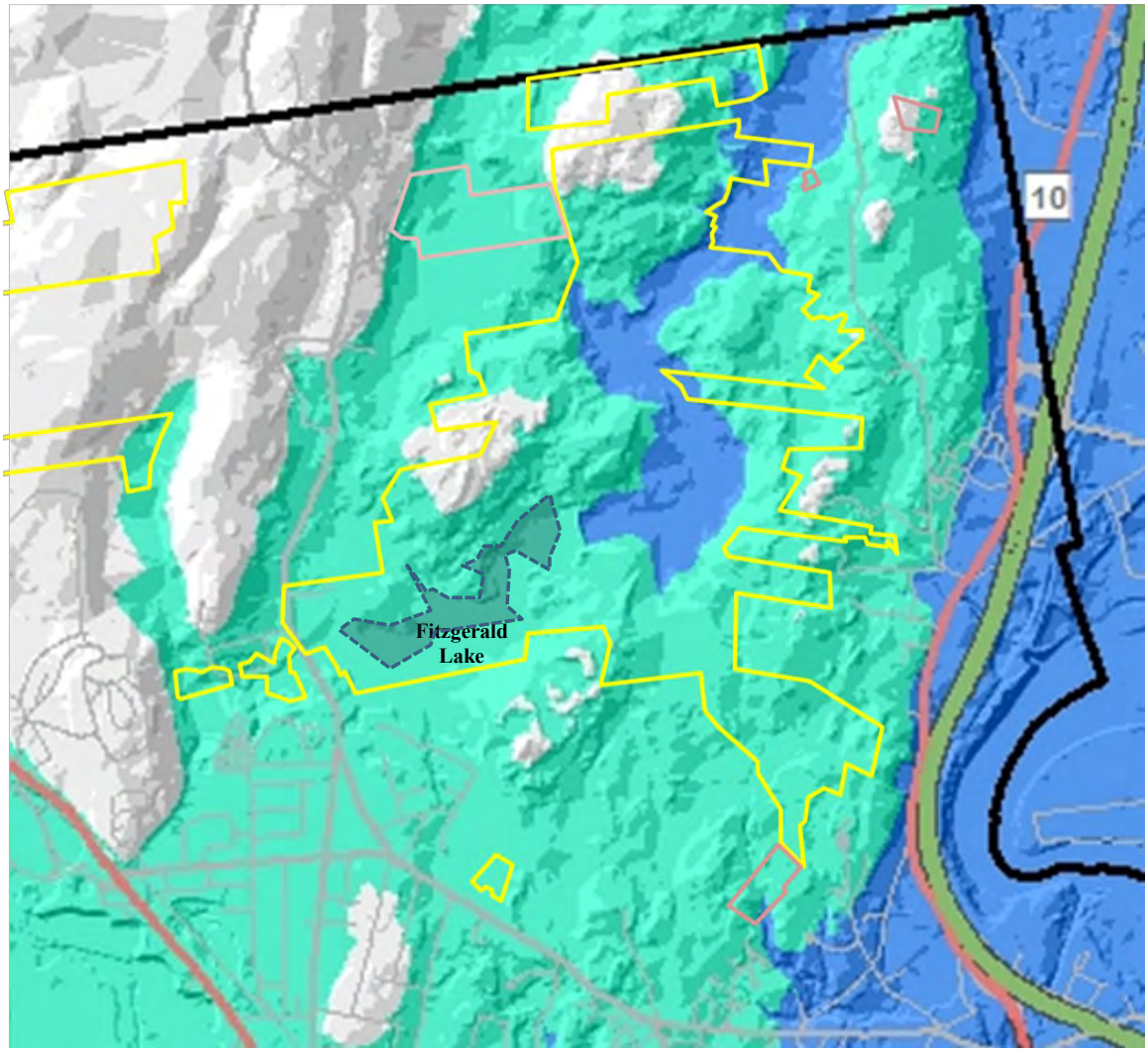
In contrast, most of the Fitzgerald Lake Conservation Area is underlain by a slightly younger (420-360 million year old) igneous rock (*green*). Known as monzodiorite, it is coarse-grained and composed of a combination of feldspars, biotite, hornblende and a small amount of quartz. It formed as a pluton, a giant mass of magma which intruded the metamorphic rock and then slowly cooled and crystallized below the earth's surface. The pluton was, in turn, intruded by even later intrusions of magma (red), which are classified as granodiorite and have a slightly different composition than the lighter-colored monzodiorite. All of these rocks were once deeply buried below the earth's surface and have been exposed after 400+ million years of erosion and weathering.

To the east are much younger (~200 mya) sedimentary rocks known as sandstones (*gray*), which formed when the giant supercontinent of Pangaea split apart and caused the incipient rift valley that created the Connecticut River Valley.



Early settlers took advantage of the bedrock resources within the city's northeast corner and frequently quarried small amounts of stone for building. The most prominent knobs earned local place names and by the time this 1831 map was made the biggest were known as Millstone Mountain, Fortification Hill, Stony Hills and Hadley Hills. Many other smaller bedrock outcrops were also quarried during the 18th and 19th century and evidence can still be found by poking around many of these sites. On this map, the Hadley Hills were so named because of the great views that they provided to the east over the Connecticut River and to the meadows in Hadley. By the 1920s, one prominent knob, known as Elizabeth Rock, had become a popular picnicking spot. It was located above the city's largest rock quarry, which is where the River Valley Market is now located. The City operated the quarry during the late 1800s and early 1900s, until selling the land in the late 1920s. By then that section of the City had become known as Rockland and the plan was that it would become a fancy development, not unlike the homes in Holyoke's highlands.

Workers at the North King Street Quarry in the 1890s.
Courtesy Images of America, Northampton, by James Parsons. P. 66.



Glacial Lake Hitchcock

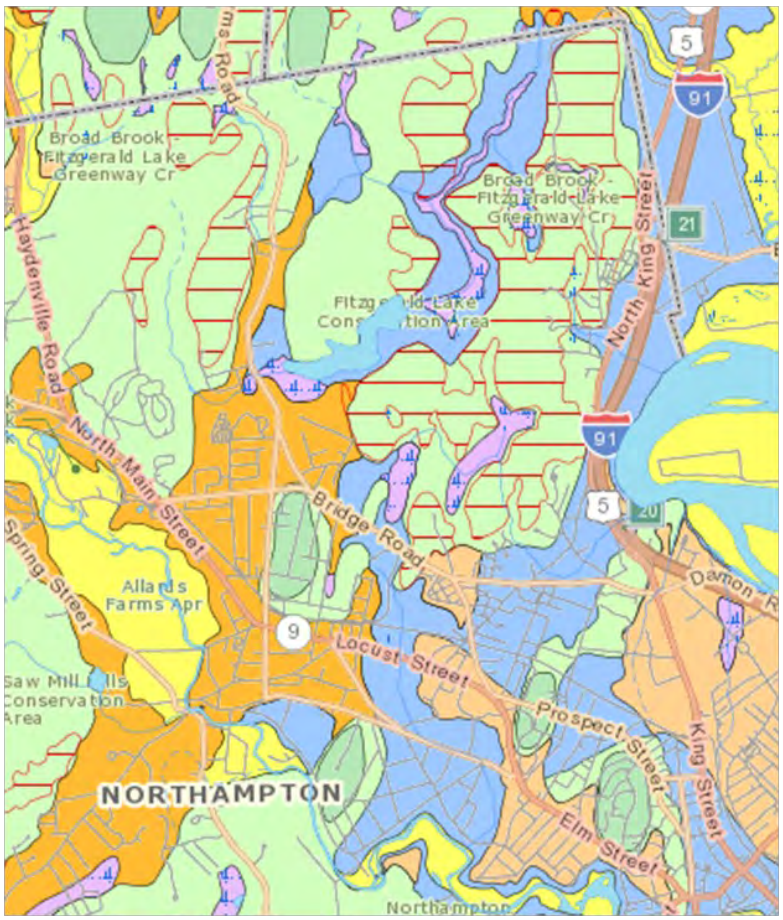
During the era of Glacial Lake Hitchcock (15,400-12,600 YBP), most of the land in the Fitzgerald Lake Conservation Area was covered by water. At its maximum height (aquamarine color), the lake's shoreline skirted the edge of what's now North Farms Road and the base of Bear Hill and Horse Mountain. At that time, the highest hills in and near the Conservation Area were small islands (grayish/white).

After a glacial-debris dam at Rocky Hill, CT let go, the lake dropped to a lower level (darker blue). At that point, the lake bottom sediments—fine silts, sands and clays—began eroding off the newly exposed land into the long, narrow inlet that now makes up the extensive cattail marshes and beaver ponds along Broad Brook.

After Glacial Lake Hitchcock completely disappeared, erosion continued and most of the thin veneer of silts and sands in the uplands eroded away, adding even more fines to what are now low-lying wetlands. This explains why FLCA's wetlands are more fertile and almost circumneutral. It also accounts for the pockets of sugar maple and patches with yellow violet, miterwort, trout lily, bloodroot and other species that only occur in fertile soils.

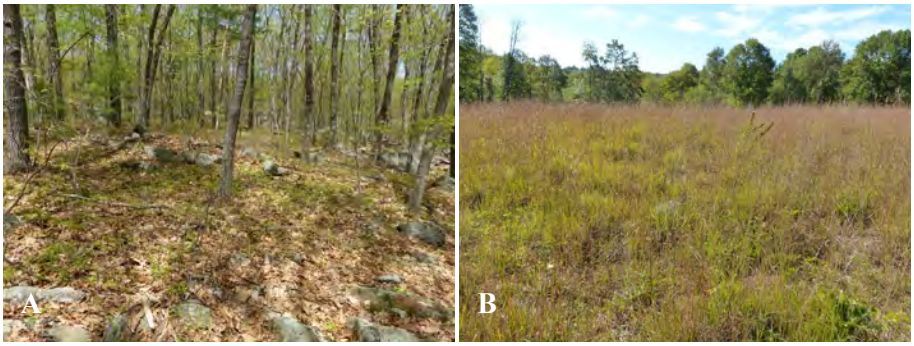
Had Glacial Lake Hitchcock with its accompanying fine sediments not covered this area, the flora within the FLCA would be much less diverse and much more similar to that found in the Sawmill Hills.

Surficial Geology



In addition to understanding something about the underlying bedrock geology and the historic location of the lake, it also helps to be familiar with the surficial geology. This image shows how the sediments left behind by the glacier and glacial lake have changed after 10,000 years,

For instance, most of this landscape is now covered with till (light green) or has bedrock close to or at the surface (red hatching). The fine silts and clays that were deposited during the time of Glacial Lake Hitchcock (light blue) have mostly eroded away, revealing till or bedrock. The remaining areas that still have some of the Glacial Lake fine sediments are now either farmland (near and including the Zimmerman conservation restriction along North Farms Road) or part of the series of beaver ponds and marshes below the Fitzgerald Lake Dam. In addition, some of these have been covered by more recent muck and organic debris (pink). The other important component are those areas represented in orange, which includes water-sorted sediments deposited in the early post-glacial period. Within the Fitzgerald Lake area, these include remnants of the lake's sandy beach and deltaic deposits from a glacially-charged Mill River. JFK Middle School and Spring Grove Cemetery are both located on the edge of the Mill River's glacial delta, and the Burke and Sullivan Conservation Areas are geographically positioned at the intersection of till deposits, glacial lake silts and the same sandy delta. As groundwater percolates down through the delta sands, it intercepts the impermeable clay layer and gushes up as springs—hence the name, "Spring Grove" cemetery One of the larger springs was covered with riprap in the 1990s, but could be restored. Meanwhile, the groundwater-fed wetland that lies within the Burke and Sullivan Conservation Areas is very unusual and includes several plants that occur nowhere else in Northampton, including larch and alder-leaved buckthorn.



(A) Most of the conservation area is covered with thin till and bedrock outcrops and supports a forest dominated by oaks and red maple. (B) Along North Farms Road a remnant beach deposit from Glacial Lake Hitchcock is now covered with little bluestem and other species tolerant of droughty, nutrient poor sands. This site, which is just outside of the conservation area, is an important nesting site for turtles.

Ecological Value

In addition to the artificial lake, the variations in geology, topography, hydrology and land use history within the Broad Brook/Fitzgerald Lake Greenway have led to a remarkable diversity of natural communities (Table 2). These areas, in turn, provide habitat for thousands of plants and animal species—some of which are exceedingly rare.

What follows are some images of a subset of these different habitat types.

Table 2: Natural Communities in and around the Broad Brook/Fitzgerald Lake Greenway*

1. Acidic Rocky Summit/Rock Outcrop
2. Acidic Rocky Cliff
3. Sandplain Grassland (Spring Grove & Horse Mountain)
4. Acidic Talus Forest/Woodland
5. White Pine-Oak Forest
6. Oak-Hemlock-White Pine
7. Successional White Pine Forest
8. Hemlock Ravine
9. Mixed Oak Forest
10. Ridgetop Chestnut Oak Forest
11. Oak Hickory
12. Northern Hardwoods-Hemlock-White Pine
13. Hemlock Hardwood Swamp
14. Red Maple Swamp
15. Black Gum –Pin Oak-Swamp White Oak Perched Swamp
16. Black Ash-Red Maple-Tamarack Calcareous Seepage
17. Deep Emergent Marsh
18. Shallow Emergent Marsh
19. Wet Meadow
20. Shrub Swamp
21. Woodland Vernal Pool

* Follows MA NHESP Classification of Natural Communities (Kearsley and Swain, 2005)

Acidic talus forest/woodland

Hemlock ravine

Oak Hemlock White Pine Forest

Successional white pine

Sandplain/Cultural Grassland (Spring Grove Cemetery)

Northern Hardwoods White Pine.

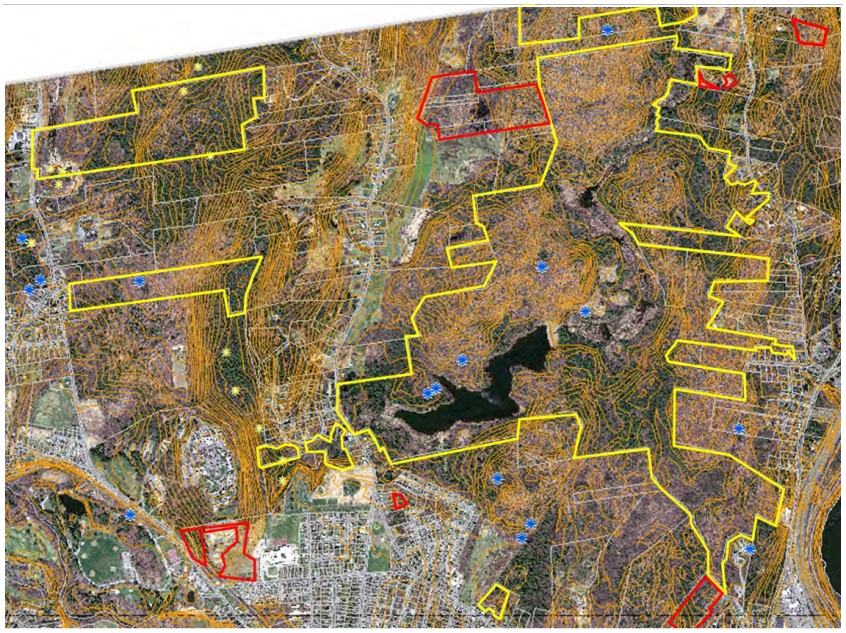
Black Gum-Pin Oak-Swamp White Oak Perched Swamp

Black Ash-Red Maple-Ironwood Circumneutral Swamp

Forested Vernal Pool

Deep Marsh

Vernal Pool Habitat

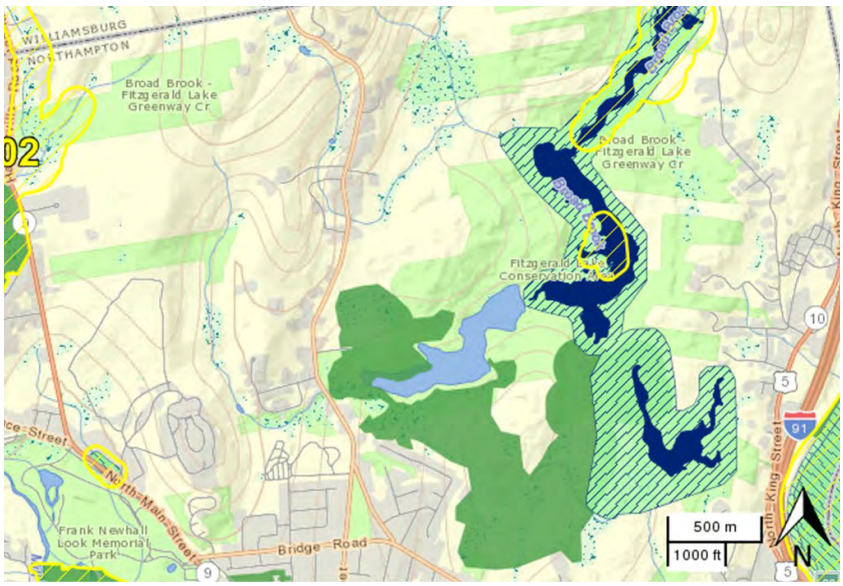


Twelve of Northampton's certified vernal pools are found within or near the Broad Brook Greenway Fitzgerald Lake Conservation Area and eleven others have been mapped by MA NHESP as potential vernal pools. In addition to these, at least two others (that do not appear on any maps and are functioning as vernal pools) occur in the area—two in the 408 Bridge Road property and another within the Pines Edge Conservation Area. All of the certified pools occur in either shallow, bedrock depressions or are located in small kettleholes.

At Fitzgerald Lake, most of the pools support wood frogs and spotted salamanders, but at least one pool just beyond the current conservation area supports marbled salamanders.

In addition, the pool (right) which lies just off the trail is the only known breeding site for the largest dragonfly in Massachusetts, the Hero Darner (*Epiaeshna heros*), a magnificent insect that measures nearly four inches in length. It is also one of two ponds used regularly for natural history programs on vernal pools.

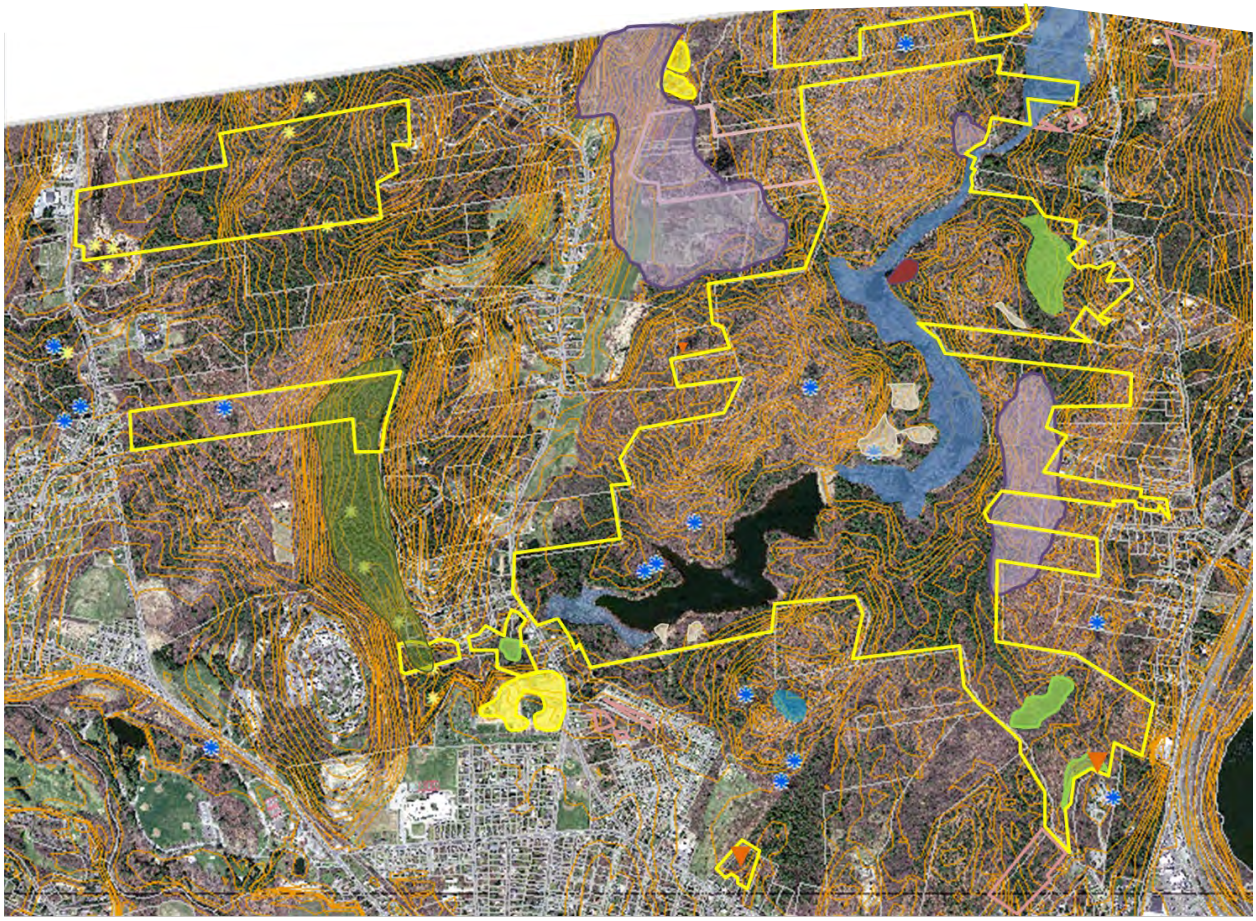
Rare Species Habitat



In addition to vernal pools, this area also contains habitat for rare species (yellow outline with hatching). At least one endangered plant species (Bush's sedge, *Carex bushii)* is found within this area, and several state-listed animals, including a federally endangered freshwater mussel. As the GIS map reveals, much of FLCA also falls within BioMap Core Habitat for Species of Special Concern (*dark green*), Core Wetlands Habitat (*dark blue*), and Critical Natural Landscape Upland Buffer of Wetland Core (*hatched green*). These ecologically valuable areas occur on both city-owned conservation land and nearby private property.

Special Habitats Within & Near the Broad Brook Greenway & FLCA

Because of differences in topography, surficial geology, hydrology and land use history, there are several locations within this large area that are interesting from a biodiversity perspective and worthy of further investigation. These include vernal pools, marshes, richer wetlands, wet meadows, cultural grasslands (old beaches & deltas), rocky talus slopes and richer pockets in the uplands. Within the conservation lands, most of the areas that are not highlighted are either rocky, oak-dominated uplands or wetter areas dominated by hemlock-hardwoods.



Sandplain/grassland on beach or delta deposits

Wet meadow (cultural—Cooke's Pasture, Kubosiak)

Cattail marsh/Beaver pond

Peat deposit dominated by highbush blueberry &false loosestrife

Rocky forested talus

Richer slopes influenced by Glacial Lake Hitchcock clay/silt deposits

Hemlock ravine with a high number of old trees

Circumneutral wetlands

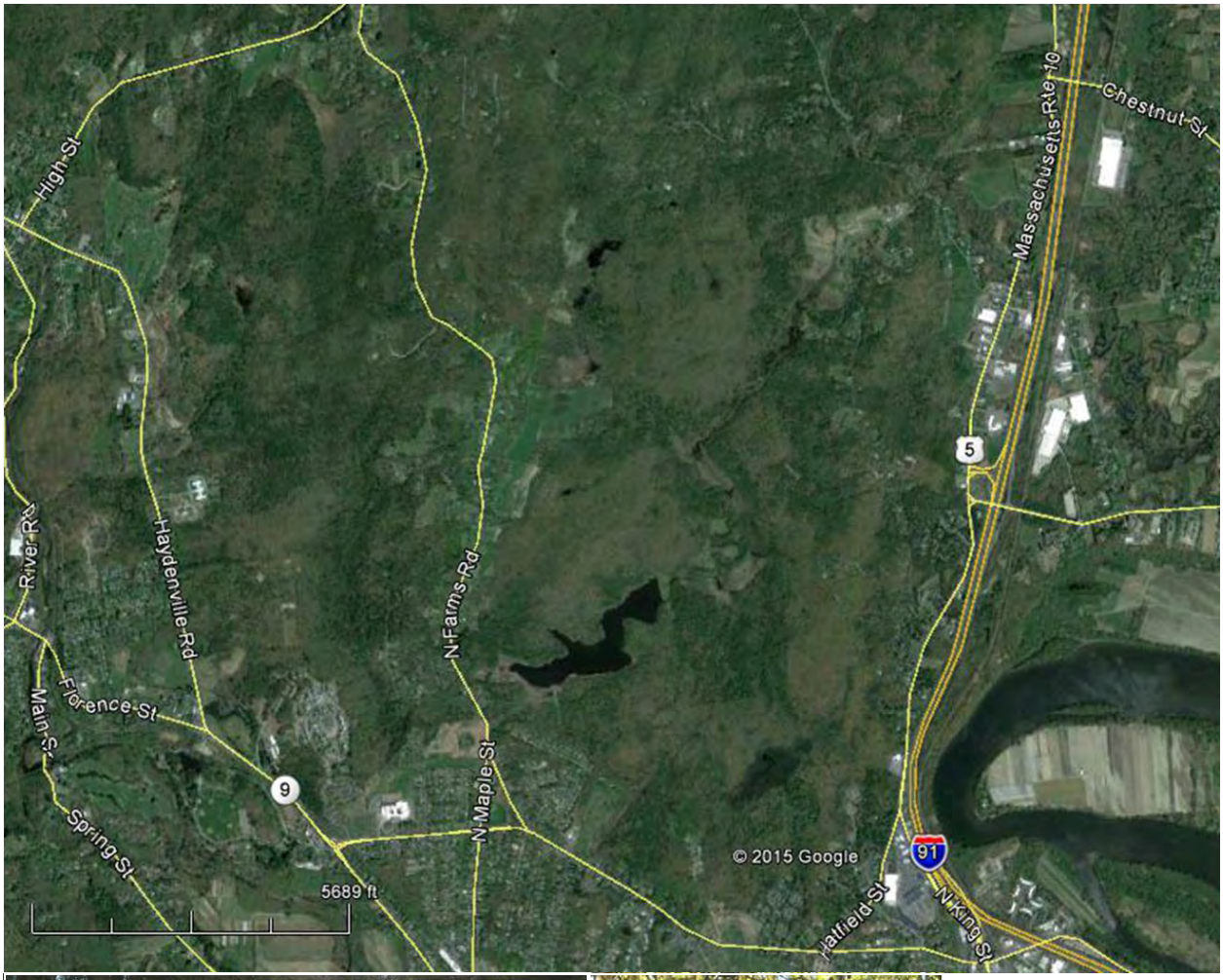
Certified Vernal Pool

Mapped Potential Vernal

Previously unmapped Potential Vernal Pool

Wildlife Value

With nearly 2 ½ square miles of undeveloped land in and around Fitzgerald Lake and another square mile in the Broad Brook/Beaver Brook drainage, the northeast corner of Northampton remains one of the least fragmented. Its proximity to the Connecticut River and continuity with additional forested land to the north makes it excellent habitat for animals that depend on large, uninterrupted tracts of forest. Furthermore, because of its mix of wetland and upland habitats, thousands of different animal species depend on this area, either transitionally or permanently.

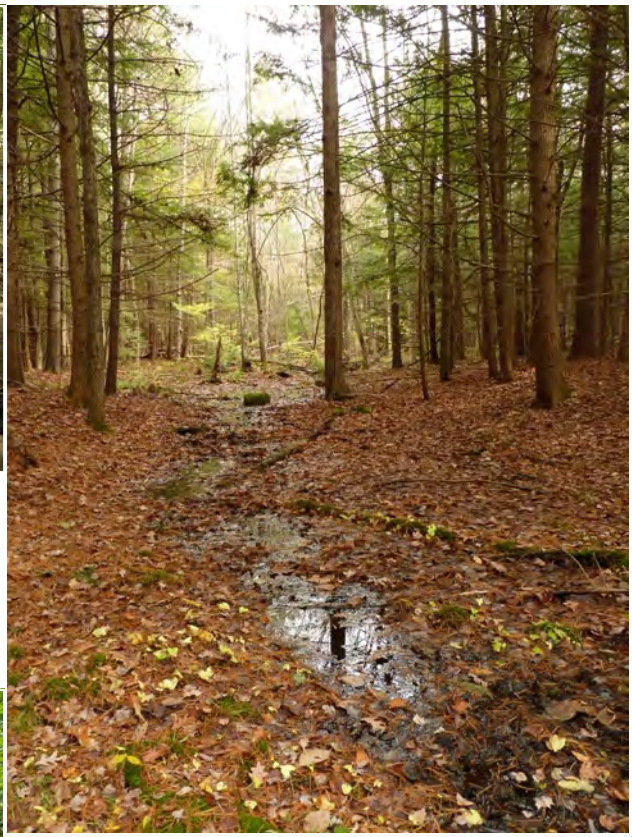


Black bears and barred owls are two species that benefit from the large block of uninterrupted habitat that this area provides.

Fitzgerald Lake, looking west from the dam, is one of the largest bodies of water in Northampton. The vast marshes below the dam and along Broad Brook look like a scene from a remote, wild place and not the scene you'd expect just 15 minutes from downtown Northampton. During the last 20 years, glossy buckthorn, Morrow's honeysuckle and other non-native shrubs have become more common in these marshes and along the edges.

King's Brook (above) is one of the main tributaries of Broad Brook and located in the more remote northern portion of the FLCA.

Wet pockets like the one below occur in many places in the FLCA. They often have occasional multiflora rose or Japanese barberry bushes.



Intermittent streams like this one near the North Farms Road entrance are important tributaries to Fitzgerald Lake and Broad Brook and provide habitat and corridors for wildlife.

Dry oak woods, underlain with till, cover most of the upland areas within the FLCA. These areas are free of invasive plants.

The telephone line, seen in this aerial image that pre-dates the creation of Fitzgerald Lake, once formed a prominent north-south clearing through the conservation area. Today, this long-abandoned route has grown in and although some of it still is used as a trail, other sections are now so forested that old line is hard to recognize, especially in the northern portion of the conservation area that was logged before its acquisition.

A section of young forest that is growing up after a logging job that occurred prior to this land's purchase.

A section of old barbed wire reveals the old pasture history of this land near North Farms Road.

This hemlock forest is located near the main entrance on North Farms Road. Unless a pathogen for hemlock woolly adelgid is discovered, all of the trees in this grove will decline and die within the next few decades. When their shady canopy is gone, this area will be more vulnerable to invasion by Asiatic bittersweet and other non-native plants. Warming temperatures through climate change are also expected to further the spread of invasive species.

Prior to the arrival of the chestnut blight, American hemlock was a much more important component of the forests within the FLCA and in the upland portions of the Broad Brook Greenway.

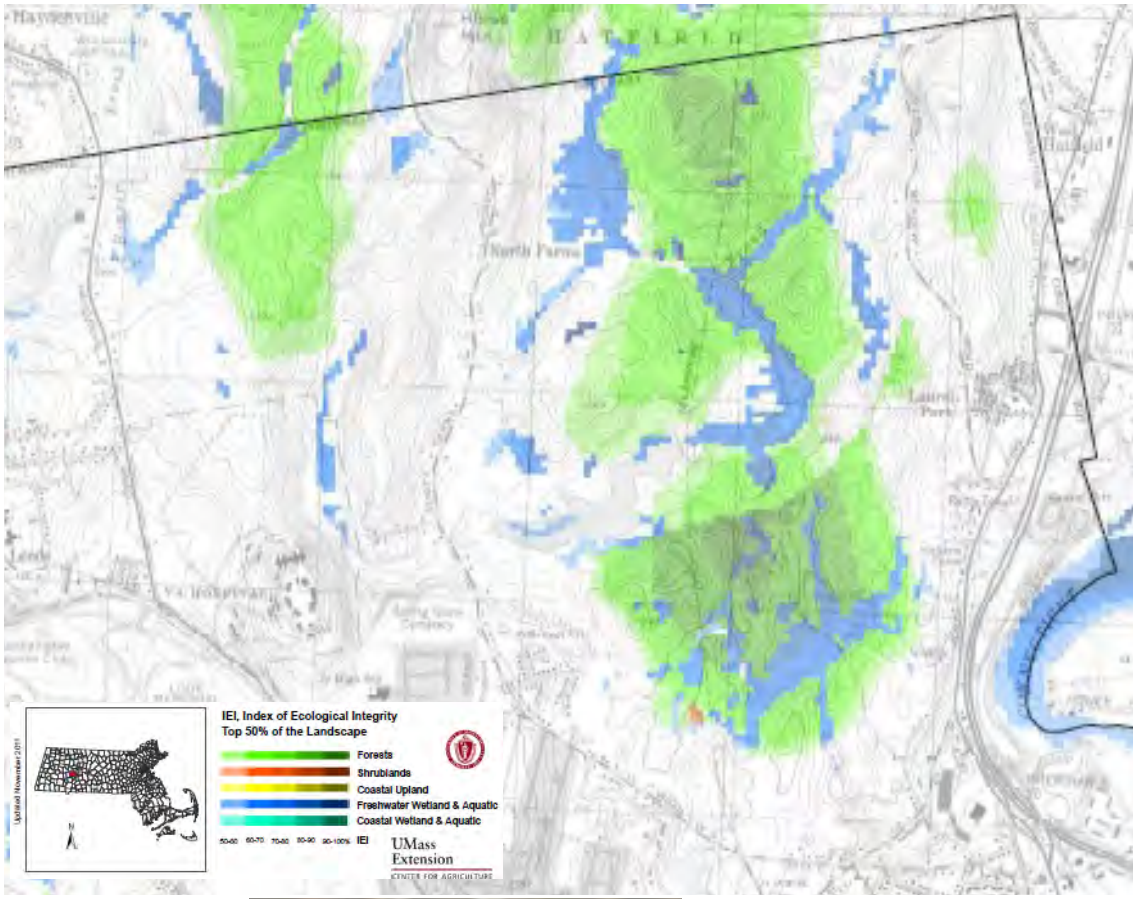
Swamp milkweed grows along the shoreline of Fitzgerald Lake and is a favorite nectaring plant of the Dion skipper, a small butterfly known from only three locations in the state, one of which is Fitzgerald Lake.

The silts and clays left by glacial lake Hitchcock have made some of the soils in the FLCA sweeter. This added fertility increases the area's overall botanical richness and creates conditions that allow for maidenhair fern (*above)* and this whopper, multi-stemmed hackberry to grow (*right*). This is the second largest hackberry in Northampton; it grows on land protected by Bob Zimmerman, who is in the image.

UMASS Conservation Assessment Prioritization System (CAPS)

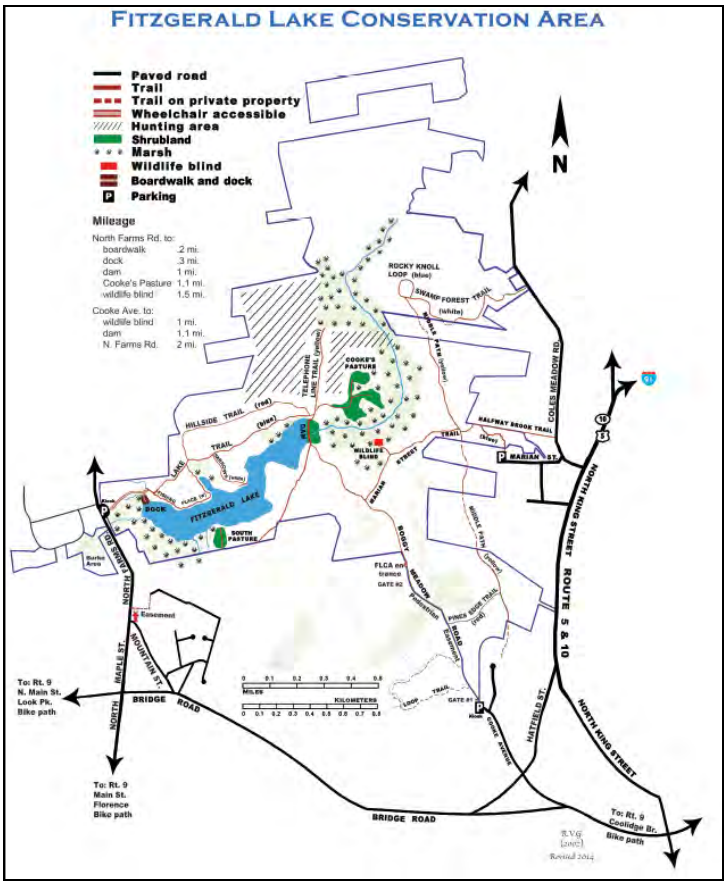
During the last decade, researchers at UMASS have developed computer software (CAPS) that analyzes the landscape and prioritizes land based on its ecological integrity and long term sustainability. Based on this analysis, the Broad Brook/Fitzgerald Lake Greenway is one of a few areas in Northampton that rank high in terms of its ability to sustain ecosystem processes and maintain biodiversity over the long-term. CAPS is another way of measuring the land's "value" and it provides a strategy for acquiring property.

In this image, the colored areas are better than average, with blue representing aquatic habitats, red for shrub and grassland, and green shading for forest. The darker the color, the higher the conservation/biodiversity value. White areas are below average based on CAPS.



CAPS is another tool to narrow and refine priorities for acquisition, in this case based on biodiversity value and long-term sustainability, which helps safeguard ecosystem processes and special and common habitats.

Recreation Value



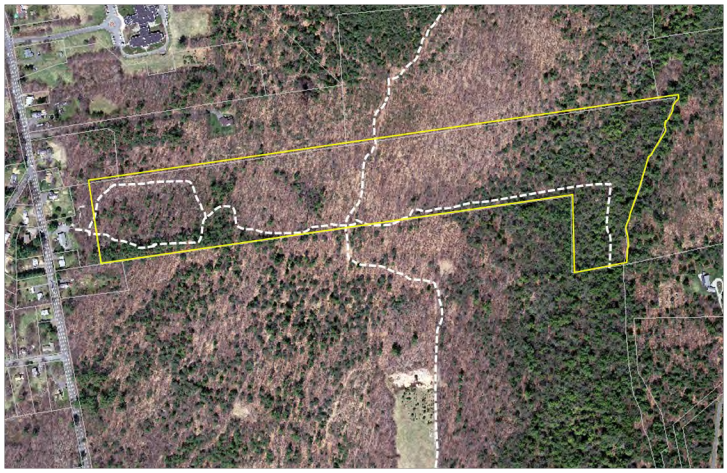
Fitzgerald Lake Conservation Area
The 800+ acres within the FLCA includes a ten-mile network of well-maintained trails and (of course!) the lake itself.

All of the trails are excellent for walking, many are good for cross- country skiing and several of the wood roads are suitable for mountain biking. The trails lead past multiple habitats (vernal pools, rich wetlands, cattail marshes, rocky woodlands, etc) and are easily accessed from Coles Meadow Road, the end of Cooke Avenue or by parking at the lot on North Farms Road.

Canoes and kayaks can be launched from the dock off the trail on North Farms Road. Aside from general nature study, the lake (technically a pond) is also a popular place to skate in winter and fishing takes place year-round.

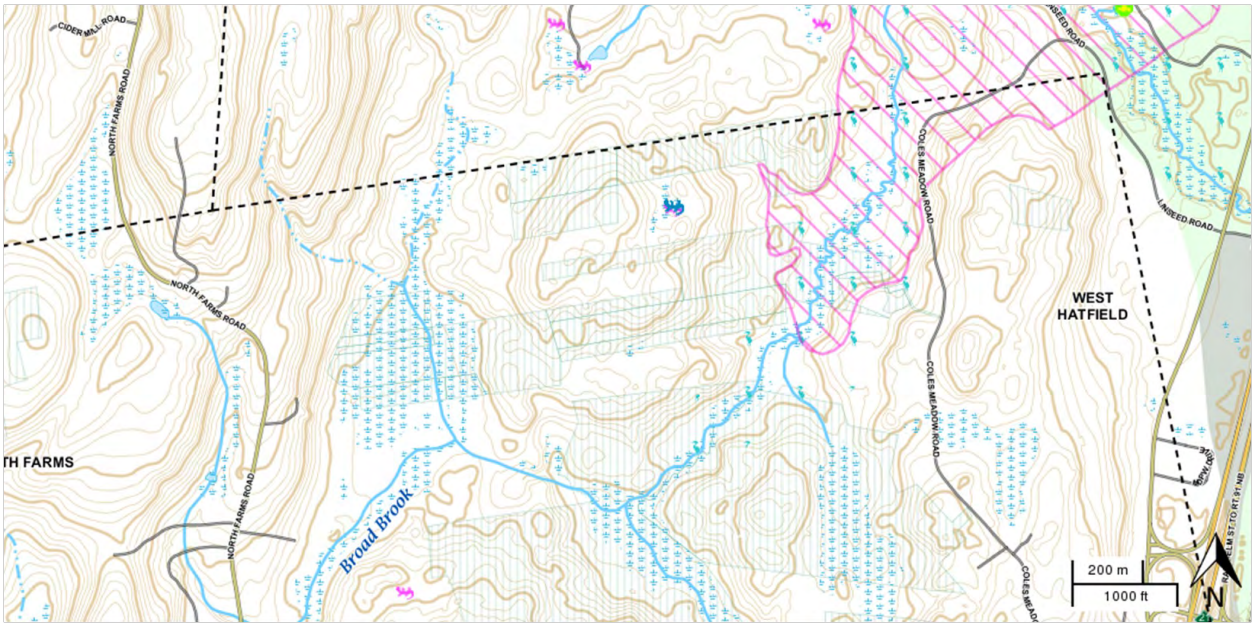
Broad Brook Greenway
Although a number of trails exist within the Broad Brook Greenway, the challenge is getting to them or knowing how to find them. At the moment, none are accessible without crossing one (or more) abutting properties and none are marked.

There is, for instance, a nice loop trail that leads past the Sullivan and Burke Conservation Areas. It begins behind JFK Middle School, crosses a wooded portion of the VA property, and loops along the margin of the Sullivan and Burke conservation areas before bending back to the school property.



The former Girl Scout property, with trails marked in white. The field in the southern section of this image is owned by Smith Vocational and borders the VA.

Further upstream, there are several trails on the former Girl Scout property. Unfortunately, since the Girl Scout's headquarters on Route 9 were sold, there is no public access. One way to reach them, however, is to follow a snowmobile trail from Williamsburg that passes through the Beaver Brook/Broad Conservation Area to the north. This main trail eventually crosses land owned by Smith Vocational (see photo) and ends behind some of the VA buildings. The longest trail on the former Girl Scout property leads to a ravine along Broad Brook, which boasts an impressive stand of hemlock and many other old trees.

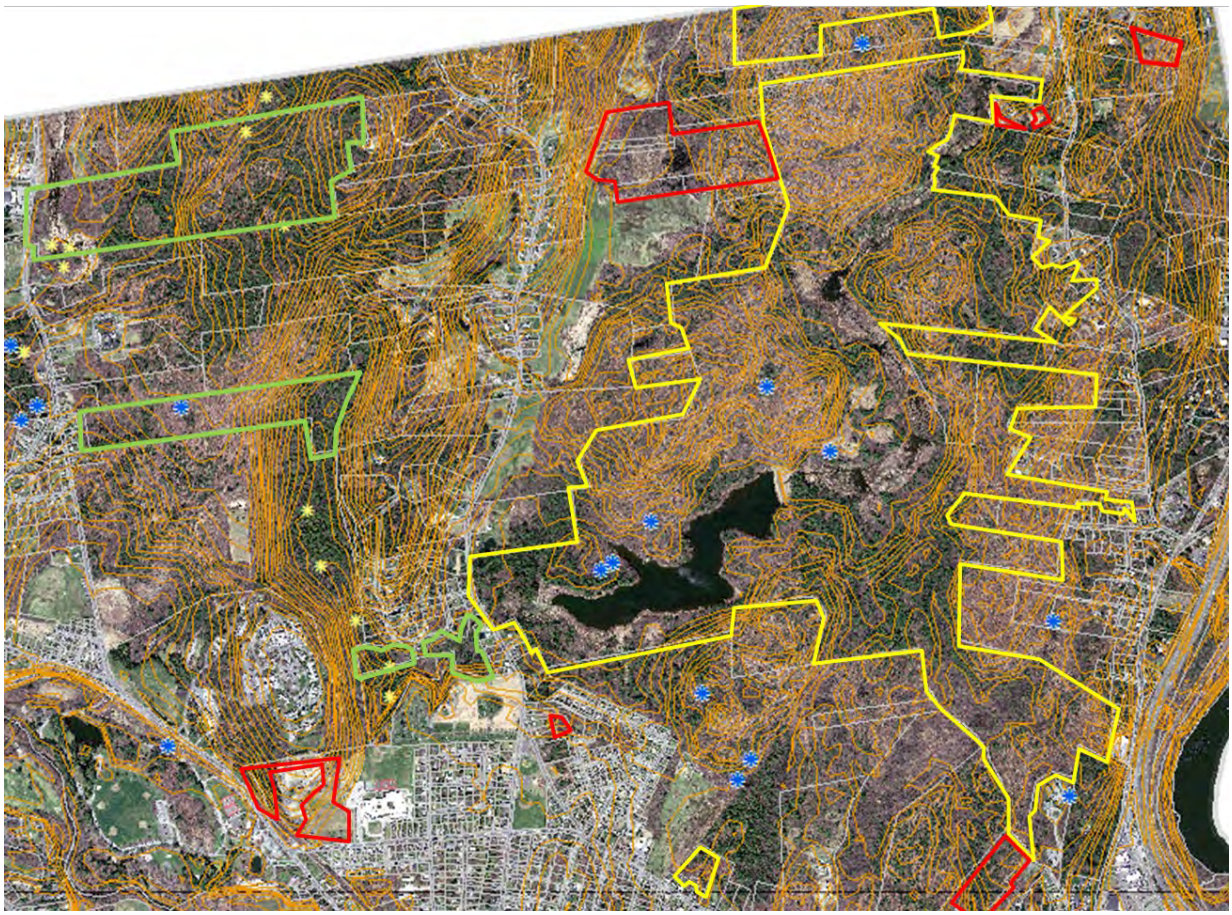


Water Quality & Groundwater Recharge

The final reach of Broad Brook is part of a DEP-delineated Zone II (pink hatching),. A Zone II protects and helps to recharge a public drinking water supply. In this case, it is part of the aquifer for Hatfield's nearby public wells.

Aside from their habitat value, vernal pools like this one within the FLCA also help contribute to groundwater recharge.

Appendix



This appendix includes updates of selected parcels, some of which were described in the 1993 version of *Rediscovering Northampton*, others that have subsequently been inventoried and a few entirely new conservation holdings that were investigated in more detail during 2014.

Properties within the FLCA (outlined in yellow) are described in Section 1, while parcels in the upper Broad Brook drainage (outlined in green) are described in Section 2.

Parcels outlined in red are under private conservation restriction and are not described, but are shown here for context.

Section 1: Fitzgerald Lake Conservation Area

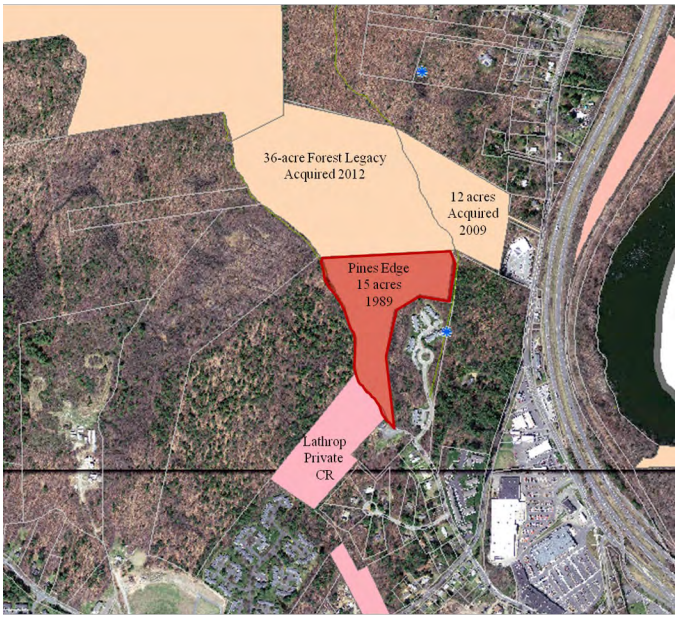
Featuring more detailed profiles of:

Pines Edge
Elizabeth Rock
Forest Legacy Lands
Marian Street
Kubosiak
408 Bridge Road

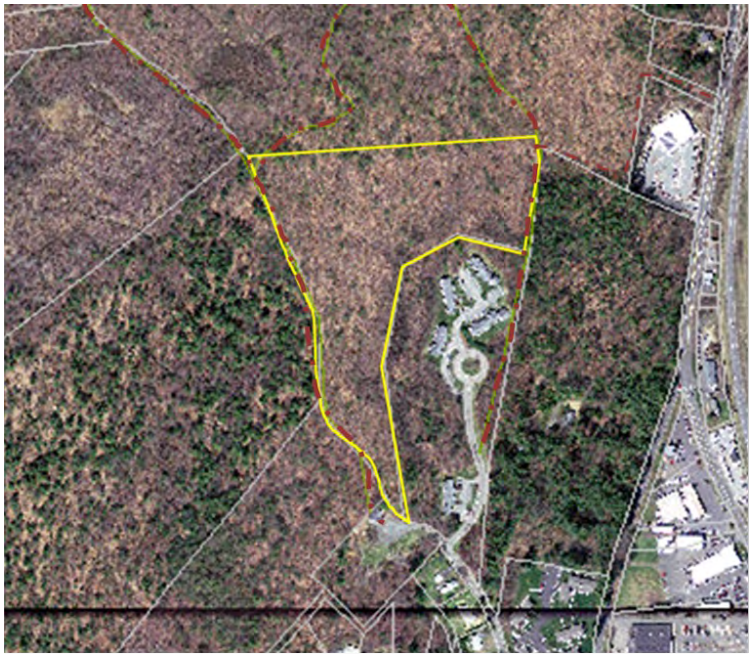
Large bedrock outcrops are common within this conservation area, especially within the FLCA portion. This one is near the intersection of King's Brook and Broad Brook. The dog is included for scale.

Pines Edge (15 Acres)

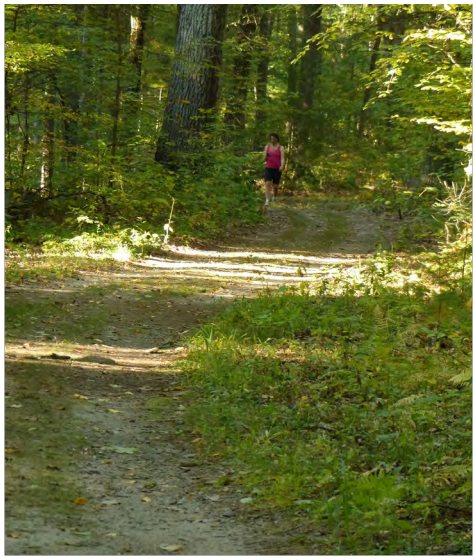
Donated as part of a cluster subdivision in 1989, the 15-acres that wrap around Pines Edge Condominium Complex have changed very little since they were first surveyed in 1993. In the intervening years, only three invasive plant species --privet, Asiatic bittersweet, Morrow's honeysuckle—have become established and they were in such low numbers that I removed all of them by hand-pulling. That said, it will be important to monitor this area, not only for more of those three species, but also because there is more bittersweet growing along the forest edge near the Moose Lodge and there are patches of garlic mustard along the edge of the condominium clearing.



The most significant "change" at Pines Edge is that this once isolated conservation area is now contiguous with nearly 800 acres of protected land. In 2009, the 12-acres of upland woods to the north and east around the former city quarry/now River Valley Market site were protected and in 2012, 36 acres to the north were purchased using Forest Legacy funds.



To explore the Pines Edge Conservation Area, you can park near the Moose Lodge at the end of Cooke Avenue and go in via Boggy Meadow Road. You can also follow a trail that begins near the northern most condominium units. This connects to a trail that leads to the edge of the former City Quarry above what is now the River Valley Market.



Although hundreds of people now regularly pass the Pines Edge Conservation Area, either walking along Boggy Meadow Road (*above*) or on Middle Trail, few of them ever venture into this conservation area. That's not really so surprising as there are no footpaths leading through it, and most of the upland forest is similar to the oak-pine mix found throughout most of the FLCA.

(A) About 2/3 of the property is uplands, with well-drained soils and bedrock outcrops. These areas are covered with a mix of oaks (red, scarlet, white oak), as well as shagbark hickory, ironwood, red maple and scattered pine. Below the canopy, the shrub and herb layers vary—sometimes sparse, sometimes patchy. Among the more common shrubs are mountain laurel, shadbush, maple-leaved viburnum, American hazelnut, huckleberry, and low-bush blueberries. The wildflowers include wood anemone, Canada mayflower, spotted wintergreen and asters. (B) A strand of barbed wire along the eastern boundary reveals that the property to the east was once used as pasture, maybe when this land was part of the Cooke Farm.

(C) Although its oak-pine uplands are similar to much of Fitzgerald Lake, its wetland is an unusual natural community within Northampton and classified as a black gum-pin oak-swamp white oak "perched" swamp. What's more, in the spring, the wetland's deeper pools function as vernal pools and are used for breeding by both wood frogs and spotted salamanders. (B) The wetland has much higher diversity than the surrounding uplands. Sensitive fern (seen here) is widespread, but several other ferns are common (cinnamon, interrupted fern, spinulose woodfern, and Christmas fern).

The wetland also supports a variety of wildflowers, including blue flag iris, jack-in-the-pulpit, wild geranium, fringed loosestrife, partridgeberry, starflower, and Canada mayflower (seen here on this moss-festooned log). High bush blueberry (flowering here) grows on the hummocks along with meadowsweet, lowbush blueberry, three kinds of viburnum, pinxter flower, silky dogwood, ironwood, winterberry and spicebush. In the canopy, aside from red maple and swamp white oak, are occasional pin oak, hemlock, green ash, hop hornbeam, pine oak and black gum. The diversity of this wetland is higher because this area has soils derived from Glacial Lake Hitchcock sediments, making the soil's chemistry is closer to neutral.

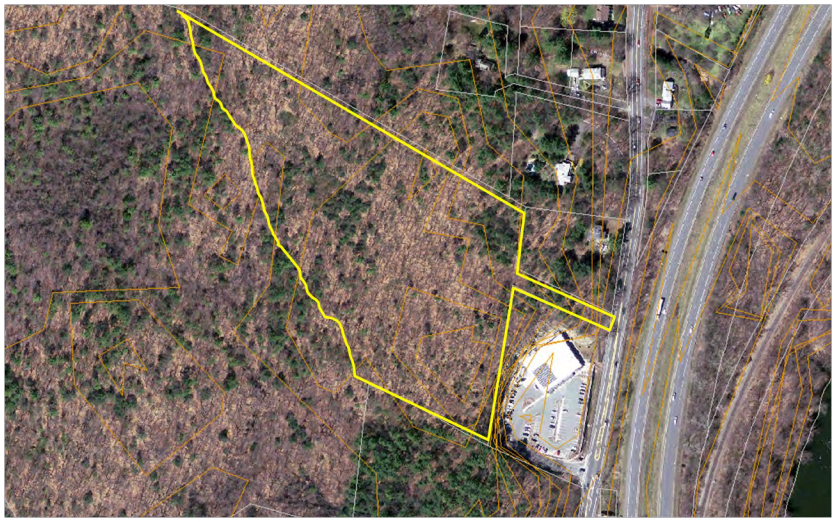
Elizabeth Rock (formerly Merrimack Mortgage)

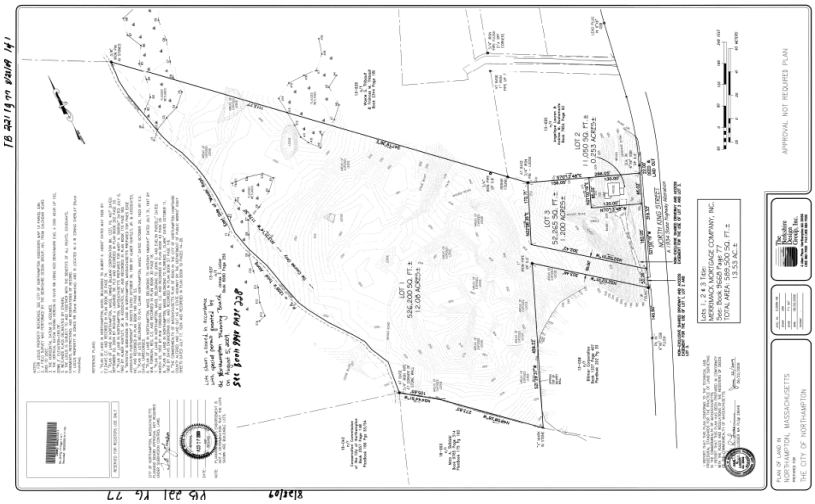
This 12-acre property wraps around the long-abandoned city quarry, now known to most people as the site of the River Valley Market. It is almost entirely upland, and without question, its best feature is the impressive view from the rim above the old quarry where you can look out toward the Connecticut River and Hadley Meadows.

The parcel in context to other protected land, Route 5/10 , Interstate 91 and the Connecticut River.

The traffic noise from the interstate is constant along the quarry edge, but fades as you head into the interior of the property. This area, which is mostly level with only modest ups and downs, is dominated by oaks (red, white, black, scarlet, chestnut), with red maple and scattered patches of white pine. Parts of this area were logged in the mid-

2000s, mostly likely in anticipation of an 88-unit condominium project, which was first presented in July 2006. The cluster development was going to be built on about ten acres and as part of the cluster equation, another 29 acres were going to be donated to the City as open space. Given the size of the project, the tough site conditions and neighborhood opposition, the project went through numerous iterations before it was finally approved—with 47 conditions(!)—in November 2007. By then, however, the economy had collapsed and that was the real deal breaker. The developer, who had purchased 13 acres for $525,000 the year before and had options on another 30+, was unable to find financial backers and became overextended. In 2008, he put the entire project up for sale for $2.4 million. With no takers and unable to make his mortgage payments, he lost the property to foreclosure. The mortgage company assumed ownership in 2008 and sold 12 of the 13 acres to the City's Conservation Com-





mission for $75,000 the following year. (The remaining acreage includes a home along Route 5).

Middle Trail, seen here, forms one boundary of the conservation area.

Since that time, it appears that few people have explored the interior portion of the property. Two trails skirt the property's boundaries, one begins at the edge of the Pines Edge Condominiums and the other, Middle Trail, forms the property's western boundary and connects to Boggy Meadow Road. Within the property, the old logging roads are easy to find and the borders have been blazed.

The forest is mostly open, with a patches of mountain laurel, low bush blueberry and scattered maple-

(A) Typical rocky uplands; (B) Mountain laurel mix with oak, pine and hemlock. (C) Woolly adelgids on hemlock. (D) Juvenal's duskywing, a common early season butterfly in forested woodlands.

leaved viburnum. The herb layer is also mostly absent in these dry, rocky woods, with wintergreen, bracken, Canada mayflower, partridgeberry and Pennsylvania sedge.

In spite of its small size, this small wetland supports about as many plant species as the 11+ acres of wetlands. Of particular interest in the wetland is the presence of red trillium, white baneberry, ironwood, jack-in-the-pulpit and wood anemone—all species that require sweeter soils to survive. This wetland drains directly to the Connecticut River.

Near the property's northern boundary, nested between two bedrock exposures, are the headwaters of a wetland that drains north. Nearly all the vegetation is native, but this wetland does include a few barberry and multiflora rose.

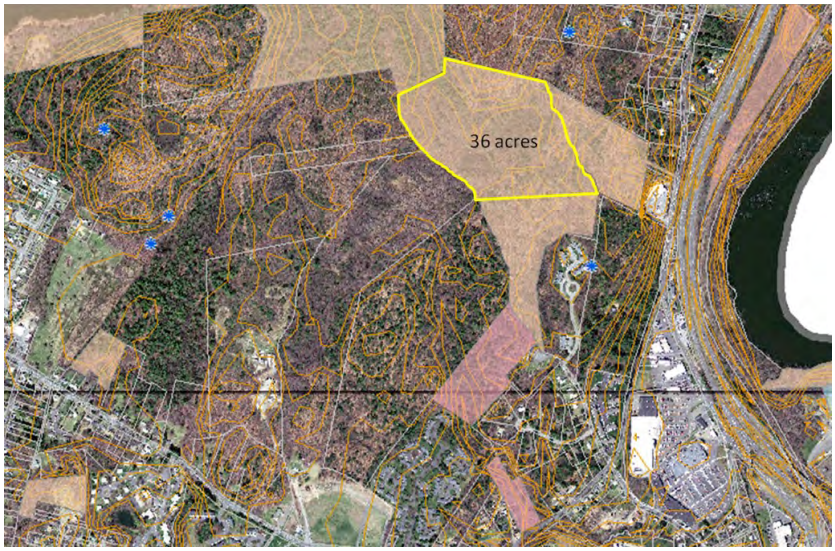
In general, however, this property has very few invasive non-native plants. The only other location with just a few is on the rocky slope that forms the access path on North King Street. The two species present—common buckthorn and garlic mustard—are low in number and could easily be controlled.

One of the other small wetlands on the property, seen from a distance and then up-close. This area, in spite of its capacity to hold water, does not appear to be functioning as a vernal pool. Middle Path can be seen in the first image, skirting the edge of the property.

Forest Legacy Lands (36 acres)

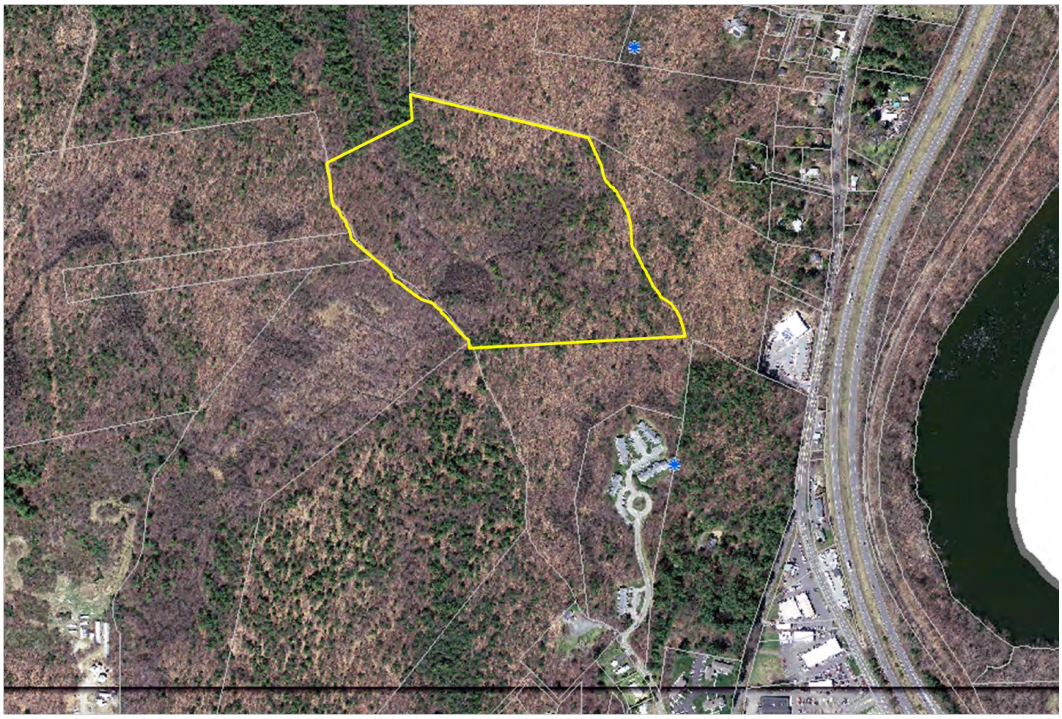
Bordered by Middle Path on the east and Boggy Meadow Road on the west, this 36 acre parcel was protected in 2012 using USFS Forest Legacy funds. Much of it is wetland, especially now that beavers have

invaded the former red maple swamp on the west side of Boggy Meadow Road, causing even a slightly higher water table in this 36-acre tract.



As elsewhere in the Fitzgerald Lake Area, this wetland includes a few scattered barberry and multiflora rose bushes, which could be removed in a single day.

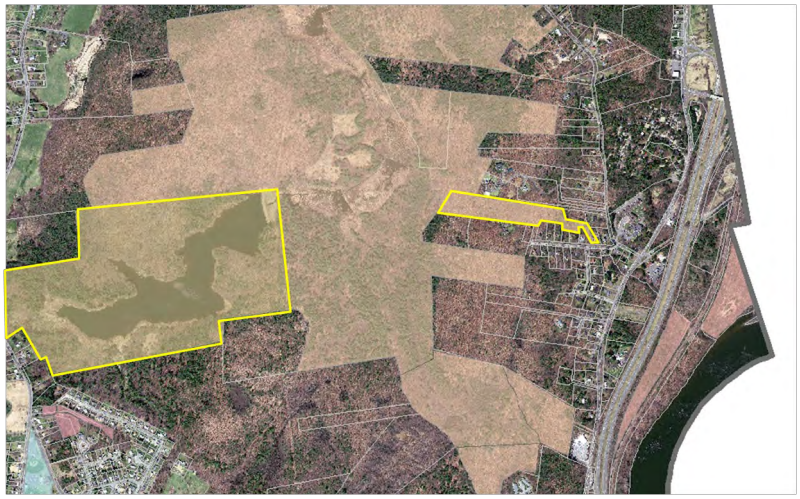
(A-C) Views of the wetlands within the Forest Legacy Tract, including dense winterberry thickets and more open water.
(D) The beaver impounded area, covered with a lens of pollen in the early spring. This wetland to the west of Boggy Meadow Road is still privately owned. During the last several decades, it developed into a red maple swamp, but all of the flooded red maple are dying now. There are some seriously large multiflora rose bushes growing in its western end.



This wetland eventually drains to the Connecticut River, first through Boggy Meadow, then into Pine Brook that runs behind the Lathrop Community. The blush of green in this image is a mix of hemlock and white pine.

The line of Boggy Meadow Road can be seen running north-south in this early aerial image. The wetland to the west is the "boggy meadow" that gives the road its name. How long it was ditched is unknown, but in 1902 forty-two acres were purchased by W.A. Bailey of Brown & Bailey Bricks. His workers did some ditching here and harvested the organic material to burn in the brick kilns, which were located near the present day high school and also nearby along the Connecticut River.

Marian Street & Vicinity (12 acres +)



In 1984 the 12-acre Marian Street parcel (outlined in yellow) was isolated from the 152-acre Fitzgerald Lake property (also outlined in yellow). All of the land shaded in light orange is now protected, but was then still in private ownership and open to the possibility of development.

In 1984, when people in the Marian Street neighborhood banded together and purchased this 12-acre property, their hope was that one day it would connect with the Fitzgerald Lake Conservation Area, which at the time was 152 acres. Frankly, that hope seemed farfetched then or even in 1993 when I first surveyed this property. But in 1994 the 147-acre Cooke's Pasture property was purchased by the City and that long-held vision of connectivity became a reality. Today, this once isolated outpost is connected to even more conservation land, and is now just one of many parcels that form the outer edge of the 800+-acre Fitzgerald Lake Conservation Area.

On the ecological front, there have also been changes during the last twenty years, most of them positive. Most important is the improvement in the overall health of the forest. During the 1993 survey, a major gypsy moth infestation was underway. Chewed bits of oak leaves littered the ground and the sound of dropping caterpillar frass was ever-present. By then, gypsy moth outbreaks had plagued Northampton's woodlands for nearly a century. But sometime in the 1990s, a non-native pathogen that targets only gypsy moth caterpillars arrived in the area and virtually eliminated the gypsy moth problem. Ever since, gypsy moth populations have been reduced to very low levels,.

The Japanese knotweed patch in early spring has been dramatically reduced. A few lone sprouts still persist and require additional control.

Another positive is that the patch of Japa-

nese knotweed, which was present in 1993, has been severely reduced thanks to a multi-year herbicide effort and BBC volunteers restoring native vegetation in the affected area. Elsewhere on the property, non-native invasive plants remain few and far between. Some garlic mustard and gill-over-the-ground have become established on the trail at the end of Marian Street, a patch of pachysandra has spread along the brook and a few barberry have established in the wetland near the property's western border. All of these could be removed by a small work party in less than a day.

Pachysandra mingles with skunk cabbage along the wetland bordering the brook within the conservation area.

(A) The narrow footpath begins at the end of Marian Street and connects to the network of trails within the FLCA system. (B) At the beginning of the trail is a patch of violets, a species that prefers richer soils and may either be an indicator of sweeter soils from the clays of Glacial Lake Hitchcock or some fertilizer dumped by neighbors long ago. This is also where garlic mustard has become established. (C) The distinctive leaves of the orchid known as rattlesnake plantain, one of Northampton's more common orchids. It prefers the mildly acidic soils that dominate so much of this conservation area.

Although the 12-acre Marian Street property is dominated by dry, rocky uplands, near its eastern edge is a small wetland and Halfway Brook. The brook originates a few hundred meters to the north in a large, hummocky red maple swamp just west of Laurel Park. After flowing through this conservation area, its bends sharply to the east, and then flows under Route 5/10 and Interstate 91. On the other side of 91, the brook has cut a steep ravine, exposing overtopping deltaic sands from layers of varved clays laid down during Glacial Lake Hitchcock. It enters the Connecticut River near the Hatfield line.

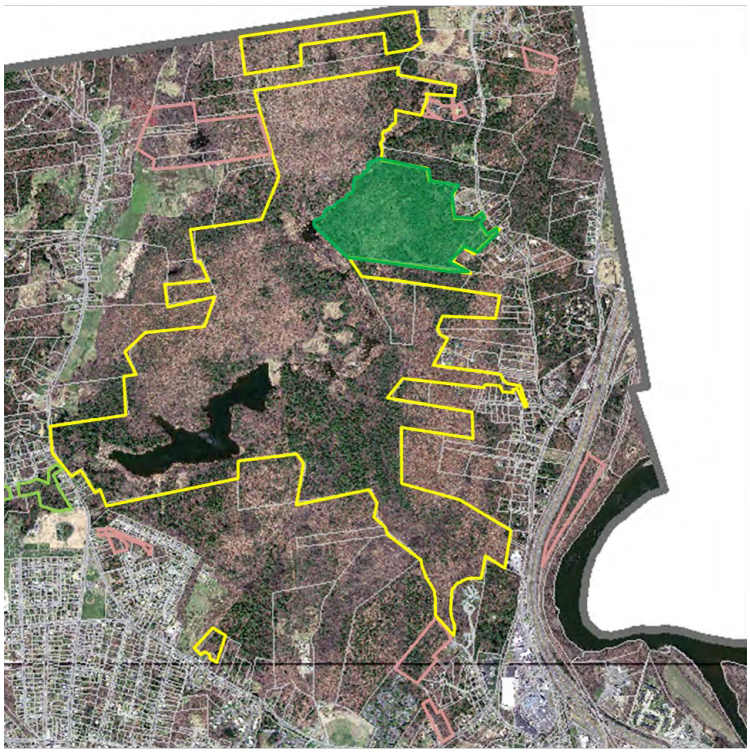
A pipe from a nearby property owner's sump pump extends to the brook.

Silt and clay layers left behind during the era of Glacial Lake Hitchcock can be seen in Halfway Brook, which flows through the property.

Kubosiak (88 acres)

Protected in 2012, the Kubosiak parcel was the largest acquisition in the FLCA since the 1994 purchase of Cooke's Pasture (147 acres). The property had long been viewed as a priority acquisition, not only because of its size and strategic location , but also because of its recreational value and ecological attributes.

When this parcel was acquired, it already included an existing network of trails within the property, which connected to the larger FLCA trail system. In 2013 the trails were augmented when BBC's trail committee built a new trail from Coles Meadow Road. The new trail links to the existing trails and also creates another entry point to the FLCA property. What is also nice about the existing trails is that they pass through or by many of the property's interesting habitats. All told, seven broad habitat types occur here, including one of the most unusual swamp forests in Northampton and a long section of Broad Brook. The property includes some of the best black bear habitat in the Commonwealth, important marsh habitat and it lies immedi-



The Kubosiak parcel in green.

Habitat Summaries

1. Rocky, upland, oak-dominated forests, with broad patches of dense hemlock stands (67 acres)
2. An extensive swamp forest (~14 acres)
3. Marsh along Broad Brook (~3 acres)
4. Broad Brook (~1 acre)
5. Rocky outcrops and boulder fields (~ 1 acre)
6. Perennial streams exiting the swamp forest (< 1 acre)
7. A small field maintained for wildlife (1 acre)

ately upstream from the known habitat of three state-listed freshwater mussels, including the Federally Endangered Dwarf Wedgemussel.

Another positive about this property is that, as of now, it has relatively few long-term management issues. ATV use is minimal and invasive plants are in low numbers. There are also only a few species, including scattered Japanese barberry and multiflora rose in the unusual swamp forest, Asiatic bittersweet along some of the trails, and glossy buckthorn and multiflora rose along the edge of the marsh bordering Broad Brook. One of the biggest concerns in terms of non-native plants is actually just off the conservation area. Growing on an old stump dump on the property that the Kubosiak's still own is a large and expanding patch of Japanese knotweed. If possible, it would be great to work with the current landowner to control it. This would require repeated treatments. In contrast, the other non-native plants on the conservation land could probably be controlled in a single day with a small crew of people cutting and spot-treating the stems.

An old yard waste dump lies just off the conservation area. At the edge, the scruffy margin are dead stems of Japanese knotweed. Several other non-native plants are in this area too, including Morrow's honeysuckle and autumn olive.

Rocky Uplands

The vast majority of the property is dominated by dry, rocky woodlands dominated by different types of oak. The metamorphic rocks lie just below or at the surface, and the terrain is hilly, with occasional knobs and large rocky outcrops. In the upland areas, the soils are fairly shallow, well-drained and acidic—a fairly tough combination, which makes this habitat

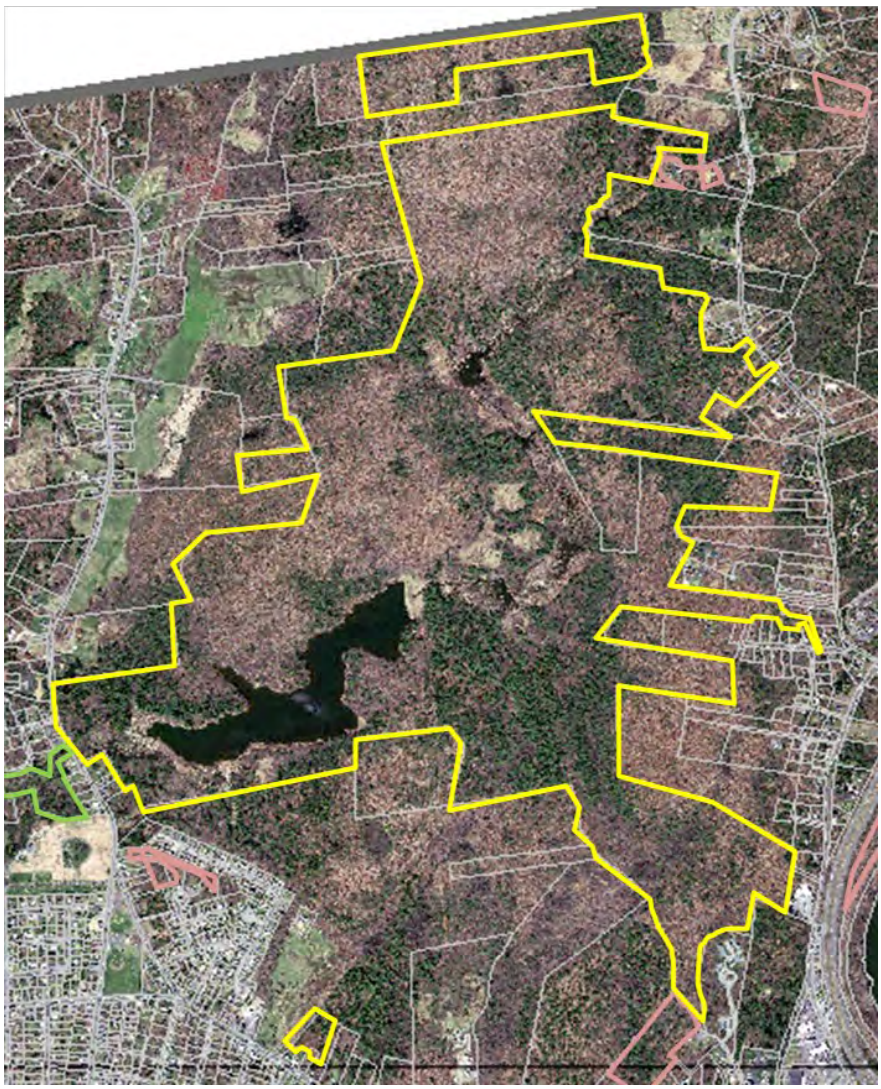
Typical forest within the former Kubosiak property.

Rocky outcrops are common and provide good denning sites for porcupines.

suitable for a relatively small suite of plant species. In the canopy, the most common trees are red oak and chestnut oak. Red maple is also abundant and throughout the forest, you can find scattered white oak, white pine, black birch, and less commonly, beech. In areas where the soils are slightly moister, the oak forests give way to extensive stands of hemlock. These are easily visible on the aerial photo; hemlock forests cover nearly 30 acres of the uplands. The shrubby understory is similarly depauperate, and includes mountain laurel, witch hazel, maple-leaved viburnum, low-bush blueberry, and occasional sassafras and ironwood. The understory vegetation is also limited in its diversity and virtually absent below the hemlocks and oaks. In the small, scattered openings, mountain laurel and witch hazel are common plants in the shrub layer, while the herb layer is mostly absent. When present, it includes wild sarsa-

In addition to a few impressive rock outcrops, this property also includes an large boulder field, bigger than any other known in Northampton, MA. The canopy includes a variety of deciduous trees (red maple, black birch, striped maple, mountain laurel, and witch hazel). There are few shrubs and the herbs are sparse. Canada mayflower, starflower, red trillium and shining club-moss, however, are commonly seen. In addition, the rocks are frequently covered with mosses and polypody fern. All of the larger outcrops and the boulder field had porcupine dens.

Pink lady's slippers can occasionally be found in the dry, acidic uplands. They bloom in mid-May.



This aerial of the entire FLCA shows that stands of hemlock and white pine are along the borders of the lake and along the edge of the marsh. While pine has invaded the old pasture land, hemlock is mostly along the margins of the wetland areas. What will replace hemlock as the trees die from hemlock woolly adelgid is uncertain.

The images below show a wood road surrounded by hemlock near the clearing on the former Kubosiak property and a thick stand of hemlock along the edge of the marsh and Broad Brook. Note the absence of vegetation growing below.

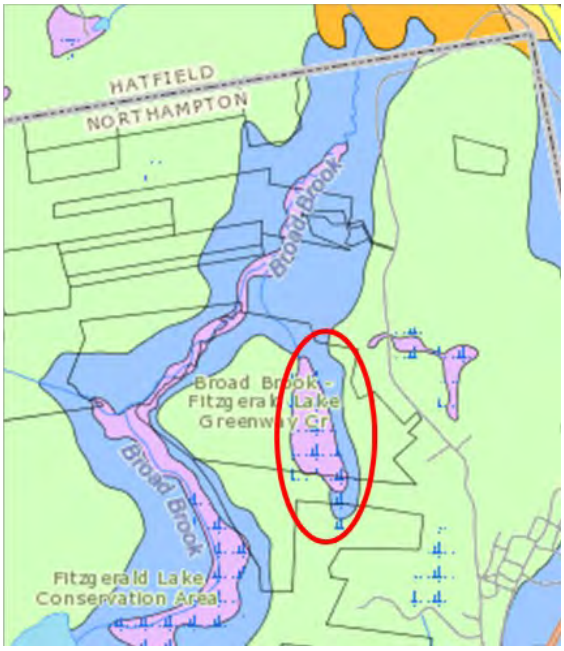
parilla, hay-scented fern, bracken, Christmas fern and occasionally trailing arbutus and pink lady's slippers. All of this forest has been logged repeatedly.

Circumneutral Swamp Forest

In the central part of the property is a 15-acre swamp forest. Underlain by glacial silts and clays, this swamp forest supports an unusual flora. Underfoot, the ground is dominated by broad swaths of grass-like sedges (*Carex bromoides*) and skunk cabbage. In addition to more common species like sensitive fern, touch-me-not, marsh marigold, and goldthread, you can also find trout lily, foam flower, common toothwort, miterwort, water avens, dwarf ginseng and even wild leeks. The few shrub species that do occur are common (ironwood, spicebush, mountain laurel on hummocks) and the canopy consists of scattered yellow birch, red maple, black ash and on slightly drier margins, hemlock.

A small, quiet water stream flows through the wetland and ultimately enters Broad Brook.

A patch of miterwort (*Mitella diphylla*), a species found in rich mesic woods and known from only a few other locations in Northampton, grows in the rich swamp within the Kubosiak property.



The swamp's botanical richness is due to the underlying surficial geology, which includes fine silts and clays left behind by Glacial Lake Hitchcock (light blue). More recent organic materials (lavender) have been deposited on top of the silts and clays.

Foamflower (*Tiarella cordifolia*), another species that only occurs in rich soils, flowering in May in this unusual swamp. A nest of American woodcock, a species in decline, with two of four chicks.

The swamp forest is important habitat for forest-dwelling animals, like this barred owl. It is also a favorite haunt of black bears, especially in the early spring when the swamp's tender shoots of skunk cabbage provide an abundant food source. In some areas, almost every skunk cabbage plant shows signs of being nibbled and bear poop is common.

Unlike most swamp forests, the lack of a prominent shrub layer allows long-distance views and creates an almost park-like effect.

Although no rare plant species have been found yet, it is possible that future surveys will reveal unusual sedges or other plant species of significance.

Deep Marsh & Broad Brook

The marsh along Broad Brook includes a variety of wetland microhabitats. Along the wetted perimeter, there is a thicket of vegetation, including meadowsweet, alder, silky dogwood, beaked hazelnut, dewberry, multiflora rose, glossy buckthorn, poison ivy, and a mix of sedges, grasses and wildflowers. Further out from the shoreline, the vegetation varies depending on water depths—in the seepy muds grow forget-me-not, sedges and rushes, while on slightly higher hummocks, there are broad tangles of silky dogwood, steeplebush and meadowsweet. Closer to the open water, there are stands of cattails. Red maple is also common here, and along the margins, black birch, hemlock and yellow birch are frequent. Big boulders are also abundant.

These marshy wetlands extend well beyond the Kubosiak property's boundaries, continuing both upstream and downstream, and create an important habitat for migrating and nesting waterfowl. Wood ducks, mallards, kingfishers, tree swallows, bluebirds, song sparrows, Canada geese, and swamp sparrows are common to see and for many years, a small, great blue heron rookery (1-4 active nests) could

be found here. The herons abandoned the area in 2014, but they may return. It is also possible that American bittern, a state-listed species, would also use the marsh as a breeding ground.

The channel of Broad Brook loses its definition in the section bordered by the former Kubosiak property.

In addition to birds, lots of wildlife use this area. Sign of otter, beaver and muskrat are easily found, many frogs breed and live in these marshes and at least three state-listed freshwater mussels, including dwarf wedgemussel (Federally Endangered) occur downstream in Broad Brook and Running Gutter Brook. These surveys were conducted by Dave McLain between 1998-2002. The FLCA marshes help protect the water quality for the mussel habitat downstream.

Stream Habitat

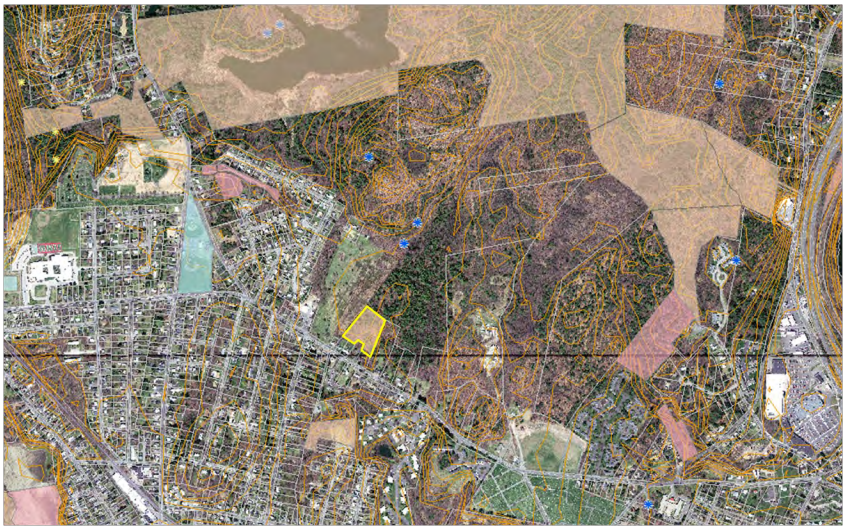
Two perennial streams flow out of the swamp forest, one to the south, and the other (shown here) to the north. The northern stream, after meandering through the swamp forest, flows down a somewhat steep gradient, revealing small cobbles in the underlying till layer. False hellebore, marsh marigold, and trout lily grow along its banks along with a variety of liverworts and mosses (*Gnium, Thuidium, Climacium*). The stream provides habitat for two-lined salamanders, crayfish and a variety of aquatic insects.

Wet Meadow

The final habitat within this 88-acre parcel is a one acre clearing (seen here), which was maintained by the previous owner for hunting and wildlife observation. It would be great to keep the meadow open and possibly build a wildlife blind. At this time, there is no easy or approved

This manmade clearing is a wet meadow, with sphagnum moss and a variety of wetland plants that depend on open sunny locations. Turkeys, bear, deer and many other animals pass regularly through.

access to the site that would allow for brushhogging. Goats might be another option.



This small parcel is currently isolated from the rest of the FLCA holdings.

408 Bridge Road (3.5 acres)

Located behind a row of homes and a small condominium complex on Bridge Road, this small property is completely undeveloped—and even lacks a path leading in. Even more awkward is that the public access isn't clearly marked, which means that parking (and exploring) feels more like trespassing at this point. The parcel, however, is open to the public and for a certain kind of visitor—and especially for the immediate abutters—the small property has its charm.

1: White pine stand
1b: White pine and old quarry site/rock knob
2: Mixed hardwoods
(red maple, sugar maple, black birch, black locust, white oak, hickory)
vp: Vernal pool (unmapped by MA NHESP)

After parking at the condominium, you just head from the edge of the paved parking lot into the woods. The site, as small as it is, is a patchwork of habitats. And although it is mostly level, it also includes a couple of rocky knobs (one of which was used historically as a very small quarry) and two small former farm ponds (now functioning like vernal pools).

The composition of the woods when you first enter the site includes a mix of hardwoods, with scattered white pine. In this section, the hardwood species include sugar maple, black birch, hickory, white oak,

Sixty years ago, the property was mostly forested.

and black locust, the latter a clue to the property's pasture history. In this part of the property, the forest floor included mostly leaf litter, but also true solomon's seal and Canada mayflower. There is also some winged euonymus growing near the edge of the property.

Moving to the rocky knobs, the vegetation shifts and includes some red oak, elm, black birch and beech. In the thin acidic soils on the rocks and nooks in between grow low blueberry, partridgeberry, Virginia creeper, marginal shield fern, spinulose woodfern, hay-scented fern, poison ivy and a few sedges (*Carex swanii*, *C. gracillima*).

Today the former clearing on the property's northern border, along the Fitzgerald family's pasture, is dominated by red maple in the canopy and a carpet of fern in the understory.

Beyond the rocks the ground levels out and old cut stumps tell a tale of a past logging. The plants here include big swaths of hayscented fern (typical after logging), scattered hemlock, young black birch, witch hazel, and some small patches of mountain laurel. Other herbaceous plants include New York fern, starflower, wintergreen, Canada mayflower, ground pine and a small amount of Asiatic bittersweet.

In the property's northeastern corner is a grove of white pine, with little vegetation below. Not far away are the two small former farm ponds, which are now functioning as vernal pools. Their margins include a mix of wetland plants, including red maple, winterberry, meadowsweet, wild sarsaparilla, sedges, sen-

The rocky outcrops, part of the long north-south trend of underlying mafic rocks, appear at the surface within this conservation area.

Above, the open forest below the mix of white pine, red maple and birch.
Right, an impressive red oak near one of the bedrock outcrops.

sitive fern, marsh fern and cinnamon fern. A dug drainage ditch forms the boundary between the conservation area and pasture owned by the Fitzgerald family.

One of the two small depressions that hold water and function as vernal pools.

Within the pine grove is the thread of an old footpath. This leads back to the end of the pasture and presumably connects to the trail system that crosses the Fitzgerald property and connects to the larger network of trails within FLCA.

Invasive Plants

In spite of its history as farm land, more recent logging and abundance of edges, this small property has only three invasive plant species: Japanese barberry, winged euonymus and Asiatic bittersweet. All are in low numbers on the property. Some of the nearby woods (i.e. behind the Fitzgerald pasture) includes more Asiatic bittersweet.

Recommendations

- Certify vernal pools
- Discuss a connecting trail with BBC
- Clarify parking
- Hand remove invasive plants

Fingernail clams like these found in a different vernal pool within FLCA may also be found in the small pools at 408 Bridge Road.

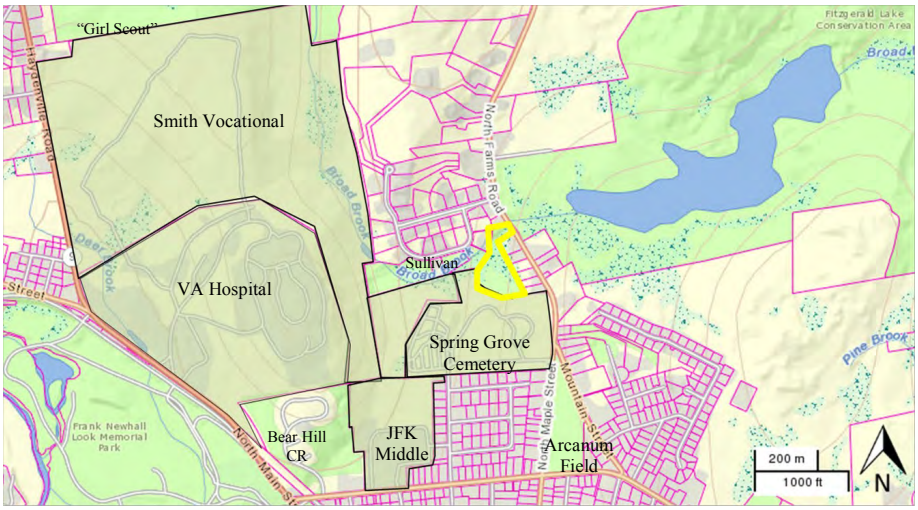
Section 2: Upper Drainage of Broad Brook *

Featuring more detailed profiles of:

Burke
Sullivan
Girl Scout Property

* For information on the Beaver Brook/Broad Brook Parcel
see the files on the Mill River Greenway

Burke Conservation Area



Donated by Dorothy Burke in the 1980s, the 5-acre Burke Conservation is near several other properties that are either fully or semi-protected from development, including a few that are owned by the City (Spring Grove Cemetery, Arcanum Field, and JFK Middle School). In addition, the land to the north and west is owned by Smith Vocational and the Veteran's Administration. During the last twenty years, four more properties in the upper Broad Brook drainage have been added to the conservation roster (Sullivan, Girl Scout, Beaver Brook/ Broad Brook Gap).

In the twenty years since I first explored the Burke Conservation Area, several changes have occurred, most of them slow and subtle.

The sand/compost pile on the neighboring Spring Grove Cemetery property that was eroding into the wetland two decades ago has continued to erode and today the lens of sediment extends slightly further into the wetland. Similarly, the patch of Japanese knotweed that was growing on this same compost mound in 1993 has also spread , although not quite as far as might be expected given this species' capacity. In addition, the thickets of multiflora rose in the swamp and along the roadside are now bigger and more abundant, and so are the tangles of Asiatic bittersweet and Morrow's honeysuckle. Meanwhile, a few other non-native plants—moneywort, Japanese barberry, and coltsfoot— have also become established. Another troubling change is the arrival of hemlock woolly adelgid, which is slowly killing the prominent

Japanese knotweed spreads out into the wetland, creeping out from the pile of sand, grass clippings and other organic waste.

stand of hemlock that dominates the surrounding slopes. So far, the hemlocks are all still alive, but they are thinner and in decline.

What vegetation will replace the hemlocks and fill in the now-shady understory as these trees die?

But not all the news is negative. On the positive side of the equation has been the protection of several properties adjacent to and in the vicinity of this property, including two parcels formerly owned by the Sullivan family, the CR on the Bear Hill development, the Girl Scout property, Beaver Brook/Broad Brook Gap, and many more parcels in and around Fitzgerald Lake.

Although controlling hemlock woolly adelgid in and near the Burke Conservation Area is probably outside of the realm of possibility, addressing the erosion problem and knocking back the invasive plants is do-able and important. Why? Because when compared to wetlands throughout the City, this site is unique. From a botanical perspective, it supports both common wetland plants as well as small populations of two plants that are rare in Northampton: alternate-leaved buckthorn (*Rhamnus alnifolia*), a shrub seldom found in the Pioneer Valley, and larch (*Larix laricina*). At present, the Burke Conservation area is the only known Northampton location for this native buckthorn, which typically grows in cold bogs and swamps further to the north or at higher elevations. It is also only the second-known, naturally occurring site in Northampton for larch, which also prefers cold peaty soils.

In addition to these two "northern" specialists, this seepy swamp also supports three other plant species typically found in

(A) A mix of white pine and larch in the wetland canopy. (B) Alternate-leaved buckthorn in full-bloom. Note its stunning, heart-stopping flowers.

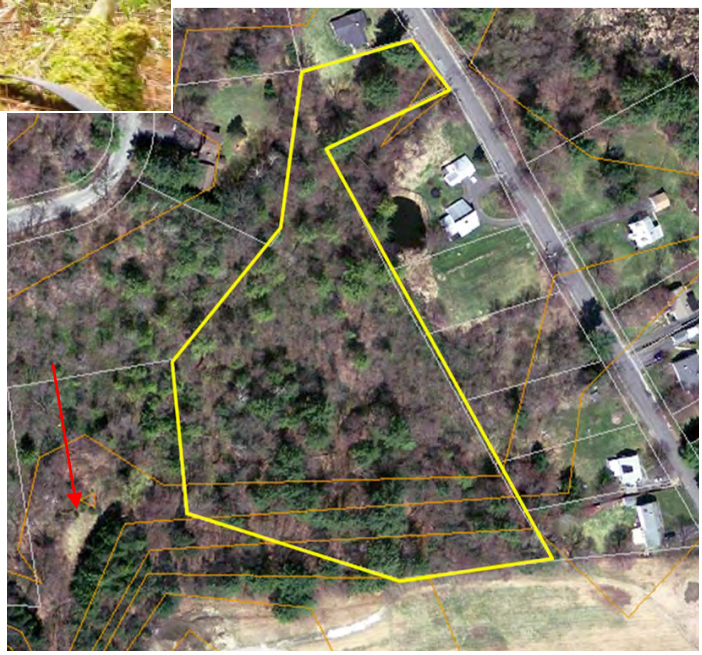
colder settings—Canada yew, bluebead lily and mountain maple. The unexpected presence of these plants in Northampton is the result of the site's geology. Several cold, clear springs flow out at the base of the sandy slope below the cemetery. The year-round cold temperatures of these springs prevent the soils from warming even during the summer, and thereby essentially simulate climate conditions that are more typical of higher elevations and latitudes.

(A) Skunk cabbage and sedges are common in the swamp forest. (B) Broad Brook flows through the conservation area. Stones and hunks of cement once created a small dam, now completely fallen apart. (C) Although much of the swamp forest is hummocky, there are open, wetter areas where seeps emerge that occur along the toe of the slope. (D) A steep slope, with the wetland below. Note the Canada yew growing in the understory.

The flat terrain to the south of the Burke Conservation Area, including the cemetery, are a small lobe of an ancient sandy delta that formed when the Mill River flowed into glacial Lake Hitchcock, 15,600-12,400 years ago. These sands were deposited over an older, impervious clay layer (also deposited during the tenure of Lake Hitchcock) and now, when ground water intercepts this clay layer, it is unable to percolate further down. The water, instead flows along the top of the clay, emerging at the bottom of the slope as seeps and springs (hence "Spring Grove").

The two plants shown here—marsh horsetail and a type of gooseberry—only occur in moist, circumneutral soils.

Saturated soil conditions lead to shallow root systems, making trees more susceptible to wind throw. Three trees can be seen in this image.



The Burke Conservation Area from the air in 2014 and highlighted in yellow looks like nothing special. Wrong!

Note the compost pile for the cemetery (red arrow) looks like a small clearing in the forest. It has existed in this same spot for decades.

The spring was located just below and to the northwest of the stormwater drainage headwall and diagonally opposite the Parsons Crypt. Due to erosion along the hillside's western edge a large amount of riprap was deposited here in the 1990s. Unfortunately so much traprock was put down that it covered the springs. Until then, you could go to the toe of the slope and see groundwater gushing up through the pure white sands. The springs could easily be restored by volunteers, assuming the proper wetland permits were received and the project was approved by the DPW.

PRELIMINARY CHECKLIST TO THE PLANTS OF THE BURKE CONSERVATION AREA

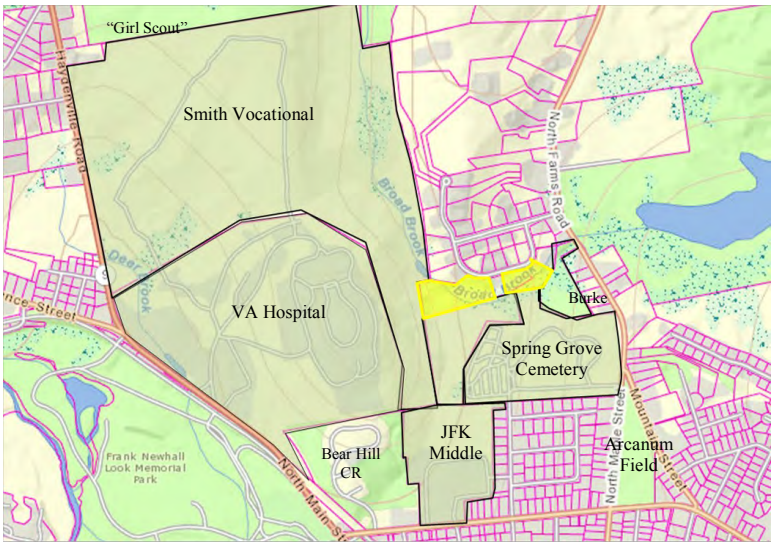
Woody Trees & Shrubs
White pine
Hemlock
Larch
Canada Yew
Red maple
Sugar maple
Striped maple
Mountain maple
Slippery Elm
Green ash
Yellow birch
Black birch
Poison sumac
Ironwood
Hop hornbeam
Witch Hazel
Mountain Laurel
Common elderberry
Speckled alder
Silky dogwood
Witherod
Northern Arrowwood
Winterberry
High bush blueberry
Pinxter flower
Chokeberries (*Aronia melanocarpa*; *A. arbutifolia*)
Serviceberry (sp.)
Spicebush
Multiflora rose
Morrow's honeysuckle
Asiatic bittersweet
Japanese barberry

Ferns
Cinnamon fern
Interrupted fern
Christmas fern
Clinton's Shield fern
Marginal Shield fern
Hayscented fern
Sensitive fern
Lady fern
Field horsetail
Marsh horsetail
Scouring Rush

Herbaceous Plants
Sedges (various)
Skunk cabbage
Jack-in-the-pulpit
Foamflower
Hellebore
Canada mayflower
Bluebead lily
Starflower
Swamp dewberry
Marsh marigold
Toothwort
Goldthread
Bindweed (sp.)
Forget me not
Common meadowsweet
Water avens
Virginia creeper
Bedstraw (sp.)
Partridgeberry
Spotted touch me not
Swamp saxifrage
Golden saxifrage
Turtlehead
Moneywort
Fringed loosestrife
Purple-flowering nightshade
Rough-leaved goldenrod
Coltsfoot

Sullivan (Total 6.14 acres in 2 properties)

Abutting the Burke Conservation Area is a 2-acre parcel that was acquired in 2011 and not far away, a 4-acre piece that was acquired by the City in 2008. Both properties were purchased from the Sullivan family, which had owned the land since 1975.



The land, formerly owned by the Sullivan family, is highlighted in yellow and surrounded by other city-owned land, including property held by the JFK Middle School, Smith Vocational, Spring Grove Cemetery, and the Burke Conservation Area. Although the City's ownership doesn't necessarily confer open space protection for the other properties, it does provide some additional control over the future uses of these abutting parcels.

Both parcel are fairly small, but they had been listed in the City's Open Space & Recreation Plan for a decade as "high priority." Not only were they within the Broad Brook greenway, but the larger parcel also includes part of a beautiful loop trail that begins behind the JFK Middle School. Furthermore, their protection also filled in the two remaining pieces within a jigsaw puzzle of otherwise municipally-owned land.

That said, the properties are not without their management issues. Invasive plants present the greatest long-term challenge and include the usual cast of characters: multiflora rose, Asiatic bittersweet, Japanese knotweed, and garlic mustard. In the short-term, there are two places where neighbors are dumping lawn clippings and yard waste, which should stop. There is also a drainage outfall on the Veteran's Administration property that has created a large, eroding gully and is washing sediments across the Smith Vocation land, into the Sullivan property and reaching Broad Brook.

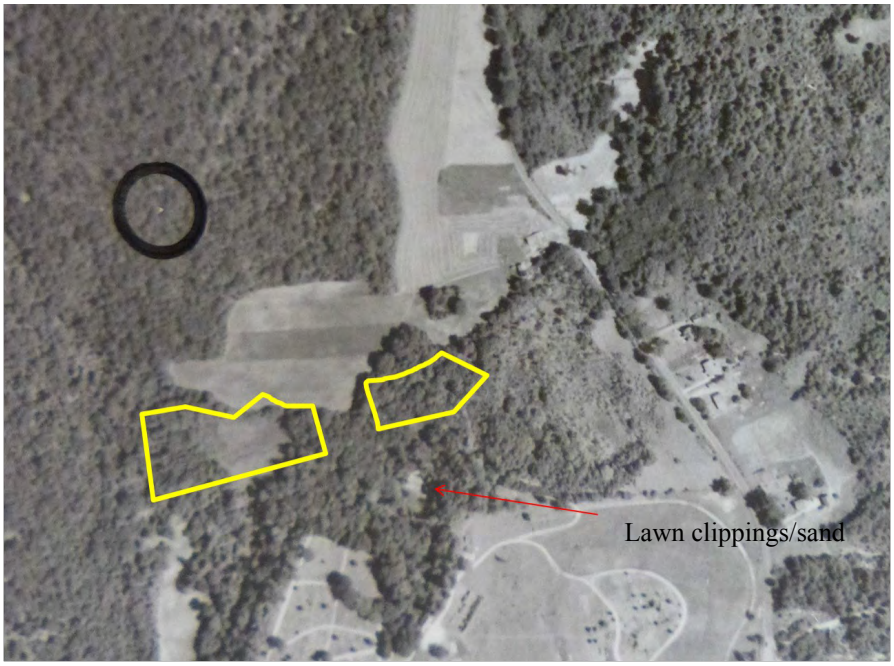
Ownership History & Ecology

The former Sullivan land represents three separate lots that were once part of a 1960 subdivision known as Brookwood. When it was approved, the subdivision included 47 lots on 50-acres, but in the intervening decades, many of the lots were reconfigured and only about two dozen homes were ultimately built.

Prior to the land's development, this area was part of a farm that had operated since at least 1900 (and

probably earlier). Interestingly, between 1901-1933, the Abercrombie Farm, as it was then known, was co-owned by Wallace Allen. Allen owned several farms in the area, including the 350-acre spread that he sold in 1935 to Harold K. Fitzgerald and now forms the core of the Fitzgerald Lake Conservation Area.

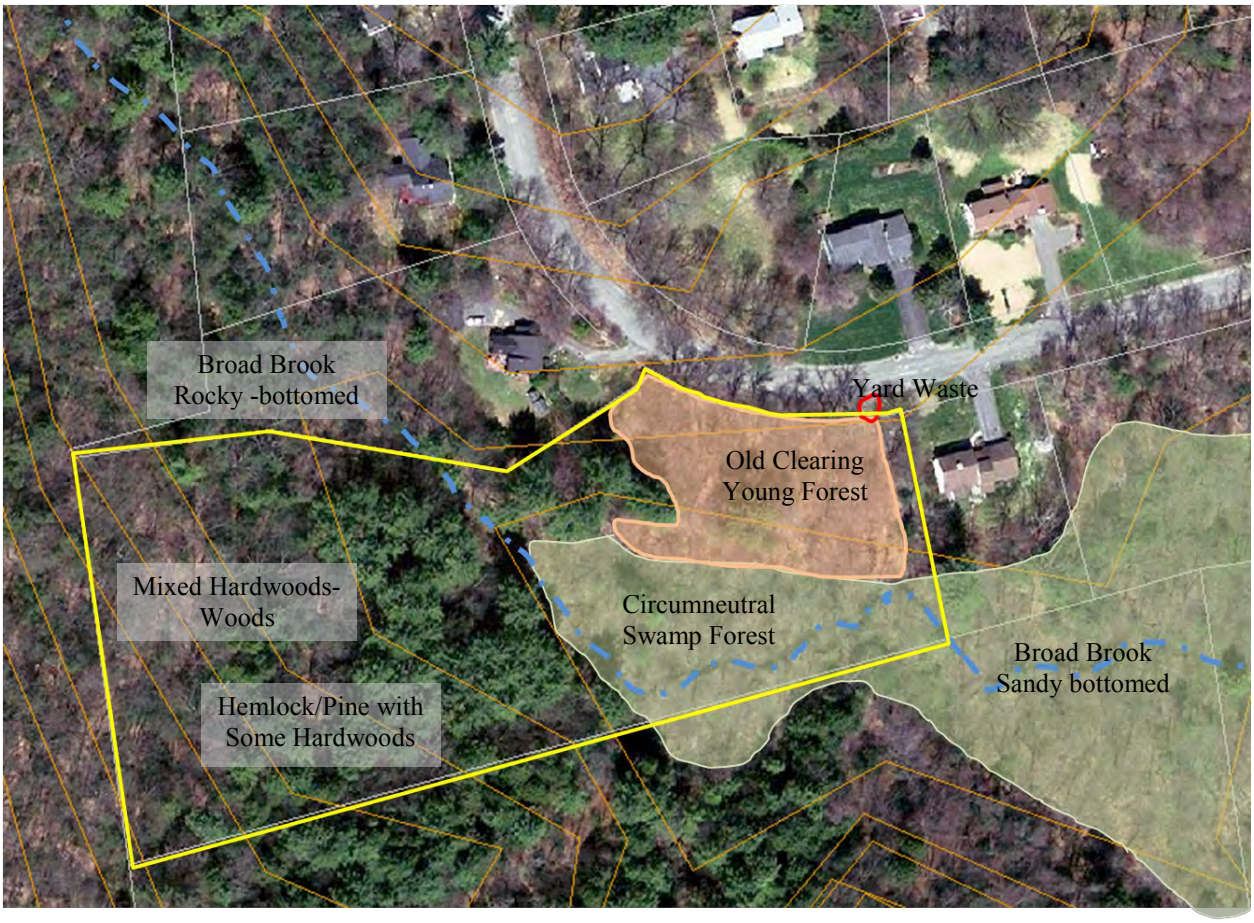
In the 1950s, the larger of the two Sullivan lots was a mix of pasture and forest, while the smaller lot was mostly wooded. Both lots abutted a much larger pasture. By 1965, by the time the first road (Country Way) was punched in, that clearing was beginning to grow in, and today, as is true elsewhere in Northampton, that spot and adjacent wetland have significantly more invasive plants than the land that was wooded in the 1950s and 60s.



Vegetation Patterns

Of the two parcels, the four acre property is the most diverse and includes a mix of former pasture/young forest, circumneutral swamp, a stretch of Broad Brook and upland woods.

Beginning at the edge of Morningside Drive, there is an edge of young trees, wildflowers and ferns—as well as a sizeable pile of lawn clippings. The bordering trees include sugar maple, red maple, white ash, tulip tree, cottonwood, white pine, and no



surprise, some invasive plants—namely, Asiatic bittersweet, multiflora rose and a few stems of Japanese knotweed.

Entering the forest, the land drops off from the roadside into what was a clearing fifty years ago. The trees are still young enough here that the understory is quite shaded, and the plant composition changes in response. Now instead of jumpseed and lady fern, the most abundant species are Christmas fern, Virginia creeper, and unfortunately multiflora rose and Asiatic bittersweet. In fact, the forest floor is awash with bittersweet seedlings! In contrast to the understory plants, the canopy mix are similar to those along the roadside edge and include big-toothed aspen, red maple, white pine, black cherry, red oak and an occasional tulip tree. Ironwood is common in the shrub layer, as is some poison ivy.

Continuing to the west and skirting the edge of the wetland, the forest composition shifts dramatically as the old clearing is left behind and the older forest begins with an impressive grove of white pine. On the other side of the brook, the land slopes upward and hemlock mixes with white pine to form a shady glade. This area also includes occasional, but good-sized red oak and yellow birch. The understory here

is sparse, but includes foamflower in wetter areas (especially near the brook) and partridgeberry. The till soils are right at the surface and the slope is very rocky. Witch hazel and mountain laurel are scattered in the shrub layer. The walking trail that begins behind JFK Middle School passes through this section, parallels the edge of the wetland and Broad Brook, and then loops back to the school.

West of the Sullivan parcels, the forested hillside is owned by Smith Vocational and at the top of the hill, by the Veteran's Administration. Although entirely forested with hardwoods, this area has been damaged in recent years from excessive erosion caused by a drainage outfall from the VA. The pipe empties out onto the Smith Vocational property and over the years, it has scoured and eroded the hillside. This scouring has opened up the area to a number of non-native plants, including Asiatic bittersweet, Japanese knotweed, winged euonymus and privet. In addition, it appears that sediments from the erosion are actually reaching the conservation area, and during periods of intense overland flow, probably entering the Broad Brook. By redirecting some of this water, the problem might be abated. Left untended, the problems of both erosion and invasives will increase.

The gully, with giant till boulders exposed, looking down gradient across Smith Vocational property and toward the Sullivan Conservation Area.

The manhole cover above the headwall for the drain from the VA.

Returning downslope, the land bordering Broad Brook is part of a larger, seepy wetland that extends into the Burke Conservation Area. This portion of the wetland, however, is more open and dominated by grasses (*Glyceria striata, G.*

canadensis), silky dogwood, sensitive fern, and spotted touch-me-not. Other common wetland plants in this area: speckled alder, red maple, and yellow birch in the overstory, and horsetails (*Equisetum arvense*, *E. sylvaticum*), cinnamon fern, crested shield fern, a variety of sedges, skunk cabbage, turtlehead, fringed loosestrife, swamp candles, joe pye weed, goldenrod, and asters.

Fifteen thousand years ago, both of these parcels were underwater, but close to the shoreline of Glacial Lake Hitchcock. Much of this area was buried by a lobe of sand, part of the northern edge of a large delta that was deposited in the glacial lake by the Mill River.

Since the lake's disappearance 12,000 years ago, Broad Brook has eroded away most of those sands and now flows across and on top of the glacial silts and clays. There is still enough deltaic sand within this area, some of it still slowly eroding off the hillsides to the south, that in this stretch Broad Brook has sandy swales and point bars.

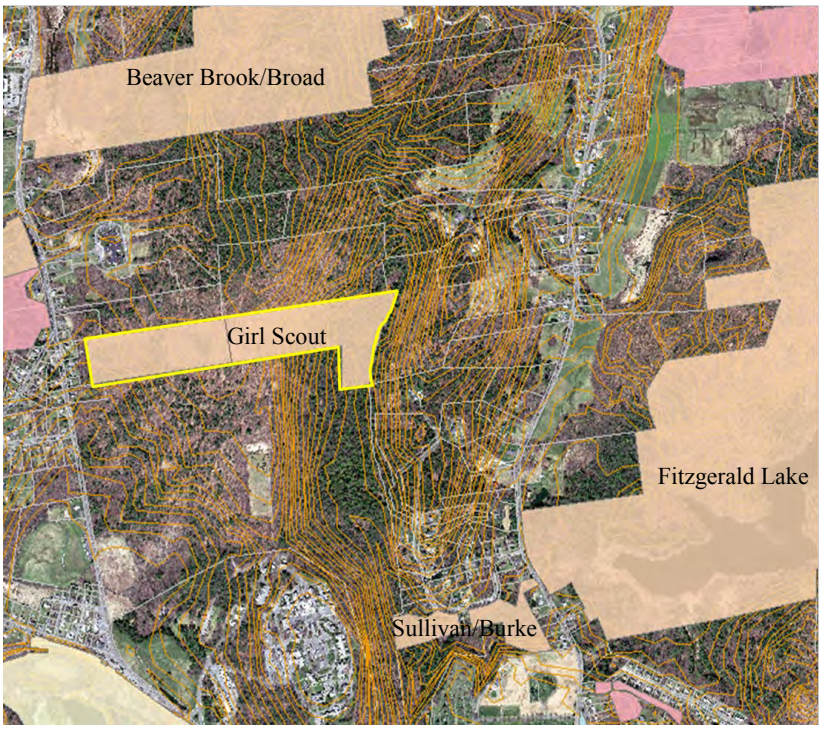
This series of images shows different views of the wetland within the Sullivan Conservation area, including the sandy point bars and Broad Brook, which isn't very broad at this point!

In 2011, the City had sufficient funds to acquire more land from the Sullivan family. Originally two separate lots, this piece encompasses a little more than two acres. Since its purchase, it has been put under conservation restriction, which is held by the Kestrel Trust. In 2012, the Kestrel Trust hired biologist Charley Eiseman to complete a biological inventory and provide baseline documentation. Little can be added to Eiseman's well-done report, which is briefly summarized here.

During the construction of Morningside Drive, the land close to the road was extensively altered and still bears the telltale signs of disturbance, with mounds and uneven topography. In this zone, the canopy "is dominated by early successional tree species such as big-toothed aspen, cottonwood, black locust, paper birch, black birch, white pine, red maple, and black cherry. Near the west end, red and white oaks with a patchy hemlock understory hint at what a more mature forest would look like here. There are two large tulip trees at the southwest corner" (Eiseman, 2012). This is the part of the property that also has the most invasives, and like the larger Sullivan parcel, it also has multiflora rose, Asiatic bittersweet, Japanese knotweed, plus Norway maple, privet, honeysuckle, garlic mustard, celandine, and even a variety of escaped garden plants (daffodils, myrtle).

From the upland area, the land dips gently to the wetland. This swamp is part of the same wetland previously described and a small section of Broad Brook wiggles through it before entering the Burke Conservation Area. Its flora is similar, not only in terms of the native vegetation, but also the non-native species. In this section, multiflora rose is particularly nasty and abundant.

"Girl Scout" Property (40 acres)



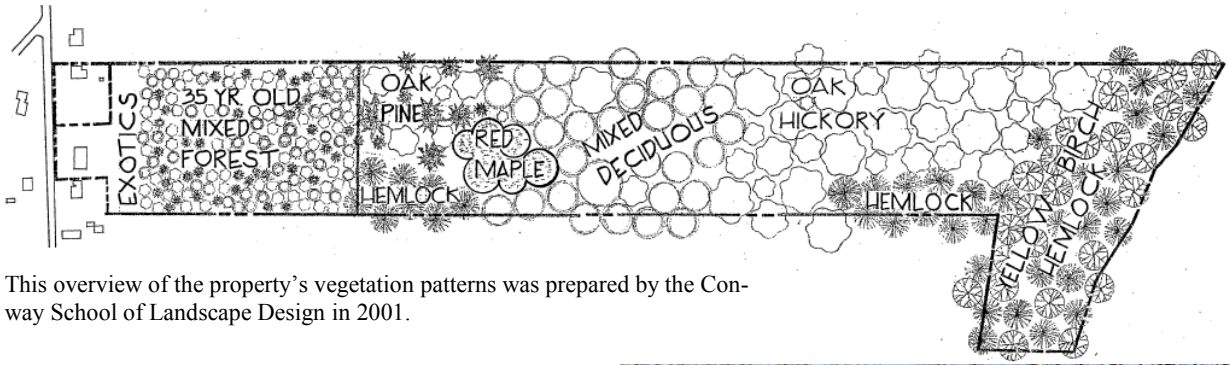
The long, linear "Girl Scout" property, seen here in relationship to other city-owned conservation land, measures about 500 feet wide and more than 3,000 feet long. Note the steep, hemlock-dominated ravine along Broad Brook.

Protected in 2011, this wooded conservation area is almost equally split between two different Mill River watersheds, with the western half draining to the Mill River in Northampton and the eastern half draining to the Mill River in Hatfield. The eastern portion is part of the Broad Brook watershed and the valley of Broad Brook is hands-down the most beautiful part of the property. In this section the stream meanders quietly through a wooded floodplain, bordered by a steep ravine with towering hemlocks and mature hardwoods. The forest continue like this for nearly half a mile downstream, extending from the Girl Scout property and into land owned by Smith Vocational, where the most spectacular trees occur. Old growth and big tree expert Bob Leverett calls this stretch of woods a "jewel." Although it does not qualify as "old growth," Leveret considers it a "mature forest" and according to his measurements, it has the greatest concentration of old trees in Northampton. Many of them are 150 years old and some are even older. These include tulip trees, oaks, and of particular note, black birch. Leverett says that this part of the Broad Brook Valley has the greatest quantity of mature black birch that he has seen in western Massachusetts. Many of the black birch exceed 100 feet in height, and the tallest black birch in the Connecticut River Valley is found here.

A footpath leads through the impressive forest that borders Broad Brook.

Beyond these age and measurement distinctions, this forested valley is visually one of the most remarkable natural areas I have explored in Northampton. So far, no rare species have been found here, but the area has been mapped by MA NHESP as "Living Waters Critical Supporting Watershed."

(A) Broad Brook winds through a narrow, flat floodplain that is often wet and swampy. This area was part of a long narrow inlet when Glacial Lake Hitchcock was here, which helps explain the richer flora, including species like toothwort, trout lily, foamflower and patches of sedge meadows. (B) As a large block of forest, this area is valuable for wildlife. In addition, this deep ravine functions as a deer yard in winter. As a result, these stems are heavily browsed. (C) Another view of Broad Brook near the property's northern boundary. As part of a large block of uninterrupted forest, it is valuable to wildlife. The ravine is a winter deer yard and the stream corridor is used by a variety of animals. So far, however, no rare species have been found and at this point, none of the property is within any kind of priority habitat as delineated by the MA NHESP. (D) Although this area seems remote and wild, a well used trail lies just to the east and remnant strands of barbed wire indicate that the land nearby was once cleared and used for pasture. A tiny piece of Broad Brook can be seen behind the tree.



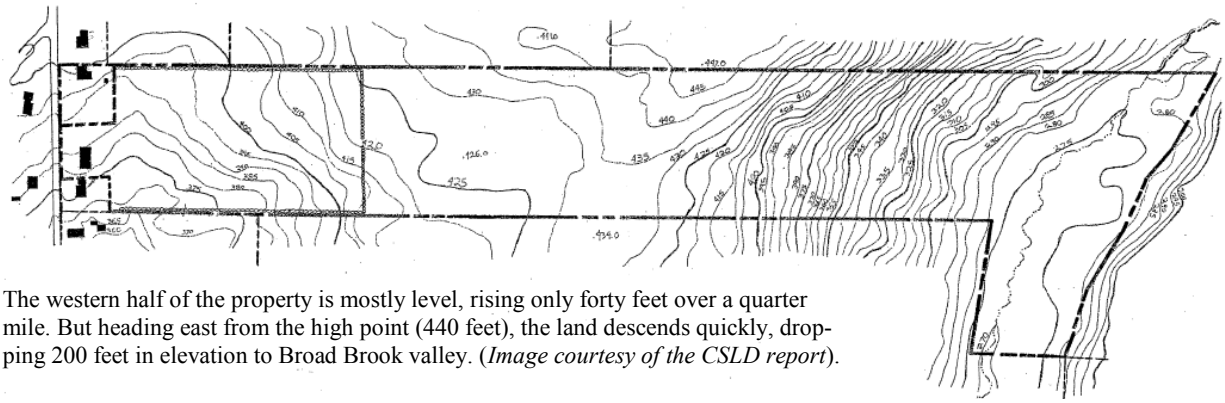
This overview of the property's vegetation patterns was prepared by the Conway School of Landscape Design in 2001.

In comparison to the Broad Brook valley, the remainder of the property is a bit underwhelming. As you climb out of the valley and move from east to west, the land flattens out and the woods are younger and not as diverse. The canopy is dominated by hardwoods (oaks, hickory, black birch, and red maple) as well as a couple of hemlock stands (*see vegetation map above).* According to the Conway School of Design's master plan, the patch of woods dominated by "oak and hickory" burned in 1978. More recently, that patch, as well as the area shown as "mixed deciduous" was logged and today there are lots of resprouts and cut stumps. Fortunately the timber job did not continue into the Broad Brook valley.

Near the center of the property, in the area shown as "red maple" is a single, isolated certified vernal pool. It is small (~50' wide) and shallow and used by wood frogs, spotted salamanders, spring peepers and other vernal pool species. The vernal pool is located on the west side of the watershed divide so its waters flow to the Mill River in Northampton.

(A) Looking down in to the Valley of the Broad Brook. This forest was thinned in the past. (B & C) Cut stumps and resprouts are common in the uplands above Broad Brook.

Continuing to the west is an impressive stone



The western half of the property is mostly level, rising only forty feet over a quarter mile. But heading east from the high point (440 feet), the land descends quickly, dropping 200 feet in elevation to Broad Brook valley. (*Image courtesy of the CSLD report*).

wall that measures 5-6 feet across, four feet high and is several hundred feet long. It marks an historic property boundary and the forest on the other side is dramatically different.

(A) A view of the vernal pool and (B) an image of a portion of the impressive wall.

Although this westernmost end of the property is now entirely wooded, sixty years ago it was still open hayfield/pasture. By 1965 the field had been abandoned and was beginning to grow in with white pine. Aside from old aerial photos (next page), the evidence of that former use is obvious in the landscape. Not only are the trees younger, but the species composition—a mix of red maple, white pine, gray birch, big-toothed aspen and black birch—also reveals that the land was cleared in the recent past. What's more, this is the part of the property where most of the invasive plants are found. Young Asiatic bittersweet is the most abundant and widespread, but there are also a few Japanese barberry, multiflora rose, and privet as well as small patches of Japanese knotweed and garlic mustard.

In 1952 the western quarter of the property was still a cleared field, but by 1965, it had been abandoned and began to grow in with brush and pine. The triple fields to the north are now occupied by Linda Manor. South of the property is the large field owned by Smith Vocational. In both images, the trace of wood roads is evident.

Two views of the young forest in the western part of the property.

Northern running pine, a type of clubmoss, covers large areas of the forest floor in the former hayfield/pasture.

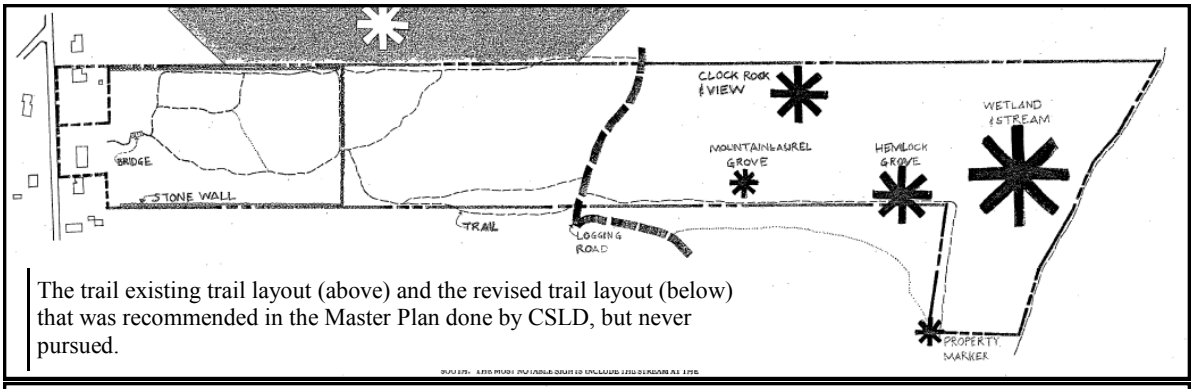
An healthy stand of tall white pine occur along the property's south-western boundary .

The intermittent stream/wetland drainage near the property's west-ernmost boundary.

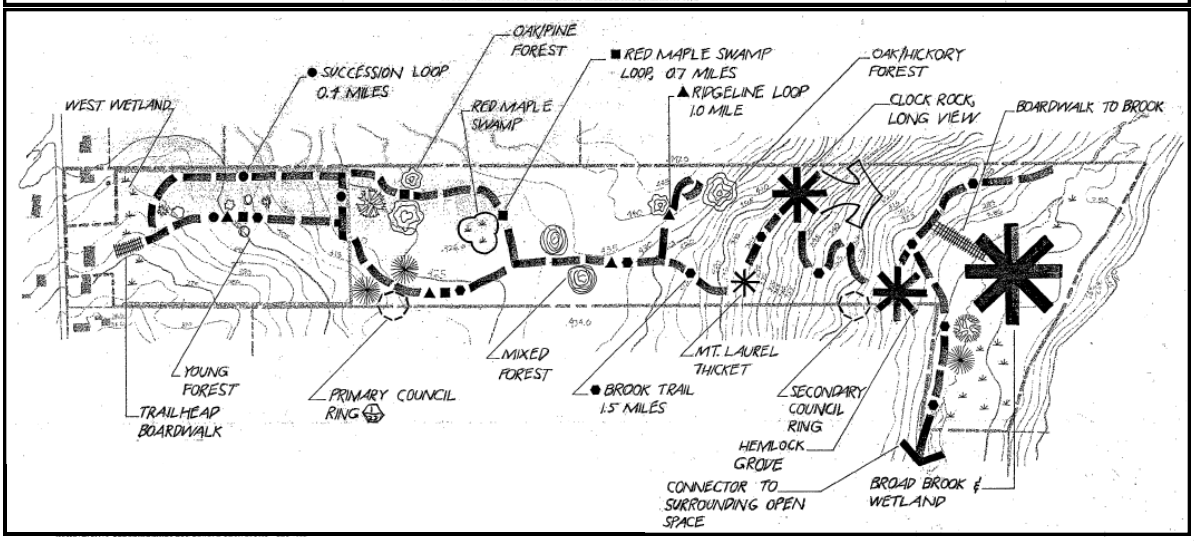
A strand of barbed wire provides another hard clue about the site's land use history.

Ownership History

The Girl Scouts of Western Massachusetts (GSWM) acquired the property in 1966 from the Moodie family, which had owned the land since the 1940s. The site became the GSWM's regional headquarters and in 2001, the organization purchased the abutting home in order to expand their office space. That same year the GSWA hired the Conway School of Landscape Design (CSLD) to develop a master plan for the wooded acreage (the "Back 40"), which by then already had a well-established network of trails (see below). The subsequent plan from CSLD included a slightly new trail design layout (see below) and a "cottage" for outdoor programming and meetings. These ideas, however, were never implemented and in 2009, the GSWA consolidated its central and western Massachusetts operations and relocated its headquarters to Holyoke. After selling the house and lot that it had acquired in 2001, the non-profit sub-divided the property, carving out the former headquarters and two acres of land, and selling forty acres of now backland to the City for conservation (23 acres for $23,000 in 2011; 17 acres for $17,000 in 2012). A conservation restriction was subsequently placed on both parcels. It is held by the Kestrel Trust, which prepared a baseline monitoring report in 2012. (This document, along with the master plan prepared by the CSLD, is available electronically in the City's public file cabinet.) In June 2014, the GSWM sold its former headquarters to a private family, ending 50 years of ownership in Northampton.



The trail existing trail layout (above) and the revised trail layout (below) that was recommended in the Master Plan done by CSLD, but never pursued.



Access

Because of the way the land was subdivided, the conservation area now truly is the "Back 40," meaning that there is no longer any public access to the property without crossing private property. At least not yet. There are, however, three options, all of which involve the cooperation of Smith Vocational.

Smith Vocational School received this land in 1958 from the VA Hospital in order to use it for its demonstration forestry program. The land wraps around the VA hospital buildings and also includes a large chunk of woods to the north, which borders the Girl Scout land and includes road frontage on Route 9. One of the potential access routes begins opposite the driving range. It is an old wood road that joins another trail that passes through the Girl Scout property. This may be the simplest and easiest access, in part because it includes the best parking option.

Two other wood roads begin behind a set of VA buildings, one heads due north, skirting a field owned by Smith Vocational and connecting to an older, well-maintained trail that passes through the middle of the Girl Scout property and continues north. A second wood road branches off to the east. This wood road drops down a hillside, passes a dammed pond on Broad Brook and then loops north. This trail borders the eastern edge of the Girl Scout property and is a good option for exploring the ravine and winding Broad Brook. ATVs and snowmobiles use portions of this trail.

Vegetation Patterns

Based on past land use, hydrology and topography, the property can be divided into seven different vegetation zones, four upland and three wetland. The following descriptions coordinate with the vegetation map.

Upland Areas

1a. The property's former hayfields (~ 5 acres) are now covered with a mixed canopy of white pine, hemlock, black birch, red maple, big-toothed aspen and occasional black cherry and white ash. An abundance of young white pine occurs in the understory, and ironwood, gray birch and chestnut are also common. The ground cover is often lacking, but there are broad patches of northern running pine, as well as Canada mayflower, starflower and wild sarsaparilla. Asiatic bittersweet (mostly small) is found in this portion of the property, especially near the wetland and trail head behind the former Girl Scout headquarters. A small patch of Japanese knotweed (about 100 stems) and a few Japanese barberry and multiflora rose grow near the trailhead and may be on the abutting property (former headquarters). These non-native species should be removed ASAP as they are still possible to control.

1b. Straddling a tumbled down stonewall, this patch of woods is also located in the former hayfields but includes only hardwood species and no white pine. A nature trail wiggles through this section of the property and loops through 1a.

2. A grove of white pine mixed with hemlock borders the property line and bends along the impressive north-south running stone wall. Almost no understory plants grow in the deep shade. A few scattered sugar maple occur in this area. Along the southern boundary are the remains of another stonewall and barbed wire.

3. Nearly level, this area was cut during the two decades as a shelterwood cut. It is dominated by red oak and red maple, with an abundance of white oak, black oak, pignut hickory, black birch and occasional white pine and big-toothed aspen. Some of the oaks have spreading crowns, indicating that they began growing up in an old pasture. The trees are mostly young. The shrub layer is sparse, with low-bush blueberries, hazelnut, and maple-leaved viburnum. The herb layer is also scant and includes Pennsylvania sedge, bracken, partridgeberry, and wintergreen. There is also some flowering dogwood, sassafras and small patches of mountain laurel.

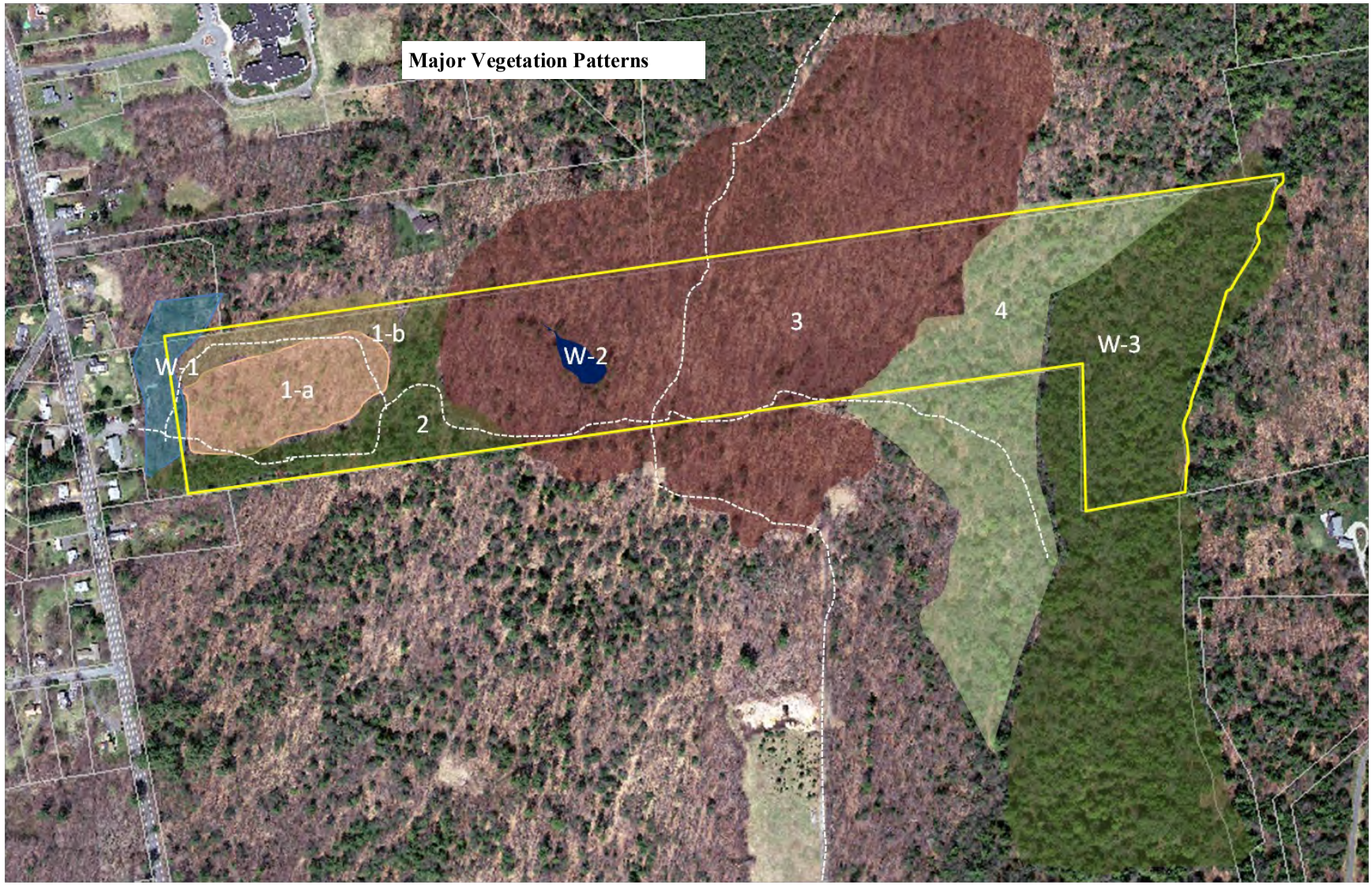
4. A transitional forest on the steep slopes that includes a mix of hemlock, red oak, hickory, white pine and red maple in the canopy. Mountain laurel and witch hazel form a dense understory. This area, like the one above, was logged in the past. There are some rocks and occasional seeps along the slope. The ground layer is thin, but in wetter areas and seeps there is sensitive fern, cinnamon fern and Christmas fern. A few sugar maple too.

Wetland Areas

w-1: A seepy/stream that emerges along the northern boundary line and forms the headwaters to Deer Brook, which ultimately flows through Look Park and into the Mill River. The rocks are moss covered, with Virginia creeper and poison ivy common in the understory. Above red maple is the dominant species, but elm is also common. Where the Girl Scout trail crosses this wetland is the patch of Japanese knotweed.

w-2: This perched wetland is a certified vernal pool. It is surrounded by red maple, with hemlock, white pine and scattered winterberry, mountain laurel and high bush blueberry. Mossy hummocks topped with goldthread are common. It is only about ten inches deep at its maximum, and mostly only a few inches deep. Only wood frogs were observed. The fauna here is depauperate, probably because of the pond's small size and hydrology.

w-3: The jewel of the property is the forested wetland along Broad Brook, which meanders back and forth, and is joined by springs. It's verdant and glade-like, with moss-covered boulders and towering hemlocks. Red maple and black birch are also common in the canopy, and the shady understory includes scattered patches of mountain laurel, poison ivy, goldthread, spinulose woodfern, Christmas fern, partridgeberry, and foam flower. It feels like another part of the country. Moving east from the stream, yellow birch and spicebush are common and there is a lot of mountain laurel. There are grassy, sedgy seeps with cinnamon fern and gold thread and white oak, red oak, yellow birch, and tulip trees grow on margins of the swamp. A broad trail is located along the border and the abutting property has been recently logged. Moving back to the stream and heading north to the property's border, the hemlocks give way to a more open hardwood swamp, with a diverse understory of herbs. Within this hemlock swamp forest and along the stream, Japanese barberry. multiflora rose and moneywort are occasionally found.



1-a: 50 year old forest with abundant pine, invasives present 1-b: Young hardwoods along old stonewall 2: White pine & hemlock
3: Young, cutover hardwoods (oak, hickory, red maple) on level terrain 4: Oak, hemlock and red maple on slope

w-1: Red maple drainage w-2: vernal pool w-3: hemlock and yellow birch dominated forest, with abundant mountain laurel.

Recommendations

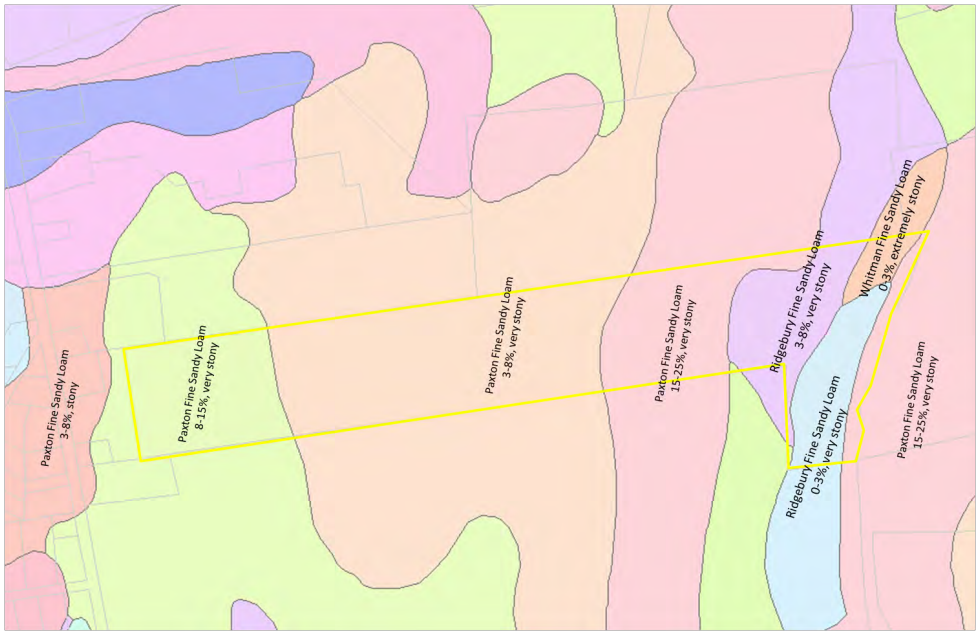
- Work with Smith Vocational and/or the VA to provide for public access point(s) to this property.
- Work with the new owners of the former Girl Scout headquarters to control the Japanese knotweed and other invasives in and along the property's western edges.
- Develop an agreement with Smith Vocational to set aside the ravine as a no-cut zone.
- Consider treating some of the larger hemlocks to protect them from woolly adelgid.
- Conduct a more detailed natural history inventory along the stream corridor for rare species (esp. dragonflies).
- Organize a field walk to the Broad Brook valley.

Massive burls on an oak in the deciduous forest that was heavily logged. My clipboard rests on one of the burls for scale.

Sources:

Levine, J. and A. Schlechter. Conway School of Landscape Design, 2001, Back 40 Master Plan. 36 pp.

Eiseman, Charles. 2012. Baseline Documentation for Kestrel Trust. 31 pp.



All of the soils on the site are sandy loams (stony to extremely stony) and were derived from till. Bedrock is close to the surface in the eastern/central part of the property.

A few final images from the Broad Brook Greenway and Fitzgerald Lake Conservation Area.