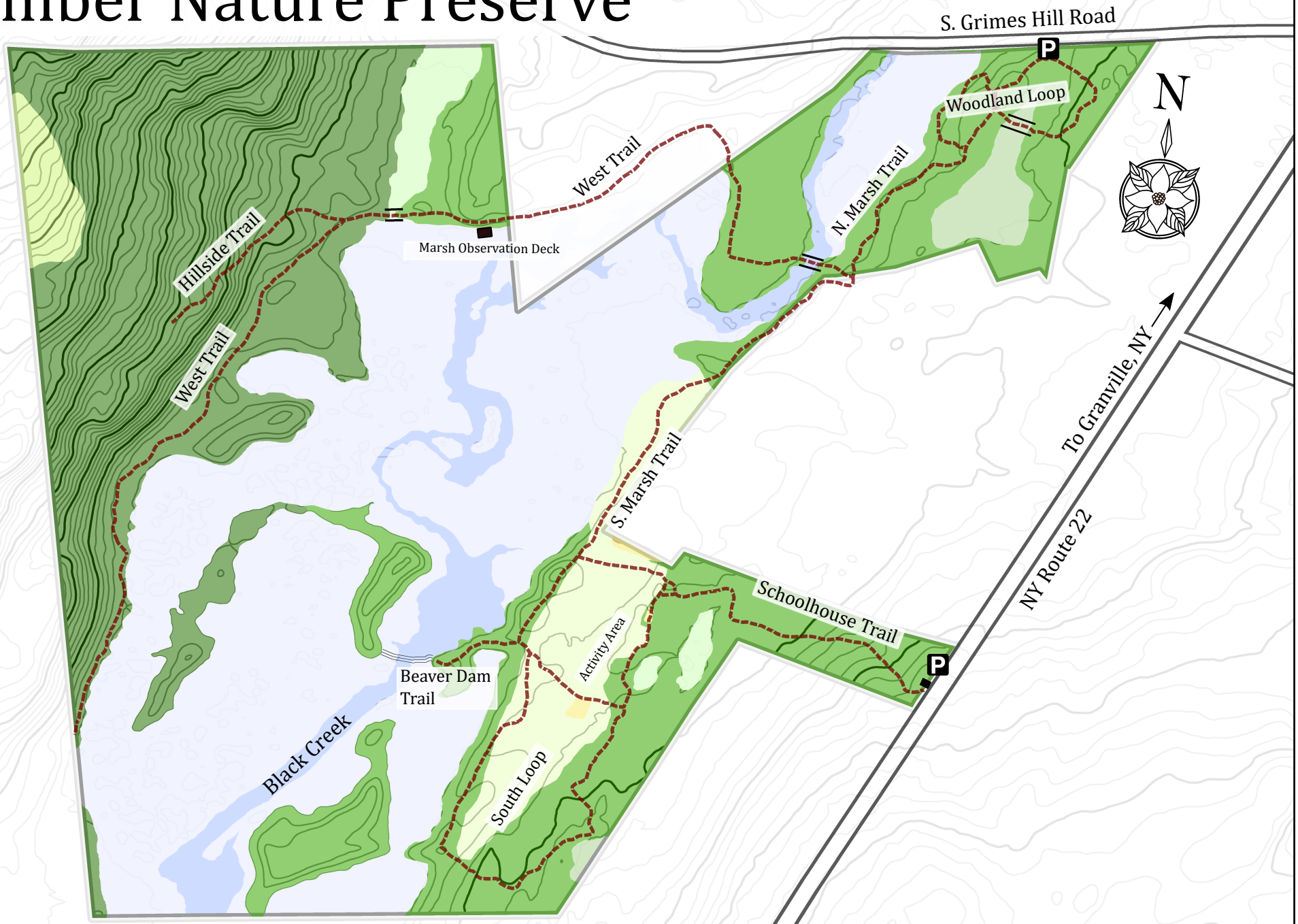
Pember Nature Preserve

Spring Mapping

Josh Duncan

Spring, 2020

Pember Nature Preserve



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Natural Communities

Upland Forests

There are four distinct upland (non-wetland) forest communities on the preserve. The two most significant are a northern hardwood forest, which covers most of the hill slope in the west portion of the preserve, and what I would describe as a red maple-white pine-oak forest on the flatter land in the east section of the preserve. In addition to these, there is a small patch of dry oak-hickory forest at the very top of the hill in the far west of the preserve, and a section of early successional forest, mostly enclosed within the south loop.

There are likely a number of factors influencing the distribution of each community, but the primary factors are topography, geology, and land use history. These forests, with the exception of the dry oak-hickory forest, occupy different temporal stages. The northern hardwood forest is composed primarily of tree species adapted for the conditions of a mature forest. Species like sugar maple, hemlock, beech, and yellow birch grow slowly, are long lived, and are capable of growing in the shade of a dense canopy.

The patch of forest enclosed within the south loop is composed of tree species whose seeds disperse quickly and opportunistically, though the trees themselves tend not to be long lived. Quaking aspen, willows, and grey birch seeds travel well on wind to colonize open land. The berries of redcedar and black cherry are brought in by birds. The tree species that make up the red maple-white pine-oak forest occupy a niche between the two.

This is likely reflective of land use history. The more even topography in the east half of the preserve probably remained cleared later than the hillside on the west half. The other important factor here is geology. The most important indicator of this is the presence of plant species on the hill slope that thrive in nutrient rich soil, which are absent east of the marsh. Trees like bitternut hickory and basswood are present and at times abundant, along with maidenhair fern and hepatica in the understory. This suggests that the soils on the hill slope are primarily till derived, while the soils of the lower terrain east of the marsh are alluvial in nature.

It is not strictly a rule that soils derived from glacial till are rich in nutrients. Often, the opposite is true. As the name implies, till is formed as glaciers grind bedrock, mixing together mineral grains of a variety of sizes, ranging from sands to large cobbles. The till soils of our region are unique because of the abundance of calcium and magnesium rich bedrock which, when crushed to till, offer those nutrients to plant life.

Northern Hardwood Forest

The northern hardwood forest can be thought of as a spectrum. On one end, there are near pure hemlock stands, which are present in several places. These are typically cool, damp coves. On the other end are stands of hardwoods that favor rich soils. Sugar maples, basswood, bitternut hickory, and white ash form the primary canopy species. Most of the forest grades between the two, depending on local conditions.

Dominant species:

- Sugar Maple
- White Ash
- Hemlock
- Beech (this is an interesting case, it isn't common in the overstory, but is by far the most common understory tree)

Locally abundant species

- Basswood
- Bitternut Hickory
- Yellow Birch
- Black Birch
- Red Oak
- Hop-hornbeam
- Shagbark Hickory
- American Elm
- Bigtooth Aspen
- Paper Birch

Common Shrubs

- Hobblebush
- Striped Maple
- Maple-leaved Viburnum

Dry Oak-Hickory Forest

At the very top of the hill in the west half of the preserve, there is a small patch of dry oak-hickory forest. These communities are common on low hilltops where soil is thin, warm, and prone to drought. Species that favor moist soils, like hemlock, are absent, favoring more drought tolerant species. There are few shrubs present and the forest floor is covered by a bed of sedges.

Dominant species

- Red Oak
- Hop-hornbeam
- Shagbark Hickory
- White Oak

Locally abundant species

- White ash
- Beech

Red Maple-White Pine-Oak Forest

The forest east of the Black Creek marsh blurs the distinction between wetland and upland. The topography here, especially in the northeast corner, provides much less relief to shed water. Red maple is the ubiquitous tree of this forest type, whether wet or dry. There are areas of dense pinewoods in several areas of the preserve, likely where soil is particularly sandy. Where slate bedrock is close to the surface (which is frequently the case) and soils are drier, red and white oak are abundant.

Dominant species

- Red Maple
- White Pine
- Red Oak
- White Oak
- Musclewood
- Black Cherry

Locally abundant species

- American Elm
- Beech
- Hemlock
- Shagbark Hickory
- White Birch
- Quaking Aspen
- White Ash

Common shrubs

- Nannyberry
- Witch Hazel
- Serviceberry

Early Successional Forest

There is a patch of very young forest within the south loop that is sufficiently large that I've decided to consider it a separate community, rather than a subset of the red maple-pine-oak forest that surrounds it. Here, there is the almost complete absence of trees like red maple, oaks, and ash trees that are typical of a maturing forest. In their place are stands of predominantly quaking aspen and grey birch, often bowed by wind and ice.

Dominant species

- Quaking Aspen
- Grey Birch

Locally abundant species

- Redcedar
- Black Cherry
- Willows
- Paper Birch

Common shrubs

- Prickly Ash
- Japanese Honeysuckle (just about outcompetes everything else)
- Glossy Buckthorn

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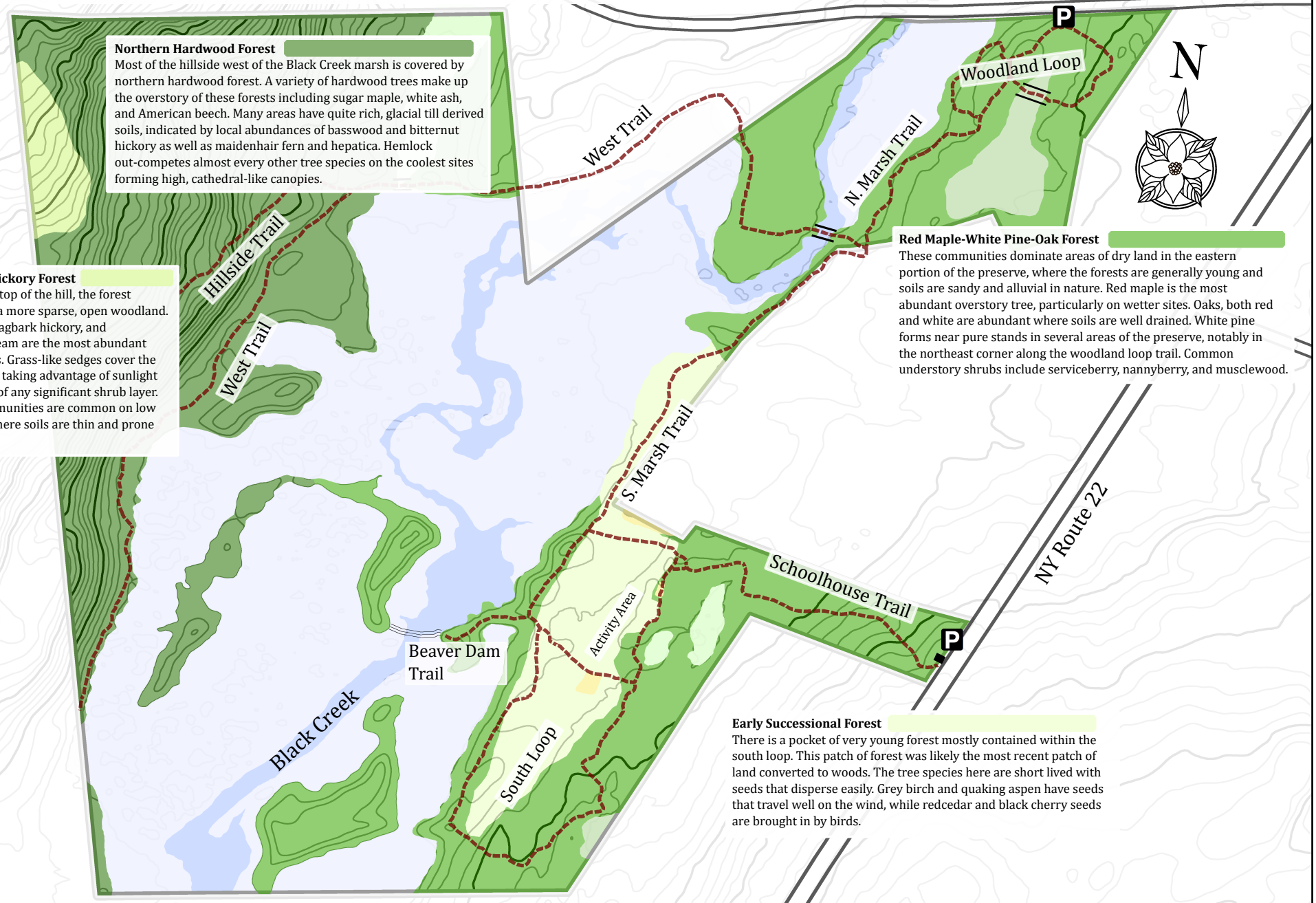
Upland Forest Communities



Northern Hardwood Forest
Most of the hillside west of the Black Creek marsh is covered by northern hardwood forest. A variety of hardwood trees make up the overstory of these forests including sugar maple, white ash, and American beech. Many areas have quite rich, glacial till derived soils, indicated by local abundances of basswood and bitternut hickory as well as maidenhair fern and hepatica. Hemlock out-competes almost every other tree species on the coolest sites forming high, cathedral-like canopies.

Dry Oak-Hickory Forest
At the very top of the hill, the forest opens into a more sparse, open woodland. Red oak, shagbark hickory, and hop-hornbeam are the most abundant tree species. Grass-like sedges cover the forest floor, taking advantage of sunlight in absence of any significant shrub layer. These communities are common on low hilltops, where soils are thin and prone to drought.

Red Maple-White Pine-Oak Forest
These communities dominate areas of dry land in the eastern portion of the preserve, where the forests are generally young and soils are sandy and alluvial in nature. Red maple is the most abundant overstory tree, particularly on wetter sites. Oaks, both red and white are abundant where soils are well drained. White pine forms near pure stands in several areas of the preserve, notably in the northeast corner along the woodland loop trail. Common understory shrubs include serviceberry, nannyberry, and musclewood.

Early Successional Forest
There is a pocket of very young forest mostly contained within the south loop. This patch of forest was likely the most recent patch of land converted to woods. The tree species here are short lived with seeds that disperse easily. Grey birch and quaking aspen have seeds that travel well on the wind, while redcedar and black cherry seeds are brought in by birds.

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Wetlands

The wetlands are the central feature of the preserve. The emergent marsh of the Black Creek is the largest natural community, and perhaps the most spectacular. There are however, many other, smaller wetlands in addition to the marsh. Each varies in the presence of and depth of standing water, as well as movement of water through the substrate. Though the species assemblage of each are similar, they are visually quite different.

Emergent Marsh

The largest wetland feature on the preserve is the marsh of the Black Creek. Marshes are defined as wetland with an inflow and an outflow and lacking in large trees. Rather, the marsh varies between thickets of speckled alder, pussy willow, and dogwood, and hummocky tussock grasses. Beavers likely play an important role in maintaining a diversity of habitats in the marsh by encouraging a dynamic flood regime. There is a patchwork of microhabitats within the marsh, critical for biodiversity.

Dominant species

- Speckled Alder
- Silky Dogwood
- Willows (at least three different species, though difficult to identify)
- Red Maple

Locally abundant species

- Nannyberry
- Winterberry Holly
- Arrowwood viburnum

Red Maple Seep

In several section of the preserve, the water table is high enough to permanently saturate soils within the surrounding red maple-white pine-oak forest. There are many small streams running through these communities, but very little standing water otherwise. Red maples, which are well adapted for wet soils, are the most dominant overstory tree with a diverse understory of shrub species. The floor of these seeps is covered in mosses and ferns, particularly sensitive fern.

Dominant species

- Red Maple
- American Elm
- Winterberry Holly
- Nannyberry

Locally Abundant Species

- Arrowwood
- Speckled Alder
- Silky Dogwood
- Witch Hazel
- Musclewood

Alder Swamp

This community is restricted to a small valley on the northern border of the preserve. It is very similar to the plant communities that occupy the edges of the Black Creek marsh, but is separated by two fingers of dry land, crossed by the west trail. This wet valley is covered by tall shrubs, with few trees extending above them.

Dominant Species

- Speckled Alder
- Nannyberry
- Winterberry Holly

Locally abundant species

- American Elm
- Red Maple
- Silky Dogwood
- Pussy Willow

Vernal Pools

East of the south loop, there is what I would describe as a complex of vernal pools. When I visited them in March there was relatively deep standing water but it appears that this is ephemeral. The edges of these pools are hugged by shrubs, but open water is preserved at the center. These provide excellent breeding habitat for amphibians.

Dominant species (limited to the immediate area of the pools)

- Winterberry Holly
- Speckled Alder
- Silky Dogwood

Locally abundant species

- Pussy Willow
- Nannyberry
- American Elm

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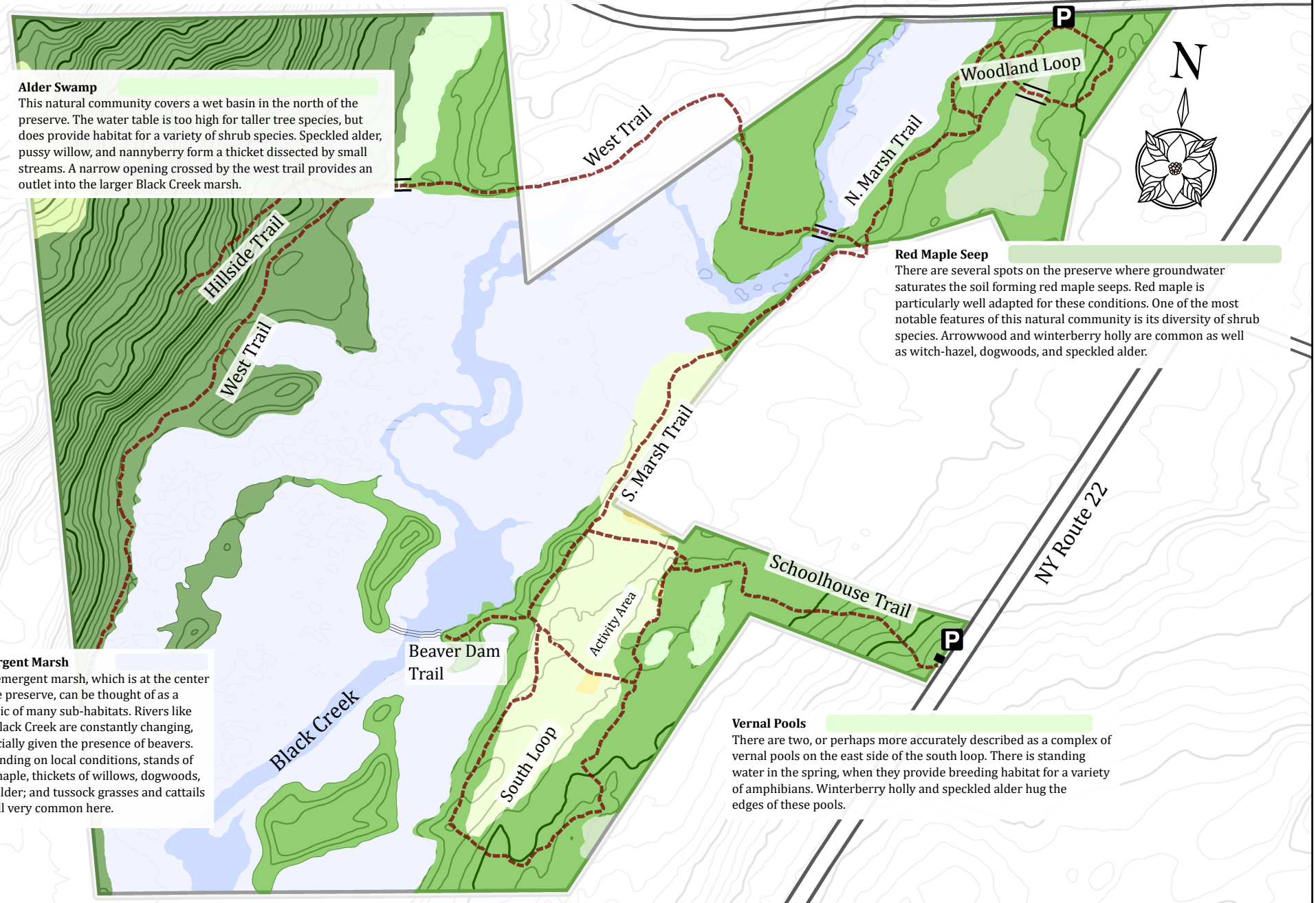
Wetland Communities



Alder Swamp
This natural community covers a wet basin in the north of the preserve. The water table is too high for taller tree species, but does provide habitat for a variety of shrub species. Speckled alder, pussy willow, and nannyberry form a thicket dissected by small streams. A narrow opening crossed by the west trail provides an outlet into the larger Black Creek marsh.

Red Maple Seep
There are several spots on the preserve where groundwater saturates the soil forming red maple seeps. Red maple is particularly well adapted for these conditions. One of the most notable features of this natural community is its diversity of shrub species. Arrowwood and winterberry holly are common as well as witch-hazel, dogwoods, and speckled alder.

Emergent Marsh
The emergent marsh, which is at the center of the preserve, can be thought of as a mosaic of many sub-habitats. Rivers like the Black Creek are constantly changing, especially given the presence of beavers. Depending on local conditions, stands of red maple, thickets of willows, dogwoods, and alder; and tussock grasses and cattails are all very common here.

Vernal Pools
There are two, or perhaps more accurately described as a complex of vernal pools on the east side of the south loop. There is standing water in the spring, when they provide breeding habitat for a variety of amphibians. Winterberry holly and speckled alder hug the edges of these pools.

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On the History of Slate

Let's take a trip backwards through time. Twelve thousand years ago vast ice sheets retreated north for the final time, leaving a landscape deeply altered. The often repeated line that it was these glaciers that brought Himalayan peaks down to the rolling hills and rounded mountains that we know today is not true, at least not entirely. A story that brings mountains rivaling the Alps down to a flat plain, and back up again, requires a more complicated telling than ice alone can tell.

500 million years ago, what would become North America sat near the equator. Geologists refer to this place and time as Laurentia, in the early Ordovician period. Though terrestrial life had not yet evolved, life in the shallow seas of the continental shelf flourished. A constant supply of microscopic skeletons formed calcium mucks in the warm water. Sands, silts, and clays eroded off the land above and were deposited by waves and rivers.

Of these, clay is unique both because of the size and shape of its grains. Clay particles are extremely small, less than two micrometers. Much smaller than sand or silt. Sand and silt are similar in that they are made up of hard minerals like quartz and feldspar. Clay on the other hand, is made of crystals that form in sheets. When these crystals are large enough to see, they are often referred to as mica.

You may be familiar with mica as large, papery crystals found in mountain top rock outcrops. Maybe you remember pulling off sheets with your fingers. A quartz crystal, kicked free by a passing deer or cracked away by ice, hardly changes at all as it washes into a stream, then a river and down to the coast, deposited as beach sand. Imagine that sheet of mica, so fragile you could easily crush it between two fingers, on that same journey. With every river bend and rapid it breaks down into smaller and smaller flakes. Imagine how small it is by the time it finds its way to the ocean.

Those clays, and for that matter the sands, silts, and calcium mucks, were buried under an increasing weight of new sediment. Under such pressure sediments harden into rock. Sands become sandstone, calcium mucks become limestone, and clay becomes shale. Those tiny clay minerals are preserved in the shale, all oriented in the same direction. Flip a coin. Chances are that it doesn't land on its edge. It lands on one of its faces. Flip another coin, and another. Soon you have a pile of quarters all lying flat. Just like a flipped quarter, the clay minerals all fell to the bottom of the shallow sea and lay flat. Like sheets of mica, you can break a piece of shale along those faces.

As it happens though, you can't pick up this shale. This shale spent its life undisturbed, buried deep beneath layer upon layer of younger rock as Laurentia drifted northward.

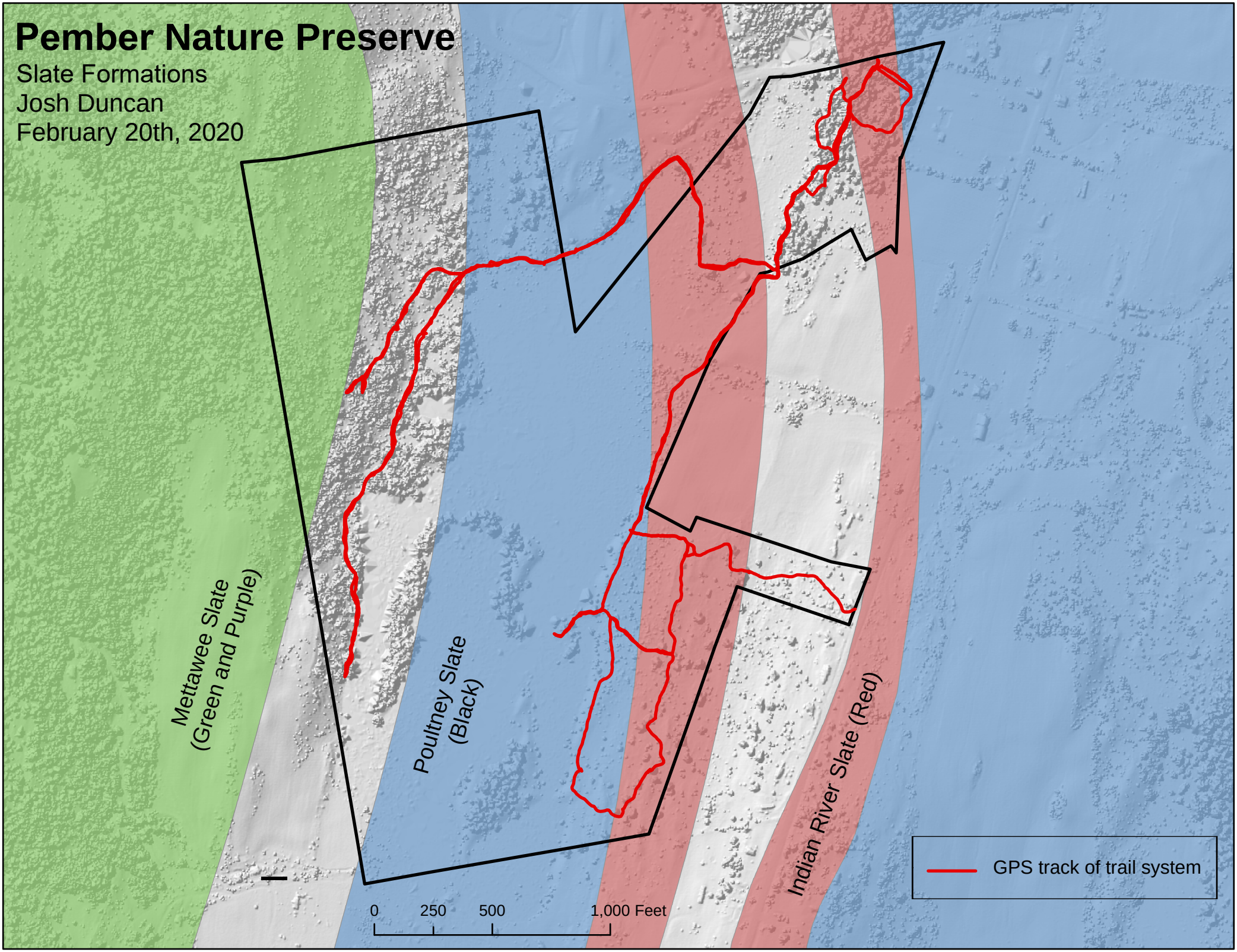
Undisturbed, that is, until a volcanic island chain similar to Japan, collided with the continent's east coast. The force of this collision raised what would become the Taconic Mountains of New York and Vermont. Rocks of the island chain, Laurentia, as well as the sedimentary rock of the sea formerly between the two got exposed to intense heat and pressure. Our shale never made it up into those lofty peaks, but rather got buried deep in the heart of them. In such extreme environments, those original clay minerals crystallized and formed stronger, tighter bonds with the crystals around them, reorienting themselves as they were compressed.

Some shales get heated and compressed to such extremes that the crystals grow enough to see with your eye, or even big enough to peel apart with your fingers. These however, did not. Just as they metamorphosed from shale to slate, the mountain building of the Taconic ceased, and Laurentia continued its drift north.

Laurentia continued to be subjected to similar collisions for millions of years, raising the Green Mountains and then the main belt of the Appalachians as high as the Alps. The world's continents converged forming the supercontinent Pangaea, around 350 million years ago. The slate, though, remained far enough removed from such events to remain unchanged, and far enough below to remain uneroded.

Slate of course is known and valued for its ability to break into clean, hard sheets. Equally impressive though, is its spectacular colors. Depending on the chemical composition of the original clay and the conditions it was deposited in, slate can be a wide variety of colors. Some of the oldest slates in our area, the purple and green Mettowee slate has very low iron content and was deposited in conditions with little oxygen, likely in deep water. Magnesium rich micas like chlorite give this slate its green color. As time went on clays mixed with rich black organic material as the water shallowed, forming the dark Poultney slate. The youngest of our slates, the Indian river slate, is rich in iron oxidized by abundant oxygen in very shallow water, perhaps even at times above the surface. These slates are a deep red.

By the time Pangaea began to split 150 million years ago, forming the continents we know today, that great mountain range forming its spine had eroded to a flat plain. Our mountains, for the time being, did not exist at al. As North America drifted north though, the eastern edge began to tip back up, exposing the folds and faults of the original mountains. The Appalachians rose again, not as towering peaks, but as rounded mountains and hills, bringing limestone, marble, and slate to the surface.


Pember Nature Preserve
Slate Formations
Josh Duncan
February 20th, 2020
Mettawee Slate
(Green and Purple)
Poultney Slate
(Black)
Indian River Slate (Red)
0
250
500
1,000 Feet
GPS track of trail system