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September-December 2019

A Semester in the Forest

A Field Guide to Upland and Wetland trail sites in Waltham's Sachar Woods

Nestled within Waltham's suburban wasteland is a paradise of green known as Sachar Woods. Consisting of only 24 acres of oak and maple forest and hemmed in by Brandeis University, Sachar isn't the most expansive or secluded woodland conservation area in Massachusetts. That said, it serves Waltham by providing a wonderful and consistent getaway for joggers, dog walkers, and really anybody wishing to escape the bustle of Greater Boston life for a little while. Over a mile of packed earth trails meander through wetlands and spiral up rocky hills, and there is even a pair of firepits complete with plastic IBS chairs free to use (students looking to start campfires should note that it is not necessarily a legal endeavor). This document contains four months' worth of journals, photographs, and information pertaining to this beautiful little forest. It also serves to highlight one of nature's most fantastic annual transformations: the autumnal explosion of New England's foliage! In a single season I have managed to fall in love with this place, and it is my hope that you will too. Get out there!

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Part 1: Site Descriptions

Main site: Sachar Wetland

Kingdom of the Maple Trees

My wetland site during mid-October. Note the iconic plastic slide!

Directions to Sachar Trails and Wetland Site

Reaching Sachar woods is not particularly difficult, especially if you are already familiar with the Brandeis campus. The following step by step instructions should get you there with few broken bones. I have included area maps (Figs 1, 3 and 4) and pictures of significant landmarks for reference. A map of Sachar woods with trails marked is included at the end (Fig. 7).

1. Begin at the Brandeis information booth. That is the small, brick structure behind the campus's main intersection (it is marked by a blue dot in both maps).

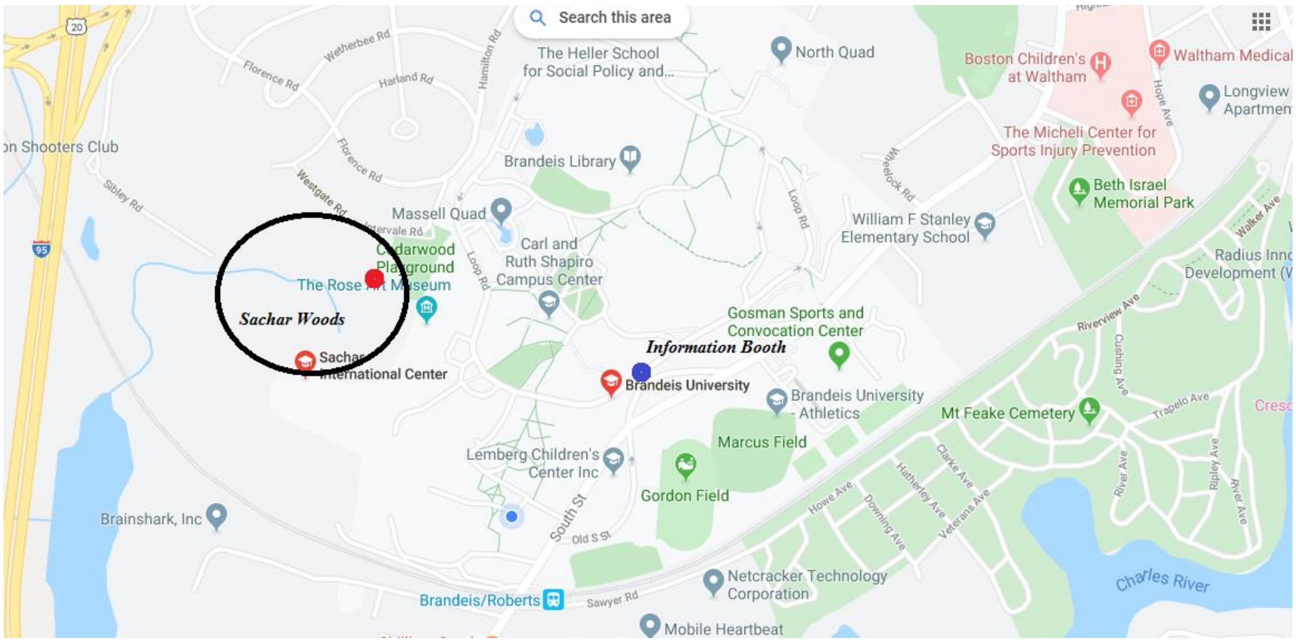


Fig. 1: A screenshot of Brandeis campus through Google's map view. Sachar woods is nestled to the west of south campus behind the art and IBS buildings. Begin at the blue dot (the information booth), and finish around the red dot (the general location of my sites within the woods—neither of them are particularly deep, and both are on-trail).

2. Follow the loop road west (turn left if you are facing the booth). Slow down once you pass the Hassenfeld parking lot.

3. Keep an eye on the woods to your right. You should eventually see a walkway leading to Florence Road (fig. 3). Follow this path; it cuts through the woods to the residential area west of Brandeis.

Fig. 2: The shaded path to the left of the street is the walkway from campus to Florence Road. Look for the blue emergency pylon.

4. Turn left once you reach Florence road and head to the park. That is Cedarwood Playground, and the forest behind it is Sachar!

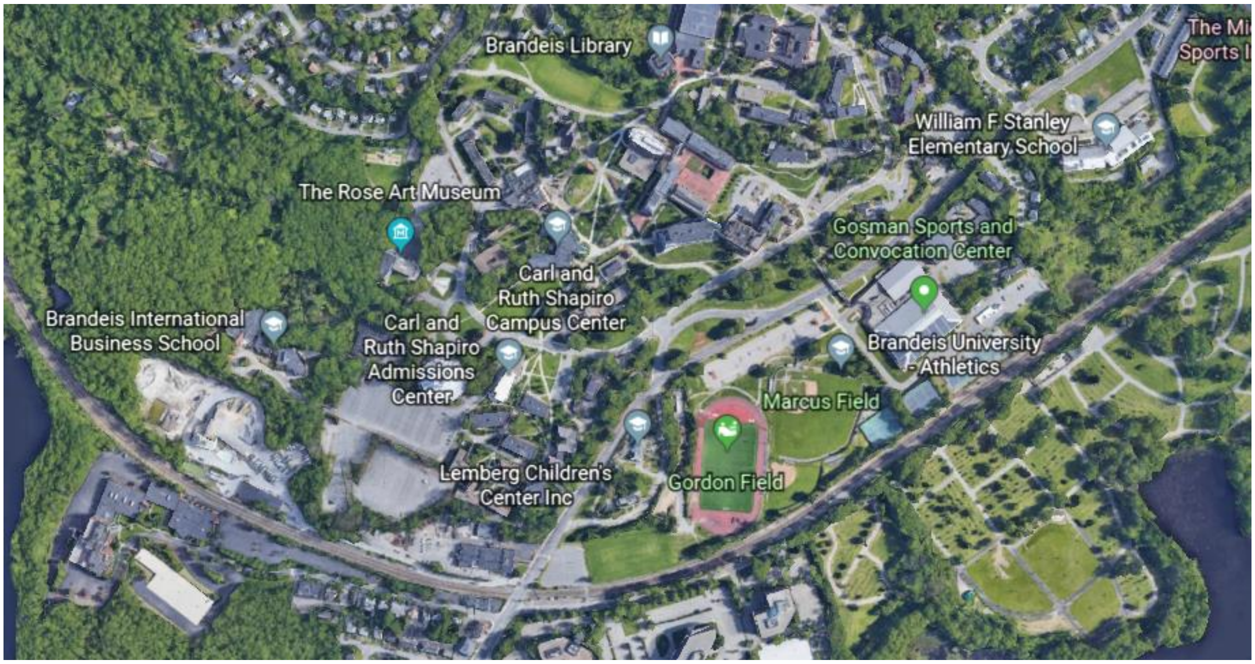


Fig. 3: This beautiful Google Earth view might be more intuitive. Notice how Sachar woods is wrapped by the railway. Behind it, unseen in this image, is i95.

5. Pass the children's playground and basketball court, then cross the grass and head towards the wide and sloping path into the woods (Fig. 5).

6. Once you climb that slope, you are in Sachar woods. My upland site will be very close at hand, but to reach my wetland site you must continue along the shabby path, descend the hill into the lower forest, and turn right. Unless there is snow on the ground, the packed earth pathway should be clear.

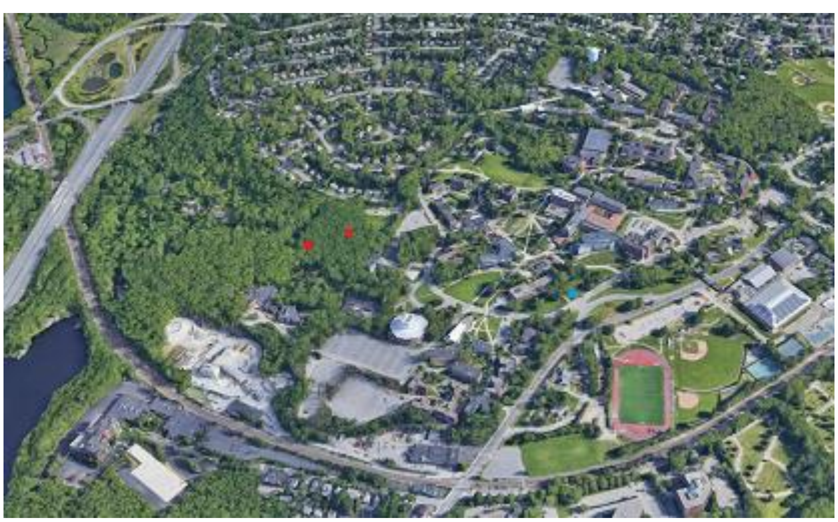


Fig. 4: Another Google Earth view. The general locations of the starting point and field sites are again marked in blue and red respectively. In this image, you can see just how close i95 is to the forest. Suburbia is claustrophobic!

Fig. 5: There are many ways to access the Sachar woods trail network, this one is just easy to spot—it looks like a gate! If you don't feel like climbing uphill, look for the less obvious entrances to the left and right.

7. Look for the yellow plastic slide next to a swampy pond. That thing marks the southern edge of my wetland field site (Fig. 6). You might even be able to spot it from the hill if the foliage isn't too dense.

   You will notice that a stream (or a dried-up ditch depending on recent weather) cuts through the path ahead of you. If you cross it and follow the path left, you will emerge from the woods near the IBS building. If you turn right instead, the path will take you up and around another hill. The fire pits are that way! If you don't cross the stream and instead follow the path right and downward, you will eventually loop around back to Cedarwood. Sachar is small enough that you will pretty much always see a sign of human civilization no matter your position, so explore the trails without fear of getting lost!

Fig. 6: A view from the center of my field site facing roughly south. When the leaves fall completely, Brandeis's IBS building can be seen clearly through the branches.

Fig. 7: This is a basic map of Sachar woods courtesy of mass-trails.org. The slight shading indicates topography shifts. The green space in the upper right of the image is Cedarwood Playground. The red circles mark the rough locations of my field sites. Sachar Woods isn't an Instagram famous hiking location, so I was quite surprised to find such a detailed map of its trails online.

Sachar Geology

Bedrock Geology

Fig. 8: A chunk of Dedham Granite, the bedrock upon which Sachar Woods and a good amount of Brandeis University sits. Notice the jagged clefts and subtle pink tones. It is a surprisingly pretty rock if you get close to it. Students that frequent the new Skyline residence hall walk by a wall of this stuff every day.

This field guide will explore Sachar from the ground up—literally. To do that, I must start with bedrock. No, I don't mean the city from The Flintstones, although there is a reason the creators of the show called it that. Bedrock is foundational. Bedrock is old. In fact, I can guarantee that the bedrock you drive by every day on your way into Boston is will be some of the oldest chemically and spatially consistent material you will ever casually be able to look at and touch. It is hard, too, because you are looking at the leftovers of hundreds of millions of years' worth of erosion. Where mountains once stood erect and proud, low, durable hills now sag. Our bodies weren't built for this kind of time scale. To steal the favorite word of my professor: the age of our state's bedrock is *ineffable*. When I put it that way, I almost feel bad about all this blasting we've done to it. All this damage, and for what? So we can build some boring highways so we can drive ourselves through our boring, postmodern lives? So I can listen to Christmas music in an expensive metal cage for two hours while I start stop up i95? I digress.

What is the bedrock in my wetland site, and where can one find it? For one thing, it is deeper than the soil and the leaf litter. All that dirty stuff is called overburden, and geologists hate it because it gets in the way of the good hard stuff underneath. Surprisingly, most of the seemingly limitless quantity of smooth boulders and stones that line the paths of Sachar are not related to the bedrock either. These rocks are known as glacial till, and they are the detritus of another place and another time (you can learn more about that under the “Glacial Geology” section of this report). To identify the bedrock, you need to look for outcroppings of granite in the hills to the east and the west of my wetland site (Fig. 8, previous page). I could not find much rooted bedrock within the literal bounds of my field site, but some massive, weathered chunks can be seen imbedded in the hill to the immediate east (Fig. 9). The tops of these boulder-like protrusions are relatively smooth from millions of years of weathering and a history of glacial scarring. The jagged angularity of the sides of these outcroppings speaks to the crystalline structure of the rock. At least one quarter of granite’s composition is quartz crystals, and you can see them glinting clear and white within the rocks if you look close enough. You might notice that the coloration of the granite is mostly greenish-grey tones (Fig. 10). This is the result of atmospheric exposure; freshly hewn chunks of this bedrock display a range of coral oranges and pinks. If you want to see this for yourself, take a walk around the IBS building. That structure was constructed on a hill of granite, and freshly exposed rock surrounds the place.

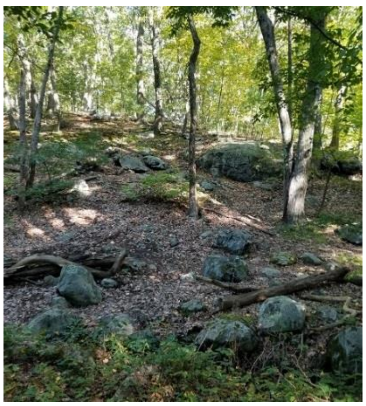


Fig 9: A view of the hill lining my wetland site, roughly east. Sachar's hills are pocked with weathered bedrock. Ignore the glacial till in the foreground!

Fig 10: Weathered Dedham Granite takes on mint toothepaste tones. This color is most prominent near the leaf litter, indicating that moisture might play a big roll in the chemical process.

The sickly green tone that my granite takes upon exposure to the air tells us that these rocks were not born on the surface. Indeed, granite is a crystalline igneous rock. For those that can’t remember their fourth-grade geology lessons, the three main types of rock are igneous, sedimentary and metamorphic. Sedimentary rocks are notable for their layers and are mainly comprised of hardened silts and sands. Metamorphic rocks are born from the transformation of other rocks through heat and pressure, and igneous rocks are the result of hardened magma. The presence of quartz crystals in the granite indicates that its source material coalesced deep within the molten, subterranean caverns through a process of intrusion. That fact begs the question: how did this bedrock end up near the surface where we can see it and touch it? To answer that, we need to zoom out considerably.

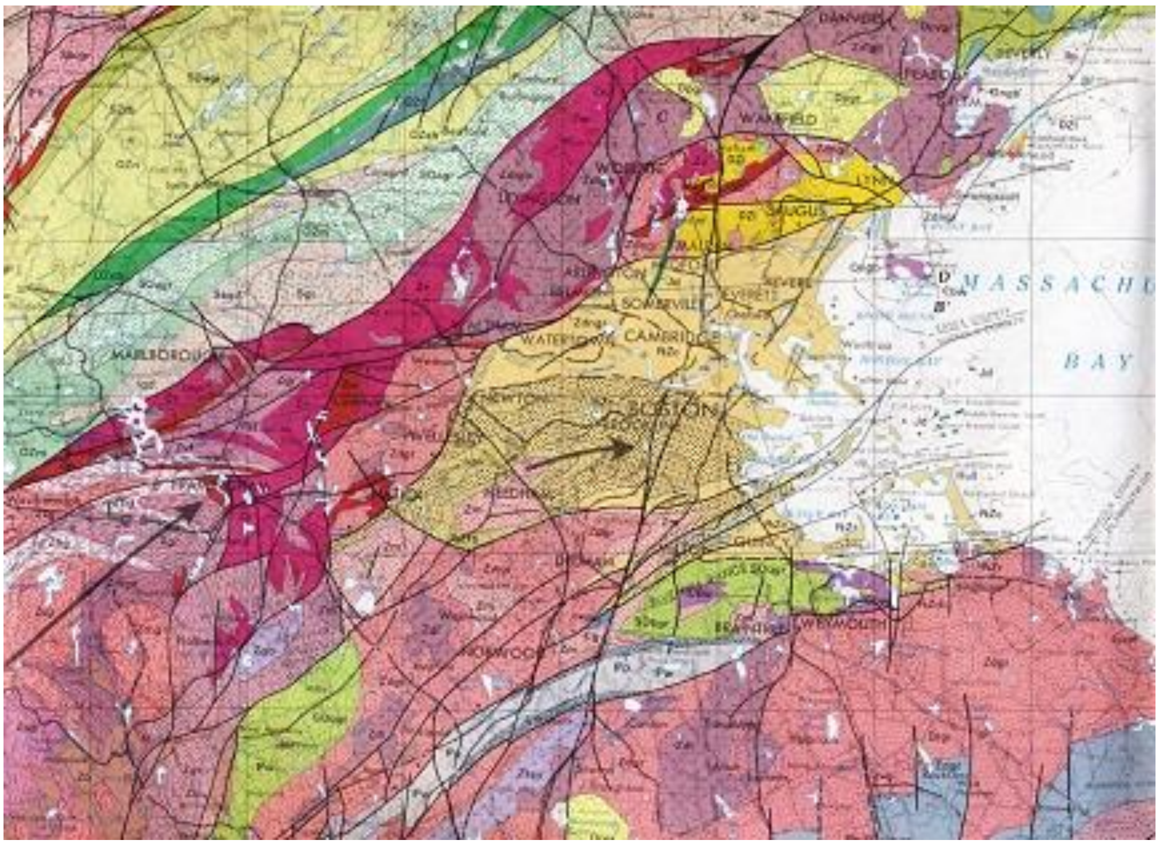


Fig 11: This geological map of Suffolk, Norfolk, and Middlesex counties is diverse. This terrain must give inexperienced geologists a headache.

This is a bedrock map of the Greater Boston area. Most maps of this kind are not so complicated, but New England has a long and tumultuous geological history. Observe the geological map (Fig). The yellow color surrounding Boston is mostly sedimentary shale; weak rock that is easily carved by water, hence the iconic bay. The pink areas south and west of Boston is made up of Dedham Granite—Sachar's bedrock. This stuff is ancient. Remember your dinosaur history? The plates of the world once converged into a supercontinent known as Pangea. This process began in the Devonian era, about 385 million years ago. For reference, the first land-based life forms had only just started to spread across the land by this point, plants and invertebrates. We humans weren't even a twinkle in the Earth's eye! The plates of North America and the now broken up and dissolved continent of Avalonia mashed together to form great mountains. With time, the tops of these mountains weathered while their roots were continuously pushed towards the surface. Thus, granite hills were eventually made visible. The granite itself could have formed hundreds of millions of years before the mountains. Such deep time is really impossible to put into meaningful words.

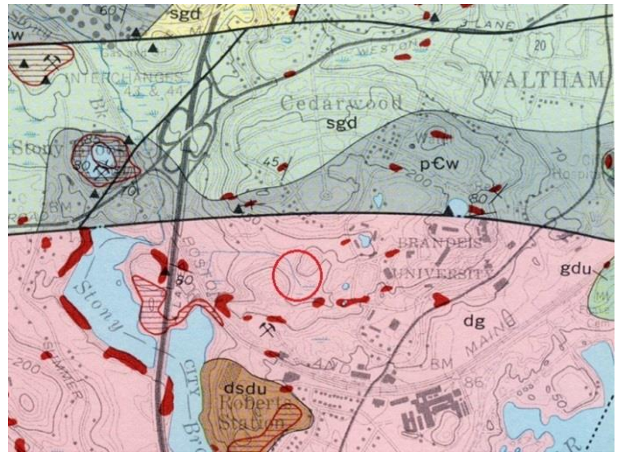


Fig 12: Brandeis is bisected by two different kinds of bedrock. The general location of my wetland site is marked by a red circle. The red highlighted areas mark significant areas of exposed bedrock.

The subsequent twisting and pulling apart of the continents into their current shapes has left New England's geological consistency looking quite funky. Zooming in, we find that Brandeis University and Sachar lie quite close to the point of transition between Dedham granite and a band of Westboro Quartzite to the north (Fig. 12). Take a look behind the water tower/Mandel Humanities Quad. There is no granite to be seen!

I rather like Sachar's choice of bedrock. A piece of Granite debris sits along the eastern path of my field site, and I used it as my writing bench throughout the semester (Fig. 13). I suspect it was a piece of rockfall from the nearby hillside. How long it has sat from its parental outcrop, I may never know, but I appreciate that such a veritable and storied boulder submitted itself to play cushion to my butt. I thank thee, Dedham Granite!

Fig 13: The eastern edge of my wetland site in November. My sitting stone, which I am pretty sure is a chunk of granite, is circled in red. A majority of my journals were written on that rock!

Glacial Geology

Fig 14: This is the center of my field site, camera facing west. During warm seasons this area is covered with ivy and other vining plants, but the autumn exposes a sea of rocks.

Sachar Woods is loaded with rocks. The ground seems to be encrusted with them. The folks that designed Sachar's trails took care to move aside the boulders that weren't too heavy to for a few bodies to lift or roll. They form neat rows and act as a naturalistic guideline for hikers. If you go off-path, however, the rocks are everywhere (Fig. 14). As we learned in the previous bedrock chapter, rocks do not just spontaneously generate. They have to come from somewhere, and the answer in this case is likely Canada. The cause? Glaciation.

The bedrock might be the foundation of Sachar, but it is the more recent happenings of New England's glacial geological history that have defined the forest's streams, ponds, soil contents, and, of course, the fields of glacial till that carpet the entire forest floor. This geological era of Earth's history is known as the Pleistocene, but you might know it better as the period during which the "ice age" occurred. The Pleistocene is the most recent scientifically delineated geological epoch besides the one we currently reside in (the Holocene). Compared to bedrock's timescale, these icy happenings are mere blips. The Pleistocene is said to have started over two million years ago and only "ended" about ten thousand years ago.

In truth, there was not a single ice age, but repeated periods of glaciation followed by thaws during which sheets of ice descended from the north and then retreated. With each glaciation, sheets of ice dredged themselves across the continent, carving lakes and valleys as they moved south. The most recent ice sheet to grace our fair country was called The Laurentide, and this is likely the mighty glacial object that carved the Great Lakes (and perhaps even Canobie Lake Park, the Greatest Lake of all time). Its influence stretched from Washington, across the Midwest, and all of New England (Fig. 15). Recall the maps of Sachar: my wetland site lies conspicuously between two slopes—east and west—with a stream running from a pond to a wetland depression south to north. My layman's hypothesis is that, hundreds of thousands of years ago, a glacier steamrolled Waltham and cut a rut straight though Sachar. Any rocks that were not broken up were beaten down and smoothed, which could explain the striated baldness of Waltham's granite outcropping (see my upland geology pages for smoothed bedrock images). Some large chunks of ice broke from the thawing glacier, and glacial outwash surrounded these chunks with silt and debris. When the lingering chunks finally melted, they left in their wake shallow depressions which filled with water. These ponds are called kettle holes—Walden Pond is a good example of a huge one! The pond that feeds my site's stream is one of these kettle holes, and the marshy area north of it was likely born from a similar phenomenon.

Fig 15: The extent of the Laurentide is shocking. It is difficult to image that the whole of Massachusetts was, for spans of thousands of years, buried beneath solid ice.

Glacial ice is considered a competent medium. "Competency", for our purposes, is a measure of a medium's ability to move heavy things. Water is not very competent; throw a boulder in a stream, or even a river, and it will sit there for a very long time. A glacier, however, is like a solid conveyer belt. It will eat up stones, rocks, and boulders and carry them with it. As the rocks are dragged along, they will roll, chip, and scrape against each other and the ground. By the time the rocks and boulders are finally deposited, they have been considerably smoothed and rounded (Figures 16 and 17).

Fig 16: Rounded stones at the bottom of the dry stream bed. This picture was taken while I was standing on a smooth boulder! So many rocks!

The distribution and sizes of Sachar's glacial till may seem random, but there is a hierarchy to a glacier's stone droppings. Remember that ice is competent while running water is not. This means that thawing glaciers actually stratify their outwash naturally by weight. The heavier rocks, like the Sachar stones, are dropped and forgotten. Smaller stones and other coarse materials are carried farther away before being deposited. Finally, sands, silts, and really small stones are capable of being washed all the way to the shores of lakes, rivers, and oceans. Geologists have mapped this phenomenon, and the distribution of materials matches what one might expect (Fig. 18). Sachar woods sits inside a zone of unstratified till and, given the seemingly random distribution of medium sized rocks, that makes sense. This model also explains why Massachusetts has so many Stoney beaches, or why lakes like Walden Pond are surrounded by gravel. Keep an eye out for little rocks next time you walk by the Charles river.

Fig 17: In the next section, I will discuss how all of these rocks make analyzing Sachar's wetland soils very, very annoying.

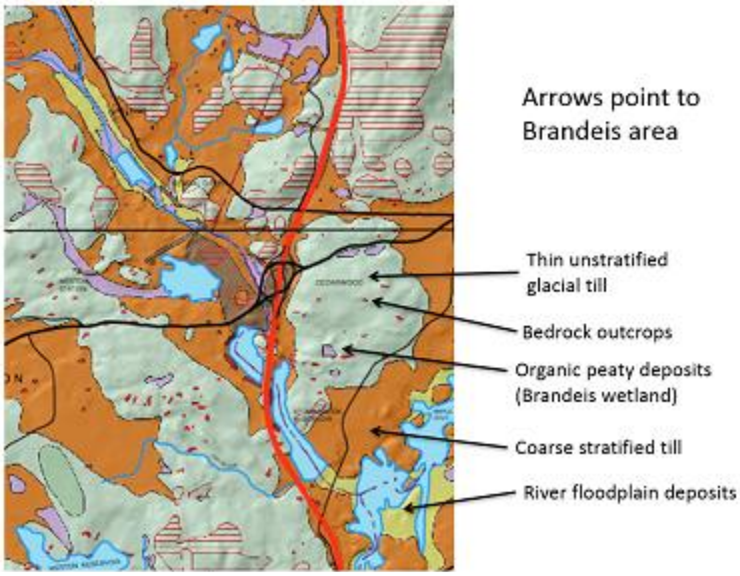


Fig 18: This map shows the stratification of glacial till in the Brandeis University area. Green areas mark unstratified till, orange areas mark coarse stratification, and yellow areas mark fine stratification/floodplain deposits. All of the graphics used in this document are supplied and marked up by my professor, Eric Olson.

Sachar Soils – Wetland

If you grew up around New England, you may recall learning about the pilgrims and the troubles they had during their first year in Massachusetts. Among these troubles, planting was the one that stood out most to me. The soils of our state are so saturated with till that working the land for agriculture is tantamount to picking hay out of a needle stack. Well, maybe it isn't that extreme, but the rockiness of our soil is no joke. I learned the reality of this fact firsthand whilst trying to dig up a decent soil cross section for this report (Fig. 19).

Fig 19: Yep, that's a rock under there. Many of my attempts at digging were foiled by "small" rocks that didn't turn out to be so small when I tried to dig them up.

In hindsight, waiting until early November to search for soil samples was a mistake. The carpet of leaves had grown so thick by this point that even much of the larger boulders were made invisible. Even when I did find a clear patch, a rock or thick root would snag my shovel and I would have to search for a new spot. My professor made the practice look so easy, but unearthing a fully intact slice of earth is tough in Sachar. In the end, I was only able to get my spade down about five inches or so. In my cross-section sketch, I have attempted to reconstruct the soil into a more meaningful image. To see a more successfully harvested cross-section, go to the soil section for my upland site. The photographs of my wetland samples are little more than balls of roots with leaves on top of them. On the bright side, the dirt on my site pretty tasty looking (Figures 20 and 21).

Fig 20: Whenever I would try to extract a cone of soil, it would crumble. There is much technique to clean digging.

Fig 21: This sample was taken from the packed earth pathway. It was loaded with roots like hair. No obvious strata.

Observe my sketch of a wetland soil cross-section (Fig. 22):

Fig 22: This sketch adds more texture than is really visible to show the graininess of my sample. My "subsoil" could not be acquired in actuality—the stones made it impenetrable. The coloration has a slight gradient, but no significant stratification could be seen.

To recap, the soil had two notable visual properties. No significant stratification could be found. The soil near the top of the cross section is slightly lighter than the lower levels, but not by much. In the sunlight, it looked sandy-brown, but in the shade, it appeared very dark and rich. The soil is also very fibrous.

Compositionally, I hypothesize that Sachar's soils are a heavy mixture of humus (organic matter) and glacial clays. The riotous growth of maple saplings and groundcover in my wetland site leads me to believe that the dirt is quite fertile. Clays and humus are particularly potent soil ingredients because of their surface area (a single gram of clay can possess a surface area of 1000m^2). More surface area equates more nutrient storage potential and more spots to interface with root and mycorrhizal connections. This measure of energy capacity is known as "CEC", or Cation Exchange Capacity. As my professor put it, soil is an "electronic sponge", and clays and humus improve this ability by grabbing up and holding onto more useful ions than, say, sand.

Fig 23: The light in this image does not do the paper justice. The paper looked like a 4.5 or 5 in person.

All of this high CEC material has its disadvantages, though. The negatively charged molecular sheets that make up clay will attract some serious H+, leading to acidity problems. I grabbed a handful of soil from the middle of one of my clumps and mixed it with rainwater to test its pH (Fig. 23). It came out to around 4.5-5: pretty darn acidic! An endless supply of decaying leaves and recent heavy rains are likely to blame. At this pH, essential nutrients that plants need to survive are not as easily soluble as they would be within a more neutral soil. If this is true, how can it be that Sachar is such a vigorous forest? The answer lies in fungi. The mycorrhizal relationship between mycelium and plant roots is highly effective. The fungal network will break down nitrogen and other nutrients for the plant roots, and in return the plant will supply the mycelium with carbon.

The ground can be a beautiful thing.

Plant Community – Wetland Site

Plant List:

COMMON NAME	LATIN NAME	FAMILY NAME
Trees	~~~	~~~
Sugar Maple	*Acer saccharum*	Sapindaceae
Red Maple	*Acer rubrum*	Sapindaceae
Shagbark Hickory	*Carya ovata*	Juglandaceae
American Elm	*Ulmus americana*	Ulmaceae
Shrubs	~~~	~~~
Spice Bush	*Lindera benzoin*	Lauraceae
Common Buckthorn	*Rhamnus cathartica*	Rhamnaceae
Ground Cover	~~~	~~~
Poison Ivy	*Toxicoderndron radicans*	Anarcardiaceae
Virginia Creeper	*Parthenocissus quinquefolia*	Vitaceae
Spotted Wintergreen	*Chimaphila maculata*	Ericaceae
White Wood Aster	*Eurybia divaricata*	Asteraceae
False Nettle	*Boehmeria cylindrica*	Urticaceae
Misc.	~~~	~~~
Cinnamon Fern	*Osmundastrum cinnamomeum*	Osmundaceae
Duckweed	*Lemna minor*	Lemnaceae
Some Mosses…	*???*	*!!!*

Noted tree species nearby but not within the bounds of my wetland site include:

Black Birch, Hop Hornbeam, Northern Red Oak, Norway Maple, a spruce of some kind, and a poor little American Chestnut…

Trees:

Before starting this project, I was tree blind. Clump of green leaves? Trunk? Maybe some roots? Must be a tree! I could tell an oak leaf from a maple leaf and I thought white birches were pretty, but that was the extent of my knowledge. It did not occur to me that trees existed in strict competition with one another. Unlike us barbaric animals that will kill each other in tooth and claw combat, trees do not possess the luxury of punching each other. Their competition is much slower, more positional.

For example, my wetland site does not contain a single oak tree despite its surrounding slopes (barely thirty feet away) being absolutely dominated by them. As it happens, maples are generally better adapted to surviving in waterlogged soils than oaks. Oaks are competitive growers; their acorns send out deep tap roots and will quickly shade a young maple. Oaks, however, will not tolerate a wet environment, so wetlands like my field site act as maple bastions in an ocean of oaks. It isn't that maples prefer wetlands—their use as ornamentals proves that a maple will be perfectly happy to sit in a dry lawn if gets the opportunity. No, they live in wetlands because they must. A tree doesn't pick its home, it simply germinates and hopes for the best. Whenever I come across a reservoir or stream, I always make sure to inspect the nearby trees. They are always maples!

Fig 24: Left: Red Maple leaf. Right: Sugar Maple leaf.

As far as I have observed, three kinds of maples call Sachar their home, and only two of these species can be found in my site: Sugar Maples, Red Maples, and Norway maples. As its name implies, the Norway maple is imported, and it gives native species some trouble. You can tell a Norway from a sugar maple by pulling off a twig and squeezing it; Norway branches will exude a milky latex. Sugar and red maples are much easier to distinguish. The red maple possesses smaller, toothier leaves (Fig. 24). The red maple will also grow much closer to water than the sugar maples. I noticed this during the autumn while walking past the IBS building to get to my field site: surrounding Sachar's southern kettle hole was a canopy of red, but my site's canopy was crisp and golden (Figures 25 and 26). The few red maples on my site were crowded in a clump near the kettle hole.

Fig 25: The canopy above my wetland site in October. I expected a greater mix of reds, but these trees leaned heavily into oranges and yellows all season.

Fig 26: A view of the kettle hole basin from the IBS building. Everyone talks about how advanced our cell phone camera technology has gotten, but this photo really doesn't capture just how striking the foliage actually was.

There is one Hickory and one Elm in my site. Both of these trees gave me considerable trouble while attempting to ID them. Before I learned that hickory leaves smell absolutely delicious when crushed, I believed I had found an ash tree. My professor just so happened to show us some Shagbark Hickory nuts and leaves before they all fell off, so I was able to correct my mistake. Both ashes and hickories have compound leaf structures, which means multiple leaves sprout from a single bud on the branch. I could not identify the shagbark by its famous bark because the tree was too young, but the star-shaped, five leaf structure should have given it away (Fig 27). I knew the elm tree was an elm because of its iconic lopsided leaf shape, but I had difficulty deciding its subspecies. The tree was slim, and its bark was covered in orange lenticels that reminded me of black birch or cherry (Figures 28 and 29).

Fig 27: If you ever see this five-pronged leaf structure, crush some samples and give it a sniff. Delicious stuff.

Fig 28: My elm's bark is lined with erupting orange lenticels. It is being strangled by some ivy—is that the cause? Or is this the natural transition from young to aged bark?

Fig 29: The bark of a black birch near my upland site for reference.

Fig 30: Upon realizing that I never actually saved a picture of my elm's leaves, I scrambled back to my field site and dug one out of the leaf litter. You can still see the asymmetry.

I ultimately went with American Elm as it is the state tree of Massachusetts, but it could easily be a Slipper Elm as well (Fig. 30). They all sort of look the same…

Bushes

When I consider the differences between a shrub and a tree, I think of trunks. Tree trunks go for a little while before the branches start, and bushes get, well, bushy very close to the ground. Of course, this is false. The buckthorn, an invasive plant from Europe, is a testament to that. One of the specimens in my site sat right across the stream from my elm, and it was almost as tall. Another one to the northern fringe was shrub sized. You can tell that this plant does not belong in New England because it does not lose its leaves alongside the other plants when the season changes (Fig. 31).

Fig 41: The whorled leaves of a buckthorn twig.

An example of a native shrub would be Spice Bush, one of my favorite plants. Crushed leaves from this plant exude a spicy or sweet aroma (Fig. 32). Up until this point, I have called this site my “wetland” site. This isn’t a whim; certain species of plants only grow in true wetlands, and the spice bush is one of them. For this reason, the state considers spice bush an Obligate Wetland Species. Because of the environmental importance and fragility of wetland areas, acquiring building permission on them is almost impossible. Auditors will use the presence of obligate species to determine if a spot is wetland.

Fig 32: This spicebush had some lingering berries. I did not try to eat them. The leaves themselves are oblong-ish, but not obvious. Do not pick too many of the them! The plant needs its leaves to survive!

Vines and Ground Cover

I have never suffered a poison ivy rash in my life, and I managed to keep it that way even as I waded through a field of the stuff (Fig. 33, next page).

Fig 33: Across the stream was a carpet of green life.

Fig 34: The scourge of the playground! Some leaves had notches like these, but others were smooth.

Can you name a more iconic arrangement of leaves (Fig. 34)? Like most vining plants, Poison Ivy's primary objective is to climb to a high place like a tree canopy in order maximize light intake and disperse its seeds. Poison ivy might look meek when it is forced to slither along the forest floor, but once it finds a good tree to climb it will transform, producing a gnarly woody vine covered in thick hair in order to aggressively ascend and hold onto the trunk of its victim (Fig. 35). The hairs are not roots—poison ivy is not a parasite, but the perilous weight of these mature vines with all their leaves can make a huge difference for a tree during a windstorm. Poison ivy gets a bad rap, though. Despite the capacity to harm us humans, poison ivy berries, which are produced in immense quantities, provide an invaluable source of nutrients to migratory birds. The leaves of this vine are also responsible for some of New England's most striking reds during the fall (I wish I snagged I picture!).

Fig 35: This turgid mass of hair is poison ivy clinging to a maple trunk.

Not all of the ground cover in my field site is terrifying. Virginia Creeper, a star-shaped crawler, was just as abundant as poison ivy, but it is safe to touch (Fig. 36). Patches of White Wood Asters also stood out in the underbrush. Asters were the only blooming flower I observed in Sachar

Fig 36: Virginia creeper snaking across the soil.

Woods during the late summer/early fall (Fig. 37). A few specimens of False Nettles rimmed the stream on my first visit, but they seemed to disappear quickly (Fig. 38). I was too afraid to test the truth of this plant's name. Once the leaves started to fall in abundance, my dense field of underbrush thinned and eventually disappeared entirely. However, life had not ceased entirely beneath the leafy graveyard. Returning to my field site after a thaw in mid-December, I noticed the leaves of Spotted Wintergreen poking out from beneath the litter. This adorable little plant is evergreen (Fig. 39).

Fig 37: The white wood aster is no pansy. These things stand upright and possess sharp leaves.

Fig 38: Unlike the stinging nettle, the tendrils of the false nettle apparently have no bite. I did not test that fact.

Fig 39: Even as the cold heart of New England's winter draws near, life persists beneath the facade of decay. This picture was taken in December!

Miscellaneous Plant Showcase: Simple but Ancient Plants

My field site once looked like something out of a fairy tale thanks to all this Duckweed. The blocked stream was engorged with the stuff. In a month or two the water began to flow again, and all of this green was gone.
Holden Caulfield would ask, "Where does [the duckweed] go?"

Cinnamon fern preparing to die for the winter.

Moss encrusting exposed stone. Mosses create their own micro-forests. It can be fun to kneel down and observe the world of insects.

Sporophytes emerging from tufts of gametophytes. The brown, spore bearing pods are called calyptra. Don't miss the speckles of lichen on the rock!

Before moving on to Sachar's animal life, I would like to dedicate this page in memorandum of this tragic specimen, the once mighty American Chestnut brought low by the ignorance of man.

These trees were once giants. A single one provided enough chestnuts to choke a few horses.

The blight brought to these chestnuts by a fungus from Asia at the start of the 20th century was deadly, but it doesn't always kill. This tree attempts to grow, reaches a certain height, dies to blight, only to try again. This results in the masses of dead branches you see here.

Wildlife of Sachar

Fig 40: A dagger moth caterpillar resting on my sitting rock. I have never seen such a striking caterpillar in all my time living in Massachusetts.

In four months' worth of visits, I saw little more than a few insects, squirrels, chipmunks, and birds populating my field sites. The only large mammal I ever saw up close around here was this skunk that came out strolling out of Sachar Woods near the Brandeis art studio. Let me tell you, I booked it! From a distance I have seen racoons and opossums slinking around, but, again, these were only on campus. I have managed to capture very few photographs of wildlife in all my time here. Thankfully, my professor's game camera was, for a time, attached to a tree just north of my wetland site. That camera caught everything from deer to coyotes, and I will be incorporating its photographs in this report. The presence of a stream and pond on my site should have allowed me to catch some frogs, but during my only warm month the stream was entirely dried up. No luck there! Flipping logs revealed ants, but no salamanders for me.

I did manage to capture some shots of a rare-looking caterpillar: a dagger moth tufted with lemon hued hairs (Fig. 40). I dared not touch it for fear that its fuzziness hid spines, and this was the correct move. Later that day, I learned that spiny caterpillars can cause quite the irritation. This bug showed no sign of movement as I observed it. I fear it might have been dead! Had it fallen from the canopy, or had it climbed atop my sitting stone in preparation to molt or pupate? Other insects were seen during my first three site visits, but sighting dropped to almost nothing afterwards. Ranging hornets, ants, and the dreaded mosquitos were creatures that constantly had to be avoided during this time (Fig. 41).

Fig 42: Photograph of a tufted titmouse by online photographer Chris Bosak. These 'miniature blue jays' could fit into the palm of your hand.

Birds certainly populated the canopy of my wetland site, but I couldn't see them. On one of my morning walks to the site I managed to spot a pair of blue jays which was a treat. Growing up, I loved to see a blue jay in my yard or on the way to the bus stop. They were a sign of good luck. My field site did not possess many low bushes or trees for smaller birds to flit between, but the path leading to the IBS building was loaded with them. I witnessed Chickadees and Tufted Titmouse flying between the branches and shrubs there increasingly as December came on (Fig. 42).

Fig 43: The dried maple leaf was stuck to my hickory leaf!

Looking through my photos, I do see one strange lifeform. While examining my hickory one day, I saw what appeared to be a fallen leaf dangling from another leaf. It stuck when I attempted to remove it, and then I noticed some silk fibers and a little green bug inside (Fig. 43). A closeup using my camera lens revealed what looked to be a cricket (Fig. 44). Did the grasshopper-like insect construct this leaf house, or was it merely trapped in some clever spider's lair? If this was the nest of a spider, did the spider purposefully weld the leaves together, or did the leaf happen to fall in a convenient way? Perhaps this is the work of some species of bagworm-like caterpillar that I do not recognize.

Fig 41: Photo courtesy of Eric Olson. The wasps would fly alone and low to the ground, scouting the forest floor.

Fig 44: It looks like a little green cricket, but crickets don't spin silk. Is this spider silk, or worm silk?

And now, the moment you have all been waiting for…

PRESENTING THE 2019 SACHAR GAME CAMERA SHOWCASE!!!

Thanks to our efforts to kill New England's natural wolf population over a hundred years ago, these bucks have few natural predators. Black bears and coyotes can't keep up.

A coyote lifting its head as if to howl. Unlike wolves, coyote howling sounds like baby screaming. Not a fun sound to hear at night!

I have had one too many encounters with Sachar's skunks during my time at Brandeis.

Red fox taking a sip.

The eastern grey squirrel is a common sight both in parks and suburbs and in Sachar. Their leafy nests can be seen lodged between branches throughout the winter.

Chipmunks always look scared.

A band of raccoons traversing the wetland like thieves.

This doe seems to know it is being watched…

Human Use Past and Present - Wetland

Sachar is presently used as a recreational conservation area. If this report is any indication, the Sachar also receives considerable attention from Brandeis's environmental studies department as a location for outings and projects. The buckthorn on my site had a blue tag wrapped around its trunk, but I never learned which class had marked it and why. Because of its use as a trail, the forest surrounding paths is heavily maintained. My wetland site is crisscrossed by logs with smooth bottoms, indicating cutting by chainsaw (Fig. 45). Paths in the lowlands tend to be surrounded by straight lines of displaced glacial till.

Fig 45: Smoothly cut logs like these are the product of branches and trunks that fell across the path during past storms. They attract a great variety of fungi.

Irresponsible adolescents and college students tend to employ the woods as a smoking and drinking spot as well as a trash can, but most of the rubbish (beer cans, shattered glass bottles, wrappers) are mostly contained to the upland ridges of the campfire spots. A friend of mine, Marissa Small, found a reusable bag of groceries filled with old containers in her wetland site neighboring my own. It was hidden in a crevice under a thick pile of leaves. Thankfully, my own site had no such litter, but it is a shame to see such wanton carelessness in one of the few easily accessed natural areas near Brandeis University. For pictures of trash, see my upland site version of this section.

Historically, Sachar Woods has seen considerable human reconfiguration. Before the Europeans came to cut everything down, Native American tribes populated Massachusetts. The most famous eastern Mass tribe from my schooling days was the Wampanoag tribe, but the group that most likely populated the Charles River (and therefore potentially Waltham) was the

Fig 46: This small line of stones crosses the eastern hill above my wetland site. More impressive walls can be seen further along the path past my field site. These structures are a colonial icon of New England.

titular Massachuset Tribe. White settlers eventually removed these persons and partitioned Waltham's land between agricultural and eventually industrial use. Waltham is nicknamed "The Watch City" because of its once famous watch factories, and the remains of these structures as well as old brick textile mills can be seen all along the Charles. A good portion of Sachar woods was at one point the property of one or multiple farmers/livestock keepers, evidenced by the existence of farmer's walls ranging across the hillsides (Fig. 46).

If the earliest colonists of the western Boston area constructed these walls, they could potentially be two hundred years old or older (of course, the glacial till that comprises them is hundreds of thousands of years old). The existence of these walls suggests that half or more of Sachar Woods was at one time clear cut for pastures. That means that almost all of the trees in Sachar Woods are a product of secondary succession. The remnants of American Chestnuts scattered throughout the woods, assuming these are growths from old stumps and not more recent attempts by humans at replanting, suggests that this succession could have occurred before the start of the 20th century. Regardless, Sachar is definitely not old growth. It would be a fun exercise to explore the forest in search of its oldest tree. I did not possess a core harvester during this project, so counting rings and calculating my own ages was beyond my scope.

Other parts of Sachar have grown much more recently. During one of my hikes I stumbled upon uncanny patches of asphalt in the middle of otherwise completely wooded terrain (Fig. 47). Perhaps a driveway, parking lot, or even another trail existed along Sachar's western edge at one point, but it is forgotten now. Sachar Woods is a palimpsest of geological and natural history with the latest wave of human mania

Fig 47: A dystopian image of the fall of modern man. Mosses and ivies are hard at work weathering this asphalt road. Who knows how many decades this has sat here?

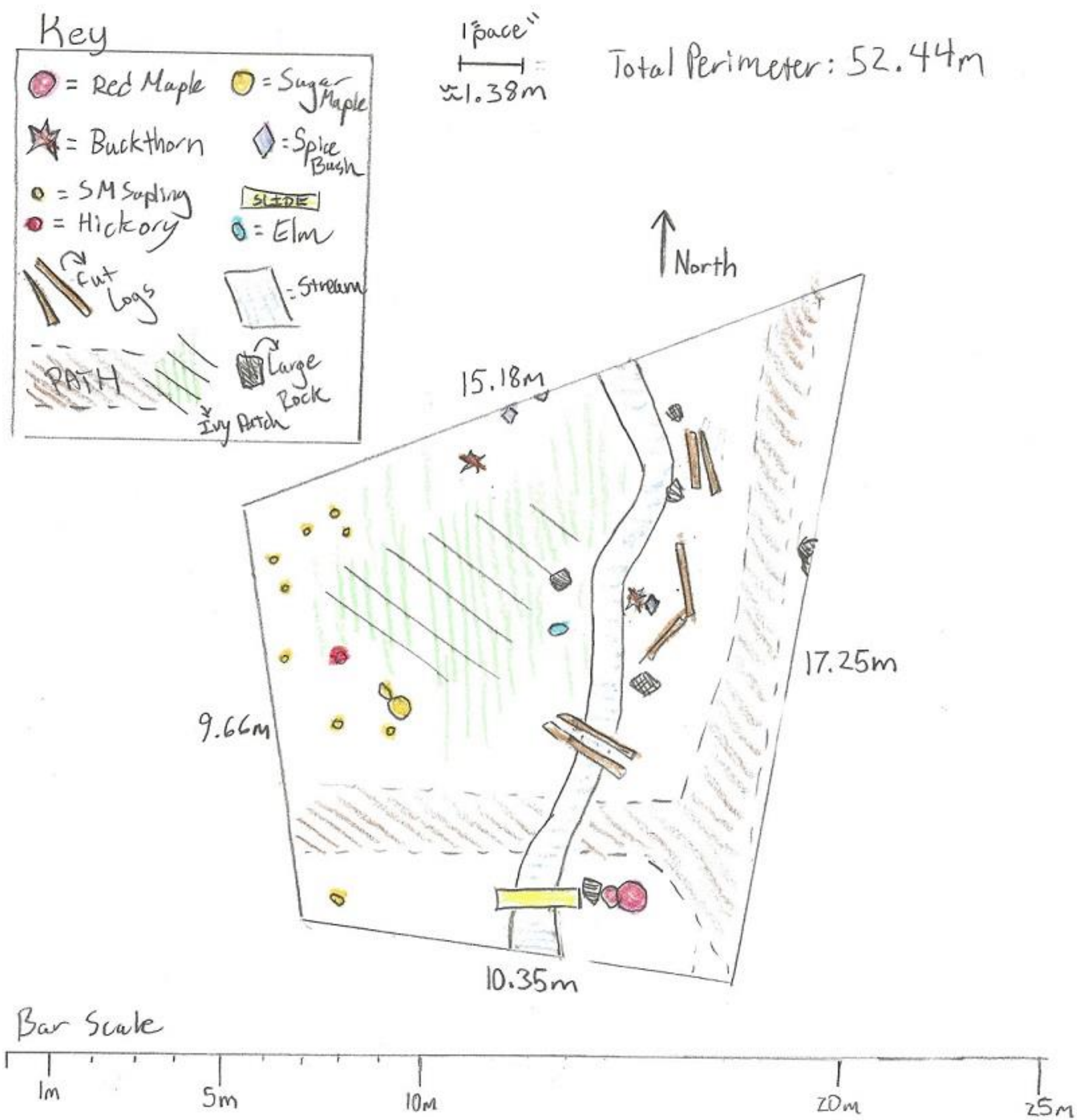
making up only a momentary chapter in the earthly timescale. Why pay for a museum when so much implied history can be accessed for free right outside Brandeis University?!

Ah yes, I almost forgot the slide. Its presence is perplexing. Did some kid drag it all the way out into the forest from his back yard? As far as litter goes, this object seems the most useful. Its bright yellow plastic is a good beacon for travelers. When the stream rages after a storm or thaw, that slide could save you from a pair of waterlogged boots when used as a bridge.

There are some wooden planks beneath the slide that sometimes act to damn the water when the pond’s level is low, but I do not know if this is an intentional feature in place to conserve the kettle hole in dry weather. I have been tempted in the past to remove it….

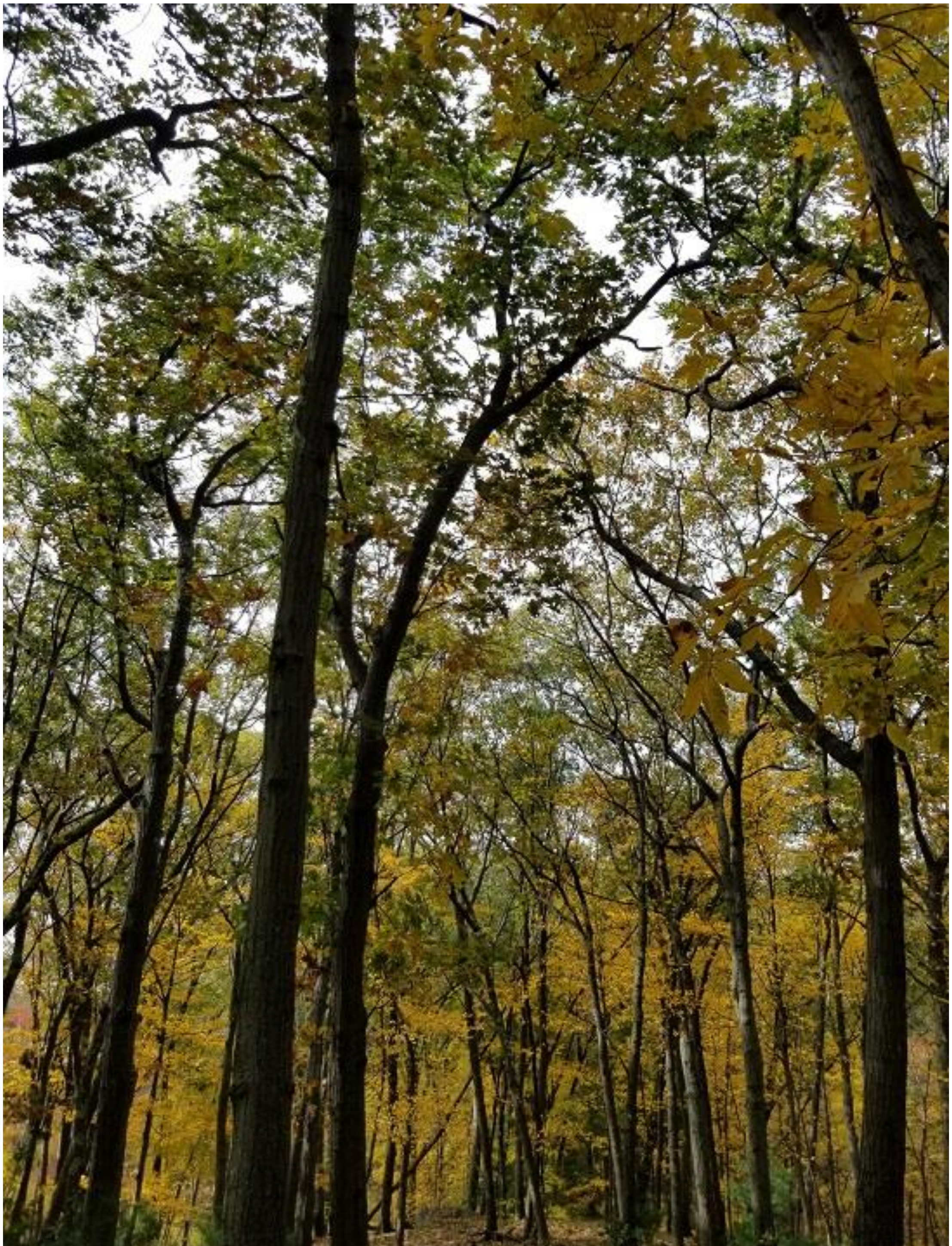
Pace and Compass Map – Wetland Site

Hand drawn. Measured with my own two feet!



Secondary site: Sachar Upland Hillside

The Oak Dominion



Just up the hill from my wetland site is a lofty place encrusted with granite and littered with glass. The trees are taller and more evenly spaced. I felt lonelier here. This is the upland, a homogenious land of oaks and sky.

Directions to Upland Site

Fig 48: Cedarwood Park in winter. Emerson was right; winter can be just as breathtaking as the warmer months if you know where to look.

For detailed instructions to reaching Sachar Woods, refer to the main directions on page 4 of this document. To reach my upland site, follow these directions to step 5. Climb the open hill between the oak trees (southwestern end of Cedarwood park) like in step 6, but instead of continuing straight down the backside of the hill, slow down and look to your left (Fig. 48). You should spot a smooth piece of bedrock erupting from the ground with some white pines behind it (Fig. 49). If you aren't sure if you have found the right rock, inspect its side. The name "Julia" should be spray-painted on it (Fig. 50). That is it! This rock and the slope surrounding it makes up my upland field site.

Fig 49: The smooth bedrock sits just before an incline. It should be the first exposed rock you see coming up the hill.

Fig 50: This defacement of the veritable Dedham Granite is helpful for navigation. Hopefully the paint doesn't fade too quickly, lest this field guide date itself.

Sachar Geology – Upland Edition

For a detailed history of Waltham's bedrock formation and glacial geology, refer to the previous segment on geology starting at page 8. The story does not change when you walk uphill.

The fact that hills exist at all in Waltham at all is a testament to how hardy its bedrock is. These hills fought the crushing onslaught of a couple million years' worth of glaciation. That said, the granite did not escape this battle unscathed. If the idea of glaciers roving across the landscape sounds somehow unreal to you, the exposed rocks bear scars as proof (Fig. 51). Glacial Striations are generally uniform across all affected rock surfaces in an area: the grooves run parallel and generally north to south. The striations on my upland site's bedrock are not the most striking glacial cuts, but the direction checks out. Notice also how smooth and rounded this rock is. Only a couple hundred tons of ice could do that naturally. Unlike my wetland site, the hillside is not too saturated with till, but it isn't devoid either. The soil is still rocky as ever (Fig. 52).

Fig 51: The glacial scars rib the exposed bedrock conically.

Fig 52: Sifting through the upland dirt revealed that glacial soil will always be glacial soil, regardless of elevation. The first pilgrims must have had nightmares about this stuff.

Soil – Upland Edition

Fig 53: Check it out, I managed to capture striation in my upland soil! Unfortunately, the angle of the sun during this afternoon was not optimal for high-contrast color photography.

Digging for a good-looking soil cross section was much easier on the hillside than down in the wetland. The color was much more diverse as well, and this time I managed to observe striation (Fig. 53). I suspect better soil drainage and the steep angle of attack that the slope offered me contributed to my success. As a result, the sketch I crafted from my upland dig is much more accurate to reality (Fig. 54). The soil actually lightened as depth increased. The organic matter rich topsoil was almost black or grey while the clay-like interior was almost orange at places. In the final layer, the colors darkened again.

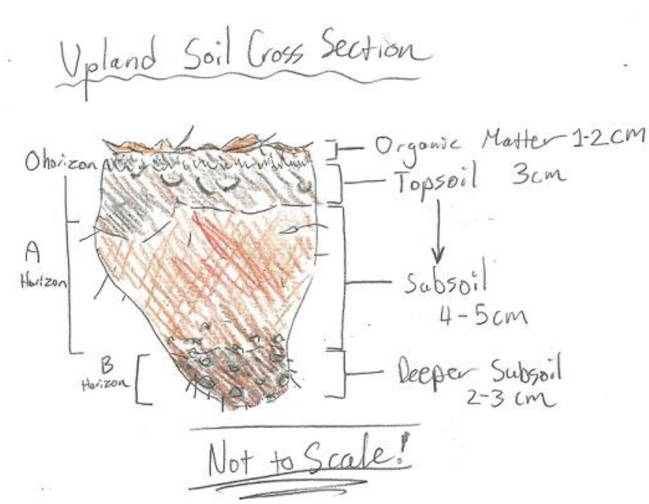


Fig 54: Unlike the last sketch, I labeled the "horizons" in this one. The difference between topsoil and subsoil vexed me, but at least I could see the layers at all.

Surprisingly, my soil test here came out to the same pH as in my wetland (Fig. 55, next page). The gargantuan number of fallen oak leaves is likely a big contributor to this acidity. I

Fig 55: This photo makes the green of the tab look lighter than it was.

literally had to wade through them as I scaled the slope in search of good digging spots (Fig. 56). As usual, for an overview of soil composition and the effects of acidity, see my original write up starting on page 15. There, I speculate about how Sachar is able to sustain so much plant life with such acidic soils. To add to that discussion, I would like to bring up worms (Fig. 57). This little guy was unearthed during one of my test digs. I recall bags of dirt in my local garden supply store boasting about “worm castings”. Indeed, worms will devour decaying organic material in soil and then *generate waste*, releasing some transformed nutrients back into the earth. Dead worms must be even better! 4.5 sounds a little too acidic to me, but evidently the little guys were still capable of working hard to keep the dirt and the forest thriving.

Fig 57: I am glad I didn’t cut him in half.

Fig 56: The Ultimate Leaf Pile…

While we are on the topic of soil aids, I realize that I have yet to showcase the great variety of mushrooms that I observed over the course of this project. This year’s autumn rains must have provided a major boon to fungal reproduction! Before undertaking this report, I had never seen so many beautiful and diverse shrooms. Here are a few of them:

Sachar Mushroom Showcase

Plant Community – Upland

Plant list:

COMMON NAME	LATIN NAME	FAMILY NAME
Trees	~~~	~~~
Northern Red Oak	*Quercus rubra*	Fagaceae
Eastern White Pine	*Pinus Strobus*	Pinaceae
Shagbark Hickory	*Carya ovata*	Juglandaceae
Other	~~~	~~~
Indian Pipe	*Monotropa uniflora*	Ericaceae
White Wood Aster	*Eurybia divaricata*	Asteraceae
More Moss!	*?!?*	*!!!*

Sachar Woods is not a particularly diverse forest, and its hills are a testament to that fact. Pretty much every tree on my field site is a Northern Red Oak (aptly nicknamed the Champion Oak). Some of the oaks in Sachar might be White Oaks, but their barks are so similar. Oak leaves are also so variable that IDing the different subspecies can be a major pain. Just plucking twigs for examination was its own hurdle. The lowest branches were so high up that I wasted almost twenty minutes thrashing and jumping trying to scramble up the side of a tree. My ape brain eventually thought to grab a stick and just bash the lower branches until I got something, and this plan proved fruitful (Fig. 58). Thankfully, the northern red oak is both one of the most common forest oaks in Massachusetts and one of the most distinctive skinned. Mature red oak bark is deeply fissured, but not shaggy (Fig. 59).

Fig 58: The field guide I was using for tree ID wanted to me inspect lobe depth… Each one was different!

Fig 59: The bark of northern red oak is marked by vertical fissures running the length of the trunk.

While I am on the subject of oaks, I would be remiss to forget that 2019 is a special year for the tree. Red oaks participate in a reproduction technique knows as masting. It is essentially a siege warfare technique; the trees will refrain from producing acorns for multiple years in order to starve out the insects, squirrels and birds that prey on them. Predator populations will ideally diminish during the acorn drought, so the sudden reintroduction of them should increase the likelihood of a couple of seeds making it to the sapling stage (we never really think of grubs as predators, huh?). The mechanism by which oaks coordinate these masts is completely unknown to me. Alas, I did not think to take a picture of this phenomenon, but the sidewalks were literally covered in crunchy acorn bits. The animal world must have been pleased this fall.

Fig 60: It would be a crime not to use a wintery picture for my only evergreen tree species, Eastern White Pine.

My upland site featured an iconic pine, the Eastern White Pine (Fig. 60). Despite its evergreen status, pine needles are not truly immortal. Needles will fall every two years, but because new needles are constantly growing, the tree is never bare. I payed particular attention to the bark on these trees. The base of the largest specimen was showing signs of mature bark while the rest of the tree was still quite smooth (Fig. 61). This project has taught me that tree bark is a very unreliable method of ID in trees that have yet to grow large.

Fig 61: The transition from smooth sapling skin mature, scaled bark appears to begin at the base of the tree.

Fig 62: Indian pipe looks more like a plant in death than in life.

Other than the oaks and a few pines, the flora of my upland site was not too exciting. There was one plant, however, that cannot go without mentioned. While digging for soil samples, I stumbled upon the dried remains of some Indian Pipe flowers (Fig. 62). In life, these plants are no less dead looking. They are a ghostly white, being one of the only plants to possess no chlorophyll. It can’t photosynthesize. This nefarious plant instead parasitizes the photosynthesis of other plants by intercepting the mycorrhizal connections between fungi and root tips. Highway robbery, but in a biologically fascination fashion!

Tranquility.

Wildlife of Sachar Cont.

Despite appearing more barren than my wetland site, my upland site actually revealed more large mammal activity. This is entirely thanks to the December snowfall. Imprinted in the snow where myriad markings and craters, but I was able to make out the tracks of deer and what I think is rabbit (Figures 63 and 64). The smaller speckles might be mice, but I have never seen a wild mouse scamper above the snow during winter.

Fig 63: The hooves of a game animal meandering across the wood. I have had venison jerky once, but I thought it was a little too tough (my hunter friend told me that was the point).

Fig. 64: Not perfect rabbit tracks. In fact, I would not be surprised if this isn't a rabbit at all, since it lacks the single-file back feet. Perhaps they were snowed over? The other speckles might be mice or chipmunk tracks.

Before the snowfall, I managed to see my first ever woodpecker. Many a morning in my grade school years did I awaken to the drum of the local woodpeckers, but I never saw one in person. My nostalgia was reawakened when, out of the corner of my eye, I spotted a red crested bird ascend a distant oak while I was inspecting my upland site. It flew off before I could hear it drum or snap a photograph, but thankfully the game camera captured variety of woodpecker called the Flicker (Fig. 65). Perhaps it is the same individual?

Fig 65: A flicker woodpecker featuring iconic red crested head and spotted body. Woody the Woodpecker's laugh is derived from this bird's manic call.

Only a few members of a hornet colony survive the winter: the batch of young queens. After maturing in their parental hive, the next generation of queens will seek out fallen logs on the forest floor to hibernate beneath. In the spring, they emerge and seek high ground in order to begin building their nest and laying workers. I did not find any queens myself, but a classmate did during one of our rainy outings. I have taken the liberty of stealing their plunder in the name of scientific completionism (Fig. 66)!

Finally, the acorns littering the crest of my upland site showed considerable wear. I did not see any grubs crawling around in them, but the signs of a struggle are apparent (Fig. 67). Something destroyed these acorns! Hopefully it wasn't just the boots of drunken teenagers. As a fun anecdote, a younger me once bit into an acorn that had been sitting on the ground. To my surprise, half of a grub was laying inside! I wonder where the other half went…

Fig 66: A hornet queen nestled within a log. We found salamanders too, but I failed to acquire pictures.

Fig 67: Torn up acorns could be seen littering the forest floor before the oak tide covered them. Not the other litter: all of that glass.

Human Use Cont.

For the big picture history lesson, see the original section on page 29. My upland site was a dump. If I had kids, they would not be allowed to play in the Sachar hills without a nice pair of boots on. The floor is not just littered with shards of glass—it is covered in finely ground grains. It is as if every miscreant in all of Waltham used my particular hill as their bottle-smashing spot (I suppose the exposed bedrock would be a good surface to smash stuff on). I found larger shards of glass beneath the leaf litter on the slope (Fig. 68). Beer cans and plastic attachments were also carelessly strewn about (Fig. 69).

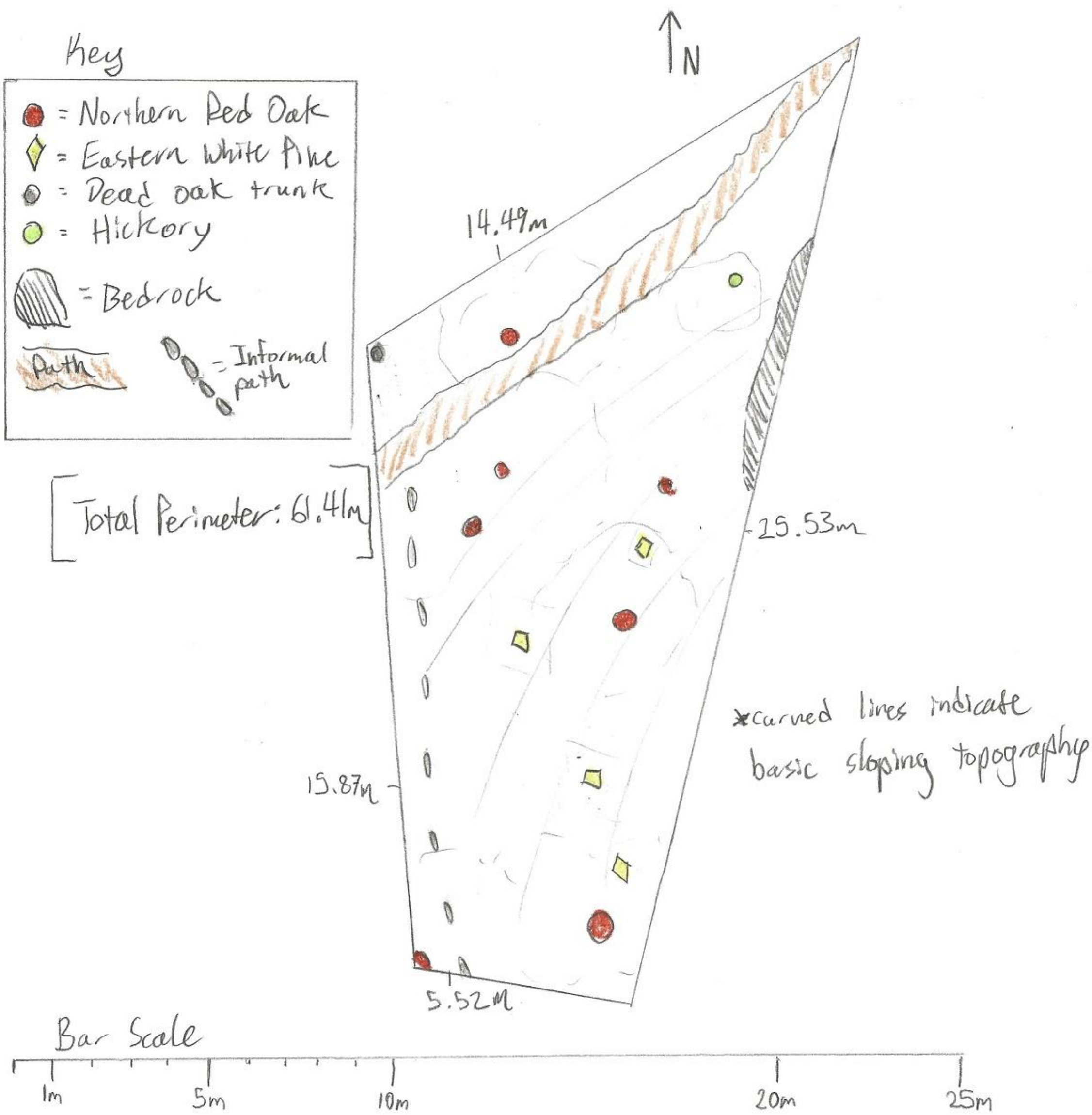
Fig 68: This deadly shard of glass was discovered lurking just beneath some oak leaves.

Fig 69: Sachar Woods is not a plastic and aluminum dump…

Cleaning the bottles and cans is easy enough, but I am unsure how trail maintainers would go about cleaning sprinkled glass. A vacuum? Fine tweezers and a comb? It is a shame that suburbanites would have so little regard for their natural spaces. Suburbia really is a problematic thing. The American suburb has nearly eliminated the concept of non-city public transportation in this country. The dependence on cars has made transitioning to less destructive forms of energy and transportation impossible lifestyle changes for most citizens. Meanwhile, spending three hours in gridlock highway transit makes our minds mushy and set our tempers on edge. Suburban kids are so fed up with the pessimism that they take to aggressive drug consumption in the only refuge they have—the local forest.

The world must be taught to love places like Sachar. These woods are suburbia's hope.

Pace and Compass Map – Upland Site



Part 2: The Journals

Writing Sachar Woods

The second component of this report is less formal. Over the course of these past four months, I documented my thoughts, feelings, and observations on Sachar. Most of these journals were written from my main field site, but I took creative liberties with a few of the entries.

This is not a perfect transcription of my notebook entries. Spelling errors and incomplete sentences have been corrected and improved for the sake of the field guide. Retrospective commentary has also been added and printed in *blue italic text*.

Though I lack the poeticism of a Thoreau, I hope to invoke at least a little bit of that American Renaissance, New England flair in these journals. It is my Massachusetts born duty.

Visit 1: Wetland

Sunday, Sept. 15

4:16 pm

~75°F

Mosquito Valley

I just *had* to pick a spot with mosquitos. They are swarming me already!

(Not even two lines in, and I stopped. The mosquitoes became too much, so I moved uphill to cool down and continue writing.)

Scratch that, I have moved considerably uphill, and am now looking over my field site from an upland vantage point. Before I left, I squashed a mosquito against this notebook page, and it left behind a nasty smear of blood (Fig. 1). I assume it is my blood? I will be itching tonight!

Fig 1: I smacked the pest right against my notebook, but he got the last laugh.

Perhaps this is a blessing. From my position I can examine both the wetland and the upland hillside at the same time (Fig. 2). The differences are stark. Up here, the oaks are king, but the wet terrain houses maples just as Eric demonstrated countless times in class. Both environments seem to have their fair share of beeches, but I have not attempted to ID them specifically yet. Perhaps they are actually black birches instead?

Fig 2: After retreating up the hill, I sat on this rock overlooking the valley. Hornets roved the cliffside.

The differences in undergrowth are pronounced as well. Up here, growing among the rocky outcrops are mostly mosses and small, thin plants sprouting through the leaf litter in patches. Near the wetland stream, on the other hand, is a carpet of ivy and other flowers/small leafage. What causes these differences? Soil quality? Access to water? Perhaps my field site is simply lucky, endowed with better light access than this uphill region. I did notice long rectangles of light from the blunted afternoon sun illuminating the ivy undergrowth. I will hopefully learn more in the coming weeks.

I suppose I should have started with a description of my site itself! Those pesky mosquitos! Anyway, my site is actually fairly easy to access. I pray it isn't overly popular. I have chosen the spot in Sachar Woods where the duck weed pond empties into a stream. It is marked by the plastic yellow slide.

I know this is an obvious spot, but it is just so darn interesting. It is a lowland stream cushioned between two hillsides. When I fled the mosquitos, I climbed the slope to the East/Northeast. The area surrounding the river is ripe with objects for consideration. Plenty of felled and rotting wood material (that may or may not be man-caused) litter the path, as well as a lot of till. The pond promises a chance at catching a toad, or maybe even some salamanders. I would like to try ad figure out why the stream access is blocked up. I remember damming up a local stream when I was a kid just for fun. Did some Waltham kids do this, or is there a serious environmental reason why the stream is limited? Would removing the dam kill the pond? I must resist the urge to perform a live experiment (Fig. 3)!

Fig 3: The duckweed pond was barely contained by a few planks. Removing them would have been cathartic, but I was hesitant to damage anything.

I have been out here for over an hour now. Small gnats are rising into the air beneath the canopy and dancing in the sunbeams. They have a whole world up there. The occasional airplane cuts through the din of insects and wind with their engine roar, but the worst sound has got the be the highway. I95 never stops!

This is all for today. I look forward to the fall colors. Only six days of summer remain.

Visit 2: Wetland

Sunday, Sept. 22

12:18 pm

~83°F

Heat Wave

Only two days of summer left, but it doesn't feel like it. The creak is all dried up, and most of the pond too. The duck weed clings to the soil like a strange sweat. There is still some moisture down there, I am sure, but things are drying quickly. The weekend heat wave hasn't deterred the mosquitoes, of course. We need a good frost, but I suppose I will have to wait until November for that.

I have come today to do some mapping. As the semester ramps up, I find I am strapped for time, so I won't be able to do much IDing today. The canopy has barely begun to turn so I should have time. Some flowers I noticed last visit have already disappeared though. Good thing I have pictures (Fig. 4)!

Fig 4: A field of hardy aster.

(The flowers I am referring to here are probably the white wood asters. The large patches of them quickly dwindled to a few rugged individuals after the first weeks of school.)

…

I just mapped the wetland. I attempted to eyeball a perfectly rectangular N-S perimeter while pacing, but it came out to be a trapezoid on paper. I guess that is why man invented the compass.

There are fewer trees in my zone than initially thought. Most are saplings attempting to persist against the established canopy. What a life to be born into, a sapling in a crowded forest. Like ambitious Shakespearian princes, these little plants sit hoping for a good hurricane to knock down their fathers so they can claim their inheritance in the sun. I wonder how many of these survive the winter? How long can a tree persist in its sapling phase before giving up? A morose subject, but it is much too hot to think happy thoughts.

Here is a list of today's discoveries:

- White flowers, still there after all
- Lots of poison ivy
- Sensitive ferns (I was wrong about this; it was a patch of cinnamon fern)
- Maybe sweet pepper bush (What was I going on about?!)
- Misc. undergrowth that I can't hope to ever identify
- Lots of moss

I haven't mapped all the fallen logs yet, but they are obviously man-cut. There are many trees besides the maples that I must eventually ID (Fig. 5)…

Fig 5: Maple trees are easy to ID. The others, not so much. In the background of this photo it is possible to make out the dried streambed in the background. Note also the intense sunlight. It was HOT.

Visit 3: Wetland

Thursday, Sept. 26

1:17 pm

~79°F

The Mysterious Worm

Fall has come. Sachar is taking on a yellow-tinge, and fresh leaf litter is already starting to pile up. I notice that much of the litter is oak. The maples, it seems, drop their leaves later. The sky is clear, but we might finally get a good rain soon if the forecast is to be trusted. I have a field trip later, so hopefully the clouds can hold off a little longer until after that.

I have found something crazy today: a caterpillar (or other worm-shaped insect) covered in shaggy, Heinz mustard yellow hair. It looks like a pipe cleaner. It doesn't move, but blowing on it brings out a slight reaction. I am afraid to touch it! A caterpillar would not be so bright if it wasn't packing some kind of poison. These hairs are probably spines (Fig. 6).

Fig 6: It looks angry. What purpose do the black eyebrow structures serve?

The stream is as bleak as ever. Perhaps it will not flow again until a winter thaw. There must be some moisture though, because the duckweed is still green as it simmers on the riverbed. How does duckweed work anyway? Does it flower? Does it have roots?

Well, time to ID some trees.

(At this point I had to run to a field trip, so I postponed further writing until the next day)

The following day, Sept. 27, 2019 (11:45):

I had to run to Fern Trip yesterday, so I have returned today to finish some business. A hawk is soaring invisibly overhead. I wish I could see him—I love how large birds catch the wind and seem to hover in the clouds. They are like kites. I know he is there because of his incessant calling. Maybe he is searching for somebody, a mate perhaps. Why would a hunter make so much noise otherwise? I wonder if his prey knows the sound of his call. Maybe he is attempting to scare some rodents into fleeing into the open.

There are many birds hopping about in the branches of the oak trees across from my site. I do not recognize the species. Some of them appear to be foraging. If I were so inclined, I could record their calls and attempt to match them with YouTube recordings, but I think that is a project for another time.

I did not googling last night and learned that the yellow caterpillar is called a Dagger Moth. It's final form looks nothing like the spiny worm of yesterday, of course.

Finally, it did indeed rain, but the drizzle did little to reinvigorate the stream. The bed is simply muddier now!

With October around the corner, I really should get to IDing these non-maples.

PS: The caterpillar is nowhere to be seen. I like to imagine it crawled off to prepare for a long winter of transformation.

Visit 4: Wetland

Saturday, Oct. 5

3:10 pm

~58°F

True Autumn

I greatly underestimated the changing season when I declared that the Fall had come in my last journal. I have grown up and lived in Massachusetts my whole life, but the typical New England unpredictability has duped me once again. We have had some impossibly hot weather in the intervening days. This weekend is feeling considerably cozier, however. We have had a steady wind accompanied by a tenuously blue sky. Some of the trees have finally exploded into color, but most have only brightened somewhat. I think artificially planted/ornamental trees have difficulty regulating their transition. The Sachar trees are largely uniform, a mild yellow, but the trees in the suburbs are flush. Perhaps those trees are less healthy, and so begin the process of leaf energy reclamation early. Regardless, I am excited to see this wood when the whole place has finally turned (Fig. 7).

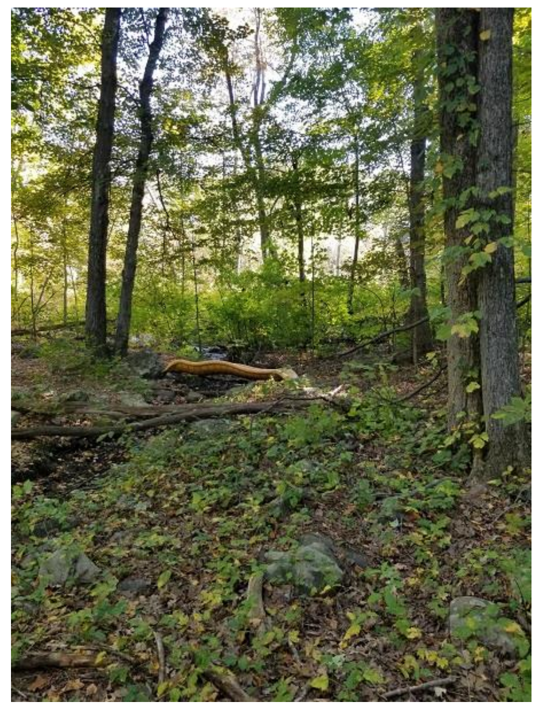


Fig 7: View from center of site, facing south. The ivy patch is beginning to thin as more leaves fall.

I am starting to love my field site. I have taken a few strolls through Sachar informally. Coming to Brandeis, I never would have imagined that the nearby public forest would become my favorite spot to unwind. Had I not taken this biology class on a whim, I might still be skulking around the common areas and dining halls.

I think blue jays are nesting near my field site, which makes me think they aren't migratory. They are currently hanging around here, anyway, as I saw some fluttering near the entrance to the forest a few weeks back, and just yesterday I saw another hopping between branches of the maple canopy above my site.

I have yet to talk about the rocks. Till lines the paths of Sachar and there is a stone farmers wall in view of the stream, along a hill. What does something like that say about the forest? Was this place once a farm or something? How old does that make these trees? I look at these towering maples and imagine that they are ancient, but I have to remind myself that a plant can only grow to its resources. I am sure there are many ancient trees in this forest that are stunted, living in the shadow of giant neighbors.

Enough idle hypothesizing. I need to wade through the ivy patch one more time and ID this hickory tree that has long evaded me. I also have a "beech" that I should probably verify as such (Fig. 8)..

(I don't know why I was so caught up on beeches being near my site. It was actually an elm tree!)

These trees are giving me a headache! Is this thing a hickory at all?

Pinnately compound, 5 leaflets, light hair, grey bark, toothed leaflets, and a taper near the base of each leaf…

(I did not yet know to check for smell.)

Fig. 8: View of site from path, facing north. Try to appreciate my confusion. I am an English major taking his first real science class since high school. This wave of plant life is anxiety inducing!

Visit 5: Wetland

Wednesday, Oct. 9

5:37 pm

~56°F

Storm Season

(Day 1:)

It is finally raining. I guess I deserve this. The canopy is not barren yet, however, and is doing a decent job of shielding me and my paper from the drizzle. I did not take the shortening days into account either. Already, the forest is taking on blue shadows, and the already dark sky is not helping one bit (Fig. 9). One observation: the leaves of the trees around the pond have quite turned, but the trees deeper in the forest remain mostly green with a yellow tinge. I am still stressed though; I can't decide what trees these are! What I thought was a hickory is actually a green ash, or at least some kind of ash.

Fig 9: A shot of the foreboding canopy as the sky darkens.

(My uncertainty must have been messing with my head. I was right the first time—it was a hickory!)

We lost sunlight and had to abscond. Of course, I came with a friend of mine and ended up helping her with her IDing rather than worrying about my own site. Her spot is just north of mine, but the terrain is much more treacherous. The stream opens up into a kind of marshland filled with boulders and downed logs. We had to perform some acrobatics to get to her leaves, but the work seemed unnecessary. She has the same maples as me! That is, besides a few low to the ground Norway Maples. We checked their branches and sure enough, they exuded white sap.

Oh no, I get the sense that I am running out of time.

…

Visit 5, day 2! (5:40pm)

I have returned for more. I could not suffer to leave so much business unfinished, so with what little light I have I am going to finish this IDing once and for all.

Item 1: IT WAS A HICKORY! Olson showed us some samples in class, thank god. It's a shagbark, it seems. It smells the same, anyway. I also squared away the maple trees.

Toothed maple = likely red (check for latex)

Smooth edge = likely sugar

Item 2: I am investigating a tree along the eastern edge of the stream with a spicebush beneath it. Marissa suggested that it is an apple tree. I think the leaves are too tiny for that. A blue plastic ribbon is tied around its trunk. Is that a Brandeis thing? My current ID track says nannyberry, of the blackhaws and arrow woods.

(Referring to the buckthorn)

Item 3: The one next to it is a saw-toothed elm tree. I should have known.

(Referring to the tree that I thought was a beech.)

Business concluded for the most part, and with no light to spare.

Visit 6: Wetland and Upland

Thursday, Oct. 17

10:05 pm

~52°F

Aftermath

It is the morning after the torrent. Last night was the storm we have been waiting for! Howling winds, rending sheets of water. I could see the trees swaying violently from my dorm, and it terrified me because I still have a few oaks and such to ID in my upland site.

On my way to the upland this morning, I passed through my wetland site. The stream, which has been stagnant all month, is gorged and flowing rapidly again. The icy patch is now filled with golden maple leaves, and downed branches are everywhere. Last time it rained I got to see a lot of mushrooms, but I do not notice nay this time. Perhaps they have yet to push through the new round of leaf litter, or perhaps the storm was too aggressive. There is some fresh shelf fungus on some of the newly fallen wood, though.

It’s autumn alright. The canopy is golden with touches of red. I have come to assume that most of these trees are sugar maples. Their twigs did not exude latex.

In past visits I noted much animal activity: chipmunks and squirrels scurrying across logs and up trunks. Today, all is quiet. I hear no birdsong or chirping; only a strong breeze and highway sounds remain. This place smells like rain. How do you describe that? Rain smell is unique, like wet dog but not unpleasant. Well, it is time to check the upland damage. On the bright side, I have not encountered a single mosquito. In that sense, *a truly beautiful morning!*

…

I am at my upland site now. It is much colder up here, and the wind is cutting into my hands. Writing sucks when you can’t feel where your hand is. IDing trees up here is super annoying because the intact branches (all of the branches, really) are out of my reach.

I think I have these oaks pinned. Northern Red Oaks. Wikipedia calls them “Champion Oaks”. They possess seven lobes with sharp tips, three lobes to a side. Glossy without hair. Alternate. The leaf stems are bright red and yellow.

The bark is the real giveaway. It looks like shagbark. Rifts run all the way up and down them. The crazy thing is, every single oak in this forest has this exact same design (Fig. 10).

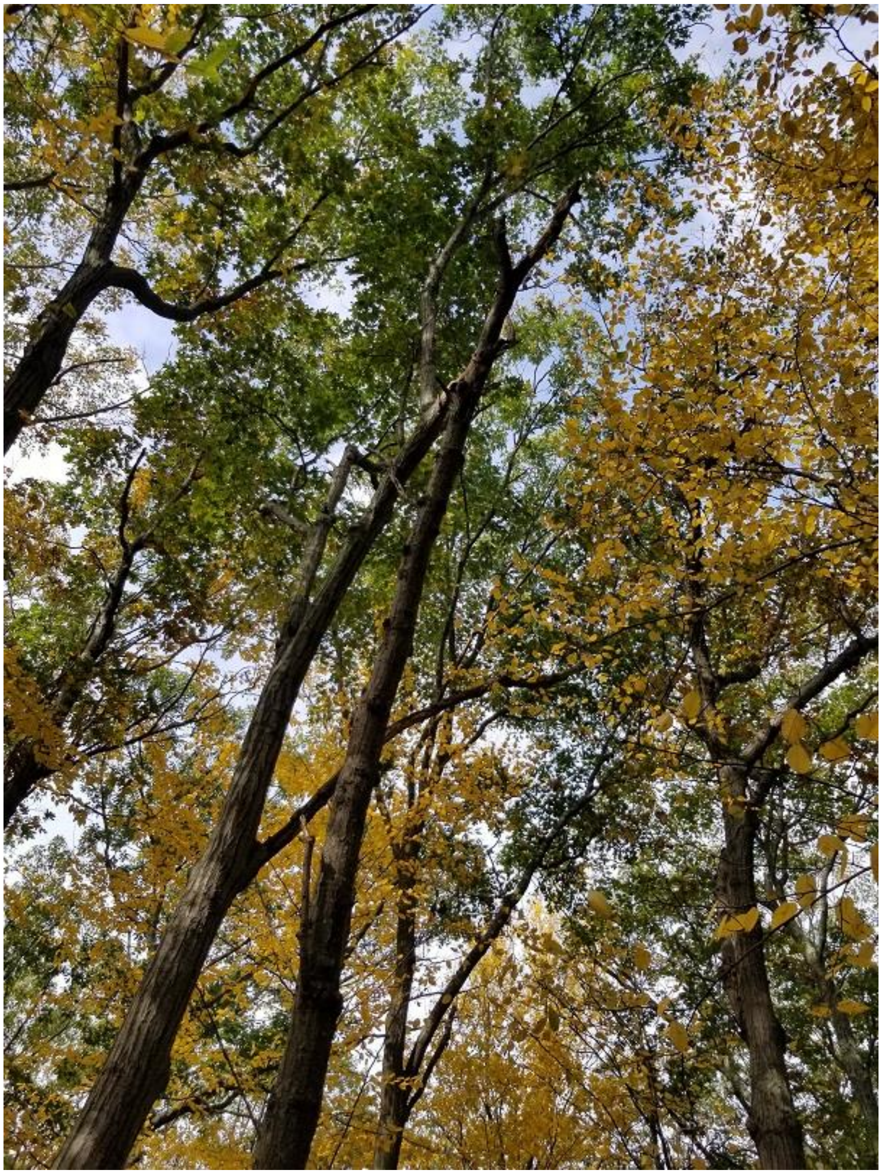


Fig 10: Looking upward at the oaks. This image shows off the iconic bark pretty well.

Interlude Visit: Sachar's Upper Campsite (stump seats)

Sunday, November. 10

11:20 pm

~40°F, surprisingly warm

Fire Night

(My friends and I got into some mischief. The proceedings were quite exciting, so this entry was written after the fact.)

A couple of days ago we had the most insane field bio class ever. Olson took us down to the Charles to do some fishing, which was incredibly fun in its own right. As we were wrapping up, however, one of my classmates rounds the hill carrying the largest largemouth bass I have ever seen, and I come from a family of casual freshwater fishermen. My uncles have pictures hanging up on their walls of the large bass they have caught, and this thing was bigger. Before we know what the think, our professor had carried the monster fish behind a tree and started hacking away at it, severing its spine and slicing off a fillet. The sky threatens to start raining, so he scrambled under a tree to light a portable burner. He sets the burner up with a pan holder and begins to fry the bass with butter and salt.

Oh my god, it was delicious. Without a doubt the freshest fish I have ever eaten in my life. I was hooked, I needed to cook something outdoors again before the snows and freezing winds put an end to camping season altogether. I managed to convince a couple of friends to come out to Sachar with me later that weekend and try a hand at out own cooking. The day before, I drove home to say hi to my mom and steal her caste iron skillet, some plates, a pair of tongs, and a packet of bacon. Once I filled up an emergency bottle of water, everything was set and ready to go. Fire Night was happening (Fig. 11).

Fig 11: Fire night went off without a hitch!

I had scouted Sachar's campfire pits in past hiking trips throughout October. One has chairs, the other has stumps. The one with the chairs is more desirable, but it is further downhill and therefor rather dangerous to navigate to in the darkness. My friends and I circled around the IBS building and made it down leaf-covered path with zero casualties.

I will admit that we weren't very professional about our campfire making. We did take safety precautions: we cleared a three-foot radius around the campfire, we had our water bottles at the ready (in hindsight, what could that have done against a blaze?).

The leaves and sticks were still a little damp from recent drizzles, so we used a stack of school newspapers to get things going. We managed to use of the rocks around the fire ring as a stovetop for the skillet, half of which was immersed in embers. It didn't cook evenly, but the iron got hot enough to produce some crispy bacon. Although the moon wasn't full, the sky was clear, and we were able to see the surrounding wood pretty easily. The intrusive highway noises were eclipsed by the warm crackling of the fire.

We were content (Fig. 12). Best Sunday I've ever had!

Fig 12: A happy man and his fire. The art of fire making is probably our oldest pastime. Thousands of years ago, humanity was doing just as we were then: cooking delicious meat and basking in the glow of a warm campfire.

Visit 7: Wetland

Friday, Nov. 15

2:01 pm

~51°F

The Dirt

It has been almost a month since my last formal field site journal, but I have visited Sachar many times in between. I saw the wood shift from a golden paradise to a brown, scraggly waste. This place is great! The trails are smooth and navigable, the elevation shifts are dynamic without being daunting, and, until recently, the canopy acted as a good cover from these insistent late autumn drizzles. We have made good use of the campsites as well. As someone that doesn't camp nearly as much as he should, I must say that that bacon was delicious. So much better than that turkey substitute they force us to eat in the dining halls.

I have just gotten through sampling the soil at both of my sites. It has been so cold and wet recently that I was beginning to panic. My professor warned us against using wet dirt for our cross sections. I feared that autumn had left early. We even had some mild flurries the other day! It has been bitterly cold, but thankfully the trend of 20 below weather earlier in the week has subsided. The world has been given a chance to dry, perhaps for the last time until March (although, this IS New England I am talking about…). I started today wearing gloves, but I am beginning to think that even my winter jacket is too much.

Soil digging in my upland site was surprisingly easy. I got some good stratification, but the pH of 4.5 concerned me. My wetland site gave me a lot of trouble. I can barely get the shovel down a few inches before snagging a root or boulder. Now that the creepers and ivy gave died, I am seeing more clearly just how rocky this place is. It seems more till than earth! I am sure the glaciers drove right on through this place, depositing rocks with thoughtless abandon. The pond that feeds my stream is probably a kettle hole, and the wet depression that the stream runs to is probably the same. What is this whole valley is one big kettle hole? Are the hills really hills, or boulders that have been covered with dirt? That is an interesting theory.

In contrast to the buzzing and chittering forest of September, very little active wildlife is making itself known now. I thought I heard a crow above me but looking up I only saw some brown bird. It was a noisy thing that I couldn't quite make out, but it flew off pretty quickly (Fig. 13).

The stream is still going. It is hard to imagine that I thought it was gone for good! I regret not finding any amphibians. Other students must be scrambling to complete their projects as well; I have seen some other classmates wandering the paths around here.

Fig 13: The bird gave me a good reason to look up and admire the barren canopy.

Visit 8: Wetland

Saturday, Nov. 30

10:24 pm

~26°F

Highway and Stars

The sky is clear. A light wind ensures that my hands won't remain warm for long. Unfortunately, I have to remove my gloves to write.

Yes, it is 10:30. I nearly forgot to do my last November site visit, but I couldn't make it back to campus until the afternoon. I meant to go in the dwindling daylight but, well, oops! The sun sets at 4:30 these days. The students that waited until now to do their soil sampling and mapping must be kicking themselves. For once in my life, I have been prompt. No matter, coming here so late is a treat.

Am I nervous? Only a little. I have spotted skunks on campus on three separate occasions, and I sure as hell don't want to stumble upon one here. What would a skunk have to do with me anyway? They are probably sleeping. Do skunks hibernate? I have no idea.

The thing that strikes me most about Sachar at night is how loud it is. The nighttime peepers and insects are gone, but the cars sound almost magnified. The highway is the worst. I don't remember if it was this loud before, but without visual stimuli it is all I can focus on. Three airplanes have flown overhead already. I can hear the creak too, trickling away beneath a thin layer of ice.

When I turn off my flashlight, my eyes adjust, and I can make out the shapes of trees and rocks. In the distance, IBS, a suburban home, and the distant ambience of the parking lot are all visible (Fig. 14). Still, no signs of life.

The moon is crescent. Waxing, I think. When I look at it, it brightens, and even a few stars penetrate the light

Fig 14: The night is rarely ever truly dark in Suburbia.

pollution. I am almost done, aren't I? I hope I can find the time to come back here next semester. All of my friends are going abroad, but Sachar won't be going anywhere!

Alright, enough of this. My hands are freezing. Next week, we might get a snowstorm!

Visit 9: Wetland and Upland

Monday, Dec. 2

3:40 pm

~56°F

Snowfall

I almost got stuck in Cambridge last night. I grabbed an Uber, but the driver got himself stuck in the snowfall at least twice. Thankfully, this kind of car-destroying snow is the perfect consistency for snowballs, snowmen, and general merrymaking. It is wet and packable. It also should have been the ideal snow for a snow day, but I suppose we can't have everything.

Crossing the stream in my wetland site is treacherous. The water level has only risen as autumn has advanced, and now the high waters are covered in a dubious layer of slushy ice. The slide is still a viable bridge I suppose, but the wooden boards that I prefer to walk on seems submerged. The preexisting footprints guided me (Fig. 15). Footprints are the theme of today; alongside human tracks I have spotted a variety of animals including rabbit and deer. I am sure if I trekked across the whole of Sachar, I might be able to find other tracks. It occurs to me that this is the most wildlife action I have seen all semester. Most of the tracks were caught while climbing the hill to my upland site. My pine trees are looking lovely and festive, especially today (Fig. 16).

Fig 15: The perils of past humans ensured my own safe passage.

The good thing about all this snow is that it covers all the ugly things up. The litter is magically made invisible beneath a veneer of snow. When thinking about the environment however, it is important to always remember that invisibility does not equate nonexistence. So many problems in the world are things that the average American will never see. The plastic island in the Pacific, global warming, the widespread wildfire epidemic, to name a few. It is too easy to ignore what cannot be seen.

Fig 16: The outstretched hand of a snowy eastern white pine.

I suppose I ought to use this journal to reflect. It is, after all, my last one ever. But what to write that has not already been written? I guess I wish I saw a flying squirrel this semester. That would have been super cool.

I don't think there is a way to satisfactorily end a project this long. Let's go make some hot chocolate!