

A compromise between clear skies and the forested
landscape: Assessing the diversity and size of trees in
the proposed Astronomy clearing site at the
MacLeish Field Station, West Whately,
Massachusetts

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May 8, 2009

Abstract

The MacLeish field station in West Whately, Massachusetts represents over 200-acres of forested land that is part of one of the largest contiguous areas of forested land in the state of Massachusetts. The field station represents a living laboratory for students and professors at Smith College and the larger five-college area. The Smith College Observatory on the site has remained unused since 1994, but remains part of a long heritage of women in science and the spirit of exposing undergraduates to research experience. As awareness of the field station has grown the astronomy department has expressed interest in reopening the observatory. In order to get full use out of the observatory the removal of trees that have grown up in the interim is necessary to open up the view of the sky. Using three transects this study examined the diversity and sizes of the trees located on the proposed clearing site. Our research surveyed 220 trees and found a total of 15 species and 10 different genera over a wide range of size classes. The largest trees on the site (DBH > 40.0 cm) were also surveyed over the entire study plot. Additionally, this study documented the existence of a vernal pool located on the site. GIS data was used to map the study plot, transects, largest trees, a stream that runs through the site, and the location of the vernal pool. Our study encompassed several land management issues and represents a workable compromise between the interested departments. It is our hope that this research will be used in the land management plan for the area east of the observatory.

I. Introduction

History of the land

In 1962 Smith College purchased 180 acres of forested land in West Whately, Massachusetts to be used for the construction of a new observatory to replace the colleges on campus observatory that had recently been torn down in order to build Wright Hall (Letter from Smith College 1962). Since the 1800s the land had been used for sheep and cattle farming, which is evident from remaining pastures, stonewalls, and an old cattle pond that remains on the site (Bellemare).

The observatory was completed in 1964 and furnished with a state of the art 16-inch Cassegrain reflecting telescope. The observatory was designed to be a space where Smith and Five-College students could get hands on research experience in the astronomy field. Two structures were built on the site: the observatory, a circular brick building with an electrically operating revolving dome, and a small brick building, designed to be used as a dark room and reference room. At the time the observatory was built the

telescope was the only modern instrument in the valley. The elevation of 830 feet raised the telescope above the haze in the valley and the remote location removed the telescope from the light pollution of Northampton (Observatory nears completion 1963).

The observatory remained an important resource for the college for several decades; however the last entry in the logbook is recorded in 1994. When Smith built a rooftop observatory on top of McConnell the convenience of an on campus observatory essentially put an end to the Astronomy department's use of the Whately Observatory. While the Whately observatory had proven ideal for viewing the sky because of the lack of light pollution the remote location proved to be too far from campus to be useful. As University of Massachusetts Astronomy Professor Michael Skrutskie put it, "The telescope was largely intended to be an undergraduate tool. It got students into the lab... Since then it [has] just faded away." Smith College Astronomy Professor Susan Edwards valued the convenience of the McConnell rooftop telescopes over the remote Whately location. Professor Edwards said that observing the sky from the roof of McConnell amid the city lights did not present a major disturbance "In Northampton you can't see things that are faint, but that's more than made up for by being able to use it every night and having a location that students can walk to (Too far to go to view the sky 2001)."

Up until 1994 when the observatory was last used, the area immediately around the observatory, an approximately 15-meter radius, was kept clear of trees that would obstruct the view of the telescope. Once the observatory fell out of use trees were allowed to grow and the area surrounding the observatory again reverted to a fully forested site. Currently, there are a mix of young saplings and large older trees that have been on the site since the 1940s and were not removed while the telescope was in use

(Bellemare). A small stream and vernal pool are present on the site just east of the observatory.

Dedication of the MacLeish Field Station

On May 3, 2008 the Whately property was dedicated as the Ada and Archibald MacLeish field station supported by a gift from former President Jill Ker Conway. The property currently encompasses over 200 acres of forested land. The area is on one of the largest contiguously forested areas in Massachusetts; Smith's 200 acres are abutted by the Franklin Land Trust and the land protected by the Department of Fish and Wildlife to the East and by the primary drinking water reservoir for Northampton to the West. Several departments have recognized the research and teaching potential of the site and plans for a system of trails, research plots, and outdoor classrooms are underway. The effort is largely interdisciplinary with students and faculty from landscape studies, environmental science and policy, biology, geology, exercise and sports studies, and Smith Outdoors becoming involved in the planning of the site. Already landscape studies students have begun designing a trail system under the guidance of Professor Reid Bertone-Johnson. Smith Outdoors and the exercise and sports studies Wilderness Skills class began using the area for orienteering this fall (Neurath 2009).

The MacLeish field station represents a "living laboratory" for students to research and explore the forested New England landscape. In the future, field station and Geology Professor Amy Rhodes, hopes to see development of long term environmental monitoring and permanent research plots. Currently on the site is a 70-foot tower equipped with sensors to measure ozone, carbon monoxide, and nitrous oxide. The tower also measures meteorological conditions such as wind speed and direction, air

temperature, pressure, and relative humidity. This equipment makes the MacLeish field station one of six AIRMAP sites across New England that collects air quality and climate data and that allows students to investigate the connections between the two (Rhodes 2009).

As the interest of different departments has grown surrounding the MacLeish field station members of the Astronomy department have investigated the reopening of the observatory. In recent years astronomy classes have brought portable telescopes up the surrounding fields to escape the effects of light pollution on the McConnell rooftop observatory. Professor James Lowenthal of the Astronomy department has cleaned up the observatory and confirmed that both the rotating dome and the telescope remain in working order. While the renewed interest of the department is somewhat contingent on funding for a modern telescope to replace the 1964 model, the department is anxious to provide a site for astronomy majors to do research away from Northampton lights. The department has requested the clearing of trees in order to expand the view of the sky. In order of preference the department has requested the eastern, southern, northern, and western horizons be cleared to the neighboring fields (Lowenthal 2009).

Perspectives on Land Use

Given the diverse interests in the MacLeish field station several concerns exist surrounding the clearing of trees around the observatory site. The observatory is one of the first visible parts of the property and several Professors spoke with us about the importance of maintaining the entrance of the field station as a forested area. Professor Reid Bertone-Johnson of the landscape studies department spoke with us about the importance of preserving a forested view for neighbors whose property abuts the field

station to the South. Additionally, Professor Bertone-Johnson added that because of the rise in elevation to the North and West clearing trees along those horizons would not add appreciable amounts of sky for the observatory. Professor Bertone-Johnson states that for these reasons the landscape studies department would not consider clearing trees to the South, North, or West. He added that selective clearing to the East, the Astronomy department's first priority, would be a possibility to improve the usefulness of the observatory and increase the amount of sky viewable from the observatory (Bertone-Johnson 2009). The geology, biology, and environmental science and policy departments have expressed concerns about the loss of tree species diversity, the loss of habitat space, and an increase in erosion and the release of nutrients into the stream and vernal pool (Rhodes 2009). Each of these concerns must be considered in the plan for the area around the observatory.

The vernal pool remains one of the most important considerations for the site because of its importance as breeding and nursery grounds for amphibians, insects, and crustaceans. Vernal pools are ephemeral wetlands that become completely dry over the summer months but provide essential habitat to a diverse group of species (Kenney and Burne 2000). The vernal pool was identified as we completed our study of the site. The pool is supplied by the stream on the site and was formed from an old cattle pond and is a breeding site for wood frogs and spotted salamanders. More work remains to be done to see if the hydro-period of the pool remains long enough for the pool to be an effective breeding site. Options surrounding the planning of the vernal pool will be discussed later in this paper.

Specific research objectives

The diversity of tree species on the MacLeish property and the location of ecologically sensitive regions remain largely unknown. With the recent interest in removing trees around the astronomy observatory our study assessed the diversity of tree species and the size distribution of these trees. Additionally, our study assessed the site for any ecologically sensitive areas that were located near the astronomy observatory that might suffer as a result of a loss of forest cover or through increased foot traffic to this area. Our assessment is an essential first step to determine if the clearing of trees around the observatory is in the best interest of the ecological community, the local ecosystem, and the Smith faculty and students that will be using the MacLeish field station for research.

II. Materials and Methods

Tree Sampling

Trees were sampled at the MacLeish Field Station in West Whately, Massachusetts on four separate afternoons in April. An eastern facing rectangular study plot was set up abutting the MacLeish observatory in order to assess the diversity and sizes of the trees present in consideration for cutting. The study plot was oriented towards the eastern horizon because the eastern horizon was the highest priority for clearing. The plot extended East from the observatory fence until the edge of a field 62 meters away and continued South 24 meters. The approximate area of the study plot was 3,500 square meters.

Three transects were set up within the boundaries of the plot. Transect 1 ran 180° South from the observatory fence and was 28 meters in length. Transect 2 was 150° South East and 62 meters in length. Transect 3 was 85° East and 62 meters in length.

The locations for transects were chosen using a compass and were selected in order to evenly divide the study plot into three sections. The perimeter of the study plot, the location of transects, and the path of the stream were each plotted using a 2001 series GPS Trimble GeoExplorer XM with 2-5 meter accuracy.

All trees taller than breast height and within arms width of either side of the transect line were included in the study. All of the trees that were included were identified to the species level and had the diameter at breast height measured to the nearest tenth of a centimeter (Appendix B). Trees with multiple trunks at breast height had each trunk measured and the separate diameters were added together. Trees were identified by twig and bark characteristics since spring leaves had not yet emerged. All of the trees in the study plot that had a DBH greater than 40.0 cm were additionally identified to the species level and had the diameter at breast height measured. All of the trees with a DBH greater than 40.0 cm also had their locations plotted (Appendix A).

Vernal Pool

The vernal pool was searched for evidence of species using the pool on the last day fieldwork was completed at the site. Individuals found to be using the pool were identified to the species level. The boundaries of the vernal pool were mapped with a GPS.

III. Results

Tree Data

A total of 220 trees comprising fifteen different species and ten different genera were sampled along the three transects. The most common species were sugar maple (*Acer saccharum*) (47%), white pine (*Pinus strobus*) (20%), and black birch (*Betula lenta*) (13%). The species alternate leafed dogwood (*Cornus alternifolia*), common apple

(*Malus sylvestris*), eastern hemlock (*Tsuga canadensis*), striped maple (*Acer pensylvanicum*), and yellow birch (*Betula alleghaniensis*) each only had one species present among the sampled trees. Also present among our sampled species were American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), grey birch (*Betula populifolia*), red maple (*Acer rubrum*), red oak (*Quercus rubra*), white ash (*Fraxinus americana*), and white birch (*Betula papyrifera*) (Fig. 1).

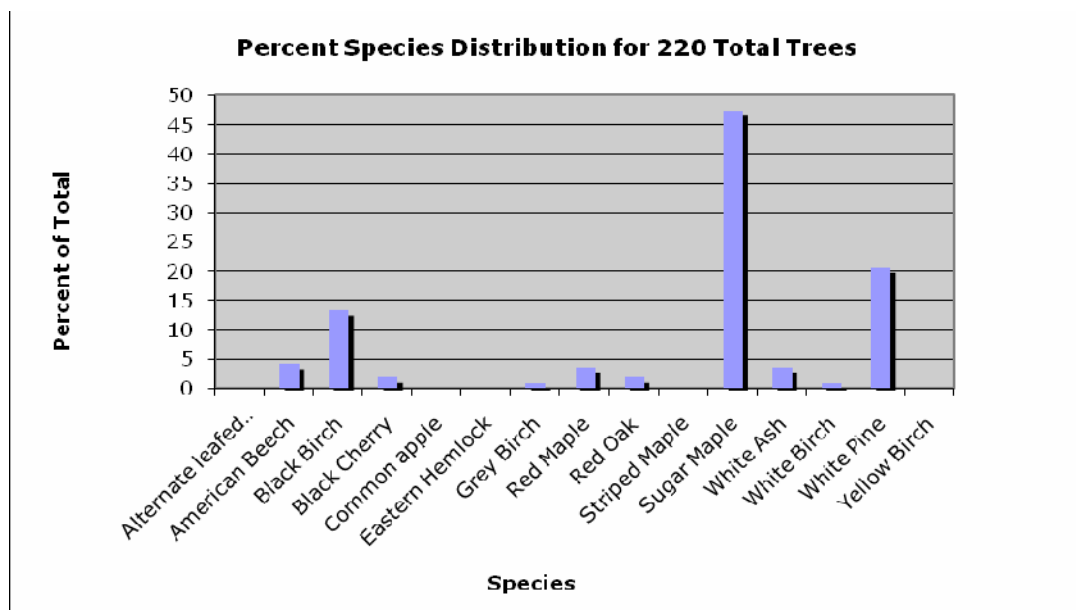


Figure 1. Species Diversity of Sampled Trees

For species with more than one sampled representative DBH values had a wide range of values. Looking at the three most abundant species sugar maples had an average DBH of 4.8 cm and a range of 0.8 cm DBH to 54.1 cm DBH, white pines had an average DBH of 7.6 cm and a range of 0.4 cm DBH to 48.1 cm DBH, and black birches had an average DBH of 9.7 cm and a range of 1.2 cm DBH to 40.0 cm DBH (Fig. 2, 3, & 4).

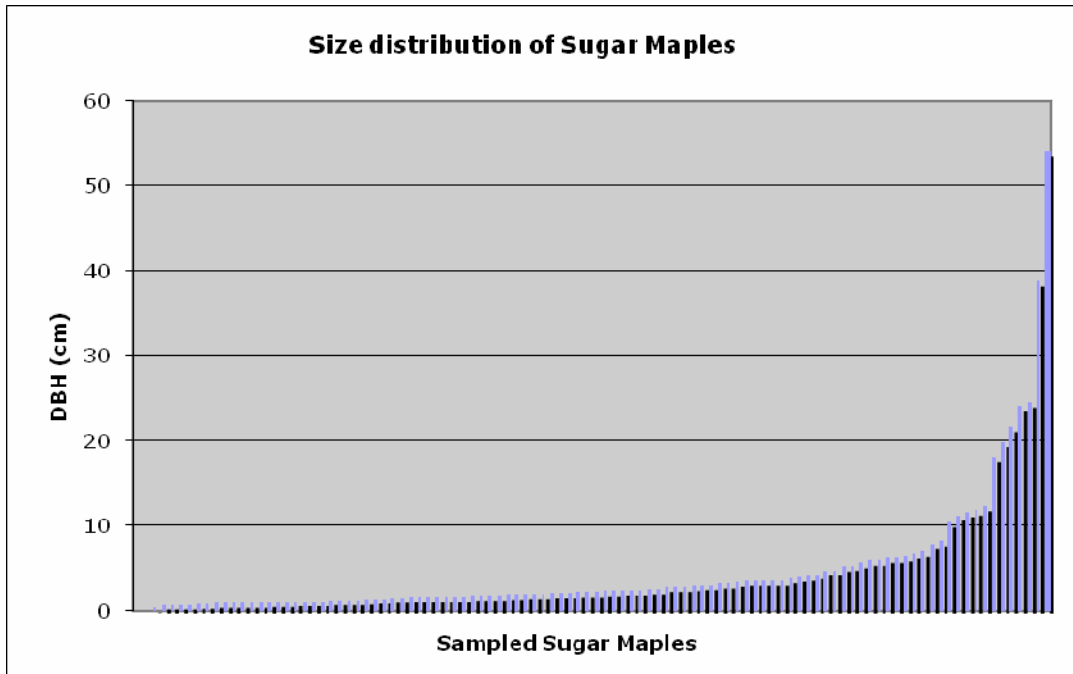


Figure 2. Distribution of DBH values for Sugar Maples

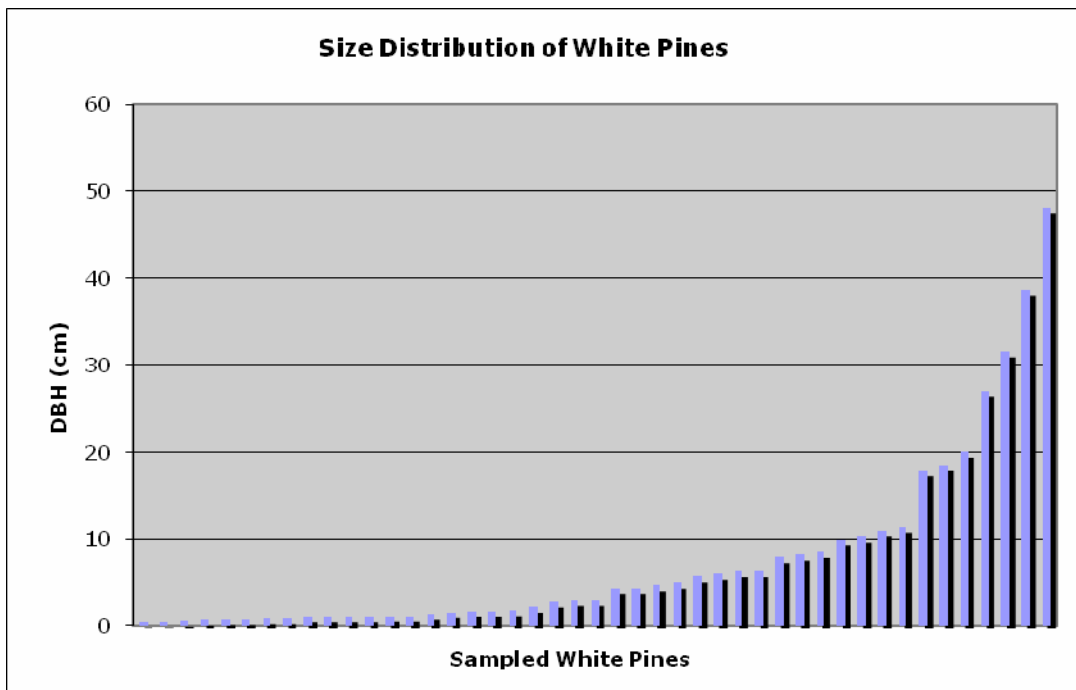


Figure 3. Distribution of DBH values for White Pine

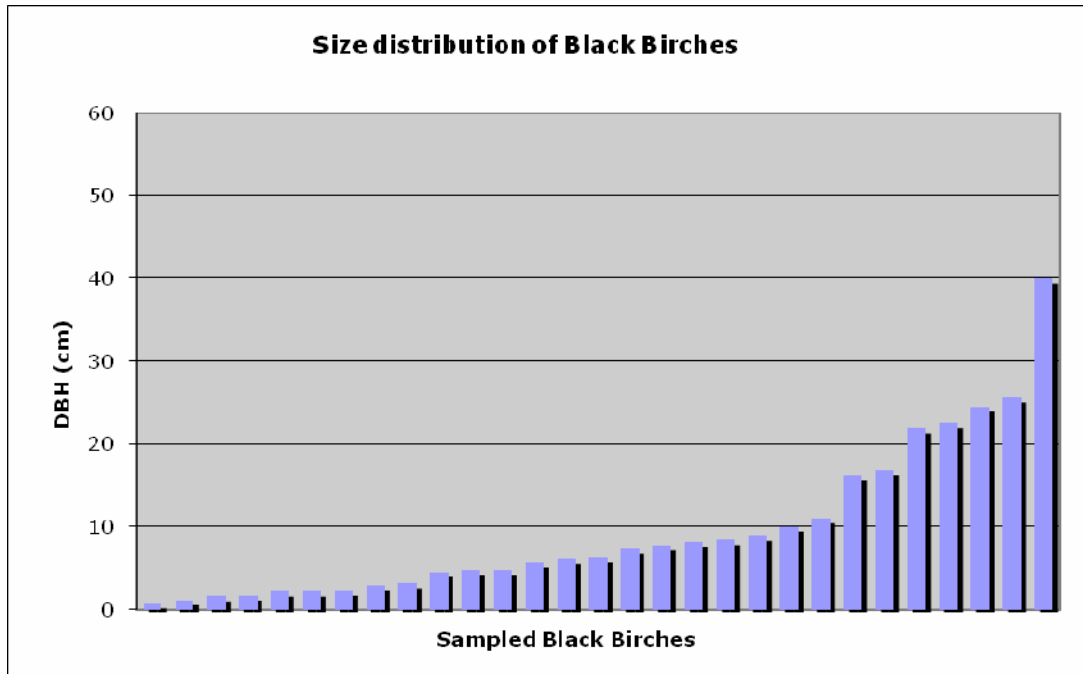


Figure 4. Distribution of DBH values for Black Birch

Sixteen trees within the study plot had a DBH greater than 40.0 cm. Of these 16 trees there were five different species: white pine, black cherry, black birch, red maple, and white ash. Of the 16 trees white pine made up 44 percent, black birch and black cherry each contributed 19 percent, red maples made up 13 percent, and white ash added 6 percent (Table 1). The location of these trees was mapped using the GIS program ArcMap (Figure 5).

Table 1. Trees with DBH greater than 40.0 cm

Species	Average DBH (cm)	Number	Percent of Total
Black Birch	52.27	3	0.19
Black Cherry	63.17	3	0.19
Red Maple	67.40	2	0.13
White Ash	44.10	1	0.06
White Pine	53.26	7	0.44
Total	56.13	16	1

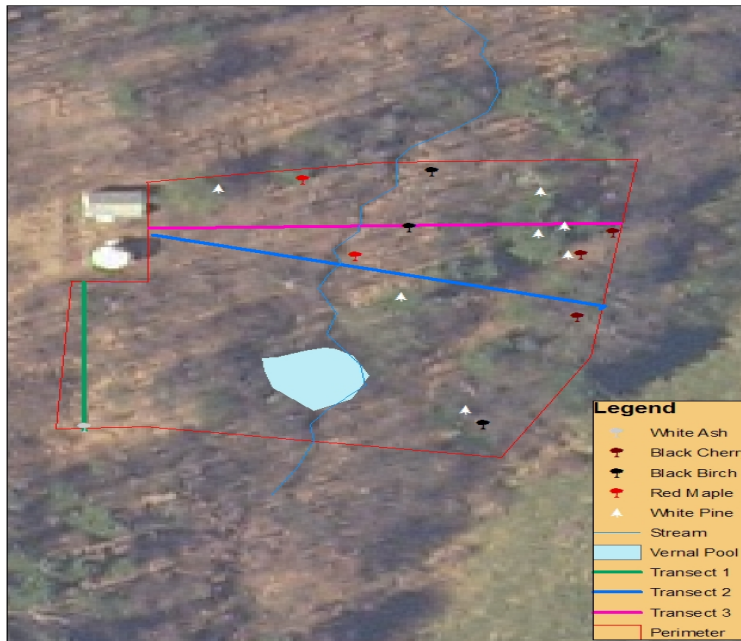


Figure 5. GIS Map of study plot including location of the observatory, transects, the stream, the vernal pool, and trees with DBH greater than 40.0 cm

Vernal Pool

Egg masses of the spotted salamander (*Ambystoma maculatum*) and the wood frog (*Rana sylvatica*) were identified in the vernal pool. Over the course of our field work the vernal pool shrank in size.

IV. Discussion

Tree Data

The trees sampled throughout the three transects made up diverse group of fifteen species and ten different genera. The species present were characteristic of a New England forest and likely represent many of the species that are present throughout the MacLeish property. It is important to note, however, that our study did not include a comparison plot in any other area of the MacLeish field station, and our data does not show if the trees in the area of our study plot are more or less diverse than in any other area.

Of the 220 sampled trees sugar maples were dominant and represented 47% of our sample. Of the fifteen species present along our transects, five had only one sampled representative. These relatively rare species were alternate leafed dogwood, common apple, eastern hemlock, striped maple, and yellow birch. Apple trees are not common as part of a natural forest succession. The apple tree that was sampled was located along the border of the fence and was more than likely planted to mark the border of the field just beyond our study plot. More work remains to be done to determine if the distribution of the other less frequently represented species are distributed with the same frequency throughout the property.

A variety of size classes were present among the sampled trees with most species represented by a large recruiting class of saplings and several large representatives. In particular sugar maples were skewed towards a heavy recruiting class with the majority of the sugar maples on the site under five centimeters DBH. These data suggest that this area is a good area for recruitment.

A study done at the nearby Harvard Forest in Petersham, Massachusetts followed the succession of a forested area for 40 years after the 1938 hurricane removed many of the trees. The author of this comprehensive study found that ten years after the hurricane the dominant species on the site were pin cherry, red maple, white ash, and red oak (Hibbs 1983). The author's ten-year analysis is roughly analogous to our fifteen-year period of succession after the clearing around the observatory ceased. With the exception of pin cherry, each of these species were present in our study plot however none of them were dominant in our transects. The study at the Harvard Forest highlights the importance of this area for succession studies. Differences between the succession

patterns of different areas in close geographic range highlight the diversity of New England forest and are an important area of study.

The diversity of size classes on the site is one of the things that make this area an interesting area for study. As a result of the partial clearing of the area immediately surrounding the observatory, heavy recruitment of saplings tended to happen in the area closest to the observatory. Beyond the approximate fifteen-meter radius that was maintained as a cleared area large trees persist, many of them (especially along the fence bordering the field) likely date back to the 1940s. The different stages of succession present in a relatively small area give this area its size diversity.

The largest trees on the site (DBH greater than 40.0 cm) were also very diverse with five species and five genera representing sixteen different trees. These trees are likely some of the tallest trees on the site and may represent the largest points of view obstruction for the observatory. Additionally, the removal of these trees is likely to have the largest effect on the ecosystem because of their ability to cycle nutrients, water, and retain soil (Likens et al. 1970).

Any removal of trees on the site can be expected to add to the nutrient load of the watershed, increase runoff and soil erosion, and lower the pH of the stream and pool. In a now famous study which ran from 1966 to 1968, researchers examined the effects of deforestation on the nutrient budget in the Hubbard Brook watershed-ecosystem by removing trees in the area and suppressing the re-growth of plants with the application of an herbicide. The watershed experienced large amounts of runoff, an increase in many major ions, and increased acidity of the water. Researchers concluded that the retention of nutrients within the ecosystem was dependent on constant and efficient cycling of

nutrients. The removal of plant life that utilized a large proportion of the nutrients in the soil resulted in the accelerated removal of those nutrients into the local watershed (Likens et al. 1970).

Vernal Pool

Vernal pools are among the most threatened of freshwater wetlands globally and the vernal pool located on the study site remains the largest area of concern for the proposed cutting (Baldwin et al. 2006). The temporary hydro-period of vernal pools makes them highly susceptible to environmental changes. Reduced canopy cover can be enough to significantly change the hydro-period of the pool and influence the reproductive success of the species that use the pool. Nutrient additions and decreased pH as a result of removing trees may also be harmful for the species that depend on the pool (Tilley 2009). The importance of seasonal pools for amphibian, insect, and crustacean breeding and rearing habitat makes the sustainability of vernal pools a significant concern. Egg masses of both wood frogs and spotted salamanders were observed at the vernal pool.

The vernal pool at our study site was observed to shrink throughout our data collection. To date we do not know if the hydro-period of the pool will last long enough for the hatching of the eggs and for the completion of the juvenile stages of the wood frogs and spotted salamanders. If the pool were a viable breeding site for these species the protection of the pool and the surrounding forested area would be a top priority.

In Massachusetts conservation concern is focused on the family Ambystomatidae, which includes spotted salamanders. In particular, the meta-population structure of ambystomatid salamanders requires a series of pools to link areas of important habitat.

Vernal pools in areas with little or no car traffic remain a high priority for conservation because of the low risk of migrating salamanders being run over as they cross roads to reach pools (Compton et al. 2006). The importance of maintaining rural vernal pools cannot be stressed enough as development and climate change threaten the existence of many vernal pool species.

While vernal pools support the breeding and rearing of many species the maintenance of surrounding forest is essential for the survival of adult populations. Ambystomatid salamanders spend 90-95% of their lives in upland forest area up to several hundred meters from breeding pools (Compton et al. 2006). Researchers have established that ambystomatid salamanders require a radius of 165 meters of forested habitat from breeding pools to encompass 95% of their post-breeding movements (Lannoo 2005).

Wood frogs similarly require maintenance of the habitat surrounding vernal pools for the continued viability of their populations. Wood frog populations may be adversely affected in habitats where forest cover has been reduced by 50% or more. Authors of a recent study used tracking devices to show that wood frog migrations from breeding pools ranged from 102-340 meters with half of post-breeding movements outside of a 169-meter range. Corrected for body size, this annual movement distance is roughly equal to values reported for barren ground caribou and thirteen times greater than for wildebeest (Baldwin et al. 2006).

Recommendations

As previously mentioned the presence of the vernal pool on the proposed cutting site remains the largest concern in the planning of the land management strategy east of

the observatory. The most important question surrounding the planning of the vernal pool is whether or not the pool is an effective breeding ground for the species using the pool. A simple solution would be to construct a dam to extend the hydro-period of the pool and ensure that the pool was a productive breeding space for the spotted salamanders and wood frogs that are currently using the pool. Having a vernal pool located at the entrance to the field station will be a huge asset for Smith students and professors and we hope the existence of this pool will be protected.

The desires of the Astronomy department to have full use of their observatory are also noteworthy. Selective removal or trimming of specific trees that are view obstructions is a good alternative to clearing the land east of the observatory. Felled trees should ideally be left as they fall to contribute to the nutrient cycling of the forest and to provide upland habitat for species using the vernal pool. Additionally stumps and roots of felled trees should be left in place to reduce runoff, erosion, and the flushing of nutrients into the stream and pool. A conservative riparian buffer zone should also be included in the land management plan. Our observations suggest that a riparian buffer of ten-meters around the pool and five-meters around the stream would be a conservative distance that would further reduce the effects of selective tree removal.

Acknowledgements

This study would not have been possible without the generous donation of time and experience from many Smith College Professors. We would like to thank Dr. Smith, Dr. Lowenthal, Dr. Rhodes, Dr. Tilley, Dr. Lello, Dr. Berone-Johnson, Dr. Bellemare, Joanne Benkley, Jon Caris, and the Smith College Archives for their help and support. It is our hope that this study will prove useful for the management of the MacLeish Field Station.

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Appendix A

GPS points for trees with DBH greater than 40.0 cm

Big tree points	Northing	Easting	DBH (cm)
B1 (white pine)	911547.739	102902.704	62.0
B2 (red maple)	911549.569	102913.691	85.7
B3 (red maple)	911533.142	102920.668	49.1
B4 (black birch)	911539.385	102927.839	40.0
B5 (black birch)	911551.239	102930.697	40.0
B6 (white pine)	911538.114	102.944.994	43.3
B7 (white pine)	911546.981	102945.26	41.4
B8 (white pine)	911533.497	102948.901	50.5
B9 (white pine)	911539.621	102948.442	48.1
B10 (black cherry)	911538.156	102954.729	57.3
B11 (black cherry)	911533.51	102950.429	76.6
B12 (black cherry)	911520.066	102950.013	55.6
B13 (white pine)	911500.115	102935.373	74.1
B14 (black birch)	911497.109	102937.539	76.8
B15 (white pine)	911524.415	102926.877	53.3
B16 (white ash)	NA	NA	44.1

Appendix B

Identification	DBH(cm)	Common	Species
t1-1	44.1	White Ash	<i>Fraxinus americana</i>
t1-2	6.2	White Pine	<i>Pinus strobus</i>
t1-3	10.9	White Pine	<i>Pinus strobus</i>
t1-4	3	White Pine	<i>Pinus strobus</i>
t1-5	6.2	Black Birch	<i>Betula lenta</i>
t1-6	4.6	Black Birch	<i>Betula lenta</i>
t1-7	7.4	Black Birch	<i>Betula lenta</i>
t1-8	0.6	White Pine	<i>Pinus strobus</i>
t1-9	0.4	White Pine	<i>Pinus strobus</i>
t1-10	2.4	Black Birch	<i>Betula lenta</i>
t1-11	2.3	Black Birch	<i>Betula lenta</i>
t1-12	16.9	Black Birch	<i>Betula lenta</i>
t1-13	1	White Pine	<i>Pinus strobus</i>
t1-14	0.4	White Pine	<i>Pinus strobus</i>
t1-15	2.6	American Beech	<i>Fagus grandifolia</i>
t1-16	1.5	White Pine	<i>Pinus strobus</i>
t1-17	0.5	White Pine	<i>Pinus strobus</i>
t1-18	1.7	White Pine	<i>Pinus strobus</i>
t1-19	1.3	White Pine	<i>Pinus strobus</i>
t1-20	1.6	American Beech	<i>Fagus grandifolia</i>

t1-21	2.2	White Pine	<i>Pinus strobus</i>
t1-22	4.6	White Pine	<i>Pinus strobus</i>
t1-23	5.8	Black Birch	<i>Betula lenta</i>
t1-24	11.1	Black Birch	<i>Betula lenta</i>
t1-25	3.4	American Beech	<i>Fagus grandifolia</i>
t1-26	1.1	White Pine	<i>Pinus strobus</i>
t1-27	4.8	Sugar Maple	<i>Acer saccharum</i>
t1-28	1	White Pine	<i>Pinus strobus</i>
t1-29	3	White Pine	<i>Pinus strobus</i>
t1-30	15.9	Grey Birch	<i>Betula populifolia</i>
t1-31	11.5	Grey Birch	<i>Betula populifolia</i>
t1-32	4.9	White Pine	<i>Pinus strobus</i>
t1-33	1.5	American Beech	<i>Fagus grandifolia</i>
t1-34	10.2	White Pine	<i>Pinus strobus</i>
t1-35	1.8	White Pine	<i>Pinus strobus</i>
t1-36	8.5	White Pine	<i>Pinus strobus</i>
t1-37	3.6	Sugar Maple	<i>Acer saccharum</i>
t1-38	1.6	Sugar Maple	<i>Acer saccharum</i>
t1-39	4.3	White Pine	<i>Pinus strobus</i>
t1-40	0.8	White Pine	<i>Pinus strobus</i>
t1-41	5.9	White Pine	<i>Pinus strobus</i>
t1-42	7.8	Black Birch	<i>Betula lenta</i>
t1-43	1	White Pine	<i>Pinus strobus</i>
t1-44	1	White Pine	<i>Pinus strobus</i>
t1-45	8.2	Red Maple	<i>Acer rubrum</i>
t1-46	10.1	Black Birch	<i>Betula lenta</i>
t1-47	4.1	Red Oak	<i>Quercus rubra</i>
t1-48	1.7	American Beech	<i>Fagus grandifolia</i>
t1-49	0.9	Sugar Maple	<i>Acer saccharum</i>
t1-50	3	Black Birch	<i>Betula lenta</i>
t1-51	2.5	Sugar Maple	<i>Acer saccharum</i>
t1-52	8.5	Black Birch	<i>Betula lenta</i>
t1-53	1	Sugar Maple	<i>Acer saccharum</i>
t1-54	3	White Ash	<i>Fraxinus americana</i>
t1-55	0.8	Black Birch	<i>Betula lenta</i>
t1-56	1.1	Sugar Maple	<i>Acer saccharum</i>
t1-57	1	Red Maple	<i>Acer rubrum</i>
t1-58	0.8	White Pine	<i>Pinus strobus</i>
t1-59	0.7	White Pine	<i>Pinus strobus</i>
t1-60	0.7	White Pine	<i>Pinus strobus</i>
t1-61	2.3	Sugar Maple	<i>Acer saccharum</i>

t1-62	0.8	American Beech	<i>Fagus grandifolia</i>
t1-63	1.1	White Pine	<i>Pinus strobus</i>
t1-64	8.3	Black Birch	<i>Betula lenta</i>
t1-65	8.5	Red Oak	<i>Quercus rubra</i>
t1-66	1.6	Sugar Maple	<i>Acer saccharum</i>
t2-1	8.3	Sugar Maple	<i>Acer saccharum</i>
t2-2	9	Black Birch	<i>Betula lenta</i>
t2-3	2.3	Sugar Maple	<i>Acer saccharum</i>
t2-4	3.9	Sugar Maple	<i>Acer saccharum</i>
t2-5	11.7	Sugar Maple	<i>Acer saccharum</i>
t2-6	2.6	Sugar Maple	<i>Acer saccharum</i>
t2-7	7.9	Sugar Maple	<i>Acer saccharum</i>
t2-8	6.8	Sugar Maple	<i>Acer saccharum</i>
t2-9	1.4	Sugar Maple	<i>Acer saccharum</i>
t2-10	1.5	Sugar Maple	<i>Acer saccharum</i>
t2-11	3.3	Sugar Maple	<i>Acer saccharum</i>
t2-12	2.5	Red Maple	<i>Acer rubrum</i>
t2-13	1.9	Sugar Maple	<i>Acer saccharum</i>
t2-14	1.9	Sugar Maple	<i>Acer saccharum</i>
t2-15	25.7	Black Birch	<i>Betula lenta</i>
t2-16	54.1	Sugar Maple	<i>Acer saccharum</i>
t2-17	11.3	White Pine	<i>Pinus strobus</i>
t2-18	15.7	White Birch	<i>Betula papyrifera</i>
t2-19	26.1	White Birch	<i>Betula papyrifera</i>
t2-20	2	Sugar Maple	<i>Acer saccharum</i>
t2-21	5.3	Sugar Maple	<i>Acer saccharum</i>
t2-22	2.9	Sugar Maple	<i>Acer saccharum</i>
t2-23	19.9	Sugar Maple	<i>Acer saccharum</i>
t2-24	1.1	Sugar Maple	<i>Acer saccharum</i>
t2-25	6.4	Black Birch	<i>Betula lenta</i>
t2-26	16.3	Black Birch	<i>Betula lenta</i>
t2-27	35.9	Red Maple	<i>Acer rubrum</i>
t2-28	1.2	Black Birch	<i>Betula lenta</i>
t2-29	3.1	Sugar Maple	<i>Acer saccharum</i>
t2-30	0.8	Sugar Maple	<i>Acer saccharum</i>
t2-31	2.5	Sugar Maple	<i>Acer saccharum</i>
t2-32	1.1	Sugar Maple	<i>Acer saccharum</i>
t2-33	2.3	Black Birch	<i>Betula lenta</i>
t2-34	1.9	Sugar Maple	<i>Acer saccharum</i>
t2-35	1.8	Black Birch	<i>Betula lenta</i>
t2-36	1.7	Black Birch	<i>Betula lenta</i>

t2-37	2.2	Sugar Maple	<i>Acer saccharum</i>
t2-38	3.2	Black Birch	<i>Betula lenta</i>
t2-39	2.1	Sugar Maple	<i>Acer saccharum</i>
t2-40	2.9	Sugar Maple	<i>Acer saccharum</i>
t2-41	6.2	White Pine	<i>Pinus strobus</i>
t2-42	0.8	Sugar Maple	<i>Acer saccharum</i>
t2-43	17.8	White Pine	<i>Pinus strobus</i>
t2-44	18.2	Sugar Maple	<i>Acer saccharum</i>
t2-45	4.3	White Pine	<i>Pinus strobus</i>
t2-46	31.5	White Pine	<i>Pinus strobus</i>
t2-47	46.6	White Ash	<i>Fraxinus americana</i>
t2-48	2.8	White Pine	<i>Pinus strobus</i>
t2-49	11.9	Sugar Maple	<i>Acer saccharum</i>
t2-50	4.8	Sugar Maple	<i>Acer saccharum</i>
t2-51	12.4	Sugar Maple	<i>Acer saccharum</i>
t2-52	1	Sugar Maple	<i>Acer saccharum</i>
t2-53	5.7	Sugar Maple	<i>Acer saccharum</i>
t2-54	1.7	White Pine	<i>Pinus strobus</i>
t2-55	5.6	White Pine	<i>Pinus strobus</i>
t2-56	1.8	Sugar Maple	<i>Acer saccharum</i>
t2-57	9.9	White Pine	<i>Pinus strobus</i>
t2-58	1.1	White Ash	<i>Fraxinus americana</i>
t2-59	20	White Pine	<i>Pinus strobus</i>
t2-60	2.1	American Beech	<i>Fagus grandifolia</i>
t2-61	1	Sugar Maple	<i>Acer saccharum</i>
t2-62	1.8	Sugar Maple	<i>Acer saccharum</i>
t2-63	2.4	Sugar Maple	<i>Acer saccharum</i>
t2-64	1.5	Sugar Maple	<i>Acer saccharum</i>
t2-65	1.2	Sugar Maple	<i>Acer saccharum</i>
t2-66	1.7	Sugar Maple	<i>Acer saccharum</i>
t2-67	1	Sugar Maple	<i>Acer saccharum</i>
t2-68	2.2	Sugar Maple	<i>Acer saccharum</i>
t2-69	1.7	Alternate leafed dogwood	<i>Cornus alternifolia</i>
t2-70	1.8	Sugar Maple	<i>Acer saccharum</i>
t2-71	1.2	Sugar Maple	<i>Acer saccharum</i>
t2-72	1.2	Sugar Maple	<i>Acer saccharum</i>
t2-73	32.1	Eastern Hemlock	<i>Tsuga canadensis</i>
t2-74	24.6	Black Birch	<i>Betula lenta</i>
t2-75	12	Yellow Birch	<i>Betula alleghaniensis</i>
t2-76	7.9	White Pine	<i>Pinus strobus</i>
t2-77	18.4	White Pine	<i>Pinus strobus</i>

t2-78	22	Black Birch	<i>Betula lenta</i>
t2-79	6.1	Black Cherry	<i>Prunus serotina</i>
t2-80	3.3	Sugar Maple	<i>Acer saccharum</i>
t2-81	3.6	Sugar Maple	<i>Acer saccharum</i>
t2-82	11.8	Black Cherry	<i>Prunus serotina</i>
t2-83	8.4	Black Cherry	<i>Prunus serotina</i>
t2-84	6.3	Sugar Maple	<i>Acer saccharum</i>
t2-85	3.6	Sugar Maple	<i>Acer saccharum</i>
t2-86	3.6	Sugar Maple	<i>Acer saccharum</i>
t2-87	4.2	Sugar Maple	<i>Acer saccharum</i>
t2-88	2.1	Sugar Maple	<i>Acer saccharum</i>
t2-89	24.6	Sugar Maple	<i>Acer saccharum</i>
t3-1	5.4	Sugar Maple	<i>Acer saccharum</i>
t3-2	4.8	Black Birch	<i>Betula lenta</i>
t3-3	2.1	Sugar Maple	<i>Acer saccharum</i>
t3-4	24.2	Sugar Maple	<i>Acer saccharum</i>
t3-5	3.1	Sugar Maple	<i>Acer saccharum</i>
t3-6	1.7	Sugar Maple	<i>Acer saccharum</i>
t3-7	38.8	Sugar Maple	<i>Acer saccharum</i>
t3-8	10.5	Sugar Maple	<i>Acer saccharum</i>
t3-9	1.3	Sugar Maple	<i>Acer saccharum</i>
t3-10	0.9	Sugar Maple	<i>Acer saccharum</i>
t3-11	1.3	Sugar Maple	<i>Acer saccharum</i>
t3-12	2.3	Sugar Maple	<i>Acer saccharum</i>
t3-13	4.8	Black Birch	<i>Betula lenta</i>
t3-14	2.9	Sugar Maple	<i>Acer saccharum</i>
t3-15	3.5	Sugar Maple	<i>Acer saccharum</i>
t3-16	1.1	American Beech	<i>Fagus grandifolia</i>
t3-17	0.4	Red Maple	<i>Acer rubrum</i>
t3-18	6.3	Sugar Maple	<i>Acer saccharum</i>
t3-19	3.6	Sugar Maple	<i>Acer saccharum</i>
t3-20	1.8	Red Oak	<i>Quercus rubra</i>
t3-21	0.5	Red Oak	<i>Quercus rubra</i>
t3-22	2.3	Red Maple	<i>Acer rubrum</i>
t3-23	0.8	Red Maple	<i>Acer rubrum</i>
t3-24	3	Sugar Maple	<i>Acer saccharum</i>
t3-25	48.1	White Pine	<i>Pinus strobus</i>
t3-26	5.1	White Ash	<i>Fraxinus americana</i>
t3-27	2.6	White Ash	<i>Fraxinus americana</i>
t3-28	2.4	Sugar Maple	<i>Acer saccharum</i>
t3-29	1.3	Sugar Maple	<i>Acer saccharum</i>

t3-30	7	Sugar Maple	<i>Acer saccharum</i>
t3-31	11.3	Sugar Maple	<i>Acer saccharum</i>
t3-32	1	Sugar Maple	<i>Acer saccharum</i>
t3-33	4.1	Sugar Maple	<i>Acer saccharum</i>
t3-34	31.9	Common apple	<i>Malus sylvestris</i>
t3-35	6	Sugar Maple	<i>Acer saccharum</i>
t3-36	0.8	Sugar Maple	<i>Acer saccharum</i>
t3-37	6.5	Sugar Maple	<i>Acer saccharum</i>
t3-38	1.3	Sugar Maple	<i>Acer saccharum</i>
t3-39	2.6	White Ash	<i>Fraxinus americana</i>
t3-40	1.3	American Beech	<i>Fagus grandifolia</i>
t3-41	1.8	White Ash	<i>Fraxinus americana</i>
t3-42	4.4	Sugar Maple	<i>Acer saccharum</i>
t3-43	27	White Pine	<i>Pinus strobus</i>
t3-44	2.6	Sugar Maple	<i>Acer saccharum</i>
t3-45	38.6	White Pine	<i>Pinus strobus</i>
t3-46	1.1	Striped Maple	<i>Acer pensylvanicum</i>
t3-47	0.4	Sugar Maple	<i>Acer saccharum</i>
t3-48	1	Sugar Maple	<i>Acer saccharum</i>
t3-49	40	Black Birch	<i>Betula lenta</i>
t3-50	8.2	White Pine	<i>Pinus strobus</i>
t3-51	1.2	Sugar Maple	<i>Acer saccharum</i>
t3-52	49.1	Red Maple	<i>Acer rubrum</i>
t3-53	22.6	Black Birch	<i>Betula lenta</i>
t3-54	1.8	Sugar Maple	<i>Acer saccharum</i>
t3-55	0.3	Sugar Maple	<i>Acer saccharum</i>
t3-56	0.3	Sugar Maple	<i>Acer saccharum</i>
t3-57	21.7	Sugar Maple	<i>Acer saccharum</i>
t3-58	0.8	Sugar Maple	<i>Acer saccharum</i>
t3-59	1.9	Sugar Maple	<i>Acer saccharum</i>
t3-60	23.1	Black Cherry	<i>Prunus serotina</i>
t3-61	1.7	Sugar Maple	<i>Acer saccharum</i>
t3-62	2.5	Sugar Maple	<i>Acer saccharum</i>
t3-63	2.2	Sugar Maple	<i>Acer saccharum</i>
t3-64	6	Sugar Maple	<i>Acer saccharum</i>
t3-65	2	Sugar Maple	<i>Acer saccharum</i>