

Preliminary Investigation of a Local Vernal Pool  
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ABSTRACT

Vernal pools are ephemeral pools that dry up every year or few years. Massachusetts Natural Heritage & Endangered Species Program (NHESP) developed a certification process for vernal pools that protects the pool under certain state and federal laws. In order for a pool to be certified evidence must be provided that the pool is in a confined basin with no permanently flowing outlets, there must be breeding or presence of indicator species, and there must be no fish. Smith College owns 200 acres of property in Whatley, MA and on the property is a potential vernal pool. My chief objective in this project was to conduct a preliminary investigation of the pool and begin the certification process. I visited the site twice once on 4/14/08 and once on 4/23/08. Photographic evidence was taken of the pool and of indicator species. The first visit yielded no visual evidence of indicator species. The second visit yielded four photographs of species in the pool: one obligate, two facultative, and one unidentified. During my two visits I observed two outlets and no inlets into the pool. While, further investigation is necessary to provide the specific evidence to legally certify the pool, I have shown that the pool/wetland is being utilized by multiple species. My hope is that Smith College and the community will take advantage of this significant resource.

INTRODUCTION

Imagine walking through a New England forest on a beautiful spring morning and coming across what seems like an oversized puddle teeming with life and activity. Frogs, salamanders and insects abound. Now imagine returning to the same spot several months later and there being no evidence of the pool or of its bustling inhabitants. This is the magic of vernal pools. Vernal pools are ephemeral pools that dry up every year or few years. In Massachusetts, the density of potential vernal pools is 1.1 per square kilometer (2.8 per square mile) (Burne and Lathrop 2008). Because vernal pools can be so small and temporary they are often threatened or destroyed by development. This is a problem because certain species of amphibians and invertebrates rely on vernal pools for breeding purpose because there are no fish present. In fact in the state of Massachusetts several threatened and species of concern under the MA Endangered Species Act that rely solely

on vernal pools to breed (Massachusetts Natural Heritage & Endangered Species Program 2001).

There are many definitions, scientifically and legally, of what is a vernal pool. According to the Massachusetts Division of Fish and Wildlife, “vernal pools are temporary bodies of fresh water that provide critical habitat for many vertebrate and invertebrate wildlife species (Massachusetts Natural Heritage & Endangered Species Program, 2001, p1).” Eliazbeth Colburn in her book Vernal Pool offers a five part definition (2004). She states that vernal pools must be in or near wooded areas, be isolated from streams or other bodies of water, be small and shallow, fill seasonal and dry up at least every few years, and contain no fish (Colburn, 2004). This is similar to the definition used by the Massachusetts Natural Heritage & Endangered Species Program (NHESP) for certifying vernal pools. In order for a pool to be protected under Massachusetts law evidence must be provided that the pool is in a confined basin with no permanently flowing outlets, there must be breeding or presence of indicator species, and there must be no fish.

The NHESP developed a certification process for vernal pools in part because they are often difficult to locate. The National Wetland Inventory run by the US Fish and Wildlife, uses aerial photography to identify wetlands across the nation. However vernal pools are often missed because the minimum size of open water identifiable by the NWI is 1 acre to 3 acres depending on the forest type (Burne and Lathrop 2008). Vernal pools tend to be much smaller than that. It is for this reason that states such as Massachusetts have developed protocol for identifying and certifying vernal pools. According to Mathew Burne and Richard Lathrop Jr, “Massachusetts was the first state to conduct a

comprehensive, statewide survey of vernal pools and to develop a large-scale database of vernal pool locations” (2008 p63). According to the National Heritage website as of January 2007 there are currently 4350 certified vernal pools in Massachusetts, 72 of them in Northampton, and only 8 in Whately. The certification protects the pool (and sometimes up to 100 feet beyond the edge) under certain state and federal laws.

Smith Colleges recently dedicated the Ada and Archibald MacLeish Field Station in Whately Massachusetts. On this 200 acre property there is a site of potential vernal pool. My chief objective in this project was to conduct a preliminary investigation of the pool and begin the certification process. In order to meet the NHESP guidelines for certification I must provide two different maps and photographic evidence of the following: indicator species, no permanent flow source, and evidence no fish.

## METHODS

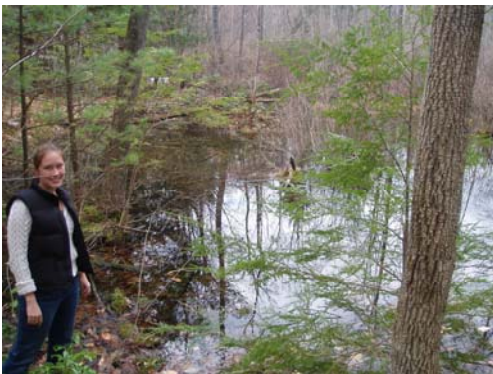
The vernal pool site was located in West Whatley, Massachusetts on Smith College’s property off of Sandy Hill Rd (Appendix A). I visited the site twice once on 4/14/08 and once on 4/23/08. A preliminary visit just to locate the pool was conducted several weeks earlier, but no data was collected as the pool was still covered in snow and ice. At each site visit I searched for evidence of a combined basin, flow outlets, and searched the perimeter of the pool for evidence of obligate and facultative species. These search criteria and the specific species searched for were according to guidelines laid out by the NHESP in *Guidelines for the Certification of Vernal Pool Habitat*. The first time I visited I had help from a field assistant, Alexandra Selbo-Bruns, but the second time I conducted the search on my own. Photographic evidence was taken of the pool and of

indicator species. Species in the photographs were identified using multiple online field guides. Professor Steven Tilley was also consulted on the amphibian eggs found.

## RESULTS

The first visit yielded no visual evidence of indicator species. However I did hear the breeding call of the Spring Peeper which is facultative species as well as another unidentified call. I also observed two flow outlets. Figure 1 shows the pool on my first visit. The pool was large enough that it was difficult to estimate its size. This is also partly due the many islands of thick vegetation in the middle of the pool. In fact there was an entire uprooted tree in the middle which was only observable from one side.

The second visit yielded four photographs of species in the pool: one obligate, two facultative, and one unidentified. The pool was also covered with a fine film, which made it difficult to see below the surface. Figure 2 shows a picture of the pool from the second visit as compared to Figure 1 which lacks the film and plant matter on the surface.



**Figure 1 Photograph of pool from 4/14/08.**



**Figure 2 Photo graph of pool from 4/23/08. Note the film covering the surface.**



**Figure 3 Caddisfly larva.**  
**Observed on 4/23/08.**

The first visual evidence of life in the pool that I was able to capture was that of caddisfly larva (Figure 3). Most species of caddisfly (*Trichoptera*) have a larva lifestage that makes a protective casing from the materials around. Different species will use different materials and textures. Some caddisfly casings are smooth, others are square, still others look like just a bunch of rocks and twigs stuck together. The ones I observed were rough and appeared to be made primarily out of short twigs, leaf bits, and hemlock needles. According to the NHESP guidelines caddisfly larva are a facultative species.



**Figure 4 Red Spotted Newt**  
**(*Notophthalmus v. viridescens*)**  
**Observed on 4/23/08**

Another facultative species I observed on 4/23/08 was an adult Red-Spotted Newt (Figure 4). The newt was identifiable by the row of orange spots on its back (difficult to see picture). Before this picture was taken I had the opportunity see the newt up close and was able to identify it from personal experience. Red-Spotted Newts (*Notophthalmus v. viridescens*) spend both their adult and larval stage in water. Thus just the presence of an adult is a potential indicator of a vernal pool.



**Figure 5 Wood Frog (*Rana sylvatica*)**  
**Observed on 4/23/08**

The only evidence of obligate species I observe was an adult Wood Frog (Figure 5). The Wood Frog (*Rana sylvatica*) was identified by brown mask over the eyes, the white upper lip and the

markings on legs. Besides this one adult I also observe the presence of several other frogs (possibly wood frogs) that fled before I was able to identify and photograph them.

According to NHESP guidelines evidence of wood frog breeding is necessary to prove vernal pool and the sighting of an individual is not enough.

On my second visit I did observe evidence of amphibian breeding in the form of an egg mass (Figure 6). Thus far, I have unable to identify what amphibian laid these eggs. I know that it is not a salamander as it has no outer casing surround the whole egg mass. I also know that it doesn't fit the description of toad eggs which are laid in a line and Spring Peeper eggs which are laid signally. Other species of frogs, such as the wood frog, tend to lay many more eggs per mass (between 200 to over 895) (Colburn 2004). Professor Tilley came to the same conclusions and was unable to identify them (personal communication, May 6<sup>th</sup> 2008). Though he did suggest that "There's a possibility that the eggs were deposited by a member of the triploid, asexual complex that occurs around here" (personal communication, May 6<sup>th</sup> 2008).



**Figure 6 Unidentified amphibian eggs.**

**Observed on 4/23/08**

## DISCUSSION

I have gathered enough evidence with the adult red-spotted newt and the caddisflies to meet the biological criteria under the NHESP guidelines. However since both of these are facultative species evidence must also be provided of the lack of fish. The easiest way to do this is by a photograph of the dried up pool. As this project had to be completed before the pool would dry up, this was not possible. Another way of showing lack of fish is by finding verification of breeding obligate species.

I was unable to find sufficient evidence of breeding of obligate species to certify the pool, though I did observe a Wood Frog adult. Acceptable evidence of breeding includes 2 or more egg masses, tadpoles, and transforming juveniles with tail remnant evident. However, the snow and ice had just receded from the vernal pool which is when Wood Frogs breed. In addition adults usually live 400m to 800m from their breeding pools (Colburn 2004). Thus it is probable that the adult I saw was there to breed and a more exhaustive search might yield evidence of breeding. I could have very easily missed egg masses when searching the pool by myself as it is a large pool with vegetative islands that I was unable to access.

Another part of the certification that is missing is the documentation of no permanent flow outlet. During my two visits I observed two outlets and no inlets into the pool. One of the outlets was already drying up by my second visit, but other one was still flowing strong. It is possible that later in the summer that both dry up completely. If this is the case then the pool may be certified, however if it is not the case then the pool might not be able to be certified under the according to the guidelines. This would mean that the pool was acting as a vernal pool, but could not be legally certified and protected. Smith

College with its commitment to sustainability and the new environmental field station should make an effort to conserve and preserve the pool even if it is not protected by state and federal law.

One of my recommendations to Smith College and the community is to extend my study and conduct a full survey of the pool throughout all seasons. This could be done by a student or a group of students. The study should document the pool and the species found there starting early spring (when there is still ice and snow) and go until the pool dries up (most likely in fall). This study would answer many of the questions that I was unable to answer in my project and would allow certification to proceed. Since the study would document all seasons, it could resolve the flowing outlet question, provide evidence of breeding obligate species in form of eggs, but also tadpoles and juveniles and record audio evidence of the mating calls I heard.

My preliminary exploration of this resource and the follow up study I'm recommending is by no means the end of investigation that should be done on the pool. More detailed analysis of the invertebrates, plants, and amphibians could all be student research projects. Also exploration could be done on the nutrients and chemical composition of the water and soil. A study of the combination of any of these things would be a valuable resource for any student interested in ecology. All these projects could be completed by future ES&P minors (or maybe even majors) or other Smith students. In addition to resources for science majors, the vernal pool has potential to be much more interdisciplinary. Art majors interested in photography could get involved as visual evidence is required for the certification process. Also a photography project documenting the changes in the pool over time might be interesting. Smith students interested in

creative writing might be interested to know that Robert Frost wrote a poem about vernal pools. Even education majors could take advantage of the vernal pool as a resource.

Vernal pools are excellent hands-on educational tools for students of all ages (Colburn 2004, Gruner and Haley 2008). An educational curriculum called Diving Into Wicked Big Puddles engaged middle and high school students in the vernal pool certification process. In the first three years of the program, two-thirds of the certified vernal pools in Massachusetts were contributed by students (Gruner and Haley 2008). A field study in a vernal pool can meet many U.S. national Science Education Content Standards and National Research Council Content Standard (Calhoun Gruner and Haley 2008). Besides meeting national standards, first hand experiences with nature are becoming increasingly important for instilling environmental literacy in children, during this day and age of electronics. As David Orr in his book Earth in Mind puts it “a course on a river or a forest or a farm might help make up the experience deficit now common among urban and suburban young people whose minds have been exposed overly long to shopping malls, videogames, and television. (1994 p96) ” Orr also states that these learning experiences “remove the abstractness and secondhand learning that corrupts knowledge at its source” (1994 p96). Smith College wants to commit to sustainability, and what better way then to teach future educators about this vital educational tool and technique. My recommendation is that the vernal pool be used as resource for education majors to learn about environmental field studies. Smith students for example could lead campus center school class field trips to pool. Hopefully both the teacher and the students would be enriched by this experience.

In conclusion, I have found evidence that the of both obligate and facultative indicator species within the pool. While, further investigation is necessary to provide the specific evidence to legally certify the pool, I have shown that the pool/wetland is being used by multiple species. Thus the pool is a valuable ecosystem that should be preserved. The vernal pool, regardless if it's certified, can provide a useful educational tool for Smith students of all majors. My hope is that Smith College and the community will take advantage of this significant resource.

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APPENDIX A



These images were taken from <http://maps.google.com>