

Vermont Biology Technical Note 1

Vernal Pool Habitat in Conservation Planning

Vermont NRCS, Updated 2010



Vernal Pool in Winter (top), Spring (bottom left) and Summer (bottom right) – Vernal Pool Association



Background and Description

Vernal pools are temporary bodies of water that provide important breeding habitat for a variety of vertebrate and invertebrate wildlife. Unlike most natural communities in Vermont that are characterized by their flora, vernal pools are characterized more by their fauna. Classic “vernal pools” are found in forest depressions, underlain by an impermeable layer, with no inlet or outlet. The pools typically dry in summer and often fill again with fall rains and persist through the winter. When they are dry, they may be recognized by water stained leaves, organic soils and having evidence of invertebrates such as caddisfly larval ‘cases’, fingernail clam shells or shed skins of dragonfly. They are generally small (1/2 acre or less) with less than three feet of maximum water depth. Vernal pool habitat occurs wherever water is contained for more than two months in the spring and summer of most years and where no fish are present. In early spring, species such as wood frogs (*Lithobates sylvatica*) and spotted salamanders (*Ambystoma maculatum*) migrate from the upland forests to the pools to breed in a very short period of time. After breeding, they leave their eggs unattended and move back into the upland forests where they spend the majority of their lives.

Most of the conservation focus around vernal pools is on classic forest pools. This is because they are small, surrounded by uplands, and may not be as readily recognized and protected as the larger wetlands on the landscape. This focus should not be lost. However, vernal pools are important wildlife habitat because of the species that rely on them for their life cycle; not because of their physical location and condition. So, we will use the term a bit more broadly and focus on pools that support breeding of indicator species such as wood frogs and spotted salamanders.

Important breeding pools can occur in meadows, floodplains and as parts of other wetland types (e.g. scrub shrub wetland) and not just in upland forest vernal pools. If in open areas, the pool would typically need to be within 300-600 feet of forest to be used by species such as spotted salamanders. Studies have shown that forest habitats are preferred over open areas such as fields. Fragmented landscapes tend to become less suitable for vernal pool species. These species are strongly associated with forest and spend most of their life in these settings. The mole salamanders (*Ambystoma* spp.) spend the non-breeding period in the forest under logs and underground in small mammal tunnels while wood frogs are more visible while foraging through the forest.

Suitable hydro-period (water present for more than 2 months in spring) and the lack of fish populations are essential to the breeding success of vernal pool species. Many species, such as wood frogs and the mole salamanders, have evolved breeding strategies intolerant of fish predation on their eggs and larvae.

The Wildlife

Vernal pool specialists or “indicator species” in Vermont include wood frog, spotted salamander, blue-spotted salamander (*Ambystoma laterale*), Jefferson salamander (*Ambystoma jeffersonianum*), marbled salamander (*Ambystoma opacum*), and fairy shrimp (*Eubranchipus*). Remember that these species are most successful in classic vernal pools but will also breed in pools within other wetland types (e.g. pools within a forested swamp). Other species that may use vernal pools (and other wetlands) but are not considered indicator species include spring peepers (*Pseudacris crucifer*), gray treefrog (*Hyla versicolor*), American toad (*Anaxyrus americanus*), green frog (*Lithobates clamitans*), pickerel frog (*Lithobates palustris*), American bullfrogs (*Lithobates catesbeianus*), eastern newt (*Notophthalmus viridescens*), turtles, caddisfly, fingernail clams (*Pisidiidae*), and various other species. Wetlands with long hydro-periods (surface water present year round or multiple years) may support some indicator species but generally these conditions are better for semi-permanent or permanent water species such as green frogs and bullfrogs that require one to multiple years for their tadpoles to develop into adults. Pools that periodically dry are important because it will eliminate fish if present and it will limit competition by some of these other species.



Wood Frog



Spotted Salamander



Blue-Spotted Salamander



Jefferson Salamander

Identifying Vernal Pools

It is particularly important for NRCS planners to recognize these wetlands during the resource inventory phase of the planning process. Then, we can help the landowners understand their importance and help them protect these habitats and the surrounding uplands. Species that use these pools use significant acreages in the surrounding uplands so simply protecting the wetland is not sufficient to meet their life history requirements.

In the spring (April), listen for breeding choruses of the wood frog (sounds like ‘clucking’ or ducks ‘quacking’) or spring peepers. Look for salamanders, frogs and or their egg masses in the pool (April-May). On rainy, warm spring nights (March-April) walk the area in question to look for migrating adults. If later in summer, look for frog tadpoles and salamander larvae. A small dip net can be a very useful too. Vernal pools may not be used every year depending on the size of the pool and precipitation. Speak with the landowner to help determine the characteristics of the pool. Ask whether it holds water in a typical year and what a typical depth in spring might be. In general, pools in Vermont should hold water through mid July to support mole salamanders (time for larval salamanders to mature) (Jim Andrews, personal communication). Pools with a shorter hydro-period may very well support wood frogs which breed earlier and have young which mature faster. Has the landowner seen some of these amphibians on their property? When in doubt, take pictures and seek assistance. Contact the NRCS state office, other biologists or locals with knowledge of amphibians and vernal pools.



Spotted Salamander Egg Mass



Wood Frog Egg Masses



Spotted Salamander Larva



Wood Frog Tadpole

Planning for Vernal Pool Habitat

First, determine if the pool is or is likely functioning (providing breeding habitat) for vernal pool species. Get help with this step if you need it. Once these important breeding habitats are identified, describe the habitat (size of pool, number of egg masses, surrounding habitat, etc.) and collect GPS coordinates of the pool and then bring it into GIS. Take digital pictures for later reference.

Look at the pool within the surrounding landscape using aerial photography, topographic quads, waterways, etc. Is the pool in a forested setting or fragmented landscape (forest, agricultural, developed)? Can we plan to connect the forest block with another using a tree planting practice? Large forest blocks are generally going to be the best habitat as there is little fragmentation and will allow for genetic exchange between individual pools and groups of pools. Vernal pool species have high site fidelity to their breeding pools (return to the same pool to breed each year) but a percentage (~10-15%) of the young of the year may disperse to other pools. This allows genetic exchange between populations to maintain long term viability of groups of populations (meta-populations). While it is important to protect individual sites, it is also important to conserve landscape level forest blocks and connections. Make landowners and managers aware of these potential important connecting habitats.

Create a Pool Buffer Conservation Area

Now that landscape level conditions have been considered, develop a buffer conservation area for the pool based upon the landowner's objectives. This will provide a level of protection for the critical upland forest habitats where the amphibians spend the majority of their lives. If the landowner is interested in managing for vernal pool wildlife then a 600 foot or larger buffer should be used. This will accommodate the upland habitat needs of the majority of the population of mole salamanders (note: wood frogs will generally travel much further). When productive forest and timber harvesting is an objective, buffer the pool area to 400 feet. **Note that this 400 foot distance will only address a portion of the habitat used by pool breeding amphibians.** This distance is intended to be a practical management approach in managed forests which readily allow for multiple objectives to be met. A 600 foot buffer on a 0.2 acre pool encompasses an area of about 30 acres where as a 400 foot buffer on the same size pool only encompasses about 15 acres.

Map the buffer by using a GIS based buffering tool (Toolkit or geo-processing wizard). Remember to account for the size of the pool when buffering (i.e. delineate larger pools using a polygon feature).

Management Recommendations at the Site Level

Any activity (logging, ATVs, etc.) that may disrupt the hydrology of the pool; both in the pool area and within 100 feet should be avoided. This includes activities during the dry pool phase. Be aware that there may be species present in the dry pool in a 'drought-resistant' stage. Livestock should be excluded to limit physical disturbance and to eliminate nutrient inputs. If the forest area is being managed for timber, silvicultural prescriptions should maintain high canopy cover such as through small group selection within the buffer zone. See the 'Forest Management' section below for in depth guidelines. Forest management that encourages maintenance of a thick duff layer (leaves/organics), good crown cover, and large woody debris on the forest floor is recommended. Timber harvesting should be scheduled for winter. Smooth out large ruts that are formed during forest management activities as these generally are unfavorable to amphibian breeding (often dry out prematurely). Do NOT introduce fish into pools that are providing habitat for vernal pool species. If creating pools, be aware that it is difficult to create a true vernal pool that dries out periodically. More permanent pools will create a more competitive environment for these species.

In a farm setting, follow the same general recommendations. Try to protect important migration routes from forest blocks to pools. These should be areas of least intensive management if possible.

Forest Management¹

The following recommendations for vernal pool conservation in managed forests are from *deMaynadier & Houlahan 2008*. Recall that the 400 foot life zone represents a mean distance for mole salamander migration from vernal pools and will only protect a portion of the habitat being used by the animals. Where wildlife is the primary objective, expand the Life Zone to 600 feet or more. Herbicides or pesticides use should be avoided or minimized around the vernal pool depression, protection and life zone.

Vernal Pool Depression – Defined as the pool area out to spring high water where spring breeding takes place. The goals are to maintain water quality, physical basin topography and vegetation in a natural state. Rutting or compaction can alter the water holding capacity.

- Leave depression undisturbed. Avoid harvesting, heavy equipment operation, skidding activity or landing construction
- Keep the pool free of sediment, slash and tree-tops from harvests. Normal leaf and tree fall are desirable for organic inputs and branches are desirable egg attachment sites

Vernal Pool Protection Zone – Defined as a 100 foot radius around the pool from spring high water mark. This zone is approximately 1.5 acres for a 0.2 acre sized depression (total area is 1.7 acres). The goal is to protect the pool and surrounding upland habitat. This zone will provide protection to the pool, provide organic inputs and be the primary habitat for amphibians migrating to (in spring) and from (in summer) the pool.

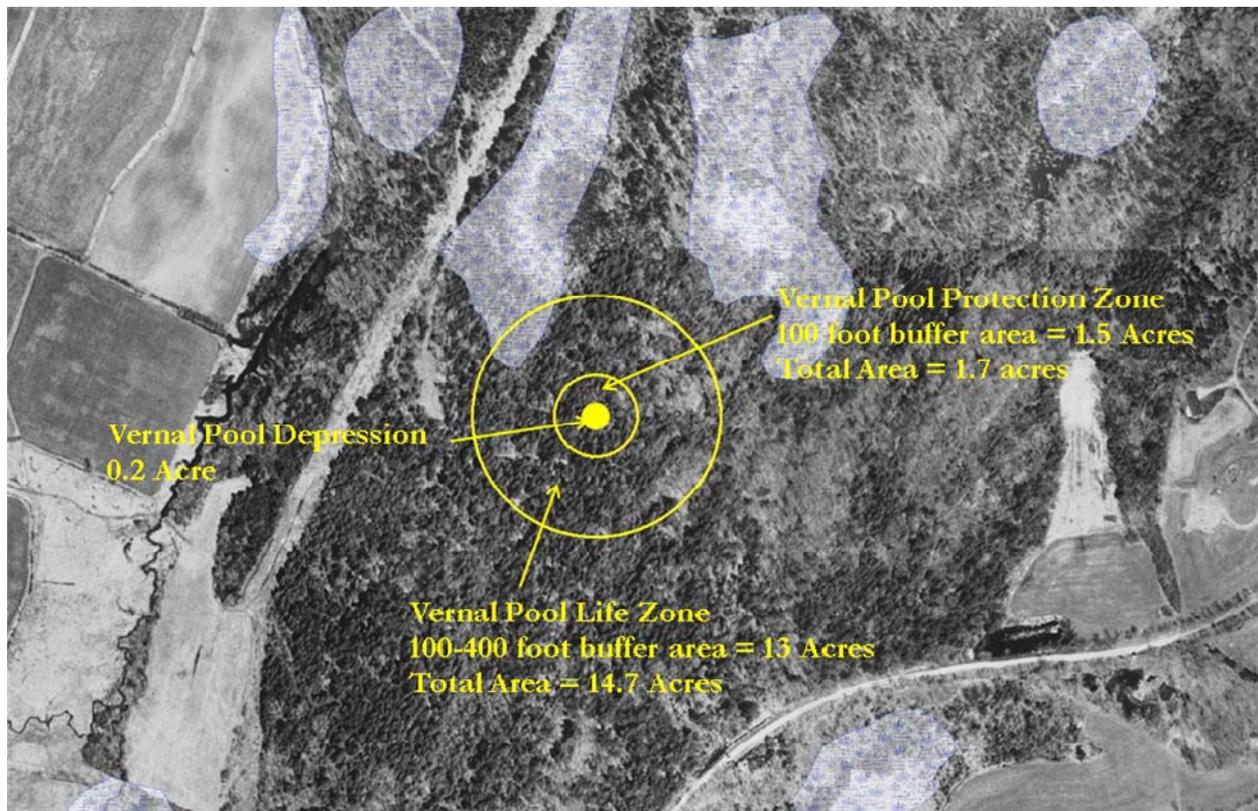
- Maintain 75% canopy cover of trees at least 20-30 feet tall
- Harvest only during frozen or completely dry conditions; do not create ruts and minimize soil disturbance
- Avoid use of heavy equipment; use directional felling, winching to minimize need
- Avoid new road or landing construction

- Leave a few larger or older legacy trees to serve as recruitment for coarse woody debris (CWD)
- Avoid disturbing fallen logs (prime cover for mole salamanders). Leave limbs and tops where felled or return slash to the zone during whole tree harvesting

Vernal Pool Life Zone – Defined as a 100 to 400 foot zone out from the Vernal Pool Protection Zone. This zone is approximately 13 acres (total area is 14.7 acres). The goal in this zone is to provide suitable upland habitat for pool breeding amphibians by maintain a partially closed-canopy stand that provides shade, deep litter, and woody debris well distributed around the pool.

- Maintain at least 50% canopy cover of trees 20-30 feet tall
- Avoid openings greater than $\frac{3}{4}$ of an acre in size. Where even-aged management is practiced, extended shelterwood or similar systems with partial overstory retention will help maintain suitable forest floor conditions
- Avoid significant shifts in forest cover type – avoid plantation silviculture
- Harvest only during frozen or completely dry conditions; do not create ruts
- Minimize soil compaction and scarification by limiting machinery passes, roads, directional felling, etc.
- Leave a supply of larger or older trees, ~1-2/acre to serve as recruitment for large diameter CWD
- Avoid disturbing fallen logs. Leave limbs and tops where felled.

¹ Guidelines are summarized from *deMaynadier PG, Houlahan JE. 2008. Conserving vernal pool amphibians in managed forests. Pages 253–280 in Calhoun AJK, deMaynadier PG, eds. Science and Conservation of Vernal Pools in Northeastern North America. CRC Press.*



Example of Vernal Pool Buffer Areas in Managed Forest

Monitoring

The landowner is the best person to monitor their site. Engage them in the process so that they recognize the importance of these habitats. Consider officially documenting the findings through the Vermont Vernal Pool Mapping Project or species through the Vermont Reptile and Amphibian Atlas by submitting records of occurrence. Information for these two programs and others can be found below under 'Resources.'

Resources

Vermont Reptile and Amphibian Atlas - <http://community.middlebury.edu/~herpatlas/index.html>

Vermont Vernal Pool Mapping Project - <http://www.vtecostudies.org/VPMP/index.html>

Field Guide to the Animals of Vernal Pools - http://www.mass.gov/dfwele/dfw/nhosp/publications/nhosp_pubs.htm

Vernal Pool Association - http://www.vernalpool.org/vernal_1.htm

Field Guide to Amphibian Larvae and Eggs of Minnesota, Wisconsin and Iowa -

http://www.umesc.usgs.gov/terrestrial/amphibians/mknutson_5003869_field_guide.html

Frog Calls – USGS Patuxent Wildlife Research Center -

<http://www.mass.gov/dfwele/dfw/nhosp/nhvernalcert.htm>

Farm ponds as critical habitats for native amphibians -

http://www.umesc.usgs.gov/terrestrial/amphibians/mknutson_5003869.html