

IDENTIFICATION & CONSERVATION OF VERNAL POOLS IN PENNSYLVANIA

*Adapted from an educational presentation developed spring 2010 by the Pennsylvania Natural Heritage Program.
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VERNAL POOL DEFINITION

- A wetland that dries up every year or every few years (cyclical wet and dry phases)
- Lacks a permanent inlet or outlet (i.e. no stream flowing through)
- Relatively small in size / shallow in depth
- Supports a distinctive biological community of plants and animals including indicator species that require vernal pools as breeding habitat. May have wetland plants but some are completely unvegetated.
- Do not have fish!!

Definitely NOT one size fits all!

Vernal pools come in many different shapes and sizes. This variability is reflected in names used for seasonal wetlands: seasonal, temporary, ephemeral, spring, autumnal, frog or salamander pond. The pool basin may contain varying amounts of plants, shrubs, and trees that tolerate swampy conditions. The basin bottom may be covered with a thick layer of decomposing tree leaves with no plants or trees at all. There isn't a right or wrong amount of vegetation or amount of time for a pool to hold water. Some plants and animals prefer pools that hold water for less time and/or have no vegetation in the basin. Others prefer pools that hold water a long time and/or have lots of vegetation in the basin.

Vernal pools are special because they are so variable and can provide specialized habitat for many different kinds of plants and animals. A number of rare plants and animals are found in vernal pools that meet their specific needs. The best vernal pool sites are ones with many vernal pools of different sizes and shapes in close proximity to one another, surrounded by a large protective patch of forest. In a vernal pool 'cluster' or 'complex', pools often are different sizes and contain different amounts of vegetation in the pool basins. But one or two isolated vernal pools have great wildlife value as well. Isolated pools may be the only wetlands available in an area for vernal pool amphibians to breed, and where resident birds, mammals, and reptiles can find abundant food and water.

How do you recognize a dry vernal pool?

You can walk through it without getting all wet! Look for shallow basins with:

- Grayed, water-stained leaves
- Wetland soils under the water-stained leaves
- Evidence of aquatic life such as: remnants of amphibian egg masses, caddisfly cases, snail or fingernail clam shells
- Mosses marking pool perimeter
- No trees or any other vegetation (unvegetated pools)

- Wetland plants but little or no standing water (marsh and shrub pools)
- Flood resistant trees (e.g. pin oaks) with 'high water' marks (swamp forest pools)
- Trees growing on hummocks, mounds of sphagnum moss (swamp forest pools)

Vernal pool hydroperiod (frequency and duration of flooding):

- Vernal pools exhibit great variability in hydroperiod (duration and frequency of flooding). Some pools hold water for a month or two and then dry up. Others hold water years at a time and only dry down completely during extended droughts. Some pools fill and dry once a year, others fill and dry multiple times a year
- Vernal pools are mainly filled by precipitation, runoff, & snow-melt, therefore they are 'isolated' – meaning they are not continually connected to other water bodies via a stream.
- But many vernal pools intersect the water table, especially those located on floodplains, at the headwaters of streams, or on the sides or bases of hill slopes. Many vernal pools will have temporary inlets and outlets when they overflow as a result of heavy rains & snow melt.
- Some pools located on floodplains will get flooded by streams overflowing their banks during high water events.
- An ephemeral hydroperiod is important because it eliminates fish; variations in hydroperiod influences what other plants and animals will use the pool too.

Vernal pools are relatively small & shallow

The maximum area of many vernal pools is less than 0.25 acres (0.1 ha) and depth less than 3 feet (~1 m)

Vernal pools have a distinctive biological community

The dry phase of a vernal pool prevents fish from becoming established. Fish are a top predator in permanent ponds...when they are missing from the food chain there is less predation and competition pressure. Animals whose young develop in vernal pools must have special adaptations to survive the dry phase. Two common strategies:

- 1) The young mature into terrestrial-living adults that leave the pool before it dries (may include a shift from water-breathing to air-breathing and/or plant-eating to meat-eating)
- 2) The animal completes an egg-to adult-to egg again cycle while the pool is wet. These animals must have a drought and freeze resistant egg that can lie dormant in the dry pool bed until it floods again.

VERNAL POOL INDICATOR SPECIES

Vernal pool indicator species are specialists that reproduce most successfully in fishless waters. In Pennsylvania, there are five species of amphibians and a type of crustacean that use seasonal pools almost exclusively for breeding and larval development.

1. MARBLED SALAMANDER (*Ambystoma opacum*): Chunky black & white mole salamander 4-5" long. Female lays eggs in a dry pool basin in autumn; she guards them until the pool floods again

2. JEFFERSON SALAMANDER (*Ambystoma jeffersonianum*): Slender, dark, long (4-7") mole salamander with blue flecking on sides and very long toes. First salamander to arrive in the spring, often crossing snow & ice. May be confused with leadback (*Plethodon cinereus*) and dusky (*Desmognathus spp*) salamanders.

3. SPOTTED SALAMANDER (*Ambystoma maculatum*): Large (6-8" long) with unmistakable yellow spots. The most commonly encountered mole salamander in PA vernal pools. Only the spotted salamander lays cloudy, opaque egg masses, but, they will lay clear egg masses too!

Note: Spotted versus Jefferson Salamander Egg Masses: Jefferson egg masses are always clear with a softer jelly than spotted; overall smaller & more linear in shape. Individual embryos encircled with a thin milky white ring. Spotted egg masses can be clear or opaque white, and have a very firm jelly that is 'blob-shaped'. In clear egg masses, look for a thick milky white ring encircling individual embryos.

4. WOOD FROG (*Lithobates sylvaticus*): Distinctive dark mask through eye and white 'upper lip'. Distinctive quacking call. Softer jelly than the mole salamander egg masses. Communal masses help eggs retain heat & the embryos can develop faster.

5. EASTERN SPADEFOOT (*Scaphiopus holbrookii*): Small stout primitive species of frog; greenish-gold protruding eyes. A hard projection on webbed hind feet functions like a digging spade. Rarely encountered. Unpredictable breeding events take place after heavy rainstorms, uses quick-drying vernal pools in sandy areas

FAIRY SHRIMP: Small crustaceans only found in seasonal pools. Springtime Fairy Shrimp (*Eubranchipus vernalis*) are the most common shrimp species encountered in PA pools. Females carry eggs in a small pouch; eggs are agitated like clothing in a washing machine. Males have 'trunks' or claspers on their head; used to grab hold of a female.

VERNAL POOL FACULTATIVE SPECIES

Vernal pool facultative species are commonly found breeding in vernal pools but can also reproduce successfully in permanent waters. A few examples: spring peepers, American toads, gray tree frogs, green frogs, dragonflies and damselflies, predaceous diving beetles, back swimmers, water boatmen, water striders, caddisflies, mosquitoes, phantom midges, aquatic worms, amphibious snails, and fingernail clams. Together indicator and facultative vernal pool species form a complex food web of predators and prey, meat eaters and vegetable eaters.

SPRING PEEPER (*Pseudacris crucifer*): A tiny frog ~1" in length with diagnostic X on its back.

AMERICAN TOAD (*Anaxyrus americanus*): Typically has one or two large warts per dark spot on its back & spots on its chest & belly. Fowler's Toad (*Anaxyrus fowleri*) usually has three or more large warts per dark spot & an unmarked chest & belly. American toad eggs are laid in long ropy strands

GRAY TREE FROG (*Hyla versicolor*): Perfectly patterned to blend in on a tree trunk...a good strategy because it lives in trees most of the year. Diagnostic yellow coloration on legs and sides of belly. Calls like an old-fashion telephone.

DRAGONFLIES & DAMSELFLIES (Order Odonata): Present in the vernal pool as nymphs. Look for adults patrolling or laying eggs in wet or dry pool basins. Commonly find dragonflies in the skimmer family using vernal pools (Libellulidae).

PREDACEOUS DIVING BEETLES (Order Coleoptera, Family Dytiscidae): Present in the pool as adults (pictured) and as larvae known as 'toe-biters'.

BACKSWIMMERS (Order Hemiptera, Family Notonectidae)

CADDISFLIES (Order Trichoptera): Examples Cigar tube Caddisfly (Family Phryganeidae) and Log Cabin Caddisfly (Family Limnephilidae)

WHY ARE VERNAL POOLS IMPORTANT?

Ecological Services

Vernal pools provide services that humans would and often do have to pay for if the environment has be altered to the point it can no longer perform it's ecosystem role.

Vernal pools do all these things for FREE!

- Slow Flooding & Erosion by trapping RUNOFF
- Remove Pollutants & Sediments by slowly FILTERING water through plants and soils
- Improve the Quality & Quantity of our DRINKING WATER
- Improve the Health of our STREAMS

Wildlife

Vernal pools are often the only wetlands found in an otherwise dry landscape. They increase the abundance and variety of food, water, and habitat available to wildlife in the forest. Vernal pools are good for amphibians, turtles, bats, insects, wetland plants, deer, bears, turkeys, wood ducks, and songbirds. In the winter look for deer and turkey tracks in the snow around pools as they seek fresh water.

Distinctive Biological Community

Vernal pool indicator species depend on vernal pools for successful development and survival of their young. In the mid-Atlantic region, 26% of all threatened & endangered amphibians depend upon vernal pools (Colburn, 2004).

SEASONAL POOL CONSERVATION

Vernal pools are sensitive habitats that consist of the vernal pool wetland & the surrounding uplands. Multiple tiers of habitat need protection (Brown & Jung 2005):

- Seasonal pool depression
- Seasonal pool envelope (100 ft)
- Seasonal pool terrestrial habitat (1000 ft)

Upland habitat

Each new generation needs somewhere to live. Young aquatic animals must develop into terrestrial adults & leave the pool before it disappears or else they will dry out and perish. They need to find an upland home. During the many months that a vernal pool is dry, adult amphibians find food and shelter in the surrounding upland forest. They live under rocks, rotting logs, and the moist layer of leaves on the forest floor. Mole salamanders and spadefoot toads move into underground burrows.

The Environmental Protection Agency recommends managing a **1000 ft radius area** beyond the edge of a vernal pool basin as forested upland habitat. This distance will **protect 95% of a vernal pool's amphibians** in the uplands where they spend most of the year (Brown & Jung 2005).

The 1000 ft distance is based on scientific studies of animal movement. Amphibian movement between upland and breeding pool habitats as reported in (Brown & Jung 2005 and Colburn 2004):

- Four-toed salamanders move a maximum of 650 feet
- Wood frogs commonly move 1,200-1,600 feet
- Spotted salamanders average over 500 feet but will move 2700 feet
- Jefferson salamanders average around 820 feet but will move up to 2050 feet
- Marbled salamanders average about 635 feet and but travel up to 1475 feet

Fragmentation

The smaller the forest patch around a pool, the less food and shelter is available. Roads and other barriers located between pools and uplands increase the odds of mortality during migration to and from a pool.

Water Quality

Buffers are critical to protecting vernal pool water quality. Pools are often degraded by run-off received from nearby roads.

Legal Protection

Vernal pool habitats and vernal pool plants and animals are protected under a number of state and federal laws. State laws vary but in Pennsylvania a permit from the Department of Environmental Protection is required to fill or excavate any vernal pool, regardless of size.

Vernal pools can receive protection under section 404 of the Federal Clean Water Act, administered by the U.S. Army Corps of Engineers (ACOE). Section 404 can be viewed at <http://www.wetlands.com/regs/sec404fc.htm>. The ACOE cannot regulate "isolated wetlands" that lack a connection to a stream or waterway. However, indirect wetland connections may count, such as if the vernal pool is connected to another wetland which drains into a stream or located in the floodplain of a stream.

Federal and state laws only go so far. They regulate impacts to the pool basin but often neglect the equally critical terrestrial upland habitat. State legislation can fill in the holes and provide protection to the vernal pool envelope and upland terrestrial habitat. Better protection can be achieved through greater education, communication, and action of the scientific / conservation community and the public.

The Pennsylvania Seasonal Pools Registry (<http://www.waterlandlife.org/54>) helps maximize existing regulations in PA by documenting locations of seasonal pools and providing information on seasonal pool habitats, species, and recommendations for conservation and management. The Pennsylvania Seasonal Pool Registry utilizes Citizen-Scientists (expert and amateur volunteers and landowners) to:

- Register locations of seasonal pools in the Commonwealth
- Document locations of characteristic vernal pool animals.
- Collect basic descriptive information on seasonal pool habitats
- Create a database of seasonal pool locations for conservation planning and environmental review

Similar "citizen-scientist" initiatives in other states have been very successful in raising awareness of seasonal pools and have directly contributed to their conservation. Individual landowners can play a critical role in the protection of vernal pools.

Federal Resources

- Natural Resource Conservation Service (NRCS): <http://www.nrcs.usda.gov/>
- Conservation Reserve Enhancement Program (CREP): <http://www.nrcs.usda.gov/programs/CRP/>
- Wildlife Habitat Incentive Program (WHIP): <http://www.nrcs.usda.gov/Programs/whip/>
- Environmental Quality Incentives Program (EQIP): <http://www.nrcs.usda.gov/PROGRAMS/EQIP/>

References

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Private Landowner Assistance for Vernal Pools in Pennsylvania:

The following list provides contact information for organizations that support landowners seeking technical assistance with managing their vernal pools and surrounding upland forests.

Conservancies: The Pennsylvania Land Trust Association maintains a list of conservancies, visit their website to find one near you at <http://conserveland.org>

County Conservation Districts county directory at: <http://www.pacd.org/districts/directory.htm>

Department of Conservation and Natural Resources (DCNR) Service Foresters: http://www.dcnr.state.pa.us/FORESTRY/serviceforesters_select.aspx

Department of Environmental Protection (DEP) Watershed Management: <http://www.depweb.state.pa.us/watershedmgmt/site/default.asp>

Department of Environmental Protection (DEP) Regional Offices: http://www.depweb.state.pa.us/portal/server.pt/community/regional_resources/13769

Department of Agriculture Pennsylvania Invasive Species Council (PISC): <http://www.invasivespeciescouncil.com/>

Natural Resource Conservation Service (NRCS): <http://www.nrcs.usda.gov/>

- ♦ Conservation Reserve Enhancement Program (CREP): <http://www.nrcs.usda.gov/programs/CRP/>
- ♦ Conservation Stewardship Program: http://www.nrcs.usda.gov/programs/new_csp/csp.html#fact
- ♦ Environmental Quality Incentives Program (EQIP): <http://www.nrcs.usda.gov/PROGRAMS/EQIP/>
- ♦ State Acres for Wildlife Enhancement (SAFE): http://www.fsa.usda.gov/Internet/FSA_File/safe08.pdf
- ♦ Wildlife Habitat Incentive Program (WHIP): <http://www.nrcs.usda.gov/Programs/whip/>
- ♦ Wetlands Reserve Program (WRP): <http://www.pa.nrcs.usda.gov/programs/WRP/index.html>

NatureServe - A Network Connecting Science with Conservation: <http://www.natureserve.org/>

- Species information: <http://www.natureserve.org/explorer/>
- Species conservation ranking definitions: <http://www.natureserve.org/explorer/ranking.htm>

Penn State University (PSU) Cooperative Extension: Contact information for extension offices by County at <http://extension.psu.edu/extmap.html>

PA Game Commission Private Landowner Assistance Program (PLAP): <http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=513&q=168220>

PA Fish and Boat Commission Landowner Incentive Program (LIP): <http://www.fish.state.pa.us/promo/grants/lip/00lip.htm>)

PA Natural Heritage Program (PNHP) – information for the conservation of biodiversity: <http://www.naturalheritage.state.pa.us/>

The Nature Conservancy (TNC): <http://www.nature.org/wherewework/northamerica/states/pennsylvania/>

Watershed Organizations: The Pennsylvania Directory of Watershed Organizations is available online at www.pawatersheds.org/WatershedDirectory/index.asp

Western Pennsylvania Conservancy: <http://www.paconserve.org/>

- ♦ *Visit the PA Seasonal Pool Registry at <http://www.waterlandlife.org/54>*