PENNSYLVANIA VERNAL POOL IDENTIFICATION GUIDE

WHAT IS A WOODLAND VERNAL POOL?

Now you see it, now you don't

Woodland vernal pools are temporary bodies of water that are typically wet in the winter and spring but dry up by mid-summer. Vernal pools are primarily found in forested areas and are characterized by absence of fish, lack of flowing water, small size, shallow depth, and presence of plants and animals that can withstand a period of drought *(Brown and Jung 2005)*.

Many species of amphibians (frogs, toads, and salamanders), insects, and crustaceans are adapted to breed in vernal pools. This is because vernal pools provide an ideal nursery where their young can mature. The dry period reduces or eliminates populations of dominant competitors and predators such as fish, which cannot survive drought, and bullfrogs, which usually take more than a year to develop from tadpole to adult. The presence of these voracious eating machines in permanent wetlands is the main reason vernal pool species have adapted to breed in temporary wetlands. Protecting vernal pools and the surrounding 1000 feet of upland habitat is critical for protection of water quality, amphibian breeding, and terrestrial habitat for adult and juvenile amphibians *(Brown and Jung 2005)*.

COVER PHOTO OF A WOOD FROG (*LITHOBATES SYLVATICUS*) TAKEN BY M. CURRIE/ TNC

M.CURRIE/ TNC

A vegetated woodland vernal pool with Golden Club *(Orontium aquaticum)*, an uncommon wetland plant

Wetland Oasis

Vernal pool wetlands usually lose all of their surface water over the course of the summer. Most pools in Pennsylvania slowly refill during the fall and winter. They reach their maximum size with the frequent rains and melting snows of early spring, in time for the arrival of masses of breeding frogs and salamanders. To identify a pool during the wet period, look for the indicator species listed on pages 5-6. Indicator species are animals that "rely on seasonal pools as essential habitat for a portion of their life-cycle" *(Brown and Jung 2005).* The best time to look for vernal pool amphibians as adults, egg masses, and larvae is between March and May.

A Disappearing Act

A key characteristic of a vernal pool is that it dries in the summer or fall. While the dry period lessens predation pressure, the cycle of filling and drying creates a uniquely harsh and unpredictable living environment. Vernal pool species use a variety of strategies to survive the summer drought. Many species have an aquatic immature phase and leave as terrestrial adults before the pool dries. Mobile species can freely move between temporary and permanent waters. A variety of insects and crustaceans have drought-resistant eggs that lie dormant in the pool bottom until the waters return.

To identify a pool during its dry phase, look for a depression of water-stained, decomposing leaves and debris; trees with buttressed trunks; tree trunks with stains marking high water levels; hydric soils; and wetland plants growing in dry soil *(Brown and Jung 2005).* Examples of common vernal pool plants are shown on pages 9-10.




J. DERR/ TNC

Two vernal pools in their dry *(left)* and wet *(right)* phases

VERNAL POOL INDICATOR ANIMALS

M.CURRIE/ TNC

Spotted Salamander
Ambystoma maculatum

- Large and dark with yellow spots, 6-8 inches long
- Most common of Pennsylvania's five mole salamanders
- Like all mole salamanders, spends most of the year underground
- Breeds in March, often forms large breeding congregations

M.CURRIE/ TNC

Marbled Salamander
Ambystoma opacum

- Short, chunky, black and white, 4-5 inches long
- Only fall-breeding mole salamander (August–September)
- Females lay their eggs in dry pool beds and guard them until the pools flood.

C. EICHELBERGER/ PNHP

Jefferson Salamander
Ambystoma jeffersonianum

- Slender and dark with blue flecking on sides, 4-7 inches long
- Conspicuously long toes
- First mole salamander to arrive in the spring (February–March), often crossing snow and ice
- *Note:* The **Blue-spotted Salamander** *(Ambystoma laterale)* is a similar species that is rarely encountered in Pennsylvania. It is currently known from only three counties.

M.CURRIE/ TNC

Wood Frog
Lithobates sylvaticus

- Small earth-toned frog with a black mask, ~2 inches long
- Raucous call sounds similar to people laughing or ducks quacking.
- Breeds February–March; lays soft egg clusters in large communal rafts

M. REDMER

Eastern Spadefoot
Scaphiopus holbrookii

- Small primitive species of frog, 2-3 inches in size
- Endangered in Pennsylvania
- Like mole salamanders, a 'fossorial' species that spends most of the year underground
- Their hind feet are equipped with a hard projection they use as a digging "spade" to burrow into sandy soils.

L. KENNEY

Springtime Fairy Shrimp
Eubranchipus vernalis

- A large vernal pool crustacean, 0.5 to ~2 inches in size
- Lays tough eggs that can pass unharmed through the gut of a bird or lie dormant for decades in a dry pool bed
- Eggs hatch when the pools fill with water in winter or early spring.

OTHER COMMON VERNAL POOL ANIMALS

M.CURRIE/ TNC

Green Frog
(Lithobates clamitans)

C. EICHELBERGER/ PNHP

Spring Peeper
(Pseudacris crucifer)

J. DERR/ TNC

Red-spotted Newt
(Notophthalmus viridescens)

B. LEPPO/ PNHP

Swamp Darner
(Epiaeschna heros)

B. MOUL

Meadowhawk
(Sympetrum sp.)

R. KOVAL

Four-toed Salamander
(Hemidactylium scutatum)

VERNAL POOL SOILS AND HYDROLOGY

Where and why vernal pools hold water depends on where the water comes from, the soils under the pool, and where the pool is found on the landscape. Water can enter pools from the surface via run-off from rain and melting snows or from flooding of nearby streams, ponds, or lakes. Water can enter the pool from below when the water table is near the surface and intersects the pool basin.

The soils under perched vernal pools are usually very "tight" and can slow or stop the downward movement of water. Soil tightness is usually due to a high clay content or a hardpan layer. Hardpans typically form in soils where the water table fluctuates near the surface, causing dissolved minerals to concentrate in a narrow band that hardens and becomes fairly impervious to water. In contrast, vernal pools on floodplains may have very porous soils with water moving freely below the ground surface. The water level in a floodplain pool may be directly related to the water level in a nearby stream or river.

Where a pool lies on the landscape (e.g. topography and geology) also affects hydrology. In Pennsylvania, vernal pools can occur on high ridgetops. Here, the only source of water is rainfall and melting winter snow. In contrast, vernal pools that occur at the foot of a mountain may be filled with groundwater. A pool located on a slope may actually receive groundwater on the upslope side and discharge it to the water table on the downslope side.

The hydrology of vernal pools can vary from year to year depending on the weather patterns, precipitation, stream flow, water table levels, etc. If you observe the same pond over a number of years, you will see variations in how long it holds water, when it goes dry, and when it refills.

FINDING VERNAL POOLS IN PENNSYLVANIA

Important factors in vernal pool formation are precipitation, topography, soil permeability, and bedrock. Vernal pools form under a variety of hydrologic and geologic conditions that vary by region. In Pennsylvania, vernal pools most commonly form:

- in rolling, glaciated terrain with poorly developed drainage networks (northeast and northwest);
- on ridgetops and plateaus, in ridgetop saddles at the headwaters of small streams, and on the toeslopes of mountains (ridge and valley, unglaciated plateau);
- in poorly drained valley bottoms and lowlands (Piedmont, statewide);
- in flooded depressions, back channels, and abandoned oxbows of streams and rivers (statewide).

VERNAL POOL PLANTS

In addition to wetland hydrology and soils, the presence of wetland vegetation is another important indicator of a vernal pool. Vernal pools hold water long enough to develop wetland (hydric) soils, and often support water-loving (hydrophytic) plants, though some pool basins are completely unvegetated. The following plants are commonly found in or at the edge of vernal pools.

Common Name	Scientific Name	Plant Type
Cinnamon fern	*Osmunda cinnamomea*	herbaceous
Manna and meadow grasses	*Glyceria acutiflora, G. canadensis, G. melicaria, G. septentrionalis, Torreyochloa pallida*	herbaceous
Marsh fern	*Thelypteris palustris*	herbaceous
Northeastern bulrush	*Scirpus ancistrochaetus**	herbaceous
Rice cut-grass	*Leersia oryzoides*	herbaceous
Royal fern	*Osmunda regalis*	herbaceous
Sedges	*Carex gynandra, C. crinita, C. canescens, C. vesicaria, C. lupulina*	herbaceous
Three-way sedge	*Dulichium arundinaceum*	herbaceous
Wool-grass	*Scirpus cyperinus*	herbaceous
Buttonbush	*Cephalanthus occidentalis*	shrub
Highbush blueberry	*Vaccinium corymbosum*	shrub
Winterberry	*Ilex verticillata*	shrub
Pin oak	*Quercus palustris*	tree
Red maple	*Acer rubrum*	tree
Sourgum	*Nyssa sylvatica*	tree
Swamp white oak	*Quercus bicolor*	tree

** A rare plant found in vernal pools; A Federally endangered species*

B. LEPPO/ PNHP

Blister sedge
Carex vesicaria

G. GRESS/TNC

Buttonbush
Cephalanthus occidentalis

B. LEPPO/ PNHP

Cinnamon fern
Osmunda cinnamomea

B. LEPPO/ PNHP

Winterberry
Ilex verticillata

C. EICHELBERGER/ PNHP

Northeastern bulrush
Scirpus ancistrochaetus

M.CURRIE/ TNC

Highbush blueberry
Vaccinium corymbosum

VERNAL POOL EVIDENCE - SUMMARY CHECKLIST

- ✔ Ephemeral: Typically dries up every summer and refills in late winter or early spring.
- ✔ No fish: Seasonal drying maintains a fishless environment that is necessary for successful reproduction by indicator species.
- ✔ No flow: No permanent inlets or outlets of flowing surface water.
- ✔ Indicator species: Presence of mole salamanders (Jefferson, Marbled, or Spotted), Wood Frogs, Eastern Spadefoot, or Fairy Shrimp.
- ✔ Wetland plants: Presence of water-loving plants; see page 9 for a list of common species. Note that some vernal pools will not have any wetland vegetation.
- ✔ Dry phase: Evidence of water-stained leaves in a depression, buttressed and/or water-stained tree trunks, presence of sphagnum moss and/or other wetland plants growing in dry soil, and wetland soils.

B. LEPPO/ PNHP

Buttressed tree

C. EICHELBERGER/ PNHP

Sphagnum moss

RESOURCES

Brown, L. J. and R.E. Jung. 2005. "An introduction to Mid-Atlantic Seasonal Pools," EPA-903-B-05-001. U.S. Environmental Protection Agency, Mid-Atlantic Integrated Assessment, Ft. Meade, Maryland. *epa.gov/bioiweb1/pdf/EPA-903-B-05-001AnIntroductiontoMid-AtlanticSeasonalPools.pdf*

Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Hulse, A.C., C. J. McCoy and E. J. Censky. 2001. *Amphibians and Reptiles of Pennsylvania and the Northeast*. Cornell University Press, New York. 419 pp.

U.S.D.A. Natural Resources Conservation Service (NRCS). 2009. Hydric Soils. Available at *soils.usda.gov/use/hydric*

WEB SITES

Pennsylvania Fish and Boat Comission Landowner Incentive Program (LIP): *fish.state.pa.us/promo/grants/lip/00lip.htm*

Pennsylvania Game Commission Private Landowner Assistance Program (PLAP): *pgc.state.pa.us/pgc/cwp/view.asp?a=513&q=168220*

Pennsylvania Seasonal Pool Registry: *WaterLandLife.org/54*

Pennsylvania Herp Identification: Online Guide to Reptiles and Amphibians of Pennsylvania: *paherps.com/herps*

Pennsylvania Herpetological Atlas: *paherpatlas.org*

The Nature Conservancy's Vernal Pools Web site: *nature.org/pavernalpools*

ABOUT US

The Nature Conservancy: *nature.org/pennsylvania*
Pennsylvania Natural Heritage Program: *naturalheritage.state.pa.us*
Messiah College: *messiah.edu*
Western Pennsylvania Conservancy: *WaterLandLife.org*

This project was funded in part by grants received by the Western Pennsylvania Conservancy:

- The Community Conservation Partnerships Program, Environmental Stewardship Fund, administered by the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation & Conservation
- The U.S. Fish and Wildlife Service Landowner Incentive Program (LIP), administered by the Pennsylvania Fish and Boat Commission

The Nature Conservancy
Protecting nature. Preserving life.™

PNHP
Pennsylvania Natural Heritage Program

MESSIAH COLLEGE
messiah.edu

Western Pennsylvania Conservancy

DCNR pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES