

Silt fences seriously inhibit amphibian migration and should be removed from the buffer and nearby areas as soon as possible.

Regularly used skid trails and landings should be situated outside the buffer. Close existing roads in the buffer area to prevent off-road vehicles from disturbing the buffer and pond areas. At the pond itself, keep tree tops and slash out of the depression. However, to keep from disturbing amphibians, if a tree top falls in, it should not be removed from the pond.

For More Information

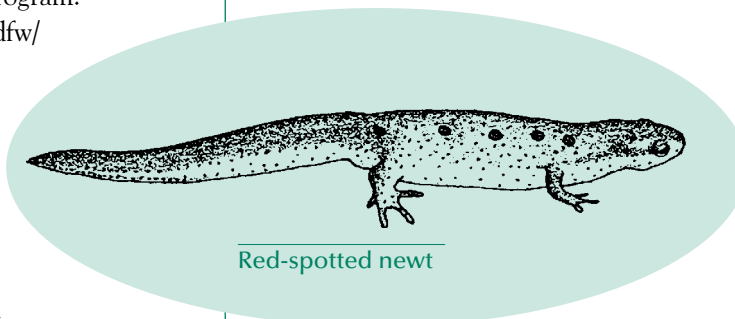
Books

Kenney, L. and M. Burne. *A Field Guide to the Animals of Vernal Pools*. 2001. Massachusetts Natural Heritage and Endangered Species Program. www.mass.gov/dfwele/dfw/nhosp/publications/nhosp_pubs.htm.

Shaffer, Larry L. *Pennsylvania Amphibians and Reptiles*. 1999. Pennsylvania Fish and Boat Commission. (Color illustrations, identification descriptions, range, habitat, and reproduction facts on Pennsylvania salamanders, frogs, toads, turtles, lizards, and snakes. Identification posters are also available separately.) Order forms and online purchase available at www.fish.state.pa.us.

Van Dusen, Barry W., Betsy Colburn and Chris Leahy. *Pond Watchers, Guide to Ponds and Vernal Pools of Eastern North America*. 1995. Massachusetts Audubon Society, Lincoln, MA. (A full-color, laminated pocket field guide to common vernal pond life.) Call 781-259-2214 or email audubonshop@massaudubon.org.

Welsch, David J. et al. *Forested Wetlands: Functions, Benefits, and the Use of Best Management Practices*. 1995. U.S. Department of Agriculture Forest Service. Publication No. NA-PR-01-95. (A booklet on managing forestry opera-



Red-spotted newt

tions in forested wetlands, including chapters on vernal ponds.) Available on the Web at www.srs.fs.usda.gov/pubs/abstract/viewpub.jsp?index=10891 or ncrs.fs.fed.us/pubs/.

Web sites

The Vernal Pools Association (www.vernalpool.org) is an environmental project of the Reading Memorial High School in Reading, Massachusetts, and encourages the study and protection of vernal ponds. This organization also produces online and printed educational materials for youth and adults, including vernal pond management recommendations, natural history books, and lesson plans.



Wood frog

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Illustrations

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Vernal Ponds: Seasonal Habitats for Wildlife

Have you ever walked through the woods in spring and found an immense puddle that wasn't there over the winter? You may have discovered one of the most ecologically important habitats to be found among Pennsylvania's woodlands.

Vernal ponds are temporary wetlands that fill after the snowfall each spring. They become the seasonal breeding and feeding grounds for many intriguing amphibians and insects, as well as the reptiles, birds, and mammals that depend on them for food. You may have been led to this pond by the unmistakable sounds of spring peepers and wood frogs calling for a mate.

If you crouch by the water's edge, you'll find an entire community of creatures. You might witness the bustling activity of salamanders, frogs, toads, and newts that have come to breed, as well as all kinds of aquatic insects and their eggs that will develop over the spring months. Jellylike masses and strings of eggs will be visible in the water and on the pond vegetation, where salamanders and frogs have left them behind.

Vernal ponds are extraordinary wetlands fascinating to observe and essential to the lives of many woodland species. With the rapid population declines of so many amphibian species, it's crucial that these often unnoticed habitats be recognized and protected.

What To Look For

It's easy to recognize vernal ponds in the late winter and early spring. Named from *vernalis*, the Latin word for spring, vernal ponds are formed seasonally in shallow ground depressions from spring snowmelt, precipitation, and rising water tables. Generally drying up in late summer, these ponds are only temporary woodland reservoirs. They are slightly harder to identify during the summer and fall months; however, there are several clues to look for. Blackened, compressed leaf litter; gray soil; watermarks on surrounding tree trunks; and the presence of moisture-tolerant vegetation all suggest an area that collects water part of the year. Red maple, high-bush blueberry, and buttonbush are all common at these locations.



Spring peeper

Vernal ponds themselves are generally less than 40 yards in diameter and no more than 4 feet deep, although they receive water from a larger surrounding landscape. Much of the topography that makes Pennsylvania's vernal ponds possible was first formed during the last glacial period and is the result of 10,000 years of irreplaceable geologic history.

Ecological Importance

If a vernal pond's physical features don't tip you off, the wildlife living there will certainly give away its location. Vernal ponds are home for a diversity of animals that count on them for the spring breeding season.

The seasonal nature of vernal ponds means that they are uninhabited by fish. This makes them the perfect habitat for a variety of amphibians and invertebrates to breed and develop with less chance of predation. Species like mole salamanders, wood frogs, and fairy shrimp depend exclusively on vernal ponds for this part of their life cycles. Often a pond is the ancestral home of an amphibian community that resides nearby in the forest each winter, then migrates to the same pond each spring to lay its eggs.

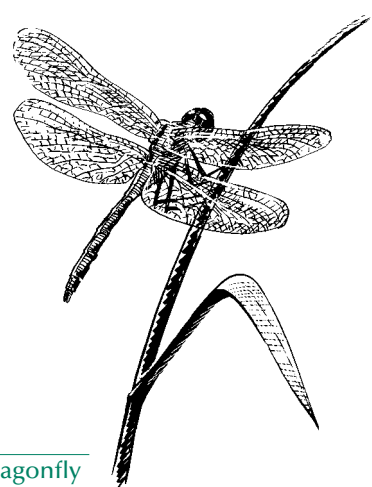
The first creatures to arrive each season are Jefferson salamanders, members of the mole salamander group, which

spend most of their lives in underground burrows. On rainy nights from mid-January to early March, Jefferson salamanders travel an often snowy forest floor to reach their chosen vernal pond. Here, they mate and lay a long string of beadlike eggs on branches and other vegetation submerged in the pond. The next mole salamanders to arrive are spotted salamanders, which migrate in late February to early April to lay their eggs on pond vegetation.

During the same period, wood frogs make their trek to the ponds. Finding this species in its breeding season is a guarantee that you have found a vernal pond—and wood frogs noisily make their presence known. Male wood frogs attract females with a loud, distinctive call that sounds like the quacking of ducks. Often an entire chorus of this species can be heard from afar, and you can easily follow the sound until you find the pond.

Many other species use vernal ponds in spring. The spring peeper, Pennsylvania's smallest frog species, has one of the animal kingdom's loudest voices for its size. Choruses of its high-pitched, birdlike peeps can sound like sleighbells from a distance. American toads, spadefoot toads, gray tree frogs, green frogs, and red-spotted newts are among the many other creatures that may come to breed. By the end of the breeding season, ponds are filled with egg clusters that appear as jellylike masses containing small, round eggs.

As young amphibian larvae hatch and develop, they feed on invertebrate species that have emerged from their eggs at the same time. Fairy shrimp, dragonflies, damselflies, caddisflies, mosquitoes, daphnia, and other invertebrates drop egg cases in vernal ponds each year. The egg cases lie dormant over winter and hatch the following spring. While amphibian larvae feast on these



Dragonfly

delights, insect predators like fishflies, diving beetles, and backswimmers also look for amphibian larvae to feed upon.

As activity inside the pond increases each spring, it attracts other animals to the vernal community. Some turtle species visit the ponds to feed on egg masses, while snakes and raccoons may feed on tadpoles and frogs. Birds like the green heron and red-shouldered hawk also visit ponds to feed.

By late spring or early summer, tens of thousands of young salamanders and frogs that have undergone metamorphosis leave the pond for the forest, to continue their life cycles. The huge number of organisms using vernal ponds each year shows how essential they are to the life cycles of forest species both in and



Toad

out of the ponds. In fact, the amphibian species developing in ponds alone generally amount to more vertebrate biomass than the mass of all the birds and mammals in a forest. The ability of vernal ponds to continue supporting this biodiversity remains dependent on the activities occurring around them.

Protecting Your Vernal Pond

If you think your property contains a vernal pond, you can do a lot to protect it from potentially harmful effects of land use. The key is to protect both the stability of the forest and the hydrology of the pond. For instance, amphibian species depend on forests for their adult lives and on ponds for breeding and the development of young. This is especially important because this kind of unique wetland has failed to be successfully replicated through artificial means in Pennsylvania's forests. Surrounding land that may be used for recreation, timber harvesting, or residential structures can be managed in ways that keep the impact on vernal ponds to a minimum.

■ Avoid using chemicals and fertilizers.

Vernal ponds accumulate runoff water from surrounding upland areas. Even a minimal amount of pesticide, herbicide, or fertilizer can upset the food chain and cause deadly results in a water body as small as a vernal pond.

■ Maintain forest canopy.

The forest canopy provides essential shade for regulating pond temperatures, and slows the loss of water from the pond by evapotranspiration. In addition, the forest canopy helps to maintain a cool, moist environment in the surrounding forest, a necessity for many amphibians.

■ Do not add or remove plant debris.

Amphibians use small to medium-sized twigs on which to attach their eggs, so no woody material needs to be added to the pond. Although tree tops and debris should be kept out of the pond depression during forest maintenance, if some material does fall in, it should be left there. Removal could disturb amphibian eggs or young.

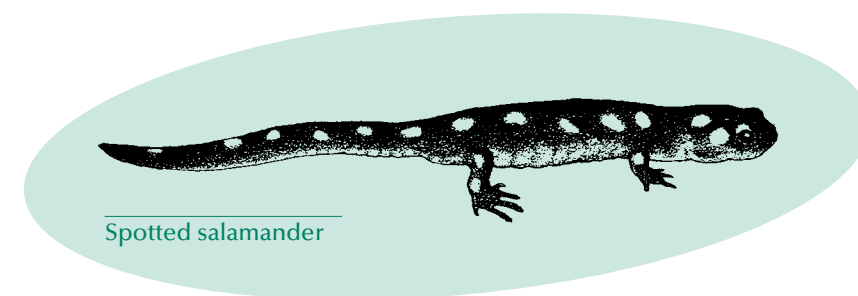
■ Do not drain ponds or alter the surrounding watershed.

A vernal pond's location, dimensions, and surrounding topography are the product of thousands of years of geologic evolution. Diverting or draining the area's water or depleting the underground water table would cause irreversible changes to the ecosystem.

■ Protect water quality.

Be aware of water flow patterns and the amount of area that drains into your property's vernal pond. This way, it is possible to prevent the flow of materials like chemicals, fertilizers, and silt from reaching ponds. All earth-moving activities must be carefully managed to prevent silt from flowing into the pond. A minimum 100-foot buffer is

recommended between ponds and any activities that can alter water quality or produce sediment. This material is hazardous because it fills in pond floors, suffocates egg masses, and can harm developing larvae. Nearby roads with water diversion structures should be positioned in a way that keeps sediment from entering the buffer area and pond.



Spotted salamander

Late winter and early spring vernal pools are filled with water.



■ Protect from off-road vehicles and machinery.

Consider fencing off vernal ponds; also be sure to prevent disturbance from recreational and industrial off-road vehicles in the surrounding area, year-round. It is essential that pond beds and walls remain undisturbed even during the dry season. Compaction of the soil can change water flow and damage dormant eggs and larvae buried in the pond leaf litter. Tire ruts in the pond also can promote early drainage at a time when amphibian eggs have not yet hatched. Ruts in the surrounding forested area can cause amphibians to lay eggs in locations too shallow to sustain their young. Ruts also can trap young salamanders and turtles on their way into the forest, leaving them to be eaten by

predators or die of dehydration. Existing ruts can be filled in with soil.

■ Do not add fish or other animals.

Making a fish pond out of a vernal wetland quickly defeats its ecological purpose. The animals in a vernal pond's food chain rely on the absence of fish or other animals that would feed on amphibian young or compete with them for insects.

■ Do not allow collection of plants or animals.

Be sure that plants and animals are not removed from the pond. Even small changes in a vernal pond's ecosystem can upset the balance of predator-prey relationships and could include the removal of endangered plants and animals.

■ Keep the effects of timber operations to a minimum.

Timber harvesting in a forest with vernal ponds can be done in a way that minimizes sedimentation threats to the ponds. The most important consideration is to keep a buffer zone around the pond. A buffer of 100 feet or wider is recommended where trees and shrubs are retained and there is minimal disturbance to the leaf litter or soil. Following these guidelines will ensure that the temperature and moisture is adequate for the travel habits of amphibians. To minimize disturbance, forest operations in the buffer area should occur when the ground is frozen and covered with snow; operations should always be avoided in muddy conditions that would cause ruts deeper than six inches.

Vernal pools begin to dry up in summer; some are completely dry by late summer.

