

Vernal Pools – teacher reading

Vernal pools (vernal means “spring”) are contained basins or depressions, usually found in **deciduous** woodlands, that hold water for at least 3 months from late winter/early spring to mid summer. These temporary wetlands fill in winter and early spring from rain, runoff, and/or rising groundwater. They usually dry up from **evaporation** and **transpiration** of surrounding trees and other vegetation later in the year. They are extremely variable in shape and size. Some are small in size but quite deep while others have an extensive surface area but are shallow. A few may even hold water all year, only drying out under certain drought conditions.

Not every puddle in a woodland is a vernal pool. The blackened leaves found at the bottom of a depression are an indicator that water was held for a period of time and that the depression may well be a vernal pool. Carefully pushing aside the leaves may lead to the discovery of vernal pool amphibious flat snails and/or another species like the fingernail clam (pill clam).

Certain “**indicator**” amphibians and invertebrates, that use vernal pools exclusively for breeding or to complete their life cycles, characterize these unique ecosystems. Because they are dry for part of the year, there are no fish. The amphibians that depend on them for breeding live a few hundred feet away in the surrounding forest the rest of the year. In late winter or early spring, when the frost is gone from the ground, they awaken from hibernation and return to the pools of their birth. After laying their egg masses, they will return to the forest to feed and live. Breeding occurs over a period of a few days to about two weeks. The hundreds of amphibians visible for the short breeding season are seldom seen once they return to their upland habitat where they live and forage under the leaf litter and fallen logs of the forest floor.

Amphibians that breed only in vernal pools and the invertebrates that are found nowhere else are called “**obligate**” species. Other creatures, such as spring peepers and American toads, may use the pools to breed but may also breed in other water bodies. These animals are called “**facultative**” species. The most common obligate species in CT vernal pools are the spotted, marbled, blue-spotted and Jefferson salamanders, wood frogs and fairy shrimp.

The dead leaves at the bottom of the pools provide the nutrients and energy that cycle through these wetland nurseries. Plant material like the leaves and **algae** that grow in the pools are from **producers**. The complex food web begins with these leaves being broken down by fungi and bacteria that are in turn fed upon by slightly larger organisms like daphnia, copepods and worms. **Herbivorous consumers** like larval insects of many species, crustaceans like the isopod, and tadpoles of the wood frogs consume leaf material and algae but may also be **scavengers** of dead material in the pool. Other insects and the salamander larvae are **predaceous secondary consumers** and hunt the herbivores. Some reptiles like the ribbon snake and spotted turtle will hunt the larvae and emerging juvenile and adult frogs and salamanders. Red-shouldered hawks and barred owls prey on the adult and juvenile amphibians also. Vernal pools are not only essential nurseries, but also serve as critical sources of food and water on which other forest inhabitants depend.

There are many **Abiotic** factors affecting the vernal pools as spring progresses. The inhabitants of vernal pools are in a race against time and the possibility of the pool drying up before they complete their life cycles. As spring progresses, the water warms and surrounding trees and vegetation leaf out. These plants are now actively carrying on **photosynthesis**. The trees especially, pull tremendous amounts of water out of the ground (and pool) as they capture energy from sunlight and take in carbon dioxide to manufacture food energy for the growing season. This removal of water from the habitat by the vegetation during photosynthesis is called **transpiration**. The pools need to be replenished by rain or a high ground water table for life to continue. As the pool warms up, the **dissolved oxygen** levels are lowered. The warmer water and lower dissolved oxygen stimulate the egg masses of frogs and salamanders or their larvae to speed up their development and undergo **metamorphosis** before the water is gone.

In some years, the creatures of the vernal pools lose their race. The pools dry up before life cycles are completed. Life in the forest still benefits, scavengers will feast on the dead and dying egg masses and larvae and be nourished from them.

If a juvenile wood frog migrates successfully to the surrounding forest, it will take approximately 3 years before it is mature enough to return to the pool it was born in to reproduce (5 years for a spotted salamander). The females of both species will only breed every other year because of the tremendous energy it takes to produce their egg masses.

GLOSSARY
For
Vernal Pool Ecosystems

Abiotic = Non-living parts of an ecosystem (sun, water, soil, air, temperature, rocks, etc)

Algae = Simple organisms that are photosynthetic (utilizing sunlight energy to manufacture food); lack structures like roots, leaves, stems of true plants; marine species are “seaweeds”

Consumer = Primary consumers are herbivores and eat plants
Secondary consumers are carnivores and eat other animals

Crustacean = Invertebrates of Phylum Arthropoda; most are aquatic; have jointed paired appendages and paired antennae; Examples: crabs, lobsters, shrimp, sow bugs, isopods

Deciduous = To “shed” (plants, including trees that shed leaves in fall)

Dissolved Oxygen = Quantity of oxygen found in water (measured in parts per million – ppm)

Ecosystem = A living community interacting with its physical environment; the inter-relationship between living and non-living elements operating together to form a system through which energy flows and materials cycle.

Evaporation = Process by which liquid water is converted into a gaseous state of water vapor

Facultative species = Species sometimes found in vernal pools but **do not** require vernal pools to complete their life cycle. Examples: spring peeper, american toad, dragonfly larvae, Isopods.

Herbivore = Plant eater

Indicator species = an organism whose presence or absence reflects a certain environmental condition – These species require vernal pools to carry out their life cycle. Example: The presence of spotted salamanders, wood frogs, or fairy shrimp means a woodland puddle is indeed a vernal pool.

Metamorphosis = process of transforming from one stage to another.
Examples: **Wood Frogs** – Egg – larva (tadpole) – metamorphosis involves: hind legs grow, gills and tail are absorbed and lungs and front legs develop – froglet (emerges from pool) – adult; **Spotted Salamanders** – Egg – Larva – metamorphosis involves growth of legs, gills absorbed and lungs develop - Juvenile (emerges from pool) - adult

Omnivore = Eats everything; a consumer of plants and animals

Photosynthesis = Process of converting light energy into chemical (food) energy & storing it as a simple sugar:
($6 \text{ CO}_2 + 6 \text{ H}_2\text{O} + \text{sunlight energy} = \text{C}_6 \text{ H}_{12} \text{ O}_6$)

Producers = Organisms such as algae and green plants (produce their own food through photosynthesis)

Scavenger = Feeds on dead or decaying plants and animals

Transpiration = Process by which water is carried through a plant from roots to small openings (stomata) on underside of leaves and released into atmosphere

Note: This is a teacher reading for before the field trip. After the field trip there is the option to follow-up in classroom with reading Wallace Way Vernal Pool story and relate that to the Wadsworth Mansion vernal pool.