Seeps and Vernal Pools

The two natural communities described in this section do not fit well into other wetland categories. Although Seeps and Vernal Pools have many differences, they also share some important ecological features. All known examples of Seeps and Vernal Pools are small, usually less than one half acre. These two wetland community types typically occur in depressions and at the bases of slopes in areas of upland forest. Although Seeps and Vernal Pools only contain occasional trees, both are effectively shaded by the overlapping crowns of the adjacent forest trees. Because of this characteristic, Seeps and Vernal Pools are included in this book as a type of forested wetland. Despite the shade, Seeps may have dense herbaceous vegetation that is composed of species characteristic of this community type, while Vernal Pools generally lack vegetation and are best characterized by the associated assemblage of invertebrates and amphibians.

How to Identify

Seep and Vernal Pool Natural Communities

Read the short descriptions that follow and choose the community that fits best. Then go to the page indicated and read the full community profile to confirm your decision.

Seep: A common but small community occurring on slopes or at the bases of slopes in upland forests. Groundwater discharge is evident at the seep margin. Scattered trees may be present but canopy closure is usually from the adjacent forest. Herbs are characteristic, including rough-stemmed sedge, slender mannagrass, and spotted touch-me-not. Go to page 303.

Vernal Pool: These are small depressions in forests that fill with water in the spring and fall. They provide breeding habitat for many salamanders and frogs and have characteristic populations of fairy shrimp, fingernail clams, snails, water fleas, and copepods. Vegetation is usually sparse or absent, although adjacent forest trees may shade the pool. Go to page 306.

DISTRIBUTION/ABUNDANCE

Seeps are known to occur throughout the Northeastern United States and adjacent Canada. Their distribution is likely much more widespread, but this community has received little concentrated study. Seeps occur throughout Vermont.

ECOLOGY AND PHYSICAL SETTING

Seeps are a common but often overlooked wetland community associated with groundwater seepage. They occur at or near the base of slopes, in coves, and on benches in areas of upland forest. In these topographic settings, it is common to find a sub-surface layer of bedrock or ***hardpan*** that impedes the downward movement of groundwater, resulting in horizontal flow and discharge of water at the surface. The local topography and the linear extent of seepage determine the size of individual seeps. It is common to find several locations with groundwater seepage at the upslope end of each seep. Seeps are typically long and narrow with a total area less than one half acre.

Groundwater discharge provides a constant supply of water to the seep community, with flows at many seeps persisting even through the driest summer months. As a result of the continuous soil saturation, thin surface organic layers are generally present over saturated mineral soils. Seeps are often the headwaters of perennial streams and have traditionally been used as sites for the construction of spring boxes for household water supplies. Another feature of groundwater that is important in this community is temperature. Groundwater in our region is typically about 47°F and varies only a few degrees from this temperature. The constant supply of 47°F water at the upper edges of seeps typically results in early spring development of grasses and sedges. This early spring vegetation can be an important source of food for black bears emerging from their winter sleep.

The chemical composition of groundwater flowing into seeps is closely related to the type of bedrock and surficial deposits through which it has moved. Water with high concentrations of dissolved calcium will result from contact with limestone and calcareous schists, while acidic water low in dissolved minerals results from contact with granite. The effects of variations in water chemistry on the flora and fauna of seeps needs further study.

VEGETATION

Trees and shrubs are usually absent from seeps, although most seeps are so narrow that they are well shaded by the overhanging canopy of the adjacent upland forest. Occasional trees may also be found in the seeps themselves, but these usually tip over at a young age as a result of the saturated, unstable ground.

Herbaceous cover can be lush and dense. Characteristic species include rough-stemmed sedge, slender mannagrass, golden saxifrage, swamp saxifrage, water pennywort, and spotted touch-me-not. Other species that may be abundant include sensitive fern, false hellebore, swamp buttercup, and drooping woodreed. Bryophytes may be abundant on areas of soil without flowing water and covering small stones and rotting logs. Moss species typical of this seepy habitat include *Brachythecium rivulare*, *Atrichum undulatum*, *Mnium punctatum*, and common fern moss. More study of the flora of this community is needed.

ANIMALS

Characteristic amphibians associated with this community are spring salamander, dusky salamander, and northern two-lined salamander, all species that spend their adult lives in or near water. The gray petalwing is a rare dragonfly that is closely associated with seeps. Seeps may also be important to black bears for early spring and summer feeding if they are located in a suitably undeveloped landscape.

VARIANTS

None recognized at this time.

RELATED COMMUNITIES

Rich Fen: Fens are open peat-accumulating wetlands dominated by sedges, brown mosses, and in some cases, low shrubs. The dissolved mineral composition of groundwater seeping into fens is a major factor affecting plant species composition.

CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS

Seeps have not been the focus of study or of conservation planning, and consequently there is much that needs to be learned about this common wetland community. Historically, many seeps that occur in the vicinity of early homesteads were developed as water supplies. Seeps are threatened by alteration of the quality or quantity of groundwater discharge resulting from development in the associated groundwater recharge area. They are also threatened by logging with heavy machinery either in the seep itself or in its immediate vicinity. The mucky surface organic soils may not freeze during the winter because of the constant input of relatively warm groundwater, and heavy machinery can create deep ruts that alter the hydrology and disturb resident amphibians. It is recommended that machinery be kept out of seeps and that a forested buffer of at least 100 feet be maintained around the seep with no logging or only selective thinning within this buffer.

PLACES TO VISIT

Mount Mansfield State Forest, Stowe, Vermont Department of Forests, Parks and Recreation (VDFPR)
Coolidge State Forest, Sherburne, VDFPR
Green Mountain National Forest, Ripton
North Springfield Reservoir, Weathersfield, U.S. Army Corps of Engineers

CHARACTERISTIC PLANTS

HERBS

Abundant Species

Rough-stemmed sedge – *Carex scabrata*
Slender mannagrass – *Glyceria melicaria*
Spotted touch-me-not – *Impatiens capensis*

Occasional to Locally Abundant Species

Golden saxifrage – *Chrysosplenium americanum*
Swamp saxifrage – *Saxifraga pensylvanica*
Water pennywort – *Hydrocotyle americana*
Sensitive fern – *Onoclea sensibilis*
False hellebore – *Veratrum viride*
Swamp buttercup – *Ranunculus hispidus* var. *caricetorum*
Drooping woodreed – *Cinna latifolia*
Wood nettle – *Laportea canadensis*
White turtlehead – *Chelone glabra*
Jack-in-the-pulpit – *Arisaema triphyllum*
Foam flower – *Tiarella cordifolia*
Gynandrous sedge – *Carex gynandra*
Fowl mannagrass – *Glyceria striata*
Water avens – *Geum rivale*
Marsh blue violet – *Viola cucullata*
Northern willow-herb – *Epilobium ciliatum*
Skunk cabbage – *Symplocarpus foetidus*

BRYOPHYTES

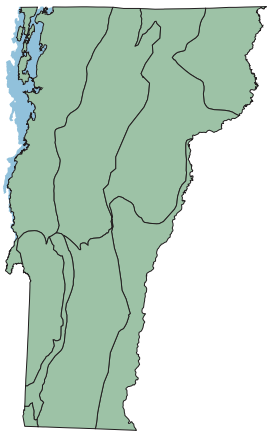
Occasional to Locally Abundant Species

Moss – *Brachythecium rivulare*
Moss – *Atrichum undulatum*
Moss – *Rhizomnium punctatum (Mnium punctatum)*
Common fern moss – *Thuidium delicatulum*

RARE AND UNCOMMON PLANTS

Wild Jacob's ladder – *Polemonium van-bruntiae*

Vernal Pool



Distribution/Abundance

Vernal pools are an uncommon community found throughout Vermont and much of North America.

Ecology and Physical Setting

Vernal pools are small, temporary bodies of water that occur in forest depressions. These depressions are typically underlain by a relatively impermeable layer, such as compact basal till, bedrock, or hardpan. Consequently, runoff from melting snow and spring rains fills these depressions with water that persists into the summer. Water depths are usually less than four feet. They typically become dry during the summer but may fill with water again as a result of fall rains. Vernal pools generally lack both stream inlet and outlet, although water may flow out of the pools during springs with especially heavy rains or rapid snow melting. Most vernal pools are under one half acre and all have very small watersheds.

The presence of a rich, organic surface layer of soil is a characteristic of vernal pools resulting from the long duration of standing water in the spring and fall. This hydrologic regime is also responsible for the general paucity of vegetation in the portion of vernal pools that are regularly inundated. Most importantly, the seasonal pattern of inundation and drying is what makes them such critical habitat for the characteristic amphibians and invertebrates that define the biological component of this natural community.

Vernal pools may be difficult to identify after water levels have receded. However, the cup-shaped basin, the general lack of vegetation, the presence of relatively thick organic soil layers compared to surrounding forests, and the water stains left on leaves and the forest floor can reveal the locations of these ephemeral pools. Work is ongoing to characterize the soil invertebrates that inhabit these pools. The invertebrates could be used as a means to confirm the presence of a vernal pool at any time of year. The locations of vernal pools that provide important amphibian breeding habitat are likely well known to nearby residents, as the duck-like quacking of

wood frogs and the deafening chorus of spring peepers is hard to forget.

VEGETATION

Vernal pools generally have very little vegetation as a result of the long periods of inundation. Wetland plants may occur as scattered individuals or a narrow fringe around the margin of the pool's high water level. In some pools, annual plants may become established after water levels recede. Typical wetland species associated with Vernal Pools include sensitive fern, marsh fern, rice cutgrass, northern bugleweed, and mad-dog skullcap.

Spotted salamander is one of many species that rely on Vernal Pools for breeding habitat.

The upland forests surrounding vernal pools are critical to their ecological integrity. Most vernal pools are small enough that the canopy of adjacent upland forests keeps the pools in the shade. The result is cooler water temperature and less evaporation, which mean that the pool will persist later into the spring or summer. In addition, the surrounding upland forest is critical habitat for amphibians, which spend most of their adult lives away from the pools and may travel up to 500 feet to return to pools for mating.

ANIMALS

Unlike most natural communities that are largely characterized by their flora, vernal pools are characterized by their fauna. Vernal pools are probably best known as amphibian breeding habitat. Amphibians known to regularly use vernal pools for breeding in Vermont include wood frog, spring peeper, spotted salamander, Jefferson's salamander, blue-spotted salamander, and red-spotted newt. These species all migrate from surrounding forests to vernal pools to mate and lay eggs in early spring. Spotted salamanders are one of the earliest species to emerge and migrate, with hundreds of individuals moving toward a well used pool on the first warm rainy night in March or April. Frog tadpoles and salamander larvae that hatch from the eggs must develop quickly in their race against the approaching summer heat that will evaporate the water in their pool.

As the young amphibians mature they feed on algae and some of the rich and diverse invertebrate fauna found in the temporary pools. Work is currently underway to better describe the invertebrate fauna of vernal pools, but some of the characteristic invertebrates include fairy shrimp, fingernail clams, snails, water fleas, and copepods. These small animals have all developed strategies to survive the seasons of the year when the pool is dry. Some species disperse to other habitats, while others lay eggs and die or go into resting stages that are tolerant of both drought and freezing conditions. Another characteristic of vernal pools is the lack of fish, which can not tolerate the seasonal drying of the pools. Fish can be significant predators on amphibian eggs and larvae that are hatched in pools, ponds, and wetlands with permanent surface water.

The amphibians and invertebrates in vernal pools can provide an important source of food to other animals, however, including wood ducks, mallards, black ducks, and great blue herons.

It is important to note that the concept of vernal pool described here is only one type of significant amphibian breeding habitat. Amphibians, even some of the species that characterize vernal pools, are also known to breed successfully in many types of wetlands, including forested swamps, marshes, margins of ponds and lakes, and even man-made farm ponds.

VARIANTS

None recognized at this time.

CONSERVATION STATUS AND MANAGEMENT CONSIDERATIONS

Vernal pools have received little attention in Vermont until recent years. Currently, work is underway to better describe the flora and fauna of this small wetland type. Standard methods of statewide natural community inventory that use aerial photographs and other remote sensing techniques to identify sites are not appropriate for vernal pools. These ephemeral pools are usually too small to be detected by remote sensing methods and therefore a concentrated, on-the-ground search employing interested people statewide is necessary. The Vermont Reptile and Amphibian Atlas project organized by herpetologist Jim Andrews of Middlebury College is an example of such an effort that will improve our understanding of the distribution of individual species and of vernal pool and other reptile and amphibian habitats.

Vernal pools and the animal species that depend on them are threatened by activities that alter the hydrology and substrate of individual pools, as well as by significant alteration of the surrounding forest. A recent study concluded that 95 percent of the amphibian population using a particular wetland breeding site would be protected by a forested buffer that extended 534 feet into the surrounding upland habitat (Semlitsch, 1998). Construction of roads and other developments in the upland forests around vernal pools are known to affect salamander migration and to result in mortality associated with road crossings. Logging in the vicinity of the vernal pools can also have significant effects, including direct alteration of the vernal pool depression, changes in the amount of sunlight, leaf fall, and coarse woody debris in the pool, and disruption of amphibian migration routes by the creation of deep ruts. Even during periods when the pool is dry, alteration of the depression substrate may affect its ability to hold water and disrupt the eggs and other drought-resistant stages of invertebrate life that form the base of the vernal pool food chain. In general, it is recommended that there be no activity within the vernal pool depression or the adjacent 50 feet. From 50 feet to a distance of at least 200 feet from the edge of the pool, and preferably 500 feet, there should only be light, selective cutting conducted only when the ground is frozen and covered with snow.

PLACES TO VISIT

Vernal Pools are scattered throughout the state. We encourage readers to locate pools in their areas.

SELECTED REFERENCES AND FURTHER READING

DesMeules, M. and P. Nothnagle, 1997. Where life springs ephemeral; vernal pools are here today, gone tomorrow, and back again next year. *Natural History*. May, 1997.

Semlitsch, R., 1998. Biological delineation of terrestrial buffer zones for pond-breeding salamanders. *Conservation Biology*, Volume 12, No. 5.

CHARACTERISTIC PLANTS

HERBS

Occasional to Locally Abundant Species

Sensitive fern – *Onoclea sensibilis*
Marsh fern – *Thelypteris palustris*
Rice cutgrass – *Leersia oryzoides*
Northern bugleweed – *Lycopus uniflora*
Mad-dog skullcap – *Scutellaria lateriflora*
Nodding bur marigold – *Bidens cernua*
Tuckerman's sedge – *Carex tuckermanii*