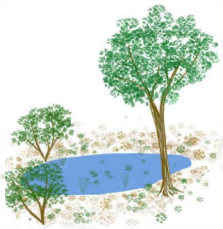


Water is essential to all the organisms living in forests, from large trees to small microscopic bacteria. Pooling water may come from **rainwater, springs, snow melt,** or may be connected to a **river or streams**. Pools that form small wetlands and only exist for only part of the year are called **vernal pools**. In Vermont, these pools typically form from snow melt, and dry up in the summer. They are **essential habitat to amphibians** like frogs and salamanders, which lay their eggs in the water. Forest management should consider impact to vernal pools in order to protect the species that depend on them.

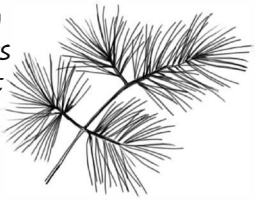
Fungi are found in many forms and play many roles in forest ecosystems. They can **break down dead organic matter** like dead trees, helping nutrients like carbon and nitrogen return to soil. **Mycorrhizal fungi** form beneficial relationships with tree roots, and support trees with accessing nutrients and water. Fruiting bodies of fungi can also serve as food for wildlife, and even medicine for people. Don't eat mushrooms you find in the forest unless you are absolutely sure they are edible! Finding diverse fungi in forests is often a sign of a healthy forest ecosystem!

Forests help keep our rivers and streams healthy. Tree and shrub roots hold soil in place, reducing **erosion**. Insects feeding on vegetation near water are themselves food for fish. Shade from tree canopy keeps **water temperatures cool**, which helps **increase oxygen** levels in water. Downed trees in streams **slow moving water** and can help it spread out, reducing erosion and downstream flooding. A well forested stream is a happy stream!

Even in the winter you can tell the difference between tree species based on how their bark appears. American Beech is a common tree in Vermont forests, and is known for its smooth bark. **Sometimes trees with naturally smooth bark may develop texture**. This may be caused by insect damage or disease. Beech Bark Disease can cause the naturally smooth bark to develop cankers and dead spots.

Bark can have many different textures. Some may peel, like paper birch, while others have deep grooves, like black locust. **The texture of bark may also change dramatically with age**. Many trees start out with smooth, thin bark and as they age the bark becomes thicker with more texture. Depending on the species, the texture of bark may indicate how old it is!

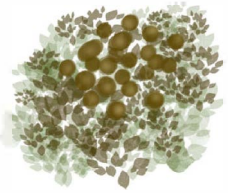
Tree leaves are one of our best tools for **identifying tree species**. Some look very different, like the needles of a pine and the lobed leaves of a maple, while others can be very similar. The types of trees growing in a forest can also tell us about the soils, hydrology, climate,and history of a site. Are there a lot of red pines about the same age? Might be a timber planting! Are there lots of red maple, silver maple, or cottonwood? You may be in a wetland or near water!



The animal species living in a forest also reveal a lot about the ecosystem and greater landscape. Some species prefer **interior forests**, far from development or fragmentation that separates blocks of forest. Some species have particular habitat needs, such as having particular food sources or breeding grounds. Learning to identify animal species, as well as understanding what species a landscape supports can help us manage our ecosystems.

The fruit, nuts, and seeds of trees is an **important food source** for wildlife including squirrels, birds, and porcupines. Sometimes you can find evidence of a feast, such as piles of discarded pine cone 'cores', which have been stripped of their seeds, or broken acorn shells. Seeds and nuts are full of fat and protein, making them a particularly valuable food source.

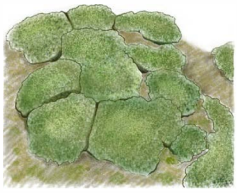
Signs of wildlife come in many forms. There are **tracks, signs of feeding or browsing, scat (poop!), feathers, hair, and more**. Sometimes it takes keen eyes, as well as learning where to look. By learning about the local ecosystem, the types of animals it can support, and by knowing things like track shapes and patterns you may even identify specific species or the movements of individuals.



Even remote, rural forests might have signs of human activity. A common example is trees **stumps, which may persist decades after a tree was cut down**. In the 1800s Vermont only had 20% forest cover. Now **Vermont is nearly 80% forested**! Other signs of previous timber harvest are old logging roads, scars on trees, and stands of trees that are all the same age.

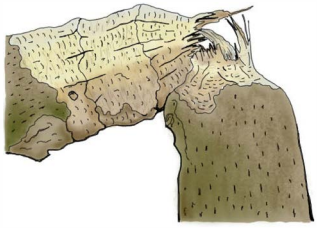
Ferns are non-flowering plants that first appeared on earth 200-300 million years ago. Vermont has 65 species of fern. These can serve as ecosystem indicators, as different species requires specific soil types and depth, temperatures, nutrients, and light.

Standing dead trees are also known as **snags**. The tree might have died from storm damage, disease, insect damage, or other changes in the habitat. Over time, these snags decay and become colonized by fungi and insects. Animals like woodpeckers feed on the insects, and **cavities** formed in the tree might become the nesting site or den for animals like owls, fishers, bats, and porcupines. **Snags are a key feature in our forests that support wildlife!**



Unlike many plants, **mosses don't have roots** to draw water from soil. They depend on rainwater, fog, and dew, which they absorb through their leaves. Lichens are actually made up of fungi and either cyanobacteria or algae. Lichen is particularly sensitive to air quality, and can indicate changes in the air.

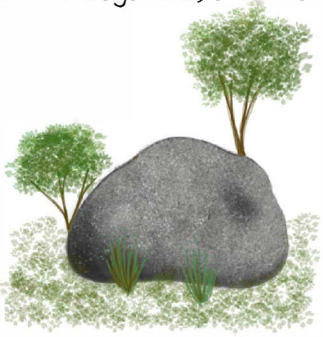
Conifer cones hold the seeds of evergreen trees. While an evergreen will produce pine cones every year, some years they will produce an abundance. These are known as **mast years**, and is a strategy the tree developed to produce more seeds than the animals feeding on them can eat. This gives some of the seeds a chance to sprout before being eaten!



Beavers are known as **ecosystem engineers**. They construct dams and create wetlands that can dramatically change the landscape. These wetlands slow flowing water, reducing its erosive forces, allowing sediments to settle, and allowing water to infiltrate into the ground. Beaver wetlands are also important habitat to many other species.

Flowers are part of many plants **reproductive system**. Many flowering plants depend on other species, including insects and birds, to pollinate them to create seeds. The pollen and nectar of flowers is a food source of insects, birds, and mammals as well. A diversity of plants that flower between early spring and late fall ensure these species have a food source throughout the growing season.

Some insects feed on plants, eating their leaves or sap. Other insects feed on decaying matter, including dead animals. Some feed on blood, such as ticks, And finally some are predators, eating other insects. Insects are also important food sources for birds and small mammals. The type, abundance, and distribution of insects can indicate other dynamics at play in an ecosystem, such as the effects of a mild winter and long summer.



Have you ever seen a large boulder sitting in the woods, seemingly out of place? These boulders are a type of **glacial erratic**, and a sign froru when glaciers covered Vermont twenty-thousand years ago. These boulders were **moved by glaciers** across the landscape, pulled by ice a mile thick. Vermont's landscape has been hugely impacted by glaciation, and we can see signs of it in our stone walls, our soils (both rocky and shallow or deep and fertile), and the distribution of species.