

The World Beneath

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The foundation is a structure's most important component. What is nature's foundation? It's soil—supporting meadows, forests, and wetlands! Soil is the substrate resulting from combined effects of an area's geology, climate, water flow (hydrology), and biological activity (animals, microbes, neighboring plants, etc.). Soil components include:

- minerals—chemical composition, size of the pieces
- organic elements—decomposing matter
- water content
- amount of air
- any critters living within the assorted ground layers

Upper layers contain more air, organics, and organisms whereas deeper strata hold compressed minerals and stone; the exact compositions depend on that area's history and topography. The different substrates at varying depths play a significant role in the ecosystem they support.

The processes sculpting soil structure occur over centuries to millennia. During this time, microbial communities form “mutualisms”—beneficial symbiotic partnerships—with plants. For example, mycorrhizae are a fungal group whose filaments both penetrate plant root cells and grow into soil nooks and crannies. The plant provides the mycorrhizae with energy-rich photosynthetic sugars while the fungus facilitates mineral uptake to the plant. The term “obligate mutualism” applies to different species which must have the other to survive or else both perish.

Given the inherent difficulties of studying subterranean species, many of the bacteria and fungi benefiting plants or their exact interactions are unknown to science. Others are better understood. For example, Indian pipes (*Monotropa uniflora*) are plants totally reliant on fungi. Living underground and only surfacing to flower, Indian pipes lack any chlorophyll and are incapable of producing their own sugars. *Monotropa's* relationship to fungi is called “myco-heterotrophic” or “epiparasitic,” meaning energy is derived by directly parasitizing soil microbes or exploiting fungi as an intermediary to tap into trees. Thus, Indian pipes only exist in older, low-disturbance forests. Other plants indicating a maturing forest include mountain laurels (*Kalmia latifolia*), maple-leaf viburnum (*Viburnum acerifolium*), downy rattlesnake plantain (*Goodyera pubescens*), ground pines (*Lycopodium obscurum*, which are closer related to ferns and not trees), and large, slow-growing trees such as white oaks (*Quercus alba*). A treasured, older growth section at Royal Lake Park is also the park's first Invasive Management Area (IMA) site, nestled along Shane's Creek (GPS coordinates: 38.806076, -77.293433), less than 0.2 miles upstream from the lake. A splendid, younger native forest flourishes on the main peninsula across from the dam.

A number of forces disturb soil. Water action (erosion, silt deposits) is a common natural force, which partially explains why floodplain flora differs from upland



Figure 1. Often mistaken for mushrooms, Indian pipes bloom in undisturbed woodlands during the summer. This ghostly bouquet was photographed at Royal Lake Park.

vegetation within the same vicinity. Examples of human-induced soil perturbations include:

- breaking and mixing layers (tilling, plowing, digging, and bulldozing)
- smothering (paving, dumping debris mounds, laying plastic sheets)
- poisoning (dumping motor oil, organic solvents, herbicides, and other chemicals)
- accelerating floods and erosion (shedding precipitation from large, impervious surfaces)
- compacting (off-trail driving or foot-stomping)

As the damage extent depends on the disturbance's type and scope, repercussions may directly destroy plants, strip beneficial topsoil, alter the hydrology, and/or kill helpful microbes. Without all of the crucial subterranean components, old growth plants and fungi cannot exist. Earth's foundation takes a long time to heal and age. Leaving Mother Nature to her own devices, early succession native plants rooting in active zones include pokeweed (*Phytolacca americana*), tulip poplars (*Liriodendron tulipifera*), poison ivy (*Toxicodendron radicans*), and spicebush (*Lindera benzoin*). Pervasive non-native invasive species also love colonizing these plots and often end up dominating the area without intervention from IMA volunteers.

Folks may be surprised about the recent “no till gardening” initiatives especially when tilling is supposed to aid the soil. When European settlers first arrived in Virginia, topsoil was much deeper than today. Plowing led to erosion; over the centuries, topsoil washed away resulting in the shallow topsoil—if any at all—we see today. A better way to cultivate garden plants and lawns is with compost tea (see “[Healthy Lawn Care, March 2010](#)”). At this point, we realize that a bit of mulch covering an inch or two of topsoil and clay subsoil is an over simplified interpretation of soil structure, though this scenario describes many landscaping projects. To help the land heal faster and improve transplant survival in forest restoration sites, Fairfax County Park Authority naturalists experiment with soil amendment strategies at Ellanor C. Lawrence Park (aka Walney), though results remain in progress. For now, soil preservation is the wisest way to keep ecosystems healthy.

We often study forest dynamics during volunteer workdays. If you would like to work the parks and see first hand the old and new growth forest differences, send an e-mail to me.

Recommended reading:

- Soil structure: <http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/biology/>
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/tools/?cid=nrcs142p2_054167
<https://www.fairfaxcounty.gov/soil-water-conservation/soils-info>
http://www.dcr.virginia.gov/virginia_naturally/erg-virginias-soil-resources.shtml
- No till gardening: <http://www.no-dig-vegetablegarden.com/no-till-gardening.html>
- Indian pipes: http://www.fs.fed.us/wildflowers/plant-of-the-week/monotropa_uniflora.shtml
http://www.fcps.edu/islandcreekes/ecology/indian_pipe.htm
http://www.botany.org/Parasitic_Plants/Monotropa_uniflora.php
- Orchids: [Understanding Orchids: Part 1 \(June 2018\)](#)
- FCPA *Underground World* brochure: <https://www.fairfaxcounty.gov/parks/sites/parks/files/assets/documents/naturalcultural/stewardship%20brochures/underground.pdf>

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