Ecological Succession

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When building a house, certain steps need to be followed and time must be given between those steps. For example, the utility lines and foundation are the first to go in, time passes for the masonry to set, then the framing goes up, and so forth. Constructing the dwelling out of sequence, such as mounting the dry-wall and adding fixtures before installing the foundation or roof, will lead to catastrophe! Failing to wait for concrete or mortar to harden are more recipes for disaster!

Mother Nature applies this same sequential approach in creating ecosystems. *Ecological succession* is the progressive cascade through which bacteria, fungi, plants, and other organisms become established in a cleared or disturbed zone. That clearance could be natural (volcanic eruption, glacial recession) or artificial (excavation, slash-and-burn). How destructive that initial disturbance was sets the stage for where succession starts. For example, soil microbes and fire-resilient plants could withstand a fast brush-fire, so reestablishing that forest would be further along in succession than a more devastating and thor-ough disturbance, such as a lava flow or a newly decommissioned asphalt surface. Exactly how succes-sion plays out depends on many factors: soil chemistry and structure, climate, topography, and even alti-tude. While this article addresses succession in forested areas, the same principle applies from biofilms to bays—just about anywhere life exists! A rough example of Northern Virginia's native successional steps are as follows starting from sterile soil:

1) Soil bacteria and fungi migrate to the area. These organisms hitch rides from wind, water, or ani-mals—the main ways bacteria, spores, and seeds move from place to place. The microbes inocu-late the soil and multiply, setting the ecosystem's foundation. More about these microbes is in the article, "The World Beneath" (June 2014).
2) Simple pioneering plants, such as mosses and liverworts, are next. Lichens, which are fungus and algae symbiotically living together, may show up, too.
3) Within the next several years, more complex meadow plants arrive: grasses, sedges, pokeweed, blackberries, greenbrier, and wildflowers like asters and black-eyed Susans. Poison ivy is a com-mon species around recently disturbed areas that many folks detest due to the itchy rash after contacting any part of this plant. However, poison ivy is excellent at preventing erosion while providing food and shelter for animals adapted to the urushiol-containing sap. Red cedars are some of the first trees to appear.
4) More trees arrive, such as Virginia pines, tulip poplars, and red maples. These species are char-acterized by growing fast, living for several decades (rarely reaching a century), and being able to survive in soils that harbor simple microbial communities that are becoming increasingly diverse and complex. At this stage, organic soil layers are still developing. Some of the sun-loving meadow plants get too much shade and die. Shade-tolerant lower canopy plants appear, like golden ragwort, arrowwood *Viburnum*, American *Euonymus*, and lady's fern. This area is called an early succussion forest.
5) The final successional stage is an old growth forest or a climax community. The tree species ma-ture slowly and are long-lived including oaks, hickories, and eastern hemlocks. Flourishing throughout the lower canopy are various blueberry species and their relatives, pinxterbloom azal-eas, mountain laurels, *Lycopodium* species (aka clubmoss), orchids, Jack-in-the-pulpits—the bio-diversity is enormous! Wet areas find skunk cabbages that can live for centuries. Some plants from the early succession forest persist into the old growth, such as American hollies and differ-ent species of *Viburnum*. As the other early succession plants die, they tend to be replaced by later succession species. For example, poison ivy is absent because it requires disturbed soil to last beyond the seedling stage.

Ecological succession can suffer setbacks. Places like floodplains routinely endure saturated soil, ero-sion, and silty deposits, which are why the plants living here are specialized for more dynamic conditions than those in an upland forest. Invasive plants may overtake a disturbed area. Without predators, para-sites, or diseases to keep them in check, these exotic weeds outcompete the native plants and derail nat-ural succession. If the disturbance was caused by humans digging, dumping, trampling, whacking,

burning, or any other destructive activities, those people could continue impacting the site, much like constantly ripping off a scab prevents the wound from healing.

Stream restorations, such as the ones completed along Rabbit Branch and Shanes Creek, cause major soil disturbances. As much as folks might like, an instant forest cannot be created when a project finishes. Just as prefab components can help home construction move faster, forest managers give succession a boost by adding appropriate native plants. These species tend to be early succession since the soil composition and microbes are unable to support late succession plants. Artificially inoculating the soil with microbes have—at best—merely minor benefits. Like waiting for foundation masonry to set, there is no substitute for waiting decades for soil structure to form. The next edition will feature a photo essay of the rich biodiversity that live in mature forests.

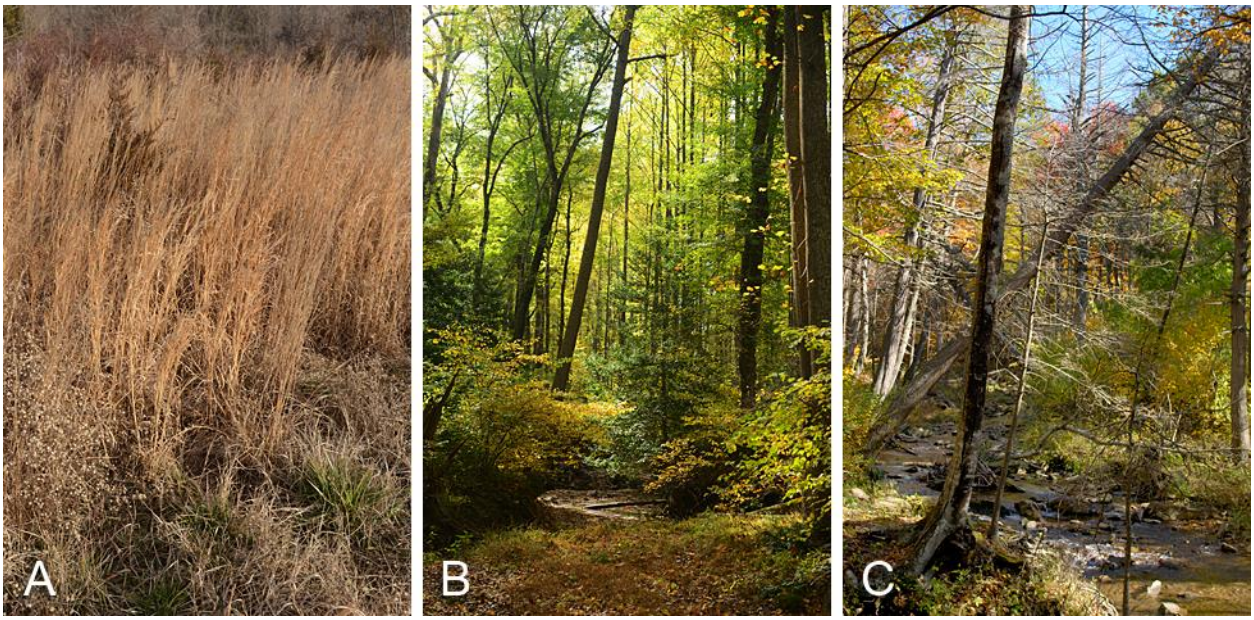

Figure 1. Reading the land is like reading a history book if the language can be understood. In this wintery image (A), grasses, sedges, aster husks, and red cedar saplings blanket an abandoned field—a sign of succession's first few years in Virginia. In addition to the specific species present, early succession woodlands (B) are usually characterized by having dense vegetation. Tulip poplars, which may grow quickly and reach colossal sizes especially when near a water source, are sometimes mistaken by the layman for being ancient. Old growth forests (C) contain many trees over 100 years old. These trees may or may not be large, depending on the species and growth conditions. These forests are more open than early succession woods with huge biodiversity and carbon sequestration.

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For more on forest succession:

https://www.novaparks.com/parks/hemlock-overlook-regional-park/things-to-do/environmental-interpretive-series-forest

https://www.nature.com/scitable/knowledge/library/succession-a-closer-look-13256638/

https://dwr.virginia.gov/blog/what-is-early-successional-habitat/

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