

The Engineers Who Do Not Build Buildings

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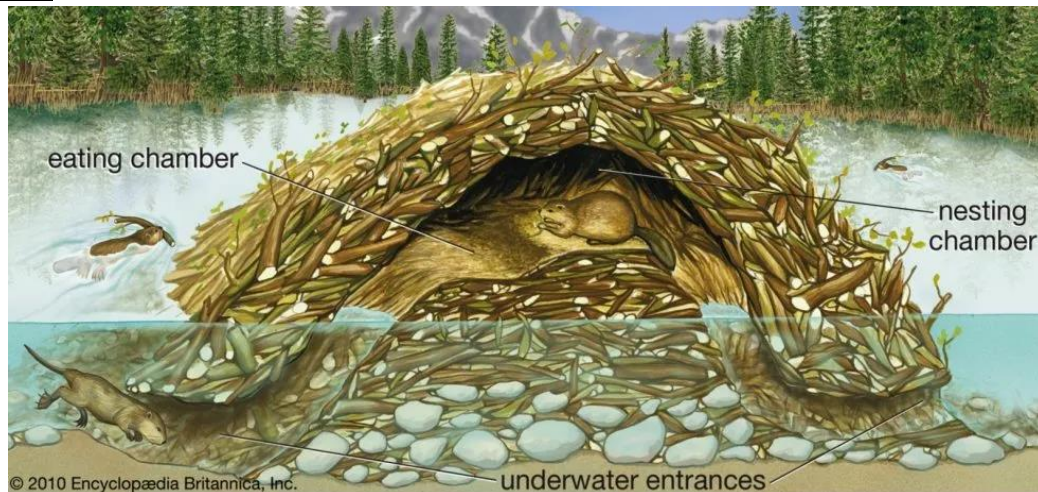
Introduction

Engineers are the people who plan, design, and build the infrastructure we rely on every day, from buildings and roads to vehicles and power systems. But what if we told you that nature has its own engineers too?

In this month's article, we will be exploring nature's engineers, species that are not only important in their own right but also shape, build and maintain nature's infrastructure, creating habitats, spaces and ecological processes that support entire ecosystems. In doing so, they help sustain the health of the natural world and, ultimately, life on Earth.

Also known as ecosystem engineers, these species can directly or indirectly modulate the availability of resources to other species by causing physical changes in biotic and abiotic materials (Kooch & Jalilvand, 2008).

The Dam



A cross-section of a beaver lodge. Photo by Encyclopædia Britannica.

Beavers are professional ecosystem engineers and are among the most iconic inhabitants of wetlands. These semi-aquatic mammals are famous for constructing impressive dams and dome-shaped lodges in deep, slow-flowing waters (BBC Wildlife Magazine, 2026).

The process of building a dam is highly intentional, from selecting the site to choosing the construction materials. Beavers first fell trees along a stream to slow down water flow before gathering branches, sticks, and mud, which they transport to the site using their mouths. They assemble these materials using their front paws, constructing a dam that retains a pool of water upstream (Champions for Wildlife, n.d.). These dams create ponds that slow the flow of water, preventing their lodges from being washed away and providing a safe refuge from predators (Champions for Wildlife, n.d.). The lodges also serve as dry living spaces and



food storage consisting of bark, roots, and leaves, ensuring a reliable food supply during winter (Western Beavers Cooperative, n.d.).

Beyond meeting the needs of beavers, these dams provide significant ecological benefits, creating productive wetland habitats that support diverse plant and animal species, forming biodiversity hotspots (World Wildlife Fund, n.d.).

Another important function of beaver dams is their ability to regulate water flow. By retaining water during periods of heavy rainfall, they help mitigate flooding while maintaining water availability during dry periods. Additionally, these structures act as natural filters, improving water quality downstream by trapping sediments and pollutants (World Wildlife Fund, n.d.).



A scene from Hoppers. Photo by The Official Disney Fan Club.

The ecological benefits provided by beaver dams can also benefit human communities. This idea was captured in last month's recommended Substack film, *Hoppers*, where beavers are portrayed as powerful landscape shapers (no spoilers!). However, the impact of beavers on human communities extends far beyond the film.

In the Czech Republic, officials were quite literally “dammed”. Despite securing millions of dollars in funding for a new dam project to protect the Klabava River from acidic water contamination, the project was delayed for years due to difficulties in obtaining building permits. Then, one January morning, eight beavers achieved in just a few weeks what human planners had spent years trying to accomplish, constructing a dam that helped protect the Klabava River ecosystem (Bittel, 2025). This once again highlights the remarkable capabilities of nature's engineers: species that not only shape their environments but are deeply embedded within them.

The Underground



An earthworm, one of the world's most important soil engineers. Photo by Soil Tech.

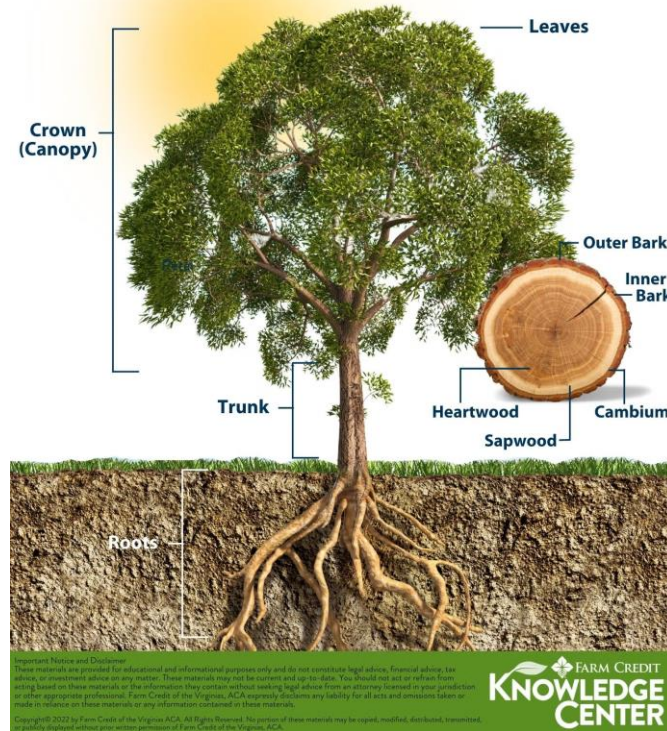
Beyond the surface lies one of the main soil engineers of the natural world, earthworms. The role of the earthworm is to alter and improve soil properties that support plant growth. By burrowing through the soil, earthworms create tunnels that improve soil structure, enhancing water transmission (Lamp'l, 2026). By consuming, breaking down, and recycling organic matter, earthworms produce castings rich in nitrogen and phosphorus, which enhance soil fertility and support plant growth (Soil Association, n.d.). Earthworms themselves are an important food source for other species, such as birds and frogs, highlighting the interconnected relationships within the wider ecosystem (Pilcher, 2018).

The contribution of earthworms to soil health may be “out of sight” to us, but their ecological functions provide significant benefits for the human community through sustainable agricultural production. Earthworms contribute to approximately 6.5% of global grain production and 2.3% of legume production, equivalent to over 140 million metric tons annually. Their role is particularly important in the Global South, where they contribute 10% of total grain production in Sub-Saharan Africa and 8% in Latin America and the Caribbean (Fonte et al., 2023).

These numbers highlight the often overlooked significance of earthworms in sustaining ecosystems and agricultural production. Through their ecological processes, they not only engineer the environment but also help engineer the foundations of our food systems.

The Nature's Umbrella

PARTS OF A TREE



An infographic about the different parts of a tree. Photo by Farm Credit of the Virginias.

Trees are often recognised for providing shade and oxygen, but a closer look reveals the intricate and vital ecological roles they play. A single tree contains multiple layers, from the canopy to the bark and roots, creating habitats that support diverse organisms, allowing trees to function as nature's engineers (Southgate, 2018).



A sloth clinging to a tree branch. Photo by BBC Earth.



The canopy of trees provides a home for arboreal animals with physical adaptations that allow them to live in treetops for extended periods of time. For example, three-toed sloths have claws on their front feet that allow them to climb high into the canopy, where they primarily feed on leaves (Allred, 2025).

Apart from supporting larger animals, trees also play an important ecological role in supporting smaller organisms. For example, oak trees serve as host plants for over 550 species of caterpillars (Ludden, 2023), providing both shelter and a food source for these insects while supporting other animals, such as birds, that feed on them. Looking beyond the familiar functions of trees, such as providing oxygen and shade, reveals a myriad of ecological connections between trees and the organisms they support. These interactions highlight the interdependence among species surrounding a single tree, forming intricate food webs that sustain the wider ecosystem.

Regardless of Size, Location, or Visibility

From the beavers that build impressive dams, to the trees that provide shelter and food, to the “invisible” earthworms beneath the soil surface, these species should not be taken for granted. They not only play crucial roles in maintaining natural landscapes but also in the natural resources that we rely on. Instead of viewing species as isolated entities, we should recognise the “strings” that connect them within a wider ecosystem; removing one thread can weaken this ecological network, potentially disrupting the entire system.

Of course, beavers, earthworms and trees are only a few examples of the many ecosystem engineers embedded within our landscapes. By paying closer attention, we will begin to appreciate the hidden roles that every species plays in shaping our natural world.

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