Openlands Lakeshore Preserve Podcast
Soil: Alive with Life

NARRATOR: If you're a gardener, you know that earthworms are good for the soil. Ants and nematodes help out, too. But the real action is on the microscopic level. That's the world shown on these bronze-colored plaques along the side of the ravine.

MEGQUIER: "Healthy soil could have six, seven billion creatures in a handful of it."

NARRATOR: That's Bob Megquier, who's in charge of the Openlands restoration plan here at the Lakeshore Preserve. What he's saying is that, there could be as many microscopic organisms in a single handful of soil, as there are people in the entire world.

MEGQUIER: "And that's pretty impressive when you think about it. It's almost incomprehensible that that's occurring, but there's a lot going on in a handful of soil."

NARRATOR: Jim Steffen, an ecologist at the Chicago Botanic Garden, explains it this way.

STEFFEN: "What you can see above ground - the trees, and wildflowers, and grasses, and butterflies and the bees flying around - that's only about 10% of the total diversity on any site."

NARRATOR: Which means the other 90% lives in the soil. But these little critters aren't just living there; they actually make the soil. In fact, this invisible world, teeming with countless bizarre creatures, is what makes the rest of life, our life, possible.

NARRATOR: The plaques along the edge of the ravine here depict some of
these microorganisms. With their exotic shapes and science fiction like attributes, they are the difference between barren sand and clay - and healthy soil that supports life. So what are these tiny creatures, and what do they do?

BLADHOLM: “Bacteria, Rotifers, Tardigrades, Protazoa, Fungi, Mites, Springtails…”

NARRATOR: Sharon Bladholm is the Chicago artist who sculpted these plaques. Let's take a look at each one, beginning with the disc on the left.

This first disc shows a tree like shape that represents a microscopic creature that is absolutely essential to plants. Plants need nitrogen, but can’t use the nitrogen in the air. These little creatures, called Actinomycetes, convert nitrogen from the air into a form that plants can use. They are also the source for many of our antibiotics.

The next disc shows five creatures. These are Mites. Mites come in different sizes and shapes. Some are just barely large enough to see, but only as a mere speck. Under a microscope, however, they can look like armored warriors. Over 30,000 species of mites have been discovered, and each has a special role.

BLADHOLM: "One kind of mite eats the flesh of the leaf and another one eats the cellulose that's in the stalky part. Other mites eat nematodes or other animals."

NARRATOR: The third disc shows Algae. You may think of algae as that scummy green stuff in ponds, but algae is important to soil, adding organic matter through photosynthesis.

The next disc shows Springtails. Like mites, springtails are arthropods, meaning they have exoskeletons and jointed legs. And like mites, there are thousands of different species. In fact, there are so many...

STEFFEN: "There are a lot of springtails and mites that haven't even been named by science yet. And at the Botanic Garden we've found about a half dozen springtails that are new to science that haven't been named yet."
NARRATOR: Next you’ll see the first of two creatures that have a more elongated shape. Each of these is a single organism, a tiny animal called a Rotifer. Most rotifers live in ponds and streams, but the ones shown here live in the thin film of water that surrounds leaf litter and soil particles.

BLADHOLM: “Rotifers are some of the strangest creatures of all. For one thing, if it gets too dry, or too hot, or too cold, they can sort of hibernate by drying up and turning into a cyst. They can stay like this - in suspended animation - for years."

NARRATOR: When conditions are better, they absorb water and are back to normal within a few hours. And stranger yet...

BLADHOLM: "They're all females."

NARRATOR: That's right - in this particular species, called Bdelloid Rotifer, there are no males. They reproduce by parthenogenesis, where the daughters are essentially clones of the mother. So how do they get their genetic diversity?

BLADHOLM: "When the cyst is rehydrating and the rotifer is patching itself back together, it can grab a little DNA from anything around it and use that foreign DNA in its own cells."

NARRATOR: On the next disc are three chubby little animals with eight legs. These are called Tardigrades or Water Bears. They’re too small to see, but they come in lots of colors, and they’ll eat just about anything. They live everywhere on earth – from the highest mountains to the bottom of the sea.

Like rotifers, tardigrades can turn into a cyst. They do this by losing 97% of the water in their body. As a cyst, they can survive temperatures higher than boiling water and 200 degrees below zero.

BLADHOLM: “They’re some of my favorites. Tardigrades have even been sent into to space. They were exposed to extreme temperatures and cosmic radiation and when they came back to earth they were perfectly normal."
NARRATOR: The next disc shows Protozoa. These are a lot smaller than the other creatures. There can be billions of protozoa in the top six inches of a square meter of soil. There are over 60,000 species of protozoa, and they mostly eat what’s shown in the next disc - bacteria.

Scientists used to think that the decay and recycling of organic matter in soil was purely a chemical process, but this is actually accomplished by bacteria. Most bacteria are so small that they are invisible even to the tiny creatures that are invisible to us, but they are essential to plant life.

Plants depend on bacteria to generate the nutrients for their roots. All 18 elements needed by plants are processed by bacteria. There are a billion bacteria in each gram of healthy soil, and that includes a million distinct species. Bacteria have been found over two miles deep in the soil.

Past the next rotifer, the final disc on the far right shows Fungi, which are important to soil in many ways. We call a mushroom a fungus, but the mushroom is really the fruit of a much larger organism. Imagine a giant spider web buried underground - that's the fungus. The mushroom pops up only when the fungus is ready to reproduce.

Different types of fungi perform many different functions for the soil.

BLADHOLM: “Some attach to the roots of plants, acting as a kind of extension, bringing water and nutrients from far away. Others are a source of food for soil animals. Other fungi help decompose dead plants and animals, and recycle nutrients to the soil.”

NARRATOR: Some fungi can even decompose toxic wastes and clean up pollution. And they can be huge. In fact, fungi may be the largest living things on earth - a single fungus occupying over two square miles was discovered in the Pacific Northwest.

So as you look around at the trees, flowers and grasses, remember: under every plant you see, there is an entire invisible universe composed of thousands ... millions ... and even billions of tiny creatures hard at work, making the rest of life above ground possible.
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