Soil—it’s what’s under our feet. But it’s also what makes sure there is food and water in our stomachs, air in our lungs, clothes on our backs, and a roof over our heads. Soil keeps us from being hungry, thirsty, breathless, naked, and homeless.

Besides just growing crops, soil is vital to securing many of the resources that hold the world together. Soil filters water, contains antibiotic-producing bacteria, and provides a stable platform on which to build homes and businesses, to name just a few ways soils are vital to life.

However, most people don’t know or understand these unique and plentiful benefits of soils, and soil scientists like David Lindbo have been trying for years to figure out why. He says that without an understanding of the importance of soils, the world’s swiftly increasing population will be at risk as food and water supplies are strained.

“There is nothing that we touch that can’t be somehow related back to the soil, so it’s critical to take care of it,” says Lindbo, a soil science professor at North Carolina State University. “Unfortunately most people don’t think of it, especially in the developing world. Soils support the plants that give us oxygen, and soils filter our water. Soils are like the kidneys and lungs of the earth.”

Soil scientists all around the world are joining forces to educate the public about the importance of healthy soils. Their efforts have culminated in 2015 being named the International Year of Soils by the United Nations (UN). The International Year of Soils will be spearheaded by the Global Soils Partnership of the UN’s Food and Agriculture Organization (FAO), which will be partnering with groups like The Soil Science Society of America (SSSA) and others around the world to raise awareness and promote the sustainability of our limited soil resources. By pairing each month of 2015 with a different theme, each complete with its own educational and outreach activities, SSSA will give its members ways to interact with and educate the public.

Reconnecting People to Soils

SSSA is hoping to restore people’s connection to the soils. Lindbo says he has conducted workshops where he asks people to name four things in the world they can’t live without. The answers always include sunlight, air and water but always leave out soils, he says.

“I ask kids where their food comes from, and they say the supermarket. We’ve lost that feel, that direct connection, to the soil. We haven’t done a good job of promoting its importance like we have with clean water and clean air. There is no Clean Soils Act.”

Soil scientists agree there are very interesting things about soil that many people aren’t aware of, and promoting those reasons is important to soil scientists like Nick Comerford, a soil and water sciences professor at the University of Florida.

“I don’t think a lot of people think about soils because they’re always looking up and soil is down,” Comerford says. “They don’t know about the diversity, the soil’s connection to the landscape or how the soil forms. We say that soils sustain life...
and to a large degree that’s true, and we want to make sure people know that.”

**Staggering Diversity**

That diversity is a big reason the soil is able to do so much for the planet. Soil includes not just roots that support the plants above but also a myriad of different organisms, both invertebrate and vertebrate: everything from mammals to reptiles to insects to microorganisms.

A great place to start talking about diversity and its importance is from the top. A reptile called the gopher tortoise makes burrows in the ground, and “while this activity seems inconspicuous, the burrows actually serve as habitat for hundreds of other organisms, like frogs and snakes, sometimes even at the same time,” Comerford notes.

Because these tortoises are in danger from habitat degradation, it also means that all of the animals they create a shelter for are also in danger. This is merely one example of the vast connectedness of the soil. Many species benefit from one another—that is until one becomes endangered.

Gopher tortoises make burrows in the ground, creating habitat for hundreds of other organisms. Photo courtesy of Flickr/FWC Fish and Wildlife Research Institute.

When microorganisms enter the mix, there can be anywhere from 10,000 to 50,000 different species in a single gram of soil, amounting to 100 million to 3 billion individual microorganisms.

“The diversity is just staggering,” Comerford says. “People just think about biodiversity above ground, but that is only a footnote to the amount of diversity that we find below ground.”

Mary Stromberger, a soil microbiologist at Colorado State University, says this breadth of diversity is very hard for people to imagine. She stresses that soils are indeed living, diverse, and complex.

“I mean when you talk about a handful of soil containing more species of bacteria than there are plant species in the entire world, it’s really hard for people to grasp the relevance of that,” she says. “You start to do comparisons, and people are like ‘wow that’s pretty amazing’ but then the problem is trying to explain why that diversity is important.”

She adds that soil scientists have a tough job to do when advocating for the importance of soil diversity because most of the soil organisms are invisible or not charismatic animals like pandas. It’s important to find relatable organisms and their direct links to soils, she points out. Earthworms are one example and so are water bears, tiny soil microorganisms that actually resemble bears when viewed microscopically.

Scanning electron micrograph of an adult water bear (tardigrade), Hypsibius dujardini. Photo by Bob Goldstein & Vicky Madden, UNC Chapel Hill, and courtesy of Flickr Commons.

Many of these microorganisms are beneficial to humans in numerous ways. One area they heavily impact is health. In 1943, Selman Waksman and his graduate student Albert Schatz discovered the soil-based antibiotic streptomycin, which was the first cure for tuberculosis.

The antibiotic is synthesized by a kind of soil bacteria to kill off its competitors. The scientists were able to isolate the compound to use it in human medicine. Waksman received the Nobel Prize in Physiology/Medicine in 1952, and streptomycin is on the World Health Organization’s List of Essential Medicines. More modern research has found a drug that has anti-depressant properties and another which appears to have a role in fighting cancer.

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To date, 12 monthly themes and three to five messages per theme have been developed by the Soil Science Society of America (SSSA) for the International Year of Soils (see www.soils.org/IYS). Members of SSSA are serving as monthly leaders, leading the efforts to create activities surrounding the monthly messages (for updates, see www.soils.org/IYS). Further, a series of videos are in production, narrated by Jim Toomey, describing the themes and concepts. View the first video below.

In addition, SSSA be sending out monthly news releases, writing Soils Matter blog posts, and covering the monthly topics in our member magazines.

Know a K-12 teacher? Have them sign up to receive monthly emails with links to that month’s activities.

SSSA members: Watch for a special edition of News Flash at the beginning of the year (and then monthly), to keep you up-to-date on the available activities for you to use (or tailor for your own message) throughout 2015. This is our opportunity to bring soils to the forefront of the public’s mind, and to help all to understand that soil is necessary for life as we know it!

In the meantime, here are some other ways that you can celebrate and support the International Year of Soils:

- Order I "heart" Soil clothing and merchandise from Lands’ End,
- Share what’s happening on your own Facebook and SSSA’s Facebook pages and Twitter feed #IYS - post pictures of any celebrations you may do,
- Make a donation to help us offset the development of our International Year of Soils materials, and
- Get Excited about the International Year of Soils! We’ll need you to be our hands and feet, going out into the public with targeted messages that help everyone see how soils relate to our daily life, health, and quality of life.

“Given the biodiversity and how little we know about that diversity, the potential for future utility coming from the soil just from a pharmaceutical aspect is quite large,” Comerford says. “And we only know about the tiniest fraction of this diversity, something like just 1 or 2%. It’s mind-blowing.”

Stromberger’s work focuses on another benefit of soil microorganisms, which is their interaction with plants. She has found a group of bacteria that live on the roots of wheat and affect the level of hormones in the plants, which allows the plant to more be drought tolerant. She explains that the plant actually releases a chemical to recruit certain kinds of bacteria. The bacteria then move through the soil and colonize the root.
The work is exciting because drought tolerance can lead to better crop yields, and this group of bacteria and drought tolerance are only one example of microbe–plant interactions. For example, there is also research into microbes giving plants tolerance to higher levels of salinity.

“I think this is all just amazing,” Stromberger says. “It’s a really exciting area to be in right now because we are learning so much about soil microbes. There are so many discoveries to be made in terms of networks of roots, bacteria, and fungi that I tell my classes to compare soil to the movie Avatar because everything is really connected.”

**Structural Support and Filtering Properties**

Lindbo, at North Carolina State, likes to add to the long list of things that make soils amazing. Two things he enjoys talking about are the structural support and filtering properties of soil.

“You have to understand how much weight the soil can take, called its bearing capacity,” he explains. “It’s a great example of soil science and civil engineering working together. You can’t put a building on a soil that you don’t understand and don’t know what its bearing capacity is. The prime example is the Leaning Tower of Pisa. There’s a great comic of that structure with someone saying ‘they should have talked to a soil scientist.’”

Lindbo’s research involves soils’ role in septic systems, wastewater dispersal, and treatment. He says it’s an example of using the physical, biological, and chemical aspects of soils to properly treat water and then disperse it back into the environment, particularly in rural areas.

Twenty-five percent of the country uses a septic system to treat their wastewater. Those individuals take water out of the well, drink it, and put it back. “This water is safe because the soil does an absolutely fantastic job of treating wastewater, and it can be taken for granted,” he says.

He adds that studying soil is important because not all soils are created equal. In some areas, the soil may be enough to sufficiently filter water, but in others, the soil may need a helping hand. It all depends on the density of the population and the type of wastewater.

**Soils and Culture**

Beyond the inherent physical ways that soils serve the world, the soil scientists also like to point out soil’s transcendence into culture. They point to how soil grounds the world in a “sense of place.” Native American culture has long shown a connection to soil through written and spoken works of art, and soil was even alluded to by Abraham Lincoln in the Gettysburg Address in 1863.

"Soils have an effect on pretty much every aspect of our lives, and we are hoping the International Year of Soils can help more people realize that," Lindbo says. “The main thing is we want people to get out there and get dirty.”

SSSA hopes to use the International Year of Soils to broaden people’s knowledge about these unique ways that soils serve the world. A goal is to get people to ask questions and think critically about what soils do for them, forging a connection between the soils and what people do, eat, and wear.

Lindbo says he would love the outreach to go beyond just individuals. He would like to see different forms of media, such as National Geographic and NOVA, begin to cover soils more heavily in print and multimedia.

“If we could meet all of these goals that would be wonderful,” he says. “Granted, that is a tall order, but we’ve got to dream. If we don’t try for it, it will not happen. We want to push members to get engaged. Get out there anytime you have an opportunity to speak to the public, K-12 students, public officials, or at rotary meetings, and other public events. Don’t be shy about it.”

The hope is that events in 2015 will create a pipeline of soil awareness between organizations like the UN FAO, soil scientists across the world, and the public—all of whom are served endlessly by soil every day.

Much of our cultural heritage is preserved by soils, to be uncovered by later generations. Photo courtesy of David Robinson.

Understanding the bearing capacity of the soil is critical for successful construction projects. Photo by Forest Starr and Kim Starr and courtesy of Flickr Commons.