

Soil - The Miracle We Take for Granted

Soil is one of America's most vital resources — a foundation of life. Every cubic inch holds a billion beneficial creatures. Yet we bury it under concrete and let it wash away. We poison it and neglect it, and then play politics with it. We treat it like dirt, although we clearly can't survive without it.

Of all the Earth's resources, the one we take most for granted is soil. It is so everywhere around us, brown and prosaic, so easily found and so easily wasted. Perhaps that's why so many of us think of soil only in the abstract - as something farmers use to feed us.

Those of us who live in the cities are aware of soil only when it becomes dirt, smudged onto our clothes after a picnic or carried into the house on our shoes. Then it is considered matter out of place and something to get rid of.

We bulldoze it out of the way to make highways and to erect shopping centers. We ignore its frailty when we cut timber to build houses on hillsides. And then it comes back to haunt us when it clogs our drains, clouds our drinking water, causes floods or simply falls away beneath the footings of our homes.

The truth is that soil is a resource of astonishing balance, complexity, beauty and frailty. If we could narrow our vision down to microscopic detail and tunnel into the top few inches of earth, we would be dumbstruck with its mystery and vitality.

There is enormous variety to soil. Experts say that there are some 15,000 different soil types in the U.S., and perhaps hundreds of thousands worldwide. They differ on the basis of the kind of rock that weathered into clay and sand to form the soil, the mix of organic matter inside it, the amount of water, the texture and the age. There are rust red soils of the tropics, from which most of the soluble aluminum and iron has been leached. There are dark brown loams in the U.S. Midwest that are made of materials scoured off the top crust of Canada and pushed southward by ancient glaciers. There are North American soils built largely from ancient silts, blown here from Asia on prehistoric winds. There are places where the soil is 200 feet deep and places where it is but a thin film on top of rock.

Living soil is full of air passages that let oxygen, carbon dioxide and nitrogen circulate. A well-aerated soil may be almost half airspace by volume. There are acres of surface area on the particles of sand and clay. Films of moisture cling to those surfaces, forming ponds and atmospheres that nurture a vast array of bacteria, fungi, viruses and protozoans. A cubic inch of soil can contain literally billions of creatures.

We know many of these creatures because they cause or cure disease. The bacterium *Clostridium tetani*, for in-

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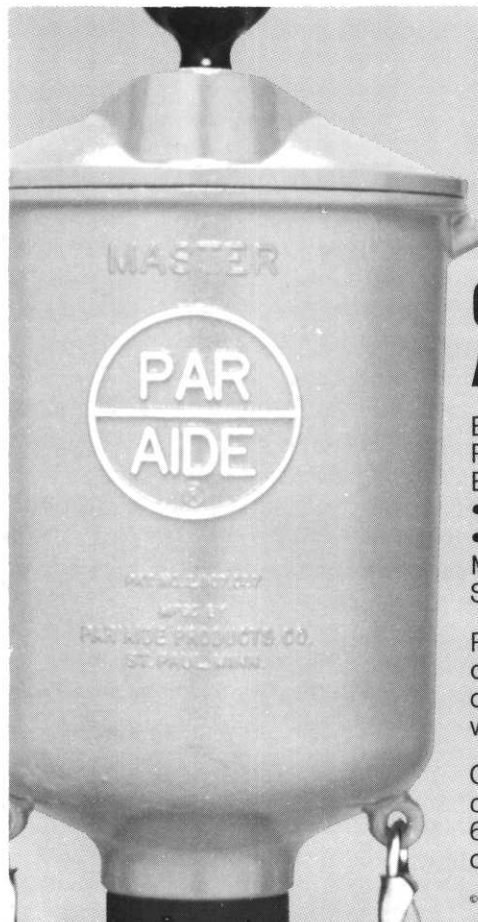
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stance, causes tetanus, while another, *Clostridium botulinum*, causes botulism. Soil fungi have given us penicillin. Actinomycetes, which are responsible for the sweet, toasty aroma of freshly turned earth, provide such useful antibiotics as streptomycin.

But the teeming life of the soil has far more powerful significance than disease or medicine. For it is the bacteria and fungi in the soil that break down the complex molecules of dead organic matter, the cellulose and lignin of wood and leaf, into molecules which plants can use for food. Only the microbes can take the salts out of soil minerals and make them available to plants. Only bacteria can oxidize ammonia into nitrite.

There are other soil creatures with which we are more familiar. Moles and earthworms, burrowing crickets and insect larvae all tunnel through the soil, moving vast amounts of dirt, rearranging it, compacting it here and opening up air and water passages there. Their digging continually changes the habitat for microbes. One day there may be billions of one kind of bacteria, and the next day they may be replaced by an entirely different species. Waterlogging may choke out those which depend on air and favor those which thrive without it. There may be thousands of species lying dormant, waiting for the right conditions. Thus, an activity like plowing can cause the number of organisms to proliferate thirtyfold in a few days.

There is an enormous commerce in chemicals going on in the ground. Microbes and fungi make nutrients available to plants and cause them to wilt and die. Some use up essential minerals and thus retard plant growth. Other microbes boost plant growth by liberating more nitrogen or phosphorus or potassium. And there are bacteria which provide plants with growth hormones.

Soil microbes also dispose of sewage and some kinds of trash. In laboratories, we see that the right sequence of bacteria can break down oil. And studies in the field have shown that some soil microbes can consume up to 99 percent of the DDT sprayed on them within a few weeks. But it doesn't always work. Other soil microbes will refuse to "digest" a pesticide as adamantly as a child may refuse to eat spinach. And too often toxic chemicals get into groundwater before any bacteria can get to them.

Healthy soil has millions of possibilities: decomposers, benefactors, curatives, tiny chemical factories. But so complex and minute is the life of soil, and so remote are its inhabitants from our eyes, that we do not think of it as a living world. Rather, we think of it as a manufactured commodity. Plow it right, water it right, add a little nitrogen here and a little phosphorus there, and, we think, things will grow.

Unfortunately, we are finding out that it doesn't always work that way. Much of our technology turns out to be bad for soil. When we take away the vegetative cover by using a plow, we leave the soil open to the forces of wind and rain.

We are now losing topsoil at a rate of about six billion tons a year in the United States, and more worldwide. The

causes are varied. Too many farmers plow up and down hillsides, leaving furrows that turn into gullies when it rains. Too many speculators are plowing up dry lands or steep lands that should not be farmed. Too many farmers are abandoning traditional crop rotations that once rebuilt overworked soils. Too many developers are careless with bulldozers.

The consequences of such actions could be enormous in the years ahead. Ours is already a hungry world. If, as the experts believe, one-third of the Earth's cropland is eroding faster than nature can replace the soil, we are losing productivity. We may cultivate the same number of acres, but as the soil gets thinner, we will harvest less food from it. And we will see more streams silting, more fish species vanishing, more sediment filling our lakes.

If we are to turn things around, we are going to have to make some choices. And to make these choices, we will have to understand that soil is not a commodity, but a habitat. And we are going to have to conserve it much the way we go about conserving other habitats—by thinking of it as part of the immense and complex variety of life.

—Peter Steinhart, writing in *National Wildlife*

Kientzle, Grand View Team To Play in Olds Scramble in Florida

A five-player team including Tom Kientzle, head golf course superintendent at Grand View Lodge, will represent this Gull Lake resort in the national Oldsmobile Scramble at Disney World in Orlando, Fla. in September.

Other team members are head professional Kevin Cashman, clinic leader Steve Stoxen, part-owner Fred Boos and his daughter, Carolyn Boos.

The Grand View team initially won its local tournament in July, then won a chip-off at the Oldsmobile sectionals in Fargo, N.D.

Thirty-two teams participated in the sectional competition at Oxbow Country Club on August 10. After finishing 18-under par for the 18-hole tourney with a team from Staples for low net honors, Grand View won the chip-off for the right to go to Disney World. In the playoff, the best three shots of the five players determined the winning team. Grand View won by four feet.

"What made the victory most enjoyable was the fact every player on our team contributed important shots," said Kientzle. "I had a good feeling that we would do well before the tournament, and we did. It really was a team victory, and the first time a team from this area has qualified for the national Olds tournament."

At Orlando, Grand View will play 18 holes at three different courses. Should its 54-hole score rank among the top 20, it will be joined by a PGA touring pro for the national finals on October 3.