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Life Underfoot

Microbial biodiversity takes surprising twist

To the naked eye, a tropical rainforest bursts impressively with biodiversity, and a desert is just as impressively short on it. But a new study suggests that at the microscopic level in soil, the situation is reversed. Dirt in a rainforest is a veritable desert of bacterial species, whereas bacterial biodiversity blooms in desert dirt.

Scientists know little about the distribution of microbial species across the globe, says Noah Fierer, a soil microbiologist at the University of Colorado at Boulder. "There are all these papers on plant and animal diversity at continental scales going back to Darwin," but similar surveys hadn't been carried out for bacteria and other microscopic life forms, he says.

To gather more information on how microbial species are spread out over large geographic distances, Fierer and his colleague Robert Jackson of Duke University in Durham, N.C., collected soil samples from 98 sites throughout North and South America. They chose a wide variety of environments, including rainforests, tundra, grasslands, and deserts. Fierer and Jackson specifically selected locations that were well stud-

ied, so that data about average seasonal temperatures, rainfall, and other characteristics would be available.

They then subjected each soil sample to a DNA-fingerprinting technique. This technique scrutinizes a specific segment of the microbes' genomes, called 16S ribosomal DNA, that tends to vary from species to species but is similar in closely related species. Rather than telling exactly which or how many microbial species are present in each sample, the technique gives a relative index of the diversity of species.

Fierer and Jackson had hypothesized that microbial biodiversity would mimic that of plants and animals in each location, with a variety of environmental conditions determining which species live where. However, notes Jackson, "the results were really surprising. None of the things that we think about being important for the diversity of animals and plants were important in this case—not latitude, temperature, or moisture."

The only factor that seemed to affect microbial biodiversity was soil pH. Soils that are acidic, such as those in the Ama-

zonian rainforest, tended to harbor fewer species. Soils closer to neutral pH, such as those in the Arizona desert, showed considerably greater biodiversity. The researchers also found that environments with similar soil pH tended to have simi-

lar communities of bacteria, even when sites were separated by large geographic distances, such as that between conifer forests in the northeastern United States and those in the Pacific Northwest.

Fierer and Jackson report their findings in the Jan. 17 *Proceedings of the National Academy of Sciences*.

The new study "adds to evidence suggesting that all microbes are everywhere, and if they find the right environment, they will prosper," says Eddy Rubin, director of the Department of Energy's Joint Genome Institute in Walnut Creek, Calif. "If you have the same pH, you'll get the same ones throughout the planet."

Jessica Green, a soil microbiologist at the University of California, Merced, agrees. "If it holds true, it suggests that bacteria are fundamentally different from plants and animals." —C. BROWNLEE

QUOTE



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