Climate change could impact vital functions of microbes

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Global climate change will not only impact plants and animals but will also affect bacteria, fungi and other microbial populations that perform a myriad of functions important to life on earth. It is not entirely certain what those effects will be, but they could be significant and will probably not be good, say researchers today at a scientific meeting in Boston.

“Microbes perform a number of critical functions for ecosystems around the world and we are only starting to understand the impact that global change is having on them,” says Kathleen Treseder of the University of California, Irvine, at the 108th General Meeting of the American Society for Microbiology.

Treseder studied the effect of rising temperatures and fungi on carbon stores in Alaskan boreal forests, one area of the globe that is experiencing greater warming than others.

“There is a lot of frozen dead material under the snowpack. There is as much carbon trapped in the soil of northern ecosystems as there is carbon in the atmosphere. It is a big unknown what is going to happen if these environments heat up,” says Treseder.

She started her research with the hypothesis that an increase in temperatures would lead to increased decomposition by fungi. Since one by-product of decomposition is carbon dioxide, rising temperatures should result in greater carbon dioxide release from the soil. What she

found was that nitrogen levels in the soil increased as temperatures rose, and nitrogen tends to suppress fungal decomposition rates.

“In reality as temperatures increase we tend to see greater nitrogen availability in the soil. Nitrogen suppresses activity and diversity. What we end up seeing is less carbon dioxide production from fungi as temperatures increase in northern ecosystems,” says Treseder.

Rising temperatures are also having an effect on snowpack and glaciers and that could be detrimental to the communities of microorganisms living below them. Steven Schmidt from the University of Colorado and his colleagues have been studying the diverse populations of microorganisms that make their home in the sub-freezing zone underneath glaciers.

“As global temperatures rise and glaciers retreat, these microorganisms lose their habitat. They will probably go extinct before we can study them and get a better idea of their contributions,” says Schmidt.

He is also studying microbial activity under the snowpack in coniferous forests. Undersnow microbial activity is especially high in the late winter as the snowpack provides ideal temperatures and moisture for the growth of mats of snow mold. To the average suburban dweller, snow mold may just be another disease that damages the lawn, but in the coniferous forest ecosystem, these mats serve an important function.

“Snow mold are extremely rapidly growing at very low temperatures – below freezing and contribute about 10-30% of the total year-round carbon dioxide production at these sites” says Schmidt.

Snow mold needs a period of a month or two at relatively low temperatures to do its job effectively. As global temperatures rises the late winter period of subfreezing temperatures will shorten, and

snowpacks may be less as well.

“As the soils warm, snow molds will have less water and will produce less carbon dioxide, which may sound good in terms of global warming, but the trees in this system also depend on snow melt water and will ultimately die under extreme drought, thus leading to an overall decrease in carbon fixation by the system. The trees may die. Overall, its probably going to be bad,” says Schmidt.

While rising temperatures may be reducing microbial carbon dioxide production, rising levels of carbon dioxide due to human activity can cause subtle but important shifts in the composition of microbial populations, says John Kelly of Loyola University in Chicago. Kelly is studying the effect of increased carbon dioxide on microbial populations both on the leaves of trees in Northern Michigan and in leaves decomposing in streams and has found a distinct shift in some microbial populations. This could have an enormous impact on the food chain as the microbes are as much, if not more, a source of nutrients for the small animals that feed on these leaves.

“It really does look like microbes are sensitive to global changes. We are just not quite sure how they will respond,” says Treseder.

Source: American Society for Microbiology