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This article is part of a series to promote better understanding of our agricultural soil resources along with practices that can influence soil health.

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Soil Health Linked to Diverse Microbial Communities

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Soils surround us: in the vast prairie countryside, beneath our forests, tundra, urban parks and in our own backyards and gardens. 2015 is the International Year of Soils and a time to reflect on the importance of soil to ourselves and society. Most of us can personally connect with at least one of the many services that healthy soils can provide: food, fibre and fuel production; nutrient cycling; contaminant breakdown and water purification; climate regulation; recreational use; and wildlife habitat. What is perhaps less obvious is the importance of the unseen microorganisms that dwell in soil and facilitate many of these services. Bacteria, fungi and other microscopic biota comprise less than 1% of the soil, but are essential to life on earth.

Healthy soils contain a remarkable abundance of microorganisms – if you were to count them, a single teaspoon would contain more individuals than all of the humans on earth. Not only are they abundant, they are diverse. That same teaspoon of soil is home to thousands of different species of microbes. Promoting microbial abundance and diversity through good soil management is like taking out insurance. A robust microbial community is able to perform essential functions under any number of changing conditions. As an example, the bacteria that are most active at converting soil nitrogen's various forms may be different under dry vs. wet or warm vs. cool conditions but we need balanced nutrient cycling no matter what the weather holds! We rely on a vigorous microbial community to withstand these changing conditions and help us to use nutrients efficiently.

Carbon (C) is the principle source of energy for a majority of microorganisms and it primarily enters soil as plant roots and residues. Continuous cropping, the use of cover crops, and improved crop and forage yields increase C inputs. Reduced physical disturbance under reduced- or no-tillage can also increase the abundance of microorganisms and retain more C and nutrients in the soil through more efficient decomposition. Carefully managed organic amendments such as livestock manure also introduce C and nutrients into soil and can increase microbial biomass. The regulation of nutrient turnover is one of the most vital services provided by microbial communities in agricultural soils.

It is also important to encourage diverse microbial communities through crop rotation diversification. Root-associated microbial communities are different among crop types, linking above and belowground diversity. A familiar example is the nitrogen benefit conferred by the symbiosis between legumes and *Rhizobia species.* Temporary changes in microbial abundance and community structure associated with different crops in rotation are just as important for nutrient cycling processes as for disease suppression and resistance. If we liken crop residues to a microbial smorgasbord, a greater variety of residues from different crop types may attract a more varied crowd to the buffet, maintaining or even enhancing microbial diversity.

The health of our soils is intimately tied to the microbial communities they support. Being mindful of the management practices that build microbial biomass and enhance biodiversity will foster productivity and provide an important component of economically and environmentally sustainable agroecosystems.