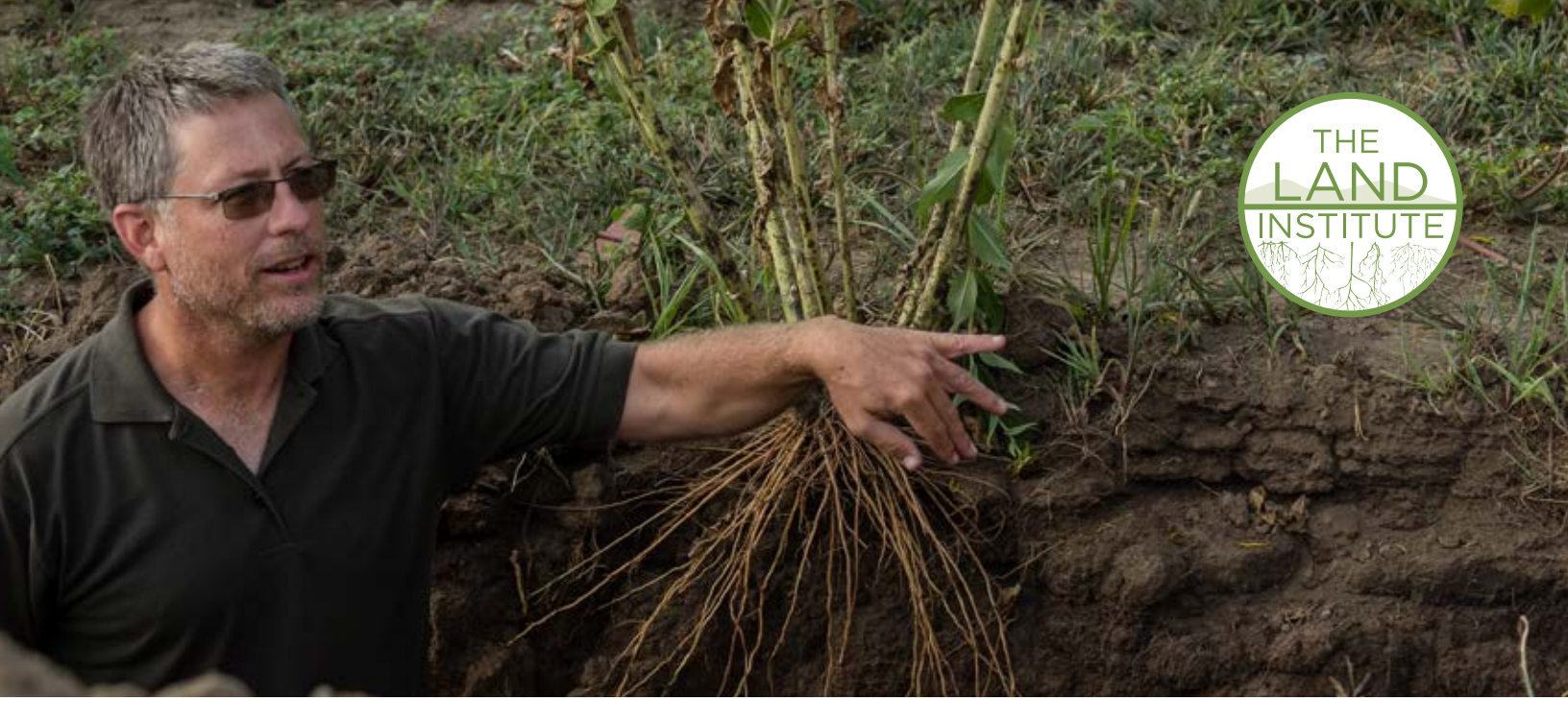


INTO THE WEEDS

Why is Soil So Important?

Healthy soils mean that the crops grown in them will have better nutrition and be able to produce better plant defenses. A crop grown in healthy soil is a well-defended crop.

EBONY MURRELL

LEAD SCIENTIST, CROP PROTECTION ECOLOGY

A thin layer made up of minerals, organic matter, roots, microbes, gases and water forms the basis of life for people and many other species. But given its importance, what soil actually is, and how it varies from place to place remains a mystery to most people. It turns out soils vary tremendously around the planet, reflecting unique, site-specific interactions between the things that make up soils — minerals from rocks or sediments, climate, organisms (such as vegetation and soil microbes) and topography. Soils can be young, meaning they have not developed very much since a glacier or volcanic eruption hit the "re-start" button of soil formation. And in the absence of glacial or geologic activity, soils can be "old" — minerals gradually dissolve and re-crystallize, losing nutrients that plants require to leaching or erosion.

Given this natural variability in soils, it is not surprising that there exists no single definition or criteria of soil health that is applicable everywhere. Soil with 2% organic matter might be considered super-healthy in Arizona, while the same content might be considered under-the-weather in Kansas. One approach our researchers have found to be useful is to establish regionally-specific benchmarks of soil health based on features of intact, never-tilled soils found under native vegetation. These soils portray what is possible, and thus what is healthy in particular geographic regions, especially with respect to soil organic matter contents and microbial activity. Some soils naturally have "unhealthy" attributes for agriculture, such as high salinity or acidity, which require management solutions for agriculture to be productive. But in general, soils that develop in natural ecosystems set a high bar of meaningful soil health attributes for agriculture to aim for.

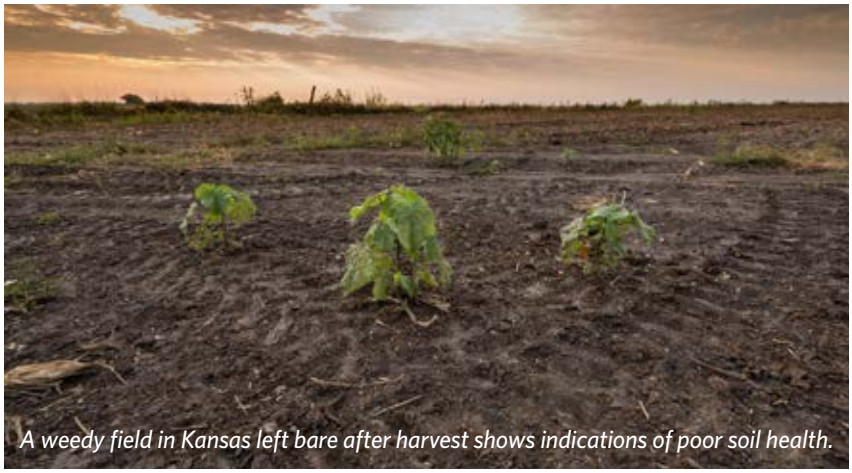
Soil erosion can have a devastating effect on land and communities, driving home the need for continued investment in perennial agriculture solutions.

The principles of building a healthy soil are the same regardless of location or soil type: stop tilling, keep living roots in the soil, and add diversity where possible. With time, we hope our research can lead to the creation of diverse perennial grain and intercrop mixtures that optimize the benefits of legumes and achieve high grain yields.

BRANDON SCHLAUTMAN
LEAD SCIENTIST, PERENNIAL LEGUMES

Healthy soil consists of multiple components: inorganic mineral material, organic matter, water, air, and biological life. The massive root system of perennial prairie grass like Kernza® supports the accumulation of organic matter in the soil, protects the loss of mineral material from erosion, provides the biological community in the soil with habitat and stability, and retains water and nutrients from leaking through the soil profile. The perennial structure of its roots in the soil promotes the stability, protection, and productivity that an agricultural system needs. Given our dependence on plant growth, healthy soil is essential for the flourishing of life.

MARTY CHRISTIANS
RESEARCH TECHNICIAN, KERNZA®



A weedy field in Kansas left bare after harvest shows indications of poor soil health.

A Nonrenewable Resource

On average, the global rate of soil loss from plowed agricultural ecosystems is 380 times that of soil accumulation in native ecosystems.* In other words, **a prairie or grassland would need 380 years to rebuild the soil that's lost on an annual basis due to erosion from tilled farms**. Soil neatly fits the definition of a nonrenewable resource — **current populations deplete soil much more quickly than they rebuild it.**

We recognize the synergies between **soil health and climate change mitigation and remediation**, and see the opportunity to achieve a three-for-one bargain. Increasing soil carbon can dramatically improve soil health and the productive capacity of plants growing on that soil. Storing atmospheric carbon in soil also helps to **remedy climate change by removing CO_2 from the atmosphere where it has been forcing global temperature increase.** Finally, better soil quality helps with climate change adaptation, since soil with greater water and nutrient storage and release capacity will **help plants survive the stresses that are caused by climate change**.

Join Us on the Journey

We're ready to begin to rebuild rather than erode soils, but we need the funds to do it. **Evidence shows that farming perennial polycultures will come much closer to achieving soil health benchmarks set by natural systems compared to monocultures of annual crops.** The profound reduction in soil disturbance and increase in soil carbon that is achieved with perennials facilitates biological and physical improvements in soils.

We invite you to be part of this regenerative agriculture by providing support for our research. Learn more about our work or make a donation at *landinstitute.org* or by contacting Amy Cole, Director of Development, cole@landinstitute.org / (785) 823-5376.

THE LAND INSTITUTE

Hope, rooted in science.
Educate, Advocate, Donate.
2440 E. Water Well Road Salina, KS 67401
(785) 823-5376 • info@landinstitute.org
landinstitute.org

*MONTGOMERY PNAS 2007