

## Living Roots Year-round

Pasture systems are perennial, providing for living roots in the soil year-round. Although growth slows significantly in fall and finally stops as pasture plants go dormant in winter, the roots of those plants remain alive and continue to support the soil microbes that depend on them. Early in the year as temperatures warm and energy from the sun grows stronger, pasture plants and the soil microbes are ready to spring into action again.

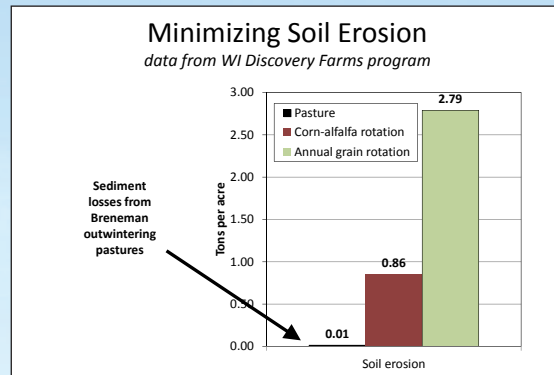
Unlike annual crops that go through a short, distinct lifecycle and all die at once at the end of the growing season, perennial pasture plants are continually producing roots. The roots age and die and contribute to soil organic matter that feeds the microbes. As they decompose, they create channels for water, air, and nutrients through the soil. New roots are always forming to take their place. The constant cycling of root tissue ensures that the soil microbial community is healthy and resilient. More extensive root systems also hold onto the soil, reducing loss of soil particles and nutrients that might leach through the soil into our waterways.

## Continual Soil Cover

Most life is dependent on photosynthesis – the process that plants use to transform the sun's energy into biomass. Although the sun shines every month of the year, most annual crop fields only have green growing plants for four or five months of the year and the ground lays bare for several months after harvest. In

contrast, a pasture begins growing in early spring and continues until late fall, allowing animals to graze for six or seven months.

Even when well managed pasture plants are dormant in the dead of winter, they are still performing the vital function of covering the soil. Every year, many tons of soil are lost through runoff from annual crop fields that are bare for a large portion of the year. Perennial pastures provide continual soil cover, reducing soil erosion to very low levels. Research in Wisconsin has shown that, while a cash grain system lost an average of nearly 3 tons of soil per acre per year, and a dairy rotation with alfalfa lost nearly one ton, soil loss from well managed pastures averaged less than 0.03 tons per acre per year.<sup>ii</sup>



## Building Soil Organic Matter and Sequestering Carbon

Well-managed, healthy pastures create the right conditions for soil microbes to break down dead plant tissue into organic matter. Over time, highly productive pastures can see an increase in soil organic matter levels, which means that pastures can contribute to sequestration of excess carbon from the atmosphere.<sup>iii</sup> The more carbon that

resilient plant communities can store in the soil, the more likely we are to reduce the impact that excess greenhouse gasses have on the Earth's climate and ecosystem. The Earth's most stable ecosystems are founded on perennial plant communities that have little soil disturbance, high levels of plant diversity, living roots throughout the year, covered soil, and significant carbon storage. Pasture systems mimic the natural grassland ecosystems that developed in many places on earth and provide all these soil health benefits in addition to providing healthy feed for our livestock.

- i Skinner, R.H. et al. 2006. "Above- and Belowground Productivity and Soil Carbon Dynamics of Pasture Mixtures" *Agronomy Journal* 98 (2): 320-326.
- ii Stuntebeck, T.D. et al. 2011. "Precipitation-runoff relations and water-quality characteristics at edge-of-field stations, Discovery Farms and Pioneer Farm, Wisconsin, 2003-8" *U.S. Geological Survey Scientific Investigations Report 2011-5008*, 46 p., plus five appendixes.
- iii Rotz, C.A. et al. 2009. "Grazing Can Reduce the Environmental Impact of Dairy Production Systems" Online: *Forage and Grazinglands* doi:10.1094/FG-2009-0916-01-RS.



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# Healthy Soils

## How Grass Farmers Conserve and Build Soil Resources Using Managed Grazing





## Managed Grazing

Managed grazing is a sustainable farming practice in which the primary crop is perennial grassland. Livestock are rotated through a series of pastures, allowing the grasses and legumes a period of rest and recovery. The result is healthy animals, vigorous grasslands and a reduced reliance on annual row crops for feed. Managed or rotational grazing maximizes the yield and quality of pastures. It also provides a high quality of life for farmers and their livestock as well as economic and environmental resilience. This brochure describes how managed grazing also promotes soil health.

## What is soil health?

Most people don't think much about the soil beneath our feet even though we are dependent on it to feed ourselves and our livestock. To continue producing healthy feed, the soil itself needs to be healthy. Soil isn't simply a substrate for plant growth – it is a

living ecosystem, teeming with billions of microbes that break down organic matter and are the catalyst for nutrient exchange. Healthy soil provides ecosystem services which are essential to human life on earth.

Five farming practices can protect and improve the health of our soils. They include 1) reducing or eliminating tillage and other soil disturbance, 2) increasing plant and crop diversity, 3) maintaining living root growth in the soil as much of the year as possible, 4) keeping the soil covered with live plants or plant residue at all times, and 5) building soil organic matter which can promote long-term soil carbon accumulation. To learn how managed grazing contributes to all of these practices – read on!

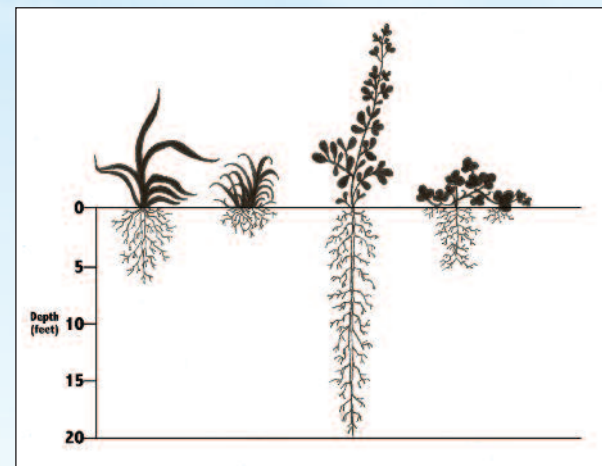
## Less Soil Disturbance

The soil biotic community includes familiar earthworms and beetles as well as many microscopic critters that we don't see, such as bacteria, fungi, and nematodes. Together all these living organisms are responsible for nutrient cycling; some even help move nutrients to plant roots where they can be taken up by the plant. They also create soil organic matter and contribute to improved soil structure, water infiltration as well as nutrient water holding capacity. Every time we disturb the soil through tillage or plowing, these relationships are disrupted and the soil microbes are set back in their important work of building soil health.

By definition, annual crop production involves disturbance of the soil, disrupting efficient functioning of the soil microbial community. In contrast, well managed pastures are planted once, and then produce their crop for years without requiring annual soil disturbance. In fact, pastures improve with time as the soil microbial community develops and functions efficiently. Some of the best, most productive pastures have never been plowed throughout generations of farming.

## More Plant Diversity

A diverse plant community with different types of leaves and different root systems is potentially more efficient at capturing the sun's energy and exploring the soil for essential nutrients and moisture. The taproots of deep rooted plants like alfalfa and dandelion can help make nutrients and water from deep in the soil available to plants with shallower root systems.



Research has shown that a diverse pasture produces more forage than one with only two or three species.<sup>1</sup> And the good news is that, most of the species in a well managed perennial pasture provide palatable, high-quality feed for our livestock, whether we planted them there or not.

The plant diversity and composition of well managed perennial pastures also contributes to soil health. A wide variety of plants ensures a more diverse microbial community in the soil. Many plant species establish cooperative or 'symbiotic' relationships with specific types of microbes, particularly fungi. The microbes live adjacent to and within the plant roots, and in exchange for breaking down organic matter and making nutrients available, the microbes receive carbohydrates produced by the plant and exuded from its roots. The more plant species and root structures in the soil, the more diverse the microbial community and the healthier the soil.

