Underground remedy

Testing prairie grassland strips to improve crop production

Prairie grassland plays a role in many of the Edward Lowe Foundation's land stewardship initiatives, and about 175 acres at Big Rock Valley (BRV), its 2,000-acre campus in southwest Michigan, have been restored to this natural ecosystem. In one novel project, strips of prairie grassland are being tested as a tool for improving cropland.

Planting prairie grass along the edges of roadways and fields has become a popular way to control water runoff and prevent erosion, and researchers at Iowa State University have expanded on this idea by integrating prairie grass strips in contours and slopes of crop fields to reduce sediment movement. Going a step further, the foundation is experimenting with prairie conservation strips to revitalize the interior of agricultural fields.

"Our primary goal is to enhance the soil, says Mike McCuistion, the foundation's vice president of physical resources. "Although we also expect erosion-prevention benefits, our main focus is to rejuvenate the soil by establishing a robust rhizosphere (the area of soil influenced by root secretions and soil microorganisms) — one that is significantly deeper and more diverse in prairies than conventional agricultural fields."

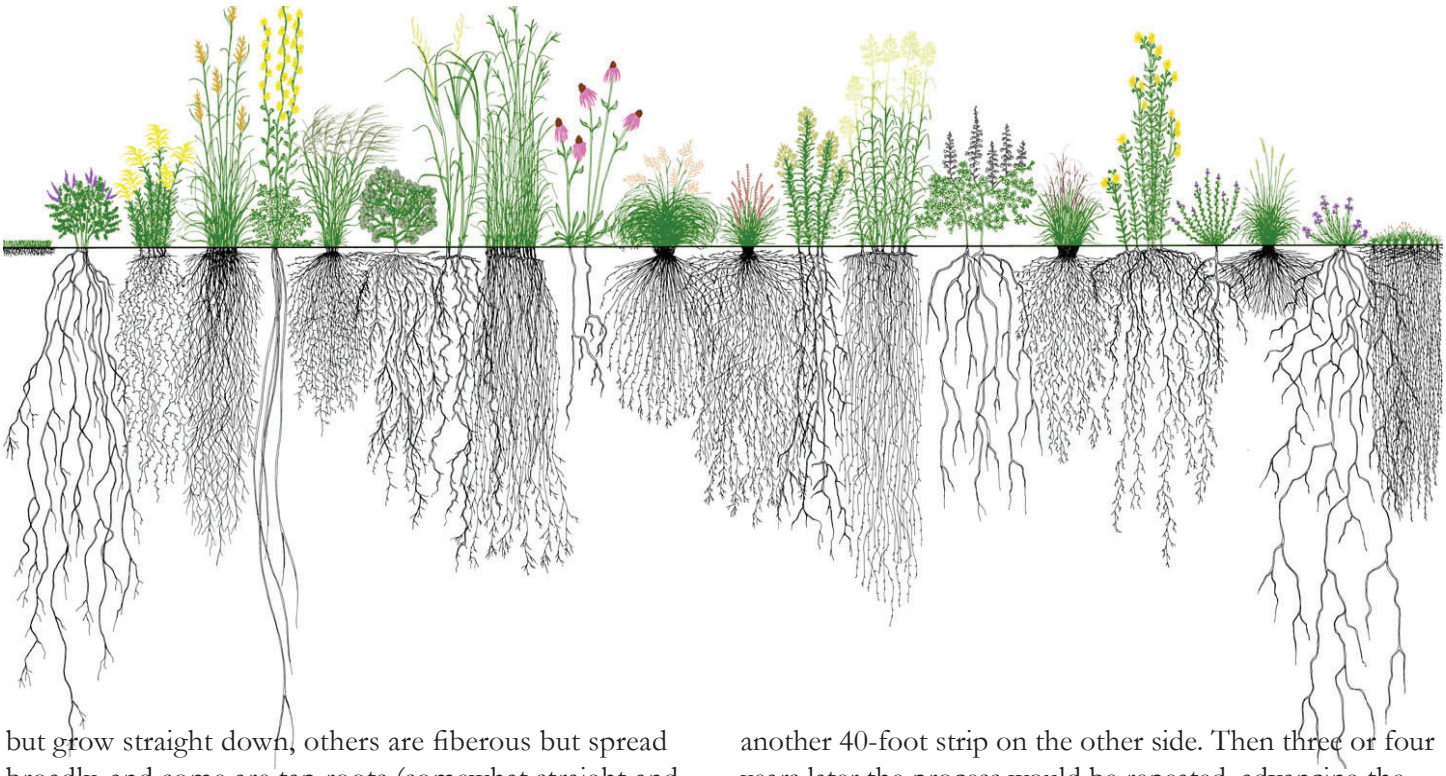
Indeed, depth is a critical factor here. In contrast to crops such as corn and soybeans that have relatively shallow roots, the roots of native prairie plants grow as deep as 15 feet — double the size of an NBA basketball player. This extensive underground system provides numerous benefits, such as:

Shown in the foreground is an 80-foot strip of native prairie grass that has been planted in a crop field near the entrance to Big Rock Valley. Another strip can be seen in the distance on the far right.

- Increasing the soil's ability to absorb water, which not only reduces runoff and wet conditions, but also helps during droughts.
- Delivering more oxygen to soil, which increases organic matter.
- Helping control invasive weeds.
- Attracting and storing large amounts of carbon.

In addition to deep roots, longevity is another plus. Prairie grasslands are viable 365 days a year as opposed to the four- or five-month lifecycle of corn and soybeans. "That means you have an active soil community, full of microbes that are constantly churning and working 24/7," says McCuistion. "With the stress of climate change, this deeper, healthier rhizosphere may be important for enabling conventional agricultural crops to thrive better."

The prairie strips are composed of many different plant species — up to 70 different varieties. That's important because different plants have different root structures. Some are fiberous



but grow straight down, others are fiberous but spread broadly, and some are tap roots (somewhat straight and thick). "The diversity of varieties creates a massive, solid, spaghetti-like root structure," explains Jay Suseland, the foundation's ground maintenance manager. "In contrast, because the crops are a monoculture, all of their roots tend to grow in the same direction in alignment with their respective rows."

Prairie strips in agricultural fields also pose numerous above-ground advantages. Because of the shading and potential snow retention offered by prairie strips, adjacent crops might produce higher yields. In addition, prairies harbor many important predator insects that can help control pest infestations in crops and reduce pesticide costs. The prairie strips also provide a travel corridor and habitat to wildlife.

In 2014 the foundation's land stewardship team began planting 80-foot strips of prairie within selected fields at BRV, leaving about 440 feet of cultivated cropland between the strips. "Our plan is to plow up these interior strips every 7 to 10 years and move them over to the next 80-foot section," says Suseland. "In the meantime, the strips of soil should become greatly enhanced and more productive."

The project is in its infancy, and there are numerous questions to address, such as the methodology and frequency for rotating the prairie strips.

One idea is to plow half of the prairie strip after three or four years and return it to cropland — while starting another 40-foot strip on the other side. Then three or four years later the process would be repeated, advancing the entire 80-foot strip every 6 to 8 years. Rotating the strip in phases would give wildlife and beneficial insects time to relocate into the next strip that is being established.

Another issue to consider is optimizing seed mix. "To maximize the root profile, a variety of plants is needed," McCuistion says. "We'd like to get academic researchers involved to make recommendations on seed types and rotational programs and help us quantify results from a soil science and microbial standpoint."

There are also economic factors to consider, including the cost of the prairie seeds, which are not cheap. Currently the foundation is testing two types of seed mixes: one with 70 species, and another with 20 species. The latter, with fewer species, is more cost-effective because the seeds aren't as expensive. Other economic factors to consider include the loss of income due to the acreage not being used for crops.

Obviously, the prairie strips won't be economically efficient right away, McCuistion admits. "Yet over time, the benefits to crop production could be significant."

He refers to a United Nations study that estimates global human population will reach 11.2 billion in 2100. "And yet our land mass hasn't increased, which means we need new techniques for increasing food production — while keeping our soil and environment healthy. Prairie strips might be one way."

Illustration courtesy of Heidi Natura and the Conservation Research Institute