Prairie Strips: Small Changes, Big Impacts

"Want to stem soil and biodiversity loss, enhance fresh water supplies, curtail climate change, and improve people's lives? Then enhance agriculture with perennials and partnerships."

– Lisa Schulte Moore, STRIPS team scientist

"This is the kind of agriculture I love—to talk about the soil, about sustainability, about production. Will I be able to say that I left the land better than I found it? Hopefully. That's what matters to me."

– Seth Watkins, farmer and STRIPS practitioner

Researchers have found that converting as little as 10 percent of a row-cropped field to prairie can help reduce soil erosion, retain nutrients, and provide habitat for wildlife without impacting per-acre crop yield. Research has demonstrated that sowing native prairie species in strips along contours and at the base of slopes on corn and soybean farmland is a relatively low cost way to garner multiple agricultural conservation benefits. Small changes can have big impacts.

Scientific findings

Starting in 2007, researchers at Iowa State University and their partners tested the impacts of integrating native prairie vegetation within cropland at the Neal Smith National Wildlife Refuge in Jasper County, Iowa. The prairie species were strategically sown to slow the movement of water within 12 small watersheds, 1 to 8 acres in size with slope inclines between 6 and 11 percent. The cropland produced corn and soybeans using no-till management and no cover crops. The scientists monitored each watershed for crop yields, sediment, water, nitrogen, and phosphorus movement off the fields, greenhouse gas emissions, and plant, insect, and bird biodiversity. The work eventually became known as Science-based Trials of Row crops Integrated with Prairie Strips, or STRIPS.

Some of the watersheds were planted with tallgrass prairie vegetation in one or two contour strips among row crops, with separate prairie plantings at the base of the slope. The total land planted with prairie vegetation in a row-cropped watershed was either 20, 10, or zero percent. The entire land area (100 percent) was planted to corn or soybean in the zero percent, control watersheds.

From 2007 to 2014, the STRIPS team found that the watersheds with only 10 percent prairie reduced sediment export by 95 percent, phosphorus export by 90 percent, and nitrogen export by nearly 85 percent in surface runoff water when compared to losses from the 100 percent row crop watersheds. On some fields, nitrogen loss through groundwater also was reduced by 70 percent.

STRIPS research also demonstrated increased biodiversity. Within the surveyed prairie strips, an average of 51 native plant species were found, compared to 13 species found within the row crop areas. This plant diversity provides habitat that fosters conservation of native communities for plants, birds, pollinators, and other beneficial insects.

Prairie strips support several species of insect predators, such as lady beetles, that help control corn and soybean insect pests. The many flowers that grow in

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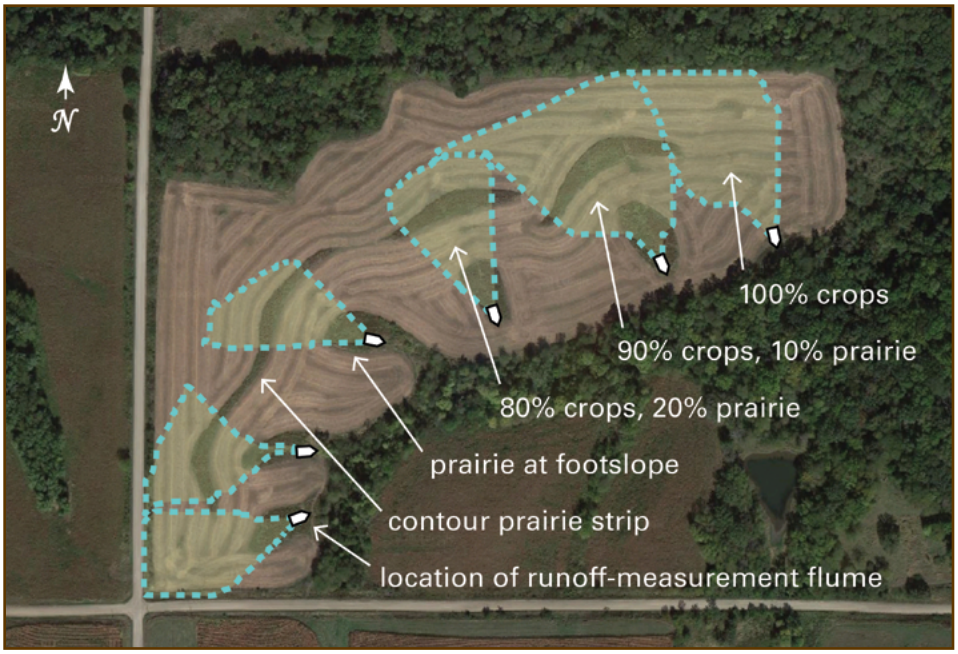
prairie strips support a diverse community of pollinators including 70 species of native bees along with the European honeybee. Research also suggests prairie strips can reduce the negative impacts of neonicotinoids, an important class of pesticides, on non-target insect species.

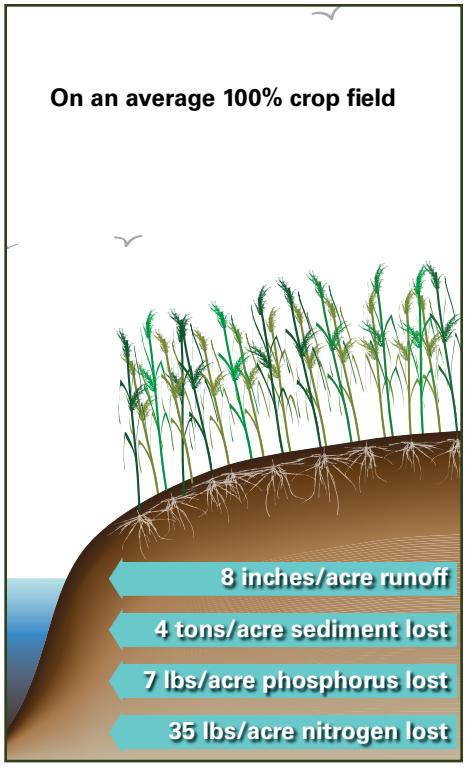
Fields with prairie strips provide habitat for twice as many birds and bird species than those with 100 percent row crops. Birds using the prairie strips included species of greatest conservation need such as the eastern meadowlark, grasshopper sparrow, field sparrow, and dickcissel.

Native plants established in prairie strips are unlikely to pose weed problems in farm fields. Financial assessments show that prairie strips is one of the most affordable conservation practices available to landowners.



This diagram shows the watershed boundaries of six STRIPS study sites after crop harvest. Dashed lines denote the watershed boundaries and the flumes are denoted by the white boat-shaped markers.

These flumes measure surface water runoff from the STRIPS watersheds. Note the amount of sediment displaced from a 100 percent no-till crop field (left) compared to a field enhanced with 10 percent prairie (center) and a field of 100 percent prairie, which has little sediment loss.

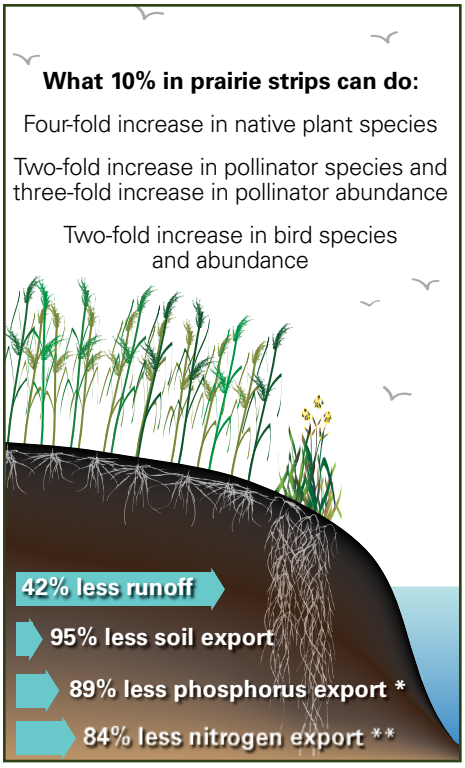


STRIPS researchers calculated average values for surface water runoff, soil and nutrient export from a field cropped entirely in corn, as well as various indicators of biodiversity. Compare this figure to its companion on page 3.

Tallgrass prairie benefits

Tallgrass prairie is a diverse mixture of native grasses and flowering plants uniquely adapted to the climate and soils of the central United States.

Prairie strips keep vital soil resources in crop fields. Deep-rooted prairie plants increase soil organic matter and improve water infiltration. The plants' stiff, upright stems slow surface runoff and help hold soil in place during heavy rains.



On a 10% strips field, all of the above-measured biological and environmental indicators show improvement. There is no appreciable loss of yield on land that remains in annual crops.
*** Phosphorus moving with surface water runoff.**
**** Nitrogen moving with surface water runoff.**

Diversity: More than just "more"

Prairie strips, with multiple plant species, have an advantage over similar conservation practices, such as contour buffer strips or filter strips, which are often a single grass species. Plant diversity lets a prairie flourish under a variety of climatic conditions. Even if an individual species performs poorly because of yearly nutrient or water fluctuations, the ecosystem as a whole thrives, reducing vulnerability to climate extremes.

A mixture of plants also supports an array of animals, insects, and birds that are found only in the central United States. A diverse ecosystem supports multiple land uses. For example, haying, grazing, hunting, honey production, bird watching and photography.

From experiment to practice

Farmers are showing interest in implementing this practice on their own farm fields based on the scientific findings. Working with several partners, the STRIPS team established demonstration sites on farms throughout Iowa and neighboring states including Missouri, Minnesota, Michigan, Illinois, and Wisconsin. In addition to private land locations, prairie strips demonstration sites can be found at several Iowa State University Research and Demonstration Farms. Field days are periodically held at these sites during which farmers, landowners, consultants, and others can view prairie strips and talk with the landowners and land managers.

The cost of installing prairie strips

The STRIPS team calculated the average annual cost for one acre of prairie strips ranges between $200 and $300. Using the "10 percent solution," the cost of protecting a farm field ranges $26-$33 per acre per year without cost-share. The cost of prairie strips with cost-share can be as low as $7 per treated acre. Costs include land costs, potential tillage and herbicides to facilitate prairie plant establishment, prairie seed, and annual and periodic mowing to encourage the prairie plants to take hold. For more detailed cost information see Iowa State University Extension and Outreach publication The Cost of Prairie Strips (AE 3611) (store.extension.iastate.edu/product/15222).

Land costs include property taxes and potentially either foregone rent or net revenue loss associated with taking land out of crops. These costs represent more than 75 percent of the total, but in some cases can be relieved through Conservation Reserve Program (CRP) contracts offered by the USDA Farm Service Agency. Overall, prairie strips are one of the least costly conservation practices available to landowners and farmers, similar to cover crops and less expensive than terraces.

The STRIPS team continues to conduct financial assessments of prairie strips. Up-to-date information can be found on the project website: www.prairiestrips.org.

Restoring balance

Iowa owes the immense agricultural productivity it reaps to the prairie. Historically, perennial prairie covered 85 percent of Iowa, and its deep root network built and held together a fertile topsoil layer that was many feet deep.

Now, that same land is in agricultural production, with the majority in row crops. However, shallow rooted annual crops such as corn and soybeans cannot reproduce the soil-retaining and building capacity of a perennial prairie system. The large-scale conversion to row crops has drastically reduced native habitat and biodiversity. Conservation practices need to be implemented to keep soil, moisture and nutrients on the field. Without such practices in place, more than half of the prairie-built topsoil of Iowa has been lost in the past 50 years, and nutrient runoff and waterway pollution have become common. Climatic extremes continue to put pressure on the productivity of monoculture cropping systems.

The public as well as local and federal governments increasingly urge the adoption of measures that reduce the impacts of agricultural production on soil health, water quality from the Mississippi River Basin down to the Gulf of Mexico, and grassland biodiversity. Programs such as the USDA Natural Resources Conservation Service (NRCS) Soil Health Initiative, the Iowa Nutrient Reduction Strategy, and Iowa's Wildlife Action Plan encourage farmers and landowners to voluntarily adopt practices that improve soil, ecosystem, and watershed health.

Agriculture in Iowa can balance production with conservation. The STRIPS research team has shown that this conservation practice can sustain agricultural production while also providing diverse and extensive benefits across a broad range of ecological and economic criteria. Landscape diversity in the form of prairie strips creates a natural buffer against soil erosion and nutrient loading of streams, and helps water infiltrate into soil. It also preserves important habitat for wildlife, including pollinators and natural predators of crop pests.

Planting prairie strips is a feasible and effective conservation practice with real benefits for farmers, landowners and society. Prairie strips provide big impacts through these small changes in farmland.

Learn more about prairie strips

These resources offer additional information on prairies and prairie strips:

- A full list of STRIPS project partners can be found at www.nrem.iastate.edu/research/STRIPS/content/partners
- Tallgrass Prairie Center website: tallgrassprairiecenter.org
- This and other publications can be found on the ISU Extension Store: store.extension.iastate.edu
- Fields with prairie strips are located at the Iowa State University Research and Demonstration farms across the state: farms.ag.iastate.edu/farms
- Prairie strips research fields are located at the Neal Smith National Wildlife Refuge, Prairie City, Iowa: www.fws.gov/refuge/neal_smith

Top ten priorities for agricultural policies and programs

Data from the STRIPS team

Priority	Addressed by prairie strips
1. Drinking water quality	✓
2. Water quality for aquatic life	✓
3. Rural job opportunities	✓
4. Flood control	✓
5. Water quality for recreation	✓
6. Game wildlife habitat	✓
7. Reducing greenhouse gases	✓
8. Tourism opportunities	✓
9. Crop production	✓
10. Non-game wildlife habitat	✓

The STRIPS team asked more than 1,000 Iowans to rank a list of benefits that could be derived from agriculture, and thus be promoted by policies and programs. Drinking water quality topped the list. More than just crop production, respondents valued agricultural practices that improved water quality, rural livelihood, and wildlife habitat, and also reduced greenhouse gas emissions and flood risk. Agriculture enhanced by prairie strips addresses all 10 top priorities for Iowans.

Acknowledgements

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Prepared by the STRIPS team. Contact Tim Youngquist, Agronomy, and Omar de Kok-Mercado, Natural Resource Ecology and Management, Iowa State University, at prairiestrips@iastate.edu for more information.

Photos by Christopher Gannon, Jose Gutierrez-Lopez, Sarah Hirsh, Lisa Schulte Moore, Tatum Watkins, Tim Youngquist, and Omar de Kok-Mercado.