STRIPS:
Science-Based Trials of Row Crops Integrated with Prairie Strips

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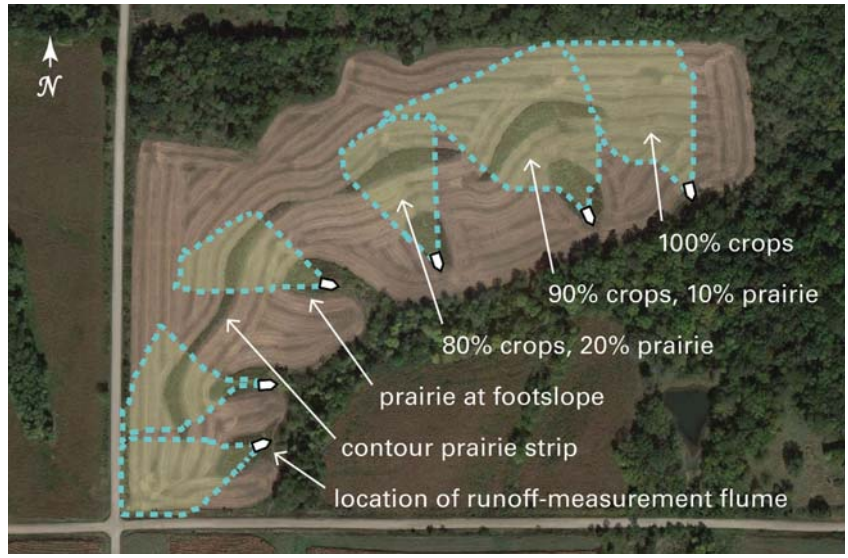
Growing demand for agricultural products to supply food, feed, fiber, and fuel comes at a time of intensified pressure by the public as well as by local and federal government agencies to reduce the impacts of agricultural production on water quality and biodiversity. Midwest land under heavy agricultural production has been identified as a major contributor to nitrogen and phosphorus losses to downstream water systems and to hypoxia in the Gulf of Mexico.

To address these challenges, a team of research scientists, educators, and extension specialists has implemented a demonstration and evaluation project called the Science-based Trials of Row-crops Integrated with Prairie Strips—or STRIPS. The team is specifically interested in how the water quality and biodiversity of watersheds committed to a corn-soybean rotation can be improved through the targeted incorporation of native prairie vegetation. The researchers determined that strategically placed prairie strips can offer a number of benefits to the watershed, including reduced soil erosion, slower gully formation, reduced surface runoff from watersheds, reduced nutrient and sediment losses, and protection of waterways from agricultural runoff.

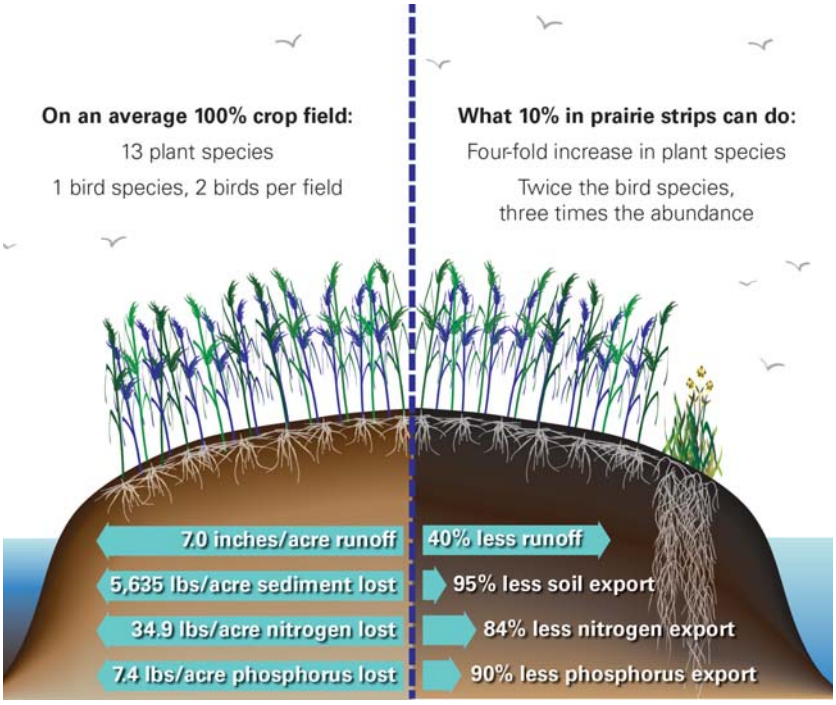
The project treatments were established in 2007 by an interdisciplinary team from Iowa State University, the University of New Hampshire, the USDA-ARS National Laboratory for Agriculture and the Environment, the U.S. Forest Service Northern Research Station, the Leopold Center for Sustainable Agriculture, and the Neal Smith National Wildlife Refuge (NSNWR) in the Walnut Creek watershed in Jasper County in central Iowa. Using twelve small watersheds, the group's first objective was to quantify the influence of different proportions and landscape configurations of annual and perennial plantings on nutrient, carbon, and water storage and losses, along with biodiversity impacts. Their second objective was to promote greater understanding among diverse groups that environmental stewardship may be compatible with viable cash crop production.

The research

To test their hypothesis, the team set up twelve small watersheds on portions of the NSNWR that were waiting for restoration to native tall-grass prairie landscapes and in the meantime were being leased to farmers for crop production in a corn-soybean rotation. The size of the watersheds ranged from 0.4 to 3.2 ha (1 to 8 acres) with average slopes of 6% to 10%. The total land planted to prairie vegetation was 0%, 10%, or 20% of the field. To measure sediment, water, nitrogen, and phosphorus movement off the fields, a fiberglass



An experimental field with different combinations of crops and prairie vegetation.



This infographic explains the benefits of STRIPS.

flume was installed at the bottom of each watershed. Researchers also took regular counts of bird and insect populations in and around the prairie strips to discern biodiversity benefits of the native prairie strips.

The results

According to results recently published by the Leopold Center of Sustainable Agriculture and Iowa State University, the impact of relatively small prairie strips is significant. Between 2007 and 2012, the STRIPS team determined that, with the addition of only 10% prairie, sediment export was reduced by 95%, total phosphorus export was reduced by 90%, and total nitrogen export was reduced by almost 85%. The team also documented substantial gains in biodiversity, creating important habitat for pollinating insects, wildlife, and songbirds. On average, 51 plant species were found in areas surveyed within the prairie strips, as compared to 13 species within the row-crop areas.

This native plant diversity provides habitat that fosters conservation of native communities—not only of plants, but also birds and beneficial insects, such as pollinators and natural enemies of crop pests. In particular, the prairie strips supported several species of insect predators beneficial to corn and soybeans as well as a diverse community of pollinators (70 species of native bees along with the European honey bee). The researchers found consistently greater numbers of birds in the areas that incorporated prairie strips, including some species in greatest need of conservation. The STRIPS team calculated that the average annual cost of treating a farm field with prairie strips ranges from $24 to $35 per treated acre.

The next steps

Based on these significant findings, combined with an increasingly urgent demand to address nutrient and sediment losses to waterways for production agriculture in Iowa, the team has expanded the demonstration project. In 2013, they began establishing a network of demonstration sites run by private landowners across the five soil regions of Iowa. By continuing to collect data on sediment retention, soil quality, nitrate-nitrogen in groundwater, and biodiversity at these new sites, the team is striving to broaden the applicability of their findings. These sites will also provide further opportunity for landowners and operators to see firsthand the economic potential of prairie strips in their own agricultural operations. Field days at the sites and other extension outreach activities are planned.

Work on the prairie strips project is being supported or has been supported by the U.S. Fish and Wildlife Service Neal Smith National Wildlife Refuge, the USDA Agricultural Research Service, the U.S. Forest Service Northern Research Station, the National Science Foundation, the USDA SARE and AFRI programs,, the Leopold Center for Sustainable Agriculture, the Iowa Department of Agriculture and Land Stewardship, Trees Forever, Iowa State University, The Walton Family Foundation, and The McKnight Foundation. Visit the STRIPS website at: www.prairiestrips.org.

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For Further Reading

Zhou, X., M. J. Helmers, H. Asbjornsen, R. Kolka, M. Tomer, and R. Cruse. 2014. Nutrient removal by prairie filter strips in agricultural landscape. *J. of Soil and Water Conservation* 69(1): 54-64.

Hirsh, S. M., C. Mabry, L. Schulte, M. Liebman. 2013. Diversifying agricultural catchments by incorporating tallgrass prairie buffer strips. *Ecological Restoration* 31: 201-211.

Tyndall, J., L. A. Schulte, M. Liebman, M. Helmers. 2013. Field-level financial assessment of contour prairie strips for environmental quality enhancement. *Environmental Management* 52(3): 736-747.

Helmers, M. J., X. Zhou, H. Asbjornsen, R. Kolka, M. D. Tomer, and R. Cruse. 2012. Sediment removal by perennial filter strips in row-cropped ephemeral watersheds. *J. of Environmental Quality* 41(5): 1531-1539.