# Strategies for Transforming Sensitive Lands and Marginally Productive Row Crops to Pasture or Other Perennial Crops

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Continuous Living Cover Series

**Introduction**

Some croplands are poorly suited for annual row crops due to ecological sensitivity or marginal productivity. These areas offer opportunities for more diversified farm income and greater ecological services from perennial crops.

Perennial cropping systems include perennial grain, forage and hay, pasture, biomass energy crops, fruit and nut crops, and timber. These systems yield a harvestable crop or pasture and keep living roots in the ground year-round.

Ecologically sensitive areas that can benefit from the conversion of row crops to perennial crops or pasture include: buffers along streams and other aquatic features, wellhead recharge areas, and karst sinkholes.

Some farmlands consistently produce at or below the cost of production. The low profitability of these lands may be related to soil type, poor soil health from past management, or site hydrology. Planted with perennial crops or as livestock pasture, these areas could result in the same or more income, with more ecological benefits.

This chapter describes perennial cropping or pasture systems that might replace annual crops on ecological sensitivity and marginal productivity lands.

**Buffers Along Streams, Lakes, and Wetlands**

Adding a perennial crop buffer between waterways and farm fields planted with annual row crops can reduce surface water that carries topsoil and nutrients off farm fields. Other benefits include improved soil health, expanded wildlife and pollinator habitat, increased water infiltration, stream bank preservation, and more carbon sequestration in soil.

**Designing Buffers with Perennial Cropping Systems**

Buffers designed with perennial cropping systems must meet environmental and farming objectives at the same time. Buffer shape and width, constructed features (e.g., to address areas of concentrated water flow), and plant selection must meet minimum requirements to address surface water management objectives. These same factors—shape, width, constructed features, and plant selection—must meet the objectives of the farming operation. To meet the needs of farming operations, the buffer shape and width need to be wide enough to match equipment width, for example, and to accommodate the optimal number of tractor passes.

Equipment width and harvestability are important factors to think about early on. Ease of management will be critical to the success of the perennial buffer system. Another point to consider is that perennial cropping systems may increase the area that can be cropped. Perennial vegetation often allows farmers to drive equipment onto areas that in the past were too wet to drive on.

**Minnesota Buffer Law**

In 2015 Minnesota Governor Mark Dayton signed into law a new buffer initiative to protect Minnesota's waters. The law calls for perennial vegetation buffers up to 50 feet along public waters and at least 16.5 feet along ditches. Landowners can also use other water quality practices with comparable water quality benefits.

A Buffer Map is at www.dnr.state.mn.us/buffers.

Another benefit of installing riparian or stream buffers is the opportunity to start the talking about riparian corridors with neighbors. On a landscape scale, continuous riparian buffers increase water quality and offer crucial refuge for wildlife, including beneficial insects.

**Resources for Technical and Financial Assistance**

- Federal Farm Bill resources: Conservation Reserve Program, Continuous Conservation Reserve Program, and the Environmental Quality Incentives Program.

- Minnesota state resources: Reinvest in Minnesota easement program, Conservation Cost-Share, and the Minnesota Agricultural Water Quality Certification Program.

- See the chapter on "EQIP, CSP and CLC" to identify NRCS programs that can fund perennial cropping systems.

**Wellhead Management Areas and Karst Sinkholes**

Areas around wellheads, the places where springs come out of the ground, can be targets for water quality improvement. When managed/planted with summer annual crops, wellhead management areas and areas around sinkholes can act as conduits to groundwater and nearby streams.

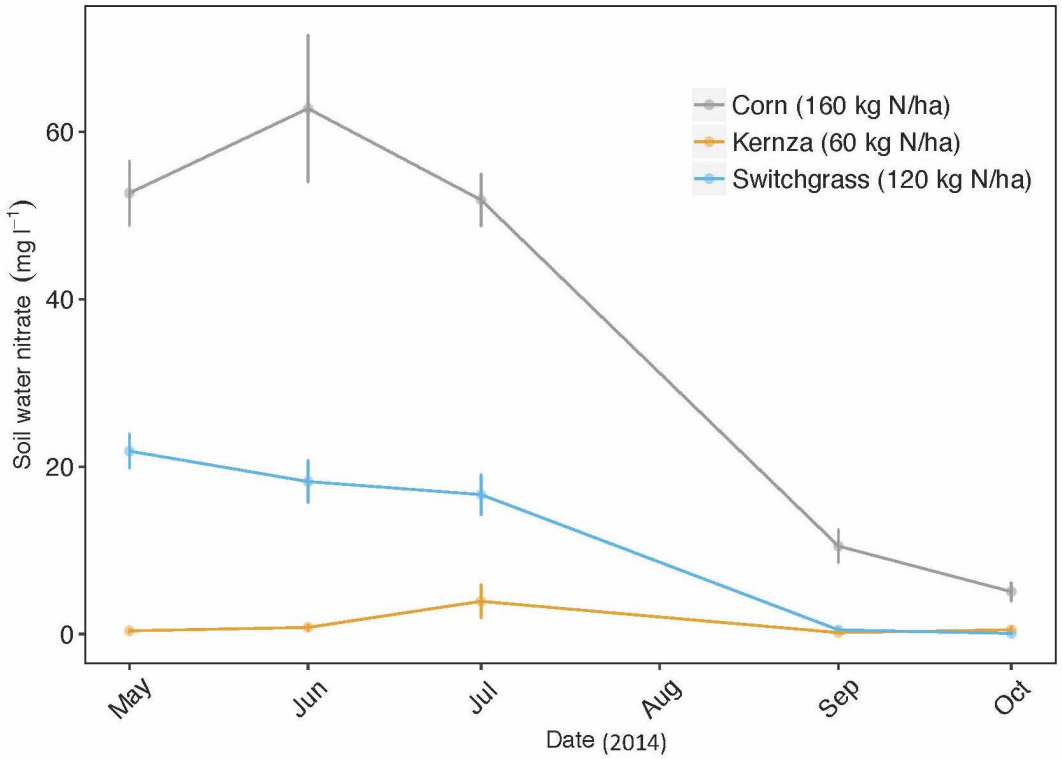
Sinkholes occur in karst areas where water-soluble bedrock exists. Water dissolves the rock and as the resulting sediment moves away into cracks and voids, the ground above collapses and creates a sinkhole. Sinkholes can serve as direct conduits from field to groundwater or nearby streams. When this occurs, debris, topsoil, agricultural inputs, and other contaminants flow freely into the groundwater.

Nitrates, pesticides, and fecal bacteria have contaminated groundwater in hundreds of wells across the Midwest. When treatment becomes a necessity, communities and private landowners bear the cost. By contrast, when these areas are managed/planted with perennial crops, soluble nutrients are reduced before they reach groundwater and surface waters. Groundwater quality can be protected by planting a perennial buffer around the sinkhole. Studies show that converting row crops to perennial systems in well recharge areas can significantly decrease contamination by nitrates and other pollutants.

The Natural Resource Conservation Service recommends a minimum width of 25 feet.

**Figure 1. Soil water nitrate comparison with annual and perennial plantings.**

Annual row crop (corn), perennial grass (switchgrass) and Kernza® perennial grain crop.




From Jacob M. Jungers, Department of Agronomy and Plant Genetics, University of Minnesota.

**Agencies Responsible for Wells and Groundwater Protection**

Illinois - Environmental Protection Agency

Iowa - Department of Natural Resources

Minnesota - Minnesota Department of Health

Missouri - Missouri Department of Natural Resources

Wisconsin - Wisconsin Department of Natural Resources

**Marginally Productive Land**

Some farms have areas that are less productive and therefore less profitable than others. This "marginality" can be due to a high water table, frequent flooding, droughtiness, high erodibility, high levels of runoff or leaching, and other soil or climate factors that can limit productivity. These areas are good candidates for conversion from row crops to perennial cropping systems or pastures. The large root systems of perennial crops are better at holding soil in place, tolerating periods of low moisture, and allowing large amounts of moisture to infiltrate. Because of this, perennial crops on less productive plots have the potential to out-perform annual row crops.

**Identifying Marginally Productive Areas on the Farm**

In situations where "marginality" is not easily identified on the land, there are a variety of tools that may help landowners determine the best areas to plant perennials. Some of the tools available include the following:

- **Whole Farm Conservation Planning**
  The U.S. Department of Agriculture (USDA)'s Natural Resource Conservation Service helps landowners create individual conservation plans at no charge. The plan can help landowners evaluate opportunities, mitigate loss, and comply with regulations. A conservation plan can identify areas with production potential and conservation improvements. Once areas for improvement have been identified, NRCS program dollars may be available—but participation is not required.

**Prairie STRIPS Research**

Research from the **Science-based Trials of Rowcrops Integrated with Prairie Strips** or **STRIPS** project in Iowa shows that converting 10% of cropland to diverse prairie forbs resulted in a 95% reduction in soil loss and 85% to 90% reduction in nutrient loss.

Key to the success of Prairie Strips is the correct placement on the land. In fields with 6% to 10% slopes, narrow strips of prairie should be placed along field contours and at the foot slope (also known as the toe slope) for best results.

For more information go to www.nrem.iastate.edu/research/STRIPs/content/about-strips

- **Profit Zone Manager**

  AgSolver's Profit Zone Manager (now owned by EFC Systems) is an online product designed to help landowners test field profitability for a variety of management scenarios. The product can project how conservation management decisions will impact producer's bottom lines, and it allows users to assess these projections before they commit to making changes.

- **Cropping Systems Calculator**

  The Chippewa 10% Project's Cropping Systems Calculator is an Excel-based tool that helps farmers determine the financial viability of planting annual crops versus planting pasture and grazing. Farmers plug in a variety of management scenarios to see how each scenario would impact their bottom line. The calculator even includes a soil loss feature.

**Perennial Solutions**

- **Agroforestry**

  Adding forest production to farm enterprises is a good way to diversify income while adding ecological benefits. Agroforestry can mean many different practices and there is plenty of room to customize for each unique situation.

  For more information, please see the Green Lands Blue Waters publication "Agroforestry" from the *Continuous Living Cover Manual*.

  Agroforestry includes growing woody trees and shrubs that produce fruits or nuts, and high-value lumber integrated into another enterprise. One example of agroforestry is the use of a fruit-bearing species as a windbreak to protect crops, livestock, or to improve energy efficiency in buildings. Another example is the use of fruit, nut, or lumber trees in a riparian buffer.

Alley cropping is great example of how to integrate forest products into farm enterprises. For more information, see the "Alley Cropping" sidebar.

- **Biomass**

  In this document biomass refers to recently living leaves, shoots, stems, stalks, and flowering parts of herbaceous or woody plants. These parts of the plant can be used on-farm as an energy source or bedding or sold to industries for processing into bioenergy or bioproducts. Biomass plant sources include perennial grasses or woody species such as hybrid poplar or willow. For more information and additional resources, see the Green Lands Blue Waters publication "Biomass" from the *Continuous Living Cover Manual*.

- **Integrating Livestock**

  The integration of livestock into a farm system can mean using perennial forage for on-farm use or sale. Areas planted to perennial pasture can be grazed, hayed to support on-farm cattle, hayed and sold off-farm, or contract grazed by a beginning grazier's cattle. The Minnesota Buffer Law does not restrict haying and grazing buffer strips. Landowners can hay or graze these areas as long as they maintain perennial vegetation.

  Grazing requires thoughtful management to successfully balance animal needs, the goals of the producer, and the condition of the pasture. However, the growing popularity of premium-price grass-fed beef can make it a profitable option. See the Green Lands Blue Waters document "Integrating Livestock" from the *Continuous Living Cover Manual* for more detail and additional resources.

**Alley Cropping**

Alley cropping refers to the use of two or more rows of woody tree or shrub species planted to form a wide alley for crops to be grown in.

Integrating woody species that provide income such as fruit, nut, or lumber products has many benefits. Deep-rooted, wind-blocking trees and shrubs can:

**Reach deep nutrients and cycle them to the surface by shedding litter.**

**Protect valuable crops from wind and sand particle damage.**

**Reduce evapotranspiration.**

**Increase soil moisture in the tillage layer.**

**Increase crop yield.**

**Provide economic diversity.**

**Increase soil carbon.**

- **Kernza®**

  Over the past two decades, the Land Institute and the University of Minnesota have worked to breed a marketable perennial grain from intermediate wheatgrass, which is related to wild wheat. While still in development, the result is Kernza®, a promising plant with the potential to be a profitable perennial crop that lessens the environmental impacts associated with U.S. agriculture. Because the crop is still in development, there are risks associated with it, and much more research and market development are needed. However, Kernza® is already used in commercial beer, bread, crackers and spirits.

**Stacking Continuous Living Cover Strategies**

The stacking of Continuous Living Cover (CLC) strategies means using more than one strategy in the same vicinity at the same time. "In the same vicinity" can mean within a single field or portion of a field, or on a whole-farm basis. Stacking of CLC strategies can even be done on a larger landscape scale, such as on a series of neighboring farms or within a watershed.

Trying to envision all of those interactions and placement decisions ahead of time could seem intimidating, but the experience of many farmers is that once they started adding CLC strategies, the interactions among them flowed naturally and contributed to the stability of their whole farming system. Please see the Green Lands Blue Waters document "Stacking of Continuous Living Cover Strategies" from the *Continuous Living Cover Manual* for more information and summaries of how 10 farmers stacked Continuous Living Cover on their farms.

**Intermediate Wheatgrass/Kernza®**

Intermediate wheatgrass (*Thinopyrum intermedium*) (IWG) is a perennial grass genetically related to common wheat that is being bred and marketed as the perennial grain Kernza®.

IWG produces large biomass and is among the most productive cool-season forage species in the western United States (Harmoney, 2015). As a perennial species, it provides substantial environmental services relative to annual grain crops, including **reduced soil and water erosion**, **reduced soil nitrate leaching**, **increased carbon sequestration**, and **reduced input of seed, tillage, energy, and pesticides** (Culman et al., 2013; Glover et al., 2010; Robertson et al., 2000). IWG has a more extensive root system, **can capture more applied fertilizer**, and **reduce total nitrate leaching by 86% or more** relative to annual wheat (Culman et al., 2013).

Please see the Green Lands Blue Waters document titled "**EQIP, CSP, and CLC**" from the ***Continuous Living Cover Manual*** for details on the use of Farm Bill program funding to implement conservation practices on working lands.