Continuous Living Cover Introduction

Summer 2014
Continuous Living Cover Series

Photo of Watonwan River, from Linda Meschke

Continuous Living Cover (CLC) means plant cover on the soil and roots in the ground all year long. The Green Lands Blue Waters collaboration works on five Continuous Living Cover practices: agroforestry, biomass, cover crops, perennial forage, and perennial grains. This publication focuses on agroforestry, cover crops, and perennial forage: these practices are well-established and proven in farming systems and in markets. Biomass and perennial grains are emerging practices that are being researched and developed for future use.

Continuous Living Cover is a process and a goal to achieve within agricultural systems. Even modest steps toward implementing year-round cover can have larger-than-expected benefits in terms of reduction of erosion and nutrient loss, improvement in soil health, improvement of water quality, and reduction in purchased farm inputs.

The larger-than-expected benefits can be seen at both the farm scale and the landscape scale. Research from the Prairie STRIPS project in Iowa shows that converting 10% of cropland to perennial prairie cover at the field scale resulted in a 95% reduction in soil loss and an 85% to 90% reduction in nutrient loss.

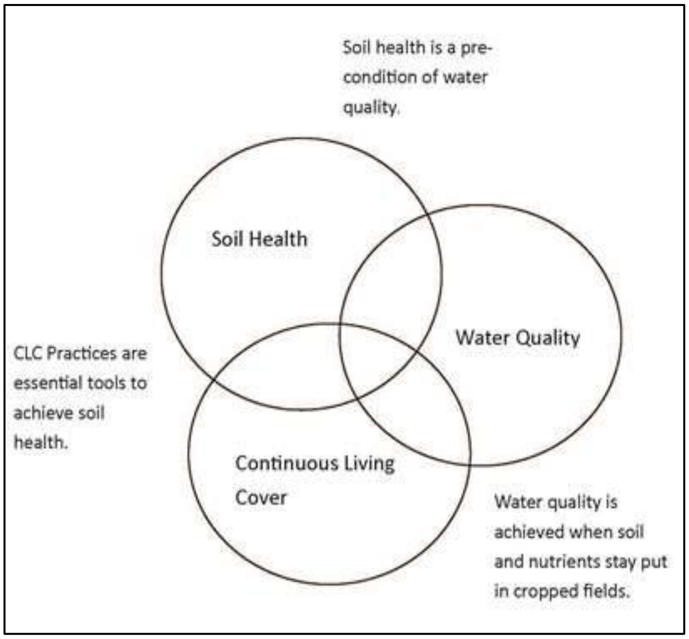
Healthy Soil

- Vibrant soil biology
- Ability to cycle nutrients
- Blocky aggregate structure; porous; allows rapid water infiltration during rainfall events
- Very little run-off of surface water
- Very little leakage of N
- Very little loss of P
- Very little soil erosion

All of these attributes of a healthy soil contribute to clean water leaving the fields, and to robust crop production with reduced purchased inputs.

Soil Biology Primer. http://soils.usda.gov/sqi/concepts/soil_biology/biology.html

Minnesota Soil Management Series. http://www.extension.umn.edu/agriculture/tillage/soil-management/soil-management-series/



Modeling of changes in cropping systems at the regional scale in Iowa's loess hills showed a shift to region-wide improvements in soil and water quality.

Region-wide modeling in Minnesota's Chippewa River Watershed showed that best management practices (BMPs) in the form of reduced tillage, riparian buffers, and recommended N application rates were not by themselves sufficient to achieve a 30% reduction in N loading into the Mississippi River. Increases in acreage under perennials would be required in addition to the BMPs to meet that goal.

Continuous Living Cover on farms is a step on the way to achieving a robust, resilient agriculture that delivers yields, healthy soil, clean water, and a good quality of life for rural and urban citizens.

Sources:

Small Changes, Big Impacts: Prairie Conservation Strips. http://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2014-03-small-changes-big-impacts-prairie-conservation-strips.pdf

Impact of Conservation Practices on Soil Erosion in Iowa's Loess Hills https://www.extension.iastate.edu/NR/rdonlyres/26DC3619-5E13-4992-9F38-C104F60E6DBE/135600/Conservation_Practices_on_Soil_Erosion_Loess_Hills.pdf

Multifunctional Agriculture in the United States. 2005. George Boody, Bruce Vondracek, David A. Andow, Mara Krinke, John Westra, Julie Zimmerman and Patrick Welle. BioScience (2005) 55 (1): 27-38. http://bioscience.oxfordjournals.org/content/55/1/27.full

What We Know

- Strategic placement of relatively small areas of continuous living cover practices on the farm can greatly reduce soil erosion.
- Use of cover crops and perennials in the crop rotation can increase soil organic matter.
- Use of cover crops and perennials in the crop rotation can reduce leakage of nitrate-N.
- Production of perennial forage and managed grazing can be profitable.
- Extended crop rotations that include perennial forages can be profitable.

Why Don't More Farmers Do CLC?

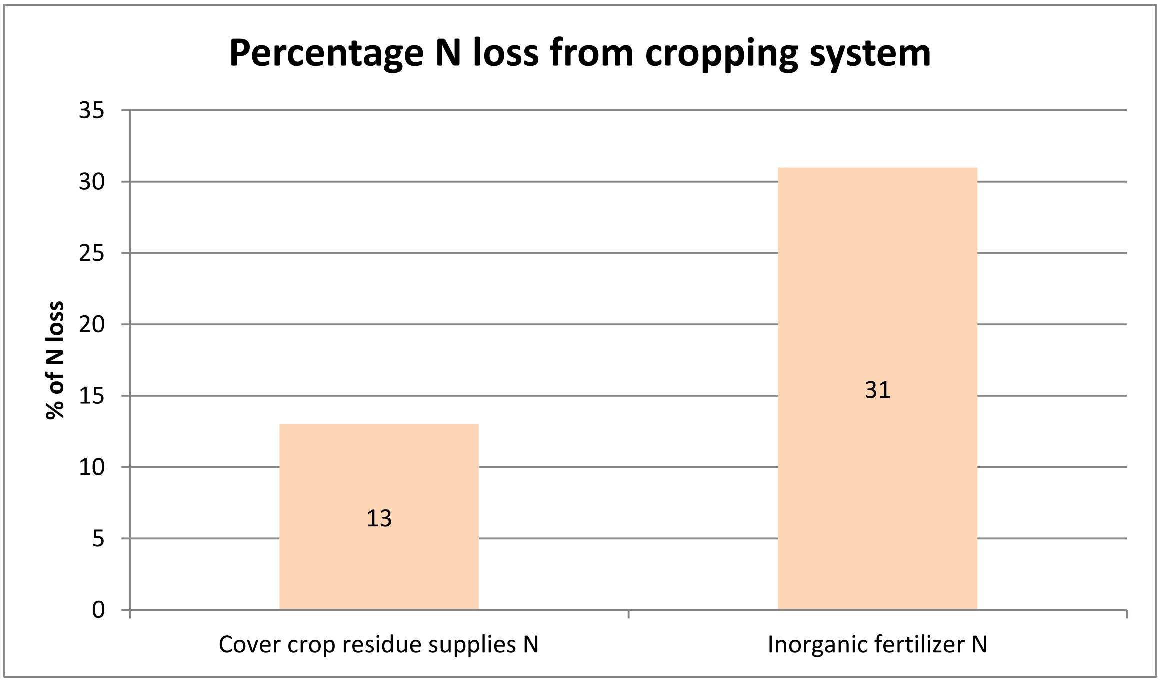
Listening sessions in Iowa clarified some barriers and pathways to adoption of CLC practices.

Concerns	Pathways to adoption
Opportunity cost of taking land out of production	• Potential for perennial strips within cropland to provide income • Need for sources of cost-share money to offset establishment costs and opportunity costs
Incompatibility of CLC practices with current farming practices	• Need for demonstration sites • Need advisors to understand and be able to articulate long-term benefits of practices
Conservation agency's ability to provide technical assistance	• More information needed on how practices fit into the "toolkit" of natural resource professionals

Source: *Investigating opportunities for enhancing farmer adoption of strategically targeted prairie strips in Iowa. Leopold Center for Sustainable Agriculture Competitive Grant Report P2012-08.*

Potential for Regulation of Cropping Systems

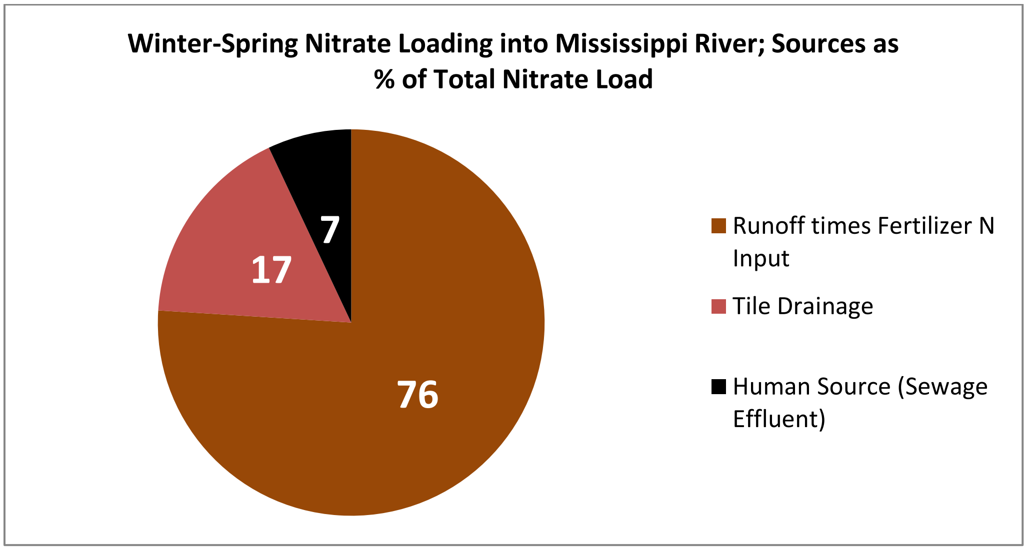
Nitrate-N leakage from row-cropped systems is estimated at 30% of applied inorganic N fertilizer. Nitrate leakage into groundwater is becoming a serious issue for municipal water supplies in some areas. Using cover crops in the system as a green manure to supply N to a subsequent crop has been shown to reduce N leakage from the system as a whole.



Source: *Using Cover Crops and Cropping Systems for Nitrogen Management*. Chapter 9 in *Advances in Nitrogen Management for Water Quality*. Edited by Jorge A. Delgado and Ronald F. Follett. 2010, 424 pages, hardcover. Soil and Water Conservation Society. ISBN 978-0-9769432-0-4. http://www.swcs.org/documents/filelibrary/advances_in_nitrogen_management_for_water_quality/ANM9_A41356AAD3B6A.pdf

Nitrate, phosphorus, and sediment loading into surface waters from cropland in the many watersheds that ultimately drain into the Mississippi River is a concern both in local areas where there are impaired waters, and downstream at the Gulf of Mexico where the size of the hypoxic zone in July has been clearly linked to the discharge of nitrate-N into the Gulf from the Mississippi River in May.

Nitrate leakage and soil erosion are costing local and state governments in the form of money spent on sediment cleanup and water treatment facilities, and are costing Gulf fisheries in the form of lost productivity. If the nutrient and sediment loading from agricultural fields into surface waters remains intractable under current conditions, regulations on discharges from agricultural fields or restrictions on cropping systems may become reality.



Source: *Sources of nitrate yields in the Mississippi River Basin*. 2010. Mark B. David, Laurie E. Drinkwater and Greg F. McIsaac. **Journal** of Environmental Quality. 39(5):1657-67.

The Natural Resources Conservation Service (NRCS) estimates that compliance with conservation standards results in $4.96 in off-farm water quality benefits for every ton of soil saved, in 2007 dollars. At what point might that number be turned around into a call to have farmers pay for the loss of water quality resulting from erosion and nutrient loss from their fields?

Proactive efforts now to add Continuous Living Cover practices to cropping systems and to reduce tillage may benefit the farmers not only with direct improvements in their soil, but also with avoidance of future regulation. Regulation may be driven by both local impaired waters concerns in the Upper Midwest, and the hypoxic zone in the Gulf of Mexico.

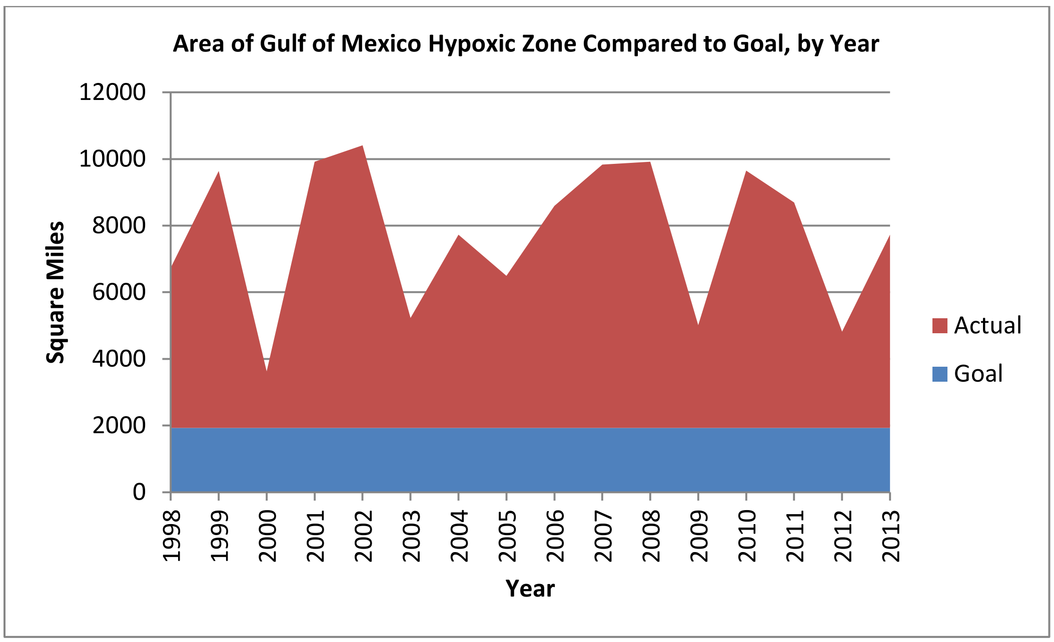
Size of the Hypoxic Zone

Long-term research by LUMCON (Louisiana Universities Marine Consortium) researchers shows a 90% correlation between the amount of N (nitrate + nitrite) entering the Gulf of Mexico in May of each year, and the size of the hypoxic zone as measured in July of the same year. The amount of nitrate + nitrite N entering the Gulf in May depends on:

1) The amount of nitrate + nitrite N in the Mississippi River water; and
2) The volume of flow of that river water.

In a widespread drought year such as 2012, both the amount of N and the volume of river flow in May are reduced so the hypoxic zone size is smaller. In the chart below, you can see the dip in hypoxic zone size in 2012.

A management goal has been established to shrink the hypoxic zone to a yearly average of 1,930 square miles. Even in the drought year of 2012, the actual size of the hypoxic zone was 2,889 square miles – which is still 1.5 times larger than the goal. If voluntary management to reduce N loading in the Upper Mississippi River Basin can't shrink that zone, regulatory measures may be applied.



References:

2014 Forecast: Summer Hypoxic Zone Size, Northern Gulf of Mexico. June 2014. Nancy N. Rabalais (LUMCON, nrabalais@lumcon.edu) and R. Eugene Turner (LSU, euturne@lsu.edu). http://www.gulfhypoxia.net/Research/Shelfwide%20Cruises/2014/HypoxiaForecast2014.pdf

Interim Final Benefit-Cost Analysis for the Environmental Quality Incentives Program (EQIP). January 2009. USDA Natural Resources Conservation Service. www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_007977.pdf