

More than just a delicious ingredient!

Environmental Benefits of Continuous Living Cover (CLC) Cropping Systems

Document background:

The following document includes research-based background text and plain-language talking points on the Environmental Benefits of ingredients/ crops grown in “Continuous Living Cover” cropping systems. These talking points are written for a general audience and are intended for uses such as food business marketing materials and consumer-facing communications.

Background and talking points are provided for:

- **Perennial Grains**
- **Perennial Forage**
- **Agroforestry**
- **Perennial Biomass**
- **Cover Crops/ Winter Annual Crops**

Green Lands Blue Waters is a vision for productive, profitable agriculture in the Upper Midwest based on the straightforward concept of getting as much value as possible from farmlands by growing crops that keep the soil covered year round – what we call farming with Continuous Living Cover. The values from the crops we promote can be measured in yields and farm profits; but also as reduced risk, improved outlook for long-term productivity from the soil, more jobs, more wildlife, cleaner water and resiliency in the face of a changing climate.

This document was created by Green Lands Blue Waters with support from the Walton Family Foundation.

PERENNIAL GRAINS

Perennial grains are crops that are alive year-round and are productive for more than a year. They offer a variety of environmental benefits compared to annual crops like wheat, corn, and soybeans that dominate agriculture today. They can have deeper root systems and longer growing seasons and therefore absorb and hold more rainwater, better capture nutrients - leading to less runoff, reduce erosion, maintain and capture more carbon in soil, require less fertilizer and herbicide, and need less tillage. Because they don't need to be tilled each year, perennial grains could build soil and store carbon rather than deplete and release it as annual crops do (worldwide, 10-14% of greenhouse gas emissions come from agricultural production).

Kernza® (*Thinopyrum intermedium*) is a promising new perennial grain species being developed by the Land Institute in Kansas and the University of Minnesota's Forever Green Initiative to be an edible grain with environmental benefits. It's the first perennial grain commercially available in the U.S., and it offers a way to curb greenhouse gas emissions and lessen the impacts of climactic warming by shifting agricultural practices.

More work on the grain needs to be done to improve yields and lifespan beyond a few years (the grain only produces 10-20% of what wheat yields now) and to produce a crop that's better for baking (Kernza® has more protein in it than conventional wheat, but it's got less of the protein needed for dough-strength). While there is a lot of interest in Kernza® and products made with it, supply is limited and more research is needed to develop a grain that meets widespread market demands. Researchers are also working to develop perennial wheat, sorghum, and rye species.

Environmental Benefits

- Uses nutrients more efficiently than annual crops
- Requires less tillage
- Traps more atmospheric carbon than annual crops
- Maintains carbon levels in soil
- Builds soil organic matter
- Reduces erosion and nitrate leaching
- Uses less water than annual crops
- Captures and retains more water than annual crops
- Filters more water
- Reduces the need for fuel, fertilizers, and pesticides
- Protects wildlife habitat and provides habitat for pollinators and beneficial insects

PERENNIAL FORAGE

Perennial forage refers to land planted with perennial plants that feed livestock like alfalfa, white clover, and red clover. Perennial forage plants can be grown as cover crops or in rotation and are eaten by grazing animals or harvested and fed to livestock as hay or haylage after the growing season is over. Perennial forage fields act like a sponge; they absorb water and nutrients and allow very little of either to escape into groundwater or surface water. Farmers also use perennial forage plants like alfalfa to enrich their soil with nitrogen before planting row crops of corn, which has the added benefit of higher yields due to fewer insects and better soil tilth.

Managed grazing is a way to feed livestock by rotating animals through different pastures or cover-cropped fields using lightweight fencing that can be quickly and easily moved. It is also a form of agroforestry known as *silvopasture*. Livestock are moved in response to their nutritional needs and the amount of forage that is available. Animals can be grazed to enhance soil biology and manage invasive species in specific areas. Carefully managed grazing can benefit the environment by improving soil, reducing runoff and soil erosion, creating wildlife habitat, sequestering carbon, and conserving resources. However, studying the environmental benefits is challenging and additional research is needed to fully understand its impact on carbon sequestration and conservation.

Environmental Benefits

- Improves soil health
- Reduces soil erosion and nutrient losses
- Adds nitrogen to soil
- Controls invasive species
- Helps mitigate water contamination due to the leaching of nitrates
- Legume forage crops can break disease cycles and cut down on weeds and pests
- Provides habitat for wildlife, birds, and beneficial insects

AGROFORESTRY

Agroforestry is a land management approach that integrates trees and shrubs with plant and animal farm operations. USDA describes it as “combining trees and agriculture to enhance long-term production of food and other useful products while protecting the soil and water, diversifying and expanding the local economies, providing wildlife habitat, and ensuring a more pleasing and healthy place to work and live.”

There are five types of agroforestry:

1. **Silvopasture** is when trees, livestock and forages are grown together.
2. **Alley cropping** is when agricultural and horticultural crops are grown between rows of woody plants, like when corn is planted between pecan trees.
3. **Forest farming** or multi-story cropping combines forestry with small-scale farming or gardening of high-value crops like ginseng and mushrooms.
4. **Windbreaks** are used to protect soil and improve crop yields as well as control snow drifts and improve wildlife habitat.
5. **Riparian forest buffers** use trees and other plants by water to protect waterways from the negative impacts of agricultural fields.

Environmental Benefits

- Helps to store carbon in soil and can help mitigate greenhouse gas emissions
- Reduces soil erosion
- Improves soil health
- Can change the microclimate, which may improve crop yields and protect livestock
- Protects streambanks
- Minimizes water pollution
- Protects water quality and ecosystems
- Creates wildlife habitat and connectivity across fragmented agricultural landscapes
- Protects biodiversity and creates habitat for wildlife, pollinators, and beneficial insects
- Conserves energy
- Produces bioenergy
- Leads to more sustainable farms, ranches and woodlands

PERENNIAL BIOMASS

Perennial biomass crops are perennial plants that are grown and used for renewable energy. They can be grown as cover crops, perennial grasses, and short-rotation trees. Many of these crops can also be used as forage for livestock. While not widely produced for energy needs now, perennial biomass crops offer a renewable energy source with ecological benefits. Compared to grain ethanol crops, growing perennial biomass plants may benefit the environment rather than harm it by storing carbon in soil, and requiring less fuel, fertilizer, pesticides and water. They can be managed to reduce soil and water erosion, build healthy soil, and increase wildlife and pollinator habitats. Beyond uses for fuel/ renewable energy, application of perennial biomass crops is also being explored in the emerging field of 'plant-based chemistry' ('green chemistry'). Innovative industrial applications of bio-based products could span a wide range of industries, everything from cosmetics and packaging to automotive and construction markets.

Switchgrass (*Panicum virgatum*), a highly productive hay and forage crop native to the Midwest, is an example of a perennial biomass species. Studies have shown that grown as a biomass crop it would protect water, soil, and air quality; increase biodiversity, and create wildlife habitat.

Environmental Benefits

- May reduce CO2 emissions (store carbon in soil and require less greenhouse gas-emitting fuel)
- Does not deplete soils
- Reduces soil and water erosion
- Creates wildlife and pollinator habitat
- Increases biodiversity

COVER CROPS/WINTER ANNUAL CROPS

Cover crops are legumes, grasses, and other forbs planted within the regular growing season or outside it to improve or maintain the ecosystem (*United States Department of Agriculture*). In the Midwest cover crops are often used between corn and soybean plantings to protect and add nutrients to the soil. Winter-hardy perennial grasses and legumes add year-round ground cover to fields. Having roots in the ground when other crops aren't growing helps to keep soil in place and minimize erosion. They also compliment annual crop production by helping to break disease and pest cycles and can be used for animal forage. Biomass from cover crops can be used for animal feed and bio-energy. "Sustainably-produced biomass is increasingly demanded for liquid fuels, high-value animal feeds, and other bioproducts." (*University of Minnesota Forever Green Initiative*)

Promising new winter-hardy crops being developed at the University of Minnesota include:

- Pennycress (*Thlaspi arvense*) - a winter annual oilseed species being developed as a rapid cycling winter cover crop and biodiesel feedstock.
- Camelina (*Camelina sativa*) – a high-quality edible oil seed crop with potential to be a cash cover crop that can benefit ecosystems and farmers.

Environmental Benefits

- Stores carbon in soil
- Improves soil quality
- Adds nitrogen to soil
- Reduces erosion and pesticide runoff
- Retains more water and improves water quality
- Retains nutrients that would otherwise be lost
- Reduces flooding and leaching
- Helps to break weed, pest and disease cycles
- Reduced use of fertilizer
- Increased biodiversity
- Creates wildlife habitat
- Attracts honey bees and beneficial insects