Minnesota Developing Markets for CLC Crops:

How state-level policy provided public funds to catalyze CLC supply chain growth

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Midwest Value Chain Case Studies for Continuous Living Cover Crops - This case study on Minnesota's Developing Markets for CLC Crops program is one of three in a series written by Green Lands Blue Waters, led by GLBW Research Project Specialist Evelyn Reilly, focused on building value chains for perennial and other continuous living cover crops. Find more background on CLC value chain work in the Midwest at the end of this case study and the full series here.

Developing Markets for Continuous Living Cover Crops

The Minnesota ***Developing Markets for Continuous Living Cover Crops*** program is supported by funding from the state legislature and is designed to "develop enterprises, supply chains, and markets for continuous living cover crops and cropping systems in the early stages of commercial development," such as by enabling access to equipment to harvest, clean, and process new crops. The ultimate goal is increasing adoption of CLC crops and systems, which have been shown to provide soil, water, and habitat benefits on agricultural lands in Minnesota. The grants are administered by the Minnesota Department of Agriculture. Learn more about the program here.

The ***Developing Markets for CLC Crops*** program is the result of collaboration between CLC entrepreneurs and intermediaries. In Fall of 2021, CLC entrepreneurs, University of Minnesota researchers and Forever Green Commercialization staff, and a State legislator connected at an Earth Day event. Their conversation highlighted the need for State investment and support, then flowing to basic research and farmer adoption, to extend to entrepreneurs developing markets for CLC crops. Forever Green staff and Perennial Pantry wrote a policy brief with ideas to spur value chain and market development for CLC crops, highlighting a CLC Value Chain Development Fund. This was modeled on Minnesota's Renewable Development Fund, which has deployed over $100 million for research, development, piloting, and deployment of renewable energy projects. These partners developed a diverse coalition including farmer coops, BIPOC growers and entrepreneurs, start-ups, and advocates, which then moved the concept through the state legislature with bi-partisan support, in a non-budget year in which little else was funded. The grants of up to $50,000 each total to $1.5 million invested to date in CLC value chain development. The unique program will soon receive another $500,000 in federal resources, part of the $200 million in Inflation Reduction Act funds allocated from the EPA to the Minnesota Pollution Control Agency for climate-smart food systems. The *Developing Markets for CLC Crops* program demonstrates a grassroots solution piloted by a State and expanded by an initial round of federal funding. In several instances, receiving these state funds through Developing Markets for CLC Crops grants has spurred grantees to contribute additional funds and combine them with other grant funds for related projects, thus helping grantees reach or at least get much closer to the critical mass of funding they need to make big advancements in supply chain development for CLC crops.

This case study highlights four projects, focused on winter camelina, hybrid hazelnuts, Kernza, and American elderberries, which were funded by the first and second cycles of the program in March and September 2023. They illustrate how the grants helped address key needs in plant propagation, post-harvest processing, and food product production, creating pathways for these CLC value chains to move from early stage to investable. In doing so, they encouraged value chain actors to contribute their own time and capital towards the project, and, with both concrete financial support and a vote of confidence from the State of Minnesota, they positioned these businesses and value chains to attract future private investment.

Winter Camelina Cleaning - Paul Novotny

Winter camelina is a cash cover crop - an oilseed that can be planted in fall after corn or soybeans and harvested in the spring. It provides cover for the soil during the fall and winter, and can offer an additional revenue stream for farmers. Winter camelina oil can be used for sustainable aviation fuel, bioplastics, and more. Cargill recently completed a camelina production pilot project with farmers in Minnesota and North Dakota, and is now launching a winter camelina program. Enrolled farmers will grow the camelina and deliver it to Cargill's crush plant in West Fargo. Camelina is still in development and there is ongoing research at the University of Minnesota and elsewhere, but there is proof of concept: the first camelina-powered flight from Minneapolis-St. Paul airport took off in September 2024.

The mobile cleaning unit in operation, with intake and outtake augurs and storage bins. Photo: Paul Novotny

Paul Novotny (via his Chatfield-based business MSX Nexgen) received a 2023 Developing Markets for CLC Crops Grant for $50,000 to clean and store camelina. Originally, Paul planned to purchase a cleaner along with intake and outtake augurs and storage bins, and install the system in a building on his property. While researching machines, he came across a manufacturer who assembles cleaning machines. They had a mobile unit set up on a trailer - a retrofitted hemp cleaning machine that, with new screens, would work for camelina. It came with the necessary augurs, so those wouldn't need to be purchased separately.

"Doesn't it make more sense for me to figure out how to buy this unit?" Paul recalls thinking, realizing that the mobile unit could help reach more farmers, reduce transportation costs, and avoid processing losses during multiple moving steps. He presented the idea to the MDA, which approved the slight change in plan. The mobile cleaning unit cost $88,000, more than what the grant would cover, so Paul contributed over $30,000 to purchase it. Paul isn't yet sure what he'll be able to charge other farmers for processing - that will depend in large part on future crop prices - but he is optimistic about the impact of the cleaning machine on increased adoption in his area. "You plant it, you harvest it, you can bring it here, we can clean it," he says. "You don't have to make all those adjustments. Now, maybe they'll try it."

> "*The reservation*," farmer and grant recipient Paul Novotny explains, "*wasn't that [farmers] didn't want to try it. It's like, well, what if I grow this and it's too dirty, and…they won't take it at Cargill.*" Paul's mobile cleaning unit addresses this.

How did this grant meet a need in a Continuous Living Cover supply chain?

One of the biggest challenges with camelina is post-harvest cleaning. The small seeds come out of the combine in hulls, often with large amounts of debris mixed in. The combine on its own, designed for larger seeds like corn and soy, simply couldn't get the camelina to a state that would be acceptable to end users, which are generally looking for no more than 5% foreign material. In addition, the debris is voluminous and makes shipping less efficient. "You're hauling so much more volume because the foreign material's super light," Paul explains. "You end up with a whole bunch of stuff you didn't really need, and it fills up your trailer." Even when camelina is being grown for seed, cleaning is still essential to prevent the spread of noxious weeds.

The cleaning unit closed down for transport. Photo: Paul Novotny

Although there is now a regional market for camelina through Cargill's West Fargo oilseed crushing plant, farmers won't grow it if they don't feel confident about cleaning it to buyers' specifications. The gap: cleaning capacity. Cargill doesn't have cleaning facilities for camelina, and nothing like the mobile unit currently exists anywhere else. Paul figured out a way to clean his own camelina by retrofitting a rotational screener, but it wasn't practical for large amounts.

While combines can be retrofitted to produce cleaner lots of camelina, it simply doesn't make sense for most farmers who might be testing out a small acreage of camelina but growing primarily corn and soy - these common crops require a completely different set up. Paul explained why farmers might hesitate. "I'm going to plant 20 acres of camelina, hypothetically, right? Am I going to retrofit my combine to try this? 20 acres? Probably not." It can require hours to retrofit the combine, and hours more to undo it all after cleaning the camelina. For many, it's simply not worth the time and aggravation when they have other crops to harvest and clean as well. Even if they are willing to make the adjustments, getting it exactly right is tricky for a seed the size of ground coffee. Knowing that this cleaning capacity would be available has already swayed some farmers. Paul saw a nearly immediate shift in interest once the mobile unit became available: "There's been more people that are committing for this fall, to grow, knowing that they can get it cleaned."

How did the Developing Markets for CLC Crops program fill a need for financing?

Paul explained that other types of funding were not available for this need, in part because camelina is a new crop and the supply chain does not yet have an established business model: Paul didn't know how many people would be growing it, or what he'd be able to charge. There is clear potential for this crop and interest from both farmers and buyers, but yields are variable since the crop is still in development. There are also uncertainties around how incorporating camelina into the rotation will impact the yield of the following soybean crop, which affects the break-even price of camelina, and thus the rate farmers can afford to pay to have it cleaned.

Though huge demand for sustainable aviation fuel is expected, camelina does not yet have the economy of scale or fully established supply chains needed for maximally efficient production. This grant provided funds for a key bridging step, removing a barrier to increased production, which is then likely to spur further investments in processing capacity. Paul believes it has promise, but the effort to develop the supply chain, to make sure farmers have a way to clean it so they can deliver the product, is essential. Economic uncertainty can be an insurmountable barrier - even for those who might be willing to take a loss to try something new; sometimes they simply can't afford it. This purchase removes some of that uncertainty, paving the way for expanded production and private investment.

Sustainable aviation fuel (SAF), made from non-petroleum feedstocks such as oilseeds, is a key part of the industry's efforts to reduce air transportation emissions. The SAF market is already worth over $1 billion and is predicted to grow to nearly $17 billion by 2030. Minnesota farmers and companies could benefit from this rapidly growing market.

How does this grant benefit the people, economy, and environment of Minnesota?

This grant is an investment in the supply chain of a new crop that offers a range of benefits. Camelina adds diversity to the agricultural landscape and can reduce erosion and support pollinators. It will give farmers another viable crop option, thereby diversifying income streams as demand grows for sustainable aviation fuel and other bioproducts. Finally, Paul noted that the mobile cleaning unit isn't camelina specific: with tweaks to screen size and air flow, it can also be used for other CLC crops like pennycress, another winter oilseed crop, and Kernza® perennial grain.

Hazelnut Propagation - Gertens

The American Hazelnut (*Corylus americana*) grows wild in the Midwest. While it is cold-hardy and disease resistant, the native nuts are too small for commercial use. By crossing it with the European Hazelnut (*Corylus avellana*), widely used for commercial production in Oregon, Europe, and the Middle East, breeders have been able to produce hybrid hazelnut plants that combine the best of both. Efforts are still in progress, however, and a variety of needs remain to move the nascent Midwest Hazelnut industry forward. Read more in our case study on Hybrid Hazelnut Processing.

Hybrid hazelnut plants in Gertens Inver Grove Heights Greenhouse. Photo: Evelyn Reilly

Beginning with high-performing selections from farmers, University breeders have developed higher-yielding, disease-resistant, cold-hardy varieties of hybrid hazelnut trees that are good candidates for commercial production. These varieties can be produced on a large scale by commercial nurseries for planting on-farm. In order for new trees to remain true to the selected traits, they must be propagated clonally from cuttings, rather than grown from seed: seedlings can vary greatly from the parent plants, even in improved varieties. This makes seedlings a valuable source of genetic diversity for ongoing variety development, but the bulk of commercial plantings will need to come from vegetatively propagated selections. Sufficient supply of high-quality clonal plant material to establish hybrid hazelnut plantings across the Midwest is currently a major bottleneck in the industry.

Researchers have been working for over ten years on micropropagation, a method that could produce clonal propagates quickly and for as little as $1 per plant. Once established, these protocols could be refined and carried out by large commercial greenhouses, but protocols are not yet perfected for use on a large scale. In the meantime, traditional clonal propagation methods, including stem cutting and mound layering to produce sprouts for cutting, are being used to produce plants for commercial farms, but these methods are slow and expensive. Researchers, University Extension staff, and commercial partners are working to meet demand as fast as possible to provide high-quality plant materials to growers well-positioned for successful production.


A mound-layered hazelnut plant at a U of M research site. Photo: Evelyn Reilly

Gertens, a large family-owned nursery, received a $50,000 Developing Markets for CLC Crops Grant to propagate up to 10,000 farm-ready hybrid hazelnut plants, including both seedlings and clonal propagates. By addressing the key bottleneck of plant supply, this grant facilitates hazelnut industry expansion, helping to get more plants in the ground over the next several years. The project is led by Steve Unverzagt, an emerging crops consultant who has worked extensively with other perennial crops, including cold hardy grapevines. He was interested in hybrid hazelnuts because they offer the qualities he knows are key for new Midwestern crops: cold hardiness, drought and disease resistance, and flavor. He learned of the Developing Markets for CLC Crops program through the University of Minnesota Forever Green Initiative, and saw an opportunity to address the propagation bottleneck. Unverzagt also knew that Gerten's would be well-equipped to produce plants on the scale they needed. Gertens propagates and sells over 90,000 poinsettias every holiday season, along with hundreds of other plants for consumer sales and wholesale orders for other garden stores. Their facilities offer the specific environmental controls needed, including extensive greenhouse space, robotic watering and misting, even warmed floors.

"I knew that they would be able to handle the nuances, and be able to figure out, from all of their capabilities, how to get not just 1 or 10 plants through all those stages, but 1000s of plants through all those stages at the same time," Unverzagt says. The "grant is supporting acceleration of new plant material, whether it's germinated seeds or tip cuttings or bare root. It's all accelerating higher numbers that likely wouldn't have been possible at any other place."

Go First Farms

The Upper Midwest Hazelnut Development Initiative (UMHDI) and Midwest Hazelnuts, LLC are establishing a network of commercial scale demonstration farms with high quality plant material. The goals of the Go First Farms are to 1) De-risk early adoption by demonstrating commercially viable production and using partnerships to share the costs and risks 2) Serve as catalysts for regional supply chain development and 3) Help advance the UMHDI breeding program. The first five Go-First Farms are in place with the goal to have ten or more in place by the end of 2025.

Part of the project entails seedling germination for the University of Minnesota hazelnut program. Dr. Lois Braun provided 2000 seed nuts from genetic crosses of promising varieties, and Gertens will grow them out in preparation for planting on Go First Farms. Those plants will help pollinate clonal varieties on-farm (hazelnuts do not self-pollinate) and can also be screened as future selections for crossing. Unverzagt describes this aspect of the grant as more service-oriented, since Gertens cannot sell them. They are critical, however, to the development of the hybrid hazelnut industry in Minnesota, and thus are a key part of the larger commercial strategy for developing the supply chain.

The first round of bare root plants, a type of clonal propagate created by a method called mound layering, are specifically designated for Go First Farms or other commercial-scale demonstration farms. Gertens cannot sell them to the general public. Unverzagt explains that “it's only after we reach a specific threshold of plants created from new propagation that we can even start talking about selling to somebody. We're limited by the original Plant Material Testing Agreement to not talk about commercialization until we get to our threshold.” In other words, Gertens has committed to producing this round of plants specifically for the demonstration farms within the Midwest hybrid hazelnut industry, rather than offering them for general sale. University staff working on hazelnut development acknowledge that this prioritization of top plant material is essential to develop a profitable, large-scale industry. Ongoing communication between researchers and market partners is also key to matching the pace of business development with breeding advancements.

Patient Investment in Long-Term Work

One of the most valuable things about this grant was that it provided funding for long-term work that would have had difficulty attracting other investment. Unverzagt explains that part of this work had been going on before the grant began, and it won’t end with this grant. “This is a ramp up for the industry, and as we get further into it, we will have different growth needs.” Two years ago, he says, they weren’t even talking about clonal propagation on this scale - they were still focused on “the growth factors of how to get a tiny cutting to be a successful big plant. Now we're talking about field-scale next steps…” The grant was hugely beneficial in providing momentum and allowing partners to plan for those steps.

At the same time, the grant stimulated significant industry contributions: Unverzagt estimates that Gertens has contributed three times the value of the grant towards this project, and all of his time is donated. This project exemplifies the value of the Minnesota Value Chain Development Grants, as it leveraged local expertise, commercial capacity, and research contributions to address a key bottleneck in the Midwest hybrid hazelnut industry.

Kernza Perennial Grain Products - Perennial Pantry

Kernza® is the trademarked name for the grain from improved varieties of intermediate wheatgrass. This perennial grass is commonly used as a forage species and has been in development for perennial grain production since the early 1980’s. Efforts began at the Rodale Institute, then moved to The Land Institute in Salina, Kansas. In 2011, the University of Minnesota launched a Kernza breeding program, and over the following decade, significant state, local, and business support has encouraged early-adopter farmers and food businesses to try growing and using Kernza.

Perennial Pantry is a consumer packaged goods food company focused on climate positive ingredients that are good for people and the environment. Through a Community Supported Agriculture (CSA) share model, as well as some grocery store sales, Perennial Pantry sells Kernza flour, pasta, crackers, baking mixes, granola, pilaf, and more. They also offer a variety of perennial

2023 KernzaCon attendees tour Perennial Pantry’s Northfield plant. Photo: Evelyn Reilly

products from other brands, including maple syrup, apple cider vinegar, honey, and hazelnut oil. Founded in early 2020 by Christopher Abbott, the company has drawn on a variety of capital and investment sources to grow, including research grants, value-added equipment grants, private corporate grants, and economic development grants. In summer 2023, they launched a new processing facility in Northfield.
To support the operationalization of the new plant, Abbott applied for and received a 2023 Developing Markets for CLC Crops Grant of $50,000.

> *"One aspect that has been very effectively told from an R&D perspective, but I don't think has been effectively told in terms of the supply chain side of things is: this takes time. I just don't think it's possible to really rapidly find product-market fit for a novel crop, build out a supply chain, build out a distribution strategy, and get things out into the world."*
>
> -Christopher Abbott, Perennial Pantry founder

Abbott explained that after significant capital outlay on the facility itself, they still needed to get it up and running. The grant supported retrofitting equipment as well as improving inventory tracking systems. For example, they had recently purchased dough tables for large scale cracker production. Kernza crackers - buttery, crispy, and slightly sweet - are their most popular item. But, Abbott explained, reaching full cracker production capacity required a lot of work: "taking [the pieces of equipment] apart, fixing them, cleaning them, getting them back up, running up to speed; and then some amount of using them: is this machine faster than this machine? Do we need to put dough in a freezer and then bake it all at once? Or can we be making crackers and baking crackers simultaneously?" In addition to retrofitted equipment, Perennial Pantry purchased new vertical lift conveyors and bigger dryers, which needed to be operationalized and fine-tuned as a part of the overall production process. The grant also enabled them to set up the business systems required for future growth - shifting to software that can handle expanded sales and setting up HR systems to smoothly onboard new employees. "It enabled a big investment of time and resources" into improved business organization, Abbott said, leaving him "more confident that we can go forward faster."

Some of Perennial Pantry's products, including flour, whole grain, pancake mix, and pasta. Photo: Evelyn Reilly

How the Developing Markets grant met the unique needs of a startup

Abbott notes that startups built on a fundamentally new concept are different from other, existing small businesses, and points to craft breweries and bakeries as examples of business concepts that are better understood and carry less risk for creditors. In contrast, we are still figuring out how people eat Kernza. Start ups are new ideas, almost guaranteed to be wrong at first, he explains. "If we can learn enough, we can figure out what's right…You don't know what the business plan that's going to work is, and so that means it's significantly higher risk. That means that it's not well aligned with

traditional sources of financing." Abbott gets to the heart of why public funding matters to launch CLC crops and bridge the gap between the development stage and the point at which private capital will be ready to invest. Describing the challenge of finding investment for a new business, he points out that it "begs the bigger question of, why aren't companies working on CLC crops pursuing venture funding?" While it's an obvious path for many high-risk start ups, Abbott sees a misalignment between typical venture funding goals and the broader mission of CLC crops. Venture investors are typically hoping for a 10-fold return on investment in 7-10 years, and "that's the number one priority. It's sort of, 'who cares how you get there, you just have to get there'," Abbott says. That has a huge impact on how businesses are built, and how they operate. **"CLC crops are very, very long term projects....and venture funding is not the long game. This grant makes a lot of sense because it's a way to try to fill that void and to say, hey, here are really high risk but compelling ideas that can benefit the public.** So how do you pull those under the umbrella of state support and make this whole thing work?"

Investment for Minnesota

Perennial Pantry focuses on buying Kernza grown in Drinking Water Source Management Areas, land that has been designated as particularly vulnerable to groundwater contamination. With its ability to reduce soil water nitrate by up to 95% compared to corn, Kernza is a good option for planting on these sensitive areas. By purchasing this grain, Perennial Pantry supports a crop that protects Minnesota's drinking water while economically supporting farmers and landowners who grow it. Their delicious crackers play a key role by ensuring that Kernza actually gets to consumers, who hopefully like it and continue to create demand. "If we don't figure out how to get Kernza into people's kitchens," Abbott explains, "all of this is for naught." Luckily, Abbott is doing just that. Learn more about Perennial Pantry's work and offerings here.

Elderberry Processing - Midwest Elderberry Cooperative

American Elderberry is a shrub native to central and eastern North America that produces small, dark purple berries. It has historically been and continues to be used for medicinal and nutritional purposes by Indigenous people, as well as many others now settled in the United States. In Europe, the European Elderberry has a history of culinary use dating back to ancient Greece and Hippocrates, who wrote a book about the healing benefits of different parts of the elder tree.

American elderberry. Photo: USDA

Elderberries are packed with potent antioxidants and are thus of particular interest to the health food market. They can be used in jams, wine, baked goods, juices, and more, as well as in the form of extracts that can be incorporated into supplements. The flowers are also used for flavoring syrups and liqueurs, such as France's popular St-Germain.

Most elderberry production currently takes place in Europe, and American companies that use elderberries rely almost entirely on imported ingredients. Interest in elderberries is growing among food and beverage manufacturers in the United States, thus presenting a double opportunity for domestic elderberry production - meeting new demand and displacing imports. However, there are key processing bottlenecks, primarily de-stemming, that limit the scale-up of American elderberry production. In addition, American growers will be competing with the European market, which has been developing and establishing infrastructure for over 100 years.

Improving Elderberry Processing Efficiency

To address part of this gap, the Midwest Elderberry Cooperative, led by Christopher Patton, applied for and received a 2023 Developing Markets for CLC Crops Grant of $48,000 to design, build, and test a prototype continuous flow elderberry destemmer. The destemmer is designed to be compatible with other parts of the processing line for washing, drying, and freezing the berries.

Midwest Elderberry Cooperative

The Midwest Elderberry Cooperative, formed in 2012, aims to assist small organic and natural farmers with elderberry production and processing in the Midwest, including through integrated marketing efforts. Membership includes farmers across the country, organized in regional hubs. Funding comes primarily from elderberry and elderflower sales, as well as some grants.

The de-stemming process “is the number one challenge that we face,” Patton says. American elderberry production, overall, is still highly dependent on people power. Patton noted that for a typical harvest, up to four people are picking and another two to four are destemming, washing, and packing - the best destemmers can work through 300-500 pounds per hour. This highly focused, intensive work involves hand sorting; picking out branches, bugs, and unripe berries; putting berries into buckets; and often triple washing. “This grant is going to allow us to build a prototype for continuous flow destemming that will require fewer people and yield a higher, cleaner volume.” Patton estimates that the continuous flow destemmer, once connected to the rest of the processing line, will reduce labor needs by two-thirds.

Supporting Greater Competitiveness in an International Market

“American elderberry is facing competition primarily from Europe, where the infrastructure has been in place for hundreds of years.” Patton explains. “We don't have that infrastructure here. We started from scratch 20 years ago.” Patton recalls his experience attending trade shows such as Expo West through the Minnesota Department of Agriculture trade show program: “here's what happened. I would talk to these companies, new innovative companies, looking for new ideas. And I'd let them sample some of the elderberry juice — I had a retail elderberry juice I was marketing. And they get all excited. And those that moved forward with elderberry ended up moving forward with European imports. Because we didn't have the supply. I could not produce them at a price and in a form that was competitive with the European imports. So still today, well over 95% of the elderberry used in this country — and it's millions and millions of dollars — is from the imports.” It will take time, of course, for American production to become competitive with European imports, but filling critical needs in the supply chain, such as the de-stemmer, is exactly what is needed to move the industry in the right direction.

Stimulating Future Investment

About the grant, Patton says, “We're all excited!” But he cautions that it will require more investment to accomplish everything that’s needed. However, he adds, “Having the confidence and the support from the state should help us get other interest from investors or partners… the confidence expressed by the legislature’s vote, by Forever Green and our efforts as farmers is very helpful in getting our story told to other people.”

Patton sees each piece as moving them closer to a streamlined production system, and closer to attracting private investment. The current grant, along with investments from the farmers and the co-op, allows him to address the de-stemming challenge.

The next stage will be a processing line that feeds into an individually quick-frozen machine. The mobile processing entity, one of the most expensive pieces, will be the final part. With each successful grant, Patton says, “we end up with an improvement in the reduction of labor, improved efficiency and quality of production. It brings us that much closer, which of course then makes it easier for me to talk to CoBank or somebody else on financing.” As it has for many other businesses, the Developing Markets for CLC Crops grant helped build on previous work done by Minnesota small businesses, and positions them to attract the next stage of investment.

The elderberry de-stemmer in action. Photo: Christopher Patton

This case study is part of a series of three case studies on developments in Continuous Living Cover value chains in the Midwest. For more context on the development of these case studies, please see the following context and key takeaways section. Many thanks to Christopher Abbott, Colin Cureton, Shaymus McLaughlin, Paul Novotny, Christopher Patton, and Steve Unverzagt for their invaluable contributions to this project. Front page photos: Evelyn Reilly and UMN Forever Green Initiative.

Continuous Living Cover Value Chain Case Studies: Context and Key Takeaways

Why Continuous Living Cover Value Chains?

Continuous Living Cover (CLC) cropping systems maintain living roots in the ground year-round while keeping the soil covered. Green Lands Blue Waters identifies five strategies to implement CLC on the landscape: agroforestry (integrating trees and shrubs into farming systems), CLC with annuals (cover crops, winter oil seeds, and small grains), perennial grains (e.g. Kernza), perennial biomass (e.g. switchgrass, *Miscanthus*, and other bioenergy crops), and perennial forage and grazing (well-managed rotational grazing, silvopasture, and perennial forage crops such as alfalfa and grasses). CLC systems offer a range of environmental benefits - improved soil structure and organic matter content, reduced erosion and nutrient losses to ground and surface water, and habitat for birds and pollinators. They also offer economic, social, and nutritional benefits to farmers, rural communities, and consumers. CLC value chain coordination is critical to actualizing these benefits on working lands by bringing CLC products to market.

The term 'value chain' was coined in 1985 by Michael Porter to describe how businesses add consumer value to a product along the supply chain. Some agriculture and food system practitioners in the Midwest also use it as shorthand for *values-based supply chain*: one that delivers food, feed, fiber, and fuel in ways that align with the values of and bring value to producers, processors, consumers, and other stakeholders. For example, they may prioritize cropping systems that deliver soil and water quality benefits, humane treatment of livestock, and fair pay for farm and food system workers.

One of the most important levers for increasing CLC crop acreage across the Upper Midwest landscape is markets, but between farm field and consumer sits a complex web of processing, storage, aggregation, distribution, wholesale purchasing, marketing, and other value chain coordination activities. A network of organizations and individuals is working to create functional values-based supply chains for CLC crops by centering farmer economic viability, community wealth building, and business opportunities, while elevating the importance of relationships, integrity, transparency, and social and environmental impacts.

CLC Value Chain Case Study Project Rationale

These case studies are informed by years of collaborative work across the Upper Midwest. As a recent example, the Artisan Grain Collaborative hosted a retreat in 2022 to connect CLC value chain practitioners, build awareness of each others' work, and develop shared language and messaging around the definition of 'value chains' and the *values* we are working towards (see infographic below). In 2023, Green Lands Blue Waters hosted a multi-day CLC value chain workshop in Madison, Wisconsin. In 2024, the Wallace Center led discussions on value chains through a Regional Food System Planning grant. In addition, these organizations, partners, and supporters across the Midwest continue to do daily work on value chain coordination.

Innovation in supportive policy, market development, and financing is ongoing. These case studies are a snapshot in time, which we hope can inform, inspire, and help build next steps. In creating these case studies we looked for successes, particularly with diverse capital stacks and private equity or impact investment. However, we heard a recurring story of how private investment is not yet accessible in this space, while public grants, philanthropy, and dedicated individuals are driving technology advancement and business growth. Midwest CLC value chain practitioners

have been smart and resourceful with the assets they do have, and as a result, there are now opportunities for early private investment. We hope to highlight those opportunities in these case studies and drive further investment in the sector in ways that benefit businesses, consumers, rural communities, and the environment.

Key takeaway: Continuous Living Cover agriculture and value chains need ongoing public and philanthropic investment as a bridge to private investment

Continuous Living Cover cropping systems require public and philanthropic investment to reach the point of attracting private investment. These case studies describe how value chain actors used creative combinations of federal and state grants and philanthropic sources to finance values-based CLC supply chains, with additional support from ag lenders, private equity, local economic development funds, and individual in-kind donations of time, resources, and expertise. So as not to portray CLC crops as inherently economically risky compared to conventional crops, it is important to emphasize the broader contextual reasons for why public and philanthropic support is critical as a bridge to private investment in CLC value chains:

- Conventional row crop agriculture is highly incentivized and subsidized through publicly-funded research, supportive policy, and risk mitigation via cost-share programs and crop insurance, as well as established infrastructure and readily available markets that are intentionally designed to absorb crop surpluses. Conventional crops did not come to dominate the landscape solely through market forces and private investment; CLC crops and systems are also unlikely to overcome initial barriers and expand significantly solely through market forces and private investment.
- Public and philanthropic funding is often designed to incentivize, support, or reward the provision of public goods such as improved human and ecosystem health, which accrue broadly to many people over time, rather than rapidly to individual investors. Many of the key benefits of CLC systems are either public goods or avoided negative externalities for which the market does not, by definition, take responsibility. Thus, these systems may be excellent investments from a public standpoint, even before they can offer short-term capturable returns.
- Public investment can help develop CLC enterprises to the point that traditional investment can step in, at which point they can provide both profits and broader benefits. For example, a key factor for many crops is production scale-up to achieve the volumes necessary for efficiencies of scale, which facilitates increased profitability. However, it takes time to reach this point, during which crops need other forms of support.
- Investment that tolerates long-term return on investment is essential for the development of novel CLC systems. For example, research on new crop species, production scale-up, and market development efforts can take decades, but can ultimately benefit millions of people. This work is valuable, but not necessarily attractive to private investors due to the long time frame.
- Public and philanthropic funding can complement private investment. For example, an explicitly stated goal of the $60 million Expanding Agroforestry Project (EAP) is to catalyze private investment in agroforestry and "further develop and leverage new private financing options developed for agroforestry operations." The EAP is funded by the USDA Partnership for Climate-Smart Commodities program and is led by the Nature Conservancy in partnership with regional lead organizations (including the Savanna Institute for the Upper Midwest). Goals include greater adoption of agroforestry systems by providing incentive payments to farmers, increasing agroforestry staff capacity, and expanding markets for climate-smart agroforestry products.

MIDWEST VALUE CHAIN COORDINATION:

STRENGTHENING FOOD SYSTEMS THROUGH SHARED VALUES

and some examples of those values in action

COMMUNICATING CLEARLY AND HONESTLY ABOUT OPPORTUNITITES AND BARRIERS

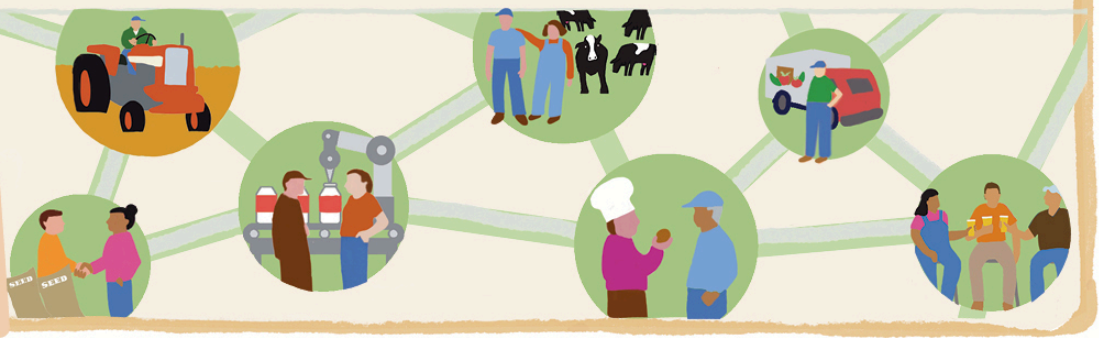
To illustrate this, **Savanna Institute's** work includes communicating honestly with stakeholders about the benefits & challenges of agroforestry. Their resources include info on cost, yield, and profits of twelve key tree crops.

FINDING PRACTICAL PATHS TO ECONOMIC VIABILITY, OWNERSHIP, & WEALTH CREATION

Putting this value into practice, the **Forever Green Initiative** is developing and improving winter-hardy annual and perennial crops and cropping systems that protect soil and water while driving new opportunities for growers, industry and Minnesota communities.

FOCUSING ON REGIONAL COMMUNITY-LED NETWORKS THAT ARE MAKING GOODS THAT SUPPORT HEALTH, STEWARD NATURAL RESOURCES, AND HAVE OTHER POSITIVE IMPACTS

As one example, the **Wallace Center** supports diverse value chain actors and professionals to connect, learn, and pursue common goals. This includes providing curriculum-based trainings, conducting value chain analyses, facilitating collaborations, and offering evaluation frameworks



DECENTRALIZING POWER AND DEMOCRATIZING DECISIONS

An example of this value in action: **Grassland 2.0** is engaging communities through Learning Hubs to assess the current landscape of livestock farming and decide together about strategies to move towards a better future.

BUILDING JUST, FUNCTIONAL, AND MUTUALLY BENEFICIAL RELATIONSHIPS THAT ADAPT TO CHANGE

Demonstrating these values, **Green Lands Blue Waters** connects, collaborates, convenes, and communicates so partners can work jointly on continuous living cover projects they can't tackle alone.

Case in point, the **Artisan Grain Collaborative** is built on deep connections across the grain chain. As the pandemic began, this network was immediately able to launch an effort to distribute thousands of locally grown, milled, and baked loaves to neighbors in need.

This list of shared values was developed jointly by a group of peer organizations building value chains for small grains, perennials and other crops that provide continuous living cover on the farm landscape: Artisan Grain Collaborative, University of Minnesota Forever Green Initiative, Grassland 2.0, Green Lands Blue Waters, Savanna Institute, and Wallace Center at Winrock International. It shows the shared vision of what we are collectively working toward with an aim for greater connectivity across and impact in value chain coordination work at the landscape-scale in the Upper Midwest.