

Agricultural Opportunities for a Climate-Smart Minnesota

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1. Introduction

Corn and soybeans dominate Minnesota's agricultural landscape, covering 14 million of the state's 25 million acres of cropland.¹ Despite being highly productive, the corn-soybean cropping system is characterized by an extended fallow period in the fall and spring. During these seasons, the erosion of nutrients and organic matter is a significant risk to farmers²; wind has been found to remove the fine, nutrient-rich particles and carry soil up to thousands of miles away.³ Although erosion control practices have become increasingly common over time,⁴ the average wind erosion rate in Minnesota is 5.2 tons of soil loss per acre per year.⁵ NRCS staff report that each ton of soil eroded contains the equivalent of 2.32 pounds of nitrogen and 1 pound of phosphorus⁶, while the estimated costs per pound for nitrogen and phosphorus in 2021 were \$0.34 and \$0.39, respectively.⁷ *Thus, the average yearly cost of lost nutrients alone for Minnesota's 26 million acres of farmland, without replacing lost fertilizer or amending soil, is an estimated \$160 million dollars.* It is important to note that this number does not reflect the cost of the environment externalities associated with erosion and nutrient pollution, nor does it account for water erosion of soil; this estimate is therefore conservative and the true cost may be higher.

The cost of soil erosion is just one example of the private costs associated with annual-dominated cropping systems. Many public costs also result from the current agricultural landscape. For example,

researchers estimate that the cost of remediating private water wells in southeastern Minnesota will range from at least 0.7 to 12 million dollars over the next 20 years.⁸ The yearly costs of sedimentation (i.e. loss of recreation, degradation of aquatic habitat) to freshwater creeks in southwestern Minnesota ranges from \$10,000 to \$213,000 per year.⁹ Other impacts are harder to quantify economically, but will result in significant social challenges – take, for instance, the decline of pollinators¹⁰ and the contribution of agriculture to greenhouse gas emissions.¹¹

While a number of agronomic strategies exist for mitigating these problems, increasing continuous living vegetative cover (CLC) in agricultural landscapes, though the use of perennial and winter annual crops, diversified crop rotations, agroforestry, and other practices, has been highlighted as having the potential for significant mitigation of the negative environmental externalities associated with current cropping systems. A growing body of research suggests that incorporating living cover into a farmer's toolkit of best practices mitigates nutrient runoff, improves soil health, increases biodiversity, and reduces greenhouse gas emissions, while often yielding profits.¹² Despite the potential benefits, CLC practices have not been widely adopted in Minnesota or much of the upper Midwest even with extensive outreach efforts.

In response, the Forever Green Initiative (FGI) at the University of Minnesota, alongside affiliated groups like Green Lands Blue Waters, have focused on

creating market-driven pathways to CLC adoption in Minnesota through the development of new or improved crops and cropping systems. These new agricultural technologies include perennial grains such as Kernza®; new winter hardy cover crops such as camelina, pennycress, and winter barley; perennial oilseeds such as perennial flax and silphium; agroforestry crops such as hybrid hazelnuts and elderberries, improved common winter annual cover crops such as hairy vetch and winter rye; and perennial forage legumes such as kura clover and alfalfa. Many aforementioned crops have recently emerged or are soon to emerge onto the commercial landscape. However, it is unlikely that even crops which provide both new revenue streams for farmers and new products for markets will be adopted on the scale needed to realize environmental gains without adequate infrastructure and support.

Researchers have invested significant effort into determining what support is needed to scale up adoption of CLC practices by farmers.¹³ Previous research has identified many barriers to adoption: logistical difficulty, farm size, land access, and perception of government programs and workers.¹⁴ Economic concerns in particular are one of the most cited barriers to CLC adoption.¹⁵ Farmers consistently express concern about the cost of new equipment and inputs, the cost of the farmers' time and the cost of additional labor required. Given the variable nature of commodity crop prices, farmers are extremely averse to risking their bottom line for new practices.

The growing number of environmental challenges in the state and lack of CLC adoption by farmers indicate that re-envisioned public policy is needed to hasten the transition towards CLC agriculture in Minnesota. State and federal funds play a significant role in determining which practices are implemented through crop insurance, conservation payments, and other programs. While regulation, voluntary compliance, and land retirement are useful tools in improving environmental quality, they

have not proven sufficient to achieve widespread environmental gains. To determine potential avenues for policy change, we reviewed existing policies in which CLC practices are eligible and interviewed MN agricultural experts – professionals who are not farmers, but who are directly involved with creating resources and delivering information to farmers – about challenges and opportunities in expanding continuous living cover in Minnesota. We then established criteria for evaluating the suitability of new and current policy proposals.

2. Policy Review

To better understand the limitations and opportunities for policy to increase CLC adoption in MN, we surveyed the landscape for cost share programs and loans which currently support CLC adoption and Forever Green crops on the federal and state level. To determine if programs qualified, we looked at program criteria to ensure it contained the following keywords: “cover crop/s”, “perennial crop/s”, “agroforestry”, “water quality” or specifically mentioned FGI crops (“Kernza”, “hairy vetch”, “pennycress”, etc.). Out of all federal and state programs, only seven programs were identified as readily supporting CLC agriculture and FGI crops. Here we report the available funding, relationship to CLC efforts, and requirements of each program to the best of our understanding.

Environmental Quality Incentives Program:

Environmental Quality Incentives Program (EQIP) funds, authorized through the Farm Bill in 1996 and re-appropriated by Congress every 5-6 years, provides “agricultural producers and non-industrial forest managers with financial resources and one-on-one help to plan and implement improvements, or what USDA Natural Resource Conservation Services (NRCS) call conservation practices.” EQIP is a cost share program that pays up to 90% the cost to install conservation practices and equipment through contracts up to a maximum of 10 years long. In 2021, EQIP funding was authorized by Congress at \$1.85 billion dollars. An important caveat is that this funding is not distributed among

all conservation practices equally – 50% of EQIP funding is designated solely for livestock practices. In Minnesota, roughly \$25,000,000 in financial and technical assistance was awarded in 2020 (FY21) through EQIP. Applications to the program are evaluated based on the practice(s) proposed, farm location, national and state conservation priorities, and whether the farmer is part of a “historically underserved” group, such as beginning, veteran, or minority farmers. Cover crops, buffer strips, diversified rotations, no-till practices, perennial crops, perennial forage, and silvicultural practices are several of the CLC strategies eligible for funding under EQIP. Cost share rates vary widely by practice – as of 2021, eligible Minnesota farmers would earn roughly \$1600-\$3000/acre for riparian buffer installation, \$20-50/acre for the addition of cover crops, and \$350-\$500/acre for filter strip installation.

Conservation Stewardship Program: Like EQIP, the Conservation Stewardship Program (CSP) is a federally funded program administered by USDA-NRCS focused on strengthening voluntary conservation efforts on working lands. Under CSP, participants must meet a “stewardship threshold” for a set number of priority resource concerns when they apply for the program. Then they must agree to meet or exceed the stewardship threshold for additional priority resource concerns by the end of a five-year contract. In exchange, participants receive annual payments. The minimum payment for all successful applicants is \$1,500. Many of the CLC practices covered under EQIP (i.e. cover crops, buffer strips, diversified rotations, no-till practices, perennial crops, perennial forage, and silviculture) are also eligible for funding under CSP. The main difference between CSP and EQIP lies in that CSP is focused on an entire operation, rather than one narrow modification, as is eligible under EQIP. National funding for the CSP program in 2020 (FY21) was authorized at \$750 million. Minnesota payment rates in FY21 varied from \$5-8/acre for a cover crop, \$17-70 for a conservation cover, and \$170 for a perennial conservation crop rotation.

CRP: CRP is a land conservation program administered by the USDA Farm Service Agency (FSA). Signed into law in 1985, CRP is one of the largest national private-lands conservation programs. The long-term goal of the program is to re-establish perennial land cover to improve water quality, prevent soil erosion, and reduce loss of wildlife habitat. Farmers enrolled in the program agree to retire environmentally-sensitive land from agricultural production for 10- 15 years by planting a mix of perennial vegetation in exchange for a yearly rental payment. The average CRP rental rate varies from \$50-130/acre. Minnesota farmers are also eligible to enroll in the Conservation Reserve Enhancement program (CREP), a state-and-federal funded offshoot that provides additional payments in return for permanent land retirement. As of 2019, MN CREP total payment rates were reported to be at least 50 percent higher than CRP payment rates. Critics of the national CRP program draw attention to trends that show periods of CRP acreage withdrawal coinciding with periods of greater commodity crop prices.¹⁶

AgBMP: A state program administered through the Minnesota Department of Agriculture (MDA) and operated through county Soil Water Conservation Districts (SWCDs), the AgBMP Loan Program is “a water quality program that provides low-interest loans to farmers, rural landowners, and agriculture supply businesses.” Loans assist with the purchase of supplies and services needed to establish agricultural Best Management Practices (BMPs) that prevent or reduce runoff from feedlots, farm fields and other pollution problems identified by the county in local water plans. Cover crops, buffer strips, tillage equipment, and silvicultural practices are just a few of the CLC strategies eligible for financing under the AgBMP program. Loan amounts are limited to \$200,000 to any one individual or project, the maximum length of a loan is ten years, and the maximum interest rate on loans may not exceed three percent. In 2020, roughly \$20 million was available for projects or practices through the AgBMP loan program during

which 476 loans were processed. From 1995-2017, roughly 30% of loans were appropriated to manure management and conservation tillage equipment, while roughly 50% of loans were appropriated to improving septic systems; less than 5% of loans were allocated towards CLC implementation.¹⁷ It is unclear if there are few applications for CLC-enabling loans, or if such practices are lower priority than aforementioned practices.

Nutrient Management Initiative: The MDA developed the Minnesota Nutrient Management Initiative (NMI) to assist farmers and crop advisers in evaluating alternative nutrient management practices. Participating farmers can work with a crop adviser to set up field trials to test out CLC nutrient-mitigating strategies in field corn plots, such as cover crops and perennial crops. Farmers and crop advisers are reimbursed for their time and receive a summary of the results of their trials. Farmers and crop advisers are compensated in two \$400-\$500 increments over the duration of the program. However, farmers are only eligible to enroll in the program once, while crop advisers may enroll up to ten field trials

Whole Farm Revenue Protection: Whole-Farm Revenue Protection (WFRP) is a crop insurance program provided through the USDA Farm Service Agency (FSA) to provide a risk management safety net for all commodities on the farm under one insurance policy. This insurance plan, first made available in 2015, is tailored for any diversified farm with up to \$8.5 million in insured revenue, including farms with specialty or organic commodities, or those marketing to local, regional, farm-identity preserved, specialty, or direct markets. FGI/CLC crops not eligible for single-crop farm insurance programs, such as Kernza, camelina, pennycress, elderberries, and hazelnuts, are eligible to be covered under WFRP. However, to be eligible, a pre-determined proportion of revenue from a new crop must contribute to the farm income to be considered a commodity under WFRP. For example, if farm income was 95% corn and only 5% camelina, camelina would not be counted as a commodity. A

commodity count calculation is used to determine the number of commodities that count under the policy.

Note: As of 2021, limited grant-based funding and pilots for CLC projects are available through the MDA (i.e. Sustainable Agriculture Demonstration Grants, MN Ag Water Quality Certification Program), SWCDs (Cover Crop Demonstration Grants Initiative, State Cost Share Program), federal programs (CRP SHIPP), and non-governmental organizations (University of Minnesota, North Central Sustainable Agriculture Research and Education). However, given location requirements (i.e., not available in every county) and unpredictable nature of grant funding, they are not covered in detail in this report.

3. Interviews

Given the very limited number of existing state and federal policies (7) which currently incentivize CLC practices, we conducted interviews with practitioners to determine challenges with current programs, opportunities for expanding existing programs and potential avenues for new policies.

Methods

Participants interviewed are all agricultural professionals who identified as working with farmers in the upper Midwest. These professionals consisted of employees of state agencies (3), federal agencies (1), non-or-quasi-governmental organizations (6), and University of Minnesota employees (2). Participants were identified based on roles at relevant agencies of interest (i.e. BWSR, MNDA, NRCS, FSA) and past collaborations with Friends of the Mississippi River, the Forever Green Initiative, and Green Lands Blue Waters.

Interviews were conducted using a semi-structured interview.¹⁸ In this interview style, a series of open ended questions are asked, which allows interviewees to more fully express their opinions yet also allows comparisons across interviews to be made.¹⁹ The interview questions focused on issues related to scaling up adoption of CLC practices by

producers. Specifically, interviewees were asked about their (and their organizations’) work to date on new and developing CLC crops (i.e. pennycress, winter camelina, hazelnuts, Kernza, elderberries), roadblocks in advancing work on CLC crops and systems, grower interest in CLC programs (i.e. programs which incentivize cover crop, perennial crops, silvoculture, and perennial forages), and opportunities for policy to mediate change. Email was used for clarification of answers and follow-up questions. All interviews were recorded and transcribed. Transcriptions were analyzed for themes related to each of the questions. Through semi-structured focus group discussions, broader themes emerged that contributed to the analysis presented in this report. Themes were concepts that were repeated across multiple participants and identified from careful reading of transcriptions. To further illustrate themes and assure transparency in the analysis, direct quotations from participants are reported.²⁰

4. Results

The following sections outline discussions alluding to the three main themes identified: inadequate support, federal policy barriers, and knowledge transfer challenges. These sections are not comprehensive but rather meant to add new understanding surrounding each type of challenge from a variety of perspectives.

Theme 1: Inadequate support

Not surprisingly, nearly all participants mentioned

that financial risk associated with changing practices and new crops is a significant barrier to expansion of CLC practices.

- “We’ve had some success with our Kernza programs, but it is hard to attract farmers from outside of that core group to participate – it’s just too risky for most folks”
- “Based on my experience over the years I’ve been working on this, a barrier for the new crops is crop insurance – there’s just a lack of support for the risk of new crops.”
- “Beyond just farmers, there’s no incentive for farm service providers, buyers, and companies to engage with the new crops - there is risk at those levels also. Especially for small companies who want to use these new crops”
- “For the farmers we work with, the new crops are on their radar, but there are still a lot of questions and that makes it hard to try out.”

Nearly all participants subsequently agreed that current policies were inadequate for attracting a wider group of adopters beyond those who were already interested and willing to enact them on their land. Another participant mentioned that within the membership of their farmer-supported NGO, nearly 50% of farmers rented land, which made adding new practices even more untenable, because it is the land owner—and not the renter-farmers—who are most likely to reap the long-term benefits of a conservation practice.²¹ Multiple participants also identified crop insurance as significant barrier.

Question list for semi-structured interviews

1. Where is work to date on these new crops? What are your future plans for them?
2. What is the biggest barrier to furthering work? Where do you think opportunities exist that we aren’t utilizing?
3. What programs that you are involved with generate the most stakeholder (grower/industry) interest and why?
4. Have you thought about any programs or tools that could remove barriers and make your work easier? What would they be and what would they require?
5. Who else would you recommend I talk to who is working on these issues?

Several pathways currently exist for adding crops to eligibility guidelines: the Farm Bill, submission of private sector developed plans, and USDA Risk-Management-Agency-developed plans.

Many participants added that in addition to adequate financial support, the organizations they represent are unable to provide adequate technical support due to limited staff and budgets.

- “We face capacity issues like everyone else – we can only assist roughly a third of all applicants each year, across the board”
- “Despite working on a smaller scale than NRCS, we also don’t have the capacity to assist everyone who asks due to our budgets, our staff, and the efforts we prioritize with those limited resources.”

Theme 2: Federal inflexibility

New FGI crops are often touted for their multi-use qualities. For example, Kernza, a perennial grain, can be harvested for grain, used as an erosion-control crop, and grazed as forage. One major challenge identified by several participants is meeting the eligibility requirements to be enrolled in a federal conservation program. In Minnesota, Kernza is an eligible crop under NRCS guidelines for CSP and EQIP programs. However, under NRCS guidelines, Kernza cannot be counted as a conservation crop, a forage crop, AND be harvested for grain – a producer would need to choose one category. Interviewees noted:

- “Despite all the work on perennial harvested crops, perennality and harvest is an uneasy partnership, and it makes incorporating CLC and getting paid for it a lot more challenging.”
- “From our NRCS perspective, we have something to meet your needs - we can make something work where you can get assistance for planting Kernza, but there are certain rules that you would need to be aware of – you can’t go in with the expectation that one crop can do it all, at least in terms of providing payments.”

One participant also mentioned that they often hear from farmers they work with is that lease agreements for conservation practices are too long. It is documented that higher levels of CRP withdrawal coincide with higher commodity prices¹¹ which may explain why producers are less satisfied with long contracts. The same participant suggested that farmers may be more amenable to long contracts if they were able to generate substantial revenue, such as that generated from harvesting perennial crops.

Another issue that emerged was on the market-development side of FGI crops. Currently, new oilseed crops pennycress and camelina, which are believed to have substantial potential to act as new, healthy cooking oil options and sustainable, plant-based proteins, are currently not certified by the Food and Drug Administration (FDA) as “Generally Recognized as Safe” (GRAS). One group of participants noted that without this certification, “ability to influence the markets, and get to a place where farmers want to grow because they know a market is out there for it, is really limited.” The process of submitting a food product for evaluation and receiving a verdict from the FDA typically takes, at minimum, 1.5 years, pending adequate food safety research.

Theme 3: Knowledge transfer challenges

Multiple participants also mentioned the difficulty of both deploying and creating infrastructure for crops that are still in the research and development phase – “we’re trying to do something that happened over millennia in 10 years.” Another participant added “there are still so many questions about the new crops – for example, we have a lot of members who are curious about animal nutrition and the oilseeds– and they want those questions answered before they try those crops out.” Interviewees noted that the process of amending federal programs, such as NRCS funding, crop insurance, and other certifications to upscale development, requires a significant body of research to become altered.

An inherent challenge in knowledge transfer lies in available funding and capacity to do additional work; capacity was previously mentioned as a significant barrier to CLC work and is connected to the challenge of knowledge transfer. Two participants proposed that certified crop advisors (CCAs), trusted sources of information, were likely not aware of the latest updates or opportunities with FGI crops, and that providing SWCDs with adequate funding to train CCAs could be an effective avenue to further education and outreach efforts. It also appears that there are different outreach approaches even with state/federal agencies and NGOs in regards to CLC – several participants we met with stated they were primarily focused on advancing grain/oilseed outreach, despite other participants arguing that perennial tree crops should have greater focus given that tree crops are “relatively well understood [economically and environmentally] but underutilized” in the policy sphere and on the landscape. One participant suggested that education on previously underutilized crops to various agencies and organizations could result in new opportunities to connect with farmers.

5. Discussion

The work of nonprofit workers, university leaders, and government employees to advance continuous living cover grows; however, across all interviews, there was a clearly expressed need for more resources, collaboration, and above all, flexibility, to be successful in generating widespread CLC adoption. While all interviewees mentioned the challenges of juggling multiple institutional priorities (i.e. maintaining existing programs, balancing the needs of many different agricultural practitioners, maximizing limited budgets, meeting the cultural expectations of clients) there was a clearly expressed desire to engage with the new crops and improve capacity to support farmers in CLC conservation practices. The experts included in this research both broker information and assist with the logistical information of programming, working in both “upstream” and “downstream” of information transfer.²² Thus, insights from these

experts’ perspectives are uniquely well-suited to identify avenues for policy changes in Minnesota agriculture. According to informal conversations with experts not included in this report, state government and state chapters of federal agencies are not as receptive to new and improved CLC crops in other states, meaning that Minnesota may also be uniquely positioned to be a leader in CLC agriculture given adequate support by elected officials. Based on our findings, we present three criteria upon which to evaluate and improve policy interventions to scale CLC agriculture across the state.

1. Flexibility in the presence of new information

From our interviews, we gathered that work is often constrained by the need for more information; research questions about best practices and economics remain active while scaling up of landscape adoption occurs, which is a marked departure from past advances in agricultural production. Given that significant questions still remain regarding CLC crops and cropping systems agronomics, environmental gains, and end-use capabilities, we suggest that policies be evaluated to determine the extent in which they can accommodate certain amounts of uncertainty, which would allow programs to rapidly take advantage of new, evolving knowledge and cope with rapid shifts in climatic, ecological, and sociological conditions. These findings reflect the previous work by scholars of sociotechnical transitions,²³ who argue policy programs must allow for periods of experimentation, learning, and iterative development in order to create the radical transformations needed in a sustainable food system. It is well understood that human-environmental systems, such as agricultural systems, have an inherent level of unpredictability²⁴; they experience continuous change due to social, economic and environmental pressures.²⁵ Climate change will further exacerbate the uncertainty of these systems. The capability to respond quickly to these changes will be essential to good public policy as the effects of climate change impact agriculture in the upper Midwest.²⁶

2. Long-term sustainability

Given the competitive nature of grant funding and the limited current capacity of agencies to respond to demand, there is a need to think about longer-term changes to institutions and programs. The shift to CLC agricultural systems will take a significant amount of time and resources, and policies must recognize this and provide adequate solutions, such as reliable funding sources, to realize longer-term changes. Governments and organizations, when faced with limited resources, often must prioritize short-term needs over long-term risk mitigation. However, long-term planning can also mitigate short-term needs; for example, pre-planning for disaster response to flooding along the Mississippi River corridor could help reduce costs over time.²⁷ Similarly, economists and analysts have found that the cost of mitigation to large environmental challenges such as climate change is significantly less expensive than the cost of adaptation.²⁸ An advantage of CLC crops is that they are viewed less as conservation agriculture tools, but more like new technologies such as solar panels or electric vehicles. While CLC agriculture may require higher investment initially, FGI crops such as oilseeds and perennial food and biofuel crops will generate new revenue streams for farmers and therefore become self-sustaining conservation practices once adequate infrastructure is in place. The strategic planning of adequate resources now can be used to build and sustain economic opportunity for future generations of Minnesotans.

3. Ability to improve knowledge/knowledge-sharing

Both publicly and privately-funded organizations – including cooperative extension, state Departments of Agriculture, Soil and Water Conservation Districts, and the National Recourse Conservation Service, and CCAs – provide farmers a critical source of information and a bridge to the latest agricultural research.²⁹ In that context, it is troubling that our analysis reveals limited communication and shared resources among these groups. These problems do not mean that people within the groups are unaware of one another, but rather they are so focused on

their own activities that they do not have capacity to work with one another. This scenario can lead to unfilled gaps in services the group is trying to serve, like farmers.

Interview participants also noted that many questions from producers resulted from gaps in existing knowledge. Research and development organizations must continue to have access to resources so that they can work together to answer the remaining questions about these crops and subsequently de-risk their use on the landscape. Greater certainty about the agronomics and economics of CLC and FGI crops may in turn make the programs promoting these practices more appealing and accessible to producers. It is therefore prudent to evaluate potential policy options based on ability to fill significant information gaps and/or improve knowledge sharing within the complex network of agricultural stakeholders.

Caveats

It is important to note the limitations of this research. All interviewees predominantly worked with landowner commodity farmers. Inclusion of intermediaries who work with more diverse farmers may result in the emergence of new themes; future research must work to include broader perspectives to result in policies that work for all farmers. In addition, the information of interviewees are somewhat limited due to the number of participants. We recommend future work focus on attempts to connect even more experts in Minnesota's agricultural policy space to elucidate more potential opportunities for agricultural policy improvement.

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