Growing beyond the research realm: Green Lands Blue Waters reflections on early-stage commercialization and farmer adoption of Kernza® perennial grain

Collaboratively written by Evelyn Reilly, Aaron Reser and Richard Warner

Photo Credit: Karl Hakanson - A-Frame Farm, MN

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Introduction

This document is a narrative reflection from the perspective of Green Lands Blue Waters (GLBW) staff involved in early commercialization, policy support, and farmer adoption of Kernza® perennial grain. It aims to capture GLBW organizational history to inform the broader story of outreach through many partners, as well as future enterprise development of other innovative crops and cropping systems.

This work has been a deeply collaborative effort from the beginning, both by necessity and by nature of the collegiality and good will of the many partners involved in the effort. Foundational research on intermediate wheatgrass domestication began at the Rodale Institute in 1982. Research programs at The Land Institute (launched in 2003) and the University of Minnesota Forever Green Initiative (launched in 2011) continued breeding efforts, began agronomic, environmental, and food science research, and connected to farmers and businesses. GLBW has worked closely with both programs in all efforts described below.

Green Lands Blue Waters was formed in 2004 by representatives of land grant universities and key agricultural and environmental organizations in the Upper Midwest as a regional consortium that supports the development of and transition to multi-functional agricultural systems that integrate perennials and other forms of continuous living cover (CLC). GLBW works primarily in Illinois, Iowa, Minnesota, and Wisconsin but has strong partnerships across the Mississippi River Basin and Steering Committee representation from Missouri and Louisiana. Through work with a broad network of partners including universities, researchers, educators, producer associations, environmental groups, businesses, nonprofits, governmental agencies, and practitioners, GLBW actively supports the development and commercialization of perennial crops and cropping systems and highlights models of positive agricultural transformation that can inspire and inform agricultural stakeholders and practices across the nation. GLBW is staffed from a regional office established within the Minnesota Institute for Sustainable Agriculture (MISA) at the University of Minnesota.

The Land Institute (TLI) is a non-profit research organization based in Salina, Kansas, focused on developing perennial crops and agricultural systems that mimic those in nature. It was founded in 1976 by Wes and Dana Jackson and in the following decades has emerged as an international leader in visionary ‘natural systems agriculture’ research, through the work of a team that includes plant breeders, agronomists, ecologists, and soil scientists. As crops advanced, TLI expanded staffing to work on commercialization and other aspects of crop development beyond foundational research. The University of Minnesota has worked with TLI extensively on the development of Kernza and other perennial crops.

The Forever Green Initiative (FGI) is based at the University of Minnesota (UMN) and is co-led by Don Wyse and Nick Jordan. Don developed the conceptual framework over several decades of research on various CLC crops. Some of the first Minnesota, Federal, and UMN funding for FGI was approved in 2010, and funding was added to the State of

Minnesota base budget in 2022. This research platform is focused on using a combination of summer annuals, winter annuals, cover crops, and perennials to keep living cover on the Minnesota agricultural landscape year-round in a way that both provides economic resilience and opportunities for farmers, and protects soil, water, air, and habitat. A unique aspect of FGI is the holistic approach to crop and cropping system development, addressing both basic science and supply chain development to bring together high-quality germplasm, effective management, and markets. Based in the UMN Department of Agronomy and Plant Genetics, FGI has led UMN's Kernza research, in partnership with others across the institution. FGI and TLI were two of the leading organizations that came together to form GLBW in 2004 as a regional convener and promoter of CLC. Thus, GLBW's role in Kernza development was a natural result of its purpose to promote CLC as well as its close connection with the two institutions leading the research.

Decades of visionary research on intermediate wheatgrass took place before Kernza emerged beyond the research environment as a commercial, food-grade grain. (Intermediate wheatgrass refers to the plant itself, including both forage and grain varieties, while *Kernza* is a name trademarked by TLI for grain from specific improved varieties.) There was no clear point when it was time to leap from research to farm fields and restaurant kitchens. For many years, a group of loosely organized collaborators forged relationships and undertook activities to spark early farmer engagement, business use of Kernza, and value chain coordination. Many of those involved were new to the complex, challenging process of value chain development for a new crop. Progress often felt bumpy, but slowly and steadily moved forward.

Understanding commercialization timing and needs was particularly challenging due to the dynamic nature of the work. For example, research on potential environmental and climate change benefits of perennial crops piqued consumer and commercialization partner interest and led to surges of demand and publicity. Similarly, breeding technology advanced rapidly, bringing with it new possibilities and faster results. Partners embraced learning opportunities and figured out how to move forward together. Enthusiasm about the crop continued to blossom; the network of collaborators grew along with advances across formal research, on-farm knowledge, ingredient functionality, public support, and general awareness.

Again, this reflective account is told from the perspective of GLBW staff involved in early Kernza work; other partners would have their own rich reflections. GLBW staff hope that our learnings, successes, and missteps captured here from the early stages of Kernza commercialization are informative to others doing similar work. For that reason, throughout the document we specifically call out **lessons learned**. At many points along the winding, early commercialization path there are sticky decisions to be made. Partners may have very different opinions and there is likely no right answer. To share some of these examples we also call out **strategic tensions**. At the end of the document, we summarize **key lessons learned** from the view of GLBW staff.

We cannot overemphasize the importance of cross-sector partnerships in this work. While many organizations and individuals (farmers, businesses, agency staff, and so on) are named below, there are many more not named. This piece includes ~2010 to the time of this writing, with a focus on ~2011-2018 when GLBW staff was most closely involved with early farmer and commercialization work. Starting in 2019, GLBW staff phased out of their early, transitional gap-filling roles in commercialization as the work accelerated through formal commercialization staffing by TLI (launching what is now their Crop Stewardship team) and the FGI (synchronously launching what is now the Commercialization, Adoption and Scaling team). More on early-present commercialization history for Kernza can be found through Sophia Skelly's work to create a TLI commercialization timeline (currently in process of being added to kernza.org) and via the potential publication of "Towards a practical theory for commercializing novel continuous living cover crops: A conceptual review through the lens of Kernza Perennial Grain, 2019-2022" currently under review for the GLBW CLC Research Topic in Frontiers in Sustainable Food Systems. The KernzaCAP project is also working on a Kernza timeline and other historical documentation of the Kernza network more broadly.

Document Outline

GLBW's Unique Role

For new crops, value chain development can be slow, risky, expensive, time consuming, and frustrating. Despite these challenges, every GLBW staff member who worked on early-stage Kernza roll out considers it some of the most enjoyable and rewarding work they've ever done. Value chain conveners (as GLBW staff were for early Kernza work) fill a litany of dynamic roles. In addition to constant logistical problem solving, value chain conveners must be attentive listeners and be comfortable moving quickly between varied topics, from equipment details to whole-systems strategy. They must learn on their feet, excel at nurturing relationships and building networks, and keep communication feedback loops flowing at all times - when things are going well *and* when they are not.

GLBW has been well positioned as a partner in helping to facilitate Kernza's development for a number of reasons. GLBW has close ties with researchers and is embedded in a broad network of nonprofit and other cross-sector partners. GLBW's programmatic flexibility and small staff size allowed it to maneuver quickly in the early space of Kernza farmer adoption, post-harvest processing, and market development, acting as a convener and connector between farmers, processors, end users, and others, as well as an advocate and a source of credible information.

LESSON LEARNED: Consider how to staff and fund early value chain coordination.
Early value chain coordination work takes significant time and funding, and will likely present gaps that don't clearly pertain to a specific role or organization. The process thus raises a series of questions: Who fills gaps that are no one's formal role? How can it be done such that the work can be passed on? What funding sources might cover staffing and expenses related to extremely early coordination work that is risky, exploratory, and pre- "proof of concept"? How might organizations be engaged in this work to provide in-kind support because missions and visions align with the longer-term "greater good"?

Early production, processing, and marketing requires significant problem solving, as well as funding. Kernza farmers and businesses could not be compensated equitably early on through sale of grain or Kernza products alone, as both would have been extremely expensive and thus impractical for most buyers. Funds were needed to pay farmers for their time and product, provide free samples for businesses to test, and more. Many early Kernza partners offered grain or products with little or no compensation, or provided contributions of staff time for troubleshooting. GLBW's staff time during this period was often provided in-kind, largely supported by Walton Family Foundation and McKnight Foundation, along with contributions from the MISA, TLI, FGI, and farmer donations.

During this time period, GLBW supported farmers directly through visiting farms and bringing seed, organizing field days, co-hosting grower calls, and organizing the publication of an initial Kernza grower management guide. GLBW bridged supply gaps between the farm and the end user through identifying and contracting grain processors, advancing dehulling and milling knowledge, and delivering samples for chefs, bakers, brewers, and product developers to test. GLBW has contributed to supportive policy and technical assistance by promoting Kernza at technical conferences, working extensively on policies to incentivize adoption, and by co-organizing meetings and calls around commercialization and technical support. With other Kernza leaders, GLBW has wrestled with and advanced strategic conversations and initiatives around Kernza scaling, governance, funding, and shaping future collective priorities.

A note on GLBW staff mentioned: GLBW's early Kernza commercialization work was launched and spearheaded by then Director Richard Warner, with GLBW staff support from Sadie Schroeder (now Mathison). UMN MISA staff were also critically important for farmer and restaurant connections during this early time, particularly Dr. Helene Murray, Kate Seager, and Jane Jewett. Aaron Reser joined the GLBW team in November 2015 and picked up the bulk of early Kernza value chain development work while Richard continued leading Kernza policy work. Richard retired from GLBW in January 2018; Erin Meier began as Director in April, assuming GLBW's role in policy work. Evelyn Reilly, hired jointly by GLBW and the KernzaCAP grant in April 2022, led the fact-finding, interviewing, and most of the writing of this document.

Commercialization of new crops takes a network, and it is worth highlighting several other frequently mentioned names. Early Kernza commercialization grew out of Kernza research programs led by Dr. Lee DeHaan (TLI) and Dr. Don Wyse (FGI); all of GLBW's earliest work was done in close partnership with them and other TLI and FGI staff, who had begun to piece together early supply chain activities and, in the case of TLI, processes for managing the trademark. Other key associates in early Kernza grower work include UMN agronomist and professor Dr. Jacob Jungers, several Minnesota Crop Improvement Association (MCIA) staff, and a small regional grain company, Plovgh, led by Lizzy McVay Greene Haucke and contracted by TLI in 2015.

Farmer Adoption and Support

A crop can't get off the ground without farmers behind it, so early outreach and support was critical. Early Kernza growers tended to be leaders in their communities - innovative, self-reliant, entrepreneurial, and willing to take a risk on a new crop. Naturally, they had many questions about how to grow Kernza, and needed accurate technical support to get started. There were some major challenges in this initial phase of technical assistance due to many agronomic unknowns, variation in quality of seed, and inconsistent communication with farmers. GLBW worked closely with Lee, then Plovgh, in farmer support and commercialization work, including by finding grant funding to cover time organizing and developing technical assistance.

Very early on, Lee DeHaan (TLI) was the first contact for farmers, especially in Kansas. In Minnesota, Don Wyse drew on his relationships with Carmen Fernholz, an organic farmer in Western Minnesota, and RL Growers, a group of grass seed producers in Northern Minnesota with whom he had worked for many years on turf grasses. RL Growers was particularly well-suited for trialing Kernza because they were organized, already connected to the UMN, and experienced in handling small seeds (Kernza is smaller than wheat). They also had processing equipment for dehulling. Building off of these earliest farmer connections made by Lee and Don, GLBW soon stepped in to help support early Kernza growers.

One of GLBW's earliest roles was working directly with farmers across Minnesota, Wisconsin, and Illinois who were interested in growing Kernza. Activities included getting seed to select growers, visiting many farms, and connecting farmers to each other and to Kernza management resources like Lee DeHaan and Jake Jungers. Lee was the primary source of seed and technical resources for several years, fielding many grower calls, as well as acting as the primary contact for end users. Jake became a key resource for Minnesota farmers when he began working on Kernza. While they were knowledgeable and dedicated, it was a lot of extra work on top of their research responsibilities.

In 2015, TLI contracted a small, regional, boutique grain company called Plovgh to assist with management of administrative (trademark, acreage tracking, etc.), agronomic, and commercialization aspects of Kernza. Part of Plovgh's role included working with farmers on best practices, especially planting information, due to Plovgh's role with acreage scale up. While Plovgh provided a lot of farmer information, they were also overextended and not always able to

provide consistent follow through, which sometimes resulted in a loss of goodwill with farmers. Farmers continued to reach out to Lee, Jake and GLBW with questions.

Photo credit: Carmen Fernholz - Kernza harvest

In 2015, GLBW began developing a farmer technical bulletin and a model contract for use by businesses and farmers to contract for Kernza production. Anticipating growing demand, maintaining clear and organized processes for production and sale would be essential. TLI, with the support of Plovgh, and FGI, with the support of MCIA, were working to develop the contracting process and Identity Preserved certification steps. GLBW assisted with this work.

In 2016, GLBW began soliciting and collating agronomic research findings and on-farm knowledge and led the writing of what would become an early grower management guide in partnership with the UMN Agronomy Department, FGI, TLI, and farmer partners. This early research-based guide addressed site selection and preparation, stand establishment, nutrient and weed management, pest and disease concerns, plant growth and development, harvest and storage, potential challenges, dual-use potential, and obtaining seed.

In August 2016, an early version was released to a select group including farmers asking for credible advice on Kernza management. To balance the need to provide farmers with information without over-representing what was known about Kernza, GLBW communicated that the guide was "a set of suggestions based on early production years, not time-tested practices." With feedback from growers and technical advisors after the 2017-2018 seasons, along with continued input from researchers, GLBW contributed to refining the guide. The updated version, released more widely in 2019, reflected the rapid evolution of research on management practices for Kernza as well as farmers' in-field on-farm experience. The growers' guide was developed with philanthropic as well as United States Department of Agriculture (USDA) Sustainable Agriculture Research and Education (SARE) funding.

GLBW also helped address farmer technical assistance needs by co-hosting grower calls with Plovgh in early 2017, often with Lee or Jake on the line offering agronomic expertise. The calls gave growers a chance to ask questions and voice concerns, and helped reinforce the Kernza network of growers and basic technical assistance.

Questions around organic and conventional production were also an early area of work, including assessment of which would garner more market interest, effectiveness of stand establishment in organic systems, and for those interested in growing conventionally, a regulatory hurdle: conventional inputs were not approved for use on Kernza perennial grain. The systems that govern agricultural input use had never considered the concept of perennial grains, and years of work into the future, still happening today, would be needed to move these regulatory questions forward.

STRATEGIC TENSION: Pacing, Part 1 - When is a new crop 'ready'?

A major tension in early Kernza development centered around the pace of expansion. Some pushed for expanding on-farm production regardless of what cycle of seed was grown in order to build knowledge around Kernza's in-field performance. Others, concerned that early varieties might not perform well and result in a bad reputation, urged restraint. Similarly, many researchers didn't want a grower guide released because the information was so preliminary, but at the same time the growers that already had the crop in the ground and were in immediate need of advice. GLBW tried to balance both perspectives by offering the best available information with the caveats that Kernza was a new, risky crop, with research and on-farm knowledge constantly evolving.

LESSON LEARNED: Support early growers, especially by helping mitigate risk, and cultivate early grower champions.

Helping farmers mitigate risk will be essential for new crops, even for those willing to experiment early on. This is important both logistically and as a way to manage perception. Early-adopter farmers must be supported, and that support can take many forms: providing access to free high-quality seed, technical assistance (more in the next 'lesson learned' section), compensation for grower time and production, and help in accessing processing and markets, developing grower contracts and securing documented purchasing commitments. Growers should be listened to, looped in on updates and developments, given opportunities to share feedback and help academics prioritize research needs. Early growers are innovators that will likely be turned to by future growers and should be provided with accurate information so they can credibly share with their farmer peers. Maintaining strong connections between researchers and farmer partners benefits everyone by maximizing knowledge creation and supporting early production. These strong connections were a cornerstone of Kernza's development.

Ensuring the success of early plantings is important because it shapes perception by farmers. Word-of-mouth has powerful effects in farming communities, an important consideration for any agricultural technology transfer work. If farmers plant outdated varieties, don't get good technical assistance, and don't have markets or processing partners, this can have negative effects on perception, even if a farmer was ready to grow and enthusiastic about the crop. Thus, supporting farmers is important for improving the crop and building relationships, but also from an early 'damage control' perspective in the farmer community. Having basic vetting criteria for determining which farmers might be well suited to trial a crop will also help encourage success.

Supporting farmers early on with risk mitigation is a key piece of this. Not only are farmers trialing new crops, but often they are taking land out of production from crops with more assured markets, crop insurance, and other USDA program coverage. In the very early stages, new crops also do not have local or state adoption cost-share or technical assistance supports that may develop down the road, as it did for Kernza in Minnesota. For some of the first Kernza growers, guaranteed purchasing contracts were made directly with buyers ahead of planting. In one or two cases, favorable terms were specifically written to acknowledge the risk to farmers, for example, guaranteeing a purchase or price even if the crop did not yield as well as anticipated. In some cases, GLBW paid with philanthropic funding for the purchase of grain to compensate the producer without a guaranteed buyer, leaving GLBW the flexibility to then offer the grain to end users free of charge for experimentation or at a subsidized purchase price.

LESSON LEARNED: Anticipate and plan for how to provide farmer technical assistance.

Technical assistance will likely be needed for new crops before there is established funding, clear information, or staffing to provide it. How will those gaps be filled? Who will help with knowledge exchange for the earliest farmers taking a risk? For Kernza, this took many forms. Farmer peers and champions are critical, and it is worth finding a way to compensate them. In the case of new crops, early researchers will likely be called up to answer many technical assistance questions because they will likely be some of the only people who have experience with a new crop.

GLBW played another role in farmer adoption by organizing early field days, creating an opportunity for farmers to see Kernza in the ground and ask questions about production details. On August 10, 2017, GLBW helped organize a field day at A-Frame Farms (the farm of Sally and Carmen Fernholz, a Kernza grower since 2011 and a sought-after organic farming presenter and educator) that included Kernza snacks, a field visit, overview of Kernza, updates on commercialization and markets, and an overview of agronomy with an emphasis on harvest logistics. In 2018, GLBW participated in two field days, in Chatfield (August 22) along with Olmsted County SWCD, UMN Extension, FGI, and the

Minnesota Rural Water Association, and in Lincoln-Pipestone (August 23) with similar partners. GLBW presented information on Kernza commercialization and emerging markets.

On March 11th, 2019, a Minnesota Kernza Grower and Researcher meeting was held at the UMN to strengthen connections between the University and the farmers producing Kernza. The meeting sought farmer feedback in shaping agronomic research priorities, including how to increase and maintain grain yield, best establishment and harvest methods, fertilization rates, dual-use management, rotations, weed control, and intercropping. Information was also provided on ecosystem services, economics, and on-farm storage requirements. Aaron, Jake, and Mitch Hunter (then a post-doc in Jake Jungers' lab, now Associate Director of FGI) planned and hosted the meeting. Goals of the meeting were twofold: provide farmers with the latest research and seek grower feedback for future research priorities. This two-way communication flow has been a critical element in Kernza's development since the beginning.

Photo credit: Dr. Jessica Gutknecht - A-Frame Farm field day

LESSON LEARNED: Encourage clusters of activity, especially tied to research institutions. Encouraging geographic clusters of activity worked well for Kernza. It creates a peer group of farmers that can support each other with information and potentially equipment, and facilitates efficient supply chains. For example, it might allow grain to be aggregated and processed together, or reduce shipping costs when farmers are clustered geographically nearby to a processor. GLBW has observed that farmers were often most successful when they had close ties to research institutions, which facilitated access to improved seed, connections with individuals that can answer questions, consistent updates on best management practices, and feeling part of a community moving this work forward.

From 2015-2018 there was a strong cluster of organized and experienced small grain growers in Illinois very interested in working together to grow, clean, and mill the crop in their area. The group was brought together by Woody Woodruff at Illinois Stewardship Alliance and discussions rippled through the Grand Prairie Grain Guild. While the interest was there and a handful of growers experimented with on farm plantings, this work faltered in part because there was not consistent communication and support from research partners, with no Kernza research institutions located in the Northern Illinois area.

Quality Control Through Development of Guidelines and Record Keeping

For new crops, maintaining quality control is important and challenging. TLI and FGI, led by Lee and Don, were very involved with wrestling through the development of guidelines and record keeping systems in partnership with MCIA, Plovgh, and GLBW. TLI developed the original draft Identity Preservation guidelines used as a measure of quality control for Kernza. Throughout this period, developing effective and efficient record keeping was time consuming. Standards and systems needed to first be created, and then record keeping processes built in alignment. GLBW was closely involved with developing and piloting the record keeping systems related to IP iteratively as they were designed.

Basic data was needed on farmers growing Kernza: contact information, acreage planted, location, seed year and source, per acre and total yield, etc. Such records were necessary for everything from general awareness of where the crop was being planted to how it was performing. Accurate contact information for farmers was also essential for communicating research and management updates and ensuring that growers were properly registered to grow Kernza

as licensing procedures developed. TLI, Plovgh, MCIA, and GLBW kept various forms of these records, with more formal processes agreed upon by those four parties and FGI in 2016. Plovgh was responsible for keeping grower records, though follow through was inconsistent. Collecting information on businesses using Kernza in products was also important, though it was done to a lesser degree early on.

While Plovgh was tasked during this time with keeping Kernza grower records, MCIA was responsible for piloting several important pieces of standard creation and verification. MCIA staff had significant experience with verification processes such as organic certification, so some of the early required Kernza field documentation and verification was modeled off of those experiences. Building off of the IP document led by Lee, Jennifer Pernsteiner at MCIA worked closely with Lee to develop Kernza grain grading standards (a quality control measure for grain sold as Kernza) and germ testing standards for seed. Aaron worked closely with Jennifer during this time as well. The fields managed by GLBW and the grain cleaned and dehulled by GLBW were some of the first instances of Jennifer piloting the grading systems and reports.

Food safety was also a key consideration. As with other quality control systems for early Kernza work, processes and parameters needed to be created for food safety testing needs. In the absence of formal requirements early on, any grain that GLBW moved to end users was tested on the UMN campus for deoxynivalenol (DON) and other mycotoxins common to small grains. Care was taken by GLBW to pay to store Kernza at a food-grade cold storage facility. Over time, it was important to continue to build systems and processes that supported a high rigor of food safety, building partnerships with the players who had the equipment, licensing, and industry information appropriate to food grade grains.

Photo credit: Dr. Prabin Bajgain - Stand of improved Kernza from UMN breeding program

Just as MCIA assisted with grower and grain related verification, MCIA staff also helped create standards for seed that was intended for planting and sale as Kernza grain. MCIA, again in consultation with TLI, FGI, Plovgh, and GLBW created and piloted early germ testing standards. The seed-related conversations also included the critical voice of Jim Anderson, UMN Kernza breeder. Many iterative conversations on seed supply and seed quality happened over the years and eventually led to the first UMN variety release of Minnesota Clearwater in summer 2019.

LESSON LEARNED: Start early with piloting record keeping and vetting processes to protect quality control.

Developing record keeping and vetting processes is important for quality control with new crops. It will likely be messy and iterative; there is simply no way to do it without some trial and error. The early work may be more informal, but pilot systems should be started early. This could include keeping basic records such as grower names, contacts, locations, seed sources, acres planted, years planted; and some analogous tracking of businesses using the crop. Developing record keeping, forms, and processes more specifically related to quality control could include: grain grading standards, germ testing standards, food safety requirements; recommended criteria for growing the crop (for example, familiarity with growing and processing small grains, access to existing small grains markets) and a grower vetting process; registration paperwork and licensing requirements; and other IP related documentation.

Commercialization and End-User Recruitment: *Making Kernza Usable and Marketable through Post-Harvest Processing, Distribution, and Connection-Building*

GLBW's early commercialization roles involved work at every step of the supply chain - including securing grain production and actual grain handling, including dehulling, cleaning, testing, milling, and delivering grain and flour to potential end users. Equally important to logistical elements was relationship development with partners, everyone from farmers, food businesses, and researchers to state agency staff, policymakers, and media.

Value Chain Coordination - Processing, Distribution and End User Outreach

Finding the right partners to process a new, small-scale crop was challenging. Large-scale processing equipment required truckloads of grain that didn't exist, and at first there were no food processors that could clean and dehull food-grade Kernza grain in small lots. At the same time, small scale equipment doesn't always exist or is hard to find. Kernza was sometimes processed on non-food grade equipment, such as the seed-grade equipment at MCIA. Quantities were also too small to send samples to large labs for DON testing; it was done on campus instead.

Photo credit: Mette Nielson – Kernza grain, beer and other products

GLBW and others needed to be able to distribute samples of cleaned grain and flour to bakers, chefs, and brewers to create interest, familiarity, and demand. Thus, improved post-harvest processing was a key focus. GLBW contributed to this technical knowledge by working with MCIA, UMN staff, seed cleaners, and equipment manufacturers to improve cleaning and dehulling, and by identifying millers who could handle small batches of specialty grain. GLBW led the next step through early distribution of Kernza grain and flour to potential and actual customers.

Richard had been involved with Kernza since he arrived on the UMN campus. In fact, in his first week with GLBW, he helped transplant TLI seedlings from Kansas into a UMN St. Paul research field in September 2011. Richard would take a very hands-on approach with threshing grain and delivering Kernza flour to bakers and restaurants, and he would be deeply involved in promoting Kernza planting for water quality protection.

Beginning in early 2013, GLBW started exploring post-harvest processing options for Kernza, working with farmers to procure grain for testing. Carmen Fernholz was the first Minnesota farmer to plant Kernza in 2011, in a 2-acre on-farm research plot at the behest of Don Wyse. The following summer (2012), he cut the intermediate wheatgrass for hay and sold it to his neighbor, an organic dairy farmer. The next summer, he harvested it for grain and stored it in his shed. In late 2013, he received a call from Richard, who wanted to get the grain cleaned, processed, tested and distributed to local retail businesses. Richard arranged for Carmen to ship his harvest to Forsberg, Inc. in Thief River Falls, Minnesota for dehulling and cleaning on their Model II dehuller and air column separator. Carmen credits Richard with leading this early state of post-harvest processing development in Minnesota.

Throughout 2014, GLBW explored multiple options for dehulling and cleaning Kernza grain, which at that point was a critical gap in supply chain development.

In September 2014, Carmen donated 100 bushels of Kernza to the UMN to experiment with cleaning and processing. Donn Vellekson, a grass seed production agronomist at the UMN, hand-cleaned a sample with sieves and an aspirator. That sample was sent to Ryan Bakke at Forsberg Inc. to evaluate efficiency of their dehullers. Jack Erisman, an organic farmer in Illinois, also sent 20 pounds of grain for cleaning and dehulling tests. Richard coordinated with

processing companies Grain Millers, Buhler, Codema, and MCIA to run cleaning and hulling tests on these samples. Results from Codema were excellent, but would have required a huge and expensive machine. Buhler wanted a 1000 lb. sample to send to their plant in Switzerland, which would have been very expensive. In February 2015, Richard Warner sent a sample to Stengel Seed and Grain Co. in Millbank, SD, but the volume was too small to be practical. Although post-harvest processing proved challenging and expensive for smaller volumes of grain, GLBW continued to explore effective and affordable options.

In March 2015, Richard arranged for Carmen to send the rest of his 2014 harvest to Forsberg for dehulling and cleaning. There was significant weight loss during the cleaning process, due to the still-experimental phase of post-harvest processing, but overall, the results were good. The Forsberg dehulling machine was the appropriate size and a reasonable price for the current scale of Kernza production. So, in May 2015, TLI purchased a used Forsberg Inc. Model II dehuller and loaned it to GLBW. The machine was installed in the Crop Services building on the UMN campus, directly next to MCIA, where grain cleaning equipment was used for Kernza. This was the same machine Lee DeHaan had owned several years earlier. He had been unsatisfied with the results, so had sold it to Applied Ecological Services, but thought that newer Kernza varieties might perform better.

In the summer of 2015, GLBW led a team in learning how to process and clean Kernza grain, including use of the Forsberg dehuller to complete the first step. In June 2015, Jack Erisman donated his 2013 and 2014 Kernza harvests to GLBW, about 3,700 pounds. Using five-gallon pails, GLBW staff Sadie and Richard scooped the 2014 grain from the totes into the hopper, processing 500 to 1000 pounds per day with the Forsberg dehuller. The grain was hauled across the parking lot to MCIA, where it was cleaned, separating chaff, unhulled grain, and broken grain. Grain that retained hulls was run through the dehuller again; that process was repeated twice. After 3 to 4 runs through the seed conditioner, MCIA was able to produce 99.5% clean grain. They cleaned 2300 lbs. of organic Kernza, resulting in 900 lbs. of pure grain. There were still considerable processing losses, resulting in impractically high costs for the final product. Still, these early samples of Kernza were incredibly valuable for product and market testing, resulting in greater knowledge, experience, and excitement along the value chain. Basic food safety testing was done at UMN labs equipped to test for DON and other mycotoxins.

On July 31, 2015, Richard brought 700 pounds of the clean grain to Great River Organic Milling (GROM) in Wisconsin. The 600 pounds of flour it produced would be GLBW's main distribution source for recipe testing and product development for the next few months. Richard immediately began distributing the flour. He dropped 25 lbs. of flour at Birchwood Cafe to keep this critical early partner supplied in Kernza. (The Birchwood Cafe had already been using Kernza for two years, prompted by a conversation with Helene Murray, Director of MISA, and her friend Tracy Singleton, Birchwood's owner. Birchwood became the first restaurant in the country to feature Kernza on the menu in November 2013. Tracy became one of Kernza's earliest and most important business owner champions, helping to create demand and introduce it to consumers by incorporating it into the menu as waffles, tortillas, and more.) Richard also gave 25 pounds to Common Roots Catering and samples to Common Roots Cafe and Heartland Restaurant in the Twin Cities. Samples were also provided to Madison Sourdough in Madison, WI. In 2015 and 2016, Kernza grain and flour distributed by GLBW was successfully piloted in breads, pastries, whole grain entrees, tortillas, pastas, beers, and more.

In addition to working with farmers, GLBW took over management of a small amount of Kernza production. In 2013, 90 acres were planted at the Rosemount Research Station, under contract with Patagonia Provisions for use in product development. In September 2014, GLBW took responsibility for a 31-acre field that had essentially been abandoned. On August 5, 2015 it was inspected by MCIA staff as per their protocol, and on August 14 it was cut and swathed. Shortly after, 7700 lbs. of grain were harvested by combine, then dried with heat tubes. GLBW processed the grain on site with the Forsberg dehuller, resulting in 3600 lbs. of clean grain to be shared with end users, with the goal of further developing Kernza markets. The availability of this grain provided the perfect opportunity for a new GLBW staff member to get involved.

In December 2015, Richard handed most of the post-harvest processing and distribution work to Aaron Reser, a new GLBW hire with experience in regional food system supply chain development. Over the next several years Aaron did significant work with Kernza growers, end users, and other value chain partners. She continued to expand the number of businesses sampling Kernza in MN, as well as to a few new partners in WI, IL, and nationally. Aaron quickly began meeting with potential partners, and a December 2015 meeting with Jeff Casper and Steven Horton was especially fruitful. Jeff had a professional background in food science and extensive ingredient functionality knowledge. He was launching a local fresh noodle company, Dumpling & Strand, which soon sold several types of Kernza pasta at

farmers markets, retail grocery and to restaurants. Steve, a professional baker known nationally for his work with Rustica, was in the process of opening a small-scale local flour mill in NE Minneapolis (which, ironically, required some City of Minneapolis regulatory changes to allow a flour mill… in the historic milling capital of the country known as Mill City). They were excited about a new ingredient and its environmental potential.

Jeff and Steve answered many questions about Kernza as an ingredient, which was hugely valuable in helping non-food-producers (like GLBW staff) understand the needs of end users to better work collaboratively with them on ingredient, processing, and pricing challenges. This knowledge lent legitimacy to the Kernza network as a whole, and Steve and Jeff became Kernza champions and essential food-maker peers that other interested businesses could learn from. Steve's business partner, Kelly McManus, was also a marketing whiz and contributed significantly to the network on how to talk to consumers about Kernza (along with Tammy Kimbler, then at General Mills). A critical piece of Steve's involvement was that GLBW or Plovgh could now provide Kernza grain to Baker's Field, a formal business partner, to sell and distribute grain and flour. Having the right partner in the right role was a huge step. A small, tightly connected group of Twin Cities area businesses grew around Kernza, serving as peer resources for each other as they all experimented with how to make this new crop work.

LESSON LEARNED: Cultivate, support and celebrate early business champions.
Local businesses were incredibly valuable in Kernza development. They were values-driven, communicative, willing to provide candid feedback, and fun to work with. They were flexible: they didn't need large samples to try something out, and their menus were adaptable. Many became Kernza champions who encouraged other business owners from their networks to try Kernza, and they promoted this new ingredient to their existing environmentally-conscious customer bases. They acted as proof of concept that helped others (media, larger companies, legislators) take notice. At the same time, the interest of a few large companies lent a new level of legitimacy and awareness to the Kernza work, bringing in more support and communicating a different message around the level of market interest to potential farmers, policy makers, funders, and others.

In addition to Minnesota connections, GLBW was also in conversation with a few national contacts via TLI, such as The Perennial restaurant in San Francisco and Bien Cuit bakery in New York City. Kernza appeared on the menu of The Perennial, in January 2016 (with wall-length art depicting the Kernza plant and long roots), helping to pique the interest of others in the restaurant and food industry. At Lee's request, in July 2015 Richard shipped 50 lbs. of clean, hulled Kernza grain to the Mendocino Grain Project for use by The Perennial. On December 30, Aaron shipped another 150 pounds of Kernza grain to The Perennial's co-owner Anthony Myint, to supply them in advance of their opening. The restaurant received a lot of media attention, which helped increase public interest in Kernza. In late February 2016, GLBW sent 1000+ pounds of hulled and cleaned Kernza to The Perennial via Giusto's Specialty Foods, and another 370 pounds in mid-November 2016. During this period, local Minnesota businesses continued to source grain from GLBW, Baker's Field, and Plovgh, with these organizations working together and with farmers to make grain available to end users.

As small local business interest in Kernza was blossoming, Kernza sparked the interest of large corporations, in large part due to its potential to help meet ambitious sustainability goals. Among them was Twin Cities-based General Mills, Inc. (GMI). In February 2016, at the request of Don Wyse, GLBW provided 50 lbs of dehulled grain to product developer Laura Hansen for initial testing at GMI. Kernza production overall was so small that even this multi-national company started working with Kernza at an extremely small piloting scale. Initial tests were done in a small in-house R&D lab, since their regular equipment was far too large for the limited quantities of Kernza provided.

Historical aside: Over the next few years, many GMI staff from multiple departments worked through significant trial and error to realize the eventual April 2019 release of Cascadian Farm Limited Edition Honey Toasted Kernza cereal. Even though the initial cereal was produced at a limited-edition scale, it helped to generate invaluable interest and excitement around Kernza, including media attention at a national level, and inspired confidence in other end users to develop their own Kernza products. GMI would achieve a wider release in October 2021 when another cereal produced with Kernza became available on Whole Foods shelves across the country.

LESSON LEARNED: When working with large commercial partners, engagement and enthusiasm from multiple teams and perspectives is valuable.

The early Kernza commercialization work with General Mills is a good example of how multiple teams and individuals across the company needed to be involved for the work to move forward. Top-level engagement was critical for demonstrating that Kernza was a priority at the company. Early on, this came from then Chief Sustainability Officer Jerry Lynch. GMI's interest in Kernza positioned the company as an innovator committed to legitimizing sustainability goals, particularly related to climate. There was very little existing research on ingredient functionality, making the R&D team's work foundational from day one. Over time, teams from the company's more sustainability-focused brands such as Annie's and Cascadian Farms became involved, which was critical to the sourcing and product development work needed to bring a product to life. A small committed group of employees, aligned with the ideas that Kernza represented, worked tirelessly and advocated within the company to work through supply chain challenges to bring a Kernza product to market. GMI was also committed to the continued development of the crop and the environmental benefits research, and the General Mills Foundation became part of broader discussions about how to continue to fund research and development of Kernza.

In the early years of market development, demand was stronger than supply, thanks to the excitement that surrounded the grain and facilitated word of mouth information sharing (grain supply was also extremely limited - the available supply could be absorbed by a few purchasers). Grain distribution to key end users continued actively throughout 2016. On September 2, 2016, GLBW shipped another 1750 pounds of hulled and cleaned Kernza to Baker's Field Flour and Bread in Minneapolis, moving Baker's Field into a main, important role supplying end users. In 2017, Baker's Field purchased grain from Plovgh and sold it to Birchwood Cafe and others.

This remained an experimental time for local businesses working with Kernza, not only in terms of learning how to work with it as an ingredient, but also in navigating supply and pricing challenges. From a strictly economic perspective, selling Kernza products did not always pencil out for Birchwood Cafe or Baker's Field. Kernza was still much more expensive than any other heirloom grain and required an astronomical amount of staff time to work with compared to other ingredients. However, both businesses were committed to the larger idea, and kept working with it in the hopes that it would become more available and affordable in the future. Kernza was also novel and exciting with promising environmental impact - a winning point for their most eco-conscious customers.

Through 2017-2018, Plovgh remained responsible for supplying end users with Kernza, until TLI and FGI hired new staff to lead commercialization. GLBW was occasionally brought back in to source grain for key partners when something else fell through. For example, when Plovgh stopped responding to Baker's Field, GLBW stepped in to provide grain for Baker's Field to mill for Birchwood Cafe's 2018 State Fair products, as well as their regular menu. GLBW drew on philanthropic funds to subsidize the price and help keep Kernza moving through supply chains, especially for the important promotional opportunity that the Fair provided.

In early January 2019, TLI and FGI brought on commercialization teams. New businesses became involved, and roles and processes started to shift. New processing partners were also coming on board. For example, in 2018, Healthy Food Ingredients (HFI) built an exclusive processing line for Kernza grain. Using TLI owned grain (from 2018 harvest), HFI tested and processed the grain through the dehulling stage. This was a commitment by HFI to expand their business offeringings to include Kernza processing. Having such a processing partner was beneficial to nascent Kernza supply chains and a service to other grain producers who planned to use the facility for their 2019 harvest.

As Kernza remained a feature on the menus of Birchwood Cafe and The Perennial, multiple companies continued product development work. Longtime Kernza partner Patagonia Provisions brought the first packaged Kernza product to market in October 2016, Long Root Ale brewed in partnership with Hopworks Urban Brewery. This release led to a surge of publicity and an explosion of interest in growing and consuming Kernza, and GLBW was there to help connect more food entrepreneurs who were interested in working with it.

Spotlight on Bang! Brewing

Compelling stories could be told about almost every early Kernza business partner: many hard-working collaborators with shared environmental values and a good dose of humor; a group of people willing to roll up their sleeves to make Kernza work, together. Sandy and Jay at Bang! Brewing exemplifies the spirit of these early partners:

Sandy Boss-Febbo of Bang! Brewing in St. Paul, Minnesota, followed the news of Patagonia's beer closely. As an artisan brewer committed to sustainability, Kernza seemed like an ideal ingredient, but she knew it would be hard to find. Just a few months later, while delivering kegs of beer to the Birchwood Cafe, chef Marshall Paulsen asked if she'd be interested in brewing a beer with Kernza. She recalls thinking "Are you kidding, can we do this? Yeah, absolutely!"

Paulsen introduced her to Aaron Reser and Aaron and Sandy began to work on sourcing grain for Bang! They were particularly excited about the possibility of sourcing grain in time for Bang! to brew a batch of Kernza beer for the July 2017 Annual Kernza meeting, which would be held at the University of Minnesota, co-hosted by TLI and GLBW. Jake, Richard, Lee, and Aaron all worked to help Sandy and husband/brewing partner Jay to source organically managed Kernza, in alignment with their company's standards. Sandy was warned that the flavor might be grassy, something they might not want in a beer. Undaunted, Sandy reached out to Christian Ettinger at Hopworks Urban Brewing in Portland, Oregon, who had collaborated with Patagonia to create Kernza Long Root Ale. Sandy and Jay took Christian's advice to treat Kernza like raw wheat and use about 15%. With a few tweaks to their process to account for the smaller grain and high bran content, they were able to create a recipe for a 15.36% Kernza beer.

Meeting attendees loved it. "We were incredibly pleased with that first run," Sandy says, noting that the flavor was so good, there was no need to try to cover it with additional hops. That same month, Bang! Brewing released Kernza Gold Blonde Ale. Consumer responses were fantastic. Visitors to the taproom loved the flavor and were intrigued by the concept of a perennial grain that could contribute to soil, water, and climate health. Kernza partners gave Sandy and Jay a copy of the long banner showing Kernza's impressively deep roots to hang from the taproom ceiling, a conversation starter as they poured pints for customers at the bar.

The supply chain looked a little different in those days. Sandy recalls, "We received grain from Kansas; we received grain from the University of Minnesota; it was awesome. In those days it was like the agronomists delivering the grain to us. It was so cool! As we continued to work with the grain, we've seen it progress from the research fields to farms that are working with the grain…now as the commercialization channels are really taking hold, we've shifted to purchasing our grain from the Perennial Promise Farmers' Cooperative and working with Mad Ag…this is a once in a lifetime thing, and it's such a cool process to be part of." Five years on, Kernza Gold Blonde Ale remains in rotation at Bang! Brewing.

The commercial scale up of Kernza had a wide variety of needs, and GLBW staff participated wherever they could be helpful. GLBW supported end users with a Kernza press kit that helps them communicate environmental benefits to customers. GLBW collected feedback from these end user partners that improved processing methods. GLBW was involved in discussions regarding regulatory aspects of post-harvest processing and commercialization as well, such as the IP and grain grading standards mentioned above. GLBW also connected partners to make them aware that the Generally Recognized as Safe (GRAS) process was underway for Kernza as a food crop, led by and generously shared by important commercialization partner Patagonia Provisions. GLBW took part in early conversations with the Minnesota Department of Agriculture (MDA) regarding how to move forward the potential of agricultural input licensing for use with Kernza, as well as many other discussions around troubleshooting new crop commercialization. Much more work would need to happen, and is still happening, to continue to scale the Kernza enterprise.

LESSON LEARNED: Build trust through good communication and nurturing relationships.
Transparency and communication are key when developing a new crop and network to support it. Being honest about risks and progress helps maintain credibility, even in the face of setbacks, and lets partners make informed decisions about their level of involvement. Drawing on existing connections and strengthening new ones, creating opportunities to network, and building trust have been extremely valuable for Kernza advancement. Relationship development takes time and attention, but GLBW has seen how prioritizing open, honest, and consistent communication and other forms of trust-building serves the highly interdependent nature of new crop work time and again. Trust building and open communication will also be a key to creating a more inclusive network that increases equitable access to future Kernza-related opportunities.

Commercialization Strategizing

Early in the development process, the right knowledge and skills were often missing. Professionalizing the roles was a priority, but wasn't always possible. Those involved informally filled many different roles until the network evolved further. Early entities involved were not officially grain sellers, a business type with licensing and regulatory requirements. This was one reason that GLBW often gave grain to end users free of charge rather than 'selling' grain to them; another reason was to help spur value chain development by offsetting the tremendous amount of in-kind staff time that businesses were contributing. As Kernza advanced, more professional players with relevant industry knowledge and roles became more engaged. Through these early stages, Kernza partners worked together, creatively building a commercialization strategy with the people and resources available.

GLBW participated in many commercialization planning and strategizing meetings with partner organizations, researchers, supply chain and policy partners, and key end users. Extensive planning and effort went into these early communications to develop priorities and strategies to ensure Kernza's success. On August 4, 2015, a Planning the Commercialization of Kernza meeting was hosted at the UMN, and GLBW participated in connecting key commercialization partners at this day-long meeting. Attendees included research teams from TLI, FGI/UMN, MCIA, and University of Wisconsin Extension, the co-owners of NYC bakery Bien Cuit, and representatives from several impact investment firms. The firms were interested in Kernza's social and environmental benefits but the timing was premature for impact investment - while there were many funding needs for Kernza at this point there were not clear investment opportunities.

GLBW attended a meeting on March 4, 2016 at MCIA with Plovgh, TLI, and FGI to discuss Kernza production and certification considerations. On September 6, 2018, GLBW met with TLI and FGI for a Kernza Collaboration Planning Meeting to establish a shared understanding of the approach to commercialization as well as key roles, priorities, and issues. On March 28, 2019, GLBW, FGI, TLI, and the MDA met at UMN to discuss shared strategy for Kernza commercialization and 2019 plantings.

Photo Credit: Dr. Jacob Jungers –
Dr. Jessica Gutknecht and Connie Carlson in a Kernza field

GLBW also met directly with end users and food processors on many occasions. On June 15, 2016, GLBW visited the National Foodworks Services LLC Food Innovation Center in Decatur, Illinois, interested in making products with Kernza. In November 2018, GLBW attended a TLI-led meeting at the General Mills headquarters with representatives of Health Food Ingredients, TLI, FGI, Patagonia Provisions, Birchwood Cafe, and Bang! Brewing. The meeting was intended to unite the supply chain consortium, connect key players, and move towards a centralized, transparent, and collaborative supply chain. The group also discussed a long-term vision for Kernza development and commercialization. The meeting solidified communication between supply chain partners and established TLI as the leader for the next steps in commercialization, in partnership with FGI and with support and advising from GLBW.

Progress took a great leap forward when full-time commercialization staff were hired in early 2019: Tessa Peters at TLI and Connie Carlson (already familiar with Kernza through her previous work with the MN Regional Sustainable Development Partnerships) and Colin Cureton at FGI. This team was an incredible boost to Kernza's commercialization, picking up the work and moving it forward more effectively through increasingly formalized systems. This was exciting for GLBW staff, who were eager to see the early Kernza commercialization work receive the more professionalized systems and partners greatly needed!

LESSON LEARNED: Staffing up - meaningful scale-up of commercialization activities will require dedicated team members focused on this work.

TLI and FGI's hiring of full-time staff dedicated to commercialization of Kernza and other crops (including relationship development, communication with farmers and end users, and all manner of value chain coordination tasks) was the single most important step in formalizing and scaling up the early commercialization and farmer adoption work. For future perennial crops, value chain coordination roles will be needed, even in the very early stages. While it can be challenging to know when to hire for these roles, let alone find dedicated funding, it is critically important in moving the work forward.

Communications and Messaging

Thoughtful communications and outreach have been essential in creating public interest and demand for Kernza. GLBW was an early key actor in building awareness, both through the media and directly to the public, and was an accurate source of information for journalists.

One of the first popular press articles appeared in the Wall Street Journal on Oct. 15, 2012, followed by occasional articles in other publications over the next few years. In 2015, GLBW contracted freelance writer Lansing Shepard to write about the potential of Kernza environmental benefits and commercialization. The goal of this was to raise awareness and excitement around Kernza's potential while being realistic about its early stage of development. For the first time, there were a handful of growers who had planted the crop and a few businesses using Kernza - a compelling story to be told. A few media contacts picked up on the story even without the help of Lansing's pitches, and Kernza pieces began to bubble up in the media. Press coverage picked up in late 2015, and especially after Patagonia's first beer launched in October 2016. From then on Kernza has appeared fairly regularly in the popular press.

In 2016, GLBW worked with the TLI-led Perennial Grain Story Project (PGSP) and Resource Media to bring together food businesses, researchers, and other close Kernza partners to shape and advance a strategic public-facing narrative. That project aimed for a balance of excitement and motivation while keeping realistic expectations. Goals of the project included sustaining enthusiasm across stakeholders; increasing understanding of accurate information around Kernza and what it truly takes to develop a new crop; providing partners such as food businesses with accurate talking points; and increasing financial and policy support for perennial grain development. One of the most important outcomes of the project was a shared "join us on the journey" framing - an effort to clarify to all Kernza stakeholders that we are in it together, as a community, for the winding journey of development, with sights set on a collection vision for a more perennial future.

LESSON LEARNED: Develop and promote intentional, shared messaging across partners and in the media when possible.

Kernza sparked imaginations, hope, and optimism from its first days in farm fields and on restaurant menus. People love hearing about a crop with the potential to deliver income for farmers while providing environmental benefits. The long roots imaging - from the Jerry Glover National Geographic photos to the TLI Kernza banners - proved to be iconic and catchy, and press for Kernza accelerated well before the network expected it. Network leaders attempted to be intentional and coordinated in developing shared narratives. These efforts to 'get ahead of' the next story and provide credible information to the media were helpful. GLBW's philosophy around Kernza-related media prioritized accurate, research-based information and elevating the voices of stakeholders (especially farmers and businesses).

STRATEGIC TENSION: Public communication - balancing excitement with realistic expectations.

Different stakeholders had different priorities for Kernza-related communication. In many cases, food businesses wanted simple, catchy hooks they could put on their menus or packaging to generate excitement and hype the potential environmental benefits, and they hoped for clear-cut talking points on which to base their marketing. Researchers tended to emphasize the evolving nature of perennial grains research, with a conservative, nuanced approach to describing potential benefits that did not lend itself to brevity or catchiness, especially in the case of climate impacts. Keeping dialogue flowing between researchers and marketers has been critical, helping build trust and driving home both the importance of prioritizing accuracy and the limits of customer understanding (for example, many consumers don't necessarily know what a perennial plant is, let alone why it's important).

While attempting to be intentional about public relations, most Kernza stakeholders realized that there was no one in the early Kernza-development network with PR and communications for Kernza in their job descriptions, or even in most partners' skill sets. The amount a message can be controlled in public media, even *with* a professional team, is limited. Not all press was accurate, and not all was good. Still, early media was essential in getting the word out and garnering future support for the crop, and early efforts on shared messaging were valuable.

LESSON LEARNED: Use challenges and 'failures' as learning opportunities.

Innovation takes experimentation: it's not possible without struggles and missteps. One difficult press situation had long-lasting effects across public perception and supply chains. In 2019, several media sources used a "crop failure" narrative, with headlines such as General Mills scraps market rollout for new cereal after crops don't measure up and Kernza crop failure sends General Mills unit to remake plans for new cereal. Many Kernza partners felt this narrative was inaccurate and would reflect poorly on the overall perception of Kernza's viability and potential. While it caused frustration and distress among Kernza partners, there were lessons learned. It illuminated the importance of value chain development work and of crafting intentional, targeted talking points ahead of media opportunities. Over time, several Kernza partners reflected that it was an opportunity to embrace failure as a necessary part of innovation, and was just one of what would be many bumps in the road towards a more climate smart agriculture. Collectively, Kernza partners needed to learn how to fail - faster and smarter - as part of working towards big picture goals of a more perennial future.

GLBW also produced focused outreach materials on Kernza. From 2019 to 2022, GLBW published a series of factsheets on Kernza and water quality. They highlighted drinking water protection projects around the state; the basic science behind Kernza's efficacy; and interesting links for readers to learn more. These factsheets were designed to be visually appealing and easily shared for broader distribution.

Informing Continuous Living Cover-Supportive Policies and Programs

By connecting with policymakers through events, providing information, and advocating for specific policies supportive of Continuous Living Cover (CLC) generally and perennial grains specifically, GLBW supported a favorable policy and funding environment for continued Kernza development. For example, GLBW and partners advocated for inclusion of Kernza into Natural Resource Conservation Service (NRCS) policies and practices and Minnesota state agency reports that informed the evolution of working lands initiatives to improve soil and water quality. GLBW has been particularly active in the Kernza for Source Water Protection work in Minnesota that helped motivate and incentivize plantings on land vulnerable to nitrate leaching. Fostering relationships with stakeholders across agencies and organizations helped build a network for future Kernza-related programs and policies.

Since 2014, GLBW has attended and convened many meetings and events that connected Kernza researchers, market advocates, and agency staff to address water quality issues. For example, Richard invited Dennis Fuchs of Stearns County Soil and Water Conservation District (SWCD) and staff to attend a CLC Training in Willmar on August 4, 2014; two staff members attended. This relationship with Dennis contributed to later wellhead protection work in Stearns County and elsewhere.

In 2016 GLBW helped organize and presented at high-profile events in collaboration with partners in Minnesota. GLBW played a significant organizing role at a FGI event and Kernza field tour at the UMN St. Paul campus in May for Dayton Administration staff. Governor Dayton spoke at the event, which was attended by more than 100 people, including three Commissioners, the BWSR Executive Director, and eight legislators. Aaron spoke on the market opportunities for Kernza and other CLC crops. On July 18, FGI and GLBW again co-hosted a similar tour for about 100 representatives from across the country at the National SWCD Conference.

STRATEGIC TENSION: Pacing, Part 2 - Balancing the need for proof-of-concept with readiness. There were many partners who thought, and may still think, that Kernza was pushed out too soon, particularly to farmers and food businesses. Many value chain hiccups could support this view. A counter argument is that early proof-of-concept was needed to spark snowballing support for Kernza: interest from future growers and businesses, public awareness, and critical political and funding support. Certainly, in the case of developing Kernza-supportive policies and programs, hearing from farmers growing Kernza and tasting Kernza products made by local restaurants made Kernza "real" to decision makers, thereby galvanizing support.

Beginning in 2016, GLBW advocated for increased USDA/NRCS funding for CLC crops. Richard joined the Minnesota NRCS State Technical Committee, where he was active on subcommittees that were re-writing technical guidelines for practices that could potentially support CLC. Due in part to GLBW work on those committees, the MN NRCS State Technical Committee in February 2017 approved 100% stands of intermediate wheatgrass for three practices: contour buffer strips, filter strips, and cross wind traps. Intermediate wheatgrass was previously listed in MN NRCS practice standards as part of a forage mix, but could now be planted as a grain crop. Richard and the GLBW network promoted the MN example to other states and to NRCS leaders in Washington, DC, which helped inform the recent national adoption of perennial grains in a practice standard.

Having intermediate wheatgrass on the NRCS approved plant list opened doors for source water protection projects in which municipalities and counties planted Kernza in wellhead protection areas to reduce nitrate pollution in drinking water. At the MN Rural Water Association (MRWA) Annual Meeting in March 2017, Jake Jungers and Richard met with Aaron Meyer of MRWA and managers of the Lincoln Pipestone Rural Water System, dealing with problems caused by agricultural nitrogen in drinking water. This meeting led to a series of Kernza research projects on wellhead management areas, many of which were funded primarily through MN state environmental programs.

GLBW did not have the staff capacity to promote location-specific projects across the upper Midwest, so Richard brought the opportunity to many GLBW partners. Throughout 2017, Richard traveled extensively in Minnesota, Iowa, Illinois, and Wisconsin, meeting with staff from agencies and organizations working on water protection, including the Minnesota Department of Health (MDH) Source Water Protection (SWP) Unit, Washington County Conservation District, and BWSR; Iowa Department of Natural Resources (DNR), SWP, and NRCS; Illinois Rural Water Association, EPA, and NRCS; Wisconsin Rural Water Association, Conservation Board, DNR, and NRCS; and Missouri NRCS as well as non-profit organizations Wisconsin Land and Water, American Farmland Trust, Practical Farmers of Iowa, The Nature Conservancy, and IL Stewardship Alliance, and contacts at universities.

He also presented on Kernza for water quality protection at the University of Missouri Center for Agroforestry. These meetings helped inform key decision makers about Kernza's potential to mitigate threats to drinking water sources by reducing nitrate leaching into groundwater. In September, Richard brought the same message to EPA Region 5 SWP Managers Meeting in Lansing, Michigan. In November, he led a training session on Kernza for buffers and wellhead protection at the annual BWSR Academy.

GLBW built support for perennial grain development on a national level as well. Richard made annual trips to Washington DC to promote Kernza and other CLC crops with Federal agencies, national leaders of nonprofits, and foundations. He was usually accompanied to these meetings by a member of the GLBW Steering Committee; UMN Prof.

Nick Jordan, Land Stewardship Project Director George Boody; and a representative of the National Coalition for Sustainable Agriculture joined Richard in different years. In 2017 in DC, Richard participated in meetings and held discussions with staff of the National Institute of Food and Agriculture (NIFA), the NRCS, the Conservation Coalition hosted by the Natural Resources Defense Council, the Union of Concerned Scientists, the USDA National Agroforestry Center, the Foundation for Food and Agriculture Research, and the Walton Family Foundation. Each year, the reception around CLC improved. Early on he had one-on-one meetings with one or two program leaders at NIFA. The following year, six NIFA staff members joined Richard's DC meeting, which went well beyond the scheduled time, carried by a lively discussion about the prospects for perennial grain agriculture. By 2017, national NGO partners were approaching GLBW to explore joint proposals or have GLBW endorse theirs.

Kernza for water quality gained the most traction in Minnesota. Three key plantings were established in late summer 2017. A three-year, plot-based experiment was established at Central Lakes Community College in Staples, MN, comparing irrigated, fertilized Kernza and a corn-soy rotation. Over three years, soil water nitrate concentrations under Kernza were 77 to 96% lower than under corn and soy, while Kernza yields were comparable to other sites. In Verdi, MN, 54 acres were planted on land managed by Lincoln-Pipestone Rural Water in a highly vulnerable wellhead protection area that pumps 1.8 billion gallons of water a year to rural residents in a 10-county region. In Chatfield, MN, 13 acres of Kernza were planted on city and private land, and Kernza grain and straw were harvested for three years. Nitrate levels in soil water samples were nearly zero at both sites. These projects were great opportunities for community and farmer engagement, including field days.

GLBW helped support the master's student, Evelyn Reilly, who carried out much of the water quality field work, analysis, and write up of this data, by providing part of her research assistantship funding. Evelyn updated several Kernza for source water protection documents and wrote a CLC Success Story on the Lincoln-Pipestone Kernza planting. She joined GLBW as a staff member through a joint position with KernzaCAP in April 2022.

On September 6, 2017, Richard presented "Continuous Living Cover Farming: Buffer Management, Source Water Protection and other opportunities utilizing perennials and winter annuals" to the Minnesota Association of Soil and Water Conservation Districts Area 2 Meeting in Glenwood, attended by SWCD staff from 12 southeast Minnesota counties, BWSR, NRCS, and Lincoln-Pipestone Rural Water System. Dennis Fuchs, Administrator at the Stearns County SWCD, was intrigued and requested a similar presentation in Cold Springs in October. Dennis organized a meeting at the Third Street Brewery in Cold Spring on October 31, at which Richard presented on Kernza for water protection, as well as commercialization opportunities and challenges. The meeting was attended by SWCD staff, City of Cold Spring staff, Third Street Brewery, MRWA, AURI, and Mighty Axe hops. Jake Jungers also shared information.

This meeting led to Plovgh providing Kernza grain to Third Street Brewery and Kernza seed for local wellhead protection plantings. It also led to the collaboration between UMN, Stearns County SWCD, Pope County SWCD, the Agricultural Utilization Research Institute (AURI), and farmer partners that resulted in two on-farm trials in Cold Spring and a plot trial comparing Kernza, alfalfa, and prairie for nitrate leaching under irrigated and dryland conditions.

In 2018, 20 acres of Kernza were planted near the city of Cold Spring, and the city of Edgerton planted 40 acres with the goal of protecting their water supply. In 2019, the experiment at Rosholt research farm was established. In September 2020, 37 more acres of Kernza were planted near Cold Spring, along with 10 acres adjacent to the St. Cloud wastewater treatment plant. This research work was supported by two grants through the Legislative-Citizen Commission on Minnesota Resources (LCCMR) and led to further activities and collaborations such as a new research relationship between UMN and St. Cloud State University, the Rocori FFA planting a Kernza demonstration plot and hosting a field day, and Cold Spring Brewery joining as a partner. As discussed above under Farmer Adoption and Support, growers - whether it is individual farms or organizations, agencies, and governments managing Kernza plantings - need help accessing markets and purchase contracts can go a long way to solidify relationships and establish research and trial sites.

LESSON LEARNED: Move early adoption support programs and other policy alongside all of the other pieces of new crop development.

Like all work highlighted in this document, Kernza policy and program development was necessarily integrative and drew on partnerships across the Kernza network. For example, for wellhead plantings to be successful or even considered, those managing the plantings needed access to quality seed, technical assistance, and markets, elements which were still evolving. Wellhead projects thus involved extra time and attention to relationship building, coordination, communication, realistic expectation setting, and group problem solving. Early support for cost-share policies (programs funding farmer adoption of Kernza, for example by paying a certain price per acre) provide a baseline for expanding policy tools in the future. Again, this takes developing relationships with local and state agency representatives, such as NRCS staff, and providing early agronomic and production data as available. Developing supportive policy and programs is another example of how all pieces of Kernza development needed to move forward together.

In 2018, GLBW published the paper, "NRCS Opportunities for Increasing Continuous Living Cover Farming Systems" and a companion fact sheet, "Recommended Actions to include Continuous Living Cover Farming Systems in the Environmental Quality Incentives and Conservation Stewardship Programs." Throughout 2018, Richard Warner finalized a white paper that GLBW published in 2019, "Policies and Programs Supporting Perennial Farming Systems to Protect Drinking Water in Minnesota."

GLBW continued to attend meetings and conferences to promote Kernza's water quality benefits, with a passing of the work from Richard as GLBW's outgoing Director to Erin Meier as the incoming GLBW Director. In May 2018, Erin Meier made a trip to Iowa to meet with Lisa Walters of Iowa Rural Water Association and Claire Lindahl and Catherine DeLong of the Soil Water Conservation Society. In August 2018, she and Keith Schilling, Iowa State Geologist spoke about source water protection coordinating and points of contact in Iowa.

In July 2018, GLBW hosted a CLC delegation at the US Water Alliance One Water Summit held in Minneapolis and submitted a delegation statement, "Using Perennial Farming Systems to Protect Groundwater Supplies in the U.S. Upper Midwest." GLBW delegates included Lisa Walters, IA Rural Water; Aaron Meyer, MN Rural Water; Catherine DeLong, Soil Water Conservation Society; Dr. Jacob Jungers, UMN; and Steve John, The Agricultural Watershed Institute (IL).

Also in July 2018, Erin met Dr. Cynthia Bartel at a TLI Kernza research meeting in Kansas. Erin learned of Dr. Bartel's work in New York state developing relationships and providing production data to identify USDA agency and NRCS program points of entry for Kernza. They kept in touch to learn from each other and develop connections to benefit the work of GLBW and partners in the Midwest and Dr. Bartel in New York. In 2019, GLBW and Dr. Bartel had a series of emails and calls with NRCS state staff in Iowa, Minnesota, and Wisconsin to discuss different approaches regarding adoption of Kernza into program practices to better understand state-by-state dynamics and opportunities. These connections and the previous work of GLBW and Dr. Bartel informed the design of the policy objective in the proposal for the subsequently funded UMN-led USDA KernzaCAP project - to bolster policy and program supports to increase producer adoption.

On September 19, 2018, Erin presented at the National Caucus of Environmental Legislators in Davenport, Iowa, highlighting the potential of Kernza to meet Nutrient Reduction Strategy goals. On November 14, 2018, Aaron presented on CLC broadly, including opportunities with Kernza, at the Minnesota Climate Adaptation Conference. GLBW invited Jason Overby, General Manager of Lincoln Pipestone Rural Water, to co-present with Erin at the North Central Region One Water Action Forum Session, "My Water - Connecting Farmers, Communities and the Public to Source Water Protection," on December 13, 2018 in Indianapolis. This presentation focused on Minnesota projects to protect drinking water with Kernza. On March 5, 2020, Erin presented on the MN source water projects to the Iowa Source Water Ag Collaborative at the Iowa Corn Growers Association in Johnston, Iowa.

For many years, GLBW engaged with nonprofit partners such as Minnesota Environmental Partnership (MEP), Land Stewardship Project (LSP), Friends of the Mississippi River (FMR) and others to advocate for support for CLC and perennial grains specifically in the Minnesota Legislature, mostly via organizing around funding for the FGI. As just one

example, GLBW helped prepare Kernza supply chain information and farmer and food business testimonials for a February 26, 2019, FGI Bill Hearing with the MN House Agriculture and Food Finance and Policy Division.

LESSON LEARNED: Embrace the long view, early organizing may plant seeds of support that bear fruit over time.

Early organizing to raise awareness of Kernza and its positive environmental impacts and economic potential at both the grassroots and grasstops levels had some small early successes in terms of supportive policy and programs, but also provided a learning lab to fast track Kernza partners' understanding of potential pathways for future opportunities. As a perennial grain, not only a new crop but an entirely new agricultural concept, Kernza repeatedly pushes the boundaries of existing USDA programs. Early discussions frequently created more questions than answers, including early exploration of how Kernza fits (or doesn't) within state and federal programs involving crop insurance, specialty crops to commodity crops, Risk Management Agency (RMA), Farm Service Agency (FSA), NRCS, and regulations governing licensing of agricultural inputs for use on crops. For example, as a grain-producing crop, partners learned that Kernza did not fit into the Farm Bill definition of 'specialty crop' and redirected efforts to explore other federal points of entry to de-risk adoption.

Early work is still being built upon and in many cases, early conversations and connections planted the seeds for effects we see today. At the national level, in early 2022, perennial grains were formally adopted into Conservation Practice Standard Code 328, Conservation Crop Rotation. On June 1, 2022, GLBW published "Continuous Living Cover & Perennial Grains in NRCS Practices," highlighting this new enhancement and ways to prioritize funding for perennial grains in NRCS practices. In Minnesota, significant organizing by FGI, FMR, key Kernza businesses and others resulted in the funding of a CLC Value Chain Development Fund in 2022. Also, a congressional request in fiscal year 2022 from the House Appropriations Report "…directs Economic Research Service (ERS) to produce a study on…continuous living cover practices…which shall include a discussion of the demand side of continuous living cover practices and potential markets" for agroforestry and for perennial grains. Recent discussions with ERS staff indicated that the language used in the congressional request was directly influenced by GLBW outreach materials.

Supporting Research and Practice Networks

GLBW Conferences

GLBW fulfilled a convener/connector role in Kernza research and market development through GLBW conferences, where we also hosted meetings of the Perennial Grains Working Group. Since relatively early in Kernza's development, GLBW conferences helped bring awareness of Kernza to a broader community of sustainable agriculture researchers, practitioners, and technical assistance providers and build a peer network of Kernza practitioners.

Since 2013, the GLBW Conference has highlighted Kernza, and every conference from 2013-2019 featured a working breakout session on perennial grains. The conferences alternated between Minnesota and locations across the Midwest, thereby reaching new local partners. The November 2013 conference in Minneapolis, MN, included a Kernza research update from Lee DeHaan and a Perennial Grains Working Group meeting to plan product development, led by Lee and Don Wyse. The 2014 Illinois conference included another update from Lee and a field trip to Jack Erisman's farm, home to the first on-farm Kernza planting in Illinois and one of the first on-farm Kernza plantings anywhere. The 2015 Minneapolis conference included a breakout session on Kernza and a discussion on farm-to-table FGI crops that facilitated rich discussions among the agronomists, farmers, food scientists, and end users in attendance.

In 2016, the Columbia, Missouri conference included a session on "Kernza and The Land Institute's Broader Perennial Vision; moving Kernza forward through Research and Commercialization." Aaron presented on "Markets for CLC Crops," highlighting Kernza and the active role GLBW has played in facilitating multiple points of the supply chain. In 2017, for the Madison, WI conference theme *Bridging the Gap with Livestock,* GLBW included a research update from Valentin Picasso on using Kernza as a dual grain and forage crop.

In November 2019 (Minneapolis), the Conference *Over, Under, Through to CLC*, included a presentation on Kernza market trends, the breakout session on perennial grains, and an on-stage interview with Kernza farmer Carmen Fernholz and his daughter Constance Carlson, then working on Kernza supply chains.

The menus at GLBW conferences have featured Kernza and other CLC crops as a way to highlight and promote their market potential. In 2015, Common Roots Cafe provided a specialty catering menu for the attendees highlighting perennial crops. It included apple and elderberry tartlets (with a Kernza flour and ground hazelnut crust), Kernza coated walleye sliders, Kernza-millet-quinoa salad, and Kernza crackers. The Kernza, hazelnuts, and elderberries were all sourced from Minnesota growers associated with GLBW. In 2019, conference participants went home with boxes of Cascadian Farm Kernza cereal. The CLC foods at these events were extremely popular with attendees.

GLBW Participation in Annual Kernza Conferences

GLBW has been involved in the annual Kernza Meeting/Conference since the first one was held in 2016. At this Kernza researcher focused gathering, hosted by TLI in Wilson, Kansas, Aaron presented on Kernza supply chains and the need for value chain coordination and greater staff capacity for this work. Other commercialization-related invitees to the meeting included Lizzy and Jake Hauke with Plovgh, Laura Hansen with General Mills, Zach Golper with Bien Cuit and James Farag with Patagonia Provisions. The conference included a visit to Kernza fields at the farm of Josh Svatty and his brother. Aaron brought Kernza crackers and sweets from Birchwood Cafe.

In 2017, GLBW co-hosted the annual Kernza Conference with TLI at the UMN St. Paul campus with tours and sessions led by FGI researchers. The conference featured research progress summaries on diverse aspects of Kernza research; breakout sessions on strategies and priorities in agronomy, genetics, and processing; field tours; and discussions on commercialization and building the value chain. An event was held at Bang! Brewing, at which attendees got to try Kernza beer and Kernza tabbouleh, from nearby Foxy Falafel. Concurrent with the 2017 Kernza conference, GLBW helped support planning for a separate but aligned 'Promise of Perennials' funder invite-only event hosted by the McKnight Foundation at their Minneapolis offices, giving funders a chance to learn more about the potential of Kernza and how philanthropy could play a role in perennial crop development.

Photo Credit: Scott Bontz - Dr. George Annor and Christopher Abbott, President, Perennial Pantry

In 2018, Erin attended the Kernza meeting in Lindsborg, KS. Aaron and Erin both attended the 2019 Kernza Conference in Madison, Wisconsin, where Aaron helped with planning Day 2 of the event, focused on farmer adoption and supply chain development, and served as host for a farmer panel. Between 2020-2022 GLBW stepped back from Kernza meeting planning, but is reengaging with the 2023 Kernza meeting to be hosted in Minnesota in partnership with FGI and KernzaCAP.

Other Meetings and Networking

As a network-focused organization, GLBW unsurprisingly has been a long-time champion for the importance of nurturing, strengthening, and growing a network of Kernza collaborators. Not only does GLBW believe it strengthens the work, but the amazing network of collaborators is also what makes working with Kernza so enjoyable! As discussed above, holding Perennial Grain Working Group sessions at GLBW conferences was an intentional way to create space to regularly bring a group of goal-focused peers together around Kernza. As another early example, in 2015, Lee DeHaan applied for a second tenure at the UMN as a School of Agriculture Endowed Chair. He worked on strengthening the collaboration with researchers, farmers, and food processors in Minnesota to support commercial Kernza production. Support for his position was matched by TLI, FGI, and GLBW.

For several years between ~2015-2019 there was a proliferation of people and institutions interested in Kernza, in particular in the work with farmers and markets. TLI and FGI were go-to contacts, but with no formal commercialization staffing at either organization (yet) GLBW became an informal information hub and connector helping to keep good information flowing between those newly interested. GLBW was a key advisor and informant for a McKnight-funded UMN Carlson School and Supply Chain Solutions team that worked on a project in 2018 titled

"Developing a Supply Chain Strategy to commercialize Kernza perennial grain." Aaron was also an advisor on a SW MN local supply chain project led by a group of farmers (the I-90 farmer group) and Rural Advantage, funded by UMN Regional Sustainable Development Partnerships. She spent significant time advising Erik Muckey who authored the study's final market feasibility report in January 2019, titled "Kernza® in Southern Minnesota: Assessing Local Viability of Intermediate Wheatgrass."

In addition to building network cohesion, GLBW was intentional about trying to keep good information and awareness flowing to avoid duplication. For example, there were very few farmers growing Kernza, but those few soon got peppered by numerous researchers interested in learning about their experiences as early growers. GLBW tried to encourage various projects to coordinate these requests to avoid overburdening farmers. GLBW also put off some of its own organizational plans to collect information from farmers after hearing that others such as Dana Christel (interviewing farmers for Michigan State University) and Marisa Lanker (for UW Madison) were asking similar farmer questions. Around this time there was also a hub of early Kernza farmer and market work developing on the East Coast. GLBW occasionally connected with Sandra Wayman (doing farmer research at Cornell) and others. Aaron met with other East and West Coast partners, including virtual meetings with California partners and visiting Zach Golper and Kate Wheatcroft at their Bien Cuit bakery in Brooklyn, NY.

One notable network-building meeting that GLBW helped to convene brought together a small group of leaders from TLI, FGI and GLBW in 2018, facilitated by Maggi Adamek with Terra Soma consulting firm. The meeting, focused on Kernza commercialization, included two main goals: first, shared understanding about approach, key issues, and roles around Kernza commercialization and second, to establish agreed upon channels, structures, and methods for consistent communications and collaboration among partners. This was an important leadership-level meeting on the brink of promising organizational additions of commercialization staffing at TLI and FGI.

GLBW's attendance at other conferences proved key for networking and building other projects. In May 2019, at the Perennial Grain Conference in Lund, Sweden, Valentin Picasso pressed Erin Meier into rallying partners to consider a SAS Coordinated Agricultural Project application for Kernza (and pressed Jake Jungers to serve as the project's Principal Investigator). Interested partners met for the first time in a lobby of a building at Lund University. Years of groundwork and partnership led to the CAP application, and in addition to assisting with much of the proposal writing, one small role GLBW played in getting the proposal off the ground was seeking a seed grant to convene project partners in writing the proposal. Ultimately the proposal team led a successful application for a $10 million USDA CAP grant for Kernza research - KernzaCAP - the largest demonstration of federal funding support for Kernza to date. As one piece of GLBW's many roles in the KernzaCAP grant, GLBW staff sit on the Integration team and work to help shape a Social Network Analysis to more formally document and demonstrate the incredible value of the Kernza network. In addition to capturing information about the network, the KernzaCAP Integration team also continues to ask critical questions about the racial and gender makeup of the Kernza community and how to foster more equitable inclusion across Kernza-related work in the future.

LESSON LEARNED: It takes a network!
Network development is valuable in all kinds of ways, from the day-to-day practical functionality of having a group of peers to share work with, to the ability to collaboratively activate higher-level strategic and tactical decisions. It creates a community, allowing us to accomplish more together than we can alone. In doing so, it is important to find ways communicate consistently, to be as aware as possible of the whole body of work, to avoid duplication, and find ways to build alignment and shared goals - in both formal ways (ex: working to develop governance structures, which is not yet in place for Kernza but is in development!) and informal ways (fostering a culture of collaboration).

Summary of Key Lessons Learned

In sum, involvement with early Kernza® perennial grain work has been an incredible learning opportunity for Green Lands Blue Waters staff. GLBW staff reflections on key lessons learned from GLBW and partners' work with early-stage commercialization, policy support, and farmer adoption of Kernza are summarized below.

We hope that these gleanings from GLBW staff experience can be used to help inform the development of future perennial crops. We are in the process of weaving these learnings together with reflections from other Kernza collaborators to create a 'Model for the Development of Future Perennial Crops' through the USDA-funded KernzaCAP grant. The model will be included on the project's website when available at kernza.org/kernzacap.

Working through strategic tensions

Being comfortable moving through the challenges and tensions throughout Kernza's development has been a key part of the learning, including working with partners through the strategic tensions listed in the document above. These are just a few examples of the types of decisions partners needed to address together.

- Pacing - When is a new crop 'ready'?
- Balancing the need for proof-of-concept with readiness.
- Public communication - Balancing excitement with realistic expectations.

Key lessons learned

The key lessons learned called out in the document above are bulleted below.

- Consider how to staff and fund early value chain coordination.
- Support early growers, especially by helping mitigate risk, and cultivate early grower champions.
- Anticipate and plan for how to provide farmer technical assistance.
- Encourage clusters of activity, especially tied to research institutions.
- Start early with piloting record keeping and vetting processes to protect quality control.
- Cultivate, support and celebrate early business champions.
- When working with large commercial partners, engagement and enthusiasm from multiple teams and perspectives is valuable.
- Build trust through good communication and nurturing relationships.
- Staffing up - meaningful scale-up of commercialization activities will require dedicated team members focused on this work.
- Develop and promote intentional, shared messaging across partners and in the media when possible.
- Use challenges and 'failures' as learning opportunities.
- Move early adoption support programs and other policy alongside all of the other pieces of new crop development.
- Embrace the long view, early organizing may plant seeds of support that bear fruit over time.
- It takes a network!

(For a full list of lessons learned with descriptive text see Appendix A.)

Photo credit: Queenan Productions - Kernza fields in rotation at Kimber Farm, MN

Appendix A

Compiled Key Lessons Learned

Green Lands Blue Waters staff reflections on key lessons learned from GLBW and partners' work with early-stage commercialization, policy support, and farmer adoption of Kernza® perennial grain are summarized below.

1. **Consider how to staff and fund early value chain coordination.**
   Early value chain coordination work takes significant time and funding, and will likely present gaps that don't clearly pertain to a specific role or organization. The process thus raises a series of questions: Who fills gaps that are no one's formal role? How can it be done such that the work can be passed on? What funding sources might cover staffing and expenses related to extremely early coordination work that is risky, exploratory, and pre-"proof of concept"? How might organizations be engaged in this work to provide in-kind support because missions and visions align with the longer-term "greater good"?

2. **Support early growers, especially by helping mitigate risk, and cultivate early grower champions.** Helping farmers mitigate risk will be essential for new crops, even for those willing to experiment early on. This is important both logistically and as a way to manage perception. Early-adopter farmers must be supported, and that support can take many forms: providing access to free high-quality seed, technical assistance (more in the next 'lesson learned' section), compensation for grower time and production, and help in accessing processing and markets, developing grower contracts and securing documented purchasing commitments. Growers should be listened to, looped in on updates and developments, given opportunities to share feedback and help academics prioritize research needs. Early growers are innovators that will likely be turned to by future growers and should be provided with accurate information so they can credibly share with their farmer peers. Maintaining strong connections between researchers and farmer partners benefits everyone by maximizing knowledge creation and supporting early production. These strong connections were a cornerstone of Kernza's development.

3. **Anticipate and plan for how to provide farmer technical assistance.** Technical assistance will likely be needed for new crops before there is established funding, clear information, or staffing to provide it. How will those gaps be filled? Who will help with knowledge exchange for the earliest farmers taking a risk? For Kernza, this took many forms. Farmer peers and champions are critical, and it is worth finding a way to compensate them. In the case of new crops, early researchers will likely be called up to answer many technical assistance questions because they will likely be some of the only people who have experience with a new crop.

4. **Encourage clusters of activity, especially tied to research institutions.** Encouraging geographic clusters of activity worked well for Kernza. It creates a peer group of farmers that can support each other with information and potentially equipment, and facilitates efficient supply chains. For example, it might allow grain to be aggregated and processed together, or reduce shipping costs when farmers are clustered geographically nearby to a processor. GLBW has observed that farmers were often most successful when they had close ties to research institutions, which facilitated access to improved seed, connections with individuals that can answer questions, consistent updates on best management practices, and feeling part of a community moving this work forward.

5. **Start early with piloting record keeping and vetting processes to protect quality control.**
   Developing record keeping and vetting processes is important for quality control with new crops. It will likely be messy and iterative; there is simply no way to do it without some trial and error. The early work may be more informal, but pilot systems should be started early. This could include keeping basic records such as grower names, contacts, locations, seed sources, acres planted, years planted; and some analogous tracking of businesses using the crop. Developing record keeping, forms, and processes more specifically related to quality

control could include: grain grading standards, germ testing standards, food safety requirements; recommended criteria for growing the crop (for example, familiarity with growing and processing small grains, access to existing small grains markets) and a grower vetting process; registration paperwork and licensing requirements; and other IP related documentation.

6. **Cultivate, support and celebrate early business champions.** Local businesses were incredibly valuable in Kernza development. They were values-driven, communicative, willing to provide candid feedback, and fun to work with. They were flexible: they didn't need large samples to try something out, and their menus were adaptable. Many became Kernza champions who encouraged other business owners from their networks to try Kernza, and they promoted this new ingredient to their existing environmentally-conscious customer bases. They acted as proof of concept that helped others (media, larger companies, legislators) take notice. At the same time, the interest of a few large companies lent a new level of legitimacy and awareness to the Kernza work, bringing in more support and communicating a different message around the level of market interest to potential farmers, policy makers, funders, and others.

7. **When working with large commercial partners, engagement and enthusiasm from multiple teams and perspectives is valuable.** The early Kernza commercialization work with General Mills is a good example of how multiple teams and individuals across the company needed to be involved for the work to move forward. Top-level engagement was critical for demonstrating that Kernza was a priority at the company. Early on, this came from then Chief Sustainability Officer Jerry Lynch. GMI's interest in Kernza positioned the company as an innovator committed to legitimizing sustainability goals, particularly related to climate. There was very little existing research on ingredient functionality, making the R&D team's work foundational from day one. Over time, teams from the company's more sustainability-focused brands such as Annie's and Cascadian Farms became involved, which was critical to the sourcing and product development work needed to bring a product to life. A small committed group of employees, aligned with the ideas that Kernza represented, worked tirelessly and advocated within the company to work through supply chain challenges to bring a Kernza product to market. GMI was also committed to the continued development of the crop and the environmental benefits research, and the General Mills Foundation became part of broader discussions about how to continue to fund research and development of Kernza.

8. **Build trust through good communication and nurturing relationships.** Transparency and communication are key when developing a new crop and network to support it. Being honest about risks and progress helps maintain credibility, even in the face of setbacks, and lets partners make informed decisions about their level of involvement. Drawing on existing connections and strengthening new ones, creating opportunities to network, and building trust have been extremely valuable for Kernza advancement. Relationship development takes time and attention, but GLBW has seen how prioritizing open, honest, and consistent communication and other forms of trust-building serves the highly interdependent nature of new crop work time and again. Trust building and open communication will also be a key to creating a more inclusive network that increases equitable access to future Kernza-related opportunities.

9. **Staffing up - meaningful scale-up of commercialization activities will require dedicated team members focused on this work.** TLI and FGI's hiring of full-time staff dedicated to commercialization of Kernza and other crops (including relationship development, communication with farmers and end users, and all manner of value chain coordination tasks) was the single most important step in formalizing and scaling up the early commercialization and farmer adoption work. For future perennial crops, value chain coordination roles will be needed, even in the very early stages. While it can be challenging to know when to hire for these roles, let alone find dedicated funding, it is critically important in moving the work forward.

10. **Develop and promote intentional, shared messaging across partners and in the media when possible.** Kernza sparked imaginations, hope, and optimism from its first days in farm fields and on restaurant menus. People love hearing about a crop with the potential to deliver income for farmers while providing

environmental benefits. The long roots imaging - from the Jerry Glover National Geographic photos to the TLI Kernza banners - proved to be iconic and catchy, and press for Kernza accelerated well before the network expected it. Network leaders attempted to be intentional and coordinated in developing shared narratives. These efforts to 'get ahead of' the next story and provide credible information to the media were helpful. GLBW's philosophy around Kernza-related media prioritized accurate, research-based information and elevating the voices of stakeholders (especially farmers and businesses).

11. **Use challenges and 'failures' as learning opportunities.** Innovation takes experimentation: it's not possible without struggles and missteps. One difficult press situation had long-lasting effects across public perception and supply chains. In 2019, several media sources used a "crop failure" narrative, with headlines such as *General Mills scraps market rollout for new cereal after crops don't measure up* and *Kernza crop failure sends General Mills unit to remake plans for new cereal.* Many Kernza partners felt this narrative was inaccurate and would reflect poorly on the overall perception of Kernza's viability and potential. While it caused frustration and distress among Kernza partners, there were lessons learned. It illuminated the importance of value chain development work and of crafting intentional, targeted talking points ahead of media opportunities. Over time, several Kernza partners reflected that it was an opportunity to embrace failure as a necessary part of innovation, and was just one of what would be many bumps in the road towards a more climate smart agriculture. Collectively, Kernza partners needed to learn how to fail - faster and smarter - as part of working towards big picture goals of a more perennial future.

12. **Move early adoption support programs and other policy alongside all of the other pieces of new crop development.** Like all work highlighted in this document, Kernza policy and program development was necessarily integrative and drew on partnerships across the Kernza network. For example, for wellhead plantings to be successful or even considered, those managing the plantings needed access to quality seed, technical assistance, and markets, elements which were still evolving. Wellhead projects thus involved extra time and attention to relationship building, coordination, communication, realistic expectation setting, and group problem solving. Early support for cost-share policies (programs funding farmer adoption of Kernza, for example by paying a certain price per acre) provide a baseline for expanding policy tools in the future. Again, this takes developing relationships with local and state agency representatives, such as NRCS staff, and providing early agronomic and production data as available. Developing supportive policy and programs is another example of how all pieces of Kernza development needed to move forward together.

13. **Embrace the long view, early organizing may plant seeds of support that bear fruit over time.** Early organizing to raise awareness of Kernza and its positive environmental impacts and economic potential at both the grassroots and grasstops levels had some small early successes in terms of supportive policy and programs, but also provided a learning lab to fast track Kernza partners' understanding of potential pathways for future opportunities. As a perennial grain, not only a new crop but an entirely new agricultural concept, Kernza repeatedly pushes the boundaries of existing USDA programs. Early discussions frequently created more questions than answers, including early exploration of how Kernza fits (or doesn't) within state and federal programs involving crop insurance, specialty crops to commodity crops, Risk Management Agency (RMA), Farm Service Agency (FSA), NRCS, and regulations governing licensing of agricultural inputs for use on crops. For example, as a grain-producing crop, partners learned that Kernza did not fit into the Farm Bill definition of 'specialty crop' and redirected efforts to explore other federal points of entry to de-risk adoption.

14. **It takes a network!** Network development is valuable in all kinds of ways, from the day-to-day practical functionality of having a group of peers to share work with, to the ability to collaboratively activate higher-level strategic and tactical decisions. It creates a community, allowing us to accomplish more together than we can alone. In doing so, it is important to find ways communicate consistently, to be as aware as possible of the whole body of work, to avoid duplication, and find ways to build alignment and shared goals - in both formal ways (ex: working to develop governance structures, which is not yet in place for Kernza but is in development!) and informal ways (fostering a culture of collaboration).