

Scaling Organic Grain Production in Aroostook County

Report to Maine Technology Institute

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Table of Contents

Introduction	3
Market Opportunities for Certified Organic Grains	4
Aroostook County Certified Organic Growers	14
Post-harvest Infrastructure: Drying, Cleaning, and Storing,	16
State of infrastructure currently employed on-farm:	16
Cleaning Grains	17
Drying Grains	18
Summary of Drying Issues, Concerns and Recommendations.....	20
Shared-use Facilities Versus On-farm Infrastructure	21
Aspiring to a Bigger Maine Organic Grain Economy: Introducing the “Field of Dreams” Grain Elevator	22
Capital requirements estimate	23
Possible site locations	23
Operator considerations	24
Technology transfer considerations and opportunities.....	25
Basic Economics.....	25
Possible Path to a Grain Elevator.....	25
Barriers to Success for the Continued growth of Maine’s Grain economy.....	26
Soil Health and Rotation Cchallenges	26
Sustainable Nitrogen Ssources	26
Climate Cchange	26
Financial Lliteracy	27
Sufficient Gross Margins and UMaine Organic Grain Modeling Efforts.....	27
Access to Capital	28
Recommendations and next steps.....	29
Understand costs better and adjust prices accordingly.....	29
Improve communications between buyers and growers.	29
Transition to more formal contractual arrangements between buyers and growers.	30
Build up inventory and supply grain year-round.	30
Facilitate access to capital.	30
Access markets outside of Maine.	30
Leverage the scale of conventional growers.	30

Introduction

The Maine Grain Alliance has undertaken this study to better understand and report on the economics and technologies of appropriately scaled grain processing infrastructure for Aroostook County's certified organic (OG) grain growers. Specifically, this study inventories existing grain drying and storage infrastructure and organizes the research and costs of building grain storage facilities in several locations in Aroostook County. Additionally, this report explores technologically advanced solutions for monitoring moisture, humidity, and temperature to alleviate the risk of spoilage and costly inventory losses.

There is an important distinction that is needed to be made between today's existing markets of Maine grown OG grain and the seemingly vast potential of unreached markets. While this vast potential holds many dreams of Aroostook County becoming a force in the United States Certified Organic (OG) grain economy, the recommended path forward is to support and focus on the existing players and embrace the continuation of the now small yet impressive organically growing OG grain demand of Maine's millers, maltsters, baker, brewers, and OG dairy industry. This will provide a necessary foundation to move beyond Maine into other regional and select markets.

This study adds to the work previously reported on by the Sustainability Lab's 2016 report [Planting New Ground](#) that provided an organic grain market analysis for Aroostook County & Western New Brunswick. Its primary findings were twofold; 1) Gross margins are generally not sufficient to enable increased levels of investments that are severely needed for equipment and infrastructure, and 2) The dynamics of Northern Maine transportation infrastructure including rail & trucking remains challenging with no clear path to improvement.

There are a variety of remedies to explore when examining how best to increase gross margins providing the impetus for needed investment in infrastructure. The most powerful remedy for many growers may be to move from producing a commodity priced product, to a higher value product, like malting, seed and food grade grains. A notable example of this ongoing transition can be found in the growth of organic malt barley. Just a few years ago, the only markets for OG barley was as feed for animals, most often dairy cows. A low value proposition as most all OG dairies sell into national milk markets and Maine barley must compete with large-scale Midwest and international growers of feed whose fields are measured in thousands of acres. Today though there are at least two local craft malthouses that purchase OG barley and who pay a higher price to the farmer for growing specialty varieties appropriate for malting barley. Taking this "value added" strategy a step further is the example of Maine's Buck Farms. Buck Farms transitioned from growing commodity grains for feed, to growing malting barley, to now malting the barley on-farm and selling at a premium price directly to Maine's craft brewers.

Access to capital is a significant factor for some growers. However, for some growers, especially our potato growers who grow grains because of the rotational requirements of potatoes, and who have good access to capital, they do not invest due to relative small size of the current market and low perceived gross margins as described above.

This paper describes the state of post-harvest infrastructure being employed in Aroostook County and other solutions available to dry, clean, sort and store grains. The considerations of on farm storage options and shared-use storage scenarios are also explored.

There are over 20 certified organic growers of grain in Aroostook County. This number is likely to continue to increase. The grain growing potential of these farming families is ample to meet the demand of current and foreseeable future near-term markets. Supporting these farming families with more agronomy resources, financial literacy, access to traditional and patient capital, and non-profit and governmental grant opportunities is paramount to these farms achieving success.

Market Opportunities for Certified Organic Grains

Maine's two largest buyers of certified organic grains are healthy and growing. [Aurora Mills and Farm](#), one of the pioneers of Maine's grain economy based in Southern Aroostook County, expanded operations in 2017. [Maine Grains](#) of Skowhegan, in production only since 2012, is successfully growing their business and is creating remarkable new markets. These enterprises embody authenticity and the Maine brand. They do not have the scale to produce grains and cereals that directly compete with larger companies like Pillsbury, Cargill, Quaker Oats, etc. They are growing and developing new markets by compellingly telling the story of the rebirth of grains in Maine and the important connections between the Maine family farmer, miller, maltster, baker and the consumer.

These two enterprises present an excellent opportunity for Aroostook County growers to diversify and expand operations. Successfully growing certified organic small grains in Aroostook County is not without its challenges. Growers are fortunate to have these two Maine buyers working closely and attentively with the farms toward a goal of mutual success.

There are approximately 500,000 acres of certified organic wheat being grown in the United States. This represents slightly less than 1% of total wheat acreage. The few fields of certified organic wheat in Aroostook County are measured in dozens of acres. While this demonstrates a huge upside opportunity, it puts in perspective how far Aroostook County must go to achieve some level of scale in wheat production.

Malting Barley Opportunities

By far, the most widely used grain in the beer industry is malted barley. One of Maine's two malthouses purchases certified organic barley from Aroostook County grain growers. At least one additional malthouse, outside of Maine, also purchases Maine grown certified organic barley. Currently the demand for OG (organic) malted barley is a tiny sliver of the total market available for conventionally grown and malted barley. Despite this small market, Aroostook County growers have been working towards producing a quality barley crop in greater acreage to meet the small and assumed-to-be growing market.



Aroostook County growers need to produce and deliver a higher-quality product to continue selling and penetrating this market. The malthouse outside of Maine chooses to contract with barley growers from New York, not from Maine growers, and not because transportation costs are less, but because the quality of barley is inferior to New York State growers.



Aroostook County growers have had difficulty in recent years meeting the high-quality specifications needed for malting barley. The harvested crop that does not meet malting specifications are relegated to the lower value feed grain market. During the current 2017 season, Aroostook County malting barley growers learned that even when their crop meets and exceeds "malting barley" specifications, the malthouses have additional criteria to judge the quality of the product they produce. This has lowered sales expectations for the current year. Additional cleaning to improve the barley quality may reduce yield, but could make Maine grown malt barley more acceptable to buyers.

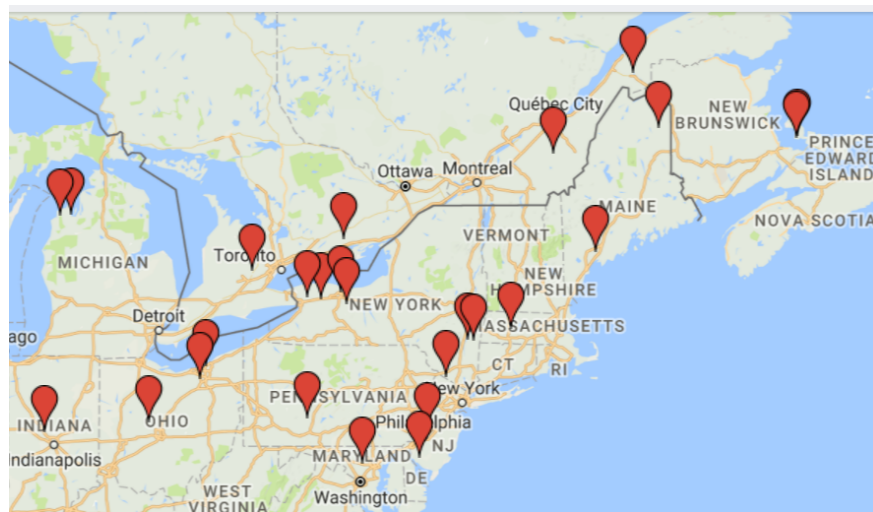
Aroostook County growers, buoyed by the progress realized over the past few years with regards to improved quality and yield, are only slightly deterred by this season's setback. With the allure of relatively higher prices they receive versus other markets, and with the belief that organic breweries will gain strength, Aroostook County growers will continue to grow malting barley.

Varietal Opportunities: Substantial trials are underway in Canada and in the Northeast to help determine varieties better suited for our region and for malting. The results of these trials suggest that there are newer and different varieties that may yield better results. Despite this, most barley grown is the two-row variety, Newdale and Cerveza. Aligning growers, maltsters, and brewers to move forward and commit to newer, potentially better varieties is a challenge that should be undertaken.



Alternative Malting Crops: Barley is the predominant malted grain but there are additional niche markets for other small grains for malting. Wheat, including heritage varieties, rye, and buckwheat present niche opportunities for Aroostook County OG grain growers.

Additional Northeast Region Malthouses: It makes sense for our growers to first establish relationships with local malthouses and master delivering a quality product to them. That being said, work should be undertaken to establish relationships to the increasing number of other regional malthouses as displayed in the map below:



Certified Organic Breweries: The number of certified organic breweries is small especially in the east coast. However, there were 40 west coast breweries represented at last year's Organic Brew Festival in Portland, Oregon. Despite lack of certified organic breweries in the east, some breweries are purchasing organically grown grains to differentiate their products. Committing to organic grains may be a valid differentiator for Maine brewers, especially as there are now more than one hundred breweries in Maine. There is a greater need to stand out and distinguish product offerings.

Modeling the Size of the Malting Barley Market: Allagash Brewing of Portland Maine has committed to purchasing 1,000,000 pounds of Maine grown grain by 2021. This represents 20% of the grain currently being purchased by Allagash. Using this as a baseline, the chart below estimates potential demand for certified organic malting barley. The chart assumes certified organic malting barley can command 5% of the 20% sourcing precedent set by Allagash.

	Single Farmhouse brewery	5-9 Small OG Breweries	Allagash	Maine	New England	Northeast	NE plus PA
Barrels brewed 2016	500	4,000	92,581	316,953	1,481,000	2,593,201	6,498,321
Total grain usage (tons)	14	108	2,500	8,559	39,992	70,025	175,477
Grain demand at 20.0% Allagash level commitment (in tons)	3	22	500	1,712	7,998	14,005	35,095
OG Potential opportunity (assuming 5.0% penetration of 20.0% local grain purchased)			25	86	400	700	1,755

To make the arithmetic easy, use the formula one ton of barley berries equals one acre harvested. Therefore, if OG could command 5% of the “locally purchased” grain market in the Northeast, OG barley demand could be greater than 700 acres – 3 times the current acreage of Malting barley grown.

Forecasting the future demand is tricky. Although the number of breweries in Maine skyrocketed in 2016, total number of barrels produced in Maine dropped by 3%¹. Future shakeouts and variability within markets are to be expected with the general trend continuing upward and taking market share away from the large national and international brewing operations.

Oats

Oats are the number one certified organic grain grown in Aroostook County in terms of acreage planted and harvested. Demand for Maine grown oats slightly outpaced supply in 2016. Oats are easier to grow relative to other small grains with more consistent results year over year. Aroostook County growers have access to significant acreage of additional, immediately certifiable fields. The additional acreage available enables growers to be able to keep up with the increasing demand while entertaining new markets. One major grower is beginning to serve as a local oats aggregator with the goal of simplifying purchasing and logistics for customers.

There is a single variety of organic oats that Maine buyers have been asking for primarily because of its taste profile. Although growers are experiencing success with this variety, there are additional varieties that may perform better in the field and should be investigated.

Oats are also an ingredient in some varieties of beer.

Rye

Rye is another small grain that is relatively easy to grow with consistent annual results. Used in baking, there are many varieties with unique flavor and baking attributes that present niche opportunities for millers and for Aroostook County OG small grain growers.

¹ Writer, J. P. (2017, May 21). Who sits atop Maine’s beer scene? It’s pretty fluid. Retrieved November 30, 2017, from <http://www.pressherald.com/2017/05/21/who-sits-atop-maines-beer-scene-its-pretty-fluid/>

Wheat

Wheat represents a major growth opportunity for Aroostook County OG grain growers. There is a large and growing unmet demand for regionally grown wheat for baking and to a lesser extent for brewing. Our relatively wet, humid climate is among the challenges that impedes grower success. Our largely clay soils often mean waiting for dry fields in spring. Too often large amounts of rainfall in Maine can prevent growers from producing wheats with high protein like those grown in the Midwest and those desired by bakers. Rainy weather during pollination can affect the heads of wheat, making them smaller, and shrunken. Fusarium or head blight can be a problem in damp seasons. Finally, our harvest season rarely offers reliable weather and getting a combine into a wet field presents a challenge. On the other hand, the weather experienced during Maine's last two seasons, categorized by drought-like conditions, has been excellent for small grain growing and the quality of wheat has improved.



Heritage Grains



Old heritage varieties of wheat, spelt, rye and other ancient grains are being revived, seed supply restored, and bakers are patiently awaiting larger fields being grown. They represent a viable, albeit niche, market for Aroostook County growers. This is an especially viable opportunity for the typical Aroostook County grower that work smaller fields measured in the “dozens of acres”. These grains may take specialized knowledge and conditions to grow successfully – just what an attentive small grower can manage well. Unique crops like heritage grain varieties gives growers opportunity to develop relationships directly with end-users and help make a strong connection that can lead to increased sales and new opportunities.

Buckwheat

Buckwheat, despite its name, is not a variety of wheat and not even a grain. Buckwheat is the seed of a fruit related to rhubarb and sorrel. It is grown, processed, and eaten like a grain and has a long rich tradition in Aroostook County. Ployes, a ubiquitous Acadian staple, is a pancake type mix of buckwheat and regular wheat. Buckwheat grows thick and can smother weeds. There is a healthy and growing market for ployes mixes. Maine grown, milled, and packaged ployes mixes are on grocers' shelves throughout the Northeast. Hundreds of conventional acres of buckwheat are being grown for this use. Certified organic demand for buckwheat is currently small, but growing. Ployes are not the only application for buckwheat. [A Japanese buckwheat variety used in making soba noodles](#)² has also emerged as a viable opportunity.

² Harry, D. (2017, June 13). Portland restaurateur, Aroostook farmers boost Maine buckwheat. Retrieved November 30, 2017, from <http://www.theforecaster.net/portland-restaurateur-arostook-farmers-boost-maine-buckwheat/>

Another market for buckwheat is the unmet demand for dehulled buckwheat groats or kasha among ethnic communities where this grain is a central cultural staple.

Flint Corn

There is a small and growing unmet demand by our millers and local tortillerías including Portland's [Tortillería Pachanga](#), for certified organic flint corn. Insufficient growing degree days, humid climate, and pests are among the challenges with regard to growing flint corn. New, shorter season varieties and seed from Amish communities outside of Maine are being trialed in small fields throughout Aroostook County. Amish farmers, who dry their flint corn by cribbing, successfully grew 8 acres of field of flint corn in southern Aroostook County in 2017. This the largest known field of OG flint corn grown in Aroostook County in recent years.



Sunflower



Fairly large acreage of conventionally grown sunflower fields has been noted in Aroostook County over the past several years. With some modifications, existing combines can harvest sunflowers. Markets exist for the bird seed market with some going to Tractor Supply Stores and some are packaged in 40 lb. bags and sold locally. A 16-acre field of Certified Organic Sunflowers were grown in the St. John Valley in a highly-visible field off Route 1 beside the St. John River. Some of the intent of this field was for

beautification and good-will, and some to learning the growing characteristics of sunflowers.

Recently, a Vermont based edible oil company has been sourcing non-GMO canola and sunflowers regionally. The company has been reaching out to Aroostook County growers and purchased County grown non-gmo canola in 2016 and contracted for sunflowers in 2017. In summer of 2017, the edible oil company suspended operations, leaving the Aroostook County grower with sunflowers growing in fields with no markets. One option the grower has is to sell the sunflowers as bird seed. A lower value proposition than the potential of producing an edible oil, but a real option nonetheless. Marketing Maine-grown bird seed is an opportunity not well explored.

In 2009, Maine Natural Oils of Houlton, ME launched an [edible oil retail product](#) pressed from County grown canola.⁴ Doug Callnan of AgriCal in Houlton built the pressing facility inside a trailer. The choice to build the facility inside a trailer was twofold: first, Agrical runs a grain elevator selling to feed markets and the constant dusty conditions prevented using existing buildings, and second, their idea was to able to bring the press to the farmer. The product was of high quality, but the infancy of the local



⁴ Pressing matters | Maine Natural Oils makes seed-based oils right at the farm. (n.d.). Retrieved November 30, 2017, from <http://www.mainebiz.biz/article/20090420/CURRENTEDITION/304209996/pressing-matters-%7C-maine-natural-oils-makes-seed-based-oils-right-at-the-farm>

food movement at that time hampered success and the company stopped producing oil in the trailer. Despite the facility being unused for several years, it appears to be in excellent shape and ready for pressing again.

With this background in mind, the opportunity currently being undertaken to create a Maine based edible oil enterprise serves as an excellent example of how other new markets and products can be developed. To wit:

1. Growers have harvested, dried and has stored 30 tons of high quality food grade sunflowers in 2017.
- 2) Doug Callnan is motivated to find a user and possible buyer for the pressing trailer and would be pleased to assist in the pressing of sunflowers.
- 3) This author, working with the principals and investors of Full Sun, is investigating reinventing the company based in Aroostook County,
- 4) Several farming operations, some with food service and retail customers throughout Maine and New England, have been actively investigating the feasibility of a start-up, small-scale pressing operation for 2018 or later.
- 5) A Maine-based food distributor is talking with its customers about the desirability of a sunflower oil product. The parties are aligned and working well together. This is a live active project that will take further shape in the next 60 to 90 days with the prospect of launching the venture in early 2018.

Pulses and Soy

Pulses refer to the edible seeds of plants in the legume family such as beans and peas. Naturally, legume crops can fix nitrogen. The ability of legumes to fix nitrogen is perhaps the most notable aspect that sets them apart from other crops. Many Aroostook County small grain growers rely on what used to be inexpensive chicken litter from Canada for their all-important nitrogen input. This supply has all but dried up as the nearby Canadian chicken plant is now drying and processing their manure into pellets and selling it as a value-added shelf-stable product and its cost is now unaffordable. Integrating legumes into small grain and potato growers' crop rotation might be an excellent solution to this "nitrogen" problem that warrants continue research.

[Legume Field trials](#) have been undertaken by the Maine Potato Board in their search for a better rotational crop scheme to assist their growers as they move from a 2-year rotation to a more soil friendly 3-year rotation.⁵

Aroostook County has a rich history of growing sweet peas. In 1985, [McCain's processed 12 million pounds](#) in their Washburn, Maine processing facility.⁶ Similar and larger sized pea processing plants were

⁵ Brino, A. (2017, January 31). Potato crop rotation research in Presque Isle points to peas. Retrieved November 30, 2017, from <http://bangordailynews.com/2017/01/31/news/potato-crop-rotation-research-in-presque-isle-points-to-peas/>

⁶ Rhodes, D. (1985, December 11). McCain Sells Holding to Canada Packers for \$53.6 Million. Retrieved November 30, 2017, from <https://news.google.com/newspapers?id=LwE1AAAAIIBAJ&sjid=GU8KAAAAIIBAJ&pg=1620%2C30638>

located in Caribou (Birds Eye) and Fort Fairfield. All of these facilities closed by the end of the 1980s as pea production moved to west where yields were greater and growing costs lower.

In 2013, Northern Girl, a startup vegetable processing operation out of Van Buren Maine started “The Pea Project” to investigate the feasibility of bringing the crop back to Aroostook County. In cooperation with MOFGA, field trials were undertaken. Field trips to McCain’s New Brunswick facility to see the old abandon pea harvesters were arranged. Processing equipment to freeze and package peas were investigated, and samples produced. Northern Girl did not have the wherewithal to pursue this and it remains a large potential market opportunity that deserves further study.



More on the nitrogen fixing qualities of pulses and the problems of synthetically produced nitrogen are described [here](#).⁷



[Heiwa Tofu](#) of Rockland Maine, and across the Northeast, there are several fast-growing craft tofu producers that desire sourcing 30 to 50 tons of food-grade certified organic soybeans grown in Maine. One of these producers have been working with Maine growers since 2011 requesting farmers to try their hand at growing OG soybeans. Low yields (not quality) have been the issue for growers making the economics not viable. There is some good news; an Aroostook County grower is reporting excellent results in 2017 with their soybean crop and expect shortly to start shipping to a local, Maine based tofu manufacturer.

There are over 15 tofu manufacturers in the Northeast, many are certified organic producers.

Soybeans that do not meet food grade have decent value as animal feed.

Flax

Flax, a flowering plant that produces an oilseed as well as linen fiber, can be grown like a grain and has a history in Aroostook County.

In the mid-1990s, as many as 40 farmers planted some 1,400 acres of flax to supply Aroostook Flax and Linen. Led by two Connecticut businessmen and financed with government loans, the company supplied farmers with flax seed and equipment and ran a small scutching mill that separated the fiber from the plant and exported it to linen makers in Europe.

The mill was an old piece of equipment that was imported from Europe and rebuilt in Presque Isle. Being old and with little availability of spare parts, it predictably broke down after two seasons and the company

⁷ Dent, D., & Cocking, E. (2017, March 01). Establishing symbiotic nitrogen fixation in cereals and other non-legume crops: The Greener Nitrogen Revolution. Retrieved November 30, 2017, from <https://agricultureandfoodsecurity.biomedcentral.com/articles/10.1186/s40066-016-0084-2>

did not have the wherewithal to fix the mill. The flax company defaulted on its loans and lease at the Presque Isle Industrial Park. The mill's equipment and raw flax and seed were later auctioned.

As a crop it had the advantage of not being potatoes and created a break from potato disease cycle. Flax also has very long roots that are excellent for our clay soils. To grow well, flax takes a lot of nutrients out of the soil. Like other small grains, flax requires the weather to cooperate, especially during harvest when the fiber is cut to dry and break-down in the field. The company was planning on trialing newer and better varieties to solve some of the known shortcomings of this crop. Flax was recently trialed by Benedicta Grains with some success.

Flax for fiber is most likely not a viable crop opportunity for Aroostook County. The story does however, provide an important warning to future large scale agricultural projects in "The County". The Flax/linen project is just one in a series of great failed promises made to Aroostook County farmers as potato acreage has gone from over 200,000 acres to now less than 50,000 acres. The most notable example of failed and over-promised ventures is the great Aroostook County "[Sugar Beet Fiasco](#)" of the 1960s.⁸ Note: the referenced article on the "Sugar Beet Fiasco" should be required reading for all Aroostook County agricultural and food system stakeholders.

Hemp

Industrial Hemp is being recognized as a multi-million dollar opportunity for growers and for hemp derived products. There are an estimated 25,000 value-added products manufactured from industrial hemp including food, clothing, oil, and pharmaceuticals. The Maine Department of Agriculture, Conservation, and Forestry accepts applications to grow outdoor industrial hemp for research and development purposes. USDA [recognizes industrial hemp](#) under their Certified Organic Program.⁹

Maine is behind some states in preparing for this opportunity. New York State for instance has [funded \\$10 million](#) for research and development.¹⁰ Colorado is ahead of many states with operations like [Colorado Cultivators](#) who are working with 7 farms and 1,400 acres of "organic" hemp production.

In Maine, one licensed grower has had success with very small 1-2-acre field trials. They are accumulating the very-expensive and hard-to-source seed and they are developing partnerships with OG grain growers in Aroostook County to expand acreage with the goal of 200 acres in production by 2019. The primary focus of this effort is for hemp oil applications. Processing requirements are like those of sunflowers and canola as described above.

Rice

Small scale efforts have been undertaken to understand the opportunity to grow, process, and market Maine grown rice.

"[The Rice Project](#)" has been ongoing for five years and is now a non-profit 501(c) and in 2017 has



⁸ Brino, A. (2016, November 27). Remembering the sugar beet fiasco in Aroostook County and its aftermath. Retrieved November 30, 2017, from <https://bangordailynews.com/2016/11/27/news/aroostook/remembering-the-sugar-beet-fiasco-in-aroostook-county-and-its-aftermath/>

⁹ U.S. Hemp Moving Forward with USDA Organic Certifications. (2017, May 01). Retrieved November 30, 2017, from <https://www.hempbizjournal.com/us-hemp-moving-forward-with-usda-organic-certifications/>

¹⁰ Industrial Hemp Research Initiative in New York State. (2017, September 19). Retrieved November 30, 2017, from <https://esd.ny.gov/industrial-hemp>

partnered with Maine Grain Alliance to assist with funding to further their R&D efforts. Current efforts are at a very small-scale level, however, short-season rice varieties that may grow well from seeds and that harvest with existing combines is possible.

Animal Feed Markets

Increasing demand for organic products among consumers is generating a resurgence for organic feed products and grains to be used by livestock markets throughout the northeast US and Eastern Canada. For producers and handlers of grains in Maine, the OG dairy market may be the largest opportunity for growth, however other growing areas of demand for feeds for poultry, turkeys, swine, beef (and other cattle), goats, sheep, wildlife and household pets, may be more viable.

There is a small informal direct farmer-to-farmer network that moves a fair portion of the OG feed grain currently being grown in Aroostook County. Aroostook County OG grain growers would like to transact with Maine's 60+ OG dairies in a bigger more organized way. However, at this time, national OG milk markets are experiencing difficulties and there is a serious [oversupply in the marketplace](#) that suggest it is a difficult time to start development of this market opportunity.¹¹

Despite Maine farmers' intentions to grow food grade grains, variable weather conditions, and unforeseen circumstances in the field and in storage will most always result in the wide availability of high quality feed grade grains that will need solid, reliable markets. Therefore, Maine should pursue a comprehensive and complimentary animal feed strategy concurrent with its goals for food grade grains.

There's no shortage of places to sell OG feed grain including Canadian buyers and third-party brokers. Too often, however, it is sold at a discouraging price discount.

Maine does not currently have a mill focusing on OG feeds and grains for the livestock community. Morrisons Custom Feeds in Barnet Vermont is the nearest (US) mill facility and does supply to Maine and throughout New England.

In 2010, [Maine Organic Milling](#) began processing grain for livestock feed in the former Blue Seal Feeds mill in Auburn, Maine. This was a collaborative effort among key OG dairy producers in the state along with support from Organic Valley Cooperative (CROPP) and the St. Lawrence & Atlantic Railroad. The mill began making dairy rations from corn, barley, okara, peas, lentils and flax. Unfortunately, due to management issues, outdated facility issues and market challenges, the facility shuttered.

The failure of Maine Organic Milling to prosper highlights the necessity of a feed milling venture in the state to look to other markets for organic feed products beyond the bulk feed products sold to the OG dairy industry. This coincides with and confirms a conclusion of a [feasibility analysis](#) conducted by the University of Maine back in 1999.¹² They looked at the feasibility of an organic grain milling and handling facility in Central Maine. In this study, the financial viability of the model facility as a free-standing enterprise was on the bubble. They found that such a facility needed to generate demand beyond the dairy sector for the enterprise to become an attractive investment (viable/sustainable).

¹¹ Abbate, L. (2017, September 23). Organic dairy farmers 'weathering the storm' as milk prices drop, production quotas set. Retrieved November 30, 2017, from <https://bangordailynews.com/2017/09/23/homestead/organic-dairy-farmers-weathering-the-storm-as-milk-prices-drop-production-quotas-set/>

¹² Smith, S., Leiby, J., Cheng, H., Allen, T., Hill, J., Grant, D., (July 1999) The Feasibility of an Organic Grain Milling and Handling Facility in Central Maine: A Report to the Maine Department of Agriculture, Food, and Rural Resources, Department of Resource Economics and Policy University of Maine

The Sustainability Lab and their [Organic Grain Collaboration](#) has been focusing on how Aroostook County can supply OG feed to their larger-scale organic members such as Organic Valley, Annie's, Dave's Killer Bread, Pete and Gerry's eggs, and others. After three years of organizing, conferring, and having a presence in Aroostook County, additional grain production to meet these companies' needs has yet to be achieved.

OG Animal Feeds Market Recommendations

Work with University researchers to re-evaluate the feasibility of an organic feed milling and handling facility in Maine (possibly Aroostook County) reflecting today's market for livestock feeds in the state and nearby markets.

- Conduct market analysis of livestock feeds
- Conduct market analysis for aquaculture feeds manufactured in Maine
- Conduct market analysis for pet feeds manufactured in Maine.

There may be a strong opportunity for OG pet food products produced by grains grown in Maine and eastern Canada. Specialty pet foods and treats are a rising star among the pet food industry with significant market growth and opportunities. As the Maine OG grain supply continues to expand and grow, feasibility studies and market analysis are needed to understand the strengths (and weaknesses) of supplying to this market and possibly manufacturing products in our region.

There appears to be [more horses than cattle in Maine](#).¹³ This could present new opportunities as horse owners may follow the general trend of a broadening array and growth of new organic products and they move more towards certified organic feed options.

Jackson Lab is the world's largest producer of laboratory mice. They sell over 2.5 million mice per year. Their laboratory mice need a very high quality that has unique-specifications for their feed. Can this feed be produced in Maine using Maine grains? Doug Callnan, President of AgriCal of Houlton, Maine is part of the team investigating this opportunity. Wheat, barley and oats are the base grains for the mix. This project is mentioned not because it is a particularly good opportunity for OG grain growers, but as an example of markets not usually considered. This is a good example of the recommendation to "leave no stone unturned" to discover, investigate and develop new markets.

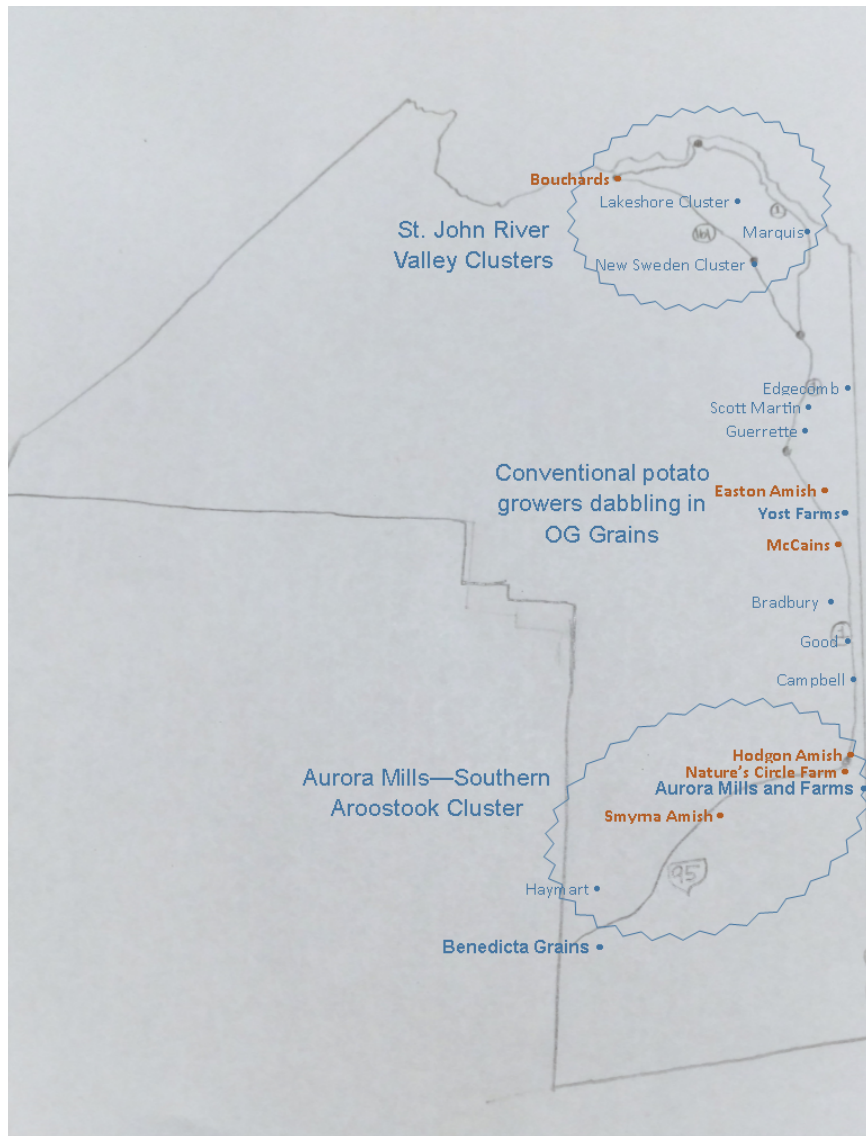
¹³ Mack, S. K. (2009, May 19). Horse Power: Maine's multimillion dollar economic engine. Retrieved November 30, 2017, from <http://bangordailynews.com/2009/05/19/news/bangor/horse-power-mainersquos-multimillion-dollar-economic-engine/>

Aroostook County Certified Organic Growers

Increases in 2017 were realized by Aroostook County growers in the number of OG small grain acres harvested, yield, and the percentage of the harvest that made food grade. Key contributors to this success were less about increased acreage and more about growers moving further down the learning-curve and favorable weather.

Much of the increases in acreage came from the dedicated grain growers and not by the OG potato growers, who like the conventional potato growers, have low expectations for grains to contribute to the success of their operations, and do not yet focus on their rotational grain crops.

There are over 20 farms in Aroostook County that grow certified organic small grains. They can be grouped into 3 major clusters.



St. John River Valley/New Sweden Clusters

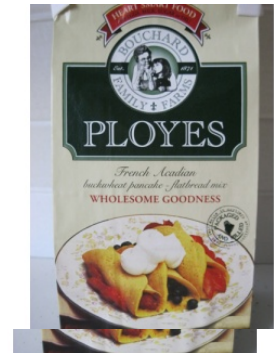
Two major OG grain operations are represented in this cluster: Marquis Family Farm and Lakeshore Farm. Both are committed to OG grains, grow several hundred acres, and have made recent investments to their

post-harvest infrastructure. The New Sweden group of 5-6 certified organic growers have small fields and currently do not grow many grains besides as a crop for their required potato rotation. However, this group of growers have a long tradition of certified organic farming and cooperation. Recent newcomers GroMaine and Ketch Organics bring new energy to this region especially for value added products such as the sunflower oil project as described above.

Lakeshore is a longtime veteran with 8-years' experience growing organic grains. They grow the full variety of OG grains in demand: oats, malting barley, wheat, and triticale. Lakeshore has begun to serve as an aggregation point where new OG growers can sell their grain and make use of Lakeshores storage and cleaning capabilities.

Marquis Farms is a large certified organic potato and grain grower. With a three plus year potato rotation, Marquis Farms grows a large number of acres of grain annually. Currently the farm is focusing on barley and this season met the specifications for malting barley. The prior years in which their barley did not meet malting specifications served them well in acquiring larger customers for their OG feed barley. The large quantities of feed barley that they had available, meant they could fulfill a need for large dairy operation deliveries all year round. The typical OG grain grower in Aroostook County with smaller fields, selling on their own, may not be able to compete for this type of business.

Bouchard Family Farms of Fort Kent is known for their conventionally grown buckwheat based “ploys” mixes. They have developed a widely respected brand. Their mixes are widely available throughout New England at Whole Foods, Hannafords, and natural food stores and Co-ops. The Bouchards represent a very successful model of adding value and developing markets that OG grain growers could emulate.



Central Aroostook McCain Growers Exploring OG Grains

The current crop of McCain growers prove year after year to be extremely competent and have the scale necessary to successfully supply McCain's potato processing plant in Easton. They have access to capital and have kept up with the high capital requirements needed to produce a quality potato annually. Some of these growers have moved into certified organic potatoes and thus grow OG grains only as their rotational crop with minimal interest. Others in this group view OG grain more positively as a diversification option with real potential. There is not a lot of post-harvest infrastructure among this group, but they have the wherewithal to make these investments once new and bigger markets are identified. This group of farmers desire grower contracts as a sign of mature markets in order for them to increase their acreage.

Aurora Mills and Farm/Southern Aroostook – Houlton area

Aurora Mills and Farm is a prominent grower and buyer of OG grain in Aroostook County. Matt Williams, the proprietor of Aurora is a true pioneer of Maine's emerging grain economy. Now farming and milling alongside his daughter Sara, their business is growing. Matt has provided mentoring and technical assistance to many of the OG grain growers in Aroostook County and has trusted relationships with these growers.

The Houlton area is home to Nature Circle Farm, one of Maine's largest certified organic farms that focus on root crops and squashes. Nature Circle does not grow grains and some of their land is rotationally farmed with grains by Aurora. Nature Circle Farms works with local Amish communities to grow winter squash for them and this aggregation allows Nature Circle to serve larger markets and make better use of their substantial packing and storage infrastructure.

These two large, committed, and successful certified organic enterprises; Aurora Mill and Farm and Nature Circle, along with the expanding number of Amish communities, together with the southern Aroostook

slightly warmer climate and being positioned closer to markets, indicate very favorable conditions for increased land and farming infrastructure investment.

An aspirational goal for this cluster could be the pursuit of 1,000 acres of OG grain production. With a three to five year crop rotation system desired to provide diversification, to avoid disease cycles, and to build soil health, a total of up to 4,000 acres of certified organic land would need to be acquired or accessed to optimally provide this 1,000 acres of small grains production goal. To achieve this, a strategy for “transitioning” larger and more desirable conventional fields should be put in place.

Post-harvest Infrastructure: Drying, Cleaning, and Storing,

State of infrastructure currently employed on-farm:

There are wide variations in the class and scale of equipment and infrastructure currently employed by certified organic small grain growers in Aroostook County.

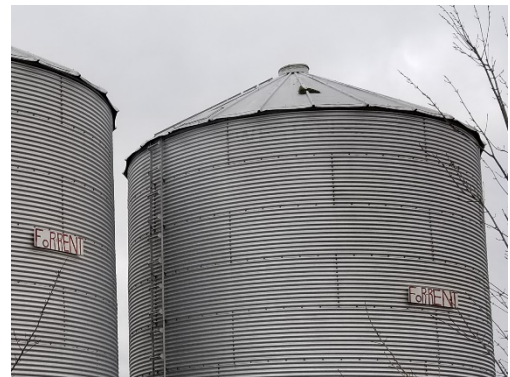


Storing the grain safely away from weather and rodents is the most fundamental requirement. Many farmers have some tank storage available on-farm or close-by.

The photo on the left shows grains being unloaded and conveyed up into a tank. This represents a very typical setup for Aroostook County small grain growers.

There are many old and functional storage tanks sitting around on farms throughout Aroostook County that are available for rent and for purchase at a great discount compared to buying new.

At least two County growers added used storage tanks in 2017. The low cost of a used tank is only a portion of total investment however; taking down, transporting, setting concrete, electrical (for fans and augers), new hardware, crane rental, floor work, and erecting the tanks are required, the same for a new tank. For example, one County grower purchased a 4,000 bushel used tank for \$1,500. The cost to get the tank online was approximately an additional \$8,500. The total investment was \$11,000 which translates to \$2.63 per bushel. A similar new tank cost with complete installation costs factored in is estimated at over \$4.00 per bushel.



As noted, Aroostook County OG growers are growing small fields of a variety of crops and there is not enough bin storage to keep them separated appropriately. As a result, it is common to store grain in tote bags as shown on the left. For instance, the 30 tons of dried sunflowers discussed earlier are stored inside a packing shed in 34 tote bags.

When considering grain storage, the bigger the bin, the smaller the cost per bushel. Conversely, small bins have relative high costs per bushel. Bins holding 20,000 bushels and less are considered “small” by industry

standards yet 20,000 bushels is “very large” by Aroostook County OG growers standards. Twenty thousand bushels represents the approximate yield of 500-600 acres of wheat. A sizeable number of Aroostook County growers are planting fields measured in “dozens” of acres, not “hundreds”, therefore developing on-farm storage solutions for Aroostook County growers will have a relative high cost compared to US and Canada growing regions.

Cleaning Grains



After storage, investing in grain cleaning equipment is a sure way to increase quality of grain being delivered to customers, increase the price the farmer can charge, and to decrease “dockage” fees. Grain cleaning equipment is widely available at many different scales including many good affordable choices for the smaller needs of Maine’s OG farms. One Aroostook County grower purchased an \$8,000 used “Clipper” grain cleaner three years ago and considers that purchase a “Game Changer” for their operation because of the new capabilities the cleaner gave to meet the quality expectations of their customers.

The two major buyers of Maine OG grain Aurora Mills and Farm, and Maine Grains, have a wide variety of high-quality cleaning capabilities with good throughput and routinely purchase grain that has not gone through any additional cleaning at the farm and for specialty cleaning beyond the capabilities of on-farm cleaning. This is a service that has been a tremendous help to establish a supply of grain. This type of service is often not available for larger markets that are within reach once quality and supply is improved.



Weed management is one the bigger issues and a continual focus for all OG small grain growers. Weeds are a fact of life in growing OG grains. There are a wide variety of combines being employed with varying capabilities to eliminate weeds from seed during harvest. Operator experience and expertise on the combine is a major factor in the quality grains being brought in at harvest. Many Aroostook County growers would benefit from going to “Combine School” (for newer combines) or investing the time and finding the expertise to optimize the combine settings for each crop.



Having the ability to run harvested crops through a “Pre-cleaner” before storing is ideal. Storing grains along with weed seeds, weed stems, chaff, and straw does nothing to the taste profile of the stored grain. New and used pre-cleaners are widely available and have the prerequisite throughput to not hold up the hectic harvest schedule and would be a good addition to many farms, especially those with older combines and those experiencing weed pressure.

Drying Grains

Aroostook County OG grain growers typically dry their grains in-bin using aeration, with fans only, and have generally been successful for small 2-3 percent moisture reductions. This success is largely due to the relatively small volumes in small tanks.

Recent seasons have been dry and favorable for grain growing and with today’s smaller acreage, growers can manage the timing of harvest to maximize quality right from the field. As operations get larger, and more grain needs to get harvested in the same amount of time, drying will become a more critical step to producing more and higher quality grains. Potato growers focus on their higher value potato harvest, sometimes at the expense of their grains. Having the ability to harvest early, and wet, as high as 18-20%, and then having the ability of drying down the grains is paramount to the continued scaling up of OG grain production in Aroostook County.



There is generally sufficient time available to dry down grains before going to market. Using malting barley as an example, with temperatures generally between 50 and 60 degrees after harvest, in Aroostook County there are at least 60 days available to dry down grains (see chart on right). Ample times are generally available for all the other small grains as well.

		Estimated Allowable Storage Time for Malting Barley (days)								
		(Criterion: Germinability)								
		11%	12%	13%	14%	15%	16%	17%	18%	19%
80 F	230	175	115	70	40	20	11	9	6	
70 F	560	420	270	175	100	50	30	20	15	
60 F	*	*	660	430	260	130	65	45	25	
50 F	*	*	*	*	630	350	140	100	60	

* Allowable storage time exceeds 700 days.

Source: Drying Cereal Grains by Brooker, Bakker-Arkema and Hall

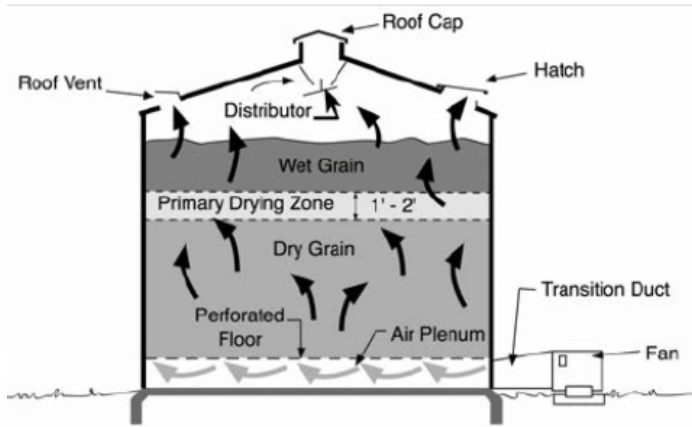


There have been drying attempts using ad hoc home-grown drying systems in recent years that have had mixed results – sometimes with success and sometimes with quality degradation of the grain.

Propane batch “batch dryers are widely available (see photo on left) and with careful monitoring to assure not too much heat is applied, can work well. Often these dryers were designed for feed corn and soy, the predominant grains grown in the US, and these grains can take high temperature heat that will ruin the food grade small grains Aroostook County is growing.

There are no shared- use drying capabilities in Aroostook County for organic or for that matter, conventionally grown grains in Aroostook County that are suitable for food quality conditioning and drying.

The conventional grain elevators in Aroostook County, MPG in Presque Isle and AgriCal in Houlton have dryers that are only suited for feed grade.



Most storage bins currently being employed are 10K bushels and smaller that drying through aeration are generally well suited for. For those currently using this practice of drying in bins with the use of aeration, the key is to aerate with dry, cool air, and it is common for farmers to simply watch the weather and turn on their fans manually on days and nights when the air is cool and dry, and turn off their fans when it is raining, or when the air feels moist (high humidity). This practice generally happens as soon as grain is loaded into the bins at harvest and lasts up until

late fall.

The problem with this practice is that that manual on/off operations, without factoring in precise humidity conditions has shown to deliver poor results when trying to lower the moisture content of stored grain. Many times, farmers (or farm hands) forget to turn the fans off (i.e., over a weekend), and the weather conditions turn wet or moist and the fans (aeration) may add moisture to the grain.

There are many sensor configurations on the market for managing aeration controls automatically, however, one Maine based supplier and installer has installed several humidity-based sensor and control points that allow farmers to set a humidity threshold (set point), and the sensor and control will automatically turn on the aeration fans when humidity is below the set point, and automatically turn them off when the humidity is above the set point. This automation is extremely valuable and can eliminate the human error of manual operation.



Beyond aeration and humidity sensors, in-bin, drying system that features lightly heated air circulated from bottom of tank upwards are being employed in Aroostook County. Optimally, they come with a top-down auger stirring device. These systems are controlled by software and sensors. The air is forced up through the grain with fans until the grain moisture content is sufficiently reduced. This is typically done in bins with a raised perforated floor to ensure even airflow, but can also be done using air ducts laid on the concrete bin floor prior to adding grain. If stirring devices are used, the temperature can be set higher as the stir augers will blend the grain sufficiently to prevent it from over drying near the bottom of the bin.



Two such systems have been employed this past year in Aroostook County. The first, pictured on the left, is a relatively inexpensive system (less than \$20K for two 20K bushel tanks) that was successfully used this season to dry down OG malting barley a couple percentage points over a 4-6 week period. This system has grain leveling devices but no stirrers. It is unclear whether this type of system can handle large 5+ percentage point moisture reductions.

The other system was employed at a large-scale (2,000+ acres) conventional grain grower. Although it has some of the same technology and basic features of the inexpensive system described above, this system costs “hundreds of thousands of dollars” and comes with significant more throughput. This system has aggressive stirring augers and can push more heat through the bin resulting in tens of thousands of bushels of daily drying capability. It has many more sensors to continuously control and to adjust the throughput and is run 24-7 during harvest. The system has proven to be able to take wet grains, up to 20% and dry them down quickly while preserving quality. With this system, there is no reason to wait until late morning, when the sun has dried off the dew, to harvest, as the drying system will dynamically adjust to accommodate a load of “wetter” grains. This has led to the elimination of previously subcontracted combine services for this grower and significant savings.

Continuous Flow Drying Technology uses warm air forced through the grain mass by a blower. This air warms the grain and causes moisture on the outside of the kernel to evaporate into the air which in turn is exhausted to the atmosphere. Then the surface moisture is removed from the kernel by evaporation, the moisture trapped inside the kernel slowly migrates to the outside and is absorbed by the warm air. Thus, a chain reaction takes place - warm air evaporates surface moisture which in turn causes moisture from the inside of the kernel to travel to the surface. Warm air is used not only because it holds much more moisture, but more

An excellent drying technology and one that Maine should aspire to is a continuous mixed-flow system. Its claim to fame is in the uniformity in which it dries the grain. These systems are designed for maximum throughput and can dry down the wettest grains while preserving quality. They are typically employed at large grain elevators of the mid-west and “starter systems” are relatively expensive. It would be well suited to be employed in Aroostook County under a shared- use scenario.

Summary of Drying Issues, Concerns and Recommendations.

Aroostook County OG grain growers generally are producing grains at a volume that is well served by employing affordable small storage bins. Good aeration and a watchful eye is often all that’s needed to lower and maintain grain moisture levels for optimal storage and quality of their grains.



A range of batch and in-bin drying systems that add heat and grain movement along with sensors and software controls are available for growers wanting additional throughput and for those wanting to manage their harvest times. This is especially true for potato growers needing to harvest later crops, e.g. wheat, that can conflict with potatoes.

More sophisticated drying technology like continuous mixed-flow dryers and high-end in-bin drying systems are designed for the larger operations that Aroostook County certified organic growers are not at now or planning to be in the very near future. However, all three of our clusters as described earlier have the potential to be at this level.

Aroostook County has experienced dry weather for the past several growing seasons. This has presented excellent conditions for growing and harvesting quality grains. This means that some of the growers have experienced only the good fortune to harvest grains already on the dry side with only a small need for reducing their grain’s moisture content prior shipping. Could this unusual dry weather trend continue?

A wet season though, is bound to occur, and it could have a significant negative impact on the quality and quantity of grain that buyers are relying on and have experienced over the recent past. In the case of a wet

season, it will be the smaller growers, because of the small volume, who have more available solutions and be in a better position to dry down their grains over the larger growers who are too big for ad hoc drying methods and too small for industrial solutions as described above.

Shared-use Facilities Versus On-farm Infrastructure

Designing up to four strategically placed facilities for the drying, cleaning, aggregating, storing, and final packing and shipping of certified organic grains is the major premise of this project. During this project, clusters of OG farms have been identified as strategic locations for prospective shared-use facilities should farmers decide that the benefits of such a facility outweigh the difficulties. Also identified are the many needs for on-farm investment that with relatively small capital outlays can increase the volume and quality of grains being produced.

There are at least three cases where additional on-farm infrastructure is currently being developed and more being planned, that could functionally serve as shared-use facilities. They are described below:

Lakeshore Farms

Lakeshore Farms has been producing small grains for over 8 years and is a critical supplier to all three of the major Maine OG grain buyers. Lakeshore is a dedicated small grain enterprise (no potatoes or other crops) that typically grows 4-6 varieties of small grains. Their own farming production has increased significantly and in 2017 they began aggregated grains grown by outside farming operations. Although Lakeside has limited access to capital, nonetheless, it is in the process of upgrading their post-harvest infrastructure commiserative with the size of their operation. Over the course of this project, this team provided important technical assistance to upgrade Lakeshore's financial controls and reporting and are in the process of assisting the development of Lakeshores 5-year master plan.

Aurora Mills and Farm

Aurora Mills and Farm are the pioneers of the Maine organic grain economy. Over the years, they have cultivated loyal and strong relationships with Aroostook County growers to provide them additional OG grains beyond their own on-farm production. Even with recent increases in acreage at their own farm, there remains significant opportunities for area farms to contract with Aurora and to make use their significant on-farm cleaning and storage infrastructure. As this report is being written, Aurora Mills and Farm are in the final stages of a significant upgrade in their storage capabilities.



Haymart

Haymart is a newcomer to OG small grain farming located just beyond the southern border of Aroostook County in Patten, Maine. After mixed results in 2016, they had good fortune and a good harvest of their 300+ acres of certified organic small grain production. In 2017, they invested in storage and cleaning equipment. This enterprise has access to capital and the financial wherewithal to continue making infrastructure investments and they look forward to expanding their capabilities to receive and market additional farmers' production.



In addition to small grain farming, [Haymart's original business plan](#) included the development of a small tree harvesting and pellet mill. Production of pellets for wood heat has been halted and a study is underway of the feasibility of converting the operation to be able to pelletize grain and other farm products.

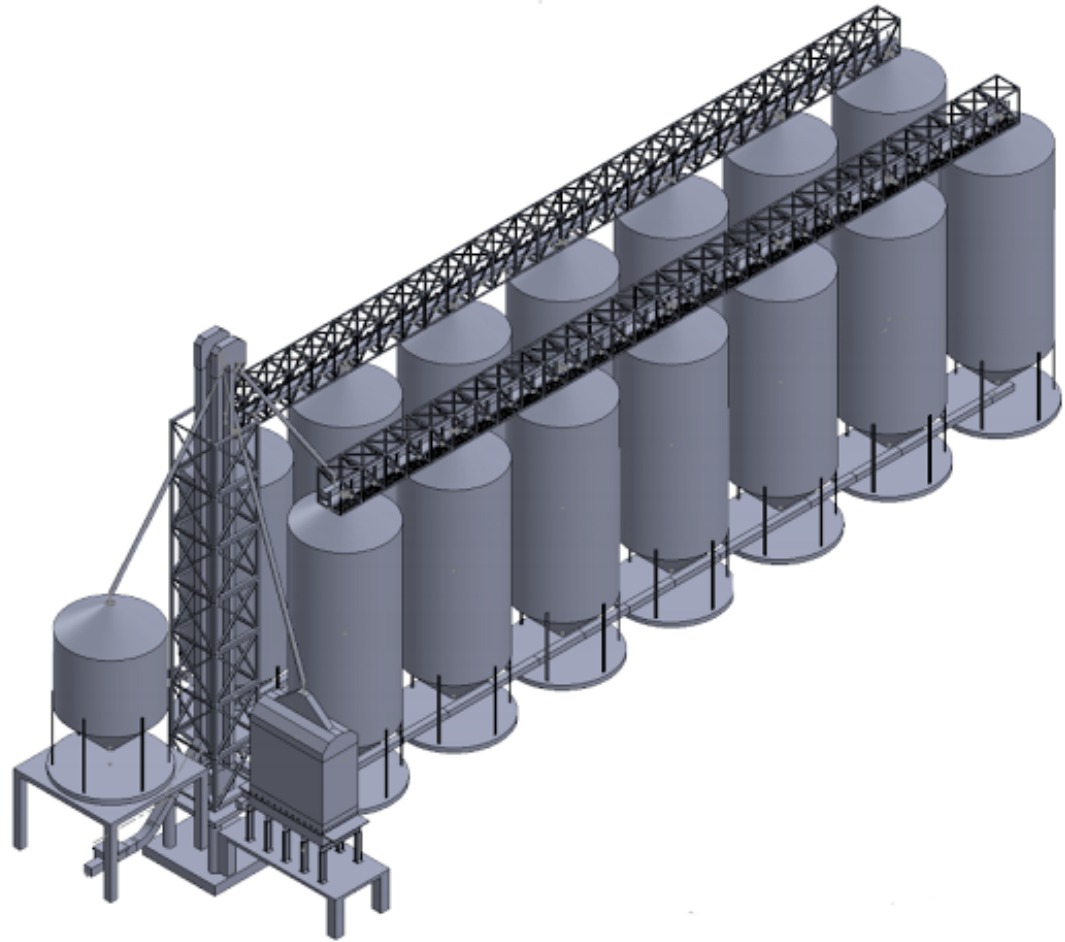
Aspiring to a Bigger Maine Organic Grain Economy: Introducing the “Field of Dreams” Grain Elevator

Aroostook County fields of OG grains are getting bigger, growers are getting better, and the major buyers of Maine grown OG grains are growing as well. In the short 1-3 year term, with continued and expected on-farm infrastructure investment as described above, the needs of the growers and the buyers can stay in sync. This can happen with the current crop of OG grain growers without additional new growers entering the scene and with no major expansions of OG production by “Conventional Potato Growers Exploring OG”.

The opening of food grade markets outside of Maine will be the event that captures the attention of the larger conventional growers and that will precipitate larger plantings of existing OG and transitional fields. A shared- use facility could accept this new potential output, and process, aggregate, store, and centrally ship.

Three key features of an Aroostook County shared-use grain elevator are:

- “No wait” quick unloading.
- Grain drying and conditioning designed for throughput and food grade quality
- Many “small” 10,000 bushel storage tanks that allow grain segregation by farm, field, grade, and variety (140,000 bushel total capacity)
- Fully automated



Capital requirements estimate

Land acquisition:	Unknown
Site work:	Unknown, dependent upon site selection
Component Costs (Equipment)	\$1.1 M
Structural Costs	0.5
System Installation	0.9
Electrical	0.25
Automation	0.4
Security, Misc. & Contingency	0.25
TOTAL INVESTMENT ESTIMATE	\$ 3.4 M

This investment summary was provided after considerable consultation with Minnesota based [Grain Handler](#). Grain Handler specializes in continuous mixed flow grain dryers. They partnered with Indiana based [RIPCO Systems](#) who specializes in the custom design, site preparation, concrete and the construction of complete grain systems. RIPCO Systems has a large team of engineers, fabricators, millwrights, electricians, and service technicians. They have considerable experience designing and building grain elevators such as the proposed system and have confidence of their investment estimate.

Possible site locations

Central Aroostook has the geographic advantage of being closest to the largest number of growers and it is where the McCain’s potato processing plant in Easton resides. In Blaine, just south of Mars Hill on Route One is a 13-acre parcel of land, formerly a truck stop,



that is paved, flat, and where 3-phase electricity is available. Asking price is \$70,000.



In Fort Fairfield, at the Tri-Community Landfill site, a combined anaerobic digester using manure from the nearby Pineland beef cattle operation and a methane recovery system at the landfill is being developed. This will result in an abundance of inexpensive electricity and a large amount of 145F waste water. The developer is looking for projects that would benefit from the inexpensive electricity. Pinelands purchases large quantities of Maine grown conventional barley and imports other grains for feed. It has significant storage and grain moving capabilities (see photo on left).

The St. John River Valley, in Northern Aroostook, at first look might not appear to be an ideal location to develop this grain elevator project. In terms of number of OG growers they are small, the northern location adds to transportation costs, and the growing season can be shorter. However, land is widely available and the costs are significantly lower than southern Aroostook. In some cases, the price can be \$2,500 per acre in Southern Aroostook and less than \$1,000 per acre in the St. John Valley.

In Madawaska, a manufacturer recently shut its door after losing a major contract. The facility features over 20,000 sq. ft. of space, 400 amp 3-phase electrical service, a fully equipped machine shop, municipal water and sewer, sits on a 10-acre parcel, and is available for \$300,000. The owner of this facility is investigating the feasibility to repurpose the facility to a large-scale malting facility. They are working with Canadian malting operators for the basic design of the facility. Sitting the grain elevator adjacent to a large-scale malting operation would have synergistic benefits.



Operator considerations

The day-to-day operational requirements of the proposed facility are fairly straight forward and require a very responsible party and proven competency in grain handling. Under a scenario where the facility is an extension of the operations of an existing farming family enterprise, there are many wise choices. For the local enterprises that are currently working with larger amounts of grain, establishing the facility at or close to their operations makes sense and the incremental cost to operate would be minor compared to a stand-alone operation.

The other consideration is how the grain being stored in the facility is sold. Is the facility purely a service for the farmers to clean, dry and store their own grains for them to market? Will the facility hold contracts with buyers and then in turn contract with growers? What should the branding strategy be? What markets will it serve? Devising a viable marketing strategy, especially one that involves the growers, could be a major impetus for the development of a shared-use facility.

Technology transfer considerations and opportunities

The Aroostook County grain elevator project is a large-scale infrastructure project that presents opportunities to transfer Aroostook County skills and technical expertise to fulfill the future infrastructure demands of our burgeoning grain economy.

There is \$250,000 of electrical work identified and there are 88 electrical motors for this project. This project also includes \$500,000 of structural work and over 600 yards of concrete. This provides the scale and breadth needed to train our local companies with state of the art components and processes that in turn can be used for future on-farm or shared-use projects.

There is \$400,000 of “automation” software budgeted for the project. This expertise largely lies within the large-scale mid-western equipment manufacturers’ capabilities. This automation software is material handling at its generic core and this software should be developed in Maine not imported from the Midwest.

The grain tanks could also be manufactured here in Maine. A separate manufacturing operation could be investigated. With an initial “order” of the 14-tanks as represented by this grain elevator, there is the potential manufacturing a higher-quality welded smooth walled tank on-site rather than purchasing and transporting the long distance of the usual corrugated tank. Smooth walled tanks are easier to clean and provide surfaces that are free of trapped materials. This is more important for the food grade grain that our growers are focusing on and may become more important as projected new food safety policies are put in place.

Basic Economics

Given the current size of the Maine OG grain economy, the basic economics of a \$3.4 millions dollar grain elevator is challenging. Assuming a high charge to the grower of \$1.00 per bushel to clean, dry and store a season’s crop and assuming the facility could turnover the total 140,000 bushel inventory 1.5 times for a total of 200,000 bushels of grain being processed per year, that would only realize a total of \$200,000 revenue for the facility. The cost to pay back this \$3.4 million of capital at 3% over 20 years is slightly more than \$200,000 annually. There will be utilities, insurance, and operational costs in addition to the cost of capital. Depending upon the organizational model, there may also be the cost to operate a marketing and selling operation. Doubling the size of the 14 tanks from 10,000 bushels to 20,000 bushels would not add a significant amount to the total investment and would potentially double the revenue opportunity. However, at the proposed 10,000 bushel tank size, there would be an achievable and realistic challenge to fill these sized tanks and 20,000 bushel tanks, at this time, are too large to consider.

Possible Path to a Grain Elevator

Although the economics of building the complete facility at once is suspect, there is a sensible approach to building the facility over time. Investing in good unloading and drying capabilities and starting with fewer storage tanks with little to no automation could be attractive. This approach would allow for a low initial capital investment while affording time to establish marketing and selling opportunities.

Another scenario that would make the investment for the complete facility more attractive would be if it was attached to a large-scale value-added grain-based operation that would serve as an “anchor” tenant for the facility.

A large scale facility with an “anchor” tenant as the primary user of the elevator may allow for an environment where, with only minimal incremental costs, the anchor tenant is able to handle the needs to process and ship small grain and pulse crops grown by the other users of the elevator.

The initial thought and design for the full grain elevator facility was for it to handle certified organic grains only. Concurrently processing conventional and OG grains can be problematic as one must have systems in place to assure the integrity of the organic designation and that no cross-contamination occurs. However, given the relatively small scale of our current OG grain economy, leveraging the needs of conventional

growers makes sense to investigate. With the opportunity to develop a state-of-the-art facility with significant automation capabilities, a mixed conventional and OG facility is possible and might provide the scale necessary to make better economic sense of the project.

Barriers to Success for the Continued growth of Maine's Grain economy

Soil Health and Rotation Challenges

Crop rotation is the practice of growing a series of diverse types of crops in the same area in sequenced seasons. It is done so that the soil is not used for only one set of nutrients and to break a disease cycle. Developing the correct and most beneficial rotational system including small grains is a constant work in progress and warrants additional and continued research.

Organic potato production is typically on a 3 or optimally a 4+-year rotation. Conventional growers, until recently have employed a 2-year rotational scheme but are now moving to a more soil-healthy 3-year rotation. In 2015, the Maine Potato Board hired organic grain grower Jake Dyer to research new rotational crops to assist with the transition to this longer 3-year rotation. Although most of the work is done for their conventional growing members, Jake's work is valuable and relevant for organic growers as well.

Sustainable Nitrogen Sources

Until recently, Aroostook County certified organic farmers have had available a cheap source of nitrogen in the form of chicken litter from a close-by large-scale New Brunswick based chicken plant. The chicken litter was considered a waste product and was available inexpensively as the plant is close by in New Brunswick. The plant now dries the manure and converts it to a shelf-stable pellet product whose cost is significantly higher. Conversations about how to solve the nitrogen problem have also included discussion of how best to access manure from animal production and revival of composting operations. Securing a reliable source of cost-effective nitrogen is a major challenge for Aroostook County growers.

Growing legumes is potentially a solution for a new rotational cash crop and one that affixes nitrogen. Research projects are being proposed for other "grow your own nitrogen solutions" including growing soybeans and, manufacturing soymeal, no-till practices, and [mob-grazing](#).

Climate Change

Climate change is a hot topic today, especially in agriculture and natural resources areas and industries. In fact, a collaboration between the Union of Concerned Scientists (UCS) and a team of more than fifty independent experts developed a collaboration called the [Northeast Climate Impacts Assessment \(NECIA\)](#) which has a great deal of research and resources available on the subject. There have been [studies](#) on impacts to Atlantic cod, ozone effects, changes to suitable tree species, and many other industry-specific research papers relating to the science behind climate change.¹⁴ Maine Organic agriculture is no exception and may in fact experience a great deal of positive and negative outcomes as a result of climate change.

Opportunities:

If warming of the climate expands the growing season for Maine, particularly for the large tracts of land situated in Aroostook County, and the viability of longer season crops improves, there will be new opportunities for growers. Many conventional growers have already started growing crops such as soybeans and corn (and a resurgence in wheat), which historically have not done well with our short season. Some are finding success.

¹⁴ Confronting Climate Change in the U.S. Northeast. (n.d.). Retrieved November 30, 2017, from http://www.ucsusa.org/global_warming/science_and_impacts/impacts/northeast-climate-impacts.html#.WiAUekqnE2x

Maine is situated in close proximity to northeast population centers with rising demand for OG products. This may bode well as land costs are generally low, relative to other Northeastern US states (i.e., New York or Pennsylvania). Growers in that area may find it more difficult to produce crops organically due to climate change vs. Maine and our region.

Heat stress is a concern for dairy cows and other livestock, so rising temperatures in other major areas may cause producers to look to Maine for more moderate temperatures. This could create new demand for OG grains and other OG products.

Climate change may affect the availability of OG grains and feed from other growing regions and may make it more attractive (affordable) to produce these in Maine and our neighboring growing regions, vs. importing them from other areas.

Barriers (challenges):

If warming of the climate causes Maine winters to be more moderate, there is concern about pest issues that pose new threats to the OG producers. For example, certain insects do not survive well in our harsh freezing temperatures which is advantageous to an OG production system where synthetic pesticides are not permitted.

Warming temperatures also may cause disease issues to arise in the production systems for OG Grains and other crops and livestock due to better survival of the pathogens.

There is a concern that rainfall and drought risks (volatility) may rise due to climate change, as with conventional agriculture, these both pose serious threats and challenges to OG production in Maine and the Northeast US.

Temperature and precipitation are critical determinants of weed populations and the distribution of vegetative plants. Increased weed pressures may challenge OG production of Grains as a result.

Financial Literacy

One of the findings of this project is the recognition of a need for a greater number of tools and increased knowledge in assessing financial outcomes associated with farming enterprises. In some cases, a solid understanding of costs is not achieved. The consequence of not accurately assessing costs is that products may not be priced in a way that fully accounts for all operating and capital expenses.

It has also been noted that some farmers need to communicate with their customers better and more fully develop basic marketing and selling skills.

To address these challenges Maine Farmland Trust and the Maine Grain Alliance have partnered to develop a 3-day workshop entitled “How to Compete in Maine’s Grain Economy” that will be held in January of 2018 in Presque Isle. The workshops will cost \$500. However, up to 20 hours of Technical Assistance will be made available per farm and upon completion of the program, registration will be reimbursed plus \$500 from Maine Farmland Trust, totaling a \$1,000, will be awarded as a seed grant for each participating farm.

Farm Service Agency (FSA), Farm Credit East, and UMaine Cooperative Extension also conduct financial and business skill seminars that are being advertised and promoted among the Aroostook County OG growers.

Sufficient Gross Margins and UMaine Organic Grain Modeling Efforts

Organic Grain economic modeling efforts led by UMaine economics professor, Dr. Aaron Hoshide have highlighted the lack of adequate gross margins that are necessary to fund and maintain the capital investments needed for the long-term viability of a farming enterprise.

A major conclusion of the 2016 report: Planting New Ground - Organic Grain Market Analysis: Aroostook County & Western New Brunswick as stated in the very first paragraph: “*The primary reason is that the*

market does not generate the profits necessary to entice producers to plant significant new ground in an organic production system, or transition from conventional to organic, when evaluating grain enterprises.”

This “lack of profitability” view is widely held, especially with the conventional potato growers that are exploring OG grain production. They may feel this way as a holdover point-of-view from their conventional grain market experiences, and the perceived, often true but not well measured, extra costs of organic production that are not off-set by the OG price premium. These growers have the infrastructure from their conventional operations to inexpensively, with only small incremental costs, grow grains on their small (dozen of acres) immediately OG certifiably fields. This gets them “in-the-game” without a major commitment. They are poised to increase production, but have no compelling reason to do so yet.

The dedicated OG grain growers who do not grow potatoes, believe that sufficient gross margins can be obtained at a certain larger scale that they aspire to.

Additional modeling efforts have been undertaken by Dr. Hoshide in 2017 to refine the original work and to test the new model with additional test (beta) sites using actual data from Aroostook County grain growers. The model is also being improved to better take into account actual realized pricing rather than commodity based pricing that the first versions were based upon. The first “beta” site to be developed using the upgraded model is scheduled for December 2017.

[Maine Farmland Trust](#) is also developing enterprise costing models and are seeking funding for a major upgrade of their current fairly simplistic models. Their goal is to develop an interview style questioning front-end module whose answers will populate their costing module to model an entire farming enterprise.

Access to Capital

In general, with exceptions, the dedicated certified organic grain growers do not have good access to capital and are challenged to fund needed on-farm capital improvements such as the cleaning, drying and grain moving equipment discussed in this report.

The potato growers, however, generally do have good access to capital and choose not to invest because of relatively small size of opportunity and perceived low gross margins.

Additional Recommendations and next steps.

Demand for organic grains nationwide is growing and businesses large and small are asking Maine to play a prominent role in increasing production. One important reason the acreage and quality of certified organic grains grown in Aroostook County has been rising is due to the demand created by Maine's emerging mills and craft breweries. To continue this growth of Maine's organic grain economy, assuring that the existing buyers of Maine grown organic grain have the supply they need for their continued growth is paramount. The good news is that the existing certified organic small grain farmers have the wherewithal, capabilities and desire to grow and continue to meet this demand

They will benefit and have a better chance of success with acting upon and following up on these recommendations:

Investment in Climate Adapted Grain Storage & Drying on Small & Mid Sized Farms

By using innovative technologies specially adapted to the northeastern climate, this Maine Grain Alliance (MGA) project has addressed the critical need for appropriately scaled drying and storage infrastructure. Designing up to four strategically placed facilities for the drying, cleaning, and storing of certified organic grains is a central focus of this project. There are at least three cases where additional on-farm infrastructure is currently being developed and more being planned, that could functionally serve the need to be able to segregate grains by type, variety, and grade which allows a farmer to market their crops to the highest and best use (seed, food, and malting), maximizing farm revenue. Three farms with the desire to achieve this goal are Lakeshore Farms, Aurora Mills and Farm, and Haymart. These three site may also be candidates for a shared-use storage scenario should the farms decide that the benefits of such a facility outweigh the difficulties. The locations of these sites would encompass both northern and southern Aroostook County.

As production continues to increase, many more organic producers will seek technologically advanced solutions for monitoring moisture, humidity, and temperature to alleviate the risk of spoilage and costly inventory losses. This report's findings and cost assessments can serve as an entry point in to the exploration of on-farm post harvest and drying infrastructure.

Understand costs better and adjust prices accordingly.

Aroostook County growers do not have the scale to compete based on price. What they do have is a compelling story of being an integral part of the rebirth of Maine's local grain economy. Millers, maltsters, and bakers are growing their businesses based on this story and need growers to be profitable and sustainable in the long term for them to also be successful. Growers too often accept the price buyers are offering because they do not possess an understanding of all their costs to ask for a higher price or to confirm that the price offered contributes to the viability and sustainability of their enterprise.

Improve communications between buyers and growers.

Buyers are getting better understanding the specifications they require to produce quality products using Maine grown organic grain. Both buyers and growers are still learning and it is a work-in-process. Growers need to communicate with buyers better to understand what is required and better communicate their capabilities.

A lot can happen with a crop that is planned in the winter, planted in spring, then nurtured, harvested, dried and cleaned, to finally ready to be shipped, starting in the fall. Better and honest communications about the quality and quantity of grain available is required for continued success.

Transition to more formal contractual arrangements between buyers and growers.

There has been great trust built between buyers and growers over these formative years, and verbal understandings to purchase grain have suited both buyer and grower well. Now that variety and quality specifications are better known as well as volumes needed are better understood, more formal contracts will suit both grower and buyer well.

Build up inventory and supply grain year-round.

In most cases, growers desire to sell all their grain as soon as possible after harvest. This has led to some shortages and un-met demand prior to harvest of the new crop. Limited supply has had some benefits for the buyers as well as they grow their customer base and understand their needs better. Developing an ample year-round supply of grain will be helped with more formal contractual agreements, and better infrastructure, starting with basic storage, is needed.

As been noted, we may be due for a wet season where quality and volumes could be seriously reduced resulting in a shortfall. Ideally, there is up to a season's worth of grain in storage to assure continuous supply throughout the year, to account for continued fast growth, and for the inevitable bad year's crop.

Facilitate access to capital.

There is a wide divide between growers with regards to their ability to access the capital necessary to make critical infrastructure and equipment investments. In some cases, the most dedicated grain growers have the least access to capital. Exposing these growers to opportunities for grant funding, patient capital, and government loan programs, and assisting them through the process to obtain financing will be important so these growers are not left behind.

Access markets outside of Maine.

There are significantly larger markets for certified organic small grains outside of Maine that need to be investigated and better understood. These markets tend to be more mature and require volume and quality specifications that are currently difficult for Maine's growers to meet. Aroostook County growers having successfully met the challenge presented by Maine's new mills and malhousers, are poised to take the next step and start acquiring customers outside of Maine.

Leverage the scale of conventional growers.

There are examples in Aroostook County of large-scale (1,000+ acres) conventional growers that are also focusing on higher-value food grade small grain markets. These conventional growers are investing in post-harvest infrastructure on scale that is ahead of the organic growers. As certified organic growers begin to reach this scale they can learn from these operations to help them make more-informed and less-risky capital investments.

Because of the scale offered by conventional growers, investigating a shared- use facility where both conventional and certified organic grain is processed, stored, and shipped makes sense. The added cost and complexity of assuring the integrity of the certified organic designation is made less problematic with modern, state-of-the-art equipment.

[Focus Maine](#) is a new state-wide organization whose purpose is to strengthen and revitalize opportunity and prosperity in Maine by accelerating the creation of quality jobs within a few select, traded sectors that have high growth potential. Maine agriculture is one of the "traded sectors" they are focusing on and a significant value chain and market access project of "Potato Rotations and Grains" is commencing starting December 2017. This will be an ideal opportunity to advance the work of this study. The Maine Grain Alliance, Maine Brewers Guild, and the Maine Potato Board are all participating in the project.