The EASTERN BROCCOLI MARKET

Opportunity Assessment for New York State

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Produced by: Eastern Broccoli Project
Hudson Valley AgriBusiness Development Corporation
Red Tomato

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Is there an opportunity for New York growers and marketers to **invest in broccoli** production and distribution as a way to **diversify and strengthen** their businesses, while adding jobs, dollars, and resilience to the economy and to rural communities?

The Farm Manager at Bauman Farms in Webster, NY stands among a broccoli variety trial managed by CCE Cornell Vegetable Program in 2019. Photo by Christy Hoepting, CCE Cornell Vegetable Program

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About This Report

Project Support: A Collaboration of Three Organizations

This study was made possible by an initiative of the Hudson Valley AgriBusiness Development Corporation (HVADC). It was conducted under the umbrella of the Eastern Broccoli Project, with funding from Empire State Development and in-kind contributions from the 3 partner organizations.

Eastern Broccoli Project

The Eastern Broccoli Project (EBP), based at Cornell University, is completing the final year of a 10-year multi-institution research effort funded by the Specialty Crop Research Initiative (SCRI) of the USDA. The project seeks to create a reliable, high-quality, year-round supply of Eastern-grown broccoli. The project, led by Dr. Thomas Björkman of Cornell University, has 4 objectives:

1. Bring to market new broccoli cultivars seed, developed in the first 5 years of this project, that are much better adapted to Eastern U.S. growing conditions.
2. Introduce new breeding tools and create germplasm, even better than today's best, to produce broccoli hybrids with the adaptation, quality, and productivity to keep the crop competitive into the future.
3. Develop a large grower base that can reliably supply quality Eastern-grown broccoli to Eastern buyers and consumers. Project Extension staff provide production, postharvest, and food safety support.
4. Enhance distribution channels for regional fresh produce and overcome barriers to increased distribution of Eastern-grown broccoli that have not resolved in the private sector (EBP, 2020).

Hudson Valley AgriBusiness Development Corporation

The Hudson Valley AgriBusiness Development Corporation (HVADC) is a not-for-profit organization with offices in Hudson, NY. It is the region's sole economic development agency with a specific focus on the viability of the agricultural economy in the Hudson Valley. It assists both new and existing agri-businesses, such as farms, food businesses, and food distributors, by providing technical and business consultation and supporting policies and regulations that recognize and support New York's agricultural economy. HVADC promotes balanced, market-based solutions that lead to enhanced agricultural entrepreneurship, rural economic growth, and community enhancement.

Red Tomato

Red Tomato is a non-profit food hub serving wholesale fruit and vegetable growers in the greater Northeast by bringing fresh, locally grown produce to supermarkets and institutions. Red Tomato also consults widely with growers and organizations working to strengthen the place of midsize fruit and vegetable growers in the food system.

Executive Summary

Introduction, Methology, Findings, and Recommendations

Is there an opportunity for New York growers and marketers to invest in broccoli production and distribution as a way to diversify and strengthen their businesses, while adding jobs, dollars, and resilience to the economy and to rural communities?

A Sneak Peek: What Can New York Do?

It is a favorable time for the Eastern U.S. broccoli sector, already $75-100 million, to grow significantly beyond that size. And there is an opportunity for New York growers and marketers, who currently claim a small share of today's Eastern broccoli, to play a much stronger role in the sector's expansion.

The opportunity we are exploring in this report—an increasingly strong role for New York growers and marketers in an overall expansion of an Eastern broccoli sector—is being *shaped* largely by external factors that are making imported broccoli more difficult and expensive to produce and distribute. That, in combination with growing demand for locally grown produce, is opening more space for Eastern broccoli. This change could lead to significant job creation and economic development for rural communities in New York. Efforts to take advantage of this opportunity will be *driven* by broccoli entrepreneurs (growers and marketers) who have secure, committed customers.

Broccoli entrepreneurs with committed customer relationships, or at least with good prospects for developing them, can go on to assess other risk factors and search for ways to overcome the obstacles that stand in the way of their success. This is where New York agencies and institutions can step in and make a critical difference. New York agencies and institutions can:

- Help growers in their search for reliable customers.
- Provide critical financial resources for icing infrastructure or cooperative/collaborative development.
- Provide financial and business planning support.
- Provide technical assistance needed for production, processing, and marketing of high-quality broccoli.

One particular collaborative venture for local frozen broccoli is developing in Maine, led by the Good Shepherd Food Bank. We believe this project is ripe for partnership with New York growers and marketers.

The large number of urban and suburban New York consumers, especially in New York City, who seek out locally grown produce are a force to be reckoned with. Farmers who sell broccoli directly to consumers at farmers markets, farm stands, and community supported agriculture (CSAs), and midsize wholesale growers who sell broccoli to nearby stores, schools, and restaurants, are the ones reaching this receptive urban and suburban market. While the impact these growers make toward job creation and economic development is limited by their cumulative scale, we recognize their important role in creating consumer awareness and appreciation for locally grown broccoli. These growers' efforts to diversify their production and marketing by adding broccoli to their crop mix are also worthy of New York agency and institutional support.

Introduction

The Eastern Broccoli Market Opportunity Assessment project focused on the obstacles and the bottlenecks that stand in the way of a brighter broccoli future for New York. The project began in January 2020 and concluded in March 2021. The study was conducted under the cloud of COVID-19. However, the horrible circumstances of the pandemic had little impact on the findings and recommendations.

Methodology

Most of the 30 farmers and stakeholders in the regional food system were interviewed once for 30-60 minutes. We returned to several participants a second and third time in search of more data and to test our emerging ideas. Most interviewees were growers or produce buyers.

A probing/investigative/conversational interview style was used rather than a traditional fixed survey approach in which all respondents answer the same set of questions. After establishing a person's background and their experience growing or buying/selling broccoli, we drilled down to understand the obstacles and bottlenecks they overcame or were unable to overcome as they tried to grow more broccoli, and/or buy and sell more local broccoli. In some cases, we probed why they decided to cut back or get out of it altogether. Throughout the 15-month process, the research approach, interview results, and the findings were reviewed by a wider team of people representing all 3 partner organizations: Cornell University's Eastern Broccoli Project, Hudson Valley AgriBusiness Development Corporation, and Red Tomato. A full list of those interviewed for this study appears in Appendix A: Study Participants, Interviewees, and Other Contributors.

Given the conversational nature of the interviews, and that this was qualitative research as opposed to quantitative research, much of the final report is written with a similar flow and style. The research and writing team included Michael Rozyne of Red Tomato (Project Manager), Cheryl Bilinski of the Eastern Broccoli Project, Alessandra Cancalosi of Red Tomato, and Susannah Hinman of Red Tomato.

Findings

Obstacles—Major Limiting Factors

Natural Conditions

Natural conditions favor production of broccoli in the West over production in the East. Insect and disease pressure is considerably lower in the West, making yields much higher. Eastern summers can be so hot and humid, making continuous harvest and year-round supply a far greater challenge. New heat-tolerant Eastern varieties developed by the Eastern Broccoli Project are only beginning to even the playing field.

Organic Risk Factors

For some growers, and definitely not all, there are agronomic, pest management, labor management, and cost factors that make large-scale organic broccoli production in the East too risky, expensive, and inconsistent.

Cost/Price Squeeze

Agricultural input costs rise steadily over time while the wholesale prices paid to farmers remain more or less level. Labor shortages and New York's new farm labor law are top of mind right now for many growers who fear that overtime pay requirements will significantly add to their total costs for a labor-intensive crop such as broccoli.

Scale of Production

Even with icing infrastructure in place (listed below as a bottleneck), it likely takes hundreds of acres to produce profitably at current wholesale commodity prices ($12-16 Freight on Board). The only apparent wholesale alternative is to produce a much smaller volume (1-20 acres) that can be sold nearby to independent stores, distributors, and institutions that will market it as farm-identified, locally grown, and be able to pay over $20 per case.

Lack of Consumer Awareness About the Local Broccoli Option

There is less consumer awareness or demand specifically for local or Eastern broccoli than there is for local corn, tomatoes, peaches, summer squash, etc. So, while consumers are open to it, they're not looking for it. And retailers seem less willing to pay extra for it.

Bottlenecks—Obstacles So Great, They Bring the Whole System to a Grinding Halt

A Secure Market to Motivate Infrastructure Investment

This bottleneck is about having (or not having) a reliable and secure large market or customer base that gives a farmer or marketer sufficient confidence to acquire and invest the capital needed to own or access the infrastructure and technology for icing, cooling, and packing broccoli to the standard that customers require. The market comes first. The investment follows, enabling the icing for the broccoli.

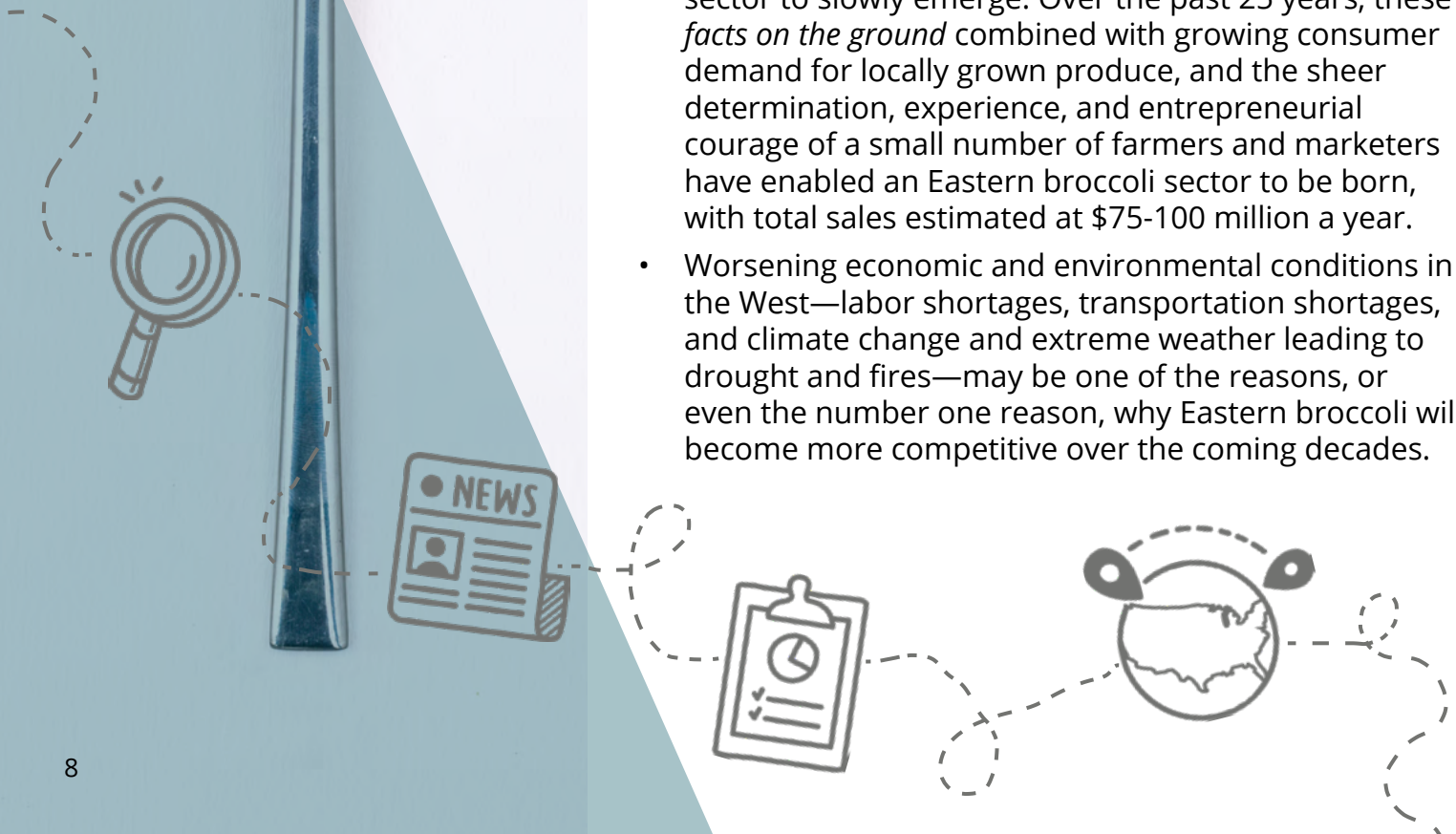
Frozen Processing Infrastructure and Capacity Limitations

There is a mismatch between the scale of broccoli production available in New York and most of the East, and the scale and operating efficiency of frozen vegetable processors who would be able to produce high-quality large volumes of competitively-priced broccoli that could supply institutions and retailers. The frozen local broccoli that has reached the farm-to-institution markets in the past decade has been manufactured at small-scale and sold at well above competitive prices, made possible by the determination and hard work of small companies and the unusually strong interest and willingness of institutional customers.

Other Considerations

To understand and assess the broccoli opportunity facing New York growers and marketers, it's helpful to consider the following:

- Demand is strong. Broccoli is popular, even among kids. It's the 6th most popular vegetable consumed in the United States. Per capita consumption of fresh broccoli has increased from 0.5 pounds in 1970 to 5.7 pounds in 2019 (USDA ERS, 2020).
- Local food fans living and shopping in the East have to search hard to find locally grown broccoli. Ninety percent of U.S. fresh broccoli comes from the West.
- Precious little broccoli is grown in New York, maybe 1,000 acres (compared against New York's production of 28,000 acres of sweet corn). Even a major vegetable-producing county such as Orange County had but 36 acres of broccoli in production on 22 farms in 2017 (USDA Census of Agriculture, 2017).
- There's a cloud over fruit and vegetable farms in America, especially the farms that are wholesaling at global commodity prices—a cost/price squeeze exists. While the cost of all agricultural inputs rises steadily, the wholesale price growers receive remains more or less constant. This cost/price squeeze impacts everything.
- Three thousand miles, 4 days on a truck, and thousands of dollars in transportation costs provided space and motivation for an Eastern fresh broccoli sector to slowly emerge. Over the past 25 years, these *facts on the ground* combined with growing consumer demand for locally grown produce, and the sheer determination, experience, and entrepreneurial courage of a small number of farmers and marketers have enabled an Eastern broccoli sector to be born, with total sales estimated at $75-100 million a year.
- Worsening economic and environmental conditions in the West—labor shortages, transportation shortages, and climate change and extreme weather leading to drought and fires—may be one of the reasons, or even the number one reason, why Eastern broccoli will become more competitive over the coming decades.



The threats to Western broccoli production suggest a large opportunity for Eastern growers to capture a larger share of the broccoli marketplace.

That is, if:

- Eastern growing conditions and varieties enable efficient production with high enough yields.
- Eastern growers can perform the necessary post-harvest work and meet the quality requirements.
- There is investment capital available and sufficient market demand to give Eastern growers and packers confidence to take on the risk.
- The availability of farm labor, and the overall regulatory climate, is favorable enough to Eastern growers.
- Marketers are able to construct supply chains that are reliable, continuous, able to deliver consistent quality, and competitive against year-round Western-based supply chains.

The wholesale side of broccoli production and marketing is prioritized in this report because it is the path to scale, and scale is what leads to the most jobs and investment in rural communities.

Before diving into a description of the wholesale broccoli deal, we call out the importance of direct-to-consumer sales and marketing—selling local broccoli in farmers markets, CSAs, and at farm stands. The explosion of direct-to-consumer co-marketing in this century is, indeed, among the most important of trends changing how the public sees and experiences farmers and local food. It puts a spotlight on locally grown produce like never before.

The version of wholesaling that is closest to direct-to-consumer marketing is when a farm delivers directly to a store, manufacturer, restaurant, or institution—what is often referred to as direct store door or direct store delivery (DSD), or farm-to-school or farm-to-institution (colleges, hospitals, business cafeterias). This is the version of wholesaling that Hudson Valley growers prefer. Located near urban and suburban populations, Hudson Valley growers, large and small, organic and conventional, choose smaller plantings of broccoli (1-20 acres) that they can deliver for prices well above the going commodity price of $12-16 per case.

The wholesale deal that feeds fresh broccoli to most Americans delivers full truckloads to distribution centers and to regional produce distributors, who then bring it to supermarkets, restaurants, and institutions. We refer to it as a *deal* because that's the common language of the growers and buyers who set up and manage these transactions.

A wholesale produce deal is made possible by some fundamental conditions: a viable crop; harvest and post-harvest handling; market and transportation relationships that move the product from farm to customer in a timely manner, at a satisfactory price, with sufficient transparency; and steady demand, consumers who want the product, repeatedly. The absence or failure of any one of them is sufficient to prevent the whole deal from happening.

Many of the conditions required for a successful broccoli deal would be the same conditions required by other fresh vegetable deals. However, there's one requirement—an expensive one—that is unique to broccoli: icing.

Broccoli has the highest respiration rate of any vegetable. Field heat must be removed immediately upon harvest, and then the product requires consistent cold temperatures near freezing. Two common ways to remove field heat from broccoli are hydrocooling (using cold water) or vacuum cooling (by vaporizing water), or the 2 processes combined. Most retail broccoli customers require that incoming broccoli be iced. Sean McFadden of Parker Farms, states: "A lot of people can grow good broccoli—that's not the hard part. Icing technology is the barrier to being successful or not in the broccoli business."

Nevertheless, there are definitely examples of major customers such as Baldor's in New York City who accept or even prefer iceless broccoli that has been hydrocooled.

Top icing is a simpler, affordable solution for growers farming broccoli at a smaller scale, though labor intensive. They manufacture ice cubes or purchase ice in bags, then throw the ice on top of the broccoli.

Slush icing is state of the art. Water and ice are mixed together in a slurry which is injected inside each box. Each box is filled with up to 15-20 pounds of ice. New York's largest broccoli grower, Kludt Farms, uses a machine called a Clamsheller, consuming 70 tons of ice per day. A modern ice slushing machine will cost hundreds of thousands of dollars. Dave Walczak of Eden Valley Growers (EVG), reports: "With the ice slusher, we got rid of the labor. One guy, in a half an hour, can do the work it took 8 to 10 guys to do in an hour." EVG's investment in icing technology had a $500,000 price tag on it.

New York does not have much land dedicated to broccoli production—around 1,000 acres is estimated. Some growers have cut back, some have exited entirely, and one new entrant has become the largest producer in the state.

- W.D. Henry & Sons, a diversified midsize vegetable farm in the Eden Valley region of Western New York, gave up on broccoli in 2020. At peak, they had 200 acres planted. A partnership with their processor/icer, the produce cooperative Eden Valley Growers, made the project possible. Bacterial head rot, exacerbated by cool, wet field conditions, was one reason they quit. But according to Dan Henry: "The high cost of labor was definitely the straw that broke the camel's back."
- The Hudson Valley Farm Hub, a research, training, and education non-profit farm in Hurley, NY, gave up hope of a continuous broccoli harvest June to Thanksgiving because of extreme summer heat. However, it maintains 6 acres as an important part of its 30-acre vegetable plantings, with spring and fall harvests.
- The Davenports in Stone Ridge, NY who trace their farming roots back to the 1840s, downsized a large broccoli venture—their father, at one time, had 400 acres planted for a supermarket chain—to a manageable 8 acres today, most of it harvested in fall.
- Matt Kludt, on the other hand, is full-on bullish about broccoli, growing 600 acres of broccoli on his family's 10,000 acres of productive land in Kendall, NY. Kludt spent $2 million on a packing facility, and over half a million on state-of-the-art icing equipment, called a Clamsheller, known to be the ideal icing machine for the retail market. Matt Kludt can be bullish on broccoli because he has committed customers—made secure by his quality product, attentive farm management, and close relationship with his broker/marketer Parker Farms—as secure as a market can be in times of climate change and rapid market concentration.

- To achieve year-round supply for customers, Sean McFadden of Parker Farms sources from New York, Pennsylvania, and Virginia during the northern summer and fall, moving to North Carolina in late October, Georgia in November through January, and Florida for winter production until cold weather gets in the way. Parker Farms does 40-50 loads of broccoli per week destined almost entirely to major retailers.

New York has a controversial new farm labor law. Richard Stup, Cornell's Agricultural Workforce Specialist, served as our *tour guide* for the 2019 Farm Laborers Fair Labor Practices Act. He named the 3 significant changes that characterize the legislation: (1) overtime pay for work after 60 hours per week; (2) mandatory day of rest (or time-and-a-half pay); and (3) collective bargaining. The overtime clause is where *the rub* exists. Growers fear that 60 hours will turn into 40 hours.

Mary Jo Dudley is Director of the Cornell University Farmworker program. She sees this moment as a missed opportunity: "Farmworkers see themselves as professionals. They take great pride in their work. There's an opportunity to make our farms places where farmworkers want to work; we could build a reputation for New York farms as... the best farms to work on." Richard Stup says that approach could have an economic impact.

Broccoli appears to be a profitable and worthwhile crop for small-scale farms who market directly to consumers to include in their diversified crop mix. Larger wholesale vegetable growers, like many in the Hudson Valley, who include broccoli as a small part of their total planting—in the range of 1-20 acres of broccoli—can deliver directly to stores, restaurants, and institutions and earn a high enough price to make the venture worthwhile. That leaves a rather substantial gap between a 1-20 acre planting and the many hundreds of acres of broccoli that a Kludt Brothers Farm has in the ground. *Is there any opportunity for a midsize wholesale broccoli grower?*

Eastern broccoli, it turns out, is a classic *Ag-of-the-Middle* story. Ag-of-the-Middle is an analytical framework developed by social scientists for explaining how and why midsize farmers in the U.S.—farmers who farm half the nation's farmland—are increasingly not competitive when it comes to supplying supermarket retailers, food manufacturers, and the institutional food sector. The framework goes like this:

- Small farmers, who sell direct to consumers at a farmers market, roadside stand, or CSA, are able to differentiate their products and earn a retail price. For example, local broccoli at an Eastern farmers market typically sells for $3-4 per pound.
- The largest growers succeed because they achieve efficiencies of scale. Farmgate Freight on Board (FOB) prices for wholesale Eastern broccoli sold to the largest customers for an average price of $12-16 per case or $0.50-0.67 per pound.
- Midsize farms—the farms of the middle—sell wholesale undifferentiated products for a price at or near the going commodity level. They are not large enough to benefit fully from scale efficiencies. And their product appears the same as all other broccoli. They are, indeed, stuck in the middle.

What are the real opportunities for New York farmers and marketers for investment in broccoli production and distribution?

How can obstacles to success be overcome and profound bottlenecks be solved?

How might the continued development of an Eastern broccoli sector contribute jobs, dollars, and resilience to New York farms and rural communities?

Recommendations

This study identified 4 major opportunities for expanding broccoli production and distribution in New York that are worthy of serious consideration.

Recommendation A: Expanding Large-Scale Commodity Production

The simplest path, and the quickest path, to more Eastern broccoli is expanding the production and volume that currently feeds the Eastern supply chains that already exist, those of Parker Farms, Hapco Farms, and Smith's Farm of Maine, which compete directly against Western supply chains.

The next quickest path would be for one of the experienced vegetable brokers or distributors to develop new broccoli sources and supply chains that mimic the existing ones. If there's anything simple and quick about expanding the scale of these 3 supply chains, it's only because they have been battle tested by 3 companies whose trial and error over decades taught them how to be competitive under Eastern conditions. New potential sources include:

- Participating growers could plant more acreage.
- New growers could be recruited. They would have to be connected to existing icing infrastructure, or be willing and able to make an investment in new icing infrastructure on their own.

Organic Opportunity

At whatever scale is possible, there is a great opportunity to produce and market more Eastern organic broccoli. Richard Thorpe, Regional Produce & Floral Procurement Leader, Whole Foods Markets--Northeast/North Atlantic regions, stated that the chain buys and sells more organic broccoli than conventional, with approximately 50-60 percent of it sourced from Eastern growers.

We also heard cautionary tales, reminders of why organic broccoli is hard to get to market, at least profitably. Nevertheless, customers are hungry for more organic and they remain encouraging.

Recommendation B: Cooperative Broccoli

New York has the right growers: vegetable farmers with the talent, knowledge, and experience to grow high-quality broccoli. While Hudson Valley growers say they have better options and would be unlikely to consider a large investment in broccoli, Upstate growers have sufficient land, and express more willingness to consider broccoli at a significant scale. For these Upstate growers, the most serious obstacles are access to affordable icing technology, investment capital, and reliable wholesale markets.

A cooperative or collaborative approach to icing, packing, and marketing holds promise, at least in theory. The scenario could involve a cluster of vegetable farmers in the same growing region who make a combined commitment to grow several hundred acres of broccoli. The processing infrastructure—icing, cooling, pack line, and packaging materials—would be centralized at a co-owned facility, or at a lead grower's facility. The financial arrangement among growers would depend upon how the venture is structured.

A caution: without strong visionary leadership and management, and without a brand-driven or mission-driven culture in place, too often co-ops end up serving the narrower interests of the largest or loudest members. Nevertheless, a cooperative or collaborative approach to broccoli processing and marketing is one of the logical ways to overcome the high cost that individual growers are not willing to risk on their own.

Recommendation C: Blended Supply Chains—If You Can't Beat 'Em, Join 'Em

This recommendation entails an avenue of informal cooperation or collaboration; a way of including product from midsize growers who farm close to the intended customers. By integrating product from both midsize wholesale growers and large-scale ones into a single supply chain, a marketer (distributor, food hub, or broker) is able to provide a customer with a familiar ultra-local farm product and story, a more competitive overall blended price, a longer selling season, and greater total volume of product.

To show how the blended supply chain works, we offer 2 detailed examples:

1. Headwater Food Hub's (Ontario, NY) use of a blended supply chain to address logistical and financial inefficiencies in their broccoli program with institutional and retail customers. Silas Conroy, Director of Supply Chain for Headwater, goes on to demonstrate why paying 2 growers a different price for nearly the same product at the same time of year, with transparency all around, can be a winning and necessary strategy for all involved.
2. In our second example, a fictitious model based on real circumstances, real companies, and real prices, a food hub in the Eastern U.S. is supplying local broccoli and other vegetables as part of a direct store delivery (DSD) program developed for 10 stores that are part of a large regional supermarket chain called Parson's. Parson's would like to offer ultra-local broccoli grown within the state. Food Hub X has the perfect midsize grower. Over several years, Parson's comes to believe that its local procurement strategy must be aligned with its central warehousing purchasing strategy—it can't have the same product coming from 2 sources at significantly different prices. The new, lower, local broccoli price no longer works for the midsize grower. Food Hub X uses a blended supply chain approach to reshape their proposal to Parson's. In presenting this example, we try to explain the thought processes of decision-makers at Parson's supermarket chain.

Recommendation D: Solving the Local Frozen Broccoli Bottleneck

> *The bottleneck shows up as the absence of manufacturing infrastructure and capacity that is willing and able to freeze and package locally grown broccoli with efficiency and scale enough to produce year-round supply and competitive pricing for both institutional and retail markets.*

It's not that frozen locally grown broccoli as a product doesn't exist. Indeed it does! There are creative examples, including those in the Northeast such as Franklin County Community Development Corporation (FCCDC) and their subsidiary brand Valley Veggies in Greenfield, MA, whose product is primarily aimed at institutional buyers. Also, Seal the Seasons (StS), which is a Certified B Corporation, working with growers and processors nationally to provide locally-grown, locally frozen produce, primarily fruit, to retailers in that grower's region. They have recently added broccoli to their product line.

Solving the frozen local broccoli bottleneck is not simply a matter of scale, investment, and compliance with rather complicated food procurement regulations. It requires coupling the right local broccoli source with the right processing infrastructure. In terms of farm production, *right* means quality control, right location, and a consistent, predictable supply at sufficient volume. In terms of processing, *right* means capacity, food safety expertise, operating efficiency and viable cost structure, and year-round storage (freezing) capability.

Good Shepherd Food Bank (GSFB) is not your average food entrepreneur. They are Maine's largest hunger relief organization. They distribute to more than 500 member food pantries throughout the state. In 2021, they will distribute 39 million pounds of food. They don't grow vegetables, nor do they process them commercially. And yet, they are organizing a frozen broccoli enterprise and writing a business plan that might just break through the bottleneck that has prevented smaller ventures from producing a cost competitive, source identified, scalable end product, available year-round.

Here's why we believe this project can solve the frozen local broccoli bottleneck: There is genius in the basic concept and design.

- By putting under-utilized food processing assets to work (wild blueberry freezing machinery that is busy 2 months of the year), they are holding down the total cost of investment and lowering risk by bringing in strategic partners with expertise in frozen food processing and food safety. These partners also bring a distribution network of their own to the venture.
- Because of their not-for-profit status, and reputation as a successful food bank, they are in a position to raise capital for the project from a creative combination of public and private sources.
- They have an extraordinary story to tell—alleviating hunger by providing access to healthy food, and supporting local farmers who are critical to the region's economy. There is so much Maine synergy involved—public and private partnerships including several of the state's favorite and best-known brands—it's hard to imagine that this project won't be seen as anything but heroic inside Maine and possibly throughout the region.
- One of these strategic partnerships, with Hannaford supermarkets, leverages a deep relationship and history in which Hannaford was instrumental in helping GSFB get off the ground. Hannaford has been known to be a company with community spirit and loyalty. Hannaford has demonstrated that that spirit lives on today after the acquisition and the merger—first, Hannaford by Delhaize (1999), followed by the merger of Delhaize and Ahold (2016)—therefore, this partnership could help anchor the project in important ways as it struggles, as all start-ups inevitably do.

We are also encouraged by the projected economic impacts associated with a processor that purchases all of their inputs—in this case, broccoli—locally. In consultation with Todd Schmit, Cornell Economist, we used 3 years of projected sales from Circle B Farms (GSFB's primary source of Maine fresh broccoli) and Harvesting Good (GSFB's new subsidiary frozen broccoli company and brand) to estimate Harvesting Good's economic impact, using a customized spending pattern in IMPLAN (Impact Analysis for Planning). The output generated from frozen broccoli sales, when using 100 percent local inputs, results in a higher degree of economic impact than the output generated from the use of non-local inputs, specifically, $0.47 additional per every dollar of output. Likewise, employment is higher, as well. When using 100 percent local inputs, every broccoli processor job supports an additional 3.55 jobs in related industries, whereas the non-local spending pattern results in only 2.26 jobs.

Despite the inherent genius in the concept and design, there are weaknesses in the plan:

- **Single Source** – No matter how good a broccoli grower Circle B Farms is, a plan of this ambition and scale should include back-up contingencies. To truly bring down the sourcing risk, the project should be connected to, and sourcing from, multiple broccoli farms in different locations to ensure continuous supply of broccoli under a whole variety of demand and weather scenarios.
- **Market Diversification –** No matter how strong a strategic partner Hannaford will be in this new venture, they cannot guarantee their customers will choose Harvesting Good broccoli over another favorite brand. It will be necessary to diversify the customer base, both retail and institutional, early on in this venture, perhaps starting now during the planning phase.

Insights: A Maine to New York Frozen Local Broccoli Partnership

The findings of this study lead us to recommend that Harvesting Good consider repositioning itself as a regional operation. This does not necessarily mean reducing the priority placed on Maine producers and customers.

There may be New England growers who would want to participate, and there are definitely New England customers who would fit well with the proposed plan. We think New York would be an ideal partner for this project. An Upstate grower such as Matt Kludt could provide volume and reliable quality of product at a competitive price. A relationship with someone like Kludt would also provide a connection to a marketer/broker such as Parker Farms who add sourcing expertise and connections that could prove invaluable if, and when, supply emergencies arise. New York has numerous other large-scale vegetable growers who might consider a role depending on how and where the broccoli is to be floretted.

On the market side, New York's substantial farm-to-institution network is hungry for local frozen broccoli and frustrated that it's not available at a competitive price year-round. Products that are 51 percent New York grown would qualify for the 30% NYS Initiative, which provides School Food Authorities an additional $0.19 per lunch served, assuming 30 percent of their lunch purchases are local. Needless to say, there's large potential to promote New York and regional frozen broccoli to the 19.5 million people who live in New York.

Reconfiguring Harvesting Good as a regional brand would require some changes in the story told by its packaging and all marketing vehicles. The fundamental reasons behind the regional approach are to greatly reduce risk and strengthen operations, and that is a part of the story that, if told right—it's still a Maine-centric story— most everyone would understand and appreciate.

If this project succeeds, *when* this project succeeds, it will be a huge accomplishment for GSFB/ Harvesting Good, for the region, for the local food movement, and for all growers, customers, and partners involved.

Part I: Understanding the New York Broccoli Opportunity

The Opportunity, Simplified

Americans love broccoli. It's the 6th most popular vegetable according to *The Packer 2017 Fresh Trends*. Retail sales of fresh broccoli surpassed $1 billion in 2018 (Shahbandeh, 2021). Per capita consumption of fresh broccoli in the U.S. has increased from 0.5 pounds in 1970 to 5.7 pounds in 2019. Per capita consumption of frozen broccoli went up from 0.7 pounds to 2.0 pounds within the same period (USDA ERS, 2020). Frozen vegetables sold through retail outlets were a $3.1 billion industry in 2019, with broccoli accounting for $522 million of that (NFRA 2019 State of Industry Report). That's a lot of broccoli, and it's grown in all fifty states. However, more than 90 percent of what's eaten fresh in the Eastern U.S. comes from the West, mainly California, Arizona, and Mexico, traveling thousands of miles and several days to get here.

Why Does the West Dominate Production?

Total domestic broccoli production is estimated at 135,772 acres, based on 2017 Ag Census Data (USDA Census of Agriculture & Björkman, 2017). Of the 90 percent of domestic broccoli that comes from the West, California is responsible for almost 90 percent and Arizona for 7.6 percent. One of the contributing factors to this disparity in East Coast versus West Coast production is the historic lack of varieties suitable to the East Coast climate. Climatic factors endemic to East Coast production regions include humidity and periods of high temperatures. In varieties adapted to the West Coast, these factors can result in broccoli deformities and the prevention of a high-quality head (Fan et al., 2019). Not only does the West dominate domestic broccoli production, their growing conditions also yield a considerably higher output per acre. 2017 Eastern Broccoli Project yield data reports 853 21-pound boxes per acre on California farms, and only 450 on New York farms (Gomez & Dai).

Watch a PBS video about the Eastern Broccoli Project featuring Thomas Björkman, Professor of Vegetable Physiology at Cornell University and Project Director of the Eastern Broccoli Project

Photo by Matt Hayes, Cornell University

What About New York?

The U.S. Agriculture Census reports 290 farms growing 562 acres of broccoli in New York in 2012, and 535 farms raising 634 acres of broccoli in 2017. Even a major vegetable-producing county, such as Orange County, had but 36 acres of broccoli in production in 2017 on 22 farms. Our research suggests that by 2020, the statewide total acreage for broccoli had grown to near 1,000. But 1,000 acres isn't much for New York agriculture. Fruits and vegetables are called *specialty crops* or *minor crops* in agricultural language. By any measure, broccoli is a minor *minor crop* for the state of New York. In 2019, in contrast, New York growers produced 28,000 acres of sweet corn, and 31,000 acres of snap beans (Gomez & Dai).

Difficult conditions in the West did not directly cause the emergence of Eastern broccoli. Three thousand miles, 4 days on a truck, and thousands of dollars in transportation costs provided space and motivation for an Eastern fresh broccoli sector to slowly emerge over the past 25 years, combined with growing consumer demand for locally grown produce, and the sheer determination, persistence, farming experience, and entrepreneurial courage of a small number of farmers and marketers.

Worsening conditions in the West may be one of the main reasons, or even the number one reason, why Eastern broccoli will become more competitive over the coming decades. As the agronomic, climatic, and economic advantages of raising broccoli in the West begin to slip away, as the costs of production increase and the reliability of supply declines, then Eastern broccoli becomes more competitive, indeed. However, those changes by themselves do not make the scaling up of Eastern broccoli easy. Even with the tail winds from problems out West, Eastern vegetable growers face significant challenges as they consider broccoli.

There's a Cloud Over Everything: The Cost/Price Squeeze

Frank Dagele farms on the magical "muck" soil—the dark black, nutrient-rich remains of a glacial lake that melted 12,000 years ago—in the Black Dirt Region of Orange County, NY, about 70 miles northwest of New York City. He's the fourth generation on the land, farming 550 acres that the family owns. They celebrated 100 years of farming in 2020. Broccoli claims 15-18 acres of the total, the more important crops are salad greens, sweet corn, and onions—the signature crop of Orange County.

For Dagele Brothers Farm, broccoli is part of the diversified vegetable line they sell to smaller customers such as independent stores, farm stands, and schools. They deliver produce to more than 100 school districts. The broccoli is chilled primarily via vacuum-cooling, technology they own to cool the large volumes of commodity crops they sell to supermarkets, such as salad greens. When they deliver broccoli directly to a smaller customer, they can earn $18-22 per case. One of Dagele's friends, a large-scale grower in the South, has been a broccoli supplier to supermarkets, until this year. The Freight on Board (FOB) average price of $12-14 for a case of commodity broccoli was simply not enough in the face of rising production costs.

Dagele becomes almost philosophical when he tells his version of the same story:

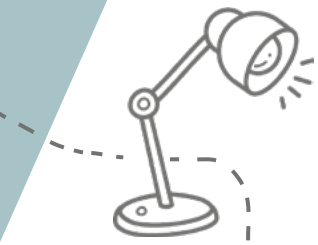
> I just learned about an 8 percent increase in the cost of boxes. Again. It goes up every year. I use 300,000-400,000 boxes a year. Everything we use costs more each year, but we can't go up on the price we sell vegetables for. Seed costs go up a minimum of 8 percent each year. I stopped raising red onions—I refuse to buy red onion seed. The cost went from $1,500 a pail to $2,500 in 3 years. Today, we only plant red onions from seed we save ourselves. And

> then there's labor. The way things are going, New York won't be much of a wholesale market provider in years to come. They're putting the American farmer out of business. Here's my prediction: In ten years, 50 percent of the food will be grown outside this country. And for this farm, I think that for every decade we farm, we're going to need off-farm income to get by in 5 of those 10 years.

This is not a new story, really. The cost/price squeeze that Dagele refers to has been told by farmers for many decades. For more than half a century, farmers have felt constant pressure to increase both total production and productivity per acre by adopting new technology, and by planting more acreage. In 1973, President Nixon's Secretary of Agriculture, Earl Butz, became famous for telling farmers "to get big or get out," an implicit challenge to larger and more competitive farmers to absorb their smaller and less efficient neighbors. What makes Dagele's telling of this same story in 2021 so poignant is the fact that Frank Dagele is one of those growers whose family farm *got big*, at least by local standards. They scaled up, they made major investments in modern technology for production and harvesting, cooling, and grading, and they diversified their markets dramatically. They applied *trick* after *trick* after *trick*, and today Frank Dagele is saying, *I'm running out of tricks.*

There's a cloud over fruit and vegetable farms in America, especially the farms that are wholesaling at global commodity prices. How can they compete against farms and imports from other countries where the labor wage is substantially lower, where environmental regulations are lesser, and where governments directly support fruit and vegetable farms in various ways? How can they afford to buy inputs, such as fertilizer, pesticides, seeds, equipment, packaging, and other production supplies from companies that behave like monopolies? Even the largest farms are grappling with these questions. They are trying to figure out how to capitalize large investments in new technology that will enable them to stay current and ahead of the curve. When they find investors from outside the industry, some from outside the U.S., how will they maintain control over their businesses and hold on to a reasonable portion of the wealth they create by farming at a large scale?

Frank Dagele mentions California as we talk about broccoli: "The California scene is thinning out as global warming sets in." As tough as times are for all kinds of reasons, conditions out West are one of the few things that might just crack open an opportunity for more broccoli production here in the East.



In this report, we identify and explain (1) the obstacles that stand in the way of expanding Eastern broccoli production, specifically in New York; and (2) the opportunities and approaches to production and marketing that could possibly result in profitability and expanded marketing of New York broccoli, leading to job creation and infrastructure investment in New York rural communities.

We begin by exploring conditions in the West because it will have significant influence on what happends in the East. And then we proceed to unpack the obstacles and opportunities that growers and markets face in the East.

Is the American West Running Out of Water?

Ninety percent of the broccoli consumed in the U.S. is produced in the West, primarily in California's central coastal Salinas Valley, in the Imperial and Coachella Valleys of southernmost California, in the Central Valley to the west of Salinas, in southern Arizona, and in Mexico.

The Salinas Valley, known as the *salad bowl of the world*, is responsible for half the broccoli we consume. The Imperial Valley, a major source of winter broccoli, is a piece of the Sonoran Desert in southeastern California, bordering Mexico. The water shortage and ecological distress in the Salinas Valley and in the Imperial Valley explain rising political tension between agriculture and its need for irrigation water, and large urban populations and their need for drinking water. The situation is felt all over the state (Philpott, 2020).

Things are not better across the border in Mexico. Mexico accounts for 20 percent of the broccoli Americans consume, and 44 percent of U.S. fruit and vegetable imports. Two major growing areas, Baja California and the Mexicali-San Luis Valley, located directly south of California, receive 3 inches of rain per year and rely on irrigation. Those 2 regions—plus Sinaloa and Guanajuato, the primary broccoli-producing regions—are all among Mexico's most water-stressed regions (Philpott, 2020).

In a 2014 paper, University of California/Irvine and NASA researchers found that California farmers and municipalities are quietly adding to their river allocations by drawing water from underground aquifers at a faster rate than had been previously known (Castle et al., 2014). One of the study's co-authors, Jay Famiglietti, wrote for National Geographic: "The American West is running out of water" (2014).

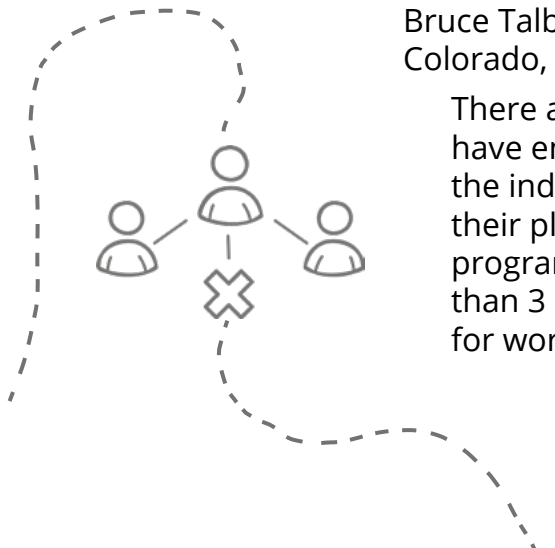
For additional insights regarding the West's water issues, refer to Appendix B: More About Western Broccoli.

Water is Not the Only Thing the West is Worried About

No one knows how quickly the coming water scarcity, extreme weather, and related events such as wildfires will severely undermine the availability and the price of Western broccoli. But there's more to the risk equation: the availability of farm labor and the availability of long-haul truck drivers.

Farm Labor

Immigration policies and practices, and lack of immigration and labor policy reform, have disrupted the availability of farm labor to agriculture. Growing uncertainty is motivating private and public research into robots that can harvest, prune, and plant various specialty crops. It has motivated more farms to rely on the government-run H2A seasonal farm labor program, although farmers have plenty of concerns about H2A as well.



Bruce Talbott, farmer and owner of Talbott's Mountain Gold farm, Palisades, Colorado, in an op-ed piece in the Washington Post, August 24, 2018, writes:

> There are 3 reasons why the family farm I run with my 3 brothers didn't have enough workers this year. First, the local workforce is aging out of the industry…Second, there's no fresh supply of new workers to take their place…Finally, we lack an efficient, farmer-friendly guest-worker program. The current one for temporary H-2A visas was created more than 3 decades ago; it's outdated and can't cope with increasing demand for workers.

Long-Haul Drivers

According to the report *Truck Driver Shortage Analysis 2019* from the American Trucking Association: "In 2018, the trucking industry was short roughly 60,800 drivers [refers to drivers of Class 8 tractor-trailers, which is where the bulk of the truck driver shortage prevails] which was up nearly 20 percent from 2017's figure of 50,700...If current trends hold, the shortage could swell to over 160,000 by 2028" (Costello and Karickhoff, 2019).

The threats to Western broccoli production suggest hard times ahead for the industry—growers, employees, packers, marketers, and transporters. It's inevitable in the world of agriculture that hard times in one place spell opportunity in another. In this case, the opportunity emerges for Eastern growers to take advantage of consumer interest in locally grown and rising transportation costs to capture a larger share of the broccoli marketplace.

That is, if:

- Eastern growing conditions and varieties enable efficient production with high enough yields.
- Eastern growers can perform the necessary post-harvest work and meet the quality requirements.
- There is investment capital available and sufficient market demand to give Eastern growers and packers confidence to take on the risk.
- The availability of farm labor, and the overall regulatory climate, is favorable enough to Eastern growers.
- Marketers are able to construct supply chains that are reliable, continuous, able to deliver consistent quality, and competitive against year-round Western-based supply chains.

Some Eastern broccoli growers and their marketing partners have already surmounted these what-ifs. During the past ten years or so, a small number of Eastern broccoli pioneers have taken a $75-100 million broccoli market share. The growers are mostly large-scale—producing 200-600 or more acres of broccoli per farm. They are aggregating from multiple sites, south to north, and are following the supply chain models of Western marketers—supplying as close to year-round as is possible. They are selling mostly to retail chains. Their prices are closely tied to the global commodity prices for broccoli. In other words, their customers expect them to be competitive against Western supply; some customers expect them to be slightly cheaper, or at least an equivalent delivered price, because the transportation involved is significantly cheaper.

Photo by R. J. Anderson, Cornell Cooperative Extension

The Wholesale Broccoli Deal

Why Prioritize Wholesale? What About Direct-to-Consumer?

We prioritize wholesale because it's the path to scale. Scale is what leads to jobs and investment in rural communities. Nevertheless, direct-to-consumer sales and marketing is completely worthy of attention.

The explosion in direct-to-consumer marketing in this century is, indeed, among the most important of trends changing how the public sees and experiences farmers and local food. The number of farmers markets in the U.S. climbed from 1,800 in 1994 to more than 8,000 by 2013. Community Supported Agriculture (CSAs) began in the U.S. in the 1980s—by 2015, more than 7,300 farms were offering CSA programs. Farm sales directly to consumers doubled between 1992 and 2007, and reached $3 billion by 2015 (Philpott, 2020). The popularity of direct-to-consumer locally grown foods may be greatest on the 2 coasts, particularly among urban residents. However, it's a national trend—for example, there are 220 farmers markets in Iowa, where corn and soybeans are king. And, while some farmers markets cater to middle and higher income residents, many of them work hard at serving lower-income shoppers. The number of markets that accept electronic payments from shoppers using federal food aid programs rose from 500 in 2004 to over 4,000 by 2013. Wherever people live in the U.S., demand for locally grown fruits, vegetables, dairy, and meats has surged in this century (Philpott, 2020).

Mark Doyle is the General Manager at Fishkill Farms in Hopewell Junction, NY. The combination apple orchard, fruit farm, and organic vegetable farm takes full advantage of its proximity to New York City and surrounding suburbs. They offer pick-your-own, a CSA, a farm stand, and they meet their customers at several nearby farmers markets as well. Doyle notes: "We get to know our customers really well, and we develop those relationships to the nth degree—as much as we can. That probably explains why we had an unexpectedly good year in 2020." Fishkill Farms wholesales a small portion of their apple and vegetable harvest, which helps explain their decision to limit broccoli production to one acre (or less), largely planted for the fall harvest. Fishkill's approach is representative of how many Hudson Valley vegetable farms, large and small, organic and conventional, think about broccoli: it's a great crop in and of itself because people recognize it, eat it and like it. It nicely diversifies a farm's product line, and it fetches a decent price when it can be sold directly to a customer or through a retailer who will merchandise it loudly and clearly as farm-identified and locally grown. However, the leap from that approach to planting and wholesaling large acreage is like crossing the mighty Hudson River itself—there has to be a secure bridge across.

The upward surge in the number of farmers markets, CSAs, and overall direct-to-consumer sales dollars leveled off around 2015. However, COVID-19 has caused another spike in direct marketing as people search for local trustworthy sources of food, and for outdoor recreational experiences that feel safe. Some farm stands and pick-your-own operations, for example, saw explosive growth in the range of 30-60 percent during the summer and fall of 2020 (Boston Globe, 2020). Yet, despite the millions of people introduced to locally grown farm-fresh foods and for all the trust and excitement built up, direct-to-consumer marketing remains a niche effort that reaches a tiny portion of the U.S. population and accounts for only 0.3 percent of total agriculture sales (NASS, 2014).

The version of wholesaling that is closest to direct-to-consumer marketing is when a farm delivers directly to a store, manufacturer, restaurant, or institution—what is often referred to as direct store door or direct store delivery (DSD) or farm-to-school or farm-to-institution (colleges, hospitals, business cafeterias). The customer wants a familiar, local source. They value the direct relationship with a farmer. They are sometimes willing to pay above the going market wholesale price, sometimes quite a bit more. And these ultra-local DSD and farm-to-school and farm-to-

institution transactions tend to last as long as the growing season or a couple weeks shorter. In the case of broccoli, the ultra-local supply may be available for 3-4 weeks or for 8-12 weeks with a gap in the middle for the hot summer. In any case, due to price, supply gaps, and a short season, the volumes of these transactions are small. Yet, because the demand for locally grown foods is strong everywhere, these ultra-local and regional wholesale deals, combined, add up to billions of dollars nationwide. By 2014, 4,322 school districts in the U.S. had farm-to-school programs. That's a 430 percent increase from 2006 (NSAC, 2014).

The wholesale deal that feeds fresh broccoli to most Americans, in contrast, delivers full truckloads to distribution centers and to regional produce distributors, who then bring it to supermarkets, restaurants, and institutions.

The *deal* is best defined by a set of standards and details—volume, frequency, varieties, grades, unit packaging standards and design (such as one pound bunches with branded hang tags showing farm ID and UPC codes), master case specifications (such as top icing over plastic bags), palletization specs (such as 50 cases per pallet, shrink wrapped), time of arrival, particular food safety certification(s), and other sustainability certifications, terms of payment—that serve as standards that growers, marketers, and customers must live up to. The produce business runs on small profit margins most of the time. Farms and firms make money when transactions recur. The longer the run, usually, the more profitable it is, as the fixed costs of operation, marketing, and overhead are spread over an increasing volume.

A wholesale produce deal is made possible by some fundamental conditions. The absence or failure of any one of them, or of even an important piece of one of them, is sufficient to prevent the whole deal from happening.

Conditions for a Successful Wholesale Deal

- A viable crop—available seed (or rootstock) for a cultivar that can produce well given the soil, climate, and pest conditions where it is planted.
- Harvest and post-harvest handling infrastructure, practices, and labor that can prepare the product for market.
- A chain of trust—market and transportation relationships—that moves the product from farm to customers in good condition, in a timely manner, at a satisfactory price, and with sufficient transparency.
- Steady demand—consumers who want the product, repeatedly.

Eastern Broccoli Project variety trials were conducted by the CCE Cornell Vegetable Program (CVP) under the leadership of Extension Vegetable Specialist Christy Hoepting. With the assistance of CVP Technicians, Hoepting has harvested and evaluated tens of thousands of heads over the duration of the project. Photo from CCE Cornell Vegetable Program

The conditions required for a successful broccoli deal are substantial—it's a high threshold to cross over. Many conditions needed to produce broccoli would be the same conditions as for other fresh vegetable deals. However, there's one condition, an expensive one, which is unique to broccoli—icing.

Farming in the Ice Age

Broccoli crowns and bunches destined for supermarket chains almost always require icing.

Sean McFadden of Parker Farms, notes: ***"A lot of people can grow good broccoli—that's not the hardest part. Icing technology is the barrier to being successful or not in the broccoli business."***

Broccoli has the highest respiration rate of any vegetable. Slush icing, hydrocooling and/or vacuum cooling are usually considered ideal ways of removing field heat from broccoli. After removing the field heat, regardless of the method, broccoli must be stored at just-above freezing temperatures (Björkman, 2013).

Types of Cooling and Icing Technologies

How to cool broccoli is a choice a grower will make depending on their scale of production, customer requirements, and access to capital. Some growers will combine some of the methods below, whereas other growers rely exclusively on one approach they have mastered. In general, the cost of icing can range from less than $1 to $4 per box (Björkman, 2013). Readers will see why the cost varies so much as we explore the differences in capital investment, scale, and labor required.

Top Icing

For small-scale and midsize broccoli production, top icing is often best. It's a relatively inexpensive approach. Farmers buy bagged ice or make it on site, cottage industry style. The ice is scooped on top of the product in boxes.

Vacuum Cooling

Vacuum cooling is a fast way to remove heat by vaporizing (evaporating) water from the crop inside of a metal container, causing the core temperature to drop. This technology is more readily accessible for a midsized grower, who can lease equipment for a season.

Hydrocooling

Hydrocooling uses cold water to quickly remove the field heat from the broccoli. The water can be sprayed overhead, or the product can be submerged in circulating water to maximize efficiency.

Top icing is a relatively inexpensive method of removing field heat. Photo from Eastern Broccoli Project

Using the top icing method, ice must be scooped, shoveled, or poured onto boxes of harvested broccoli to bring down the core temperature. Photo from Eastern Broccoli Project

A vacuum-hydro cooler combines vacuum cooling and hydrocooling technologies. The machine sprays the broccoli with water as the vacuum turns the crop moisture into vapor to quickly cool it. Photo from Postharvest Management of Vegetables

Slush Icing

Slush icing is where water and ice join forces in a slurry. Large ice slushers are considered state-of-the-art. Smaller ones do the job cottage industry style. This hydrocooling/ice slushing technology encloses a pallet inside a watertight box, which is then injected with a slurry of water and ice. The water drains from the bottom, leaving a fully iced pallet. Sean McFadden at Parker Farms is a fan of an ice slusher known as a Clamsheller. Parker Farms moves a Clamsheller up and down the coast seasonally among the various farms they source from.

All methods of cooling and/or icing broccoli that rely on water (chilled or frozen) require waxed boxes and water-resistant packaging (if packaging is involved). The use of so much water adds significantly to food safety issues that must be screened for, tested, managed, and certified. The facility must be closed and deep cleaned between conventional and organic product processing.

Iceless Broccoli

Some industry buyers look specifically for broccoli that is not iced, citing environmental concerns about water quality and excessive use of water in processing. They also find excessive water can cause problems for internal handling and for customers. Ken Bower, Produce Buyer for Baldor Specialty Foods, Inc. in the Bronx, says: "*local* is paramount for Baldor." He buys iceless broccoli largely from Maine and considers it a success—fresh hydrocooled product that arrives with detailed documentation to satisfy food safety standards. Taylor Lanzet, former Senior Director of Supply and Sustainability at the restaurant chain Dig, was willing to go out of her way to receive and use iceless broccoli. Lanzet's concerns were environmental impact, inadequate drainage of boxes, and unnecessary cost for growers. As long as the product arrived crisp and in good shape, she was good with it.

For additional information regarding icing and cooling, refer to Appendix C: More About Icing and Cooling.

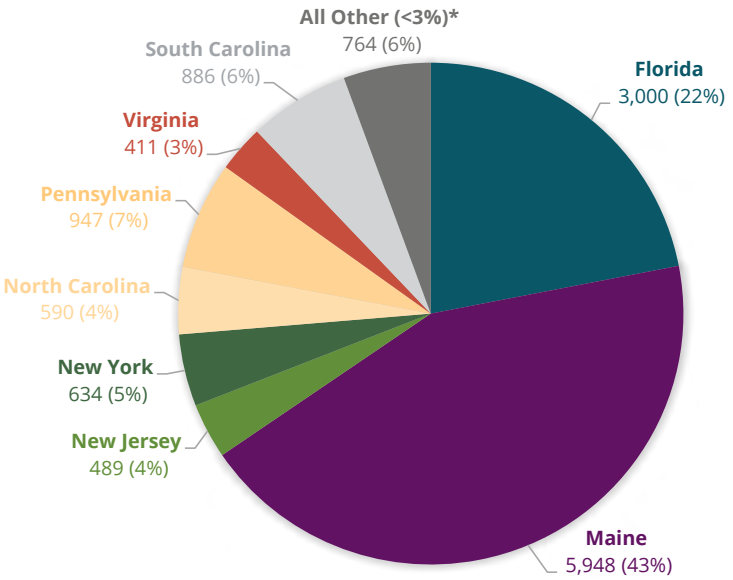
An ice slusher encloses pallets of broccoli to inject a slurry of water and ice. Photo from Eastern Broccoli Project

Broccoli emerges from the ice slusher with the water drained and ice on top. Photo from Eastern Broccoli Project

Eastern Broccoli 2021—Picture of Today

As of 2017, 13,669 acres of broccoli were being grown along the East Coast, with the lion share being produced in Maine, which is responsible for nearly 6,000 acres, and Florida with 3,000 acres. The remaining 4,271 acres are divided among the 15 other East Coast states (USDA Census of Agriculture & Björkman, 2017).

East Coast Acreage of Broccoli Production by State



*All other includes CT, DE, GA, MD, NH, WV, RI, VT, and MA

Data obtained from 2017 Ag Census Data, except acreage estimates for ME and FL. EBP data was used in place of Ag Census data.

Eastern Broccoli Project

The Eastern Broccoli Project (EBP), nearly ten years old now, was conceptualized with a clear goal in mind: create a reliable, high-quality, year-round supply of Eastern-grown broccoli. The USDA Specialty Crop Research Initiative invested upwards of $8 million to bring this ambitious goal to fruition, which is being realized through breeding, on-farm production support, and market development.

It can take 10 years or more to develop, test, and commercially release new vegetable varieties. In the early years of the EBP (2011-2015), 5 new commercial hybrids were made available to Eastern growers by collaborating seed companies. Most of these had been targeted to growing regions elsewhere in the world and were already under development when the project started. One hybrid was discontinued, but the other 4—*Lieutenant* and *BC1691* from Seminis, *DuraPak1691* from Syngenta, and *Burney* from Bejo—are regularly grown on the East Coast.

New, better hybrids developed specifically for the Eastern U.S. are just beginning to come to market. *Abrams* from Seminis and *Roxanne* from Emerald were released in 2020, following good performance in Eastern broccoli trials. Other hybrids that are close to commercialization include up to 4 inter-program "co-hybrids" with 2 different seed companies. All produced competitive yields of quality broccoli crowns in company trials and Eastern broccoli trials. We expect that at least 2 of them will be commercially available in the next 1 to 3 years, pending licensing negotiations.

Additionally, Mark Farnham at the U.S. Vegetable Laboratory has developed several small, rapidly maturing broccoli hybrids that produce high quality crowns even in the heat of the summer. These hybrids are ready for harvest 7-10 days earlier than the earliest commercial broccoli varieties, and can be harvested in just 1 or 2 cuts. At least 4 of these hybrids are available now for licensing. Inbred lines that can be used to re-create another EBP—tested hybrids were recently released, making them freely available to any interested broccoli breeding program.

Part II: The New York Broccoli Story

Insights from Experienced New York Broccoli Producers and Marketers

Dan Henry gave up on broccoli in 2020. His operation, W.D. Henry & Sons, is a diversified midsize vegetable farm in the Eden Valley region of Western New York. They raise 400 acres of sweet corn and mixed vegetables, including broccoli. They began experimenting with broccoli crowns ten years ago, and became one of New York's largest broccoli growers, with up to 200 acres planted in recent years. A partnership with Eden Valley Growers (EVG), the produce cooperative they helped found, made the project possible. To support their member growers, EVG invested $500,000 into an ice slusher, using $350,000 of their own funds and $150,000 of state funds.

Henry says that broccoli is a demanding crop to grow. "Because of our limited production windows—we had to avoid the heat of summer, the high nighttime temperatures—there wasn't a lot of room. There's really *no* margin of error with this crop. When we looked at cost of production per acre, given the yields we were getting and the access to suitable irrigated land in our area, there were just too many limiting factors. We were putting a square peg in a round hole."

There wasn't only one reason why Henry gave up on broccoli. There were several reasons, and they converged in 2019. Bacterial head rot, exacerbated by cool, wet field conditions, was a persistent problem. The increasing cost of farm labor was a contributing factor, especially given that labor is the number one cost category for W.D. Henry, and broccoli is a labor-intensive crop. When they gave up broccoli, they were able to operate without the 18-20 person crew they had employed for the broccoli harvest. Equipment costs, such as the $50,000 they invested in a trans-planter from Italy, was a third factor. Finally, and perhaps even more important, the prices received for unbranded commodity broccoli crowns—as low as $12-13 per case—were too low.

Henry wasn't the only New York vegetable grower to walk away from large-scale broccoli production. Bruce and Barth Davenport are in Stone Ridge, NY, in the Rondout Valley, farming a hundred acres of diversified vegetables plus corn. Though they raise but 8 acres of broccoli today, the brothers remember the 1980s, working the fields on the family farm, direct-seeding broccoli with an eight-row planter, at a scale that would peak at 400 acres dedicated to broccoli production. Their father had built a good relationship with the supermarket chain Grand Union, until one day in the 1990s, when, without a whole lot of warning, the chain decided to source all its broccoli from the West Coast. Bruce Davenport says: "I remember that phone call. I was in the room. After the call, all my father could say was 'What just happened?'" The convenience and consistency of year-round supply from the West had won out. Suddenly, the Davenports were without an anchor customer for one of the farm's main products.

The Davenports have come up with a winning formula for their 8 acres of broccoli. They raise almost all of it for fall harvest. They grow one "practice acre" in spring. And they stay away from the hot months in between. The roughly 2 trailer-loads of fall crowns they produce, 1,000-1,500 cases total, go to supermarkets and produce distributors for approximately $20-22 per case. Most customers promote it as locally grown broccoli.

The Hudson Valley Farm Hub, a research, training, and demonstration farm in Hurley, NY, considers broccoli a key crop, accounting for 6 of its 30-acre vegetable planting. The farm has extensive plantings of row crops such as artisanal grains. Vegetable Production Manager Jeff Arnold explains that they have had to give up on their hope for a continuous broccoli harvest, spanning June through Thanksgiving, because even the new "heat tolerant" varieties just haven't performed well during the extreme heat of a typical July. Like most Hudson Valley broccoli growers, they harvest the spring planting in June through early July. The larger fall planting comes in around Labor Day and continues into November, sometimes through to Thanksgiving.

Amy Hepworth of Hepworth Farms, Milton, NY, is one of the Hudson Valley's most successful and largest organic farmers. Hepworth stresses how disciplined she must be in the broccoli field: "You can't miss one step or your crop does not make it to market in good quality." She only raises 1-5 acres of broccoli depending upon the year (on a farm of many hundreds of productive acres). And they simply don't make money growing it. But Hepworth says this about broccoli: "It's like sex appeal–you really want to have it."

Amy Hepworth

Matt Kludt

Matt Kludt of Kludt Brothers Inc., in contrast to the Hudson Valley growers, is full-on bullish about broccoli. Kludt grows 600 acres of broccoli on his 10,000 acres of productive land in Kendall, NY. He also raises 3,000 acres of field corn, 1,000 acres of wheat and soybeans, 400 acres of cabbage, carrots, and butternut squash, 500 acres of table beets, and 1,000 acres of green beans and alfalfa. He used to grow cabbage for Great Lakes Kraut Company. When the company withdrew their operations to Wisconsin, it made room for Kludt to try something new. He ran into Rod Parker from Parker Farms, a vegetable marketing firm whose lead crop was broccoli.

Broccoli required a huge investment. Kludt spent $2 million dollars on a packing facility, and over half a million on state-of-the-art icing equipment, called a Clamsheller, required to pack broccoli for retail markets. The Clamsheller encloses pallets into a watertight box and then injects a slurry of water and ice inside each case. Water drains from the bottom, and a fully iced pallet of broccoli emerges. According to Sean McFadden at Parker Farms, the Clamsheller that Kludt Brothers farm bought is the ideal icing machine for the retail market.

Sean McFadden

Sean McFadden has been with Parker Farms since 1974. He helped the founders build their one acre of pick-your-own produce into a marketing company that today markets vegetables grown by 15 lead farmers on 12,000 acres from Northern New York to Florida. Broccoli represents over 4,000 acres of the total. It's their top product, followed by sweet corn and squash. Atlantic Fresh is the business-to-business brand that Parker Farms markets under for its year-round broccoli business, which includes organic broccoli as well as conventional.

To achieve year-round supply chains, Parker Farms sources from New York, Pennsylvania, and Virginia during the Northern summer and fall, moving to North Carolina in late October, Georgia in November through January, and Florida for winter production until cold weather gets in the way. Some of the southern climes, especially Georgia, also produce for the May-June window. To fill supply chain gaps during February, March, and April, Parker Farms relies on product from Mexico. Parker Farms does 40-50 loads of broccoli per week destined almost entirely to major retailers.

Kludt can be bullish on broccoli because he has committed customers—made secure by his close relationship with his broker/marketer Parker Farms—as secure as a market can be in times of climate change and rapid market concentration. Kludt Brothers Farm sells the majority of its broccoli to Parker Farms, and McFadden says he'll take everything they can produce. He's looking for more New York broccoli. It's the partnership with Parker Farms that gave Kludt Brothers Farm confidence to take on the risk of a large investment in packing and icing infrastructure.

Observations on a Controversial New York Farm Labor Law

Richard Stup, Cornell's Agricultural Workforce Specialist, served as our *tour guide* of New York's 2019 Farm Laborers Fair Labor Practices Act (FLFLPA). He named the 3 significant changes that characterize the legislation: (1) overtime pay for work after 60 hours per week; (2) a mandatory day of rest (or, time-and-a-half pay); and (3) the right to organize/collective bargaining on farms. Through partisan eyes, it's easy to jump at these words and quickly love or hate this law.

One perspective on the law is expressed by Miriam Pawell in the opinion section of the *New York Times* (July 16, 2019): "After more than a decade of contentious debate, New York has passed a law that entitles farmworkers to basic rights that most workers take for granted—the right to earn overtime, have a day off, collect unemployment insurance, and join a union."

Other, more cautious, perspectives on farm labor in New York are voiced by several people we interviewed for this report:

> Sean McFadden of Parker Farms stated: "The current labor laws make it seem as if New York is trying to drive farmers out of business." McFadden adds that New York's contribution to an East Coast-run operation creates excessive red tape and hoops to jump through for New York growers. "It is far easier to grow the fresh produce business elsewhere."
>
> Mark Doyle, General Manager of Fishkill Farms, states his concern that the law will have an unintended negative impact: "I fear that farmworkers will get the short end of the stick. They will work fewer hours [because farms won't keep them working after 40 hours] and they'll earn overall less pay. I think this would have a devastating effect, not only to the income of those skilled workers, but also in terms of their opportunity for training, mentorship, and advancement."
>
> Dan Henry of W.D. Henry & Sons said: "[Labor is] our biggest cost, the number one expense, hands down, by leaps and bounds...As those costs continue to go up while our market prices stay relatively consistent, something has got to give at some point." Labor costs are on the short list of reasons why Dan Henry got out of the broccoli business.
>
> The way Matt Kludt sees it, his workers from Jamaica and Mexico are skilled professionals in broccoli harvesting and processing. They can earn up to $30 per hour. Even though the new labor law feels crushing, he will figure out how to "make broccoli work, how to stay in the broccoli business." But he'll have to reduce his workers' time to avoid overtime pay that he cannot afford.

What the 4 quotes above do well is show the stress that the new labor law places directly on farmers, as well as showing some unintended negative consequences that could impact farmworkers. What these quotes do less well is acknowledge the history of hardship that farmworkers have experienced all over the United States for decades.

Stup lowers the temperature in the room a bit as he explains *the rub* as he sees it with the current legislation. He says the *day of rest* does not place a huge burden on farms. Most farms already practice it. *Collective bargaining* remains an unknown. While most farmers would see a union as a slap in the face, he reminds us that most farmworkers today are not asking for unions. They want safer working conditions, better pay, and more respect. California's union numbers have been going down. The *overtime clause* is where *the rub* exists. Growers fear that 60 hours will turn into 40 hours as it has in California, forcing disruptions in workforce management that will hurt farms and farmworkers both.

The legislation is motivated largely by progressive, urban voices, accustomed to fighting for workers' rights in an urban industrial or restaurant/small business setting. Unwittingly, it feels like an effort to shape the agrarian workforce and labor regulations to look and act like the rest of the economy. Accordingly, agriculture employees will have to work 2 jobs, as do their urban counterparts, to earn enough income when their farm employers cap their hours at 60 (or 40) per week. However it's harder to find that second job in a rural setting. Furthermore,

H2A workers, like the Jamaican workers at Fishkill Farms, cannot take another job due to H2A regulations.

Agribusiness technology companies are responding at swift speed by turning toward the mechanization of all things farming. If labor costs are on a steep long-term incline, then they conclude that robots that replace farm labor are the best or the safest investment for the future.

It makes sense that labor advocates in 2021 are advocating for justice and labor laws that protect and lift up farmworkers, the same as they advocate for justice and labor laws that protect and lift up restaurant workers and industrial workers. When the Roosevelt Administration won major reforms for workers, as part of the National Labor Relations Act of 1935—in areas such as overtime and disability pay, days of rest, and union organizing—they cut a deal with segregationist, southern Democrats and simply wrote farmworkers, mostly African American farmworkers, out of the New Deal.

Today's urban/rural divide, evidenced by profound misunderstanding on all sides, is a fact of life. But calling it out does little to nothing to suggest a productive path forward. New York's new farm labor law is part of a much larger trend. Growers and farm advocates should recognize it as part of a loud market signal being voiced in different ways, all over the country, showing that a growing majority of citizens (who are voters and shoppers) want policies and brands (products) that are actively reducing inequality in our society.

During the past century, farmworker advocates have always found their strongest support among urban progressives. Growers who comply with the new legislation and make changes to improve the pay and working conditions on their farms should turn to their urban (and rural) customers and remind them that they now have a corresponding responsibility to step up and support New York growers every way they can—with their votes, with their purchases, and by educating neighbors about what's at stake.

Passive acceptance by voters and legislators of this new legislation will not be good enough for the long-term. The antagonistic paradigm that has been at play for most of this century—farmworkers fighting farmers for a larger share of a fixed pie—is outdated and already proven it won't lead either *side* to a satisfying future. Climbing out of this mental model toward a more productive one, a path forward that can deliver more professionalized, more dignified, better-paying farm jobs for farmworkers *that add to farm viability* requires more understanding and collaboration across this urban/rural divide, and across the farm management/labor line. People with different perspectives don't have to agree on things as much as listen better and open up to real conversations that are built on new understanding.

Mary Jo Dudley is Director of the Cornell University Farmworker Program. She sees this moment as a missed opportunity: "Farmworkers see themselves as professionals. They take great pride in their work. They seek advancement and respect in their jobs, like all of us do. There's an opportunity to make our farms places where farmworkers *want* to work; we could build a reputation for New York farms as welcoming places, their first choice, really the best farms to work on." Richard Stup says that approach could have an economic impact.

Stup has a broad understanding of this debate because of his background and training. He grew up as a kid milking cows on a 50 cow dairy in Bedford County, Pennsylvania. He worked in Farm Credit finance for nine years. He ended up pursuing a PhD in workforce education and human development. He points out: "I am not an economist, I'm a management person." He deeply feels the squeeze and the pressure that farm owners are under. "There has to be a way to achieve quality work for farm employees, without wrecking farms in the process. That, of course, would eliminate jobs and harm rural communities."

For further information about the variances among states in terms of labor policies, refer to Appendix D: Breakdown of East Coast State Labor Regulations.

An Ag-of-the-Middle Story

Is There a Sweet Spot for Midsize Vegetable Farms in the Broccoli Market?

Eastern broccoli is a classic "Ag-of-the-Middle" story. Ag-of-the-Middle is an analytical framework developed by social scientists for explaining how and why midsize farmers in the U.S.—farmers who farm half the nation's farmland—are increasingly not competitive when it comes to supplying supermarket retailers, food manufacturers, and the institutional food sector. The framework goes like this:

- Small farmers who sell direct to consumers at a farmers market, roadside stand, or CSA, are able to differentiate their products and earn a retail price. Local broccoli at an Eastern farmers market typically sells for $3-4 per pound. Their customers see them as local farmers. The exchange is often mediated by personal interaction. Many small farmers are either organic or are able to tell customers how they farm and share their personal story.
- The largest growers succeed because they achieve efficiencies at scale. They keep unit costs low enough to enable farm profitability at the market's commodity prices. Farmgate FOB prices for Eastern broccoli average $12-16 per case or $0.50-0.67 per pound.
- Midsize farms often sell undifferentiated products into a wholesale market. They are not large enough to realize the transactional efficiencies of large-scale growers. And, if they are wholesaling product that's treated the same as an undifferentiated commodity, they most likely struggle to achieve profitability. They are stuck in the middle. Their future could well be *differentiate or die*. The midsize farmers who have found a happy middle ground—*markets of the middle* such as independent stores, restaurants, and nearby schools who are willing to pay extra for local—are raising broccoli in small amounts on 2 to10 acres, promoting it as locally grown, and delivering it for $20-24 per case, or $0.83-1.00 per pound, for conventional broccoli. Organic would earn a premium of +$4-6 per case.

Farm Size Defintions

Definitions are meant to clarify things. And they usually do. But sometimes imposing a simple definition on a complicated situation leads to unintended confusion. Such is the case with the categorization of farms by size. People think of farm size in 2 ways, first by the number of acres, second by how much gross income the farm brings in.

Farm Size by Acreage

The USDA uses these classifications of farm size by acreage:

- Small farms – 1-99 acres
- Midsize farms – 100-999 acres
- Large farms – 1,000+ acres

In the United States, between 1945 and 2017, the number of small farms declined by 66 percent from 3,406,285 to 1,154,703. The number of midsize farms declined by 69 percent from 2,339,984 to 714,724, while the number of large farms increased by more than 50 percent from 112,939 to 172,793 (USDA Census of Agriculture Historical Archive, 1945, & USDA Census of Agriculture, 2017).

To complicate matters, New York breaks down farm size by acreage a bit more. Between 1945 and 2017, the number of small farms with 1-99 acres declined by 85 percent from 123,628 to 18,363; small to midsize farms with 100-179 acres declined from 14,496 to 5,722. The number of midsize farms with 180-499 acres increased from 2,071 to 6,501. The number of farms with 500-2,000 acres increased dramatically from 129 to 2,455 (U.S. Census of Agriculture, 2017). Data for farms larger than 2,000 acres does not go back to 1945, and is unavailable.

Farm Size by Income

The USDA Economic Research Service (ERS), in its 2016 report *The Changing Organization and Well-Being of Midsize U.S. Farms, 1992-2014* by Christopher Burns and Ryan Kuhns, uses these farm size definitions:

- Very-low-sales farms – Gross Cash Farm Income (GCFI) less than $10,000
- Small commercial farms – GCFI of $10,000-$349,999
- Midsize farms – GCFI of $350,000-$999,999
- Large farms – GCFI of $1 million+

Here's where this gets tricky and confusing. Broad definitions of farm size, whether by income or by acreage, do not distinguish among row crop farms (those who raise corn, soybeans, grains, cotton, etc.) versus specialty or minor crop farms (those who raise fruits and vegetables) versus dairy and poultry farms (those who produce milk, processed dairy products, or eggs) versus ranches (those who raise animals for meat). There are huge differences between farms that raise row crops versus specialty crop producers in farm size classifications and income.

Example of Farm Size Classification Disparities

	 Soybean Farm (Row Crop Farm)	 Apple Orchard (Specialty Crop Farm)	 Western Broccoli Farm (Specialty Crop Farm)
Acres	200	200	200
Average Yield (Bushels per Acre)	49.5	745*	790
Average Price (Price per Bushel)	$10	$20.83* wholesale	$10 fresh broccoli
GCFI	**$99,000**	**$3,103,670**	**$1,580,000**
Farm Size Classification	**small commercial farm**	**large farm**	**large farm**

* Data from USApple, an industry association

The precise size of a farm alone, measured in acreage or dollars, doesn't help us understand much about the farm's future prospects, or the challenges and obstacles it must overcome. When we speak of ***midsize farms in this report, we are referring to a wide variety of farms as described by acreage, income, crop mix, and markets.*** They wholesale some or all of what they produce, mostly unbranded or undifferentiated. They operate at a scale roughly one-tenth to one twenty-fifth the size of the large farms who dominate their product category nationally—the farms that are able to operate profitably by selling at the market/commodity price level. In New York, such midsize farms are the vast majority of the farms. Most are family farms—where the majority of the business is owned by the operator and individuals related to the operator—and they happen to be the farms most at risk of going out of business.

We see a 3-tiered market structure for broccoli in the Northeast today:

TIER 1: A small amount of direct-market broccoli *rushed* to market typically without icing.

TIER 2: A few clever, experienced midsize farms who have figured out how to wholesale at a small-scale and deliver high quality product, with or without icing.

TIER 3: Commodity volumes and prices for supermarket chains, grown by the largest farms that own or can access expensive icing technology, marketed by brokers or farms with professional marketing and sales employees.

Part III: Recommendations

Opportunities for Expanding Broccoli Production and Distribution in New York

The study identified 4 major opportunities for expanding broccoli production and distribution in New York that are worthy of serious consideration.

Recommendation A: Expanding Large-Scale Commodity Production

Broccoli was an unconventional, perhaps even a crazy idea at Parker Farms 22 years ago. Their broccoli trials got off to a slow start. At the time, there was limited successful production in Maine. But there was none in Maryland, where Parker Farms was located, nor elsewhere along the East Coast. Parker Farms' founders were laughed at when they spoke in public about making broccoli a significant crop along the East Coast. Retailers were skeptical they could grow a crown that measured up to California standards. Stubborn as independent farmers can be, Parker Farms dug in their heels and began researching and experimenting with different varieties, fertilization, and spray techniques in different locations from Florida to Maine. Eventually, one by one, they landed contracts with major retailers. The broccoli business grew to become Parker Farms' #1 product (followed by sweet corn and squash). Today, Parker Farms represents over 4,000 acres of Eastern broccoli production, and ships 40-50 truckloads of broccoli per week, mainly to retailers.

The simplest path, and the quickest path, to more Eastern broccoli is expanding the production and volume that currently feeds the Eastern supply chains that already exist, those of Parker Farms, Hapco Farms, and Smith's Farm of Maine, which compete directly against Western supply chains on the standards for quality, packaging, and price that have evolved in recent decades to define the global commodity broccoli deal. The next quickest path would be for another experienced vegetable broker or distributor to develop new broccoli supply chains that mimic the existing ones. If there's anything simple and quick about expanding the scale of these 3 supply chains, it's only because they have been battle tested by 3 companies whose trial and error over decades taught them how to be competitive under Eastern conditions.

There are several ways that existing supply chains could expand:

- Participating growers could plant more acreage.
- New growers could be recruited. They would have to be *connected* to existing icing infrastructure, or be willing and able to make an investment in new icing infrastructure on their own. Being *connected* means relying on another, presumably nearby, grower or processor whom they would either pay for icing services or sell them their product. In this arrangement, a new grower could participate with a lesser commitment of acreage, and could thereby get a feel for the broccoli deal before making a larger commitment of land or investment in infrastructure.

Organic Opportunity

At whatever scale is possible, there is a great opportunity to produce and market more Eastern organic broccoli. From 2011 to 2019, there was an 84.9 percent increase in the number of farms and number of acres growing organic broccoli in the U.S., mostly in California, Arizona, Oregon, Washington, and Florida (Lucier & Davis, 2020). Richard Thorpe, Regional Produce & Floral Procurement Leader, Whole Foods Markets--Northeast/North Atlantic regions, stated they buy and sell more organic broccoli than conventional, with approximately 50-60 percent of it sourced from Eastern growers.

We also heard many cautionary tales, reminders of why organic broccoli is hard to get to market, at least profitably. Sandi Kronick, of the food hub Happy Dirt in North Carolina, said: "It's more about the post-harvest handling capacity of the farmers than the growing side of organic broccoli." Other growers cautioned about the pest management and labor side of organic broccoli. Matt Kludt worries about the control of head rot in a wet year. Wally Czajkowski of Plainville Farms in Hadley, MA gave up raising organic broccoli because of high input costs, noting: "Here's the thing—buyers want organic, but it has to be perfect." Dave Walczak, Operations Manager of Eden Valley Growers, said that organic broccoli wasn't worth it in the end, adding: "There are enough struggles with conventional broccoli." Nevertheless, customers are hungry for more organic and they remain encouraging.

Recommendation B: Cooperative Broccoli

New York has the right growers: vegetable farmers with the talent, knowledge, and experience to grow high-quality broccoli. While Hudson Valley growers say they have better options and would be unlikely to consider a large investment in broccoli, Upstate growers have sufficient land, and express more willingness to consider broccoli at a significant scale. For these Upstate growers, the most serious obstacles are access to affordable icing technology, investment capital, and reliable wholesale markets.

A cooperative or collaborative approach to icing, packing, and marketing holds promise, at least in theory. Imagine a cluster of vegetable farmers in the same growing region who make a combined commitment to grow several hundred acres of broccoli. The processing infrastructure—icing, cooling, pack line, and packaging materials—would be centralized at a co-owned facility, or at a lead grower's facility. The financial arrangement among growers would depend on how the venture is structured.

In a formal cooperative, the venture would be carried forth by co-op members and employees, while the assets—facility and processing infrastructure—presumably would be owned by the cooperative which is owned by its members. The co-op would secure the necessary investment capital to buy or lease the assets. The most common approach to product handling would be for the co-op to procure broccoli from members and then process and market the broccoli under the co-op's name, paying growers, and covering its operating expenses from the proceeds from sales. Or, the co-op could handle product on a fee-for-service basis, charging members, or even non-member growers, for packaging materials and for processing broccoli that farmers would then market themselves. The positive side of fee-for-service operations is that it would add volume and efficiency as it helps cover the high costs of icing. The downside would be the inevitable competition that would result between the co-op's product and brand, and the client farmer's product and brand, potentially leading to strife inside the cooperative.

Strong vision, leadership, and operational management are necessary ingredients for success in any cooperative. Co-ops work best when members see their brand as the tide that was designed to lift all boats. Without strong visionary leadership and management, and without a brand-driven or mission-driven culture in place, too often co-ops end up serving the narrower interests

of the largest or loudest members. That is why, in some parts of rural America, the word *co-op* instantly triggers suspicion and memories of an unsuccessful cooperative effort years or decades past.

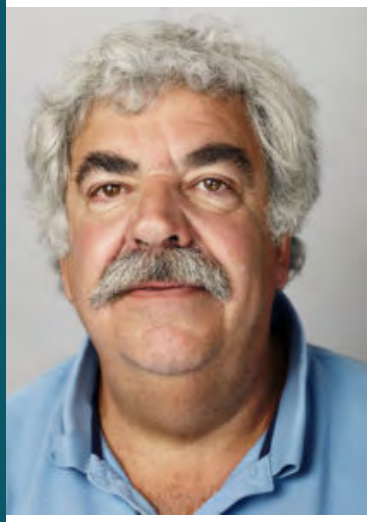
Nevertheless, a cooperative or collaborative approach to broccoli processing and marketing is one of the logical ways to overcome the high cost that individual growers are not willing to risk on their own. There are other forms of collaboration—simpler, legally and structurally, than a formal cooperative—that accomplish the same ends.

Start with a similar group of vegetable growers who farm in the same region. One grower, presumably a grower with substantial capacity and experience (both at vegetable processing and marketing), and who has established trust with the others, steps up to play the lead role. That grower agrees to take on the risk of investment, acquire the icing and processing infrastructure, as long as nearby growers agree to join in as junior partners in the venture by planting X number of acres in a coordinated schedule. The deal could be formalized by a written contract. Or, as independent farmers sometimes do, it could be sealed with a handshake.

There are multiple versions of less formal collaboration. In every case, there's substantial risk that is shared by all involved, even if the lead participant holds the greatest risk. And success, in every case, requires long-term commitment, good communication among all participants, proven customers who make reliable advance commitment, and some luck.

"I've always believed this: the so-called 'market' for any crop, which is the going price everyone refers to, is not based on the best product on the market. It's based on the lower quality commodities. So, if I can help my neighbors any way I can to have a more consistent crop then that makes it easier for all of us, together, to market our crop at a profit for ourselves. ...That's one way to level the playing field for all of us. It's a better way for us to show up in the marketplace. The stores are going to try to pound you down no matter what, that's just the name of the game."

– John Gill, Gill Corn Farms (now Hudson Valley Farm Hub)



Prior to selling his 1,000 acre farm, Gill coordinated an East Coast network of sweet corn growers who, together, through his company, sold endless truckloads of sweet corn everywhere and to everyone including export. Rather than a cooperative, it was a collaborative approach to produce brokering.

Recommendation C: Blended Supply Chains—If You Can't Beat 'Em, Join 'Em

Silas Conroy is the Director of Supply Chain at Headwater Food Hub in Ontario, NY. He purchases produce from more than one hundred growers in New York, ranging from 5 acres—basically a market garden with one wholesale crop—to a 3,000-acre multi-generational farm in the fruit belt. Headwater is interested in all New York farm-fresh products, including meat, dairy, and some value-added products.

Headwater started as a CSA program, focusing on direct-to-consumer. Five years ago, they transitioned to institutional customers including schools and restaurants. This includes 70 K-12 school districts participating in a farm-to-school program that Headwater initiated. Since COVID-19, Headwater has pivoted back to direct-to-consumer marketing, including a meal box program. They are assisting Common Market (based in Philadelphia) with the USDA Farm to Families Food Box Program. Headwater does minimal retail sales, focusing on independent stores and food co-ops.

Broccoli is an attractive item because of the strong and steady demand among institutions. However, broccoli has proven difficult for Headwater to execute for several reasons. Product quality with summer-harvested broccoli has been inconsistent. Today, Headwater plans for mostly fall-harvested product. Broccoli for retail customers was difficult for growers because preparing retail-ready product is more labor-intensive, more packaging-intensive, and many retailers require top-icing (icing infrastructure that Headwater's smaller growers simply cannot afford). To serve institutions with a longer season, Headwater teamed up with one food hub in New Jersey (Zone 7) and another in eastern North Carolina (Happy Dirt). Broccoli landed at a shared (between Zone 7 and Headwater) cross-dock in the Hudson Valley at $30 per case leading to customer pricing substantially above market. Though Headwater found that some institutional customers were willing to pay a premium for local broccoli, when prices for local and Eastern broccoli rose above 10 percent-over-market, orders remained small, and this was a reinforcing cycle that was hard to break out of.

Relationships among the 3 food hubs were strong and positive. However, the Headwater/Zone 7/Happy Dirt collaboration illustrates a situation that food hubs nationwide are trying to overcome. That is, that too many small and inefficient handlers, with too many margins layered on top of one another, lead to noncompetitive prices, and thereby small orders. On the one hand, most food hubs make for natural partners with one another. They share a value system and a commitment to act and market on behalf of small-scale, midsize, organic, and sustainable growers who are in need of marketing assistance. On the other hand, many food hubs operate with limited infrastructure and at a small-scale (less than $10 million in sales per year), which is further limited by the cost structure of their grower/suppliers—these are wholesale growers who want and need to earn $20 per case for conventional broccoli and $24-26 per case for organic broccoli. Compare this to the range of $12-16 per case FOB paid to large-scale growers for conventional broccoli heading to supermarket chains in full trucks.

Conroy has a vision of a better future: "Network optimization across East Coast food hubs and broccoli producers could look like this: instead of one hub selling to another hub, it's a picture of group buying; hubs getting together and saying, 'Okay, we're going to buy this much broccoli this year, we aim to pay a farm gate price of X, Y, or Z, and then coordinate on logistics. Everything is transparent, and aiming for load efficiency.' I'd like to be able to source up and down the East Coast for a decent part of the year until my local sources come in."

Sandi Kronick, Founder and CEO of the food hub Happy Dirt in Durham, North Carolina, shares Conroy's vision: "When I think about how we make great broccoli work along the East Coast, I see a few regional facilities that know exactly how to handle broccoli, with fast turnaround, experts at quality control, and I see field agents that go out and coach farmers about production and post-harvest quality of the broccoli. Do all that and we're golden."

Conroy explains how in 2020 he evolved a blended pricing strategy to address some of these inefficiencies: "Early in the season [early July 2020], we were buying Kludt Farms broccoli through their broker Parker Farms at around $16-17 for iced cases FOB. As we got further into the season, Parker's price dropped to the $12-14 range which enabled us to blend a smaller farm [Bauman's] broccoli into our program, while paying around $18 [hydro-cooled, delivered to our warehouse]."

Conroy goes on to explain why paying 2 growers a different price for nearly the same product at the same time of year, with transparency all around, can be a winning and necessary strategy for all involved:

> I couldn't forecast institutional demand very well this year because of the pandemic. Customers were experiencing spotty hard-to-predict attendance from students who were on-and-off campus. Therefore, I couldn't provide our smaller farms accurate numbers on

how much broccoli to plant. Having the larger farm supply available to us meant we could be flexible and responsive to customer demand, using product from the smaller farms when they had it, and sourcing from the larger farm when they didn't. Our inability to forecast didn't adversely impact the larger farm because the few pallets we needed were such a small percentage of their overall production.

In 2020 Conroy sold local broccoli at the 2 different prices. However, with this experience under his belt, and in a year where demand forecasting is more possible (either through planning or formal bidding), Conroy says: "I definitely think that blending the 2 prices into a single blended price that would last the whole season could work." It would be easier for customers, and it would lead to more sales of broccoli overall. "If we were able to contract with Kludt, and could lock in a price around $13-14 for the whole season long, it would make possible the $17-18 our smaller growers need to get, while enabling our institutions to pay an affordable 'local' premium for as long as supply lasted [instead of paying way above market price for a symbolic, small supply of broccoli over a couple of weeks]."

The blended price approach has the potential to change the economics of the deal. It keeps the small and midsize growers as important partners. It brings a large-scale grower, a marketer, a regional food hub, and midsize growers into collaboration in a way that on paper, from a distance, might be judged as unfair or impossible—paying 2 prices for the same product as part of the same deal. It provides institutions with more total broccoli at a more affordable price over a longer season. It might be a win-win-win strategy.

Let's look at another example of blended pricing: a food hub in the Eastern U.S. is supplying local broccoli and other vegetables as part of a direct store delivery (DSD) program developed for 10 stores that are part of a large regional supermarket chain called Parson's. *This example is fictitious*, though it is based on real circumstances, real companies, and real prices.

Food Hub X has a close working relationship with Middle Road Farm owned by Jerry and Marsha Cerullo, a diversified farm that raises 250 acres of both organic and conventional vegetables, including 25 acres of conventional broccoli. They used to raise organic broccoli, but gave it up due to disease issues they could not overcome. At the start of the DSD program, Parson's was paying $26.50 (delivered price) for a case of broccoli crowns packed in a plastic bag inside a waxed box, top-iced. Food Hub X agreed to supply 8 items to Parson's 10 stores, including sweet corn and summer squash along with broccoli—the high-volume items that paid for the expensive cost of delivery. At the start of the program, Parson's was paying $20 for a bag of sweet corn and $21 for a half-bushel of summer squash.

When the DSD program with Parson's began, Eastern U.S. consumers were in the early stages of discovering locally grown farm-fresh products in their supermarkets, and there was an aura of excitement and newness around all things local. Supermarkets were searching for local products, especially from farms that their customer base would recognize (the farm name and/or the location). Local was not a new concept for Parson's; they had been carrying local produce and promoting it for a long while. However, they were ready to make it a higher priority. As the program entered the year 2019, although consumer demand for local remained steady and strong, Parson's (and other large chains) began rethinking their business model for the procurement of local produce. They were buying vegetables through 2 different supply chains at 2 different prices (90+ percent of an item was coming through the central warehouse at the prevailing commodity price, while the other 2-10 percent was being procured locally and delivered directly to each store at a higher price). This duplication of effort challenged Parson's at multiple levels:

- ***Receiving at Store Level***
  Produce department managers were not trained to inspect and receive incoming produce the way warehouse inspectors were.
- ***Inventory Management***
  Some local producers did not offer the volume or consistency that stores require. An unannounced out-of-stock or shortfall on an important item, like broccoli or sweet corn, is completely unacceptable in the supermarket world.
- ***Pricing***
  Having 2 sources—the local farmer and the supermarket warehouse—feeding the same product to the same store in the same week is challenging when it comes to pricing (when the local product costs more). This gets especially challenging at the cash register which serves as the computer brain that reports on inventory numbers sold and needed, as well as on sales and the most basic financial information. Is this one product or two? They are probably using the same product code—the same Price Lookup Number (PLU sticker).
- ***Signage and Merchandising***
  Local produce displays call for custom signage, requiring the department managers at store level to generate unique signage that highlights the local farms (which will be different for Parson's stores in one state from those in a neighboring state).

Parson's highest level produce management came to see their locally grown direct store delivery (DSD) programs as costly—both the produce itself, and the labor required to manage it well. They knew that local produce was increasingly important to customers. So they prioritized all locally grown products that could be shipped through the central warehouse, which meant buying from the largest scale local growers who were able to deliver consistent quality and volume *at the going commodity price*. They had been buying from some of these large-scale local growers for years. What was challenging to figure out was how to move forward with the DSD programs that had developed throughout their selling region, many of which included midsize growers who operated at a different scale, with a different cost structure, which required higher prices in order for those farms to remain profitable.

Parson's announced in 2019 that, while they valued their DSD growers and hoped to continue doing business with them, DSD partners would need to deliver for a price closer to what the warehouse was paying for the same item. DSD growers would be given a premium of 5 percent above the warehouse price. In essence, Parson's was saying to their DSD broccoli farmers that they would pay 5 percent more (approximately $1 per box) for orders of 10-20 cases per delivery (per store) than what they were currently paying for the multiple truckloads (approximately 1,000 cases each) of broccoli they received each week from their West coast broccoli suppliers. The new DSD price for broccoli would be $18 (plus the $1/box premium = $19).

Food Hub X was paying an average of $5 per case for the trucking of each box delivered to a Parson's store. The food hub aimed to earn an additional 10 percent of each sale to cover its own costs, or approximately $2 per case. That would leave $11 for Middle Road Farm. Jerry Cerullo had been very clear; the lowest he could afford to go to make the Parson's deal work was $18 per case FOB, before the cost of trucking and the Food Hub X margin was added on top. Not even close.

The Senior Buyer at Food Hub X, Charlotte Ploch, was stubborn, persistent, and creative. She was not about to surrender without one more try. She contacted other regional DSD providers to Parson's to explore joint trucking possibilities, and discovered one company who was willing to pick up and deliver the food hub's products for $2.50 per case. Because their trucks were not filled to capacity, the Food Hub X products would actually add efficiency to their runs. Ploch approached one of the largest regional broccoli growers, which was located approximately 300 miles from the Parson's stores, who was willing to ship Food Hub X partial truckloads of broccoli crowns for $14 FOB ($15.50 delivered to Middle Road Farm) which the food hub would use to complement the supply of Middle Road Farm's own broccoli at $18 FOB. Ploch was transparent with both growers about her blended price strategy, and with Parson's vegetable buyer. She calculated that if she delivered around two-thirds of her supply sourced from the regional grower and one-third from Middle Road Farm, she would be able to offer Parson's a blended broccoli price of $20.89 ($16.39, the blended FOB price for broccoli at the farm + $2.50 for trucking + $2 for the food hub margin = $20.89). It did not match Parson's stated price of $19, but it was much closer, and it enabled Farm Hub X to greatly expand the volume it could offer and the length of the selling season.

Ploch is expecting Parson's Buyer to say no to her final blended price offer. The blended price approach is likely to be outside of the Parson's comfort zone, both because it integrates regional supply with ultra-local supply, and also as a financial model.

. . . . . .

Taylor Lanzet gives us another way to look at the benefits of a blended pricing approach to procurement. Lanzet was Senior Director of Supply and Sustainability for the Dig restaurant chain when she was interviewed. Lanzet had been pioneering a blended price approach to procurement which enabled her to source more widely and support the growers she most wanted to buy from:

> All I care about, ultimately, is the blended price, which makes what Dig does pretty unique. I know that taking a holistic approach toward regional sourcing is how we are going to celebrate seasonal differences and do more good for farmers and the planet. So if I'm buying from 7 different growers over the course of the season, and one is at $26 while another is at $18.75, as long as the Dig team manages weekly loads and volumes, we can anticipate which farmers will be supplying us and at what volumes. Of course, this approach is much more time intensive and requires a few risk management strategies, but the outcome allows us to work with more diversified growers. Nine times out of ten, I can work with a grower I trust. It's rare that we won't be able to make it work—as long as there's transparency and trust.

Recommendation D: Solving the Frozen Local Broccoli Bottleneck

Bridget O'Brien Wood is the Director of Child Nutrition Services for Buffalo Public Schools, responsible for feeding 29,000 daily meals to 34,000 students while following the strict rules and regulations, both federal and state, that spell out nutrition guidelines, allowable costs, and procurement procedures—no easy job!! One example is that schools are required to provide one cup of dark green vegetables each week. Bridget would like to fill that requirement with broccoli, locally grown in New York, on a weekly basis. To accomplish that, she would need roughly 7,000 pounds weekly. She has found a way to include 1,200 pounds total of fresh (raw) broccoli in September and October when the New York harvest is available, even though schools do precious little cooking from scratch. However, 1,200 pounds is not a lot of broccoli. It is the yield from approximately one-tenth of an acre. To incorporate locally grown broccoli at a significant scale would require a source of frozen broccoli that could be delivered year-round at a competitive price. Unfortunately, such a source is not currently available. This is the frozen local broccoli bottleneck.

> *The bottleneck shows up as the absence of manufacturing infrastructure and capacity that is willing and able to freeze and package locally grown broccoli with efficiency and scale enough to produce year-round supply and competitive pricing for both institutional and retail markets.*

The bottleneck exists, in part, because of the limited supply of broccoli that is produced near whatever frozen vegetable infrastructure is left along the East Coast. The bottleneck also exists because of the low cost of imported frozen broccoli from Mexico, Guatemala, and Ecuador. This bottleneck stymies the development of local frozen broccoli for retail as well.

From the demand side of the equation, frozen broccoli is a good choice as a green vegetable for schools. It's the third most popular vegetable purchased frozen by Americans. Only frozen peas and potatoes (french fries) have higher per capita consumption. However, as frozen broccoli has grown in popularity the past 50 years, the source of the broccoli has shifted from home grown to imported. In 1974, 95 percent of frozen broccoli was grown domestically, leaving 5 percent imported. By 2019, only 9 percent was grown domestically, while 91 percent was imported (USDA ERS Food Availability Data, 2020). A separate Economic Research Service dataset reports the volume of frozen broccoli imports from each country to be 73.3 percent from Mexico, 10.7 percent from Guatemala, 8.0 percent from Ecuador, 4.0 percent from China, 2.7 percent from Spain, and 1.3 percent from other countries (USDA ERS Data by Commodity—Imports and Exports, 2020).

It's not that frozen local broccoli as a product doesn't exist. Indeed it does. The frozen local broccoli that's successfully marketed to farm-to-institution schools today is manufactured at small-scale and sold at above-market prices, made possible by the determination and hard work of small companies and the unusually strong interest and willingness of institutional customers. There are creative examples, including right here in New York and New England.

Franklin County Community Development Corporation (FCCDC) in Greenfield, MA is an example of success at a small-scale. The mission of FCCDC is "to stimulate a more vital rural economy, maximize community control, and expand opportunities for low and moderate income residents." FCCDC helps food businesses to start, plan, and grow. Five years ago, FCCDC invested in an Individual Quick Freezing (IQF) machine to meet the demand for processed local peppers, potatoes, carrots, and broccoli. Their subsidiary company and brand, Valley Veggies, sells the frozen vegetables primarily to institutional customers.

FCCDC's broccoli operation provides a window into the steps involved in freezing broccoli. John Waite, the organization's Executive Director, explains: "We get it from nearby farmers who have been harvesting broccoli since 5:00 or 6:00 in the morning. They get it to us quickly. It comes in with ice on top. Then we have it cut, spin-dried, washed, blanched, and frozen by 4 o'clock that same day. It's as fresh as you can get."

Let's run that process in slow motion. FCCDC buys broccoli crowns for $0.95 per pound. Although FCCDC has agreements with farmers to grow broccoli, the supply suffers from the inconsistencies of summer broccoli—from the short harvest window before it goes to seed in the heat, to the inconsistently sized heads which can force FCCDC to abandon their floretting machine and hand-cut it instead. The washing, cutting (floretting), blanching, spinning, freezing, and boxing steps are a combination of tedious hand work and machine work. For example, the staff operates an air-driven machine to separate broccoli florets from stems, while hand feeding the machine 2 broccoli crowns at a time. The IQF machine can process 400 pounds of broccoli florets per hour. A good day of production at FCCDC yields 2,000 pounds. The entire process at FCCDC takes about 8 hours. Approximately 35 percent of total weight is lost.

Step 1: Hand load 2 heads in machine.

Step 2: Press 2 buttons simultaneously.

Step 3: Machine cuts stems from florets.

Step 4: Manually sort out culls.

The 4 steps of cutting (floretting) broccoli require a combination of manual and machine work. Photos from Charlie's Machine and Supply.

The main customers for Valley Veggies frozen broccoli are institutional buyers like Chartwells, who distributes to school districts in Massachusetts, New York, and Connecticut. Chartwells pays above-market price—$2.50 per pound or approximately 23 percent above a more standard price of $2.03 for domestic frozen broccoli—because of the extra value provided by FCCDC, a farm-identified local source and story, and full transparency in the supply chain. Recently, Valley Veggies has added small grocery stores in the region, to which they sell 12 ounce packages of blueberries, broccoli florets, bell peppers, diced carrots, diced potatoes, diced carrot and parsnip blend, and diced butternut squash.

Frozen local broccoli is a *labor of love* for Valley Veggies and FCCDC. Unfortunately, it's not yet a profitable one. There's too much manual labor in it, too much unpredictability at the sourcing end, and not enough scale to enable FCCDC to invest in machinery that would lower their unit cost of production (and ultimately their selling price). For the time being, they plan to keep on pouring the *love* into it.

The Farm Bridge, formerly known as Farm to Table Co-Packers, located in the Hudson Valley town of Kingston, NY, is an example of a small-scale processor that tried to make a go of source identified IQF produce, and then backed away. From their website: "The heart of our work is to create and maintain good local jobs making wholesome foods that support the resilience of our regional food-shed." The Farm Bridge works with over 30 regional farms to offer farm-identified frozen, refrigerated, and shelf-stable produce in retail sizes and in bulk cases for institutions in the Northeast. They help food entrepreneurs and midsize consumer product brands get established. They sell under their own brand name and co-pack for others under their brand names.

Jim Hyland, Founder and CEO, has tried frozen broccoli and he believes conclusively that broccoli cannot be IQF packed at a small-scale, which, for his operation, was 2,000-5,000 pounds per day. "It's not profitable, not practical, and it doesn't work." He offered several insights about scaling up local production to compete against global commodities. "Be able to offer a value proposition to the consumer such that they will pay more for smaller local production runs that cost more than what they would pay for a comparable item produced through the commodity market. And, invest heavily in varietal selections, equipment on the farm, and IQF equipment in the processing facility. Also, find ways to utilize the IQF equipment beyond the short harvest season associated with specialty crop production in New York." Saying no to IQF broccoli is one of the decisions Hyland made that has enabled them to focus on and succeed at other ventures.

Seal the Seasons (StS) is a Certified B Corporation, working with growers and processors nationally to provide locally grown, locally frozen produce, primarily fruit, to retailers. From their website: "Our mission is 'striving to make local fruit available to everyone 365 days a year. We also aim to save family farms…by providing farmers with a new reliable revenue stream.' StS products are sold in 4,000+ stores nationwide."

How can one small company procure local produce, process, freeze, and package it, and then market each product as locally grown in its own region, at a national scale? The answer is by creating a business model that utilizes the assets and infrastructure of strategic partners—farmers and processors—so that StS does not have to invest in and own all the processing and freezing infrastructure.

StS primarily relies on IQF technology to freeze local fruits and vegetables, occasionally using blast freezing technology when necessary. Co-Founder and Chief Operating Officer Alex Pisaecki says that freezing fruit is relatively straightforward. Most fruits require minimal processing, only requiring a wash and freeze process. Unlike fruits, vegetables, such as broccoli, are more labor-intensive, complicated, and expensive to process, blanch, and freeze.

For the time being, StS remains focused on retailers as their target market. Schools are more price sensitive. Pisaecki says that would undermine their ability to pay what they consider to be fair prices to family farms.

Bonduelle is about as big as freezing gets in the Northeastern U.S. Bonduelle is a €2.8 billion multi-national corporation with 3 business units: Europe, Americas, and Eastern Europe. Utilizing 4 technologies—canned, fresh, frozen, and prepared foods—they serve as a leading plant-based food company, incorporating over 500 varieties of vegetables. They work with 2,800 farmers worldwide, who collectively harvest 126,000 hectares (311,353 acres). Fifty-six processing facilities pack the following brands: Bonduelle, Cassegrain, Arctic Gardens, Globus, Ready Pac Foods, and Del Monte. Their U.S. plants are located in Wisconsin and Bergen, NY, the latter of which is strategically located in the heart of New York's vegetable producing region (Bonduelle,

2021). Whether or not Bonduelle could be a future partner in a frozen local (New York grown) broccoli program remains to be seen. However, they are a significant value-chain processing partner in New York with existing infrastructure, expertise, and a commitment to New York farms.

Explaining the Bottleneck Through a Farm-to-School Lens

Farm-to-school, or farm-to-institution, efforts have been growing in popularity throughout New York and New England. This is evidenced by steadily increasing local procurement efforts and by the emergence of incentive-based State legislation.

According to a 2017 New York Academy of Medicine report, New York public agencies and institutions purchased $957 million of food to feed 6.6 million consumers—roughly one-third of the state's population. Many of the recipients are among the most vulnerable: children, the infirmed, and the elderly. Of the total, an estimated $420 million was spent by public K-12 schools to feed approximately 1.7 million students.

New England is home to approximately 4,628 K-12 schools, 200 colleges and universities with dining services, and 256 hospitals. Based on a survey conducted by Farm to Institution New England, respondents self-reported their total annual food budget spent on local food for K-12's was 16 percent ($24.9 million); colleges and universities was 21.5 percent ($67.7 million); and hospitals was 15 percent ($6.4 million) (FINE, 2021).

State level legislation incentivizing the procurement of local food by School Food Authorities (SFAs) is playing an important role. One example in New York is Governor Cuomo's No Student Goes Hungry Program, a key provision of which is the Additional State Subsidy For Purchasing New York State Food Products, also known as the 30% NYS Initiative. Through the 30% NYS Initiative, SFAs that can demonstrate spending at least 30 percent of their lunch budget on foods grown, raised, or produced in New York are eligible to receive an additional $0.19 in reimbursement per lunch served, for a total of $0.25. The additional reimbursement has increased interest among SFAs in localizing their food supply chains. It has also encouraged both new product development, and the reformulation of existing products to meet the Initiative's requirement that qualifying products must contain at least 51 percent agricultural raw materials grown, harvested, or produced in New York, by weight or volume.

In Maine, the state legislature enacted the Local Produce Fund in 2019, providing a $1 match for every $3 a SFA pays for produce or minimally processed foods purchased directly from a farmer, farmers' cooperative, or local food hub in Maine, up to $1,500 per fiscal year (Maine Legislature, 2020). Local procurement incentive bills are also being introduced in the Vermont and New Hampshire legislatures.

School food procurement is a highly regulated and complex process. Federal and state laws govern how foods may be purchased and the nutritional meal pattern that each reimbursable meal has to comply with. Furthermore, SFAs are extremely price sensitive. Based on data from the 2014-15 school year, the average cost to produce a school lunch was $3.81 (45 percent is for the cost of food), which exceeded the federal subsidy for free meals at that time. More specifically, across all SFAs, only 93 percent of the costs required to produce a school lunch were covered by revenues from reimbursable meals (USDA FNS, 2019).

Bridget O'Brien Wood, Director of Child Nutrition Services, Buffalo Public Schools, comments on the perennial challenge in her job: "When costing out a school lunch, it comes down to pennies, quite literally. To adhere to the federal school lunch nutritional meal pattern, I have to offer each high school student 2 ounces of protein, 8 ounces of milk, 1 cup of vegetables, 2 ounces of grain, and 1 cup of fruit per day, and I need to do it all for less than $2 per student."

Given this price sensitivity, schools rely heavily on what are known as *entitlement dollars*, allotted by the federal government based on meal participation (the number of meals and students served each day). Entitlement dollars are used to purchase USDA Foods, which account for 15-20 percent of the lunch tray on any given day, and include items from every commodity group. Entitlement dollars can also be used to procure fresh produce through the Department of Defense Fruit and Vegetable Program, available through a select handful of distributors in each state.

SFAs that administer federal child nutrition programs must adhere to the Buy American Provision. This provision requires SFAs to purchase domestically produced agricultural commodities. Two exemptions exist regarding the provision. SFAs are allowed to procure imported food if (1) they are not produced domestically in sufficient and available quantities, e.g., bananas and pineapples; and (2) the cost of the domestic product is significantly higher than a similar imported product (USDA FNS Child Nutrition Programs, 2019). The school food market for domestically produced frozen broccoli is fairly protected, as it doesn't tend to qualify under either exemption. Domestic frozen broccoli is both available and cost competitive, when compared to a similar imported product. This creates a potential opportunity for processors seeking to freeze domestically grown broccoli, assuming it's affordable. Not only is frozen broccoli a product SFAs use in large amounts, favorable legislation is increasingly diverting school food dollars to staple products produced with locally grown ingredients—enter the possibility of frozen broccoli sourced from local farmers.

However, it is important to note that SFAs are able to procure frozen domestic broccoli with their entitlement dollars. And purchase it, they do. During fiscal year 2019, 9.6 million pounds of frozen broccoli were purchased by USDA for use by child nutrition programs, totaling over $13.6 million, at an average price of $1.42 per pound, 93 percent derived from California and 7 percent from Michigan (USDA State of Origin, 2019). To shift SFAs away from using their entitlement dollars to purchase the bulk of their frozen broccoli needs, either the price has to be competitive and/or the product needs to be differentiated, for example, source identified from a local farmer, thus serving as a qualifying product under the 30% NYS Initiative and possibly other policy-based procurement incentives.

A food service employee at City Honors School in Buffalo, NY, prepares locally grown broccoli for the school's lunch.
Photo by Lindsay France, Cornell University

Table A depicts the actual cost per pound of Individually Quick Frozen (IQF) broccoli for select Western New York School Food Authorities (SFAs) from a broadline distributor (personal communication, February 4, 2021). Despite differences in client size, the price quoted remained the same for all. Also included is the estimated price per pound of procuring with entitlement dollars. It's important to note, per the Buy American Provision, if using their foodservice dollars and not entitlement, SFAs are required to buy the domestically produced option at $2.03 per pound.

Table A. Cost per Pound of IQF Broccoli (Western New York SFAs)

Product	Source	Price/Lb	Customer
Broccoli Florets, IQF, Grade A, Domestic	WNY Broadline Distributor	$2.03	WNY SFAs
Broccoli Florets, IQF, Grade A, Imported	WNY Broadline Distributor	$1.61	WNY SFAs
Broccoli, Cut, IQF, Grade A, Imported	WNY Broadline Distributor	$1.18	WNY SFAs
Broccoli, Florets, Domestic*	USDA Foods	$1.28	SFAs —nationally

* Estimated price per pound used by states and school districts to estimate the entitlement value of USDA Foods orders placed for the upcoming school year.

A 2019 study conducted by the NYS Department of Agriculture and Markets found that not only are SFAs interested in sourcing local canned or frozen vegetables, many are willing to pay more for them. A survey of New York SFAs was administered to determine their interest in locally grown frozen and canned green beans and carrots, items that are available for purchase through the USDA Foods program with an SFA's entitlement dollars. Of the 259 SFAs that responded, 82 percent said they would consider purchasing frozen or canned local green beans in lieu of using their entitlement dollars on a comparable, but non-local product. Seventy-nine percent said the same of frozen or canned carrots and 12 percent said no to either. Furthermore, using a fixed case size of 30 pounds of frozen product and 6 #10 cans of canned product, 6 percent of respondents were willing to pay $1-2 more per case, 23 percent were willing to pay $3-4 more, 8 percent were willing to pay $4-5 more, and 6 percent were willing to pay $5+ more (NYS Agriculture and Markets, 2019). While there is no certainty these results would serve as a proxy for frozen broccoli, it does demonstrate that select SFAs are willing to spend school food dollars on items they can easily procure using their entitlement dollars and that they're willing to pay more for them, assuming they're locally grown.

The demand side of frozen local broccoli for schools shows promise. What about the production side? Producing frozen local broccoli, particularly IQF, is not for the faint of heart. It requires a large and reliable supply of fresh broccoli, sizeable investments in infrastructure, skilled labor, high volume, and committed customers. We found a frozen local broccoli venture that was well on the path to addressing all these requirements.

Breakthrough: Good Shepherd Food Bank/Harvesting Good

Solving the frozen local broccoli bottleneck is not simply a matter of scale and investment. It requires coupling the *right* local broccoli source with the *right* processing infrastructure.

In terms of farm production, "right" means:

- ***Quality control***—high quality product, field heat removed, packed to arrive at the processor for floretting at the right temperature with sufficient firmness.
- ***Location*** that meets the requirements of state and federal legislation that specifies location of ingredients; also close enough to minimize transportation time and costs.
- ***Consistent, predictable supply at sufficient volume*** that enables the operation to achieve efficiencies in processing reliant on continuous floretting and freezing.

In terms of processing, "right" means:

- ***Capacity*** to process, package, and freeze at the times of year when local broccoli is available.
- ***Food safety*** expertise.
- ***Operating efficiency and cost structure*** that enable the final product to be sold at competitive (or near competitive) prices to customers.
- ***Year-round storage*** capability.

Good Shepard Food Bank

Good Shepherd Food Bank (GSFB) is not your average frozen food entrepreneur. Their expertise is feeding Maine's food-insecure population. They neither grow vegetables nor do they process them commercially. And yet, they are organizing a frozen broccoli enterprise and writing a business plan that might just break through the bottleneck that has prevented other ventures from producing a cost competitive, source identified, scalable end product, available year-round.

GSFB is Maine's largest hunger relief organization. They are the source of food that has been rescued from retailers, recovered and procured from Maine farms, and provided through various U.S. government programs. They distribute to more than 500 member food pantries throughout the state. In 2021, they will distribute 39 million pounds of food. Their mission is to eliminate hunger in Maine by improving access to nutritious food for people in need, building strong community partnerships, and mobilizing the public in the fight to end hunger.

Kristen Miale, President of GSFB, began with the group as a volunteer. She came with deep experience in finance, but precious little in food, just enough knowledge to raise her hackles: "There was lots of junk food being handed out. That was my motivator at first. The obesity crisis was becoming visible and understood. I wanted our focus to be on fresh healthier foods." Kristen accepted the job of President in 2012. Today, 60 percent of the food that GSFB handles can be considered fresh, including produce, meat, dairy, fish, and seafood.

Matt Chin is Vice President of Supply Chain. He worked 25 years in operations, finance, and sales in California and Hong Kong, before moving to Maine and joining the Board of Directors of GSFB. Today, he's responsible for food distribution and for 42 of the food bank's total 90 employees.

Sourcing farm fresh products is not new for GSFB. They currently work with 70 farms, with a budget of about $1.5 million for fresh, local produce, as well as proteins, grains, and dairy products. Miale notes: "Great things happen when farmers get to know their local food pantry," such as the birth of the food bank's local food program called *Mainers Feeding Mainers* in which GFSB buys from local farmers at wholesale prices.

To meet current and growing demand, GSFB has been exploring how to source more local food. In the past, when the growing season ended in fall, access to fresh products became extremely limited. Produce through the national food bank network was typically lacking throughout winter and spring. Miale and Chin knew there was endless ingenuity inside the Maine farming community—Maine farmers could help the food bank find ways to extend the season for local produce. One of the ideas that emerged from this brain trust was Harvesting Good, the frozen broccoli opportunity that just might break through and solve the bottleneck.

Harvesting Good

Miale and Chin are behind Harvesting Good, their name for a new for-profit subsidiary of GSFB. Still in the development stage, Harvesting Good's business model calls for sourcing local produce and creating a line of source identified frozen vegetables, with broccoli serving as the anchor and debut product. They plan to freeze broccoli in the under-utilized IQF machinery of 2 wild blueberry processors. They will raise operating capital from a combination of private and public sources, including philanthropy. They will operate at a significant scale out of the gate, projecting 1 million pounds in output during the 2022-23 growing and selling season, scaling up to 5 million pounds by 2024-25.

John DuBois is the Engineering Consultant for Good Shepherd and President of Optimize, Inc. & Tandem Training Corp. His expertise has shaped the plan's post-harvest processing and technology decisions. DuBois believes that operating at a significant scale quickly is key to the project's viability and to its social impact.

As part of their due diligence, GSFB employed the services of an agri-business consultant, Jed Beach of Farm Smart Maine, to assess the feasibility of Harvesting Good's business model. Beach noted: "[The frozen vegetable industry] can generally be categorized as a low-margin, high-volume business with a global supply chain." In order to be successful and command a price that covers GSFB's expenses and affords them a small margin, Beach recommended that they find a "niche with a significantly higher willingness to pay per pound than the commodity market."

Suggested markets included premium retailers and institutions. The New England retail frozen broccoli market, at the time this study, was a $27 million market, with $10 million of these sales derived from frozen broccoli that sold at $1.75 or less per pound. However, an astounding $9.5 million was accounted for by *premium* frozen broccoli that sold for $2.75 or more per pound. The possible niche for institutional markets is for frozen broccoli that is domestically produced and is either required by law to be purchased, as in the case with K-12's through the Buy American Provision, or is simply preferred by buyers following their own individual values-based procurement practices, or the practices adopted by institutions and partner food service management companies, like Sodexo.

Maine Synergy

The wild blueberry industry of Maine provides frozen blueberries nationwide, year-round. Two such companies are Wyman's and W.R. Allen. Wyman's, a fourth generation family-owned business, started processing sardines in 1874 but, by 1900, turned its full attention to what they recognized was a truly unique natural resource, Maine's wild blueberries. They've grown to become one of the world's largest processors of this unique crop. W.R. Allen is a fifth generation family business that began canning blueberries in 1912 and turned to Individual Quick Freezing (IQF) in 1976. Both companies dedicate their IQF equipment to blueberry processing in August and early September. Wyman's is able to utilize the equipment for some other products, however, it is not operating at nearly the capacity that it does during blueberry season. For W.R. Allen, the equipment sits mostly dormant for the rest of the year.

The broccoli harvest bookends these summer months, with spring harvest in June into mid-July, with the heaviest harvest in mid-September into November. The proposed collaboration creates immediate scale and value for Harvesting Good while providing Maine's wild blueberry processors an additional source of revenue during off-season months—Maine synergy!

Broccoli will be Harvesting Good's first product line. The new venture's financial model, infrastructure upgrades, and sales projections are built on frozen broccoli. Why broccoli, one might ask? Growing conditions in Maine are favorable to the production of broccoli, and Maine farmers grow a lot of it. Forty-three percent of East Coast production, or nearly 6,000 acres, are grown annually in Maine. Furthermore, frozen broccoli numbers have jumped in recent years from a trade value of $242 million dollars in 2017 to $320 million dollars in 2020 (ERS, 2020).

Harvesting Good is working with Tom Ayer, the new Owner of Circle B Farms. Ayer is a fourth generation broccoli farmer, and is a critical cog in the Harvesting Good plan. Growing broccoli for Harvesting Good is central to the Circle B Farms business plan. Ayer is planning to acquire a hydrocooler, a $350,000 investment, with the help of GSFB.

To supply Harvesting Good, accounting for shrink (waste) in the floretting process, Circle B will need to dedicate roughly 160 acres to broccoli production in Year 1, 475 acres in Year 2, and 800 acres in Year 3. The project is a boost to Maine's farm economy as new acreage will come into production. Using an average price of $15 per box and 400 boxes per acre, it is estimated GSFB is adding $954,000, $2,856,000, and $4,764,000 of product in Years 1-3 respectively, to Maine's agricultural sales.

Good Shepherd is leveraging its deep history and partnership with Hannaford supermarkets. This allows the project to gain shelf space in retail markets, and scale operations at a faster pace. Ahold Delhaize, who owns Hannaford, is one of the world's largest retail chains, with store brands Food Lion, Stop & Shop, and Giant supermarkets. Wyman and W.R. Allen already distribute their products to Ahold Delhaize brands as well as to other customers all over the East Coast, making for efficient distribution of new broccoli products.

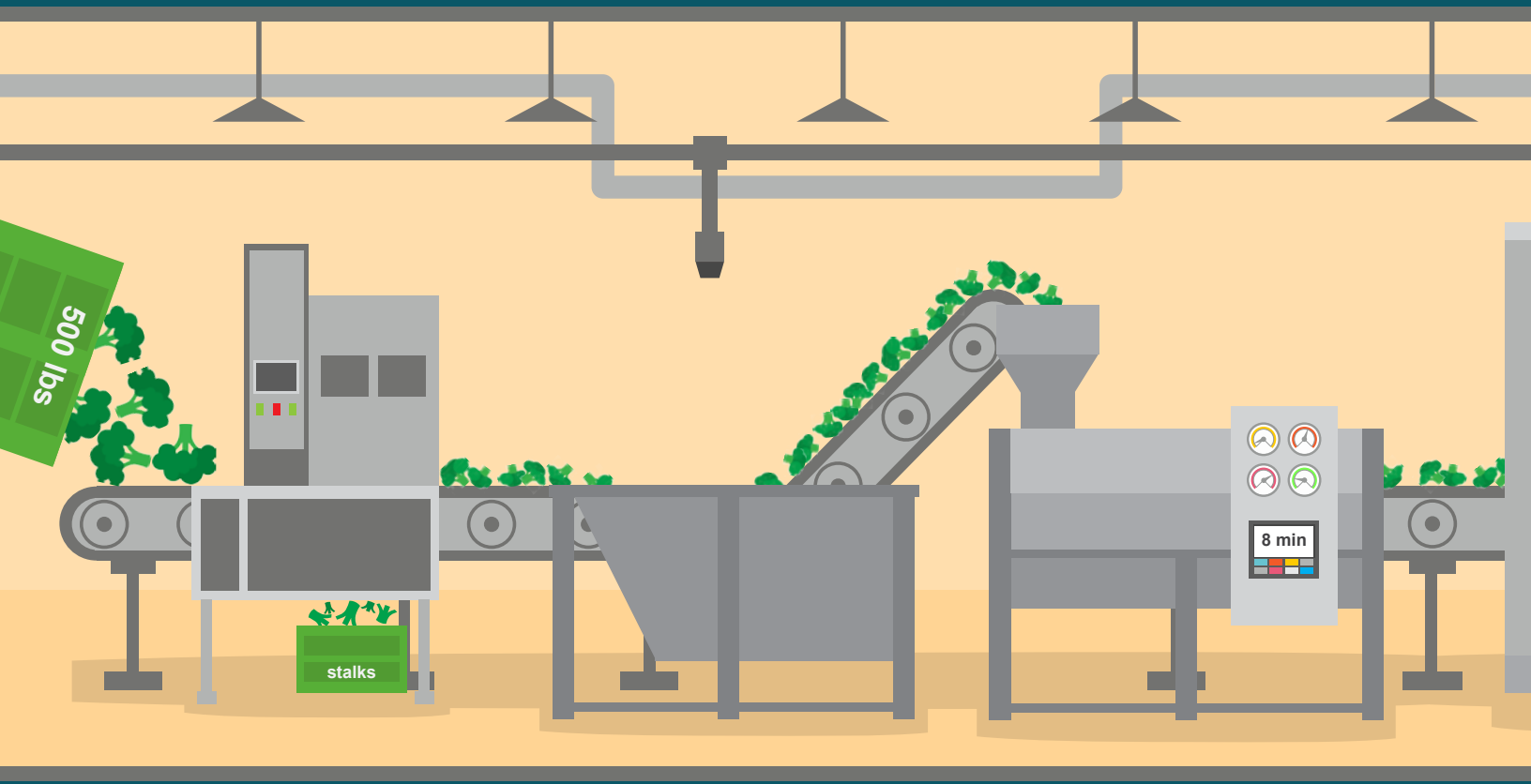
Inside the Harvesting Good IQF Broccoli Plan: Some of the Nuts & Bolts

> ***"Could a farmer/non-governmental organization (NGO) partnership like this one be successful, be profitable, in this country? We haven't seen it yet...maybe this will be the model that works."***
>
> *– John Dubois, Engineering Consultant to GSFB*

Harvesting Good is learning the meaning of *efficiency* in frozen food processing. IQF machinery runs most efficiently if it is operated 24/7. Harvesting Good is unlikely to reach that level of efficiency for several years. However, they want to grow and harvest enough broccoli to consistently process 8,000-9,000 pounds per hour. To move at that pace from the start, they are imagining a diversity of local frozen products for sale in grocery stores—in other words, more than broccoli—as fast as they can manage it.

Another aspect of efficiency is shrink (waste) management. The product loss by converting crowns into florets is projected to be as much as 25 percent. It's uncertain if the processing shrink can be repurposed into an alternative use and revenue stream. Nascent discussions regarding the possibility of a cut product that blends florets with stalks are underway. However, at first look, this option creates several new problems as it resolves only one.

Frozen Broccoli Process



Receiving — $ 60,900

500 lb totes filled with hydrocooled broccoli arrive from the farm.

Broccoli has been treated with a anti-microbial solution in the field to eliminate field born bacteria.

Totes are dumped using a tote dumper.

Floretting — $ 787,000

Broccoli florets are cut from the stalks.

Three floretters are required to keep pace with downstream processing.

Stalks can be repurposed or disposed/composted.

Washing — $ 195,500

Florets are washed in a flotation washer.

Leaves and other contaminants are removed using a vibratory sorter.

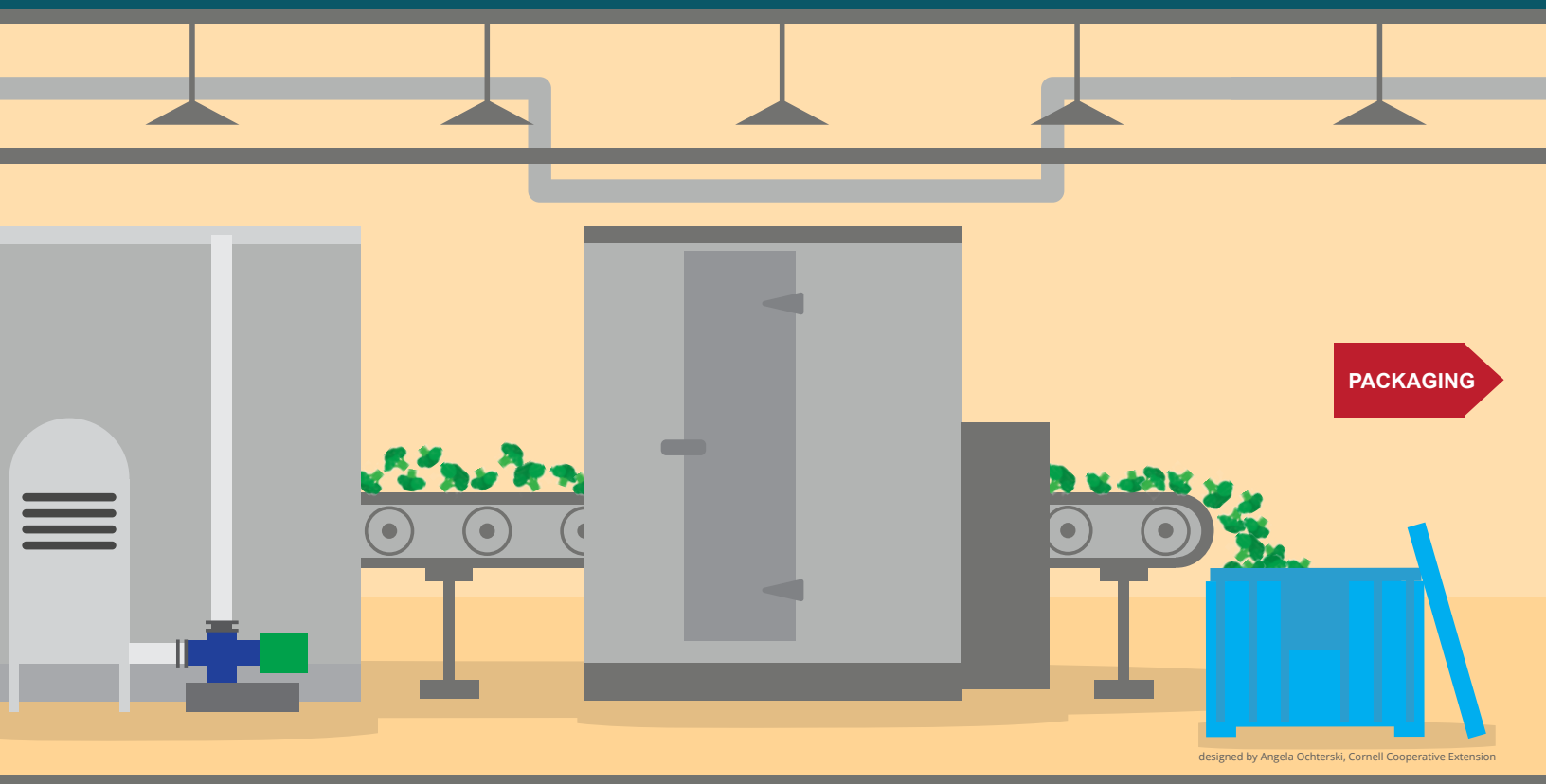
Blanching — $ 217,000

Florets are blanched for 8 minutes in a direct steam process through a blanching tunnel.

The blancher requires additional investment: a steam plant and a certified steam engineer operator.

The Frozen Broccoli Process Flow

In the model developed by Harvesting Good, 500 pound totes/bins (pallet size cubes) filled with hydrocooled, anti-microbial treated broccoli arrive to W.R. Allen, from Circle B Farm, for machine floretting in an automated process. Some broccoli may be held in refrigerated storage before processing. While in the floretter, on a conveyor belt and moved into a queue, florets are separated from the stalks which are repurposed or disposed/composted. Florets are washed, separated, and blanched, spending eight minutes in a direct steam process through a blanching tunnel. The blancher requires additional investment: a steam plant and a certified steam engineer operator. After blanching, the broccoli is hydrocooled in line, then run through a dewatering process—either vacuum or shaken, or both. When as much water has been removed



$ 410,000

Hydrocooling

Broccoli florets are hydrocooled in line.

Water is recycled. A water chiller is in the circulation loop that cools the heated water down to nearly 30°F which helps the IQF freeze the product.

Dewatering

To remove as much water as possible, florets are run through a dewatering process—either vacuum or shaken, or both.

Quick Freezing

Florets are frozen in a Individual Quick Freezing (IQF) machine.

Bulk Storage

Frozen florets are placed in temporary bins and left in bulk for transportation to a packaging facility.

as is possible, the broccoli is frozen in an IQF machine, placed in temporary bins, and left in bulk storage. Frozen bulk broccoli florets will be transported to Wyman's for packaging into institutional size or retail packages.

The emptied pallet totes from Circle B go through the hydrocooler, are washed/sterilized and returned to the farm for reuse.

Harvesting Good has a capital budget of $2.5 million. Some of the anticipated capital costs are included in the graphic. Costs depicted are estimates. Some additional manufacturing equipment costs are not represented but should be included in the capital budget.

The Numbers

Will Harvesting Good have a competitively priced product, for both institutional customers who buy through a food service distributor, and for retail shoppers who find Harvesting Good products in the frozen section of a store? Current financial projections say the cost of goods sold, which is all product and material costs, plus all processing costs, with transportation to customer included, is expected to be approximately $1.35-$1.40 per pound. Add to this an operating margin for Harvesting Good to cover their overhead, payroll, and marketing expenses, and then allow for a distributor mark-up (over the landed cost) of probably 15-25 percent. The question for the institutional customers is whether Harvesting Good broccoli can compete against the domestic frozen broccoli that broadline distributors are currently offering institutional buyers for around $2.00-2.10 per pound. Harvesting Good does not have to match a competitor's price exactly to win over customers, but they will have to get close. Competing against the imported frozen broccoli product is next to impossible; we are seeing prices under $1.75 per pound.

The retail side of this question is harder to assess. Hannaford sells its one-pound bag of private label broccoli florets for $1.85. According to ERS data, using retail scanner data from 2016, frozen broccoli nationwide retails for $1.82 per pound (USDA ERS Fruit and Vegetable Prices, 2018). Ninety-two percent of the retail market share is dominated by 2 large brands, Birds Eye (31.9 percent) and Green Giant (17.8 percent), plus 42.5 percent by private label brands (Beach, 2020).

Harvesting Good won't be able to match these average national prices. They may not come close. The question is whether the quality of the product and the extraordinary brand story (which includes Hannaford's support and participation) will create enough interest and value to propel a retail price of $2.00-$2.25 per pound to success.

The Economics

We asked Cornell Economist, Todd Schmit, about the economic impacts associated with Harvesting Good's projected cumulative sales of local frozen broccoli. Schmit employed a customized production function (spending pattern) for frozen vegetable manufacturing which uses Impact Analysis for Planning (IMPLAN) modeling.

Projected sales for Years 2021-23, when adjusted for 2021 pricing, are estimated at $23,713,675. A customized spending pattern is used that operates under 2 assumptions. First, all food input purchases are to the vegetable farming sector. Second, vegetable purchases are local (from within Maine). Operating under this model, the total cumulative economic impact for 3 years is $52,920,748. The multiplier effect of this model is 2.23, which means that every dollar in broccoli processor sales results in an additional $1.23 in output from related industries. When using the IMPLAN standard spending pattern for frozen vegetable manufacturing and not accounting for the intentional purchase of 100 percent local inputs, the multiplier effect is reduced to 1.76, meaning that every dollar in broccoli processor sales results in only $0.76 of output from related industries.

Operating under the same 2 assumptions noted in the above paragraph, $23,713,675 in broccoli processor output supports 32.1 jobs. When accounting for indirect and induced effects, total jobs supported by Harvesting Good's 3-year output is 146.2. Similar to the output multiplier, the employment multiplier effect for jobs is higher when operating under the local procurement spending pattern, namely 4.55 versus 3.26 jobs.

The economic impacts, to include direct, indirect, and induced, realized at the farm gate, e.g. the sale of raw broccoli by Circle B to Harvesting Good, are incorporated in the processor economic output model depicted in Table B and discussed in detail above, so we don't discuss them separately. However, to arrive at the processor's projected economic output, we made

2 assumptions. First, cumulative broccoli sales for Years 1-3, adjusted for 2021 pricing are $8,489,751. Second, these are new broccoli sales, not reallocated. In addition, we used the default IMPLAN spending pattern for vegetable and melon farming, with no customization.

Table B. Economic Impacts from New Processing Sales from Local Farm Purchases of Broccoli – Three Years

Impact Type	Employment by Year 3 (jobs)	Labor Income Cumulative	Total Value Added Cumulative	Output Cumulative
Direct Effect	32.1	$2,510,632	$3,962,386	$23,713,675
Indirect Effect	75.5	$6,541,786	$13,614,308	$19,414,306
Induced Effect	38.6	$3,188,036	$5,548,577	$9,792,767
Total Impact	**146.2**	**$12,240,454**	**$23,125,271**	**$52,920,748**
Multiplier	**4.55**	**4.88**	**5.84**	**2.23**

The research team did not have access to Harvesting Good's projected cumulative sales of frozen broccoli. Therefore, the estimate used, $23,713,675, is based on IMPLAN data that implies for every dollar in processor sales, $0.36 is accounted for by raw inputs, in this case, fresh broccoli. Projected cumulative sales are also price adjusted to 2021 pricing. To arrive at projected cumulative sales, we assumed Harvesting Good's local broccoli purchases for 3 years would be $8,489,751. In summary, economic impact discussed in this section is based on the price-adjusted 3-year cumulative sales of $23,713,675.

What does this mean in layman's terms? Essentially, the output generated from frozen broccoli sales, when using 100 percent local inputs, results in a higher degree of economic impact than the output generated from using non-local inputs, specifically, $0.47 additional per every dollar of output. Likewise, employment is higher as well. When using 100 percent local inputs, every broccoli processor job supports an additional 3.55 jobs in related industries, whereas the non-local spending pattern results in only 2.26 jobs.

Our Assessment of the Good Sheperd Food Bank/Harvesting Good Frozen Local Broccoli Venture

No one can accuse Kristen Miale (or Matt Chin, or the GSFB Board of Directors) of thinking small. They are in the midst of a 4-year $250 million capital campaign to end hunger in Maine by 2025. "Good Shepherd Food Bank is pushing new frontiers in how food banks raise funds…The goal is flat-out huge when compared to other recent fundraising initiatives among food banks," (Food Bank News, Feb. 16, 2021). Next to this jaw dropping objective, starting a new food processing business may suddenly seem less audacious than it did before. ***We beg to differ.***

The capital campaign will be navigated along a path where GSFB leadership has been walking for many years. It may be Everest-like in scope, but it is familiar territory. It builds on relationships, social capital, and decades of a stellar track record that turns the unimaginable into something imaginable and then attainable.

The frozen local broccoli venture, in contrast, is new territory. Running a for-profit company, freezing broccoli in a wild blueberry processing plant, growing broccoli on a new farm, selling packaged local frozen broccoli under a new brand name, developing sales, distribution and marketing capacity, and the introduction of various kinds of new technology/equipment—is a lot of new things to rev up and integrate into one successful operation. We think the new venture will be as challenging for GSFB/Harvesting Good—will cause as many sleepless nights as does the capital campaign.

Here's why we believe this project can solve the frozen local broccoli bottleneck: There is genius in the basic concept and design.

- By putting under-utilized food processing assets to work, they are holding down the total cost of investment and lowering risk by bringing in strategic partners with expertise in frozen food processing and food safety. These partners also bring a distribution network of their own to the venture.
- Because of their not-for-profit status, and reputation as a successful food bank, they are in a position to raise capital for the project from a creative combination of public and private sources. In fact, GSFB recently announced they are one of the many deserving recipients of MacKenzie Scott's Giving Pledge. A portion of Scott's $25 million gift to GSFB will be used to provide start-up funding for the launch of Harvesting Good in 2022.
- They have an extraordinary story to tell, alleviating hunger by providing access to healthy food, and supporting local farmers who are critical to the region's economy. There is so much Maine synergy involved—public and private partnerships including several of the state's favorite and best-known brands—it's hard to imagine that this project won't be seen as anything but heroic inside Maine and possibly throughout the region.
- One of these strategic partnerships, with Hannaford supermarkets, leverages a deep relationship and history in which Hannaford was instrumental in helping GSFB get off the ground. Hannaford has been known to be a company with community spirit and loyalty. Hannaford has demonstrated that that spirit lives on today after the acquisition and the merger—first, Hannaford by Delhaize (1999), followed by the merger of Delhaize and Ahold (2016)—therefore, this partnership could help anchor the project in important ways as it struggles, as all start-ups inevitably do.

Calling for a Maine to New York Frozen Local Broccoli Partnership

Despite the inherent genius in the concept and design, and despite the strength of strategic and financial partnerships already demonstrated, there are weaknesses in the plan:

- **Single Source** – No matter how good a broccoli grower Tom Ayer and Circle B Farms is, a plan of this ambition and scale should include back-up contingencies. There's plenty of land in Aroostook County, ME (6,828 mi^2, versus the entire state of Rhode Island at 1,214 mi^2), that's not the issue. To truly bring down the sourcing risk, the project should be connected to, and sourcing from, multiple farms in different locations to ensure continuous supply of broccoli under a whole variety of demand and weather scenarios.
- **Market Diversification** – No matter how strong a strategic partner Hannaford will be in this new venture, they cannot guarantee their customers will choose Harvesting Good broccoli over another favorite brand. Plus, there are only 1.34 million people who live in Maine. It will be necessary to diversify the customer base, both retail and institutional, early on in this venture, perhaps starting now during the planning phase.

We recommend that Harvesting Good consider repositioning itself as a regional operation. This does not necessarily mean reducing the priority placed on Maine producers and customers.

There may be New England growers who would want to participate, and there are definitely New England customers who would fit well with the proposed plan. We think New York would be an ideal partner for this project. An Upstate grower such as Matt Kludt would provide volume and reliable quality of product at a competitive price. A relationship with someone like Kludt would also provide a connection to a marketer/broker such as Parker Farms who would add sourcing expertise, and connections that could prove invaluable if, and when, supply emergencies arise. New York has numerous other large-scale vegetable growers who might consider a role depending on how and where the broccoli is to be floretted.

On the market side, New York's substantial farm-to-institution network is hungry for local frozen broccoli. Products that are 51 percent New York grown would qualify for the 30% NYS Initiative. Needless to say, there's large potential to promote New York and regional frozen broccoli to the 19.5 million people who live in New York.

Reconfiguring Harvesting Good as a regional brand would require some changes in the story told by packaging and all marketing vehicles. The fundamental reasons behind the regional approach are to greatly reduce risk and strengthen operations, and that is a part of the story that, if told right—it's still a Maine-centric story—most everyone would understand and appreciate.

If this project succeeds, *when* this project succeeds, it will be a huge accomplishment for GSFB/ Harvesting Good, for the region, for the local food movement, and for all growers, customers and partners involved.

Other Recommendations Considered

Given the findings of the study, there were 2 other opportunities for Eastern broccoli that were considered but left off the final list. They are worthy of mention. We also want to explain why they were not included.

- We recommend more broccoli production among diversified small-scale growers, both organic and conventional, who direct market and are able to both (1) move product to market quickly using standard refrigeration (or top icing if available); and (2) tell a local farm story as they sell their product—good for farms, good for customers. Local broccoli is bound to be a happy surprise for consumers, and it would increase public awareness of Eastern broccoli as a viable local vegetable they can begin to expect and demand. The reason we didn't include this in our list of *major* recommendations is because we don't think it will add a significant number of jobs or lead to investment opportunities for the economic development sector—and that was the litmus test for this study.
- To overcome the lack of consumer awareness and demand specifically for Eastern broccoli, we considered consumer-facing branded broccoli as well as collaborative and coordinated promotion/marketing/storytelling efforts—a promotional campaign!

Eastern Broccoli Project (EBP) research on consumer response to local broccoli showed a measurable positive response and a willingness among consumers to pay extra for Eastern broccoli. More specifically, Fan, Gomez, and Coles conducted an economic experiment to determine whether a customer's perception of quality (taste and appearance) and their willingness to pay more, would be impacted by knowing the broccoli was locally grown (2019). Two new, locally grown EBP varieties were compared against a California-grown commercial variety. In a blind study, both appearance and taste of the 2 EBP varieties were rated lower than the California-grown variety. Further, consumers were willing to pay more for the California variety. However, consumer perception regarding taste and appearance improved substantially when informed of the locally grown attribute, as did their willingness to pay more. Specifically, consumers' willingness to pay a premium for the 2 New York varieties were $0.26 and $0.19 more per pound (Fan et. al., 2019).

Among our 30 interviewees, only 2 were encouraging about coordinated branding and promotion—telling the Eastern broccoli story to a receptive consumer audience. Many of the other interviewees were lukewarm or negative about investing time and money in a coordinated Eastern broccoli brand. In the end, compounding the skepticism of interviewees with the *enormous* effort—packaging, coordination, marketing expertise, and dollars—required to succeed at this kind of campaign, we decided not to recommend a major Eastern broccoli promotion and branding effort.

What Can New York Do?

It is a favorable time for the Eastern U.S. broccoli sector, already $75-100 million, to grow significantly beyond that size. And there is opportunity for New York growers and marketers, who currently claim a small share of today's Eastern broccoli, to play a much stronger role in the sector's expansion.

The opportunity we are exploring in this report—an increasingly strong role for New York growers and marketers in an overall expansion of an Eastern broccoli sector—is being *shaped* largely by external factors that are making imported broccoli more difficult and expensive to produce and distribute. That, in combination with growing demand for locally grown produce, is opening more space for Eastern broccoli. This change could lead to significant job creation and economic development for rural communities in New York. Efforts to take advantage of this opportunity will be *driven* by broccoli entrepreneurs (growers and marketers) who have secure, committed customers.

Broccoli entrepreneurs with committed customer relationships, or at least with good prospects for developing them, can go on to assess other risk factors, and search for ways to overcome the obstacles that stand in the way of their success. This is where New York agencies and institutions can step in and make a critical difference.

New York agencies and institutions can:

- Help growers in their search for reliable customers.
- Provide critical financial resources for icing infrastructure or cooperative/collaborative development.
- Provide financial and business planning support.
- Provide technical assistance needed for production, processing, and marketing of high-quality broccoli.

One particular collaborative venture for local frozen broccoli is developing in Maine, led by the Good Shepherd Food Bank. We believe this project is ripe for partnership with New York growers and marketers.

The large number of urban and suburban New York consumers, especially in New York City, who seek out locally grown produce are a force to be reckoned with. Farmers who sell broccoli directly to consumers at farmers markets, farm stands, and community supported agriculture (CSAs), and midsize wholesale growers who sell broccoli to nearby stores, schools, and restaurants, are the ones reaching this receptive urban and suburban market. While the impact these growers make toward job creation and economic development is limited by their cumulative scale, we recognize their important role in creating consumer awareness and appreciation for locally grown broccoli. These growers' efforts to diversify their production and marketing by adding broccoli to their crop mix are also worthy of New York agency and institutional support.

Photo by Christy Hoepting, CCE Cornell Vegetable Program

Appendix A: Study Participants, Interviewees, and Other Contributors

Interviewees

We are grateful to the 30 people whose time, shared experience, and insights provided the foundation of this report.

Jeff Arnold, Vegetable Production Manager, Hudson Valley Farm Hub, Hurley, NY

Jed Beach, Farm Chief Financial Operator for hire, FarmSmart Maine, Lincolnville, ME

Ken Bower, Produce Buyer, Baldor Specialty Foods, Inc., Bronx, NY

Matt Chin, Vice President of Supply Chain, Good Shepherd Food Bank, Auburn, ME

Silas Conroy, Director of Supply Chain, Headwater Food Hub, Ontario, NY

Wally Czajkowski, Grower, Plainville Farm, Hadley, MA

Frank Dagele, Grower, Dagele Brothers Farm, Florida, NY

Bruce and Barth Davenport, Growers, Davenport Farms, Stone Ridge, NY

Peter Dolce, Director of Sales of Food Service, Bonduelle, global operations

Mark Doyle, General Manager, Fishkill Farms, Hopewell Junction, NY

John DuBois, President, Optimize, Inc., and Engineering Consultant for Good Shepard Food Bank, Auburn, ME

Mary Jo Dudley, Director, Cornell University Farmworker Program, Ithaca, NY

John Gill, Gill Corn Farms (now Hudson Valley Farm Hub), now retired in Florida

Dan Henry, Grower, W.D. Henry & Sons, Eden, NY

Amy Hepworth, Grower, Hepworth Farms, Milton, NY

Jim Hyland, Founder and CEO, The Farm Bridge, Kingston, NY

Matt Kludt, Grower, Kludt Brothers Farm, Kendall, NY

Sandi Kronick, Founder and Chief Executive Officer, Happy Dirt, Durham, NC

Taylor Lanzet, former Senior Director of Supply and Sustainability, Dig Food Group; now Senior Director of Supply, Everytable, Los Angeles, CA

Steve Levy, Grant Writer, Good Shepherd Food Bank, Auburn, ME

Sean McFadden, Head of Business Development, Parker Farms, multiple locations, VA

Kristen Miale, President, Good Shepherd Food Bank, Auburn, ME

Bridget O'Brien, Director of Child Nutrition Services, Buffalo Public Schools, Buffalo, NY

Alex Pisaecki, Co-Founder and Chief Operating Officer, Seal the Seasons, Chapel Hill, NC

Carl Sams, Distinguished Professor, University of Tennessee, and Principal Investigator of the Eastern Broccoli Project, Knoxville, TN

Richard Stup, Agricultural Workforce Specialist, Cornell Cooperative Extension, Ithaca, NY

Richard Thorpe, Regional Produce & Floral Procurement Leader, Whole Foods Markets--Northeast/North Atlantic regions, Cheshire, CT

John Waite, Executive Director, Franklin County Community Development Corporation/Western MA Food Processing Center, Greenfield, MA

Dave Walczak, Operations Manager, Eden Valley Growers, Eden, NY

Other Contributors

We are also grateful to a small number of individuals who were background advisors and supporters. They helped to shape the research and writing during the 15-month process.

Thomas Björkman, Professor of Vegetable Crop Physiology, Cornell University, Geneva, NY

Jill Eccleston, Research Associate, Cornell University, Geneva, NY

Todd Erling, Executive Director, Hudson Valley AgriBusiness Development Corporation, Hudson, NY

Sue Futrell, Director of Marketing, Red Tomato

Miguel Gomez, Associate Professor at the Charles H. Dyson School of Applied Economics and Management, Cornell University, Ithaca, NY

Mary Ann Johnson, Deputy Director, Hudson Valley Agribusiness Development Corporation, Hudson, NY

Angel Mendez, Executive Director, Red Tomato

Todd Schmit, Associate Professor at the Charles H. Dyson School of Applied Economics and Management, Cornell University, Ithaca, NY

Jeff Scott, Marketing and Logistics Coordinator, Farm Hub, Hurley, NY

Maire Ulrich, Agriculture Program Leader, Cornell Cooperative Extension Orange County, Middletown, NY

return to Executive Summary – Methodology

Appendix B: More About Western Broccoli

Is the West Running Out of Water?

The Salinas Valley, known as the salad bowl of the world, is responsible for half the broccoli we consume. It is located west of the San Joaquin Valley and south of San Francisco Bay and the Santa Clara Valley. It has no access to snow melt from a nearby mountain range. Salinas relies almost entirely on underground aquifers for both drinking and irrigation water, and all 8 of the Salinas Valley aquifers are listed by the California Department of Water Resources among the state's "most-stressed aquifers," (Philpott, 2020, pp.167-169). Twenty percent of the Salinas region's wells have a higher than legal level of nitrate, from fertilizer runoff. And as aquifer levels are drawn down, sea water from Monterrey Bay seeps in to fill the void, introducing salinization issues (Philpott, 2020, pp. 167-169).

The Imperial Valley, a major source of winter broccoli, is a piece of the Sonoran Desert in southeastern California, bordering Mexico. The Valley's sole source of water is the Colorado River, which originates hundreds of miles to the northeast. The mighty river delivers a total of 16.5 million acre-feet of water to farmers and 40 million consumers in 7 U.S. states plus northern Mexico. Imperial Valley farmers got a sweet deal in a 1931 pact which, to this day, provides them with water rights to more than 2.6 million acre-feet of water. This is more than half of California's total allotment, and more than any other state receives.

The Imperial Valley water story is intertwined with a human-made body of water called the Salton Sea. In the early 20th century, settlers began diverging a portion of the Colorado River toward the west into the Salton Sink, a depression 235 feet below sea level. An engineering blunder ended up diverting the entire river's flow for 18 months turning the Salton Sink into the state's largest lake: Salton Sea. The Salton Sea became a swank tourist resort where stars like Frank Sinatra and the Beach Boys performed. The water was teemed with fish, and the lake was a stopping place for migrating birds.

Things began to change in the 1980s. Increasing levels of salt from irrigation runoff began killing the fish en masse. Evaporation under the desert sun made matters worse. At times, the lake smelled of rotting organic waste. The tourist industry declined. The size of the Salton Sea has been shrinking since (Philpott, 2020, pp. 169-171).

The emerging ecological distress in the Salinas Valley and in the Imperial Valley explains the rising political tension between agriculture and its need for irrigation water, and large urban populations and their need for drinking water. The situation is felt all over the state. Even in agricultural areas to the northeast of Salinas where snowmelt has been a major source of water, warning signs are flashing. In the winter of 2018-19, the mountains surrounding the San Joaquin Valley (in the Central Valley) received a massive amount of snowpack, 60 percent above average. One state water administrator called it "a California water-supply dream." By September, with little rain on the heels of the snowmelt, the dream had become a nightmare. The *Sacramento Bee* wrote: "California Farmers Face 'Catastrophic' Water Restrictions. Can They Adapt to Survive?" (Philpott, 2020, p. 166).

Things are not better across the border in Mexico. Mexico accounts for 20 percent of the broccoli Americans consume, and 44 percent of U.S. fruit and vegetable imports. Two major growing areas, Baja California and the Mexicali-San Luis Valley, located directly south of California, receive 3 inches of rain per year and rely on irrigation. The region's 4 main aquifers are over-tapped and experiencing seawater intrusion, motivating the Mexican government to subsidize desalination plants to make groundwater suitable for irrigation. Those 2 regions—plus Sinaloa and Guanajuato, the primary broccoli-producing regions—are all among Mexico's most water-stressed regions (Philpott, 2020, pp. 173-174).

Labor Problems in the West

Bruce Talbott, farmer and owner of Talbott's Mountain Gold farm, Palisades, Colorado, in an op-ed piece in the *Washington Post* (Aug. 24, 2018) writes:

> There are 3 reasons why the family farm I run with my 3 brothers didn't have enough workers this year. First, the local workforce is aging out of the industry. In the period 1998-2002, 14 percent of foreign-born farmworkers across the nation were over 45, but that percentage nearly doubled between 2008 and 2012, according to research by New American Economy, a nonprofit organization focused on immigration reform [and which provided technical assistance in drafting this piece]. Every year, more of my best guys retire or find less strenuous work. The number of field and crop workers in Colorado, Nevada and Utah declined by nearly 37 percent between 2002 and 2014.
>
> Second, there's no fresh supply of new workers to take their place. We used to be able to count on 15 to 20 'walk-ins'—people who would show up to work the season—in addition to my regular full-time crew of 15 people. This year there were none.
>
> Finally, we lack an efficient, farmer-friendly guest-worker program. The current one for temporary H-2A visas was created more than 3 decades ago; it's outdated and can't cope with increasing demand for workers. The labor shortage is so severe that farmers have overwhelmed the system, which had to issue nearly 135,000 visas for seasonal agricultural workers in 2016. That's nearly double from 5 years ago.

According to *The Astorian* (Dec. 10, 2018): "Across the Pacific Northwest and California, finding enough labor for tree fruit, berries, hops—any labor-intensive crop—is heavy on the minds of growers, packers, shippers, and marketers."

Western Growers President and CEO Tom Nassif made the following statement in early 2020 following an increase in the U.S. Department of Labor's Adverse Effect Wage Rate (AEWR), the regulated hourly rate agricultural employers are required to pay H-2A temporary foreign agricultural workers. Nassif said:

> In an era where many family farms are struggling to make ends meet, labor remains one of the most pressing—and expensive—challenges jeopardizing the future viability of U.S. agriculture. Today's AEWR increase…further strains the ability of American farmers to access and afford a legal, stable supply of labor to harvest our fruits and vegetables, and perform many other tasks on the farm. In Arizona, California, Colorado, and New Mexico—which combine to produce two-thirds of all fresh produce grown in the U.S.—our farms have now experienced an average AEWR increase of more than 23 percent over the past 2 years; the AEWR already substantially exceeds the minimum wage rates set by these 4 states. As any business owner can attest, it is difficult to remain profitable in the face of such significant and repeated surges in labor costs (Vegetable Growers News, 2020).

Trucking Shortage

Reported in the *Truck Driver Shortage Analysis 2019* from the American Trucking Association:

> In 2018, the trucking industry was short roughly 60,800 drivers which was up nearly 20% from 2017's figure of 50,700…If current trends hold, the shortage could swell to over 160,000 by 2028. Today, motor carriers struggle to find enough qualified drivers, which makes the impact of the shortage seem much worse than the numbers in this report. Many carriers, despite being short drivers, are highly selective in hiring drivers because they have made safety and professionalism high priorities…The driver shortage is really a problem for the entire supply chain as 71.4% of all freight tonnage is moved on the nation's highways (Costello & Karickhoff, 2019).

return to Part I: Understanding the New York Broccoli Opportunity – Is the American West Running Out of Water?

Appendix C: More About Icing and Cooling

Growers and packers expressed additional thoughts about the pros and cons of using different approaches to cooling and icing broccoli.

More on Top Icing

Farmers like Wally Czajkowski of Plainville Farm in Hadley, MA, used to buy bags of ice to cover boxes of harvested broccoli as it cooled overnight. This was economical and efficient for a few acres of production, until the cost of bagged ice increased from $2.99 for 25 pounds to $3.99 for 16 pounds. In 2020, Wally purchased an ice-making machine to produce 1,400 pounds of ice which he keeps in insulated fish bins in the cooler. The ice is consistently made, then scooped onto the boxes of broccoli after harvest. This works well at his current scale of 40 acres of broccoli. Despite, or maybe because of, this investment Wally suggested we rename this report: "Broccoli: Not a money-maker, but everyone wants it."

More on Vacuum Cooling

Some growers vacuum cool instead of, or to reduce, the amount of icing. Growers who rely on vacuum cooling often use it for a variety of crops (to get their investment out of it). Also called hydro-vac, this technology is useful for midsize growers who want to process 12 pallets per hour; this technology is energy efficient per pound of product, however has limitations on scale (Björkman, 2013).

More on Slush Icing

Bruce and Barth Davenport of Davenport Farms in Stone Ridge, NY, remember the ice slusher their dad built, "an uncomplicated machine" that connected an ice house with an agitator that mixed ice and water to be pumped into the boxes. That machine was for the 400 acres of broccoli they were growing for a supermarket chain. The Davenports more recently built another cottage industry solution they use today for top-icing the broccoli they raise on 8 acres, thereby avoiding a major investment in a higher-capacity machine.

The ice slushing machine at Eden Valley Growers produces ice on demand which is premixed with water before it is applied to the broccoli. The largest operations, such as those in California or Maine, tend to use ice from storage, allowing for continuous use of the slusher. The ice is kept in separate storage, and the slusher mixes the ice and water directly before injecting the boxes of broccoli. The Eden Valley solution, without ice from storage, limits the amount of broccoli that can be processed in a 12-24 hour window.

More on the Clamsheller

Parker Farms will move a Clamsheller from farm to farm, up and down the East Coast to enable a longer, higher quality broccoli season. This hydrocooling/ice slushing technology encloses a pallet inside a watertight box, which is then injected with a slurry of water and ice. The water drains from the bottom, leaving a fully iced pallet. Some growers such as Kludt Brothers Farms in Kendall, NY have their own Clamsheller. The cost and scale of ice used is immense: each box is filled with 15-20 pounds of ice. Kludt uses 70 tons of ice per day. Slush icing can be done at scale for approximately $1 of ice per box (McFadden, 2021).

A Preference for Iceless

Matt Kludt likes it when he gets an order for iceless broccoli; then he uses hydrocooling and vacuum cooling combined, a popular combination for large-scale production considered ideal for broccoli. Although Kludt makes regular use of his ice slushing machine (also known as a batch cooler), he considers the ice "wasted weight" when it comes to figuring freight costs.

More Hope for an Iceless Future

"As Eastern broccoli becomes more consistent, more dependable, iceless could be a competitive advantage for Eastern growers," speculated Richard Thorpe, Head of Procurement for Whole Foods North Atlantic/Northeast Regions, thinking of the shorter distances. But the conventional ice-injected broccoli is "what's in demand right now."

Cost and Efficiency

W.D. Henry & Sons upped their broccoli acreage for several years, eventually reaching 200 acres. Eden Valley Growers, the co-op W.D. Henry & Sons is a founding member of, invested $500,000 in a ice slusher, along with necessary infrastructure: a silo, tower, support equipment, cement pad, and cover building. While this may be considered a *mini-version* of what is used for California broccoli production, this technology processes 10,000-12,000 gallons of ice and water, and towers over 2 stories high. At this scale, the ice slusher can process 8,000-9,000 cases of broccoli per day. To operate at this capacity, Eden Valley charges $0.80 per box (or $1.15 per box for non-members).

Icing broccoli required significant labor, according to Dave Walczak of Eden Valley Growers. "With the ice slusher, we got rid of the labor. One guy, in half an hour, can do the work it took 8 to 10 guys to do in an hour."

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Appendix D: Breakdown of East Coast State Labor Regulations

Breakdown of East Coast State Labor Regulations

State	Minimum Wage	Mandatory Overtime?	Working Hours Regulations?	Right or Organize?
New York	$11.80 (most of NY)	Yes, paid 1.5x over 60 hours/ week	Yes, a day of rest	Yes
Florida	$8.56/hour	No	10 hour days is the legal limit	Yes
New Jersey	$8.85/hour	No, exempt from overtime	No max hour or day requirements for adults	No
North Carolina	Minimum wage does not apply to agricultural workers	Overtime does not apply to agricultural workers	No max hour or day requirements for adults	Yes
South Carolina	SC law does not govern minimum wage	SC law does not govern overtime	No max hour requirements, unless under 20.	Yes
Maine	Agricultural workers are exempt	Agricultural workers are exempt	No max hour or day requirements for adults	No
Virginia	Agricultural workers are exempt	Overtime not addressed in VA law	No max hour or day requirements for adults	No
Pennsylvania	Agricultural workers are exempt. Seasonal farm labor $7.25/hour	Agricultural workers are exempt	No max day/hours for permanent employees. Seasonal limited: 6 days per week, or 48 hours per week, or 10 hour/day	No

Farmers Assuring Responsible Management (FARM): https://nationaldairyfarm.com/producer-resources/worker-safety-human-resources/

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Appendix E: Glossary of Terms and Acronyms

Blast freezing: An alternative to IQF, food is quickly cooled to freeze. The faster the freezing process, the better preservation of food quality.

Broadline distributor: A distributor which services a wide variety of accounts with a wide variety of products, as opposed to a system or channel distributor which stocks a narrow array of products for specific customers, such as specialty stores or restaurant chains.

Buy American Provision: SFAs in the continental United States must purchase domestic agricultural commodities and food products. For foods that are unprocessed, the agricultural commodities must be domestic, and, for foods that are processed, they must be processed domestically using domestic agricultural food components that are comprised of over 51 percent domestically grown items, by weight or volume. A domestic creditable food component is the portion that counts toward a reimbursable school meal (meats/meat alternates, grains, vegetables, fruits, and fluid milk) (USDA FNS Child Nutrition Program, 2019).

Certified B Corporation: A new kind of business that balances purpose and profit. They are legally required to consider the impact of their decisions on their workers, customers, suppliers, community, and the environment. This is a community of leaders, driving a global movement of people using business as a force for good (Certified B Corporation, 2021).

Clamsheller: A machine that encloses pallets of crops in watertight boxes. A slurry of ice and water is injected into the boxes. Water drains from the bottom. Fully iced pallets emerge.

Free on Board or Freight on Board (FOB): The price of goods at the farmgate or at the source, not including the costs of delivery.

Gross Cash Farm Income (GCFI): Annual income before expenses and includes cash receipts, farm-related income, and government farm program payments (USDA).

Hydrocooling: Cooling technology that uses cold water to quickly remove the field heat by spraying or submerging the crop.

Individually Quick Frozen (IQF): A freezing method that does not allow large ice crystals to form in vegetable cells. Also, since each piece is individually frozen, particles do not cohere, and the final product is not frozen into a solid block (Singh, 1998).

Midsize farms: Can be defined variably. The USDA ERS defines midsize into a GCFI category of $350,000-$999,999, and between 100-199 acres for the Census of Agriculture. In this report, we are referring to a wide variety of farms when described by acreage, income, crop mix, and markets.

School Food Authority (SFA): The governing body which is responsible for the administration of one or more schools, and has legal authority to operate the National School Lunch Program or School Breakfast Program therein or be otherwise approved by Food and Nutrition Service (FNS) to operate the program. The school system superintendent is typically the person authorized by the governing body to sign legal documents for the SFA (USDA, 2016).

Slush icing or batch cooler: A slurry of ice and water are injected into boxes. When the water drains, the ice remains which keeps the crop near freezing temperatures.

Top icing: A quick and inexpensive method of removing the field heat. Bagged ice is poured or shoveled into boxes and cooled overnight to reduce the core temperature.

USDA Foods in Schools: Supports domestic nutrition programs and American agricultural producers through purchases of domestic agricultural products for use in schools and institutions. Nutritious USDA-purchased food is provided to the following child nutrition programs: The National School Lunch Program, the Child and Adult Care Food Program, and the Summer Food Service Program (USDA, 2020).

Vacuum cooling: Cooling technology that removes field heat from crops by vaporizing water, causing the core temperature to drop. This is often used with hydrocooling technology to avoid wilting.

click a term or acronym to return to a related report section

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