

Agricultural Supply Chains in the Chesapeake Bay Watershed

**Julia Bassett Eugenia Chow Jack Goldsmith
Emily Jenkins Ryan M. Jensen**

Prepared for the Chesapeake Bay Foundation

July 15, 2021



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

 **Morehead-Cain**
WITH PURPOSE. WITH PROMISE.



CHESAPEAKE BAY FOUNDATION
Saving a National Treasure

Executive Summary

The Chesapeake Clean Water Blueprint, established in 2010, sets goals for nitrogen and phosphorus pollution reduction in the Chesapeake Bay watershed to be achieved by 2025. Of the three main watershed states, Maryland and Virginia have made some progress towards reducing agricultural pollution, but are still behind on their overall goals. Pennsylvania still requires significant action to meet its agriculture load reduction goals.

This report was commissioned to examine agricultural supply chains and assess motives for companies to encourage their suppliers to implement agricultural Best Management Practices (BMPs). With the Turkey Hill Clean Water Partnership (THCWP) as a starting point for our research, we were tasked with identifying similar solutions and incentive structures to help improve water quality in the Chesapeake Bay.

Dairy

With 5,430 dairy farms across the state, Pennsylvania's dairy industry is the seventh-largest in the country and a significant contributor to agricultural pollution in the watershed. We believe there are opportunities for CBF to invest in solutions such as Precision Dairy Farming and explore partnership with a Pennsylvania dairy cooperative.

Poultry

The poultry industry is a significant contributor to agricultural pollution in the Chesapeake Bay watershed, with one major source of pollution being runoff from chicken litter used as fertilizer. Due to the nature of litter ownership in the industry, there are limited opportunities for CBF to partner directly with a poultry integrator. However, we believe CBF should explore ways to invest in litter transport throughout the watershed.

Supermarkets

Supermarkets and local grocers play a vital role in the agricultural supply chain due to their relationships with farmers. We believe there is potential for CBF to partner with supermarkets by combining their conservation expertise with a supermarket-financed farm auditing program.

Other

During our research, we also looked at market-based solutions such as Ecosystem Services Market Consortium's carbon credits system and similar conservation projects such as the Great Lakes Restoration Initiative. Additionally, we considered the role of consumer behavior in driving the implementation of agricultural BMPs.

Conclusions and Recommendations

Connecting our findings, we observed several patterns among our industry-specific suggestions. We arrived at the following general conclusions:

1. Corporate partnerships based on financial incentives to drive farmer implementation of sustainability practices are currently unrealistic in the researched Chesapeake Bay watershed agricultural industries.
2. Despite the current inability to create positive corporate incentive structures, there are still opportunities for CBF to collaborate with companies in each researched industry to accelerate agricultural conservation.
3. Conservation plans and their implementation differ significantly farm by farm, so effective solutions must be tailored to the individual farm.

—

Contents

Executive Summary	2
Introduction	6
Dairy	7
Research Approach	7
Production	8
Dairy Landscape	8
Supply Chain Stakeholders	9
Sources of Pollution	15
Existing Solutions	16
Corporate Partnerships	19
Government Programs	22
Recommendations	23
Poultry	25
Research Approach	25
Poultry Production in the Watershed	26
Industry Landscape	27
Integrators	27
Industry Relationships	33
Sources of Pollution	35
Existing Solutions	36
What Not to Pursue	41
Recommendations	44
Supermarkets	47
Research Approach	47
Supply Chain Overview	48
Supermarket Company Information	48
Local Grocers	52
Existing Models	53
Recommendations	56
Other Models in the United States	57

Labelling and Certifications	58
General Recommendations	60
Alternative Sources of Funding	63
References	66

Introduction

This report is the product of our work for the Chesapeake Bay Foundation over the course of seven weeks during the summer of 2021. We are rising sophomores and Morehead-Cain scholars at the University of North Carolina at Chapel Hill and were placed on this research team for our Morehead-Cain Civic Collaboration summer.

As an idea to accelerate implementation of conservation practices in the Chesapeake Bay watershed, Beth McGee and a group of CBF agriculture staff became interested in the corporations that source from watershed farms. With the 2025 Chesapeake Bay Clean Water Blueprint deadline approaching, they wondered if companies could set conservation standards for suppliers in order to decrease agricultural pollution loads. To provide CBF with foundations for further investigation, we were tasked with developing a landscape of watershed companies that source agricultural products, evaluating company motives to improve supply chains, looking for related models or partnerships, and determining whether CBF could play a role. A company-led initiative provided to us as an example was the Turkey Hill Clean Water Partnership, a notable collaboration between Turkey Hill Dairy, the Maryland & Virginia Milk Producers Cooperative, and the Alliance for the Chesapeake Bay. We were asked to focus exclusively on market-related solutions, so we did not research legal or policy approaches to reducing agricultural pollution.

Due to the complex and multifaceted nature of the project combined with our limited experience with respect to agriculture, we focused on areas in which we could be most useful to CBF. We narrowed our geographic focus primarily to Pennsylvania, Delaware, Maryland, and Virginia, choosing to research the dairy and poultry industries in these watershed states. Additionally, we studied the role that supermarkets play in the larger supply chain. With only seven weeks to approach this problem and organize our research, we acknowledge that this report is not a comprehensive overview of the agricultural supply chains in the Chesapeake Bay watershed. However, we believe this research provides a good basis for further exploration into opportunities and collaborations that could benefit the Chesapeake Bay.

We began our research by familiarizing ourselves with agriculture and farm operations. Most of us had not previously seen a farm and were not familiar with agriculture industries or supply chains. We originally planned to start at the farm level, map individual farms to cooperatives or middle men, and then map those middle men to the companies they supplied to develop a complete picture of watershed supply chains. We also planned to look at each watershed county to make county-by-county connections to large companies. We realized that identifying connections on the individual farm or county level would be nearly impossible due to farmer privacy concerns and lack of data at the individual farm level. We determined that the most useful information would start at the company level, leading us to research individual companies and their supplier relationships. Our approaches for each industry varied and are detailed at the start of each of the following sections.

—

Dairy

Research Approach

Early in our research, we discovered the prominence of dairy farming in Pennsylvania. With 5,430 dairy farms, Pennsylvania is the seventh-largest dairy-producing state in the United States and a significant source of pollution in the watershed.¹ To better understand the landscape, we examined the supply chain and its stakeholders. We then studied different sources of pollution and identified manure and ammonia as significant contributors.

Additionally, we explored current regional and national sustainability initiatives in the dairy industry, using the Turkey Hill Clean Water Partnership (THCWP) as a model. The following section details our path in developing recommendations for potential public-private partnerships in the dairy supply chain while acknowledging barriers and existing initiatives. Due to the concentration of dairy in Pennsylvania and the state's importance to reaching agricultural pollution reduction goals, we did not focus extensively on the dairy industry in other watershed states.

Production

As mentioned, Pennsylvania is one of the largest dairy-producing states in the country. It is seventh in total production and second in dairy farm volume. Of the state's 5,430 dairy farms, 99% are family-owned. These farms hold a total of 520,000 dairy cows that produce nearly 10.6 billion pounds of milk per year.² The average herd size is 89 cows, with each producing an annual average of 21,230 pounds of milk.¹

Geography is essential to the dairy industry in Pennsylvania, with 25% of land devoted to agriculture. Most dairy farms are concentrated in southern and southeastern counties. On a county-to-county basis, agricultural land use ranges from 0% in Philadelphia County to 65% in Lancaster County, which has 1,776 dairy farms.³

Pennsylvania's dairy industry contributes \$14.7 billion annually to the state's economy.² Dairy has a complex pricing system, run by milk boards and cooperatives. This system includes over-order premiums, which are paid through cooperatives to farmers whose milk is produced, processed, and sold in the state of Pennsylvania.⁴ Pricing must also be regulated due to changes in production.

Pennsylvania Dairy Landscape

Supply Chain

The dairy supply chain involves many different stakeholders and has stringent time and quality guidelines. After cows are milked, the milk must be transported from farm tanks to dairy processors within 48 hours to prevent spoilage. This time urgency, along with truck weight limits, leads to inefficient transportation: one study found that milk trucks can be as little as 10% full.⁵ After the dairy processors check the milk for temperature and bacteria, they homogenize, pasteurize and package it before shipping it to retailers. Most regulations suggest that milk reaches a retailer in two days or less after removal from the farm. In order to meet these time and quality guidelines, the supply chain must be geographically condensed.⁶ Therefore, there are many dairy processors and retailers in Pennsylvania.

Supply Chain Stakeholders

Below is information about key players at each stage in the dairy supply chain. The volume of small companies at each level sheds light on the decentralized nature of the industry.

Large Companies

Hershey

The Hershey Company, headquartered in Hershey, PA, is an international confectionery company with over 90 subsidiary brands. In 2020, Hershey had an annual revenue of \$8.1 billion. It claims to be one of the only major chocolate manufacturers in the world that still uses fresh dairy milk.⁷

Hershey sources its products' ingredients from around the world, but a large portion of its milk comes from over 17,000 Pennsylvania cows on farms within 100 miles of its chocolate production facility in Hershey, PA.⁸ The company has two other plants in Pennsylvania and one in Virginia, but its Virginia plant mainly produces peanut-based products and does not source dairy.⁹ Hershey's highest-volume milk supplier is Land O'Lakes, a large dairy cooperative with a national presence.¹⁰

Hershey is heavily involved in a variety of sustainability and corporate responsibility initiatives that extend beyond the United States, all of which are listed in its 2020 Sustainability Report.¹¹ With respect to agriculture and dairy, Hershey recently launched a partnership with the Alliance for the Chesapeake Bay and Land O'Lakes to implement conservation practices on its dairy suppliers' farms. This partnership was announced in July, 2021 and will be elaborated on below.

Nestle USA

Nestle USA, headquartered in Arlington County, Virginia, has a large presence in the watershed. Its brands amassed \$11.3 billion in revenue in 2019.¹² Nestle has many subsidiary brands, including several in the dairy industry: Carnation, Coffee-Mate, Dreyer's, and Edy's.¹³

Nestle USA sources some of its milk from the Maryland & Virginia Milk Producers Cooperative Association (MDVA), creating a large watershed footprint.¹⁴ Nearly 16% of Nestle USA's carbon footprint is from dairy. However, it is unclear specifically how much milk the company sources from the watershed.¹⁵

Nestle USA has taken large steps in developing a sustainable supply chain, one of which is committing to zero environmental impact by 2030. Part of this goal is a sustainable packaging initiative involving a nearly \$2 billion investment in collaboration with the Nestle Institute of Packaging Sciences.¹⁶ To target its dairy footprint directly, it has entered into several partnerships. It is the first corporate partner of the Net-Zero Initiative, which will be discussed later. Nestle USA also entered into a partnership with MDVA and the Alliance for the Chesapeake Bay with a \$200,000 grant from the National Fish and Wildlife Federation (NFWF). This partnership sought to fund the Dairy Farmer Led Sustainability Project, a cost-share program for six MDVA farmers to implement innovative sustainability practices.¹⁴

Turkey Hill

Turkey Hill Dairy, headquartered in Conestoga, PA, is an ice cream and beverage brand that has an annual revenue of \$375 million and employs over 800 people.¹⁷ The company was acquired in 2019 by Peak Rock Capital, a private equity firm based in Austin, TX.

Turkey Hill sources most of its milk from about 160 MDVA farms concentrated in Pennsylvania.¹⁸ The company is preparing for national expansion and recently purchased a production facility in Searcy, AR.

Turkey Hill is involved in many different sustainability initiatives, including sustainable packaging, waste reduction, and renewable energy. In fact, Turkey Hill is powered by 100% renewable energy as of 2019.¹⁹ With respect to dairy and agriculture, Turkey Hill has pioneered the Turkey Hill Clean Water Partnership with the Alliance for the Chesapeake Bay and MDVA. This partnership has achieved industry notability as a model for cross-sector collaboration on agriculture conservation. The THCWP will be discussed in detail below.

Baldor Specialty Foods

Baldor Specialty Foods, headquartered in Bronx, NY, is one of the largest wholesalers and distributors in the Mid-Atlantic and the Northeast. It amassed a revenue of around \$232 million in 2020 and provides a variety of dairy products.²⁰

Baldor has a fairly large watershed presence, with many suppliers in Pennsylvania and New York. With a focus on supplying locally, many of its dairy partners are congregated in the southeast region of Pennsylvania. It works with Origin Milk in Lancaster County and Clover Farms Dairy in Reading, PA.

Many of Baldor's sustainability initiatives are focused on eliminating organic food waste. Its SparCs Program is focused on reducing waste in its Fresh Cuts facility, repurposing 100% of its food scraps. These scraps are also shipped to neighboring livestock operations and repurposed as feed. Another food waste initiative is its Imperfect Produce Program, which markets produce that does not meet physical standards but is otherwise edible. Baldor reduces its footprint through a Local Pledge, which involves choosing local suppliers, altering transportation use, and engaging with local communities to achieve its "Zero Organics to Landfill" goal.²¹

Smaller Operations

There are many small to mid-sized processing and distributing operations with private labels in Pennsylvania. Some of these operations source from a number of small farms, and others are independently owned, single-farm operations. Below is an example of each.

Clover Farms

Clover Farms, headquartered in Reading, PA, is the largest private dairy processor and distributor in Pennsylvania. With annual revenue of \$55.3 million, Clover Farms sells to retailers and wholesalers across Maryland, Delaware, Eastern Pennsylvania, New Jersey, and New York, including schools, grocers, and food service companies.²² It processes more than three million pounds of milk daily.

Clover Farms works with 170 dairy farms in Berks, Lancaster, and Lebanon counties to produce, process, and distribute various private-label dairy products. It supplies Baldor Foods and many large grocers in the Mid-Atlantic region, such as Giant and Weis. Its sustainability initiatives were not clarified, however it does ask farmers to pledge against using rBST, an artificial growth hormone used in cows.²³

Kreider Farms

Kreider Farms, located in Lancaster, PA, is an egg and dairy producer, processor, and distributor. With a revenue of \$126 million in 2020, it has its own private label and is a PA Preferred certified producer.²⁴ Kreider Farms produces various dairy products, with a separate private egg brand, Noah's Pride Eggs. It sells to most major retailers in the watershed, such as Wawa and Weis.

Kreider Farms is a single, 3,000 acre farm that currently milks 1,700 cows with a 15-hour robotic carousel. In addition to expansive dairy operations, it processes and packages 180,000 eggs hourly. It also has its own manufacturing facility, distribution processes, and private fleet.²⁵

Kreider focuses on decreasing its environmental footprint through several practices. Some of these include powering its processing plant with solar panels, recycling chicken and cow manure, and using manure management technologies. To reduce pollution, it uses no-till farming, crop rotations, bio-available fertilizer, and riparian buffers. Kreider Farms is also a 100% non-landfill operation.²⁵

Major Dairy Cooperatives

Cooperatives play a significant role in the dairy industry. They regulate pricing and relationships between suppliers and sellers while also offering a forum for dairy farmers to collaborate, often in a focal geographical area.²⁶ The Pennsylvania Association of Dairy Cooperatives accounts for multiple different cooperatives and nearly 3,800 dairy farms in Pennsylvania.²⁷ The association includes Dairy Farmers of America (DFA), Land O'Lakes, MDVA, Lanco-Pennland Quality Milk Producers, and Mount Joy Farmers Cooperative Association.

Dairy Farmers of America

Dairy Farmers of America, headquartered in Kansas City, MO, is the largest dairy cooperative in the US with 12,500 member farms across 48 states.²⁸ Its cows produce over 52 billion pounds of milk annually, bringing in a revenue of \$17.8 billion in 2020.²⁹ DFA also owns 85 national processing plants.²⁹

DFA has many subsidiary brands, such as Tuscan Dairy and Country Fresh. In addition to these brands, DFA acquired Dean Foods and its subsidiaries in May, 2020. Headquartered in Dallas, TX, Dean Foods owns dozens of large dairy brands, including Swiss Premium, PET, Dairy Pure, and Tru Moo.³⁰

To advance sustainability, DFA laid out a greenhouse gas (GHG) footprint reduction plan, seeking to reduce total emissions by 30% by 2030. It has also adopted the US Dairy Stewardship Commitment with the Net-Zero Initiative. DFA partners with various dairy organizations, such as the Dairy Sustainability Framework and the Global Dairy Agenda for Action.³¹ It also created the Farmers Feeding Families Fund to address food insecurity for its members.

Land O'Lakes

Land O'Lakes, headquartered in Arden Hills, MN, is a national dairy cooperative with additional dealings in feed production and agriculture technology. It has an annual revenue of \$14 billion and produces around 13 billion pounds of milk per year.³² The cooperative works with 1,700 dairy producers across the nation.³³ Land O'Lakes sells its own branded milk, butter, and cheese products, and its farmers also sell milk to other food companies in the watershed such as Hershey.

Land O'Lakes has a number of initiatives focused on sustainability, particularly in water conservation through agricultural best management practices (BMPs). In early 2021, Land O'Lakes announced a "Dairy 2025 Commitment," in which it plans for all of its member farmers to complete on-farm sustainability assessments before 2025.³⁴ In the Midwest, it collaborates with its farmers supplying milk to Bel Brands to use cover crops and other sustainable practices. Land O'Lakes operates Truterra, an agriculture technology business launched in 2016 that aims to improve farmer output and sustain-

ability. Recently, it announced a partnership with Hershey and the Alliance for the Chesapeake Bay centered around promoting BMP usage on 400 farms that supply milk to Hershey in Pennsylvania. More details about this collaboration can be found under Corporate Partnerships below.

Maryland & Virginia Milk Producers Cooperative

The Maryland & Virginia Milk Producers Cooperative (MDVA), headquartered in Reston, VA, is a dairy cooperative that owns the Maola Milk brand. MDVA has over 1,100 member farmers that collectively produce an average of 2,900 billion pounds of milk annually.³² Many of these farms are concentrated in Pennsylvania, Maryland, and Virginia. In addition to supplying its own brand, MDVA provides milk to companies such as Nestle USA and Turkey Hill Dairy.

Part of MDVA's core mission is to be a sustainable cooperative, so it is heavily involved in sustainability efforts. The cooperative has raised more than \$7 million for sustainability practices since 2018 and is also working with third-party organizations to increase efforts. It helped spearhead the Turkey Hill Clean Water Partnership with Turkey Hill and the Alliance for the Chesapeake Bay in 2018. MDVA is also a major part of the Giant Clean Water Partnership with Giant Food and the Alliance that was started in 2020.³⁵

Lanco Pennland Quality Milk Producers

Lanco Pennland Quality Milk Producers, headquartered in Hagerstown, MD, is an East Coast dairy cooperative concentrated in the Susquehanna Valley. The cooperative works with over 700 farmers who produce 741 million pounds of milk annually.³² Lanco Pennland has its own cheese brand, Pennland Pure, which operates out of Hancock, MD.

Neither the cooperative nor Pennland Pure list any corporate responsibility initiatives on their websites. No further information was found concerning Lanco Pennland's sustainability efforts.

Mount Joy Farmers Cooperative Association

Mount Joy Farmers Cooperative Association, headquartered in Mount Joy, PA, produces 741 million pounds of milk each year. The cooperative works with

over 300 farmers whose milk is marketed to processors around Lancaster County.³²

No information could be found regarding any Mount Joy sustainability efforts, and the cooperative's digital presence is limited to an infrequently updated Facebook page.

Dairy Processors

While some dairy processors are also distributors with private labels, others are simply the middle man between producers and retailers. Clover Farms and Kreider Farms are both examples of private label companies, while Harrisburg Dairies processes milk for Whole Foods 365, Farmland Fresh, and its own brand.

Dairy Farms

The Pennsylvania dairy industry consists mainly of smaller, family-owned farms averaging 133 acres.³⁶ Many of these farms sell their products through the large cooperatives above, but differ widely otherwise. There are five primary methods of dairy farming in Pennsylvania: confinement, semi-confinement, management intensive rotational grazing, organic, and Amish. Differences include farming practices, animal breeds and growth, technology use, confinement and grazing combinations, feed and milk production, nutrient management, and market prices.³⁷ In examining various combinations of these factors, one study concluded that cattle and feed type differed between farming methods, while housing and manure management changes were based on herd size.³⁸

In Pennsylvania, particularly in Lancaster County, there is a sizable Amish population with strict farming methods. A lack of technology use and smaller but more condensed farming operations characterize Amish farms. The cultural and religious restrictions make navigating many sustainability initiatives difficult.³⁹

Sources of Pollution

Manure

Feed and manure production are both large sources of pollution for dairy farms. Dairy farming contributes about 2% to GHG emissions in the US, and more than half are from producing feed.⁴⁰ With increased productivity per cow, more feed is required and more manure is produced. One animal unit produces around 85 pounds of manure daily, including about 0.45 pounds of nitrogen and 0.07 pounds of phosphorus.⁴¹ Most nitrogen in manure comes from feed; between 55-90% remains in manure and urine.⁴²

Manure is not only highly polluting, but is also often mismanaged. One study found that 41% of Pennsylvania farms handle manure as a solid, and most were surface applied.³⁸ 45% of farms reported using an open manure storage pit, 17% used covered pits, and 25% had no manure storage and implemented daily hauling. Farms are encouraged to include 1.5-2 acres of land per cow to account for proper manure application, and those that do not should have comprehensive Nutrient Management Plans.⁴³

Ammonia Emissions

Ammonia emissions and manure amounts directly correlate and account for a large amount of Pennsylvania's watershed footprint. 49% of reactive nitrogen is lost in the form of ammonia from manure. When aggregated, dairy farms account for approximately 50% of ammonia emissions in Pennsylvania.⁴⁴ Manure is the primary source of ammonia on farms, and this emission occurs when manure sits on barn floors, is in storage for long periods, and is applied to fields. One study found that the average ammonia emissions were highest on freestall housing with long-term manure storage, while they were lowest on grazing farms that hauled manure daily.⁴²

Existing Solutions

Below are current solutions and initiatives in the dairy industry that aim to reduce agricultural pollution in Pennsylvania.

Nutrient Management Planes

A Nutrient Management Plan (NMP) is a farm-specific plan that details exactly how organic and chemical fertilizers should be applied to cropland, and in the case of animal operations, how manure should be stored. NMPs are usually prepared in one-to-three-year intervals and are written by a certified consultant or extension agent in collaboration with the farmer. Tests including soil and manure nutrient content are required in order to establish a plan, and help to determine when, where, what type, and how much manure can be applied to a field.⁴⁵ Different watershed states' Nutrient Management Programs, which develop NMP regulations, have different standards for the plans, but they are generally very similar.

Nutrient management regulations vary by watershed state, and some state requirements are more robust than others. For instance, Pennsylvania only requires Concentrated Animal Operations (CAOs) to have an NMP, while farms that apply manure to land but do not meet the animal density standards for CAOs only need Manure Management Plans (MMPs). MMPs do not require a certified expert to develop and do not need to be submitted to a regulatory agency to be approved, therefore receiving little regulation or oversight.⁴⁶

Additionally, NMPs can be inaccurate and allow for more nutrient application than a field or crop needs.⁴⁶ Therefore, even farms that adhere to their NMPs can be responsible for nutrient runoff due to the prescribed over-application of nutrients.⁴⁶ Mismanagement and lack of use are both problems with NMPs. In one study, only 46% of total farms and 2% of Amish farms used NMPs.³⁸ Only 30% of farms that applied fertilizer adjusted for nitrogen crop requirements, while 3-18% of farms with nitrogen and phosphorus surpluses applied fertilizer on top of manure.³⁸

Precision Dairy Farming

Precision Dairy Farming (PDF) considers the characteristics of each cow on a given farm in order to maximize milk production, decrease likelihood of illness, and reduce waste. Due to the intricacies of dairy operations, PDF has grown in popularity over the last decade. This type of farming incorporates

technology and specific operational planning while aiming to lower costs and environmental impacts. Agricultural technologies allow farmers to increase their herd size and take advantage of economies of scale.⁴⁷ Economic returns desired by the farmer are the most common reason these technologies are implemented. Current examples of PDF include robotic milking machines and dairy feed planning.

In feed plans, rations are adjusted to target proper protein, carbohydrate, and nutrient consumption, giving farmers more control over nutrient intake of their cows.⁴⁷ Nitrogen levels in these plans are indicated by Milk Urea Nitrogen (MUN) values, which measure the amount of urea in urine. MUN values within a specific range indicate proper nutrient balances in cow feed, particularly with protein levels.⁴⁸ Nutrient intakes directly correlate with nutrients in manure, so reducing nitrogen levels in feed consequently reduces emissions.⁴⁹

Newtrient

Focused on manure management and recovery, Newtrient is a company that offers innovative manure technologies to farmers. It is headquartered in Rosemont, IL, and was founded in 2015 by 14 dairy organizations representing over 20,000 dairy farmers. Newtrient has a presence in Pennsylvania and has received funding from the state. It now works with MDVA, Agric-Mark, Prairie Farms of America, Dairy Management Inc, and the National Milk Producers Federation among others. Newtrient is seeking to create a market for manure using adaptive and individualized technology.⁵⁰

The Newtrient Technical Advancement Team developed the Newtrient Evaluation Assessment Tool (NEAT) matrix. This matrix gauges the reduction effects of different technologies, assessing nitrogen and phosphorus recovery, storage, GHG and pathogen reduction, and odor control.⁵¹ The tool allows users to compare each technology with characteristics of long-term anaerobic manure storage. After developing varying technologies, Newtrient aims to develop plans with individual farms composed of suitable and feasible manure solutions. By collaborating with other organizations on the Net-Zero Initiative, manure solutions are becoming more accessible to farmers across the

US.

Despite many innovations in technology, cost remains the main setback for farmers in implementing manure solutions. Considering this barrier, Newtrient is focused on creating a market-based solution and rewarding farmers for involvement in sustainability initiatives. As farmers must cover the operating and installation cost unless otherwise supported, Newtrient is looking to incentivize use and act as a liaison between regulators and farmers.⁵²

Pennsylvania State University Extension Program

The Pennsylvania State University (PSU) Extension Program is a research program funded by the US Department of Agriculture (USDA) and the state of Pennsylvania. It has conducted studies on nitrogen and ammonia emissions for dairy cows, milk pricing, dairy economics, management laws, and BMPs. It has also developed tools for dairy farm finances, footprint measurement, and developing comprehensive farm operation plans. Recently, the Extension Program compiled a fairly exhaustive directory of dairy plants and raw milk permit holders in Pennsylvania, which has potential use in sourcing supply chain connections. Additionally, the program has an education sector, working to provide comprehensive resources to those working in and around the agricultural industry. Researchers collaborate with the Pennsylvania Department of Agriculture (PDA) and have a council with offices in every county.⁵³

Corporate Partnerships

Turkey Hill Clean Water Partnership

The Turkey Hill Clean Water Partnership is a corporate partnership between Turkey Hill Dairy, MDVA and the Alliance for the Chesapeake Bay. This collaboration, started in 2018, is seen in the industry as a successful cross-sector approach to implementing conservation practices on Pennsylvania dairy farms. According to how the partnership is advertised, Turkey Hill Dairy has agreed to pay a premium to farmers who develop and implement a comprehensive conservation plan. The THCWP has achieved significant recognition, including the Innovation Center for U.S. Dairy's 2020 Sustainability Award.⁵⁴

While the THCWP is still a good model for other corporate partnerships, it is not a truly market or incentive-based approach and requires substantial support from the partnering non-profit organization. In reality, Turkey Hill Dairy approached the Alliance to learn about how to implement conservation practices on farms. In 2018, when searching for a new contract to procure dairy, Turkey Hill required that the cooperative work to implement these practices on its member farms. MDVA agreed to do so and began supplying milk to Turkey Hill.

The “premium” that the partnership advertises does not actually make it to individual MDVA dairy farmers. This would not be feasible due to the dairy pricing structure. Instead, the funding from Turkey Hill goes to MDVA and is used to pay for a group of MDVA sustainability staff. These staff conduct farmer outreach with the 160 farms that supply Turkey Hill through MDVA to raise awareness about the partnership and help initiate farm-by-farm conservation projects. Additionally, this program is completely voluntary for MDVA farmers. They will not incur a penalty or lose their business with MDVA or Turkey Hill if they choose not to participate.¹⁸

The Alliance plays a central role in this partnership by writing grants to finance technical assistance and BMP implementation. The Alliance is then billed directly for farm-by-farm conservation plans and implementation of projects that are initiated by MDVA sustainability staff and Alliance project managers. At the time of this writing, the Alliance has raised \$5 million in NRCS and NFWF grants for the THCWP. This funding has paid for 29 conservation and nutrient management plans, implementation of 66 BMPs, and the planting of 645 trees on participating dairy farms. Conservation plan writing or updating is 100% covered by partnership funds, and after plans are up to date, the implementation of projects are 75% covered by the partnership, up to \$60,000.¹⁸

Currently, Turkey Hill is experiencing leadership turnover, and the member of the leadership team who initiated and was passionate about the THCWP is no longer with the company. Also, Turkey Hill is embarking on an effort to grow the business nationally, so the partnership is currently stalled and lacks additional funding.

Sustainable Dairy PA

In July 2021, the Alliance for the Chesapeake Bay announced another corporate partnership with Hershey and Land O'Lakes called Sustainable Dairy PA. This partnership originated in 2020 when Hershey reached out to the Alliance. The partnership's main focus will be planting trees and buffers on Land O'Lakes dairy farms in Pennsylvania that supply Hershey with milk, but other types of conservation projects will also be sponsored.

Hershey has committed an initial \$300,000 to Sustainable Dairy PA, which the Alliance plans to match. Unlike the THCWP, this money will directly fund planning and implementation of conservation projects on farms. The initial \$600,000 will also be used by the Alliance to access grant funding for the partnership. Hershey's financial commitment to the partnership will make future grant applications more attractive to government funding sources. Sustainable Dairy PA funding will cover 100% of the cost-share for implementation of buffers on the 150 eligible Land O'Lakes farms in southeast Pennsylvania. It will cover 75% of the cost-share for other projects on farms without buffers. Hershey is also interested in finding a way to directly reward farmers who implement BMPs, but nothing tangible has come of this yet.¹⁸

Net-Zero Initiative

One of the most recent national plans in the dairy industry is the Net-Zero Initiative (NZI). Developed by the Innovation Center for US Dairy, this milestone seeks to make the industry carbon-neutral and improve water quality and use by 2050. This year, the Foundation for Food and Agriculture Research pledged \$10 million to fund the six-year pilot data collection program. This part of the initiative will gather environmental impact data on pilot farms with innovative environmental practices. This grant has been matched by Nestle and Newtrient, contributing nearly \$24 million.⁵⁵

This collaboration involves the Soil Health Institute, USDA Agricultural Research Service, and several academic institutions. Other dairy farms and model farms will participate in providing a baseline for economic and agricultural data.

In Summer 2021, Trinkler Dairy Farm, a supplier to Carnation, became the first pilot farm in the six-year program. Trinkler aims to reduce greenhouse gas emissions by 30% by 2023.⁵⁶ The data gathered from this and other pilot farms will determine what farming methods make the most environmental and economic sense for future dairy farmers. The NZI recognizes the need for a farm-by-farm system and data to incentivize other farmers to implement these practices.

Government Programs

Conservation Excellence Grant Program

In 2019, Pennsylvania passed the new PA Farm Bill, which allotted \$2.5 million to Conservation Excellence Grants. The program is regulated by the State Conservation Commission and contains a grant maximum of \$250,000, with smaller grants available for BMP initiatives under \$25,000.⁵⁷ The program also established location priorities by county. It determined that Resource Enhancement and Protection (REAP) tax credits up to 50-75% could potentially be applied to outstanding costs.⁵⁶ Lancaster and York Counties monitor applications for this program.

Projects that qualify for potential grants include design engineering and planning, construction or installation of new methods (including associated labor costs), new equipment or materials, and required inspections after implementation. The program also includes potential coverage for any services conducted by a Conservation District or private sector technical service provider.

Pennsylvania Dairy Investment Program

The Pennsylvania Dairy Investment program is another initiative aimed at funding farm-by-farm sustainability. Developed by the Pennsylvania Department of Agriculture and the Department of Community and Economic Development in 2018, this program contains \$5 million in funding. It supports research, transitions to organic standards, farm projects, or marketing, each with its own funding limits. The maximum possible grant is \$500,000 for co-

operative, processing, or multi-producer projects. Businesses, schools, not-for-profits, and academic institutions are all eligible. The program has a 15% cash match requirement for farmers that receive grants. Progress and use of funds must be tracked and reported to the Commonwealth Financing Authority, and a final report must detail the project and use of finances.⁵⁸

PA Preferred

Started in 2004, the Pennsylvania Preferred label allows for easy identification of locally grown and processed agricultural products. This benefits local farmers, agribusinesses, and the economy. PA Preferred products can be found in most grocery stores in the state. Additionally, the label features various programs, including Homegrown By Heroes, which identifies veteran-owned businesses, and Farm to School, which gives students access to local food and related education opportunities.⁵⁹ Maryland and Virginia have similar labeling programs: Maryland's Best and Virginia's Finest.

PA Preferred membership is application-based to ensure that qualifications are met. For a farmer or producer, this includes producing a commodity entirely harvested or grown for at least 75% of its production cycle in Pennsylvania.⁶⁰ Processors, farmers' markets, retailers, grocery stores, and nurseries are also eligible to apply to the PA Preferred program, but they must meet different qualifications.⁶⁰ Currently, there are 15 PA Preferred processors in Pennsylvania.

Recommendations

Seek Corporate Partnership

Many of the large companies identified in the Pennsylvania dairy landscape have preexisting sustainability partnership commitments. For smaller companies, the decentralized nature of the Pennsylvania dairy landscape makes partnership with individual farm operations difficult and not as worthwhile. Therefore, the most effective route likely being through cooperatives.

Cooperatives play many roles in the dairy supply chain, particularly with the

finished products. They often control the marketing of dairy products and source directly to large retailers. As middle men, they have relationships with farmers and companies allowing more entry into the dairy industry. While smaller farms are decentralized, cooperatives offer a consolidated way to work with many of them and could potentially influence the practices of their farmers. Additionally, cooperatives have a unique position in the dairy industry because they regulate payments between retailers and farmers. Due to the complex milk pricing structure, it is difficult to directly financially incentivize farmers for their efforts as shown by the THCWP. However, as a law was recently passed requiring cooperatives to itemize over-order premiums on farmer payments, this may be a future possibility.

A potential partnership could take shape with slight adaptations to that of Turkey Hill and MDVA. Instead of sourcing from a large corporate partner, cooperatives could be encouraged to commit a small amount of resources to employing sustainability specialists. These employees could work tangentially with the nonprofit entity, creating individual conservation plans for each farm. This structure would also capitalize on the nonprofit's ability to apply for and monitor grants, while supporting farmers in the implementation of BMPs through technical assistance. The relationship would be directly between the nonprofit, the cooperative, and the farmers.

As detailed above, some cooperatives in Pennsylvania already have sustainability commitments, such as MDVA and Land O'Lakes. However, several others could be possible partners in this capacity. One example is Lanco Pennland Quality Milk Producers, which operates largely in the Susquehanna Valley with 700 member farms. Although it has sizable coverage in the watershed, more exploration would be needed to gauge its fit for a collaboration.

Invest in Precision Dairy Farming

In Precision Dairy Farming, feed plans offer a proactive ammonia reduction strategy. For farmers, the largest barriers to implementing these plans are the cost of hiring an agricultural nutritionist and the time needed for development and testing. Considering these barriers and CBF's organizational capabilities, there are likely no direct roles for CBF to play in feed plan implemen-

tation. However, as indicated above, a corporate partnership may involve hiring sustainability specialists to work directly with farmers. Considering employment of a dairy cow nutritionist for one of these positions would remove a key obstacle for farmers and enable the use of PDF. Additional funding could also be allotted to PDF technologies that decrease strain on farm labor and allow farmers to maximize production.⁴⁷

Dairy feed plans allow farmers to have more control over inputs, often directly lowering manure production and reducing need for storage. Additionally, with volatile feed prices and low milk prices, the use of a feed plan gives farmers more control.

A Penn State Extension study noted an increased interest in feed management with Clean Water Blueprint deadlines approaching.⁶¹ According to a lead scientist on the study, a cow feeding plan is a promising method for reducing further agricultural pollution from a dairy farm.⁴⁹ With new technologies and more research on the benefits of Precision Dairy Farming, CBF should explore how it can support PDF's expansion in order to reduce pollution in the Bay.

—

Poultry

Research Approach

Our initial company-level research revealed information on the uniquely integrated nature of the poultry supply chain. We learned about how poultry integrators work with chicken growers in the watershed. We made connections with and interviewed different players in the industry, in state governments, and in the CBF agricultural department. Most of the relevant industry connections were made through the Delmarva Land and Litter Cooperative (DLLC).

Through these interviews and further research on the relationships between poultry integrators, poultry growers, and grain producers, we determined

that poultry litter and its management constituted a significant runoff concern. We therefore mainly focused on litter management and transport solutions. We researched existing litter management programs and gathered opinions from different stakeholders in the industry. Along the way, we considered various potential solutions to decrease litter runoff, eventually reaching the considerations and recommendations outlined below.

Due to time constraints and the open-ended nature of our project, we focused almost exclusively on meat-type chicken production.

Poultry Production in the Watershed

Poultry production is one of the largest agriculture sectors in the Chesapeake Bay watershed. In Delaware, Maryland, and Virginia, poultry production has the highest market value of any agriculture type. Pennsylvania's poultry industry is only marginally smaller than its dairy industry.⁶² Together, poultry and egg production in these four Bay states have an annual market value of over \$5.3 billion.⁶² This sum primarily reflects sales from the hundreds of millions of broiler chickens that are produced and processed in these states each year.

Within the Chesapeake Bay watershed, poultry operations are highly concentrated in certain areas. These areas include the Shenandoah Valley region of Virginia and West Virginia, the Lower Susquehanna region in south-central Pennsylvania, an area that also includes many dairy farms, and the Delmarva Peninsula. In 2020, Virginia processed over 270 million broilers, the majority of which were produced in the Shenandoah Valley region. Similarly, Pennsylvania's over 220 million broilers were largely grown around the Lower Susquehanna.⁶² On the Delmarva Peninsula, over 1,278 contracted growers operate 5,036 chicken houses that produce over 570 million birds annually. This amounts to \$3.4 billion in revenue for the five poultry companies operating there.⁶³

Industry Landscape

In contrast to most other agriculture and livestock industries, poultry is nearly completely vertically integrated. Industry players include poultry integrators, contract chicken growers, grain producers, and other third-party hauling and maintenance companies.

Chicks are hatched in integrator-owned hatcheries and are then transported to contract growers. Integrators provide growers with feed and other technical and bird-health support. Once the chickens reach market weight after six to eight weeks, they are shipped back to an integrator-owned processing facility, where they are slaughtered, processed, and shipped wholesale or to retailers.

Integrators

Poultry integrators are corporations that operate their own hatcheries, feed mills, grain facilities, and processing plants. The only parts of the supply chain they do not directly control are the chicken houses and grain farms. However, integrators do own the birds grown in contract houses. They do not own and are not responsible for the manure that the birds produce. Below is a list of the major poultry integrators in the watershed.

Tyson Foods

Tyson Foods, headquartered in Springdale, AR, is the largest meat producing company in the United States. It amassed \$43.2 billion in sales in 2020, 30% of which came from chicken. Tyson's chicken segment was impacted in 2020 in part by COVID-19 and what Tyson's CEO called "other inefficiencies." The company's operating income dropped to \$122 million from \$621 million the year before.⁶⁴

Tyson's chicken processing plants in the watershed are located in New Holland, PA, Temperanceville, VA, and Glen Allen, VA. Tyson also has hatcheries in Virginia and Pennsylvania. Its plants processed 37.9 million broiler heads on average in 2020, but it is unclear what proportion of this was in the watershed. Tyson had contracts with 3,890 chicken growers in 2020, but it is again

unclear what proportion of these contracted growers are located within the watershed.⁶⁵ Overall, Tyson's operations are less heavily concentrated in the watershed than elsewhere in the United States.

Tyson has a variety of sustainability efforts. With respect to implementation of agricultural conservation practices, Tyson committed to increasing sustainable land stewardship practices on two million acres of row crop corn by 2020. As of 2020, it had enrolled 408,000 acres in a pilot program with Farmers Business Network. It also enrolled 11,000 acres in a pilot program with MyFarms, a software tool that analyzes opportunities on farms for sustainability and profitability. Due to COVID-19, Tyson cancelled the MyFarms program and removed the 11,000 acres from the count. These efforts mainly focus on grain producers rather than chicken growers. Tyson encourages its contract farmers to correctly manage their chicken litter, but does not require anything beyond government-mandated NMPs. Tyson also claims to have moved 1.3 million tons of poultry litter out of the Illinois River watershed through various nonprofit partnerships.⁶⁶ But these partnerships are hard to discern, and Tyson's action was likely spurred by an Oklahoma lawsuit claiming that it was polluting the Illinois River watershed.

Perdue Farms

Perdue Farms, headquartered in Salisbury, MD, is the fifth-largest chicken company in the United States in terms of broiler production. Its revenue in 2020 was around \$7 billion, with about \$3.6 billion coming from broilers. Perdue has two main divisions: Perdue Foods and Perdue AgriBusiness. Perdue Foods is Perdue's chicken, turkey, and pork processing arm; Perdue AgriBusiness processes agricultural commodities. Perdue Foods slaughtered 12.39 million broilers weekly on average in 2020, and totaled 61.26 million pounds of weekly average broiler production.⁶⁴

Perdue has operations in almost every Chesapeake Bay watershed state. It owns four hatcheries in the state of Maryland: one in Westover, one in Hurlock, and two in Salisbury.⁶⁷ It operates six processing plants in watershed states: Salisbury, MD; Milford, DE; Georgetown, DE; Accomac, VA; Bridgewater, VA; and Prince George, VA.⁶⁸ Of the main poultry integrators, Perdue has the most developed agribusiness arm. Perdue AgriBusiness owns 13 grain

facilities in Maryland, seven in Virginia, five in Pennsylvania, two in Delaware and one in New York.⁶⁹ Part of these facilities' operations is to produce feed that is shipped to contract chicken growers, but it is unclear which specific grain facilities serve as feed mills. Perdue also has its own transportation business, Perdue Transportation Incorporated, which serves as a private fleet for Perdue Foods and Perdue AgriBusiness.

Like every other integrator, Perdue encourages its farms to follow their government-mandated Nutrient Management Plans. According to Perdue's FY2021 Company Stewardship Report, Perdue has "recycled more than 70 million pounds of nitrogen and 46 million pounds of phosphorus from poultry litter, moving approximately 50% of that material out of the Chesapeake Bay watershed."⁷⁰ Perdue recycled this nitrogen and phosphorus through Perdue AgriRecycle, a segment of Perdue AgriBusiness that pelletized poultry manure. More information on Perdue AgriRecycle can be found below.

Mountaire Farms

Mountaire Farms, headquartered in Millsboro, DE, is the fourth-largest chicken company in the United States and the leading supplier of private label chicken. It amassed \$2.4 billion in sales in 2020.⁶⁴ Mountaire works with over 1,100 contracted chicken growers. In 2020, Mountaire produced 62.13 million pounds of broiler chicken and slaughtered a weekly average of 7.84 million broilers.⁶⁴

Mountaire operations are clustered in south-central North Carolina and on the Delmarva Peninsula. Contracted chicken growers for Mountaire operate in 12 counties on the Delmarva: eight in Maryland, three in Delaware, and Accomack County in Virginia.⁷¹ The majority of Mountaire's facilities are also concentrated on the Delmarva Peninsula: three out of six feed mills, 12 out of 14 grain facilities, two out of four processing plants, and two out of four hatcheries.⁷²

Mountaire is One Health Certified, a USDA program that outlines standards and performs audits mainly regarding animal care. The program has an environmental stewardship section, but it only requires that participating farms follow their NMPs. Other than paying into litter transport cost-share pro-

grams and participating in efforts similar to other major chicken integrators, Mountaire does not seem to have any water quality or other sustainability initiatives.

George's Inc.

George's Inc., headquartered in Springdale, AR, is the ninth-largest broiler producer in the United States. It has an annual revenue of \$1.5 billion and produced 30.6 million pounds of chicken per week in 2020.⁷³ George's recently launched its first retail brand, George's Farmers Market, in February, 2021.

George's operates eight chicken processing plants, two of which are in the Chesapeake Bay watershed in the Shenandoah region of Virginia. The company contracts over 800 growers across all of its operations; its watershed chicken growers are concentrated around Rockingham, VA and Hardy, WV.⁷⁴

According to its 2021 Corporate Responsibility Report, George's Inc.'s environmental initiatives are primarily centered around its plants' energy usage and water treatment, and the certification of cardboard shipping boxes by the Sustainable Forestry Initiative® Certified Sourcing Standard.⁷⁵ It does not appear that George's is currently focusing specific attention on water conservation.

Amick Farms LLC

Amick Farms LLC, headquartered in Leesville, SC, is a subsidiary of the OSI Group, a meat-processor holding company based out of Illinois. Amick is the 12th-largest broiler producer in the US, with a weekly head count of 3.1 million birds and an annual revenue of \$826 million.^{64,76}

Amick Farms operates in two geographic areas, South Carolina and on the Delmarva Peninsula. One of the company's two processing plants is located in Hurlock, MD, along with a hatchery and feed plant in the area. The company contracts over 300 growers, and it can be assumed that roughly half of these farmers are located in Delmarva because half of its facilities are in the area.⁷⁷

On its website, the company includes a brief section about “responsibility” and has statements about water and waste recycling at its plants. There is no mention of any farm-related efforts or agricultural water conservation.

Farmers Pride Inc., doing business as Bell & Evans

Bell & Evans, headquartered in Fredericksburg, PA, is a leading supplier of USDA Organic chicken and the largest chicken supplier of Whole Foods.⁷⁸ It has a weekly production capacity of 1.25 million broilers and annual revenue of \$490 million.⁷⁸ The company is currently in the process of doubling its production capacities by building a new processing plant in Fredericksburg and expanding hatchery production, which is planned to be completed by the end of 2021.⁷⁹

Bell & Evans operates solely within the Chesapeake Bay watershed in the area around Lebanon County, PA. It has one hatchery, feed plant, and processing plant, all in Fredericksburg.⁶⁸ The plant currently under construction will replace the existing one. At the beginning of 2019, Bell & Evans contracted over 140 broiler growers, a number which has likely increased with the company’s expansion.⁸⁰ All Bell & Evans growers are within an hour of its processing plant.

Bell & Evans emphasizes how its supply chain practices set it apart from other poultry integrators. Its growers are required to remove manure and litter after each flock as well as sanitize the house. These houses are additionally left empty for two weeks between flocks. The growers’ houses all have impervious concrete floors, which differs from the dirt flooring commonly used in chicken houses. Bell & Evans claims to have a number of environmental stewardship initiatives, including manure recycling for mushroom compost. The integrator also joined the Environmental Protection Agency (EPA), the PA Natural Resources Conservation Service (NRCS), the PA Department of Environmental Protection (DEP), and a number of other agricultural stakeholders in Pennsylvania to support the “High Performance Farms Initiative” (HPFI).⁸¹ The HPFI claims to support farmers who adopt best management practices through contracts and premium pricing, though there is little to no information regarding specifics about the program. We reached out to the PA Department of Agriculture, PA DEP, the Pennsylvania Soil Conservation Commission

(SCC), and PA NRCS, all of which signed in support of HPFI and are listed on its two-page flier. However, the current state of the initiative could not be obtained. Additionally, there has been no published update regarding HPFI's progress or achievements since its origin in early 2019.

Allen Harim Foods

Allen Harim Foods, headquartered in Millsboro, DE, is an integrator with operations on the Delmarva Peninsula that offers both private label and branded chicken products. It had a revenue of \$370 million in 2020 and produced a weekly average of 7.6 million pounds of chicken from 1.3 million broilers.⁶⁴

Allen Harim is entirely concentrated on the Delmarva Peninsula. It has a single hatchery in Dagsboro, DE, two processing plants in Harbeson, DE and Millsboro, DE, and a feed mill in Seaford, DE.⁶⁷ The company had a processing plant in Cordova, MD, which it closed in 2016 to consolidate operations. It contracts about 220 independent chicken growers.⁸²

The Delaware Department of Natural Resources and Environmental Control has repeatedly fined Allen Harim for its record of mismanagement and discharge of wastewater into streams at its Harbeson and Dagsboro facilities. The company does not mention any specific sustainability efforts on its website, but it does participate in state litter transport program cost-share like the other four integrators on the Delmarva Peninsula.

FreeBird Chicken

FreeBird Chicken, headquartered in Fredericksburg, PA, is one of two chicken brands that form TableTrust Brands, which is owned by Aterian Investment Partners, a private equity firm. Aterian acquired the two TableTrust brands in 2019 from Hain Celestial Group, an American food and personal care products company. In 2020, FreeBird slaughtered 400,000 broilers weekly on average, producing 2.29 million pounds of chicken.⁶⁴ FreeBird's operations are limited to its plant in Fredericksburg, and while it is unclear how many chicken growers it contracts with, they are concentrated around this area. The company makes no mention of specific sustainability initiatives.

Empire Kosher Poultry

Empire Kosher Poultry, headquartered in Mifflintown, PA, is the other brand that is part of TableTrust Brands. It was acquired by Aterian Investment Partners in 2019 from Hain Celestial Group. Empire slaughtered 660,000 broilers per week on average in 2020, producing 1.85 million pounds of chicken.⁶⁴ Like FreeBird, its integrated operations are limited to its facility in Mifflintown. It works with independent chicken growers concentrated around its facility and only grows kosher chickens. Besides its focus on animal health, it mentions no other specific sustainability efforts.

Shenandoah Valley Organic LLC, doing business as Farmer Focus

Farmer Focus, based in Harrisonburg, VA, exclusively produced organic chicken at a rate of 300,000 birds per week in 2020.⁶⁴ Farmer Focus does not follow the typical poultry integrator business model. Instead, the company partners with independent flock owners and provides them with chicks and feed, which it sources from Pennsylvania. The growers have complete control over how they operate their chicken houses and raise the flocks. They do not compete with each other but rather receive the same price per pound for chicken they produce.⁸³

Farmer Focus and its farmers operate in the Shenandoah Valley of Virginia and West Virginia. The company works with 73 farms in this area, all of which are featured on the Farmer Focus Website. It operates a single processing facility in Harrisonburg and has plans to build a second one.

The company prides itself on working with independent farmers and third party certification standards for growing chicken, though it does not mention any company-wide sustainability initiatives.

Industry Relationships

The integrators described above control every part of the poultry supply chain in the Chesapeake Bay watershed except for chicken growing and grain farming. According to Chris Leonard, an agricultural journalist and author, in the 1960s and 1970s, integrators experimenting with owning farms “found that the farm is the least profitable end of this business.”⁸⁴ Due to high infrastruc-

ture costs and the general risk and volatility of farming, integrators decided to contract it out instead.

The relationships between integrators and grain producers are largely determined by the commodity markets for grain. While payment for products remains constant in some longer term producer contracts, feed prices vary daily. Grain producers not under contract decide whom to sell to based on a combination of price and proximity to a grain facility. Because prices are dictated by commodity markets, integrators have little influence over the farming practices of their grain suppliers.

Alternatively, the relationships between integrators and independent chicken farmers are dictated entirely by contract. These contracts provide security to chicken growers because they do not have to worry about selling their birds or paying for feed, which accounts for about 70% of the cost of growing the birds.⁸⁵ However, these relationships also give the integrator leverage over the chicken farm. Because there are only a handful of integrators in the entire watershed, a chicken farmer's business depends on securing a contract with one of them, and there are usually only one or two local options based on integrator plant locations. Part of securing a contract with an integrator involves having adequate growing infrastructure for that specific company. Chicken growers therefore invest hundreds of thousands of dollars to build each chicken house.⁸⁶ Once their houses are built, they rely on contracts to pay off construction debt. Additionally, contracts do not guarantee how many flocks farmers are given each year. Many farmers use revenue from the first three to four flocks to cover expenses and then have a "profit flock." However, farmers depend on the integrator's yearly production needs and might not always get a profit flock.

Despite the leverage integrators have over independently contracted chicken growers, contract farming is worthwhile for chicken growers given the stability these relationships provide. Contract chicken farming has been the industry standard for almost 100 years, and contracts are estimated to remove 97% of the economic risk from the growers.⁸⁵ Also, integrators typically have very high rates of retention among their farmers. Finally, contract farmers retain ownership of manure the birds produce, which serves as an additional

revenue stream.

Sources of Pollution

The poultry industry mainly pollutes the Chesapeake Bay watershed in two ways: direct runoff of chicken litter spread on cropland, and ammonia emission through ventilation fans on chicken houses.

Chicken Litter

Hundreds of millions of chickens raised in the watershed each year produce billions of pounds of manure and litter.⁸⁷ Chicken litter is a mixture of feces, bedding material (typically pine shavings), feathers, and spilled feed.⁸⁸ As noted above, poultry integrators do not own the chicken litter produced by their chickens. This places responsibility on the grower to clean the houses and remove and handle thousands of pounds of litter. Bell & Evans claims to be the only company that requires its growers to completely clean their houses after every flock. More typically, the top layer of bedding will be scraped off or additional bedding will be added after a flock has been grown. Eventually, after four to six flocks or about a year, the integrator will require its growers to completely clean the houses. How and when houses are cleaned varies widely, and this process is not well documented.

Through conversations with farmers and others involved in the broiler industry, it appears that many growers hire a third party to clean their houses. Some of these include litter brokers, who also transport litter to end-users who mainly use it for fertilizer. Whether the houses are cleaned by a third party or the farmer, chicken litter needs to be stored or transported somewhere.

Over 95% of broiler litter is used as crop fertilizer.⁸⁹ Manure is rich in nitrogen, phosphorus, and potassium, and organic material found in litter acts as a soil amendment when it decomposes.⁹⁰ Because of this, chicken litter is a valuable commodity, especially when chemical fertilizer prices are high.

Many factors inform how to properly manage chicken litter as a fertilizer. Lit-

ter should be stored for a period of time before it is applied on fields to maximize its effectiveness and kill off harmful pathogens like E.Coli and Salmonella.⁹¹ The chicken grower needs to find cropland that can receive the litter in accordance with NMPs and other state regulations. Growers must also find a way to transport the litter to its final location. The end-user of the litter needs to own or have access to specialized equipment in order to properly spread the litter on fields. Additionally, litter cannot be spread on fields where the soil is frozen. In some watershed states, it cannot be spread at all during the winter.⁹² It also takes more effort and time to cover a field with litter rather than a conventional fertilizer. These and other complexities make proper litter management difficult for farmers.

Ammonia Emissions

The Chesapeake Bay Program and the Environmental Integrity Project (EIP) estimate that around 22 to 24 million pounds of nitrogen entering the Chesapeake Bay can be attributed to the poultry industry.⁸⁷ Approximately half of that nitrogen comes from ammonia deposition, and the primary source of this ammonia is exhaust from poultry houses.⁸⁷

In order to maintain the health and comfort of birds in poultry houses, each house is fitted with ventilation fans that pull damp air out of the house. In the process, ammonia from manure and some particulate matter is released. A portion of this ammonia is deposited into Bay waters, at which point it breaks down, releasing nitrogen into the water. Additionally, ammonia emissions can be a nuisance and potentially a health risk to humans living around poultry houses.⁹³ There are no regulations regarding the environmental impact of ammonia emissions from chicken houses, but awareness about ammonia mitigation is increasing.

Existing Solutions

The following section outlines existing solutions for litter management and ammonia emissions, including successes and drawbacks of each.

Nutrient Management Plans

As described in the Dairy section, a Nutrient Management Plan (NMP) is a farm-specific plan that informs how nutrients should be managed on fields. NMPs for poultry growers and grain producers can be inaccurate, which can lead to prescribed overapplication of nutrients. Also, science and regulations regarding phosphorus application have changed significantly in recent years, so farmers have had to continually change their nutrient management practices to stay in compliance. Runoff has become a particular issue when using litter as a fertilizer due to unequal ratios of nitrogen to phosphorus needed by crops and present in litter.⁹⁴

Potentially the biggest issue with nutrient management in the poultry industry is the lack of enforcement of agricultural regulations, including NMPs. Between 2017 and 2019, EIP investigated the broiler chicken industry in Accomack County, VA. Of the 76 broiler operations examined, 74% (56) had violations. However, none of these operations were penalized, despite a number of them being repeat offenders.⁹⁴ Another EIP report found similar enforcement issues with MMPs and NMPs in Pennsylvania. The lack of enforcement in Pennsylvania might be caused in part by lack of resources, as PA DEP has seen its funding cut almost 50% over the last two decades.⁹⁴ Regardless, without enforcement of NMPs, pollution reduction goals will continue to be at risk.

Phosphorus Management Tool

Maryland has recently adopted the Phosphorus Management Tool (PMT) to more effectively regulate phosphorus application on farms. According to the Maryland Department of Agriculture, the PMT identifies fields at high risk of phosphorus runoff and helps farmers better manage saturated soils. Only fields that have high levels of phosphorus in the soil are required to use the PMT. Fields that have historically taken poultry litter as fertilizer typically have high phosphorus levels.⁹⁵ Therefore, the PMT can help effectively regulate the amount of poultry litter applied on fields in the state of Maryland.

Maryland PMT regulations have been phased into full implementation as of

July 1, 2021. It is estimated that about 20% of farmland in the state of Maryland has phosphorus levels that mandate its use. These regulations ban highest-risk farms from receiving additional phosphorus, which includes poultry litter. They also require that the PMT be incorporated into NMPs so that farmers acquire only as much litter as is needed for their fields. This program will reduce the amount of litter entering high-risk farms, allowing low-risk farms access to poultry manure to be used safely as fertilizer.

Stakeholders around the industry, in the government, and at CBF are optimistic that PMT regulations will drastically reduce litter overapplication in Maryland, helping the state meet its phosphorus reduction goals.⁹⁶ Surrounding states are currently considering similar programs.

Litter Transport Programs

Delaware, Maryland, and Virginia have state-run programs incentivizing litter transport. These litter transport programs offer farmers, haulers, and brokers reimbursement for the relocation of poultry litter from litter-dense areas. The programs vary by state, but are typically designed to cover costs of transporting litter to counties with farms eligible to receive it according to their NMPs. Litter transport programs work in tandem with NMPs: end-users' fields need to have state-approved NMPs in order to be eligible for funding. Additionally, fields scheduled to receive litter must have phosphorus levels in compliance with state programs like Maryland's PMT or, in the case of Virginia, a Virginia Tech soil test phosphorus reading. These programs act as cost reimbursements, with users filing applications to receive payment after they have made the litter transfer.

The general consensus among representatives from the Delaware and Virginia state litter transport programs was that the programs have been effective and use most of the resources allocated to them. Virginia's program worked with 46 unique farmers in 2020 and used all of its funding.⁹⁷ Delaware's program funded the relocation of an average of around 60,000 tons of litter in each of the last five years.⁹⁸ We were not able to retrieve data about Maryland's program.

Funding for litter transport programs largely comes from state legislative budgets that allocate EPA and other funding sources. For instance, Virginia's program has a budget of \$350,000 in state funds, and an additional commitment of \$40,000 from the Virginia Poultry Federation, a nonprofit poultry trade association. The five poultry companies operating on the Delmarva Peninsula pay for 50% of the transport cost in each state—a percentage agreed upon during the transport programs' inceptions in the early 2000s.⁹⁷

A few obstacles prevent these programs from more widespread use and more effective pollution reduction. Transport programs require applications, soil tests, weigh tickets from trucking, and other documentation in order to receive cost reimbursement. All of these measures require attention from the farmer, and it is often more convenient for chicken growers to instead distribute their litter through existing connections. Many chicken growers have established relationships with other farmers who want their chicken litter. These farms are often close to the chicken houses and may not be eligible to participate in cost-share programs due to proximity. For long-distance litter transport to see more use, these relationships would need to change; currently there is little incentive for the chicken grower to do so. On a similar note, some potential litter end-users likely do not have connections with growers in the chicken-dense counties and may not even be aware of a litter transport program. Depending on the program, litter tonnage, distance transported, and eligible transport locations may also be limited.

Litr. App

The Litr. app is a mobile application that connects chicken growers who have litter with farmers who want to apply litter on their fields. The app is the result of research conducted by the Delmarva Chicken Association (DCA) and DLLC. These groups sought to overcome a lack of connection across state lines between chicken growers and grain producers and other farmers. Some areas in the watershed, such as Virginia's Eastern Shore, have a large concentration of chicken houses. Other areas, such as the central part of Virginia and the northern part of Delmarva, have farmers who struggle to find litter. The Litr. app was conceived as a solution to this connection problem. In theory, it is a promising solution that, used alongside the PMT and other nutrient

regulations, will help farmers who both can and want to use litter do so, while moving litter away from areas of excess supply.

Developed by Common Logic in 2020 with funds from a government grant to DCA, a beta version of the Littr. app is currently live and available for mobile download. The grant also provided DCA with funding to market the app, and DCA is currently conducting internal marketing with its member farmers. At the time of this writing, there are 323 users on the app, most of whom are looking to buy litter. There have been over 20 listings and under 10 transactions. The Common Logic team is currently fixing bugs and looking at user data from the app's beta launch in order to improve user experience and the volume of transactions. There is a plan in place and an agreement for continued development and maintenance between Common Logic and DCA.⁹⁹

A smart, robust, user-friendly app has the potential to get more litter to those who can apply it according to their NMP and PMT. Although the app has not yet realized significant popularity, continued investment in and collaboration on software design and development will greatly increase the app's impact in coming years.

Corporate Efforts

Integrators already invest in both litter transport and the implementation of conservation projects. As stated above, the five integrators with operations in Delmarva pay for 50% of state litter transport programs. Also, each of those five integrators is part of DCA, which has its own Vegetative Environmental Buffers (VEBs) Program. VEBs are rows of various trees, shrubs, and grasses planted around the ventilation fans of poultry houses to help mitigate the release of ammonia. The VEB program conducts outreach among DCA member growers to assist in planting buffers around chicken houses.¹⁰⁰

One notable corporate partnership is between the Alliance for the Chesapeake Bay and Perdue. This partnership is still unofficial, and no deal has been made about what each entity will commit. That said, the Alliance has been working with Perdue to implement VEBs and concrete pads around Perdue's contract chicken houses. The two organizations are exploring REAP's

sponsorship program, which would allow Perdue to fund farm projects in return for Pennsylvania tax credits. The Alliance is also applying for money through the Perdue Foundation to help finance this partnership.¹⁰¹

While still unofficial, it appears that in this partnership, the Alliance will write grants, reach out to farms to plan conservation projects, and connect farmers with funding and technical assistance. Perdue will likely help pay for the implementation of said projects while getting partially reimbursed through REAP. Beyond that high-level outline, it is unclear exactly what this collaboration will become, but both sides are optimistic about its prospects.

What Not to Pursue

During the course of our research into the poultry industry, we developed several ideas to drive implementation of BMPs. We begin, however, with solutions that are unlikely to succeed.

Integrator Incentives for Grain Producers

When we first examined the Turkey Hill Clean Water Partnership, the idea of companies paying a premium to suppliers that implement conservation practices was attractive. Despite THCWP's shortcomings, this idea initially seemed transferable to the poultry industry. Since litter is spread on cropland after being obtained from a chicken grower, we explored the possibility of integrators setting up a financial reward incentive system for grain producers. However, as most grain producers sell their products according to commodity prices and proximity,¹⁰² we don't believe integrators have enough influence on grain producers to implement a system like this. Additionally, grain producers are required to have NMPs, which integrators commonly point to as proof of proper nutrient management. This response is either an assumption that every farmer is in compliance with NMPs or an acknowledgement that the integrator is not responsible for management, or mismanagement, of nutrients. In either case, it is unlikely that integrators would be open to creating their own systems of monitoring and incentives for grain producers.

Integrator Ownership of Litter

We initially believed that if integrators were legally required to take ownership of their birds' litter, they would be incentivized to develop a centralized system of litter management and transport to avoid regulatory penalties. However, integrator ownership of chicken litter is not a feasible solution due to major pushback from both integrators and their contract growers. Many growers would not want to relinquish litter ownership due to its value. Also, it is unclear that integrators could create a better system to manage and transport litter due to the farmer-to-farmer relationships involved in litter transport. Both integrators and farmers are satisfied with farmer ownership of litter, which makes transferring ownership unreasonable.

Integrator Litter Market

After realizing that integrator ownership of litter would not be feasible, we thought about the possibility of integrators creating a market for litter among their chicken growers and grain producers. Integrators have relationships with chicken growers and grain producers in multiple watershed states and an existing transportation system that spans these states. In theory, they could take advantage of cost-share programs and economies of scale to profit from buying litter from their contract growers and selling it to grain producers in areas of higher demand.

Integrators are likely not interested in this solution. They would have to navigate the costs of buying, picking up, and transporting large quantities of litter, which may be too high to make a profit. Also, integrators would be competing with existing litter brokers and haulers, who have strong relationships with farmers. Competition could increase demand for litter and potentially drive up its price. Finally, integrators in Delmarva already pay half of the cost-share for litter transport, putting them at a competitive disadvantage compared to litter brokers and haulers who do not pay into these programs.

On top of these challenges, integrators are likely wary of entering the litter market because of Perdue's unsuccessful attempt with AgriRecycle. AgriRecycle, started in 1999, sought to process and pelletize litter to sell as a soil

amendment to farmers in the Midwest. When the business started, litter was essentially free to acquire. However, the costs of buying, transporting, and processing litter became too high in the early 2000s. As a result, Perdue turned AgriRecycle into a composting operation in 2012 that took biosolid waste from its processing plants as inputs rather than litter. In 2020, Perdue sold its AgriRecycle composting facility to BioEnergy Development Company and entered a 20-year contract to supply BioEnergy with waste materials from its plants.¹⁰³ Over the span of 20 years, while AgriRecycle did prevent a lot of air and water pollution, the business suffered significant losses. AgriRecycle was a great attempt to find an alternate use for poultry litter, but it proved economically unfeasible and serves as a warning for other integrators considering the litter market.

Anaerobic Digestion

The 20-year supply agreement between Perdue and BioEnergy Development Company began when BioEnergy bought the Perdue AgriRecycle facility in 2020. BioEnergy is an anaerobic digestion company that converts organic waste into renewable natural gas or other usable products. While Perdue does not specifically supply litter to BioEnergy as part of their agreement, poultry litter is a possible input in other anaerobic digestion processes.

Each of BioEnergy's anaerobic digester facilities is built for a specific input and a specific digestion process. The company operates one digester in France exclusively for turkey litter, and broiler litter is a small input in a few of its other facilities. It does not use litter from the Delmarva Peninsula. BioEnergy reaches agreements with companies such as Perdue that have large quantities of waste byproducts from processing plants. Perdue and BioEnergy's other suppliers pay for removal of waste materials from their plants, which is part of how BioEnergy remains profitable.¹⁰³ Poultry litter, however, commands a price and has its own markets, and BioEnergy or another for-profit anaerobic digestion company would need to pay for litter as an input. This would not make financial sense for the company, especially because it gets paid to take other inputs from waste-creating companies. While BioEnergy and its processes are helpful in recycling other types of waste from poultry processing plants, using litter in anaerobic digestion is not currently feasible.

Recommendations

We believe that pollution reduction solutions involving partnerships with private corporations are limited, especially those based on financial incentives. However, the following recommendations involving collaborations with the poultry industry offer options that, if implemented, could have a tangible impact on agricultural load reduction in the watershed.

Invest in Litter Relocation

Many litter transport systems and cost-share programs already exist and receive funding from the poultry industry. We do not currently believe there is a place for CBF to directly support these systems. However, we believe litter relocation could be a major tool to reduce Bay nutrient loads, if wide-scale relocation can be accomplished.

The Phosphorus Management Tool regulations have now gone into full implementation in Maryland, and many farmers in poultry-dense counties will no longer be permitted to apply phosphorus-containing chicken litter to their fields. With many fields unable to apply it, demand for litter in these high poultry concentration counties will likely fall. This will put strain on many proximity-based manure relationships. At the same time, litter supply from chicken houses will remain constant or increase, and transport of litter to lower concentration areas with more fields that can apply phosphorus will be necessary.

Robust litter relocation systems with capacity to move litter over longer distances are vital to ensuring farmers will be able to comply with PMT and NMP regulations. DCA's Littr. app, when fully developed and marketed to a greater number of farmers in the watershed, can help meet this need. Because CBF does not have engineering or marketing capabilities, we do not think CBF can directly help expedite the Littr. app's implementation. However, we do consider the Littr. app to be an important part of the future of litter transport in the watershed and encourage CBF to explore other ways to support its progress.

One avenue to explore further is increasing demand for litter as fertilizer in watershed counties that have not previously used it on a large scale. This could be done through educating farmers, building cost-share assistance for litter storage and spreading equipment, or other methods to draw more litter out of counties where it cannot be applied. The same projects could be explored in counties with high concentrations of poultry growers, where some farmers would like to take advantage of the high supply of litter but lack the equipment to do so.

While our research did not indicate any clear, supply-chain-related paths for CBF to pursue with respect to litter management or transport, we believe it is important for CBF to continue research on how litter relocation systems might be improved and scaled.

Collaborate with DCA's Vegetative Environmental Buffers Program

The Delmarva Chicken Association and the broiler industry recognize the importance of managing ammonia emissions to achieve clean air and water, and have supported a program to help negate some of these emissions since 2006. DCA's Vegetative Environmental Buffers Program provides support to poultry growers on the Delmarva Peninsula to learn about, design, and find cost-share assistance for the implementation of VEBs. VEBs are inexpensive compared to other conservation projects, and DCA claims they are an effective way to mitigate pollution caused by ammonia emissions. However, according to CBF, it is currently scientifically unclear whether VEBs are the most effective solution. We will make this recommendation on the assumption that VEBs are an effective BMP for poultry houses, but it is important to note that VEB efficacy requires further scientific research.

Since DCA began operating the program, hundreds of growers have installed VEBs around their chicken houses. However, according to a recent DCA survey of its member growers, 30% of farms have planted VEBs outside the fans on chicken houses, and about 5% had buffers in between houses. About 63% responded either "yes" or "maybe" to the question of whether additional plantings would be beneficial to their farms.¹⁰⁴

The foundations and intentions of the VEB Program represent an effort by the poultry industry to be good neighbors. The two factors that limit the program's implementation of VEBs are greater farmer outreach capabilities and expansion of funding resources. However, CBF is very unlikely to partner with DCA to implement VEBs in any official capacity due to shared sentiment within CBF that the poultry industry, specifically poultry integrators, should be held responsible for the pollution their litter produces. We believe that due to the relationships between integrators and their growers and the fact that integrators do not own litter produced in poultry houses, integrators will not assume responsibility for the pollution on their farms under current circumstances. Additionally, integrators can point to their investment in litter transport and support for DCA's VEB program to argue they are already part of the solution.

This is one major source of tension between CBF and the poultry industry: CBF believes integrators should be held responsible for litter pollution and do more to help, while the industry believes pollution is already under control due in part to its efforts. While it is clear CBF will not currently provide financial or technical assistance to DCA's VEB program, we urge CBF to reach a consensus on whether VEBs are an impactful BMP in reducing water pollution from ammonia emissions. If VEBs are found to be effective, we encourage CBF to publicly support the VEB program and find other ways to aid its progress.

Explore a Corporate Partnership with Bell & Evans

We believe there is potential to create a partnership between CBF and Bell & Evans. This partnership could operate in a similar manner to THCWP, except poultry integrators work directly with contract growers rather than with a cooperative or middle man. Because integrators have direct connections with their growers, they are in an excellent position to conduct farm outreach. On the other hand, CBF has skills and experience in writing grants and working with farmers to implement conservation projects. While not truly incentive-based, this model would achieve shared goals: more conservation practices on farms and stronger relationships between CBF and the poultry industry.

As mentioned above, Bell & Evans works with over 140 contract farmers exclusively in Pennsylvania, the state furthest behind in reaching its 2025 pollution reduction goals. Because it is tax-liable in Pennsylvania, Bell & Evans could also make an initial financial commitment to the partnership to fund project implementation and receive reimbursement through REAP tax credits. As stated above, it is not currently clear whether VEBs are a viable conservation practice to implement on chicken houses. However, unlike DCA's VEB program, this partnership could fund any type of BMP chicken growers need on their operations that relates to litter storage or management.

On top of its placement in the watershed, Bell & Evans previously supported the High Performance Farms Initiative, which had goals similar to those of this proposed agreement. Previous involvement in a similar initiative suggests that the integrator might be open to exploring a new partnership with CBF.

—

Supermarkets

Research Approach

Supermarkets and other local grocers serve a vital role in the agricultural supply chain due to their direct relationships with consumers. We first identified the largest supermarkets and any small or locally-owned grocers in Maryland, Virginia, and Pennsylvania. We then gathered information on locations, sourcing, and sustainability initiatives for each store. It is important to note that, rather than providing a full list of farm suppliers, many supermarkets featured only a small number of farmers on its website. We next looked into existing partnerships or corporate efforts supermarkets have taken with respect to the agricultural supply chain. We analyzed two main cases to develop a potential partnership structure for CBF to explore with certain regional watershed supermarkets.

Supply Chain Overview

The supply chains of supermarkets and local grocers differ slightly. Supermarkets often purchase grocery items from wholesalers that bridge the gap between them, product manufacturers, and food producers.¹⁰⁵ Wholesalers ensure product consistency and ease of operations. For fresh produce, supermarkets often work with multiple wholesalers. However, supermarkets concentrate on providing local produce when it is in season or available rather than relying solely on their main wholesalers.¹⁰⁶ Meat products are also delivered through regional wholesalers and are sourced from large meat companies such as Tyson or Perdue. Meats may also be sourced from local ranchers or butchers. Local grocers mostly source locally made products through direct store delivery. Local grocers also often attend auctions to purchase local goods in large quantities.¹⁰⁶

Supermarket Company Information

Weis

Weis is a supermarket chain headquartered in Sanbury, PA that had a revenue of \$4.11 billion in 2020.¹⁰⁷ As of 2021, it had 198 locations throughout the watershed states including 117 in Pennsylvania, 49 in Maryland, and nine in Virginia.¹⁰⁸ According to its 2020 Sustainability Report, it sources from a total of 150 local farms throughout New Jersey and the six watershed states, with 42 farms in Pennsylvania, nine farms in Maryland, and eight farms in Virginia.^{109,110} Weis is also a known supplier of PA Preferred products.

Weis' existing sustainability programs mainly focus on transport, storage, and food waste. As indicated in its 2020 Sustainability Report, it currently partners with a variety of organizations, many of which are specific to Pennsylvania. It divides sustainability initiatives into four main pillars: Green Practices, Natural Resources, Food and Agriculture, and Social Responsibility. While the company does not have a specific focus on sustainable sourcing, it makes an effort to support local producers.

Publix

Publix is a supermarket chain headquartered in Lakeland, FL that had a rev-

enue of \$44.9 billion in 2020.¹¹¹ It has about 1,300 locations nationally, but there are only 19 in Virginia and none in Pennsylvania or Maryland.¹¹² Some of its known suppliers in the watershed include Shenandoah Growers, Fresh2o Growers, and Kirby Farms.¹¹² Publix also has its own label for products that were grown, manufactured, or produced within the same state.¹¹³

Publix has taken a storewide approach to sustainability and has multiple programs for each department. These programs, largely focused on reducing emissions, include how the departments operate and source. The main focus for sustainable sourcing is with seafood, and Publix currently partners with several conservation groups in the seafood industry. While its sourcing initiatives are currently limited to seafood, Publix seems to focus on sustainable sourcing more than most other supermarkets we researched.

MOM's: Organic Market

MOM'S: Organic Market is a grocer headquartered in Rockville, MD that had a revenue of \$4 million in 2020.¹¹⁴ It has three locations in Pennsylvania, five in Virginia, and 10 in Maryland.¹¹⁵ Its known watershed suppliers include Even Star Farm, Lancaster Farm Fresh Co Op, Oak Spring Farm, Farm of Peace, Crawford Organics Farm, Real Food Farm, One Straw Farm, Avery's Branch Farm, and Grayson Farms.¹¹⁶

MOM's is involved with the Monterey Bay Aquarium's Seafood Watch program and partners with the Wide Net Project to reduce catfish, an invasive species in the Chesapeake Bay. It has partnerships with farms to support sustainable agriculture and small family businesses. Its website lists over 109 banned ingredients and indicates a preference towards organic items, sustainable farming practices, and fair labor.¹¹⁷ Its fresh beef, bison, pork, and lamb are all pasture or forest-raised, and it is committed to only selling 100% sustainable seafood.

Walmart

Walmart is a supermarket chain headquartered in Bentonville, AR that has an estimated revenue of \$559 billion in 2021.¹¹⁸ It has a total of 5,342 stores, with 62 in Maryland, 150 in Virginia, and 163 in Pennsylvania.¹¹⁹ Walmart is

the nation's largest purchaser of local produce.¹²⁰ In addition to carrying PA Preferred products, it also has its own signage system of highlighting local produce.

Walmart has a variety of ambitious sustainability efforts that include a commitment to growing relationships with farmers and supplying local produce. In 2017, Walmart created Project Gigaton, which aims to avoid one billion metric tons (a gigaton) of GHG emissions from the global supply chain by 2030. Gigaton has become one of the largest private sector consortiums for climate action with about 3,169 participants.¹²¹ It recommends setting a target in one or more key areas: energy, waste, packaging, forest, product use and design, and agriculture. In terms of agriculture, Gigaton provides recommendations to suppliers, NGOs, and other stakeholders on how their farmers can incorporate more sustainable practices.

Whole Foods

Whole Foods is a supermarket chain headquartered in Austin, TX that had net sales of \$16 billion in 2017, when it was acquired by Amazon for \$13.7 billion.¹²² It has a total of 506 stores, with 15 in Pennsylvania, 10 in Maryland, and 13 in Virginia.¹²³ In 2013, it stated that about 25% of store produce was sourced from local farms.¹²⁴

Whole Foods currently has partnerships with various organizations to help alleviate poverty, ensure food security, and improve nutrition and wellness. It is committed to providing high quality natural and organic food and has pledged to reduce 50% of its food waste by 2030.¹²⁵ Whole Foods also supports regenerative agriculture and encourages its suppliers to participate.

Giant Food

Giant Food is a supermarket chain headquartered in Landover, MD that had a revenue of \$5.62 billion in 2020.¹²⁶ It has 320 total locations with seven in Washington D.C., six in Delaware, 91 in Maryland, 60 in Virginia, and 156 in Pennsylvania.^{127,128} Giant Food is a known supplier of PA Preferred and Maryland's Best products, but there is no publicly available information about the specific farms it sources from.

Giant Food's sustainability efforts focus on minimally-processed, fair-labor, and climate-friendly products, using the environmental social impact rating system HowGood.¹²⁹ Additionally, Giant Food has a partnership with MDVA and the Alliance for the Chesapeake Bay, the Giant Clean Water Partnership. This partnership, started in late 2020, supports local dairy farmers throughout the watershed to improve land and water quality. More information on this partnership can be found below.

Safeway

Safeway is a supermarket chain headquartered in Lanham, MD that has a revenue of \$37.6 billion in 2021.¹³⁰ It currently has 904 total store locations with three in Delaware, 59 in Maryland, 37 in Virginia, and 12 in Washington D.C.¹³¹ Some of its known watershed suppliers include Lucerne Dairy Farms, its main ice cream, cheese, yogurt, and milk brand, and Signature Farms, its fresh fruits and vegetables brand. Safeway is a known supplier of Maryland's Best products.

Some of Safeway's existing sustainability initiatives include partnerships with The Sustainability Consortium, Ocean Conservation, and Fair Trade USA.¹³² It has comprehensive guidelines for supplier sustainability and focuses on waste diversion and local sourcing.¹³³

ShopRite

ShopRite is a supermarket chain headquartered in Edison, NJ. It has a total of 323 store locations including 10 in Maryland, 31 in Pennsylvania, and six in Delaware.¹³⁴ It is a known supplier of PA Preferred products. While ShopRite does not publish a list of farms it sources from, it states on its website that "grown locally" produce is delivered from local farms to support family farmers.

ShopRite's sustainability efforts focus on managing waste from its stores. It does not have a specific focus on sustainable sourcing. It has worked with a large number of environmental organizations, including CBF, to support its communities.

Food Lion

Food Lion is a supermarket chain headquartered in Salisbury, NC that has an estimated revenue of \$1.98 billion in 2021.¹³⁵ It has a total of over 1,100 store locations, with 277 in Virginia, 78 in Maryland, and eight in Pennsylvania.¹³⁶ Food Lion is a known supplier of Maryland's Best products and has "Local Goodness" labels within stores to highlight products produced in the same state.¹³⁷

Food Lion has committed to reducing food waste, conserving energy, and sourcing products locally and responsibly. It has a food rescue program and has worked with the Ocean Disclosure Project on sustainable seafood policy and transparency. This enables customers to trace wild-caught seafood back to its source. It has also partnered with Ahold Delhaize USA to increase traceability and ensure digital transparency. Food Lion's website claims that all of its own brand coffee, cocoa, tea, seafood, and soy products are 100% sustainably sourced.

Wegmans

Wegmans is a supermarket chain headquartered in Rochester, NY that had a revenue of \$9.7 billion in 2019.¹³⁸ It has a total of 106 store locations, with 18 in Pennsylvania and 13 in Virginia, and eight in Maryland.¹³⁹ Wegmans is a known supplier of both PA Preferred and Maryland's Best products.

Wegmans has programs focused on reducing landfill waste, offering sustainable packaging, and reducing emissions.¹⁴⁰ Because it is only focused on where it can currently make the most impact, it does not feature specific sustainability standards for sourcing.

Local Grocers

Local grocers often source directly from farms in their areas. One example is Shady Maple Farm Market located in Lancaster, PA, with an annual revenue of \$17.6 million.¹⁴¹ Shady Maple has grown into a large grocery store that sources most of its local goods through weekly auctions.¹⁴²

Local grocers are common in the watershed states, but their websites are often not up to date. This is especially true in Pennsylvania, where these grocers are mostly run by Amish or Mennonite farmers. Therefore, more information is needed to understand the role of local grocers in influencing their suppliers.

Existing Models

The three initiatives below allowed us to further understand if a supermarket partnership would be worth pursuing and what it could look like.

Whole Foods Responsibly Grown Program

The Whole Foods Responsibly Grown Program, started in 2014, introduced a wide range of ambitious standards designed to elevate the environmental performance of both conventional and organic farmers. This program aimed to explore aspects of agricultural production not covered by USDA's Certified Organic program. Products sourced from farmers participating in this program were ranked in a three-tiered system. The rankings of "good," "better," and "best" were based on the level of ecological and social commitment demonstrated by the producer.¹⁴³

Responsibly Grown was quickly criticized by organic producers who said it undermined farmers' investment in the USDA Organic Certification. Under this program, conventional farmers could still obtain a "best" ranking while continuing to use a small number of pesticides that organic farmers could not. Additionally, organic farmers were already paying a fee for their certification on top of fees associated with Responsibly Grown, which ranged from \$5,000 to \$20,000. Other critics were concerned about consumer label fatigue.¹⁴³ Whole Foods tried to correct these issues by phasing out the three-tiered system in May, 2016 for a single "Responsibly Grown" logo in all of their stores. However, this was not enough.^{144,145} After national roll-out was completed in November, 2016, the program was completely phased out of stores by the end of 2017.¹⁴⁶

Responsibly Grown failed because Whole Foods essentially created their own

labeling system rather than help farmers understand and implement BMPs directly. As we discuss below, eco labeling may not be feasible or useful in this capacity. This program may have seen more success had Whole Foods invested in farmer education and assistance instead.

Stanford University Woolworths Study

In 2017, Stanford University set out to study the effectiveness of a company-led supply chain standard in improving environmental farm management practices. To do this, the study examined an initiative by one of the top five supermarkets in South Africa, Woolworths, the Farming for the Future (FFF) program.

The goal of FFF was to improve soil and plant health, preserve resources like water and soil, and protect biodiversity among Woolworths' fruit, vegetable, and flower growers. Due to variables including cost, complexity, and scale of the projects required to detect changes in landscape-level environmental outcomes, Stanford used the adoption of BMPs as an early indicator of improved environmental outcomes.

FFF provides participating Woolworths farmers with a baseline evaluation and annual third-party audits of their farming practices. Each year, farmers receive an audit score as well as recommendations to improve farm management practices by trained third-party agronomists and environmental scientists. All growers for Woolworths were required to enroll in this program and were expected to show sustained improvement in order to continue supplying Woolworths. Woolworths did not provide a price premium or other financial incentive for involvement in the program, but they did cover the cost of the annual farm audits. Overall, FFF used penalty-based incentives while also offering to help participating farmers avoid said penalties through BMP education and non-financial assistance.

FFF resulted in an increase in implementation of conservation-oriented farm practices suggested by Woolworths. Integrated pest management practices, annual crop rotation, and cover crop usage each increased by 7% by the end of the study. According to a survey conducted of participating farmers, there

was a 17% uptake of no-tillage practices compared to farmers part of other certification programs.¹⁴⁷

The study concluded that a company-led approach that couples a penalty-backed farm audit system with support and encouragement from the company can potentially be effective in driving the implementation of BMPs. The third-party audits were conducted by highly trained professionals who took a relational approach. At each audit, they gave advice and recommendations to farmers to improve their practices, which was noted as a significant differentiator of FFF compared to other environmental audits farms received. Additionally, Woolworths took a farm-by-farm approach to the standards rather than implementing the same standards for all farms.

The nature of the audits, along with Woolworths' relationships with farms, caused two-thirds of the farms in the program to see it as a partnership in which they had the opportunity to improve. The other third of farmers viewed the program as a requirement rather than an opportunity and oftentimes made just enough changes to receive a passing audit score. The perception of Woolworths' interest in the farm's long-term viability was an important component of FFF's collaborative nature.

According to the study, it cannot be inferred that FFF's positive outcomes can be reproduced by other companies. However, the study also concluded that company-led initiatives that prioritize relationships with suppliers have potential to drive BMP implementation.¹⁴⁷

Giant Clean Water Partnership

The Giant Clean Water Partnership between the Alliance for the Chesapeake Bay, Giant Food, and MDVA began in late 2020. The partnership targets Maola Local Dairies and Giant Food milk suppliers, and aims to support these dairy farmers' land and water conservation efforts through implementation of BMPs.¹⁴⁸ Direct funding pathways for this program have not yet been established. Currently, all BMP implementation projects use NRCS Regional Conservation Partnership Program funding. This cost-share program is available to any farmer and is not related to the partnership. Due to its recency and

current funding state, the success of the partnership is difficult to assess, and only two tree planting events have resulted from the partnership as of July, 2021.¹⁴⁹ Additionally, conflicts within Giant's leadership surrounding agricultural sustainability have stalled the partnership's progress.¹⁰¹

Recommendations

Based on the above research on supermarkets and partnership efforts, we determined that it could potentially be beneficial for CBF to partner with a supermarket.

A partnership could be structured similarly to Woolworth's FFF program. In this model, CBF could provide conservation experts to accompany supermarket-financed farm auditors who would give suggestions about conservation plans and projects. CBF could also use its agricultural conservation expertise to help the supermarket create improved sustainable sourcing standards. As shown by the Stanford study, it is important that conservation plans are created on a farm-by-farm basis rather than with uniform standards.

A partnership like this would help the supermarket improve the sustainability of its supply chain, CBF would achieve pollution reduction goals, and both would benefit from stronger relationships with farmers.

The supermarkets that stood out most as potential partners included Weis, Publix, and MOM's: Organic Market. These supermarkets have a strong presence within the watershed, source goods locally, and have the most developed sustainable sourcing standards. However, this list is only a starting point based on initial company research, and CBF should be open to exploring collaborations with any supermarket that has interest in improving the sustainability of its supply chain.

—

Other Models in the United States

During the course of our research, we came across a handful of conservation initiatives throughout the United States. Below is a list of what we found, along with recommendations based on each initiative.

Ecosystem Services Market Consortium

Ecosystem Services Market Consortium (ESMC) is a member-based organization that connects stakeholders in the agricultural supply chain.¹⁵⁰ It quantifies environmental assets, such as reduced GHG emissions, on farms and uses this data to certify and sell carbon credits to corporate buyers.¹⁵¹ Within these private voluntary ecosystem service markets, ESMC acts as a “carbon broker” that recognizes and rewards farmers for their sustainable practices.¹⁵² ESMC’s role is to help food companies reduce both direct and indirect GHG emissions in their corporate inventories.

In January 2020, General Mills and the Kansas Department of Health and Environment launched the Southern Plains Pilot, a program which utilizes ESMC to encourage regenerative agriculture practices and aid water quality improvement. This partnership is designed to accelerate learning about these farming practices while assessing the market value of environmental assets. The goal of this carbon credit exchange is to reward farmers for adopting more sustainable practices and allow companies to fulfill their sustainability objectives.¹⁵² Those involved in this program will be some of the first to be paid for sequestering carbon and improving water quality in the country.¹⁵⁰

More research needs to be done to assess the viability of a carbon credit system and its ability to be replicated in the Chesapeake Bay watershed. Although this does not directly pertain to BMPs, and past attempts at similar water quality trading systems have been unsuccessful, we still believe there is potential for solutions that financially quantify environmental assets to reduce pollution.

Great Lakes Restoration Initiative

The Great Lakes Restoration Initiative (GLRI) was launched in 2010 to accelerate efforts to protect and restore the Great Lakes.¹⁵³ This initiative is similar to the Chesapeake Bay Clean Water Blueprint. GLRI is operated by the EPA with the help of the Great Lakes Advisory Board, the Interagency Task Force, and the Regional Working Group.¹⁵⁴

Conservation measures are being implemented on over 700,000 cropland acres in the program's four agriculture priority watersheds.¹⁵⁵ GLRI has reduced more than one million pounds of phosphorus runoff from farmlands. The program takes a hands-on approach to assisting farmers. In addition to providing funding through grants, the GLRI helps to initiate connections between farmers and resources to help them improve their farming practices. GLRI also funded the implementation of conservation practices on four demonstration farms throughout the Great Lakes watershed.¹⁵⁶ The variety of demonstration farms in different areas of the watershed has allowed for more education on conservation practices among different types of farmers.

—

Labelling and Certifications

In investigating incentives for farmers to implement BMPs, we looked into whether or not companies would be susceptible to pressure from consumers and purchasing requirements.

Eco Labelling

While many current labels exist such as Regenerative Organic Certified and USDA Organic, none of these specifically pertain to nitrogen and phosphorus runoff. What constitutes "best management practices" also varies from farm to farm depending on factors such as type and location. Therefore, it would be almost impossible to create a universal labelling system that accurately reflects each farm's contribution to reducing pollution in the Chesapeake Bay.

Because this would be specific to different local requirements, it would not be scalable, hindering it from gaining any real authority in the market.

Although there is an upward trend in environmental consciousness among consumers, there is limited research on how this marginal increase in cost would directly impact farmers' incomes. There is also little information on whether people are willing to pay a premium for more environmentally-friendly products. Many current labels are also established during the manufacturing stage, leaving farmers with limited involvement in the process.¹⁵⁷

Consumers benefit from labels that they can trust. However, it would take a significant amount of time to design, create, and implement a watershed-specific certification. It would also take time to ensure that consumers are both educated about the significance of the label and willing to pay extra for the product.¹⁵⁷ Farmers may expect substantial data before deciding it is financially beneficial to make changes to their farming practices. Widespread food labelling could also hurt farmers in the process of improving their operations. This would deem some of their products unqualified compared to others that have already attained certain labels.¹⁵⁸

Overall, it is extremely difficult to establish a correlation between eco labelling and environmental issues. So far, research suggests it is a limited incentive for farmers.

Agricultural Conservation Stewardship Certification Standard

Established by The Maryland Association of Soil Conservation Districts (MASCD), the Agricultural Conservation Stewardship Certification Standard (ACSCS) recognizes good stewardship in compliance with state requirements for BMPs and nutrient management. Farmers may receive this certification by volunteering to be evaluated. Assessors and district planners survey the farm to assess soil conservation and water quality plans and measure BMPs. By "setting the bar," this certification aims to encourage other farmers to adopt similar measures. CBF is one of the key partners of this program.¹⁵⁹

While there are benefits to rewarding conservation practices, there are limitations to this certification program's ability to incentivize farmers to improve their environmental standards. Since it is volunteer-based, farmers who receive the certification are more likely to have existing sustainability efforts. As a result, this certification promotes little change as it mostly rewards rather than encourages better management practices. Additionally, as stated on MASCD's website, this certification serves as a source of pride for farmers.¹⁶⁰ While it is important to recognize farmers for their sustainable management efforts, the certification appears mostly for internal purposes and is hardly communicated to the buyer or consumer.

—

General Recommendations

Our team set out to research agricultural supply chains in the Chesapeake Bay watershed and assess the viability of corporate partnerships that implement supplier sustainability standards. This section outlines general recommendations to consider when evaluating the industry-specific recommendations in previous sections.

Corporate partnerships based on financial incentives to drive farmer implementation of sustainability practices are currently unrealistic in the researched Chesapeake Bay watershed agricultural industries.

The Turkey Hill Clean Water Partnership is branded as offering a premium to dairy producers who implement BMPs on their farms. As detailed above, no Turkey Hill milk supplier receives money from the company as part of this partnership. Additionally, in the THCWP and other existing collaborations, the implementation of BMPs is not mandatory for suppliers. We conclude that the industries researched in this project are not suited for positive financial incentives related to water conservation practices. The dairy industry is highly decentralized and the milk pricing structure is un conducive to premiums for milk produced on sustainable farms. In terms of the poultry industry, integrators do not have responsibility for the litter produced in chicken houses

and could not reasonably enter the litter market. Integrators also do not have enough influence on their grain-supplying farms, where much of the litter is eventually spread. While supermarkets have a direct relationship with the consumer, we do not believe an agricultural conservation labeling system would allow for premium retail pricing. We believe further research needs to be done on supermarkets' influence on suppliers to completely evaluate the possibility of financial incentives.

Despite the current inability to create positive corporate incentive structures, there are still opportunities for CBF to collaborate with companies in each researched industry to accelerate agricultural conservation.

Although THWCP does not actually pay a premium to participating farmers, its model is useful for designing potential opportunities for CBF. As described more specifically in each industry section above, a partnership between CBF and a company has several main components.

In terms of roles, the company can provide direct connection to its farms, which are generally close to its area of operation. The company could also provide an initial financial commitment in the form of either hiring a team of agriculture sustainability staff or directly seeding the partnership's budget for BMP implementation. Turkey Hill's premium actually pays for MDVA's sustainability staff, while Hershey committed \$300,000 up front. CBF could potentially match a seed commitment as the Alliance plans to do with Hershey. With this initial commitment secured, the company's sustainability staff (if hired) and CBF experts can perform farm outreach to offer financial and technical support. In almost all of the Alliance's partnerships, it has found that the partnering company has little expertise surrounding conservation on farms or BMPs. CBF can provide this expertise to companies. CBF partnership leaders would also apply for grant funding to scale the partnership and reach more farms. Additionally, CBF has unique development and fundraising capabilities and could explore raising a portion of the partnership's funds through its own campaigns.

This model benefits each entity involved. As the study of Woolworths' FFF

program shows, a company's relationships with its suppliers can impact supplier willingness to implement BMPs. Farmers are more receptive to implementing BMPs if they feel like the company they supply is invested in their long-term success and is eager to help them improve. A partnership like this in any industry would improve CBF's industry and farmer relationships. Also, these partnerships, although not based on market incentives, can still be marketed as "cross-sector collaboration." The Alliance has found that the involvement of the private sector makes the partnership enticing for government funders. Farmers can also benefit because it is easier to access partnership funding than to seek grants and cost-share on their own. For THCWP implementation projects, consultants, engineers, and contractors billed the Alliance directly for their services. Therefore, participating farmers did not have to make large upfront investments and wait for reimbursement. Finally, partnerships with a few companies could potentially set a standard for others to improve their own supply chains over time.

Conservation plans and their implementation differ significantly farm by farm, so effective solutions must be tailored to the individual farm.

The structure outlined above does not use financial incentives or company mandates to motivate farmers. Therefore, as seen with THCWP, farmer participation in this partnership would be voluntary. However, we believe the company seeking to build a relationship with and provide financial assistance to farmers will increase farmers' willingness to participate. Due to the demands of farming, many farmers do not have the capacity to acquire funding for conservation projects on their own. Some even have to sacrifice conservation efforts to keep their farms alive. Removing obstacles to funding and technical assistance would enable farmers to consider how conservation could improve their operations over time. Additionally, educating and providing conservation assistance to one farmer could indirectly impact the practices of others due to strong farmer networks. Farmers are constantly experimenting with ways to improve their operations, and frequently share ideas with each other. The individual farm approach could therefore help make sustainable farming practices more mainstream.

The importance of a farm-by-farm approach played a major role in devel-

oping the partnership model outlined above. While company mandates for suppliers or an innovative financial incentive system are enticing, these systems result in uniform requirements for farmers and fail to provide solutions to the problems they seek to fix. We therefore believe that regardless of whether or not CBF pursues corporate partnerships, it should increase its direct work assisting farmers in achieving agricultural goals for the Chesapeake Bay watershed.

—

Alternative Sources of Funding

Further research and conversations led us to consider indirect stakeholders in the agricultural supply chain and unconventional sources of funding. While these are simply starting points, we detail two related industries below and encourage further exploration.

Health Insurance Companies

Based on a 2015 study on health insurance among farmers, 65% of commercial farmers identified the cost of health insurance as the biggest threat to their farm.¹⁶¹ The rate of uninsured farmers varies by agriculture type, ranging from 5.5% among grain producers to 41.4% among dairy farmers.¹⁶² Many farmers report concerns of having to sell their farm in exchange for health expenses.¹⁶³

While obstacles vary by state and individual farm, three main barriers to obtaining health insurance include cost, availability, and lack of understanding.¹⁶⁴ Given high rates and costly consequences of uninsured farmers, one potential solution is for health insurance companies to intervene. They could offset the costs of health insurance in exchange for farmers implementing BMPs.

Insurance companies could benefit from publicizing these initiatives through their corporate responsibility programs. As they have a vested interest in

their clients' health, improving water quality could also reduce their long-term costs. This is because high water pollution levels can contribute to public health issues, so reducing this risk may reduce the need to seek medical care.¹⁶⁵ The feasibility of this as a funding source necessitates more in-depth research and relationships within the health insurance industry.

Nonprofit Hospitals

Similar to the case made with health insurance companies, nonprofit hospitals may have vested interest in water conservation practices.

The Affordable Care Act requires all nonprofit hospitals to conduct Community Health Needs Assessments (CHNAs) every three years and participate in hospital community benefits in order to maintain their tax-exempt status.¹⁶⁶ This encourages nonprofit hospitals to become more involved in promoting community health beyond hospital walls.¹⁶⁷ One organization taking advantage of this policy is Health Care Without Harm, which seeks to transform the healthcare industry into a leader in the movement for environmental health and justice. It partners with hospitals and organizations around the world to implement ecologically sound health care practices to reduce pollution and disease.¹⁶⁸

There are case studies of hospitals that have partnered with local organizations to address community issues.¹⁶⁹ Hospitals have the potential to harness their large economic resources to address social and environmental issues in the communities they serve.¹⁷⁰ For example, Northwestern Medical Center's CHNA identified obesity as a key community indicator of food and diet-related priorities. Its community benefit investment strategy involved partnering with food-related organizations such as Healthy Roots Collaborative to advocate for disease prevention.¹⁷¹

Practice Green Health is a membership and networking organization that aims to deliver environmental solutions to hospitals and health systems across the United States. Its website states "hospitals that pursue sustainable procurement programs could see annual savings of \$56,000 per operating room."¹⁷² According to a KPMG corporate responsibility study from 2017, 93% of the

world's 250 largest companies are prioritizing sustainability in their operation and procurement strategies. More than 43,000 hospitals and health systems are involved in a global network committed to sustainable operations through Practice Greenhealth and Global Green and Health Hospitals. Many health facilities are also using sustainable procurement to benefit patients, staff, the community, and the environment.¹⁷³

Although the focus of these programs is not on environmental issues specifically, there is potential for hospitals to fund agricultural sustainability initiatives. This is because improving water quality could also improve community health outcomes in the long-run. A nonprofit hospital could utilize community benefits to address pressing issues in the Bay region. In this case, a CHNA may identify common agricultural practices that contribute to health-impairing water pollution as a key community indicator. Action could prioritize investing in solutions that encourage more sustainable farming practices—one being supporting the implementation of BMPs on farms.

—

References

- ¹ Center for Dairy Excellence. Pa dairy overview. <https://www.centerfordairyexcellence.org/pa-dairy-goodness-that-matters/pa-dairy-overview/>, 2017.
- ² Pennsylvania Department of Agriculture. Dairy future commission. https://www.agriculture.pa.gov/Business_Industry/dairy-future/Pages/default.aspx, 2021.
- ³ Chuck Gill. Farmland acreage falls in pa. while population rises in prime agricultural areas. <https://news.psu.edu/story/650383/2021/03/09/research/farmland-acreage-falls-pa-while-population-rises-prime-agricultural>, 2021.
- ⁴ Milk Marketing Board. Over-order premium. <https://www.mmb.pa.gov/Pricing>, 2019.
- ⁵ Karen M. Kroll. The dairy supply chain: From farm to fridge. <https://www.inboundlogistics.com/cms/article/the-dairy-supply-chain-from-farm-to-fridge/>, 2015.
- ⁶ Jenna Allen. The story of dairy: Transporting milk. <https://www.dairydiscoveryzone.com/blog/story-dairy-transporting-milk>, 2019.
- ⁷ Hershey. The core four. https://www.thehersheycompany.com/en_us/whats-inside/the-core-four.html, 2021.
- ⁸ Hershey. Fresh milk: From the farm to hershey's milk chocolate. https://www.hersheys.com/content/dam/hersheysfranchise/images/simple-ingredients/Hershey_Simple_Infographic.pdf, 2021.
- ⁹ Hershey. Plant locations. https://www.thehersheycompany.com/en_us/home/plant-locations.html, 2021.
- ¹⁰ Hershey. Dairy. https://www.thehersheycompany.com/en_us/sustainability/shared-business/responsible-sourcing/priority-ingredients-and-materials/dairy.html, 2021.
- ¹¹ Hershey. Company sustainability report. Technical report, Hershey, 2020.
- ¹² Inc. Nestle Holdings and Subsidiaries. Annual financial report. Technical report, Nestle, December 2019.
- ¹³ Nestle. Working with dairy farmers.

- <https://www.nestle.com/brands/dairy/dairycsv>, 2021.
- ¹⁴ Maryland & Virginia Milk Producers Cooperative Association. Maryland & virginia milk producers cooperative, nestle usa and the alliance for the chesapeake bay earn a \$200,000 grant for environmental conservation. <https://mdvamilk.com/2019/10/11/maryland-virginia-milk-producers-cooperative-nestle-usa-and-the-alliance-for-the-chesapeake-bay-earn-a-200000-grant-for-environmental-conservation/>, 2019.
- ¹⁵ Nestle. Carnation farm joins u.s. dairy net zero initiative as first pilot farm. <https://www.nestleusa.com/media/pressreleases/carnation-farm-joins-dairy-net-zero-initiative#:~:text=Dairy>, 2021.
- ¹⁶ Nestle. Sustainability. <https://www.nestleusa.com/sustainability>, 2021.
- ¹⁷ Lancaster Online. Turkey hill dairy to spend tens of millions to fuel growth. https://lancasteronline.com/business/local_business/turkey-hill-dairy-to-spend-tens-of-millions-to-fuel-growth/article_bd8d20ca-aa34-11e9-894f-c761d7606833.html#:~:text=Turkey.
- ¹⁸ Mauricio Rosales. Personal Communication, July 7, 2021.
- ¹⁹ Turkey Hill. Sustainability and environmental impact-reduction projects from turkey hill. <https://www.turkeyhill.com/about/green>, 2021.
- ²⁰ Zippia. Baldor specialty foods overview. <https://www.zippia.com/baldor-specialty-foods-careers-16111/>, 2021.
- ²¹ Baldor. Baldor green. <https://www.baldorfood.com/green>, 2021.
- ²² Buzzfile. Clover farms dairy company inc. <https://www.buzzfile.com/business/Farmers-Co~Op-610-921-9111>, 2021.
- ²³ Clover Farms. Clover farms. <https://www.cloverfarms.com/>, 2021.
- ²⁴ RocketReach. Kreider farms information. https://rocketreach.co/kreider-farms-profile_b5575edef9c8aab5, 2021.
- ²⁵ Kreider Farms. Kreider farms. <https://www.kreiderfarms.com/>, 2021.
- ²⁶ Philip Gruber. Cooperatives' disclosure of pennsylvania dairy premium gets key approval. https://www.lancasterfarming.com/farming/dairy/cooperatives-disclosure-of-pennsylvania-dairy-premium-gets-key-approval/article_6b893900-a111-11eb-8466-b754e68bad89.html, 2021.
- ²⁷ Pennsylvania Association of Dairy Cooperatives. Douglas eberly. http://www.irrc.state.pa.us/docs/3154/COMMENTS_PUBLIC/3154, 2014.
- ²⁸ Dairy Farmers of America. Dairy farmers of america. <https://www.dfamilk.com/>, 2021.
- ²⁹ Dun&Bradstreet. Dairy farmers of america, inc.

- https://www.dnb.com/business-directory/company-profiles.dairy_farmers_of_america_inc.f3537b9579fce8f2486a713a7d21c229.html, 2021.
- ³⁰ Brian Kaberline. Dfa completes \$433m acquisition, with feds' blessing. <https://www.bizjournals.com/kansascity/news/2020/05/04/dfa-completes-433m-dean-foods-acquisition.html>, 2020.
- ³¹ Dairy Farmers of America. Sustainability. <https://www.dfamilk.com/our-commitment/sustainability>, 2021.
- ³² Sarah Thomas. The top 50 dairy co-ops retain market share. <https://hoards.com/file-418-the-top-50-dairy-co-ops-retain-market-sharepdf>, 2019.
- ³³ Land O'Lakes. By the numbers. <https://www.landolakesinc.com/business-overview>, 2021.
- ³⁴ Brooke Dillon. Land o'lakes, inc. unveils dairy 2025 commitments. <https://www.landolakesinc.com/Press/News/New-Sustainability-Commitments>.
- ³⁵ Maryland & Virginia Milk Producers Cooperative Association. Sustainability. <https://mdvamilk.com/sustainability/>, 2021.
- ³⁶ Pennsylvania Department of Agriculture. Pa preferred support pennsylvania farmers. https://www.agriculture.pa.gov/Business_Industry/pa_preferred/Pages/default.aspx, 2021.
- ³⁷ Dan Undersander. Pastures for profit: A guide to rotational grazing. Technical report, National Resources Conservation Service and University of Minnesota Extension Service, 2002.
- ³⁸ Michael A. Holly. Management characteristics of pennsylvania dairy farms. *Applied Animal Science*, 35(3):325-338, 2019.
- ³⁹ Discover Lancaster. The difference between amish and mennonite. <https://www.discoverlancaster.com/blog/difference-between-amish-and-mennonite/>, 2021.
- ⁴⁰ Engage the Chain. Commodity briefs: Dairy. <https://engagethechain.org/dairy>, 2021.
- ⁴¹ LPELC Extension Foundation. Liquid manure storage ponds, pits, and tanks. <https://lpec.org/liquid-manure-storage-ponds-pits-and-tanks/>, 2019.
- ⁴² James D. Ferguson. An assessment of ammonia emissions from dairy facilities in pennsylvania. *The Scientific World*, 1(S2):348-355, 2001.
- ⁴³ Virginia A. Ishler. Dairy sense: Keeping the dairy right sized. <https://extension.psu.edu/dairy-sense-keeping-the-dairy-right-sized>, 2020.
- ⁴⁴ C. Alan Rotz and Robert C. Stout. Regional environmental assessment of

- dairy farms. *Journal of Dairy Science*, 103(4):3275–3288, 2020.
- ⁴⁵ Chesapeake Bay Program. Agriculture. <https://www.chesapeakebay.net/issues/agriculture>, 2021.
- ⁴⁶ Abel Russ. Unsustainable agriculture. Technical report, Environmental Integrity Project, 2017.
- ⁴⁷ Jeffrey Bewley. Precision dairy farming: Advanced analysis solutions for future profitability. Technical report, University of Kentucky, 2010.
- ⁴⁸ Virginia A. Ishler. Interpretation of milk urea nitrogen (mun) values. <https://extension.psu.edu/interpretation-of-milk-urea-nitrogen-mun-values>, 2016.
- ⁴⁹ Virginia A. Ishler. Personal Communication, July 12, 2021.
- ⁵⁰ DairyBusiness News Team DP. Newtrient: Reducing dairy's environmental impact, growing revenue streams for famers. <https://www.dairybusiness.com/newtrient-reducing-dairys-environmental-impact-growing-revenue-streams-for-farmers/>, 2018.
- ⁵¹ LPELC Admin. Development and application of newtirement evaluation assessment tool (neat): A methodology for comparing manure treatment technologies. <https://lpec.org/liquid-manure-storage-ponds-pits-and-tanks/>, 2019.
- ⁵² Marilyn Hershey. Newtrient — a powerful tool and resource for dairy farmers in demonstrating dairy's positive environmental impact. <https://www.usdairy.com/for-farmers/blog/newtrient-a-powerful-tool-and-resource-for-dairy-farmers>, 2019.
- ⁵³ PennState Extension. About penn state extension. <https://extension.psu.edu/about-us>, 2021.
- ⁵⁴ Undeniably Dairy. U.s. dairy sustainability awards. <https://www.usdairy.com/sustainability/award-winners>, 2021.
- ⁵⁵ Scott Wallin Dairy Management Inc. Net zero initiative earns grant. https://www.kmaland.com/ag/net-zero-initiative-earns-grant/article_b8699b31-bb0f-59cc-b6b9-6776639f63a9.html, 2021.
- ⁵⁶ Cision US Inc. Carnation farm joins u.s. dairy net zero initiatives as first pilot farm. <https://www.prnewswire.com/news-releases/carnation-farm-joins-us-dairy-net-zero-initiative-as-first-pilot-farm-301319426.html>, 2021.
- ⁵⁷ Pennsylvania Department of Agriculture. The conservation excellence grant program. https://www.agriculture.pa.gov/Plants_Land_Water/StateConservationCommission/Conservation_Excellence_Grant_Program/Pages/default.aspx, 2021.

- ⁵⁸ Pennsylvania Department of Agriculture. Dairy investment grant program. <https://www.agriculture.pa.gov/Pages/Dairy-Investment-Grant-Program.aspx>, 2021.
- ⁵⁹ Pennsylvania Department of Agriculture. Farm to school. https://www.agriculture.pa.gov/Business_Industry/pa_preferred/Pages/Farm-to-School.aspx, 2021.
- ⁶⁰ Pennsylvania Department of Agriculture. Become a member. https://www.agriculture.pa.gov/Business_Industry/pa_preferred/Pages/Become-a-Member.aspx, 2021.
- ⁶¹ Pennsylvania Department of Agriculture. Dairy sense: Precision feeding's positive environmental impact. <https://extension.psu.edu/dairy-sense-precision-feedings-positive-environmental-impact>, 2020.
- ⁶² United States Department of Agriculture National Agricultural Statistics Service. Data and statistics. https://www.nass.usda.gov/Data_and_Statistics/index.php, 2021.
- ⁶³ Delmarva Chicken Association. Delmarva chicken production facts 1957-2020. <https://www.dcachicken.com/facts/docs/Delmarva>, 2020.
- ⁶⁴ WATT PoultryUSA. Watt poultryusa 2021 top broiler company profiles. https://www.wattpoultryusa-digital.com/wattpoultryusa/march_2021/MobilePagedArticle.action?articleId=1668376#articleId1668376, 2021.
- ⁶⁵ Tyson. The formula to feed the future. Technical report, Tyson Sustainability Report, 2020.
- ⁶⁶ Tyson. 2019 sustainability report. Technical report, Tyson Sustainability Report, 2021.
- ⁶⁷ U.S. Poultry & Egg Association. The national poultry improvement plan. <http://www.poultryimprovement.org/statesContent.cfm>.
- ⁶⁸ U.S. Poultry & Egg Association. Broiler slaughter plants for export. <https://www.poultryimprovement.org/documents/BroilerSlaughterPlantsforExport.pdf>, 2021.
- ⁶⁹ Perdue AgriBusiness. Locations. <https://www.perdueagribusiness.com/locations/>, 2021.
- ⁷⁰ Perdue. Fy21 company stewardship report. Technical report, Perdue Sustainability Report, 2021.
- ⁷¹ Mountaire Farms. Live production. <https://mountaire.com/animal-care-and-nutrition/live-production/>, 2020.
- ⁷² Mountaire Farms. Feed mills & grain. <https://mountaire.com/animal-care-and-nutrition/feed-mills-grain/>, 2020.

- ⁷³ George's inc. <https://www.wattagnet.com/directories/80-the-world-s-leading-broiler-turkey-and-egg-producers/listing/9564-george-s-inc>, 2020.
- ⁷⁴ George's Inc. Our company. <https://www.georgesinc.com/our-company/>, 2021.
- ⁷⁵ George's Inc. George's corporate responsibility report. Technical report, George's Responsibility Report, 2019.
- ⁷⁶ Amick farms llc. <https://www.wattagnet.com/directories/80-the-world-s-leading-broiler-turkey-and-egg-producers/listing/35464-amick-farms-llc>, 2020.
- ⁷⁷ Amick Farms. Company website. <https://www.amickfarms.com/>, 2021.
- ⁷⁸ Farmers pride inc. <https://www.wattagnet.com/directories/80-the-world-s-leading-broiler-turkey-and-egg-producers/listing/9560-farmers-pride-inc>, 2020.
- ⁷⁹ Bell&Evans. New construction. <https://www.bellandevans.com/our-story/new-construction/>.
- ⁸⁰ Philip Gruber. Growth continues at bell & evans. https://www.lancasterfarming.com/farming/poultry/growth-continues-at-bell-evans/article_f6abcd9a-2bc0-11e9-a693-37e603ff9447.html, 2019.
- ⁸¹ Scott Sechler. Signing the high performance farms initiative at the 103rd pennsylvania farm show. <https://www.bellandevans.com/healthy-living/signing-the-high-performance-farms-initiative-at-the-103rd-pennsylvania-farm-show/>.
- ⁸² Allen Harim. Company website. <https://allenharimllc.com/>, 2018.
- ⁸³ Farmer Focus. Our values. <https://www.farmerfocus.com/our-values>.
- ⁸⁴ Rural Advancement Foundation International-USA. Big chicken companies own or control everything except the farm, but why? <https://www.rafiusa.org/blog/big-chicken-companies-own-and-control-everything-except-the-farm-why/>, 2021.
- ⁸⁵ Chicken Check In. Contract chicken growers: What is a contract grower? how and why do farmers and chicken companies partner to raise chickens? <https://www.chickencheck.in/faq/chicken-contract-growers/>.
- ⁸⁶ Estimation QS. Cost of building a commercial layer chicken house for 20,000 chickens & step-by-step construction method | how to build it. <https://estimationqs.com/cost-of-building-a-chicken-house-for-20000-layers/>.
- ⁸⁷ Mariah Lamm Tom Pelton and Abel Russ. Poultry industry pollution in the chesapeake region. Technical report, Environmental Integrity Project,

- 2020.
- ⁸⁸ Rishi Prasad and Kent Stanford. Nutrient content and composition of poultry litter. Technical report, Alabama Cooperative Extension System, 2019.
- ⁸⁹ Chicken Check In. Sustainability. <https://www.chickencheck.in/sustainability/>.
- ⁹⁰ George Hochmuth et al. Using composted poultry manure (litter) in mulched vegetable production. Technical report, University of Florida, Institute of Food and Agricultural Sciences, 2021.
- ⁹¹ R. A. Bucklin et al. Storage of broiler litter. Technical report, University of Florida, Institute of Food and Agricultural Sciences, 2018.
- ⁹² R. A. Bucklin et al. Guidance for federal land management in the chesapeake bay watershed. Technical Report EPA841-R-10-002, United States Environmental Protection Agency, May 2018.
- ⁹³ Melissa N. Poulsen et al. High-density poultry operations and community-acquired pneumonia in pennsylvania. *Environmental Epidemiology*, 2(2), 2018.
- ⁹⁴ Mariah Lamm. Poultry and manure production on virginia's eastern shore. Technical report, Environmental Integrity Project, 2020.
- ⁹⁵ Dwight Dotterer. The agriculture phosphorus initiative. <https://mda.maryland.gov/pages/pmt.aspx>.
- ⁹⁶ Chesapeake Bay Foundation. Phosphorus management. <https://www.cbf.org/about-cbf/locations/maryland/issues/phosphorus-management-tool.html>.
- ⁹⁷ Seth Mullins. Personal Communication, June 29, 2021.
- ⁹⁸ Chris Brosch. Personal Communication, June 30, 2021.
- ⁹⁹ John Dawes. Personal Communication, July 9, 2021.
- ¹⁰⁰ Delmarva Chicken Association. Vegetative environmental buffers. <https://www.dcachicken.com/VEB/>.
- ¹⁰¹ Mauricio Rosales. Personal Communication, July 7, 2021.
- ¹⁰² Mike Levengood. Personal Communication, July 7, 2021.
- ¹⁰³ Vinnie Bevivino. Personal Communication, July 12, 2021.
- ¹⁰⁴ Jim Passwaters. Personal Communication, July 12, 2021.
- ¹⁰⁵ datex. How the grocery supply chain works. <https://www.datexcorp.com/how-the-grocery-supply-chain-works/>, 2021.
- ¹⁰⁶ Jill Moorhead. How your groceries get to the store: The logistics of supermarkets. <https://www.thekitchn.com/how-your-groceries-get-to-the->

- store-the-logistics-of-supermarkets-the-grocery-insider-217676, 2015.
- ¹⁰⁷ Macrotrends. Weis markets revenue 2006-2021 wmk.
[https://www.macrotrends.net/stocks/charts/WMK/weis-markets/revenue, 2021.](https://www.macrotrends.net/stocks/charts/WMK/weis-markets/revenue,2021)
- ¹⁰⁸ ScrapeHero. Number of weis markets locations in the united states.
[https://www.scrapehero.com/location-reports/Weis, 2021.](https://www.scrapehero.com/location-reports/Weis,2021)
- ¹⁰⁹ Weis. Sustainability report 2020. Technical report, Weis Sustainability Report, 2020.
- ¹¹⁰ Weis. Meet your local farmers! [https://www.weismarkets.com/local, 2021.](https://www.weismarkets.com/local,2021)
- ¹¹¹ Publix. Publix reports fourth quarter and annual results for 2020.
[http://corporate.publix.com/about-publix/newsroom/news-releases/publix-reports-fourth-quarter-and-annual-results-for-2020, 2021.](http://corporate.publix.com/about-publix/newsroom/news-releases/publix-reports-fourth-quarter-and-annual-results-for-2020,2021)
- ¹¹² Publix. Virginia. [https://www.publix.com/products-services/produce/grown-close-to-home/virginia, 2021.](https://www.publix.com/products-services/produce/grown-close-to-home/virginia,2021)
- ¹¹³ Publix. Sustainability. [https://sustainability.publix.com/storefront/, 2021.](https://sustainability.publix.com/storefront/,2021)
- ¹¹⁴ Dun&Bradstreet. Mom's organic market.
[https://www.dnb.com/business-directory/company-profiles.moms_organic_market_inc.4e9c5176deb72e05750298b16a653a01.html, 2021.](https://www.dnb.com/business-directory/company-profiles.moms_organic_market_inc.4e9c5176deb72e05750298b16a653a01.html,2021)
- ¹¹⁵ MOM's Organic Market. All locations.
[https://momsorganicmarket.com/all-locations/, 2021.](https://momsorganicmarket.com/all-locations/,2021)
- ¹¹⁶ MOM's Organic Market. Community supported agriculture.
[https://momsorganicmarket.com/csa/, 2021.](https://momsorganicmarket.com/csa/,2021)
- ¹¹⁷ Doug Ohlemeier. Organic & local fuel growth of mom's organic market.
[https://www.producebusiness.com/organic-local-fuel-growth-of-moms-organic-market/, 2021.](https://www.producebusiness.com/organic-local-fuel-growth-of-moms-organic-market/,2021)
- ¹¹⁸ Macrotrends. Walmart revenue 2006-2021 wmt.
[https://www.macrotrends.net/stocks/charts/WMT/walmart/revenue, 2021.](https://www.macrotrends.net/stocks/charts/WMT/walmart/revenue,2021)
- ¹¹⁹ Statista Research Department. Number of walmart sotres in the united states as of 2021, by state.
[https://www.statista.com/statistics/1167169/walmart-number-of-stores-by-state-us/, 2021.](https://www.statista.com/statistics/1167169/walmart-number-of-stores-by-state-us/,2021)
- ¹²⁰ Walmart. Walmart commits to america's farmers as produce aisles go local. [https://corporate.walmart.com/newsroom/2008/07/01/walmart-commits-to-americas-farmers-as-produce-aisles-go-local, 2021.](https://corporate.walmart.com/newsroom/2008/07/01/walmart-commits-to-americas-farmers-as-produce-aisles-go-local,2021)
- ¹²¹ Walmart. Project gigaton.
[https://www.walmartsustainabilityhub.com/climate/project-gigaton, 2021.](https://www.walmartsustainabilityhub.com/climate/project-gigaton,2021)
- ¹²² Daniela Coppola. Global net sales of whole foods market 2010-2017.

- <https://www.statista.com/statistics/258673/net-sales-of-whole-foods-market-worldwide/>, 2020.
- ¹²³ Allstays. Whole foods market locations. <https://www.allstays.com/c/whole-foods-locations.htm>, 2021.
- ¹²⁴ Whole Foods. We love local. <https://www.wholefoodsmarket.com/tips-and-ideas/archive/we-love-local>, 2013.
- ¹²⁵ Whole Foods. Our commitment to fighting food waste. <https://www.wholefoodsmarket.com/mission-in-action/environmental-stewardship/food-waste>, 2021.
- ¹²⁶ Best-Met Publishing Co. Giant extends lead; walmart, cvs gain sales in \$50b market. <https://www.foodtradenews.com/2020/06/23/giant-extends-lead-walmart-cvs-gain-sales-in-50b-market/>, 2020.
- ¹²⁷ Giant. All giant food locations. <https://stores.giantfood.com/index.html>, 2021.
- ¹²⁸ Giant. All giant food stores locations. <https://stores.giantfoodstores.com/>, 2021.
- ¹²⁹ EnsembleIQ. Giant co. launches sustainability rating system. <https://progressivegrocer.com/giant-co-launches-sustainability-rating-system>, 2021.
- ¹³⁰ Forbes. Safeway. <https://www.forbes.com/companies/safeway/?sh=1f2d89de6d15>, 2021.
- ¹³¹ Safeway. All safeway locations. <https://local.safeway.com/safeway.html>, 2021.
- ¹³² The Sustainability Consortium. Safeway becomes first grocer to be founding member of the sustainability consortium. <https://www.sustainabilityconsortium.org/2010/03/safeway-becomes-first-grocer-to-be-founding-member-of-the-sustainability-consortium/>, 2021.
- ¹³³ Safeway. Environmental initiatives at safeway. <https://www.safeway.ca/about-us/sustainability/environmental-initiatives/>, 2021.
- ¹³⁴ Inc. Wakefern Food Corp. Company website. <https://shop.shoprite.com/globaldata/banner-pages/store-locator>, 2021.
- ¹³⁵ Dun&Bradstreet. Food lion, llc. https://www.dnb.com/business-directory/company-profiles.food_lion_llc.d89e60dfed92e393cdccdd47a98f5091.html, 2021.
- ¹³⁶ Supermarket Page. Food lion- supermarkets.

- <http://supermarketpage.com/supermarkets/Food-Lion-23207.htm>, 2021.
- ¹³⁷ LLC Food Lion. Local goodness. <https://www.foodlion.com/in-our-community/local-goodness/>, 2021.
- ¹³⁸ Forbes. Wegmans food markets. <https://www.forbes.com/companies/wegmans-food-markets/?sh=2dbced35ff4e>, 2021.
- ¹³⁹ Wegmans Food Markets. Find a grocery store near you. <https://www.wegmans.com/stores/>, 2021.
- ¹⁴⁰ Wegmans Food Markets. Sustainability at wegmans. <https://www.wegmans.com/about-us/making-a-difference/sustainability-at-wegmans/>, 2021.
- ¹⁴¹ Owler. Shady maple. <https://www.owler.com/company/shady-maple>, 2021.
- ¹⁴² Shady Maple. The history of shady maple. <https://www.shady-maple.com/about-us/shady-maple-history>, 2021.
- ¹⁴³ Rob Guillemin. Op-ed: Can grocery stores teach farmers how to be more sustainable? <https://foodtank.com/news/2018/03/op-ed-rob-guillemin-food-retailers-develop-policies-sustainable-agriculture/>, 2021.
- ¹⁴⁴ CCOF Certification Services. Company website. <https://www.ccof.org/blog/update-whole-foods-market-responsibly-grown>, 2020.
- ¹⁴⁵ Adam Chandler. Is the new whole foods label better than 'organic'. <https://www.theatlantic.com/national/archive/2015/06/whole-foods-organic-responsibly-grown/395795/>, 2015.
- ¹⁴⁶ Ron Ruggless. Whole foods completes 'responsibly grown' rollout. <https://www.supermarketnews.com/produce-floral/whole-foods-completes-responsibly-grown-rollout-0>, 2016.
- ¹⁴⁷ Tannis Thorlakson et al. Improving environmental practices in agricultural supply chains: The role of company-led standards. *Global Environmental Change*, 48:32–42, 2018.
- ¹⁴⁸ Alliance for the Chesapeake Bay. Giant clean water partnership. <https://www.allianceforthebay.org/project/giantcleanwaterpartnership/>, 2021.
- ¹⁴⁹ Maryland & Virginia Milk Producers Cooperative Association. Sustainability. <https://mdvamilk.com/sustainability/>, 2021.
- ¹⁵⁰ General Mills Inc. General mills launches multi-year regenerative agriculture pilot with wheat growers in central kansas.

- <https://www.generalmills.com/en/News/NewsReleases/Library/2020/January/General-Mills-launches-multi-year-regenerative-agriculture-pilot>, 2020.
- ¹⁵¹ Ecosystem Services Market Consortium. Explaining “scope 1” carbon offset credits and “scope 3” supply chain reporting assets in esmc’s program. https://ecosystems-services-market.org/wp-content/uploads/2021/06/ESMC_Scope-1-v-Scope-3_June-2021.pdf, 2021.
- ¹⁵² Amanda Reed. Personal Communication, July 6, 2021.
- ¹⁵³ Great Lakes Restoration. About. <https://www.glri.us/about>, 2021.
- ¹⁵⁴ Great Lakes Restoration. Partners. <https://www.glri.us/partners>, 2021.
- ¹⁵⁵ Great Lakes Restoration. Great lakes restoration initiative action plan iii. <https://www.epa.gov/sites/production/files/2019-10/documents/glri-action-plan-3-201910-30pp.pdf>, 2019.
- ¹⁵⁶ Great Lakes Restoration. Great lakes restoration initiative report to congress and the president. <https://www.glri.us/sites/default/files/fy2015-glri-report-to-congress-20160616-37pp.pdf>, 2016.
- ¹⁵⁷ Elizabeth Gingerich. ‘eco-friendly’ marketing: Beyond the label. *Valparaiso University Journal of Applied Business and Economics*, 17(3):45–60, 2015.
- ¹⁵⁸ Food labeling pro’s and cons. <https://sites.udel.edu/understand-de-ag/2017/12/01/food-labeling-pros-and-cons/>, 2017.
- ¹⁵⁹ St. Mary’s Soil Conservation District. Farm stewardship certification and assessment program (fscap). <https://stmarysscd.com/farm-stewardship-certification-and-assessment-program-fscap/>, 2015.
- ¹⁶⁰ Maryland Association of Soil Conservation Districts (MASCD). Maryland farm stewardship certification and assessment program. <https://mascd.net/fscap/>.
- ¹⁶¹ Shoshanah Inwood et al. Health insurance and national farm policy. *Agricultural & Applied Economics Association*, 33(1):1–7, 2018.
- ¹⁶² Lisa Foust Prater. Farming without a net. <https://www.agriculture.com/family/health-safety/farming-without-a-net>, 2017.
- ¹⁶³ The Conversation. Family farms are struggling with two hidden challenges: health insurance and child care. <https://theconversation.com/family-farms-are-struggling-with-two-hidden-challenges-health-insurance-and-child-care-159542>, 2021.
- ¹⁶⁴ Tyne Morgan. Left behind: A political battle for affordable healthcare for farmers. <https://www.drovers.com/news/business/health/left-behind->

- political-battle-affordable-healthcare-farmers, 2020.
- ¹⁶⁵ Health Care Without Harm. Community health risks of industrial agriculture.
<https://foodcommunitybenefit.noharm.org/resources/community-health-needs-assessment/community-health-risks-industrial-agriculture>, 2018.
- ¹⁶⁶ Julia James. Nonprofit hospitals' community benefit requirements.
<https://www.healthaffairs.org/doi/10.1377/hpb20160225.954803/full/>, 2016.
- ¹⁶⁷ Health Care Without Harm. Healthy food and communities.
<https://noharm-uscanada.org/ResilientCommunities>, 2021.
- ¹⁶⁸ Health Care Without Harm. About us.
<https://noharm-uscanada.org/content/us-canada/about-us>, 2021.
- ¹⁶⁹ Health Care Without Harm. Case studies.
<https://foodcommunitybenefit.noharm.org/case-studies>, 2018.
- ¹⁷⁰ Health Care Without Harm. Delivering community benefit: Healthy food playbook. <https://foodcommunitybenefit.noharm.org/>, 2018.
- ¹⁷¹ Health Care Without Harm. Connecting farm viability and community vitality. <https://foodcommunitybenefit.noharm.org/case-studies>, 2018.
- ¹⁷² Practice Greenhealth. Homepage. <https://practicegreenhealth.org/>, 2021.
- ¹⁷³ Practice Greenhealth. Sustainable procurement guide.
<https://practicegreenhealth.org/sustainableprocurementguide>, 2018.