DIVERSIFYING THE AGRICULTURAL BASKET

RISKS IN CONVENTIONAL POULTRY GROWING ON MARYLAND'S EASTERN SHORE AND OPPORTUNITIES FROM DIVERSIFIED LOCAL AGRICULTURE

A report by Aiden Irish
ACKNOWLEDGMENTS

Insight and numerous thoughtful comments for this report were provided by the following individuals: Betsy Nicholas, Mitchelle Stephenson, Shelby Kalm, and Dan Furmansky of Fair Farms; Evan Isaacson of the Center for Progressive Reform; Abel Russ of the Environmental Integrity Project; Kathy Phillips from Assateague Coastal Trust; and Tarah Heinzen of Food and Water Watch. Additionally, Carole Morison and Lisa Inzerillo provided input on local, diversified farming practices that keep this report grounded in the needs and experiences of Maryland farmers; Weathervane Graphics for illustrations and design assistance.

ABOUT THE AUTHOR

Aiden Irish is an agriculture and local food systems policy analyst for Fair Farms Maryland and a Ph.D. student in the John Glenn College of Public Affairs at The Ohio State University in Columbus, Ohio.

Suggested Citation:


Cover photo: “Hen Eggs Four” by Thierry Vialard.
INTRODUCTION

Perhaps nowhere is the phrase, “don’t put all of your eggs in one basket” more appropriate than in reference to the U.S. poultry industry. From business and financial investment to healthy ecological systems, diversification is the most common attribute of healthy and resilient systems. Despite the tried and tested wisdom of diversification, the U.S. poultry industry – and much of U.S. agriculture as a whole – has ignored the long-term effects of homogenous systems in pursuit of mass production and higher company profits. However, this narrow pursuit has come at the expense of farmers and rural communities.

Communities that have invested heavily in poultry production find themselves strapped to a precarious product market that is compromising the health of the environment and communities around it in exchange for little to no financial security for farmers. In its current structure, if the poultry industry experiences a sudden shock, growers and their communities will suffer from the financial strain — or taxpayers will be forced to bail them out.

Agricultural markets and policies only perpetuate this rigged system. Production oriented crop subsidies and market influence of agribusiness have tipped the scales against the interests of farmers, the quintessential example of small business innovation in the United States, while undermining the long-term sustainability of rural communities. Despite these forces, the tide is beginning to turn. Shifting consumer preferences and agricultural practices offer economically viable, socially just, and environmentally sustainable alternatives to a rigged agricultural market.

A growing body of research and practice point to diversified, sustainable farming practices as economically profitable and environmentally preferable to current industrial methods. Simultaneously, market analysis points to local and direct-to-consumer food markets as critical frameworks for constructing equitable and sustainable food systems. Together, these shifts offer financially lucrative, ecologically sound, and economically just alternatives to agribusiness controlled markets.
The following paper reviews recent research on sustainable and local agriculture, focusing on Maryland's Eastern Shore, one of the top broiler producing regions in the United States. This analysis finds that the evidence against conventional poultry production and the support for local agriculture markets and sustainable farming practices as an alternative is growing among farmers, researchers, and food consumers. Capitalizing on this movement is essential to developing a more secure, sustainable, and equitable agricultural system for farmers, rural communities, and consumers.

**HOW WE GOT HERE: POULTRY INDUSTRY GROWTH AND STRUCTURE**

As late as the 1950s, farm production of broilers and other meat products was supplemental to row cropping on farms, with the average broiler producing farm selling fewer than 350 chickens in a year. Over the past 65 years, however, gross broiler production in the United States has increased 14-fold, totaling 8.5 billion in 2012. Simultaneously, broiler growing has become an industrialized process for specialized operations. This enormous growth in production was made possible, in part, by changes in the rest of the agriculture system, including production subsidies for commodity crops. Staple poultry feed ingredients such as corn and soybeans were made cheap and easily available, helping to catalyze dedicated broiler growing operations. Today, 99.99 percent of broilers produced in the U.S. come from 32 states, from a total of 15,830 growing operations, each of which sells an average of 535,000 broilers each year.

Cheap feed crops, though, were only one part of the equation. Out of evolving broiler production have emerged a handful of companies that specialize in managing the growing process from the milling of feed and breeding of chicks through to processing and distribution of the final ready-to-cook product. This process of vertical integration allows the companies – termed “integrators” – to capitalize on economies of scale and coordination that have driven production increases. Integration has yielded enormous profits for this handful of companies. In 2015, forty-five percent of ready-to-cook chicken was sold by only three companies – Tyson Foods, Pilgrim’s Corporation, and Sanderson Farms – each with annual revenues ranging from nearly $3 billion (Sanderson) to $41 billion (Tyson). These profits, however, are facilitated by significant externalized costs.

Broiler production is made possible by three factors; externalization of waste disposal costs, genetic homogenization and concentration, and process monopolization. Each of these areas produces risks...
that undermine the sustained security of the surrounding industry and communities, economies, and ecological environments. Regional concentration of production and waste harms the health of aquatic environments; genetic homogenization, combined with high production density, contributes to the overuse of antibiotics and facilitates the transmission of disease to birds and people; and finally, process monopolization and regional concentration produces vulnerable local economies burdened by high capital costs and uncertain returns on investment. Each of these areas will be discussed in depth in the following sections.

Developments in the broiler industry have brought agricultural communities to a critical inflection point. To this point in time, decisions that have shaped the agricultural system have benefited the profits of agribusiness, ignoring the harms done to the general public and the environment while undermining the financial security of many farmers. The following report explores the research that illuminates the externalized costs associated with industrial broiler production and potential alternatives that offer the opportunity to reduce or eliminate current risks.

Many of these methods and market structures for local, sustainable food systems reduce farm reliance on external inputs and shorten the product path from producers to consumers. Such features benefit farmers and their communities largely by reducing the need for agribusiness and food companies that currently wield significant market control.

A zero-sum relationship between the financial and ecological sustainability of farmers vs. the bottom-line profits of corporate agribusiness points to a fundamental ethical question about the U.S. food and agricultural system: Who should benefit from agriculture?
Poultry Waste Concentration

One side effect of vertical integration in broiler production is regional concentration. Poultry processors, known as “integrators,” manage production throughout the process. As a result, these corporations are incentivized to reduce the distance between feed mills, growers, and slaughterhouses in order to minimize transportation costs. This process of grouping facilities in close proximity to each other creates high density broiler regions, as seen in Figure 1. This practice also concentrates poultry waste, known as “litter,” at levels that cannot be appropriately integrated into the local environment.

Broilers produce approximately 1.25 tons of nutrient dense litter per 1,000 chickens. When this waste is added to crops in

1.25 TONS of manure are produced for every 1,000 chickens raised

Figure 1: Broiler Producing Regions Nationally

Source: USDA Census of Agriculture, 2012
limited amounts, it can be useful as a fertilizer. However, regional concentration of litter, combined with excessive application on agricultural fields and poor storage management, renders it an environmental hazard (Chastain, Camberato, & Skewes, 2003, p. 1; Gerber et al., 2007; Maheshwari, 2013). Erosion of litter-laden soils and nutrient groundwater infiltration contributes to algal blooms and aquatic “dead zones,” resulting from the decomposition of large amounts of algae by microbes that deplete dissolved oxygen levels in waterways. Low dissolved oxygen kills living organisms and critical aquatic habitats. Additionally, algal blooms reduce water clarity and block sunlight, further harming plants and habitats.

If integrators were legally responsible for the responsible utilization of poultry litter and held financially responsible for pollution linked to excess poultry litter — that which cannot be absorbed by cropland — companies would undoubtedly reevaluate a business model that relies on excessive regional concentration of poultry production at the expense of the local environment. However, despite owning both the birds and the feed, poultry litter is externalized by leaving it in the responsibility of the grower. Integrators justify this action by asserting that litter is a valuable resource for growers who can sell it. However, litter prices vary significantly depending on the local supply (MacDonald, 2014, p. 23). When the costs associated with transporting litter long-distances out of high density regions exceed its value, litter becomes a costly liability for growers rather than a valuable resource. In addition, states don’t do a good job of tracking litter outputs.

In order to avoid pollution concentration, governments step in to assist with disposal. In Maryland, the State’s Department of Agriculture subsidizes the transportation of litter. While necessary as a means of reducing pollution concentrations, this program permits broiler integrators to continue to externalize much of the waste disposal cost associated with production. Such subsidies remove economic incentives for integrators to reform the practices that contribute to broiler litter pollution and rather places the burden on both growers and tax payers.

Long-term solutions to waste concentration must seek to not only manage the disposal of industrial poultry waste, but to aid farmers in the adoption and utilization of sustainable practices that minimize waste concentration in the first place. Support for these practices
can come in the form of both financial and educational assistance for best practices, and development of markets and infrastructure that supports the sale of goods from sustainable farms.

WASTE CONCENTRATION AND CHESAPEAKE BAY POLLUTION

In the Chesapeake Bay region, broilers are concentrated on the Eastern Shore, averaging over 325 chickens for every acre of agricultural land, according to 2012 USDA agriculture census data. Even with assistance from the Maryland Manure Transport Program, nutrient runoff in the region is also high. Ninety percent of nitrogen and phosphorous inputs on the Eastern Shore and 66 percent of the resulting nitrogen runoff and 84 percent of phosphorus runoff comes from agriculture, according to the State of Maryland’s “Baystat” pollution monitor.

Analysis by the U.S. Geological Survey (USGS) finds that the Maryland Eastern Shore receives nearly twice as much nitrogen and phosphorous per acre as the rest of the Chesapeake Bay watershed and contributes to 50 percent more nutrient pollution per acre (Ator & Denver, 2015, 9). Notably, increases in broiler production over the past 65 years correlate with increases in nutrient runoff (Ator & Denver, 2015, 4).

Nutrient pollution from the Eastern Shore is also facilitated by its sandy soil composition (Ator & Denver, 2015, 18) and limited permanent vegetative cover (Rogers & McCarty, 2000, 236).

These factors reduce the ability of the environment to absorb large applications of nutrients. Analysis by the USGS indicates that a 13 percent reduction in nitrogen loads to groundwater is needed simply to maintain 2012 levels of dissolved nitrogen pollution and greater than a 40 percent reduction in nitrogen runoff is needed to reduce nitrogen loads to the annual maximum proposed by the U.S. Environmental Protection Agency (EPA) of approximately five thousand metric tons per year (Ator & Denver, 2015, 8). Failure to pursue these goals of pollution reduction poses a threat to adjacent industries in the region. Continued high levels of pollution contribute to declining fish and shellfish populations, both of which are essential to the local economy.
The process begins with taxpayer subsidies for commodity crop production and hatcheries that rely on heavy concentrations of antibiotics.

Integrators control food, chickens, medications, and all other growing methods.

Contracts with growers give integrators ultimate control over practices and price.

The inputs are handled by the integrators, but the outputs (manure and dead birds) are left for the grower.

The manure is used as cropland fertilizer or flows into the Bay as runoff or through groundwater.

Runoff to the Chesapeake Bay
Commercial and Recreational Fishing: The commercial and recreational fishing industry is central to the economies around the Chesapeake Bay, contributing $3.4 billion in sales, $890 million in income, and 34,000 jobs (Chesapeake Bay Foundation, 2012, 5). A principal catch in this industry is the blue crab, which constituted over one-fifth of commercial fisheries revenue for the entire Mid-Atlantic region in 2012, second only to sea scallops (NOAA, 2012, 73).

A study published in the Journal Science in 2008 estimated that dead zones, caused by nutrient runoff, kill or prevent the growth of 75,000 metric tons of clams and worms every year in the Chesapeake Bay, which are important food sources for blue crabs. This is the amount of food needed to feed 60 million crabs, or approximately half of the commercial harvest (Diaz & Rosenberg, 2008). Dead zones also kill crabs directly by asphyxiation, contributing to a 65 percent decline in the number of legal-sized crabs (measuring five inches or more across) between 1968 and 2002 (Chesapeake Bay Foundation, 2008, 8). Maintaining the sustainability of the fishing industry necessitates significant reductions in nutrient runoff, which disproportionately originates from poultry production on the Maryland Eastern Shore.

Potential Impact of Climate Change: Broiler industry pollution and threats to the stability of the Eastern Shore are also expected to worsen as a result of climate change. Already, the Mid-Atlantic region is experiencing a greater increase in severe rainfall events...
than anywhere else in the United States (Horton et al., 2014, 380). The amount of rain and frequency of severe storms are likely to continue to increase (Horton et al., 2014; Ning et al., 2012). Such storm events exacerbate nutrient pollution from chicken litter spread on fields by washing more excess nutrients in waterways. The current high levels of nutrient pollution and the potential for increased pollution as a result of climate change represents the most significant human-made ecological threat to the Chesapeake Bay (Rogers & McCarty, 2000, 238). Moreover, climate change threatens Maryland and the stability of the poultry industry in a variety of other ways.

In the Mid-Atlantic region, the effects of climate change will range from increases in extreme heat events to increased occurrences of storms (Prasad, 2012; Knox et al., 2014). An independent assessment of the need for a commercial poultry insurance system indicates that the most likely direct impacts on the poultry industry from climate change will be increased expenditures for heating and cooling of poultry barns and a greater likelihood of extreme weather events, such as hurricanes and snow storms, that could damage infrastructure (Watts and Associates, Inc., 2015, 81). Expenses from both of these factors will be borne to a great extent by contract growers rather than integrators, exacerbating growers’ precarious financial security.
Sea level rise resulting from climate change also poses a risk to the viability of the agricultural system supporting the broiler industry. Globally, average sea levels are expected to rise between 1.7 and 4.6 feet by the end of the century (Boesch et al., 2013, 15). However, sea level in Maryland are rising at twice the rate of the global average (DeJong et al., 2015, 4) and are expected to rise between 2.1 and 5.7 feet along the Maryland coast by 2100 (Boesch et al., 2013, 15). Increases in sea level are also exacerbated by storm surges that are likely to increasingly severe.

Rising seas are particularly critical for the Maryland Eastern Shore – and all of the Delmarva Peninsula – where the highest point of elevation is 400 feet above sea level and much of the region exists at or below 35 feet above current sea levels. Rising relative sea levels and increased risk of severe storm events threaten fresh groundwater resources with salinization resulting from infiltrating sea water. Research in the Hobcaw Forest in South Carolina two years following the severe 9.8-foot storm surge produced by Hurricane Hugo in 1989 found that 66 percent of trees in the study area died, even though wind damage had been minimal. Similarly, high rates of tree mortality were also found on the Delmarva Peninsula following Hurricane Sandy (Middleton, 2016, 63). Moreover, increasing frequency of intrusion events reduces the ability of ecosystems to recover after such saltwater intrusions (Middleton, 2016, 68). Similar damage to corn and soybean production from depleted fresh water in the region would likely have deleterious effects on the broiler industry, negatively impacting its long-term stability.

ADVANTAGES OF SUSTAINABLE FARMING PRACTICES

Growing research and practice indicates that agricultural practices that minimize soil disturbance, maintain continuous soil cover, and cultivate diverse species of plants and animals (practices that, together, are referred to as “sustainable agriculture”) offer not only myriad ecological benefits, but are equally productive and more profitable per acre than conventional industrial methods (Kassam & Brammer, 2013). The following discussion reviews the literature on the notable ecological and economic advantages of diversified and sustainable agricultural practices. Because such practices, by definition, require diversified production in order to avoid depleting soil resources and excessively concentrating waste, this section focuses on agriculture as a whole, rather than focusing narrowly on poultry production.
Some of the earliest literature on the benefits of sustainable agriculture comes from the English botanist, Sir Albert Howard, and his observations of traditional farming methods in Asia and indigenous communities around the world. While Sir Howard has been credited with introducing what are now termed ‘organic’ and ‘biodynamic’ farming to the industrialized world, those practices are the product of generations of development and stewardship among a wide array of indigenous communities. Early on, Sir Howard noted the similarities between diverse natural ecosystems and successful sustainable agriculture. Though industrial agriculture practices based on mono-crop production and large external inputs of fertilizer, chemicals, and machinery dominated during Sir Howard’s life and into the present, his observations formed the foundation of contemporary research on sustainable agriculture.

Sir Howard’s work has been further supported by ongoing empirical analysis, including work by several U.S. sustainable agriculture research stations, including the Kellogg Biological Station (KBS), associated with Michigan State University, and the Rodale Institute Experimental Farm, an independent research center in Pennsylvania, as well as by the Sustainable Agriculture Research and Education (SARE) program of the USDA. Empirical assessments of a variety of sustainable practices indicate that such practices are not only ecologically beneficial, but productive and more profitable for farmers.

**Soil Health:** Among the advantages of sustainable agriculture is its beneficial effect on the environment. One such advantage for the Maryland Eastern Shore is the reduction of nutrient runoff. Research at KBS finds that sustainable no-till practices contributed to reduced nitrate erosion by a factor of up to three compared to conventional practices (Robertson et al, 2014, 5). Independent studies of erosion rates indicate that conventional plowing produces rates between one and two orders of magnitude greater than no-till agriculture or native vegetation. No-till or reduced tilling methods offer promising alternatives to conventional agriculture methods that maintain high yields while reducing erosion and improving profitability (Montgomery, 2007; Mirsky et al., 2012). Most importantly, minimized erosion maintains the long-term sustainability of farming in a region that ultimately relies on the continued health of the soil.

**Climate Change:** Sustainable agriculture practices also sequester greenhouse gases (GHGs) that contribute to climate change. Currently, the global food system constitutes approximately 30
The precise makeup of products and practices on a farm will necessarily vary by farm size, location, and farmer preference. The following provides an initial list of notable organizations that provide a wide array of resources for farmers for alternative and sustainable agriculture.

- USDA Alternative Farming Systems Information Center: The Alternative Farming Systems Information Center provides a starting place for learning about region appropriate alternative agricultural practices.
- Rural Advancement Foundation International (RAFI): RAFI provides numerous resources for farmers, activists, and policy makers on sustainable agriculture and supportive policies and markets.
- Sustainable Agriculture Research and Education (SARE): SARE is a research support program of the USDA that provides grant funding and publicizes the findings of empirical research and farm trial research on sustainable agriculture methods.
- Center for Rural Affairs (CRA): CRA is a policy development and advocacy organization for sustainable rural development. It provides resources for rural businesses and market and policy formation.
- National Sustainable Agriculture Coalition (NSAC): NSAC is a leading policy advocacy organization for sustainable agricultural practices and provides useful guides and resources for policy makers, advocates, and farmers on national policy.
- The Rodale Institute: The Rodale Institute is the longest running side-by-side study of conventional and sustainable agricultural practices. Researchers at the Rodale Institute provide empirical analysis of sustainable practices as well as online and in-person curriculum and trainings for farmers on sustainable farming.
SUCCESSFUL TRANSITION OUT OF CONTRACT GROWING: 
THE EXPERIENCE OF BIRD’S EYE VIEW FARM, WORCESTER CO., MARYLAND

Carole and Frank Morison grew broilers under contract for Perdue for 23 years before shifting to selling eggs in 2011. Now they maintain a flock of approximately 600 Rhode Island Red, Barred Rock, and Delaware laying hens, producing over 270 dozen eggs per week. Purchased from a breeder in New Mexico, these are hardy heritage* breeds requiring little support in order to resist diseases or cope with seasonal temperature fluctuations. The flock is rotated across five acres of pasture during the daytime and the existing broiler barns provide laying roosts and protection from predators.

This rotational grazing practice maintains healthy pastureland and minimizes waste concentration, which had previously been a management nightmare with the much higher density broiler growing operation. Most of the resulting egg production is purchased by Whole Foods Market in Annapolis, Maryland, aside from a small number of sales directly to local consumers. Additionally, Bird’s Eye View eggs garner a premium from being Animal Welfare Approved (AWA), a third-party certification considered by experts to be the highest animal welfare and environmental standards for meat and dairy products.

The financial viability of this operational model was corroborated by a formal business analysis, conducted with assistance from a USDA Value Added Producer Grant. The resulting study revealed that the farm could generate a consistent profit with a flock size as few as 500 to as many as 5,000 birds, a stark contrast to the high cost, high debt, and unpredictable income of contract broiler growing that often requires outside income!

Perhaps the most striking advantage of this business model is its limited capital intensity. Much of the existing broiler infrastructure was repurposed with only minor adjustments for layers and operational costs are drastically lower. Fuel expenses for the laying hens is a small fraction of what was required to maintain Perdue-mandated growing conditions and the heritage breeds require little to no medication or support to achieve “near zero” mortality rates. One of the few significant operational expenses is the purchase of new chicks to replace aging birds and supplemental feed, which is purchased from the nearest bulk independent supplier in Pennsylvania.

*Heritage breed chickens are a return to a slower-growing bird that mates naturally and has a long productive life, suited for the outdoors.
percent of all GHG emissions (Sims, 2011, iii) and reducing this contribution is central to tackling global climate change goals adopted in Paris in 2015. Towards this end, sustainable agriculture has been shown to sequester GHGs, improving soil fertility in the process (Robertson et al, 2014, 6; Mirsky et al., 2012, 37).

Key to such practices is incorporating animals into cropping systems. Research by the Rodale Institute indicates that rotational use of livestock and other animals in combination with row crops is essential to farm system health and productivity. With respect to poultry, a variety of production practices – including free-range, pastured, and semi-intensive production – offer methods for profitably incorporating poultry production into sustainable crop agriculture (Fanatico, 1998). The business viability of such methods is born out by the experience of farmers such as Carole Morison on Maryland’s Eastern Shore (see insert on page 9).

**Farm Profits:** Of paramount importance to farmers is an assurance that sustainable practices are equally productive and profitable -- if not more profitable -- per acre of land than conventional methods.

A 30-year review of data by the Rodale Institute finds that sustainable agriculture methods are equal to or more productive per acre than conventional methods and outperformed conventional methods during drought years (Rodale Institute, 2011). Furthermore, such methods are more fuel efficient than conventional methods, consuming 45 percent less energy (Rodale Institute, 2011). This reduced reliance on fossil fuel energy is important for farmers.
Diversifying the Agricultural Basket

and the food economy. A United Nations Food and Agriculture Organization (UNFAO) report points out that decoupling food production from fossil fuel energy is essential to avoiding future agriculture production price spikes and harming already narrow farming profit margins. This will become increasingly important if energy prices continue rising in the future (Sims, 2011, iv). All of these factors translate into higher and more reliable net per-acre profits for farmers utilizing sustainable methods.

Long-term analysis by the Rodale Institute finds that sustainable practices offer financial returns nearly three times that of conventional methods: yielding annual per acre profits of $558 compared to $190 for conventional practices. This is due both to reduced demand for costly inputs and higher prices for sustainably produced products (Rodale Institute, 2011). Importantly, lower operational costs and higher profit margins are essential factors in increased farm survival rates. USDA analysis finds that farms with lower machinery costs and lower land values per dollar of sales have survival rates over six percent higher than farms with higher capital costs (Low et al., 2015, 12-13). The experience of Maryland farmers corroborates this analysis.

Since transitioning to a smaller, free-range layer operation, Carole Morison’s farm has generated a more consistent profit without the unpredictability associated with broiler growing contracts. Furthermore, her operation requires fewer capital investments and is less expensive to operate, decreasing the financial risk of the operation (see text insert on page 9).

These attributes of sustainable agriculture practices point to its viability as both an efficient means of production and a method of reducing pollution. In the short-term, regulation should seek to carefully manage poultry litter in order to minimize pollution.

Long-term solutions must seek to not only responsibly manage poultry litter, but to aid farmers in the adoption and utilization of sustainable practices. Support for these practices can come in the form of both financial and educational assistance on best practices, and development of markets and infrastructure that facilitate the sale of diverse goods.
HOMOGENIZATION RISKS AND BENEFITS OF AGROBIODIVERSITY

In addition to farm-level and regional concentration, production efficiency in the broiler industry has been made possible by breeding chickens that grow faster, require less feed, and produce more meat per bird. Between 1925 and 2010, the average weight of broiler chickens has increased 128 percent, the number of days to market has decreased by 59 percent, and the amount of feed required per pound of bird has decreased 60 percent (Pew Charitable Trust, 2015, 3). Unfortunately, this efficiency comes with a significant cost.

Unlike genetically diverse chicken breeds, commercial broilers are highly inbred. One analysis of genetic diversity in the poultry industry indicates that commercial chicken breeds are 60 percent less genetically diverse than their ancestral breeds (Muir et al., 2008). This deficit has practical implications for the resilience of poultry flocks. Genetic diversity is an essential asset of organism populations in resisting widespread disease outbreaks. Genetic similarity of commercial chickens makes them less likely to be able to resist infection introduced to a flock, elevating the possibility of widespread infection. This environment carries consequences for the health of poultry flocks and people living or working in proximity to those flocks.

PUBLIC HEALTH RISKS FROM COMMERCIAL BROILERS

Limited genetic diversity is important because of high population density in commercial flocks, which are often as high as 60,000 birds per barn. High density combined with high degrees of genetic similarity create environments conducive to infection that necessitate medical interventions to limit disease exposure.

**Overuse of Antibiotics:** The risk of infection requires strict flock isolation and frequent use of medication and antibiotics as prevention against disease (Dibner & Richards, 2005). The Center for Disease Control (CDC) estimates that the majority of antibiotics
Antibiotic resistance to drugs is not a new concern. Alexander Fleming, who first noted the effectiveness of penicillin on bacteria, also recognized the potential threat of resistance. The Center for Disease Control (CDC), the World Health Organization (WHO), and numerous doctors and medical experts have been warning the public and policy makers about the dangers of antibiotic resistance for years. That threat is approaching a critical threshold.

Most notable has been the discovery of a strain of E. Coli in a Pennsylvania woman in 2016 that is resistant to colistin, a particularly powerful antibiotic and last line of defense against infection. Researchers suggest that this finding “heralds the emergence of a truly pan-drug resistant bacteria” (McGann, et al., 2016). In other words, the medical community is rapidly approaching a point where a growing number of bacteria are able to resist all available antibiotic treatments. Yet, neither policy restrictions on the use of antibiotics nor development of new drugs has responded to the threat. Global use of antibiotics rose 36 percent between 2000 and 2010 (Van Boeckel, et al., 2015); in the U.S., antibiotics in meat producing animal feed rose 23 percent between 2009 and 2014 (FDA, 2015, 6); and in the first decade of the 2000s, only nine new antibiotics were developed, compared to 52 in the preceding two decades (Giorgi, April 2016). The implications of lackluster responses is visible in public health.

The dangers of drug resistance derive not from apocalyptic new pandemics, but in increasingly prevalent and untreatable everyday infections. The CDC estimates that, at a minimum, 23,000 people in the United States die directly from antibiotic resistant bacteria each year (CDC, 2013, 6). However, approximately two million people annually in the United States develop serious infections caused by resistant bacteria, such as sepsis, pneumonia, colitis, and diarrhea. According to a study by the CDC, cases of sepsis alone nearly doubled and sepsis deaths increased by 34 percent between 2000 and 2008. These increases are due in large part to the emergence of bacteria such as MRSA, a strain of Staphylococcus aureus that is resistant to methicillin, a drug historically used to treat such infections (The Grim Prospect, 2016, 19). As bacterial resistance becomes more prevalent, common infections will be increasingly life threatening health concerns.

Antibiotic resistance is made more threatening by a unique bacterial ability. These pathogens can transfer genetic information directly to adjacent bacteria by swapping strands of DNA. With this ability, bacteria are able to rapidly evolve drug resistance across entire microbial ecosystems, even across multiple bacterial species. This ability makes the emergence of drug resistance in one species a likely indicator of similar resistance in others. Thus, the appearance of a bacteria that is resistant to all available drugs is not simply a dangerous singular occurrence, but an indicator of impending future threats.
on the market today are used in farm animals in “micro doses” as prevention against infection and as a means of aiding growth (Aarestrup, 2015, 4). Such routine antibiotic treatments, however, undermine the long-term effectiveness of those drugs.

Medicinal treatments in commercial meat production serve as a short-term stopgap against infection, but with widespread consequences. Antibiotic micro-doses provide environments for microbes to adapt to antibiotics, contributing to the development of antibiotic resistant bacteria that pose greater health risks to humans. According to the Center for Disease Control (CDC), the medical community is “running out of drugs to treat serious infections” (CDC, 2013, 22). Nationwide, minimum CDC estimates suggest that nearly 23,000 people die annually from antibiotic resistant bacteria, two million contract serious antibiotic resistant infections such as sepsis, pneumonia, and diarrhea, and minimum estimates suggest that 60,000 people in the U.S. die as a result of such infections (CDC, 2013, 6).

Poultry integrator Perdue is transitioning away from routine antibiotic use in feed. Following public demand for a reduction in routine antibiotic use, Tyson Foods and Pilgrim’s Pride have promised reductions. One of the larger poultry integrators on the Eastern Shore, Mountaire, has made no public mention of transitioning away from current antibiotic regimens in feed.

Independent assessment of antibiotic use in overall meat production (including pork and beef) tells a different story.

Analysis by the Food and Drug Administration (FDA) indicates that the sale of medically important antibiotics has increased in recent years rather than decreased (FDA, 2015, 6). The use of medically important antibiotics in animal feed increased by 23 percent between 2009 and 2014 and three percent between 2013 and 2014 (FDA, 2015, 6). Continued use is facilitated by FDA guidelines on the use of antibiotics, which retain allowances for antibiotic use as security against potential infection as opposed to a treatment against actual infection. These allowances ultimately undermine many efforts to control antibiotic overuse. On top of the profligate use of antibiotics, concentrated animal operations, such as poultry, also serve as a means of transmission to humans.

**Disease Risk to Those in Proximity to Broilers:** Increasingly, infection research finds meat production to be a serious threat to public health. Analysis of antibiotic resistant bacteria “strongly suggested a spread of antibiotic-resistant E. coli from animals
Diversifying the Agricultural Basket

32x

Odds a poultry worker is a carrier of antibiotic-resistant E. coli compared to the general public

to people – not only to farmers but also at a lower level to the consumers of poultry meats” (Bogaard et al., 2001, 769).

However, this is part of growing scientific research concerned about the methods of commercial meat production. While consumers may be at risk of infection due to commercial poultry, even greater risk lies with farm operators and communities in proximity to production.

A study of Maryland poultry operators conducted by researchers at Johns Hopkins University found that “poultry workers had 32 times the odds of carrying [a specific antibiotic]-resistant E. coli compared with community referents” and “were also at significantly increased risk of carrying multidrug-resistant E. coli” (Price et al., 2007). The spread of such drug-resistant bacteria is facilitated through the spreading of manure.

These figures may change as poultry producers bow to consumer demands to limit routine antibiotic use.

Due to environmental transmission through soil and water, risk of exposure to pathogens – both antibiotic resistant and otherwise – is particularly elevated among communities in proximity to broiler operations. A 2013 study in Maryland found that rural communities are six times more likely to be infected by campylobacter – bacteria that causes gastroenteritis – than those in urban zip codes, and communities in zip codes with broiler chicken operations are 1.45 times more likely than other rural communities to be infected (Zappe Pasturel et al., 2013). Similar connections have been found between poultry operations and increased population contraction of H1N1, aka “Bird Flu” (Graham et al., 2008). These findings indicate that current poultry production methods expose the populations around them to greater risk of infection with deleterious societal health effects.

**PATHOGEN OUTBREAK RISKS FOR THE BROILER INDUSTRY**

The potential for disease outbreak among poultry flocks is a significant industry risk. The production efficiency of industrial broiler industry rests heavily on homogeneity and concentration, but these characteristics are also notable industry vulnerabilities. As Martin Weitzman (2000) describes in a paper on the economic effects of diversity:

> When humans artificially create or maintain genetically homogeneous host-crop target areas, they are also creating or maintaining breeding grounds with higher probabilities that potentially lethal pathogens will emerge, some of which, by the laws of chance, could wipe out the very monocultures that
spawned or supported them. Thus, there is an inescapable long-run trade-off between the gains of increased crop specialization and the increased risks of lethal infection (238).

The poultry industry epitomizes this tradeoff. Not only is it prone to disease vulnerability as a result of its structure, but it has contributed to the prevalence of antibiotic resistant bacteria that further amplifies both its own risk and that of human populations in proximity to broiler operations.

Genetic, biological, and ecosystem research has long recognized the importance of diversity in biological systems including in agriculture. As early as the 1950s, Sir Albert Howard (1956) noted that nature never farms in a monoculture and never without livestock. This remains a fundamental component of healthy farming systems (Notter, 1999).

The advantage of genetic variability comes from adaptability and resilience. In the face of infection by pathogens, greater genetic diversity of a biological population increases the likelihood that a number of individuals will be able to fight off the pathogen. Limited genetic variety, brought about by decades of inbreeding, exposes the industry to higher levels of risk in the face of infectious pathogens.

A 2015 study commissioned by the USDA asserts that, while the frequency of “disease perils” in the lifespan of the modern broiler industry is “rare,” past frequency of disease events may not be predictive of the future frequency” (Watts and Associates, Inc., 2015, 81). The literature on viral transmission supports this rather understated acknowledgement. Graham et al. (2008), analyzing data on the occurrence of H5N1 avian influenza outbreaks, note that genetically homogenous commercial poultry flocks are more likely than smaller, genetically diverse flocks to be infected. The researchers assert that such risks should be included as part of industry risk analysis.

Research on the transmission of pathogens to people in proximity to poultry operations also indicates that humans likely serve as infection vectors between flocks (Zappe Pasturel et al., 2013; Price et al., 2007; Graham et al., 2008). The potential for human transmission of pathogens negates, to a significant degree, the effectiveness of flock isolation as a means of disease prevention.
The accumulation of risk factors suggests that future risk of large-scale disease outbreaks among broiler flocks is likely increasing. This risk was recognized by Maryland’s Agriculture Secretary Joe Bartenfelder in an official statement:

[Highly pathogenic avian influenza (HPAI)] could very well bring economic disaster to our largest agricultural sector if we don’t take steps to protect the birds now. We have every reason to believe that HPAI will enter Maryland... I strongly encourage all flock owners and managers to take this disease as seriously as they have ever taken anything and to practice enhanced biosecurity at all times.

The Secretary’s statement is correct in its assertion of the risk that infection poses to Maryland agriculture. Biosecurity, however, is not a solution, but rather only a stopgap measure. The combination of population concentration, genetic homogeneity, and a growing understanding of the prevalence of pathogen transmission between humans and birds, manifests in a precarious industrial situation. Rectifying this vulnerability cannot be fully solved with medication and biosecurity. Fundamentally, ameliorating disease risks from the broiler industry necessitates reforming industry practices to support diverse flocks and farm production. A positive move in this direction is Perdue Farms’ decision to adopt more resilient, slower-growing poultry breeds as one of an array of new practices included in its animal welfare plan, which was announced in June 2016.

ADVANTAGES OF AGROBIODIVERSITY

The foundational means of ameliorating current biosecurity risks from poultry rest on diversity. Genetically and biologically diverse agricultural systems are more resilient, healthy, and socially beneficial production environments. This measure of agricultural diversity is called agrobiodiversity, defined by the United Nations Food and Agriculture Organization (UNFAO) as; “the variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries… It also includes the diversity of non-harvested species that support production” (FAO, 2000). Such diversity of species in agricultural systems is essential to, among many factors, protecting soil health, making farm systems more sustainable and secure, reducing the risk of infection and production collapse, improving human nutrition, and conserving ecosystems in proximity to farmland.

Notably for the broiler industry, diversification of poultry breeds provides a means of resilience against widespread infection. Martin
Weitzman (2000) describes the rationale for diversification:

My point of departure is the idea that humans may be so stuck in the trenches, battling pathogen foes every day, that we fail to stand back a sufficient distance to take full measure of the fundamental character of this long-running war against nature, in which we have been engaged, with accelerating intensity, since neolithic times… But is this strategy of putting out fires as they arise a good use of resources overall? Would it not be more prudent to invest, so to speak, in less-flammable biomass proportions right from the beginning (240)?

The full benefits of agrobiodiversity, however, are realized not only with diverse breeds of animals, but when animal and cropping systems are integrated. Research on agrobiodiversity indicates that it is essential for protecting ecological and social health as well as food security in local regions (Thrupp, 2000). Diversified farming practices have been shown to improve farm tolerance of drought, increase soil fertility, reduce dependence on external fertilizers, and control the prevalence and impact of pathogens and pests, while promoting beneficial species that provide pest control and pollinator services (Kremen & Miles, 2012).

In Maryland, Carole Morison (inset, page 16) noted a dramatic decline in flock mortality after switching from producing commercial chickens to growing heritage breeds, despite the elimination of antibiotics in feed. Lower mortality rates and the elimination of antibiotics also improved profits by reducing production losses and limiting expenditures on medical supplies. Finally, switching to genetically diverse heritage breeds reduced the prevalence of pathogens carried by both her and her birds.

**NEXT STEPS**

The public health implications of industrial broiler production are significant. In the near-term, policy must closely regulate the use of antibiotics in order to preserve the effectiveness of those drugs into the future. This, however, does not solve the root of the public health concerns created by industrial poultry.

Eliminating health risks from poultry growing must be tackled by responding to the foundational problem of homogenized production. Increasing agrobiodiversity not only reduces infection and flock mortality rates, but improves social health, food security, and soil fertility with myriad associated benefits. Ultimately, farming policy should seek to reward farmers for fostering agrobiodiversity at the farm level. This shift is needed in order to tackle the foundational problem of homogeneity that creates environments conducive to the spread of disease. Measures less than this are band aid solutions.
The final pillar on which broiler production has been built is process monopolization. Vertical integration in the U.S. broiler production allows integrating companies to control and manage the process completely in order to maximize company profits. Within this system, broiler growers contract with integrators for only the five to seven weeks that it takes to grow a flock from chicks to market-ready birds. Integrator control over the process deprives growers of bargaining power and regional control by integrators leaves growers with few or no alternatives (Levy, 2000). In this environment, integrators have been reported to provide inferior chickens and feed to growers that challenge them; unilaterally restructure the terms of a contract after an initial contract has been signed (Leonard, 2014); provide no assurance of when chickens will be delivered or how much time will pass between flocks; and to not provide a contract to growers before the grower takes out a loan for infrastructure investments (Pew Charitable Trusts, 2015).

Though the USDA is supposed to have the authority to protect contract growers from unfair trade practices under the 1921 Packers and Stockyards Act, funding for USDA action under this legislation is frequently cut by annual amendments introduced during the Congressional budget appropriations process. Most recently, Representative Andy Harris of Maryland introduced a rider into the fiscal year 2017 budget that eliminated funding for contract grower protections. These defunding riders strip growers of protections against reprisal by companies, reduce their freedom to organize, and hinder their ability to sue integrators for unfair trade practices.

The nature of poultry contracts and their exploitative nature — brought to light by former growers and industry whistleblowers like Carole Morison, Kay Doby, and Craig Watts – are contrary to the ideals of free and fair competition in U.S. economics. In the long-run, abusive business practices can also be destructive to local economies. At the level of the individual operation, broiler contracts can saddle growers with tremendous debt from company-required infrastructure upgrades. These investments, with a promise of high income potential, don’t always yield returns (Pew Charitable Trusts, 2015; MacDonald, 2014). Such financial insecurity among individual growers and local concentration of broiler production contributes
to economic vulnerability in broiler producing areas, reducing the economic resilience of these regions.

**GROWER FINANCIAL INSECURITY**

Growers assume significant personal risk in the form of debt from capital investments. Conventional industrial broiler production methods necessitate enormous debt-supported investment in growing barns and equipment mandated by integrator companies. On average growers invest approximately $1 million in site preparation, construction, and equipment at the beginning of a contract, in addition to hundreds of thousands of dollars in upgrades periodically required by integrating companies (MacDonald, 2014, 15; Pew Charitable Trust, 2015, 22).

In Maryland, the impact of this investment is apparent in average farm operation annual interest payments, which are approximately $10,000 greater than the average for farms in non-poultry producing counties of Western Maryland (See Figure 2). The burden of high interest payments for broiler operations is compounded by other high fixed operations costs, such as utility payments for climate control in growing barns, fuel costs, and maintenance (MacDonald, 2014, 35). The average annual farm operation payments on these expenses on the Eastern Shore is significantly higher than non-broiler producing counties (See Figure 3). These fixed operation expenses, combined with infrastructure specialization, create barriers to production transition for broiler growers if the market for poultry were to suddenly decline or when integrators cut back on or cancel growing contracts.

The debt risk associated with broiler growing limits the ability of growers to respond to changing market demands. This market “stickiness,” or reduced ability to shift production in response to market stimuli,

![Figure 2: Average Inflation-adjusted Interest Payments](image-url)

*Data from the USDA Census of Agriculture*
Figure 3: Average Annual Fixed Farm Expenses (2012)

- Utilities: $11,660
- Fuel: $12,129
- Maintenance & Supplies: $18,867
- Property Taxes: $8,442
- Total: $47,284

Data from the 2012 USDA Census of Agriculture
constitutes a significant reduction in local economic resilience. Growers cannot easily respond to changing demand if, for instance, a disease outbreak in the broiler industry reduced consumer demand for poultry, leaving the region vulnerable to fluctuations in that market. In regions where a plurality of farms are industrial broiler growing operations, operation-level stickiness becomes a significant economic risk for the agricultural sector of the entire region, including row crop farmers, who supply corn and soybeans to the poultry industry.

Regional Concentration and Economic Dependence

A growing area of economic interest concerns resilience, particularly because of the expected impacts of climate change. Once again, diversification is key. Similar to the impact of diversified farming practices on preventing disease outbreaks, diversified economies serve as built-in security against widespread economic decline brought about by downturns in single product markets. High concentrations of broiler production within regions such as the Maryland Eastern Shore is antithetical to the development of resilience.

On the Maryland Eastern Shore, where 99.8 percent of the poultry industry is concentrated, broiler production accounts for as much as 33 percent of all farm operations and up to 88 percent of gross agricultural sales in each county (See Table 1). Furthermore, information from the Delmarva Poultry Industry (DPI) asserts that “most” of the corn and soybeans grown on the Delmarva peninsula are used for broiler feed. This reliance of row crop farmers on the poultry industry further expands the influence of the market to the majority of agriculture sales and farms on the Eastern Shore. Such dependence on a single product market creates a precarious agricultural economy, vulnerable to changes in the broiler market and industry. The impacts of such product dependence can be seen by looking at examples of regional or national economies dependent on other product markets, such as energy sources.

The most prominent examples of economies dominated by a single sector are energy economies, such as coal in West Virginia, or oil production in Venezuela or Nigeria (Dode, 2012). While these economies often demonstrate rapid growth rates, they have also been historically vulnerable to demand fluctuations. Nigeria’s current economic condition under the low global price of crude oil demonstrates the price that single product economies ultimately pay. As the price of crude oil has dropped to extreme lows, Nigeria’s economy, which is particularly dependent on oil exports, has been...
Climate change and disease outbreaks increase the probability of shocks to the agricultural system that could destabilize the broiler market in the region.

Both climate change and the potential for widespread disease outbreaks among poultry flocks, to which the Eastern Shore is particularly susceptible, increase the probability of shocks to the agricultural system that could destabilize the broiler market in that region. While agriculture constitutes a small component of the total Maryland economy, risk to this sector poses an economy-wide vulnerability that differs from other production sectors. Unlike other industries, agriculture lies at the heart of essential goods and services that undergird the basic health and functionality of society. Farmers are important land stewards and agricultural practices play a central role in improving land care and ecological sustainability, ameliorating pollution, and supplying food.

Recognizing the important and unique position of agriculture in the economy and the vulnerability of broiler dependent economies, the following subsections explore the advantages of economic diversification and the role of local food markets in supporting production diversification.

AUGMENTING ECONOMIC RESILIENCE THROUGH LOCAL DIVERSITY

In contrast to the precariousness of single product economies, findings suggest that diversified economies fare better in the long-term than those dominated by a single product (Briguglio et al.,

Table 1: Broiler Operations and Gross Poultry Sales in Maryland Eastern Shore Counties

<table>
<thead>
<tr>
<th>County</th>
<th>Industrial Broiler Operations (200,000+ Animals)</th>
<th>Total Farms</th>
<th>Industrial Broiler Operations as Percent of all Farms</th>
<th>Gross Agriculture Sales ($1,000)</th>
<th>Gross Poultry Sales Including Eggs ($1,000)*</th>
<th>Percent of Sales From Poultry*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerset</td>
<td>95</td>
<td>286</td>
<td>33.2%</td>
<td>$218,950</td>
<td>$ 191,990</td>
<td>87.7%</td>
</tr>
<tr>
<td>Wicomico</td>
<td>111</td>
<td>510</td>
<td>21.8%</td>
<td>$236,321</td>
<td>$ 181,265</td>
<td>76.7%</td>
</tr>
<tr>
<td>Worcester</td>
<td>86</td>
<td>374</td>
<td>23.0%</td>
<td>$199,265</td>
<td>$ 147,206</td>
<td>73.9%</td>
</tr>
<tr>
<td>Caroline</td>
<td>138</td>
<td>658</td>
<td>21.0%</td>
<td>$257,915</td>
<td>$ 157,834</td>
<td>61.2%</td>
</tr>
<tr>
<td>Dorchester</td>
<td>66</td>
<td>423</td>
<td>15.6%</td>
<td>$187,057</td>
<td>$ 111,731</td>
<td>59.7%</td>
</tr>
<tr>
<td>Queen Anne’s</td>
<td>42</td>
<td>530</td>
<td>7.9%</td>
<td>$166,855</td>
<td>$ 56,520</td>
<td>33.9%</td>
</tr>
<tr>
<td>Talbot</td>
<td>27</td>
<td>328</td>
<td>8.2%</td>
<td>$89,509</td>
<td>$ 23,344</td>
<td>26.1%</td>
</tr>
<tr>
<td>Total</td>
<td>565</td>
<td>3,109</td>
<td>18.2%</td>
<td>$1,468,122</td>
<td>$ 869,890</td>
<td>64.2%</td>
</tr>
<tr>
<td>Maryland</td>
<td>574</td>
<td>12,256</td>
<td>4.7%</td>
<td>$2,271,397</td>
<td>$ 1,220,840</td>
<td>53.7%</td>
</tr>
</tbody>
</table>

Data from the USDA 2012 census of agriculture.
2008; Röhn et al., 2015). Economic analysis by Xiao & Drucker (2013) suggests that diversified local economies recover from major storm events faster than more homogenous economies. This economic analysis fits with assertions from urban and regional planning, which argue that diversified economies absorb shocks more effectively than mono-product economies by creating multiple overlapping demands for labor, providing more options to workers unemployed in one sector to find work in another (Underwood et al., 2015). This research also suggests a tradeoff between the speed of economic growth and economic resilience (Xiao & Drucker, 2013). That is to say, single sector dominant economies may grow more rapidly than diverse economies, but they pay for this growth with increased vulnerability to economic crashes and reduced ability to cope with them. Within local agricultural economies, diversification can be facilitated both through on-farm agricultural practices and the creation local direct-to-consumer (DTC) markets.

In national and international markets, regions specialize in the production of particular food products, but are dependent on imports from other regions for many of their own food needs. In contrast, localized food markets rely on diversity within their own production to meet consumer demand. This, combined with the financial and environmental benefits of diverse farm production discussed previously, encourages greater diversity in local agricultural production. In this diversified production environment, decline in demand for any particular product is less impactful on the market as a whole.

**Farm Benefits of Local Food Markets:** For farmers, local agricultural sales offer an opportunity for greater income generation per unit of production compared to conventional sales to large food companies. Though food companies have greater marketing reach and wield greater economies of scale, the cost of marketing cuts into farm profits and is passed on to buyers. At the point of purchase, consumers end up paying food prices that reflect not so much the value of the product, but the cost of marketing it. A 2008 report by the Food Marketing Institute found that 81 percent of the average dollar a consumer spends on food at a grocery store goes to companies for “marketing value” of the product, while only 19 percent pays for the farm operation (Food Marketing Institute, 2008). This analysis reveals significant potential for increased farm operator income by pursuing DTC and “mediated” sales. The combined financial benefits of both sustainable practices and direct sales offer significant potential for improving the financial stability of farmers while local markets also play a notable role in stimulating
economic activity within urban-rural or regional economies that develop such markets.

Initial research into the economic stimulus benefits of local food markets suggest that they enhance economic activity across local economies. One measure of this impact is analysis of the economic multiplier, which is a measure of the increase in final income resulting from an injection of new spending. Initial results suggest that local and DTC markets contribute to greater economic stimulus than conventional food and agriculture markets. Even after factoring in opportunity cost of reduced agricultural export income, studies investigating the multiplier associated with local and DTC food markets find multipliers as high as 2.6, compared to a multiplier of approximately 1.4 for conventional agriculture sales (Fitch & Santo, 2016, 10). This improvement stems from from several factors, including the recirculation of money spent on food within the local economy and the potential to encourage further spending on local businesses within proximity to public market venues.

Notably, these studies do not include the economic benefits of displacing industrial farm practices with sustainable methods, that, in turn, reduce public health costs. For instance, localizing the sale of poultry and reducing both the number and scale of broiler farms carries the potential to reduce the prevalence of diseases associated with current production practices. The spread of these diseases, discussed previously, carries an economic burden that is not reflected in the price of poultry, but rather burdens the local economy. Conversely, localizing sales and reducing the concentration of poultry production will likely result in quantifiable health benefits.

As an additional benefit, local markets provide a means of sidestepping national agriculture market policies and improving food distribution. Belo Horizonte, Brazil has utilized local food markets since the early 1990s to promote rural development and the economic viability of small farms while improving the nutrition and food access of low income residents within the City (Rocha et al., 2012). Belo Horizonte’s success has contributed to food action plans by cities across the globe, from London to Seattle, endeavoring to develop local resilience while improving public access to nutritious food. Urban planners around the world are adopting food planning as a critical element of urban and regional development while consumer awareness and preference for local and sustainable agriculture products continues to grow. Strengthening these markets
provides greater economic rationale for farmers to pursue sustainable practices that are preferred by local consumers.

Recent Growth in Local Food Sales:
A 2015 report by the USDA on local food systems in the United States finds that DTC agriculture markets have increased dramatically within the past decade. Between 2007 and 2014, the number of farmers markets increased by 180 percent. Similarly, the number of food hubs grew by 288 percent between 2006 and 2014, and there was a 430 percent increase in farm-to-school programs over the same period (Low et al., 2015, 3). These increases reflect significant emerging market opportunities for producers (Diamond et al., 2009). While still a relatively small percent of total food sales in the United States, local and DTC sales continue to grow rapidly.

Critical Obstacles to Local Food Markets: The most important challenge to sustainable agriculture is not the potential profitability of products nor lack of empirical or practical understanding of the methods. The most pressing constraint lies in existing market and policy frameworks. While the financial and environmental benefits of sustainable agriculture are increasingly apparent, farmers face challenges to adopting them in the form of unsupportive market and policy structures and their own personal investment in conventional practices and technologies. Asking farmers to adopt sustainable practices, which are often more labor intensive, constitutes a significant individual risk for the farmer if done without a reliable market environment conducive to the sale of their goods. Thus, fostering such a market environment is a key action area in supporting sustainable, local agriculture systems. Developing local, sustainable agricultural systems is a two-part challenge, composed of strengthening both consumer demand and farm supply.

Producer obstacles: On the production side, one critical area of action is the provision of knowledge resources for farmers. Not only is information on agricultural practices important, but farmers also need information on farm grant and loan opportunities for alternative and local agriculture. The USDA offers incentives for
conservation, diversified farming, and small-scale production through the Natural Resources Conservation Service, the Alternative Farming Systems Information Center, and the Sustainable Agriculture Research and Education (SARE) program. However, the number and availability of these resources is limited. Both Carole Morison and Lisa Inzerillo, Maryland Eastern Shore farmers, note that the lack of financial support is a significant obstacle to local agriculture.

Most grants and subsidies are tailored toward supporting commodity crops, such as corn and soybeans, which support the production of feed for the poultry industry. Between 1995 and 2014, the eight poultry producing counties of the Eastern Shore of

Motivations for Sustainable Local Agriculture in Somerset County, Maryland

Lisa Inzerillo’s farm, located in Somerset County, Maryland, is 66 acres of mixed farm and forest land that has been in her family at least since 1875. The majority of the cropland in recent years has been rented out to other farmers to grow corn and soybeans for the broiler industry. Lisa, however, remembers a time when the farm supported the family with a traditional mix of livestock and crops. Motivated by growth in local markets and a personal feeling of responsibility to develop a sustainable farm, Lisa is resurrecting diversified agriculture once again.

One significant motivation for Lisa in this development process is the opportunity for sales at local farmers’ markets and increasing consumer support for local and sustainably raised products. Yet an additional motivation and opportunity for income generation is the growing public interest in agritourism. The interest is well founded. While farm tourism is not a new phenomenon – epitomized by seasonal corn mazes, hay rides, and U-pick farms – it has grown dramatically in recent years. According the USDA Census of Agriculture, farm income from tourism rose 24 percent and the number of farms with tourism income rose 42 percent between 2007 and 2012. A survey of agritourism operations in Tennessee found that the average visitor to a farm attraction spends approximately $35 on admission, farm merchandise and products, etc., and the median number of visitors per year was 1,000 (Jensen et al., 2013, 13). Both recent growth in agritourism and its potential profitability make it an attractive additional income source for small farms like Lisa’s. Additionally, agritourism provides an effective means of further marketing consumer supported agriculture (CSA) programs and selling farm products, further strengthening local sales.
Maryland – Caroline, Dorchester, Kent, Queen Anne’s, Somerset, Talbot, Wicomico, and Worcester – received $276.9 million in corn subsidies and $141.9 million in soybean subsidies, according to data from the Environmental Working Group (EWG). As a point of contrast, the 2014 Farm Bill authorizes just $72.5 million for Specialty Crop Block Grants to support agricultural diversification and only $63 million for Value Added Producer Grants to support farm businesses nationally.

While financial sources for diversified farming are less abundant than commodity subsidies, USDA resources such as the Rural Microentrepreneur Assistance program and Rural Business Development grants offer some support for farm businesses to pursue alternative production methods. Compiling, disseminating, and assisting farmers on how to best avail themselves of these resources while advocating for further small farm and local agriculture assistance are critical steps towards strengthening sustainable agricultural practices and local food economies.

Additionally, lack of access to food processing facilities is often an obstacle to strengthening local food markets. Meat in particular is a high profit agriculture product, and as such can be an important revenue source for farmers. However, most slaughter and processing facilities are owned and operated by and for corporate meat companies. Lack of access to meat processing facilities by non-contract farmers is often perceived as a key barrier to local meat sales (Johnson et al., 2012, 3). Carole Morison’s hope to utilize spent laying hens as an additional income source by selling them to a local slaughterhouse was stymied by this lack of access to local slaughter facilities (see insert on page 23).

Scaling up local meat processing, however, is complicated by inconsistent or seasonal supply of animals produced by local, diversified farms. Output from small scale animal operations fluctuates significantly, making financial viability for fixed location, privately owned slaughter facilities difficult.

Mobile slaughter units (MSUs) offer a potentially feasible method of responding to the needs of small producers and their variable production. The number of MSUs currently in operation, though, is limited. As of 2011, only nine mobile poultry units were operating in the United States and only one on the East Coast (Johnson et al., 2012, 18). Increasing this number is a matter of both cost – MSUs can range in price from $150,000 to $200,000 – and uncertain demand. Given these challenges, cooperative ownership and management may be potential methods for ameliorating the
Exploring opportunities to support access to local food for low-income communities is not solely a moral imperative, but an opportunity for strengthening local food markets by broadening the consumer market for local production.

financial risks of individual investment in MSUs. Collaborations on MSUs or fixed location small-scale slaughter facilities can be developed as farmer cooperatives, or through partnerships between farmers and local food hubs or other community managed facilities, discussed in a following section. In such arrangements, facilitating multi-stakeholder collaboration is a key area of action.

**Consumer Access and Equity:** On the consumer side, an essential area of development for local food markets is incorporating food equity. A variety of programs are in operation in the United States to increase low-income consumer access to healthy, local foods, most notably through the Supplemental Nutrition Assistance Program (SNAP) and various urban distribution initiatives. Examples in the Maryland-DC area include the Capitol Area Food Bank’s Fruits and Vegetables Fund, which purchased fresh produce from five local farms, and Washington D.C.’s Produce Plus Program, funded by the Department of Health, which subsidizes food purchases for low-income residents at farmers’ markets (Arabella Advisors, 2016, 2). Exploring opportunities to support access to local food for low-income communities is not solely a moral imperative, but an opportunity for strengthening local food markets by broadening the consumer market for local production.

**Local Market Structures:** Several market structures in particular offer potential for strengthening local food sales. One such is community supported agriculture (CSA). CSAs involve a group of customers paying in advance of the growing season to receive routine installments of the produce or products from a farm. CSAs provide up-front income for farmers, reducing farm reliance on debt as a method of financing seasonal growing, which in turn reduces the financial risk of farming. However, initiating a CSA program is a labor intensive endeavor for individual farmers. Under good conditions, farmers can expect to keep approximately 70 percent of their customers from season to season, necessitating constant marketing and public outreach in order to retain participants and find new ones (Marks, 2011).

Nonetheless, growing awareness of food issues is sparking a significant increase in CSA programs. Community groups, including church congregations and businesses with multiple employees, are becoming significant sources of demand for CSAs (Marks, 2011). Facilitating such interactions and providing resources and support for farmers looking to establish CSA programs will be essential to developing local food systems.

A particular area of growth for CSA programs is in meat CSAs, which
are more burdensome for farmers to start due to the complexity of handling, processing, and storage requirements for meat that are less burdensome for produce (Union of Concerned Scientists, 2009). Nonetheless, meat CSAs offer an important area of growth for improving farm profitability. Supporting farmers with meat CSAs with legal advice on navigating food handling regulations and through support for processing facilities is essential to growing such programs. Processing facilities, in particular, are an essential area of support for local agricultural production that can be supported by an additional local market structure.

**Community Food Hubs** offer a further market structure for coordinating and supporting local food production and purchasing. “Food hub” is both a relatively new and variable term that depends on the community and situation. A common characterization of food hubs, however, involves the aggregation, processing, and wholesale distribution of regionally or locally produced agricultural products. Increasingly, food hubs are also associated with community ownership, both by producers and consumers (Horst, et al., 2011, 211). The precise structure, target consumer, and operation of food hubs depends on a variety of factors. Formats range from tourist attractions, such as Pikes Place Market in Seattle, WA, to city neighborhood or rural community food hubs characterized by service to a portion of a city or a rural community. Examples of these latter models include the Chinatown-International District market in Seattle, WA and the local food processing and distribution market in Hardwick, VT (Horst, et al., 2011, 216). Despite their variability in form, the overarching purpose of food hubs is to directly connect producers to consumers within a geographic region.

For producers, food hubs offer both a market for goods and, often, facilities for preservation, processing, and sale of goods. From the consumer perspective, food hubs facilitate local purchasing by aggregating local food resources. Finally, food hubs that emphasize food equity can reduce food waste and improve access. The Farmers Against Hunger (FAH) cooperative in New Jersey, for instance, provides facilities and coordination for gleaning and distributing food products that would otherwise be wasted in conventional grocery markets (Edward J. Bloustein School of Planning and Public Policy, 2012, 26). Such market coordination structures, whether private or public, physical markets or online, are crucial structures for connecting producers to consumers and developing the infrastructure necessary for aiding local production.
The most important overarching theme in supporting local food systems, regardless of the market structure utilized, is multi-stakeholder collaboration. Local food systems differ significantly from conventional product markets in that they shorten the distance between producers and consumers. In many ways, local food markets are a direct reaction to the impersonal buyer-seller relationship of conventional markets. Consumers of local food are impacted not only by the quality of the food being purchased, but the practices used to grow it. Thus, the relationship between farmer and consumer is not just one of food cost, but shared management of local resources, including food, water, environment, and health.

Supporting local markets requires not only shifting economic incentives, but facilitating local relationships through multi-stakeholder collaborations between community groups and farmers. These relationships can manifest in many forms — from farmers’ markets and CSAs to food hubs and multi-stakeholder managed food sheds. Fostering these interactions throughout all socio-economic levels of society via grassroots mobilization, support for community food hubs, and farmer cooperatives will be central to transforming the agricultural system, one community at a time.
Over the course of the last century, industrial poultry production has become increasingly concentrated, contributing to dramatic increases in the number of chickens sold. Though the industry is traditionally marketed to communities as economically advantageous because of its size and income generation, its scale has reached a critical mass. The features that have made poultry efficient are also building blocks for significant risk, both to the continued operation of the industry and the communities and ecological environments that contain it. These instabilities include waste concentration and resulting pollution, industry and public health disease risks, and economic vulnerability of broiler dependent agricultural economies. Much like the “too big to fail” phenomenon of the U.S. financial sector during the 2008 recession, poultry production has reached a point where it is no longer wise to consider its size an asset.

In response to these risks, sustainable agriculture practices, combined with diversified local food systems, offer promising alternatives to conventional industrial poultry production. In response to nutrient pollution, sustainable agriculture offers a means for efficient production while minimizing nutrient concentration and pollution and improving financial security for farmers. Farm-level biodiversity in the form of diversified breeds and integrated animal and cropping practices minimize the threats from disease exposure in addition to allowing farmers to better manage waste materials. Finally, in the face of agricultural economies increasingly exposed to likely fluctuations in the industry, diversified local food markets offer numerous opportunities: the potential to sidestep entrenched agriculture policies while benefiting low-income consumers; financial security for local farm businesses; and greater economic resilience.

The benefits of sustainable agriculture methods and local food systems are clear. Fostering transition away from conventional monoculture commodity production towards diverse local systems will require numerous action areas, ranging from consumer awareness and food knowledge to reformation of farm subsidies and creation of infrastructure to facilitate diverse small-scale farms. This transition is already well under way. Nonetheless, maintaining and augmenting existing momentum towards agricultural transformation while minimizing existing risks from industrial poultry requires further support.
The following are four critical action areas to minimize risks from the poultry industry while developing frameworks that will support a resilient, sustainable agricultural economy in Maryland.

1. **Regulate pollution and avoid further concentration of the poultry industry.** While long-term changes to the Maryland agricultural economy rely on shifting fundamental operating norms of the current system, the immediate risks to and from the commercial broiler industry in Maryland require short-term efforts to ameliorate the most critical threats posed by this structure. Additionally, the sheer density of the industry within local regions such as the Maryland Eastern Shore poses not only environmental, but social health risks. Limiting further growth and densification in the region is therefore important.

2. **Support FDA oversight and management of antibiotics in the farm sector.** In the near-term, routine antibiotic use in farm animals must be more stringently regulated in order to maintain the long-term usefulness of these drugs in preventing disease outbreaks among both animals and humans.

3. **Facilitate farm transition to sustainable agriculture** through expanded resources, training on such practices, and support for independent regional infrastructure. Provide resources, support best management practices, and coordinate learning networks for sustainable agriculture practices.

4. **Foster local and direct-to-consumer food markets.** The long-term growth of local and sustainable agriculture depends on the health of the local market environment. Thus, supporting community collaboration and farmer-community networks are essential to strengthening local food and sustainable systems.

These areas constitute critical initial steps in the pursuit of a sustainable, diversified, and local agricultural system. Growing knowledge and awareness of the harms and risks associated with current poultry production practices indicate that such a move is essential to the long-term social, economic, and ecological health of Maryland. Yet, ameliorating these harms and risks cannot be accomplished by mere adjustments to the existing system. Rather, addressing risks necessitates a paradigmatic shift in the current food and agriculture model. This transition holds the potential to improve food quality, reduce current and future environmental risk, strengthen local communities and economies, and make farming economically profitable for the farmers.

In pursuit of agricultural reform, much work needs to be done to help both farmers and consumers. Fortunately, the transition is already in progress.
REFERENCES


Chesapeake Bay Foundation (2008). Bad Water and the Decline of Blue Crabs in the Chesapeake Bay. Annapolis, MD: Chesapeake Bay Foundation.

Chesapeake Bay Foundation. (2012). The Economic Argument for Cleaning up the Chesapeake Bay and its Rivers. Annapolis, MD: Chesapeake Bay Foundation.


