

POLICY ACTIONS TO IMPROVE ECONOMIC AND ENVIRONMENTAL OUTCOMES OF  
POULTRY LITTER MANAGEMENT IN DELMARVA

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## ABSTRACT

### POLICY ACTIONS TO IMPROVE ECONOMIC AND ENVIRONMENTAL OUTCOMES OF POULTRY LITTER MANAGEMENT IN DELMARVA

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On the Delmarva Peninsula, poultry production reigns supreme as the most dominant industry of this region's agricultural sector. This industry generates massive economic output for Delmarva agriculture, as well as a large amount of poultry litter (i.e., feces and bedding). Poultry litter is a valuable soil amendment used as an agricultural nutrient source. Historic land application of nutrient-rich poultry litter has led to high soil phosphorus levels in many areas of the Delmarva Peninsula, which has motivated a push to move litter out of the region to avoid negative environmental impacts of overapplication. However, there is also cropland without phosphorus surpluses that can benefit from poultry litter application as a valuable source of nutrients and organic matter. Despite the benefits that poultry litter application offers to agriculture, there are vast inefficiencies in its storage, transport, and utilization across the Delmarva Peninsula. The various regulatory schemes that govern poultry litter management are grossly uncoordinated. This lack of policy coherence has left many willing Delmarva farmers with distinct nutrient needs without access to this resource and created problems for poultry producers looking for a place to send litter. Additionally, there are numerous environmental and economic impacts to this inefficient distribution, such as excess nutrient runoff and unnecessary synthetic nutrient purchases. This report examines the underlying economic and environmental implications of the current system, identifies and analyzes the main policy barriers that discourage more effective poultry litter management, and provides succinct recommendations to improve and harmonize the Delmarva poultry litter policy landscape to achieve environmental and economic goals, noting obstacles to implementation.

# POLICY ACTIONS TO IMPROVE ECONOMIC AND ENVIRONMENTAL OUTCOMES OF POULTRY LITTER MANAGEMENT IN DELMARVA

## **Introduction**

Across the Delmarva Peninsula, poultry production reigns supreme as the most dominant industry of this region's agricultural sector. This region processed 4.2 billion pounds of chicken in 2020, with poultry producers and processors bringing in \$1.02 billion in income (Delmarva Chicken Association, 2021). In the context of the broader Delmarva agricultural industry, the total market value of all agricultural products sold on the Delmarva Peninsula is just over \$3.5 billion (USDA National Agriculture Statistics Service, 2017). The poultry industry is also a massive market for Delmarva grain: chicken companies purchased 90 million bushels of corn, 36 million bushels of soybeans, and 403,000 bushels of wheat primarily from Delaware, Maryland, and Virginia grain farmers for chicken feed in 2020 (Delmarva Chicken Association, 2021). While this industry generates massive economic output for Delmarva agriculture, it also produces a large amount of poultry litter, a waste product composed of feces and bedding.

Poultry litter is a valuable soil amendment that farmers often use as a nutrient source. In addition to macronutrients like nitrogen (N), phosphorus (P), and potassium (K), it also provides the crop with micronutrients and organic matter. Due to consistent application of poultry litter over a long period of time in Delmarva, some fields have soil test phosphorus levels that exceed the agronomic needs of crops, which has prompted environmental concerns about additional land application of phosphorus-rich litter that could runoff into local waterways via various pathways. This concern has motivated a push to move litter outside of the Chesapeake Bay Watershed, which includes much of Delmarva. However, many crops grown on the Delmarva Peninsula need additional nutrients, primarily nitrogen, to sustain crop production. As such, farmers may choose to apply poultry litter to fulfill crop nutrient requirements if their fields have sufficiently low phosphorus soil test levels such that application of poultry litter is permitted based on state-wide nutrient management regulations.

While large amounts of poultry litter are generated on the peninsula itself, the various regulatory schemes that govern poultry litter storage, transport, and use in Delaware, Maryland, and Virginia are grossly uncoordinated. This lack of policy coherence has left many willing

farmers on the Peninsula with distinct phosphorus needs without access to litter and created additional obstacles outside of normal seasonal supply/demand dynamics for poultry producers looking for a place to send litter. For example, state litter transport policies often incentivize the transport of excess litter outside of state borders, sometimes for alternative uses like mushroom production in Pennsylvania, without meeting the agricultural nutrient needs within the state that may be met by Delmarva poultry litter if seasonal poultry litter supply is available. Not only may farmers lack access to poultry litter during an appropriate application window, but there are also numerous environmental impacts to this inefficient distribution. The primary environmental impact of inefficient distribution is excess nutrient runoff into the Chesapeake Bay, mainly nitrogen and phosphorus (Pelton et al., 2020). Additionally, farmers who would otherwise use poultry litter to amend low soil test phosphorus levels may resort to unnecessarily purchasing synthetic phosphorus fertilizer, the production of which is harmful for water quality, hydrology, air quality, and human health in mining areas (Reta et al., 2018).

More environmentally and economically efficient distribution of poultry litter would contribute to multiple positive outcomes: i) poultry litter would be distributed to farmers for cropland application where it would be most agronomically beneficial, ii) farmers who wish to use this local resource to fulfill their nutrient needs are able to do so with relative ease, iii) litter distribution to areas with existing excess soil phosphorus levels would be more difficult, and iv) pollution derived from organic nutrient application on the Delmarva Peninsula would decline. Tackling the existing policy barriers to achieve this more efficient distribution will increase litter mobility across the Peninsula and reduce the environmental impact of poultry production in this region of the Chesapeake Bay watershed.

With these implications in mind, this report first examines underlying economic and environmental implications of the current system, as well as political realities in Delmarva policymaking. Then, a comprehensive literature review is conducted to understand the existing body of work on technical, practical, and policy issues that currently and historically impact Delmarva poultry litter management. Following this literature review, the main policy barriers that exist among the Delmarva states that discourage more effective poultry litter storage, transport, and use are identified and analyzed. This analysis culminates in succinct recommendations to improve and harmonize the Delmarva poultry litter policy landscape to achieve environmental and economic goals, noting obstacles to implementation.

## Literature Review

Chesapeake Bay protection has been a cornerstone of environmental management and research in the Delmarva region going back to findings of the U.S. Environmental Protection Agency (EPA) in 1983 (United States Environmental Protection Agency, 1983). This document is the compiled research of an EPA technical program prompted by Congress in 1976 which sought to identify and study the environmental problems in the Chesapeake Bay. This document provides an authoritative understanding of the common environmental management issues of this region. While that document refers to the specific issue of nutrient management simply as non-point source pollution, more contemporary scholars have worked to consistently establish the relationship between Delmarva poultry litter management and nutrient fluxes into the Chesapeake Bay (Feyereisen et al., 2010). Individual scholars have refined the environmental elements of this issue and pinpoint the main excess nutrient of poultry litter to be phosphorus. A 2018 paper even goes into how much more prone to excess phosphorus pollution the Delmarva Peninsula is compared to other areas of the watershed (Moyer & Blomquist, 2018). This study helps to emphasize the outsize contribution that better litter management on the Delmarva Peninsula would make to overall Bay health.

Taking a step back to the broader issue, regional organizations including the Chesapeake Bay Foundation and the Chesapeake Bay Program have been able to marshal extensive scientific inquiry into the environmental issues associated with poultry production. For the Chesapeake Bay Foundation, this information ranges from estimating agriculture's total contribution to Bay pollution to describing specific effects like eutrophication (Chesapeake Bay Foundation, 2020). The Chesapeake Bay Program has extensive structures in place to study environmental issues with poultry production, such as their Agricultural Modeling Subcommittee, whose impressive 2015 report details how poultry production dynamics affect environmental outcomes (Chesapeake Bay Program Agricultural Modeling Subcommittee, 2015).

Existing literature specifically focusing on the negative economic outcomes of an unharmonious poultry litter management landscape are scarce. However, one of the main economic impacts of poultry litter market inefficiency is the amount of money spent on synthetic

nutrient inputs rather than a local organic nutrient input like poultry litter. Thus, publications from USDA and land-grant universities on farm input prices provide key insights into an essential policy driver like agricultural input price fluctuation. In 2019 USDA's Economic Research Service charted a 10-year rise in phosphorus price (USDA Economic Research Service, 2019), and in 2021 researchers from the University of Illinois examined the effect of the COVID-19 pandemic on agricultural input prices (Schnitkey et al., 2021). Both of these studies help examine an economic trend that may motivate policy action due to the negative effect of rising input prices and global supply chain disruptions which face an inefficient Delmarva poultry litter market. Many other economic inefficiencies like the use of litter transport programs to subsidize transport to areas outside of Delmarva prone to nutrient runoff like Pennsylvania mushroom country have to be examined at an individual level. Annual reports of the respective regulatory agencies are helpful in this, such as the Delaware Nutrient Management Commission's annual report to the Governor and General Assembly which describes precise tonnage moved via program assistance (Delaware Nutrient Management Commission, 2021).

The scholarly conversation on poultry litter management and nutrient pollution more broadly has evolved over the years to explore many different elements of the issue including practical, technical, and policy. Going back to 2002, a study from Virginia Tech examined on-the-ground poultry litter management dynamics on the Virginia Eastern Shore via workshops and surveys. This was not entirely focused on policy, but it did include an evaluation of farmers' desire to utilize litter and state programs to assist in litter acquisition. This study is obviously dated now, however, it provides a modest historical perspective that even 20 years ago Delmarva farmers in Virginia indicated a desire to utilize local litter resources, but Virginia policies were not sufficient to appropriately incentivize or assist (Pelletier et al., 2002). A survey-based study to evaluate the litter management landscape was also conducted in 2006 by University of Maryland researchers hoping to examine a more localized study sample of farmers and poultry producers in just four counties on Maryland's Eastern Shore (Parker & Li, 2006). This study may be older and more practically focused, however, its discussion of farmers' practical reasons for hesitancy or enthusiasm for poultry litter application remains valuable for proposing policy changes. Most recently, in 2020 a team of researchers from the University of Delaware (UD) conducted a survey of poultry producers across the Delmarva Peninsula to determine what practical factors currently affect how litter may be inefficiently distributed across the Delmarva

Peninsula (King et al., 2021). This study provided an excellent foundation for looking into the contemporary on-the-ground issues with poultry litter management on the Delmarva Peninsula from Delmarva growers themselves.

Outside of studying the more practical and technical elements of poultry litter in environmental impact mitigation, there is some existing research into what state policy barriers exist that allow for negative environmental impacts from the poultry litter market's status quo. One such study came from a researcher out of the University of Maryland in 2015 who examined how the policymaking process in each Delmarva state affected farmer compliance with nutrient management regulations (Perez, 2015). While this was an excellent study for analyzing nutrient management policy outcomes, particularly regarding poultry litter, the policymaking process itself was the focus rather than indicating inherent flaws in existing regulations and implementation strategies to correct them. A very recent policy-heavy study from January 2022 examines how to connect manure nutrients back to grain producing regions, particularly the Delmarva Peninsula (Duke & McGrath, 2022). This study has an excellent examination of the current distribution of poultry litter outside of the Peninsula, due in large part to policy drivers like the litter transport programs of Delaware and Maryland. This study had a narrow policy scope, however, and does not examine policy barriers or ineffective outcomes more broadly.

The most recent broad presentation of policy barriers comes from a group of Delmarva agricultural and environmental stakeholders called the Delmarva Land and Litter Collaborative (DLLC). In 2015, the year of their founding, their *New Approaches to Poultry Litter Management in the Chesapeake Bay Watershed* report briefly pointed out numerous policy issues at play regarding poultry litter storage, transport, and utilization and provided minor recommendations on improvements (Delmarva Land and Litter Work Group, 2015). This broad overview document focuses mainly on the various technical and practical barriers to progress in litter management, but the detail in its review of policy incoherence among Delmarva states is not terribly robust. The DLLC appears to have spent much of its time in preparing publications by evaluating these technical barriers. This as exemplified in a brief 2019 mass balance report which sought to examine if local Delmarva poultry litter nutrient distribution exceeded local crop nutrient demand (Mulkey et al., 2019). The report was written over three years and may have informed policy via addressing a technical issue like the true geographic distribution of Delmarva soils saturated by nutrients derived from litter. In 2017, the group homed in on policy

changes in another report that may render poultry litter transport programs specifically in each state more effective while preventing environmental degradation (Delmarva Land and Litter Challenge, 2017). This is a focused list of recommendations with modest detail on the mechanics of the recommended policy changes, but it lacks guidelines on how the recommended policy changes could be initiated.

While the body of work on this subject spans at least 20 years, it is evident that there is not a study which examines specific poultry litter management policy issues, proposes recommended actions to alleviate them, and describes viable ways to carry out its recommendations. This study seeks to achieve that goal.

## **Research Questions and Hypothesis**

This study seeks to examine the following research questions:

*Research Question 1:* What are the most crucial state-level policy barriers to achieving more environmentally responsible and economically efficient poultry litter management on the Delmarva Peninsula?

*Research Question 2:* Is there a distinct forum to discuss these policy barriers and would change in poultry litter management policies based on these discussions be preferable to the status quo?

*Research Question 3:* Can succinct recommendations and implementation frameworks be developed to guide policymakers in ameliorating any identified policy barriers to having more efficient Delmarva litter storage, transport, and utilization?

*Hypothesis:* Specific state policy barriers exist and may inhibit the pace by which more environmentally responsible and economically efficient poultry litter management on the Delmarva Peninsula is achieved. Moreover, there are existing fora in which stakeholders can debate policy solutions and propose changes to be implemented. Finally, concise recommendations and implementation guidelines can be developed to assist in these



conversations. The recommended changes will enhance environmental and economic outcomes of the poultry litter value chain.

## **Methods**

To begin, literature about the economic and environmental issues with the current poultry litter management were analyzed. The studies and reports ranged widely from current trends, drivers of demand, and pressures in nutrient markets and price fluctuations to studies evaluating the physical causes of increased phosphorus runoff from poultry litter. These studies provided a foundational understanding of the basic economic and environmental motivations behind future policy action. The political realities of agricultural policy change on the Delmarva Peninsula were also examined. First, an analysis of political representation of the Delmarva constituency of each respective state was conducted to examine legislative motivations. This analysis of Delmarva political representation was supplemented by identifying non-Delmarva constituencies that have a distinct interest in poultry litter policy outcomes due to their nutrient demands. Second, an institutional mapping exercise was conducted to identify nutrient management regulatory authorities of each state. The political analysis of Delmarva agricultural policymaking helped ground the implementation strategies of later proposed recommendations in political realities.

A policy issue identification process followed the economic, environmental, and political review. Much of the base understanding for practical problems with poultry litter management that may affect policy came from the aforementioned UD study (King et al., 2021), as well as older counterparts from the University of Maryland (Parker & Li, 2006) and Virginia Tech (Pelletier et al., 2002). For example, in reviewing the UD study, policy barriers were identified through looking at survey responses such as: “how helpful has the poultry litter transport price share program in your state been in acquiring or sending out excess poultry litter?” Negative responses suggest that there are issues with that particular policy that may be amended. More technical barriers like localized nutrient saturation issues were partially examined in publications such as the DLLC’s public mass balance study (Mulkey et al., 2019) and provided a glimpse into

how policy may interact with environmental conditions that give poultry management issues more nuance.

These survey-based and technical studies were evaluated alongside information collected from conversations with regional policy experts from organizations focused on the health of the Chesapeake Bay. These conversations were conducted between mid-2021 and early 2022 with numerous professionals in positions ranging from state government in each Delmarva state, regional collaboratives dedicated to nutrient management solutions, inter-state organizations with broad Chesapeake Bay health goals, and Delmarva academic institutions. Each of the conversations gave a unique perspective to the body of research analyzed in this study and provided essential insights into how the practical and technical issues at play interact with existing policy barriers. Further conversations with professionals looking into policy-specific issues, as well as analyzing policy-focused publications from their respective organizations, supplemented the practical and technical barrier information received through other studies and conversations.

Policy barrier identification was followed by recommendation development. Other organizations have crafted recommendations, such as those found in the aforementioned inaugural DLLC publication (Delmarva Land and Litter Work Group, 2015). However, this study seeks to not only develop recommendations, but discuss environmental and economic impetuses for policy change, existing statutory and regulatory authorities, the methods of implementation, existing fora to elevate the issues, and potential obstacles to implementation. Thus, these previous recommendations helped inform elements of the distinct recommendations presented in this study.

The mechanics of recommendation implementation were founded in statutory research to ensure that existing authorities may enable these changes. Additionally, implementation requires an essential forum to begin discussions on the policymaking process, thus existing fora for discussion were evaluated not only in literature but also in conversations with professionals from these institutions. Finally, obstacles to implementation were identified organically through an analysis of previous literature, political realities, and candid admissions noted during the aforementioned conversations with professionals.

All of the recommendations and conclusions in this study are grounded in a unifying framework of essential conceptual elements which describe programmatic incoherence as well as underlying issues with the economic and environmental status quo (Table 1).

**Table 1: Framework of Current Delmarva Poultry Litter Management Conceptual Elements**

Conceptual Elements	Delaware	Maryland	Virginia
<i>Nutrient Management Regulatory Authority</i>	Delaware Nutrient Management Commission	Maryland Department of Agriculture	Virginia Department of Conservation and Recreation
<i>Storage Requirements</i>	Strict	Moderately strict	Flexible
<i>Transport Program Requirements</i>	Flexible	Flexible	Inflexible
<i>Delmarva Population out of Total State Population</i>	Significant	Low	Low
<i>Delmarva Political Representation</i>	Significant	Low	Low
<i>Chesapeake Bay Environmental Culture</i>	Moderate importance	High importance	Low importance
<i>Delmarva Ag Sector Economic Contribution</i>	High	Moderate	Low

## **Economic Implications of Litter Management Policies**

Economic inefficiency caused by current poultry litter management policies on the Delmarva Peninsula may be costing farmers money. This is exemplified by rising synthetic agricultural phosphorus costs compared to a regional organic phosphorus source like poultry litter. Between 2004 and 2014 alone, the last year that the U.S. Department of Agriculture (USDA) Economic Research Service surveyed average U.S. farm prices of select fertilizer

prices, the price of phosphorus rose over 133% (USDA Economic Research Service, 2019). Looking at 2021, the rising cost of fertilizer has been noted in numerous national publications as a grave issue for the average U.S. farmer. Synthetic fertilizers are tied to international markets and supply chains in ways that the regional Delmarva poultry litter market is not, leaving the price of synthetic fertilizers tied to international market fluctuations. This has been abundantly evident in the global supply chain recovery from the effects of COVID-19. Between July 2020 and July 2021, agricultural phosphorus prices rose from \$390 per ton to \$717 per ton (Schnitkey et al., 2021).

In the case of poultry litter, some costs in using this resource can be offset by state policies. One example would be state poultry litter transport assistance programs. These cost share programs simply do not exist for synthetic fertilizers. Litter transport programs represent an economic incentive to mobilize existing Delmarva nutrient resources and potentially drive positive environmental outcomes through shaping litter utilization patterns to meet Delmarva nutrient demands in areas that have distinct nutrient needs. These programs can affect not only the quantity of litter moved, but the location of its movement as well. Additionally, non-standard storage requirements in each Delmarva state create localized confusion for poultry producers, litter haulers, and farmers in a way that may inhibit the economic efficiency of transporting litter from one locale to another. For example, even if transporting litter from point A to point B were simple and low in cost, storage and utilization requirements differ between states so commonly that a more expensive management decision may be made due to the uncertainty caused by this lack of regulatory coordination.

There is a strong economic case for embracing a regional nutrient source, untied to global market disruptions, with existing incentive-based and clear policy structures in place. Without continuous improvement in these policy structures, unnecessary economic costs will continue to be incurred by farmers and poultry producers who must cope with a disparate landscape of litter management regulations.

## **Environmental Implications of Litter Management Policies**

Each year, the Chesapeake Bay receives an enormous amount of excess nutrients from agriculture. The most abundant excess nutrient from poultry litter is phosphorus. In fact, between 2009 and 2018, every acre of agricultural land in the Chesapeake Bay watershed released an average annual load of 0.52 lbs. of excess phosphorus per acre (Moyer & Blomquist, 2018). The Delmarva Peninsula itself releases higher amounts of phosphorus than this watershed average, with some areas of the Peninsula releasing over 2 lbs. per acre (Moyer & Blomquist, 2018). This excess phosphorus pollutes the Chesapeake Bay and causes negative environmental outcomes that culminate in localized eutrophication across the Bay. Eutrophication is a process by which microorganisms rapidly proliferate in the presence of excess nutrients like phosphorus and nitrogen, consuming the majority of dissolved oxygen in an area, thus depriving fish and other aquatic species of necessary oxygen. This lack of oxygen harms not only economically and environmentally important species alike, from blue crabs and rockfish to underwater grasses (Chesapeake Bay Foundation, 2020).

The general trend in phosphorus pollution in the Bay has been environmentally positive, with a roughly 45% decrease between 1985 and 2020 in the total phosphorus load from agriculture (Chesapeake Progress, 2021). However, according to the Chesapeake Bay Program, nutrient runoff from agriculture remains the single largest source of nutrient pollution to the Bay (Chesapeake Bay Program, 2021a). The Chesapeake Bay Foundation estimates that roughly half of all of the phosphorus pollution entering the Bay comes from agricultural sources, which includes poultry production (Chesapeake Bay Foundation, 2021). These agricultural sources are not exclusive to crop and poultry production. The mushroom industry in southeastern Pennsylvania was noted among policy experts interviewed in the study as a common destination for poultry litter as well as a large source of excess nutrient runoff into the Chesapeake Bay. As such, a large part of managing phosphorus pollution into the Bay is tied to continuous improvement in poultry litter management and distribution.

Part of this continuous improvement is related to reducing the actual concentration of phosphorus in poultry litter itself. According to the Chesapeake Bay Program's Agricultural Modeling Subcommittee to the Poultry Litter Subcommittee and Agriculture Workgroup, various improvements in feed mixes and poultry genetics have generally driven down nutrient concentrations in poultry litter since the mid 1990's. However, these improvements have slowed down, and poultry litter phosphorus concentrations have actually been rising since 2005 across

the Chesapeake Bay watershed (Chesapeake Bay Program Agricultural Modeling Subcommittee, 2015). Additionally, the subcommittee recognized that this may be due in part to the general trend among poultry producers in certain parts of the watershed to grow larger birds who simply create more litter than average-sized birds (Chesapeake Bay Program Agricultural Modeling Subcommittee, 2015). It was not indicated if this trend is taking place mainly on the Delmarva Peninsula or elsewhere in the watershed.

Outside of these improvements via changes to feed and genetics, poultry litter management is closely tied to environmental outcomes and phosphorus pollution. This is evidenced by the sheer amount of poultry litter produced on the Peninsula previously referenced and size of the industry. With this in mind, some of the most impactful existing policies which govern poultry litter management are the respective storage requirements, litter transport programs, and utilization nuances in each Delmarva state. The various requirements of these programs such as maximum litter storage time, specifics of litter transport assistance, and the phosphorus saturation of destination farms affect environmental outcomes of these programs.

## **Delmarva Political Realities and Regulatory Dynamics**

With the economic and environmental status quo described above, the political realities currently preventing meaningful action to improve the policy environment on this issue are explored below.

While Delaware, Maryland, and Virginia are geographically unified by the Delmarva Peninsula, the political representation of the population residing on the Peninsula within each state differs. For example, nearly half of the entire population of Delaware resides on the Peninsula in the region below the C&D Canal (United States Census Bureau, 2019), however only about 7% of Maryland's total population (United States Census Bureau, 2019) and less than 1% of Virginia's total population (United States Census Bureau, 2019) live on the Peninsula. In the case of Maryland and Virginia, these populations are starkly lower than their counterparts on the other side of the Chesapeake Bay. This reality of population distribution is reflected in the number of seats by which the residents on the Delmarva Peninsula are represented in each respective state legislature (Table 2).

**Table 2: Delmarva Constituency Representation in State Legislatures. Sources:**  
*Delaware General Assembly, Maryland General Assembly, and Virginia General Assembly*

State	Legislative Chamber	Number of Seats out of Total	Percent of Representation
<b>Delaware</b>	House of Representatives	19 out of 41	46%
<b>Maryland</b>	House of Delegates	9 out of 141	6%
<b>Virginia</b>	House of Delegates	1 out of 100	1%

The political representation of Delmarva residents in their respective state legislature is decidedly small in Maryland and Virginia compared to their western shore counterparts, whereas in Delaware the representation is nearly equivalent to urban populations in the state. As such, legislative outcomes in Maryland and Virginia on matters of agricultural law may favor those on the western side of the Chesapeake through the amount of funding appropriated to state programs or otherwise that end up being allocated for production practices popular in Delmarva agriculture. The regulatory agencies and authoritative bodies in each state are the most direct decision-makers for Delmarva poultry litter management policies. However, they operate under the laws set by state legislatures which possess distinct legislative imbalances for Delmarva residents.

Each Delmarva state has a different executive body responsible for poultry litter management policymaking. In Delaware, the Delaware Nutrient Management Commission directs the Delaware Nutrient Management Program and develops relevant regulations (Delaware Department of Agriculture, 2021). In Maryland, the Maryland Department of Agriculture administers all the Maryland nutrient management programs and develops regulations of the to carry out its goals (Maryland Department of Agriculture, 2021). In Virginia, the Virginia Department of Conservation and Recreation administers the Virginia Nutrient Management Program (Virginia Department of Conservation and Recreation, 2021).

All of these regulatory authority arrangements governing poultry litter management have advantages and disadvantages. For example, Virginia's Department of Conservation and Recreation has a broad authority over both urban and rural agricultural operations, therefore their ability to focus on improving specific poultry litter management policies may be diluted. However, in Delaware the Delaware Nutrient Management Commission is appointed specifically to develop nutrient management regulations for agricultural operations in the state. As such, they may have greater opportunities to focus on specific issues like litter storage requirements, transport programs, and utilization specifics.

Finally, it is important to recognize that Delmarva poultry litter storage, transport, and utilization policies are not only important to those on the Delmarva Peninsula. In Maryland and Virginia, the agricultural producers of their respective western shore counties have a clear interest in preserving the movement of litter outside of the Delmarva Peninsula to meet their organic nutrient demands. Additionally, the aforementioned expansive Delmarva poultry litter market for mushroom producers in Pennsylvania may affect policy dynamics with its large economic contributions to Delmarva poultry producers and litter haulers. For example, between 2017 and 2019 out of all of the litter transported via funding assistance from a state litter transport program, 9% of litter transported from Delaware and 71% transported from Maryland went to Pennsylvania mushroom farms (Duke & McGrath, 2022). As such, regulatory decision-making is undoubtedly shaped by the nutrient demands of western shore constituencies as well as a recognition of the value of interstate transport of litter to Pennsylvania.

With these economic, environmental, political, and regulatory dynamic realities in mind, the following section describes key issues with each state's poultry litter storage, transport, and utilization policies.

## **Main Policy Issues**

### *Litter Storage*

Poultry litter storage on the Delmarva Peninsula often refers to the practice of "field staging." Field staging is when a producer stores litter outside temporarily at the site of its



application. This storage method is the final destination for poultry litter after transport and before its application on a farm field. Maximum field staging times and management actions for the litter stockpile pre- and post-removal vary between each Delmarva state. The differences in each state's regulations are found below in Table 3.

***Table 3: Delmarva State Poultry Litter Field Staging Regulations. Sources: Delaware Administrative Code, Maryland Department of Agriculture, and Virginia Department of Environmental Quality***

State	Maximum Field Staging Time	Required Staging Area Actions Post Pile Removal	Staging Area Utilization Frequency	Stockpile Cover Requirement
<b>Delaware</b>	90 days	First 1-2 inches of topsoil removed, and cover or production crop planted	Cannot use the same staging area for more than two consecutive years	Up to 14 days without a cover
<b>Maryland</b>	No maximum day limit; must be applied before the first spring after stockpile establishment	If stockpile is established in the fall, a cover crop must be planted on staging area	No limit on consecutive uses of staging area	No required Cover
<b>Virginia</b>	No maximum	No required actions post stockpile removal	No limit on consecutive uses of staging area	Up to 14 days without a cover

The mismatched nature of these various field staging regulations affects the decision of poultry litter haulers or producers on where to send their litter, if a farmer may decline the litter even if they want it, as well as the overall distribution of litter nutrients across the Delmarva Peninsula. Maximum staging times range from highly prescriptive to absent, and this trend continues in how strict post-application procedures are in each state as well as staging area

frequency limits. The only divergence in this trend is in stockpile cover requirements. All of these requirements affect on-farm storage times as well as transport frequencies and distribution. For example, Delaware farmers with a hard deadline to apply litter or move it off of their land may contribute to more frequent transport of litter in the upper parts of the Peninsula in or near Delaware. Additionally, some Delaware farmers may miss out on litter storage one year because they do not have an appropriate location for a pile that is not on an application site that has reached its two-year limit on consecutive uses. Looking down to Virginia, stockpiles remaining outside for longer than 14 days must have an impermeable cover. However, they may be kept outside without a maximum time limit or restrictions on consecutive years that a staging site may be used, causing a less mobile litter market and higher chances for nutrient runoff. This lower mobility may reduce the appeal of moving litter far up the Peninsula when a transport program incentive can send it more cheaply over the Bay to Virginia coastal counties on the western shore.

Litter storage policies alone are limited drivers of environmental and economic outcomes. When regarded in the context of other Delmarva poultry litter management issues like transport and utilization, these negative effects are complementary.

### *Litter Transport and Utilization*

Each Delmarva state has a program designed to reduce the total cost of transporting poultry litter from poultry producers to farmers who need to amend their soils. These are called poultry litter transport programs, and each Delmarva state has set up their respective program differently than the next. Due to vastly different price guarantees, access opportunities, and eligibility requirements for the litter transport programs of each state, poultry litter transport is often conducted with unnecessary economic inefficiency as well as environmental detriment. Litter utilization issues are tied directly to this economic incentive, with soil fertility requirements and calculation methods varying across each state.

One example of an issue with these unharmonized programs pertains to out-of-state transportation of litter to the detriment of in-state growers who have nutrient needs. Some programs may inadvertently incentivize the transport of poultry litter out of the respective state's counties within the Chesapeake Bay watershed. While the intention is to remove litter from

Delmarva areas saturated with phosphorus, this may take litter to places out of state that are still within the Chesapeake Bay watershed yet more at risk of nutrient runoff. Additionally, it may deprive the region's farmers of a local nutrient source. One example of this is in Delaware where 6,446 tons, roughly 5% of total litter, moved via the Nutrient Management Relocation Program was sent to Pennsylvania mushroom producers (Delaware Nutrient Management Commission, 2021). Another specific issue is inconsistency in soil fertility requirement nomenclature for utilization and funding access. Each state's soil fertility requirement is expressed or calculated in different terms. This simple inconsistency may lead to unnecessary confusion for transport program applicants. Table 4 below describes each program and their respective characteristics:

**Table 4: Delmarva State Litter Transport Programs.** Sources: U.S. Environmental Protection Agency, Delaware Department of Agriculture, Maryland Department of Agriculture, Maryland Department of Budget and Management, Virginia Department of Conservation and Recreation, and Virginia Department of Planning and Budget

State	\$/Ton of Litter Removed	Maximum Volume of Litter per Request	Transport Distance/ Location Requirements	Destination Soil Fertility Requirement (phosphorus)	FY2021 Program Budget
<b>Delaware</b>	Up to \$18/ton	No Maximum	Any nutrient-eligible farm within or outside of Delaware	$\leq 75$ ppm P	\$511,915
<b>Maryland</b>	Up to \$28/ton	No Maximum	Must be transported more than 7 miles from sending farm	$\leq 91$ ppm P	\$527,317
<b>Virginia</b>	\$20/ton for litter sent from the Delmarva Peninsula	800 Tons	Must originate in Virginia Delmarva county and be sent to Virginia areas	$\leq 253$ ppm P	\$420,000

The disparate nature of these criteria is clear. Great dissimilarities exist in the price guarantee per ton of litter moved, transport distance/location requirements, and soil fertility requirements of the destination. All of these differences create greater incentives for some areas while leaving other areas less favorable. For example, the transport incentive program in Virginia only provides funds for litter transported to other counties in Virginia, all of which are not on the Delmarva Peninsula. Whereas in Delaware and Maryland, the litter may be transported anywhere that will accept it with suitable soil phosphorus levels, without preference for Delmarva destinations.

Additionally, soil fertility requirements for the destination farms are similar but calculated using different methods. Each required phosphorus saturation level is expressed differently in transport program informational literature, whether that be Fertility Index Value (FIV) or lbs. P per acre according to different calculation methods. This simple difference in nomenclature is an unnecessary mismatch in transport program criteria that may elicit confusion for Delmarva litter haulers or producers should policies become greater aligned in the future.

#### *Risk of inaction:*

The negative effects of continuous inaction on Delmarva poultry litter transport program reform are stated well by the DLLC in its founding 2015 report: “The net effect of nonuniform and changing regulatory environments is financial uncertainty and unnecessary complexity for grain farmers, poultry growers, litter haulers, and integrators in managing nutrients associated with poultry production” (Delmarva Land and Litter Work Group, 2015). Simply put, the existing situation with Delmarva poultry litter transport programs is unnecessarily complex, and modifications to each program specific to their application on the Delmarva Peninsula may help achieve regional environmental goals and improve economic outcomes for poultry producers and farmers alike.

### **Existing Fora to Address Policy Challenges**

Environmental and economic challenges faced by the agricultural industry on the Delmarva Peninsula, as well as solving these challenges for positive progress, are not new concepts. For Delmarva poultry litter management issues, there are two main existing fora in which these issues are discussed: the Delmarva Land and Litter Collaborative (DLLC) and the Chesapeake Bay Program (CBP). These groups are different in structure, history, mission, and composition. However, they both are collections of professionals from a variety of organizations and institutions in the public and private sectors looking to improve the relationship between agriculture and the Chesapeake Bay through well-informed public policy and scientific inquiry. The DLLC and CBP are described below in terms of their compositions, influence on policy, and the venues within each structure in which issues regarding poultry litter management policies may be debated and affected. Lastly, the question of which institution may be best suited to debate and address recommendations to improve these policy challenges is discussed.

#### *Delmarva Land and Litter Collaborative (DLLC)*

The DLLC is a forum of diverse stakeholders in government, academia, private enterprise, and others brought together to identify solutions that support healthy, productive ecosystems as well as farming and poultry on Delmarva. This group formed in 2015 with the intention of developing new approaches to tackle poultry litter challenges and protect Delmarva waterways. In terms of state agency participation, this group includes the Maryland and Delaware departments of agriculture, as well as the Virginia Department of Environmental Quality. It is a coalition of many of the interested stakeholders at this time and does not currently serve as a policy-influencing body. It's 2019-2024 Strategic Roadmap contains the following five goals which indicate a mission more along the lines of information-sharing rather than influencing (Delmarva Land and Litter Collaborative, 2019):

1. Convene a forum of a diverse group of respected members and create a collaborative approach to achieve DLLC's mission
2. Engage stakeholders to learn about both the needs and possible solutions to achieve DLLC's mission
3. Craft credible and vetted solutions that address regional issues related to the mission
4. Share findings with stakeholders and decision makers

## 5. Leverage and diversify resources to support the mission

In the original 2015 program overview, the DLLC identified five major recommendations. One of these recommendations was to “Standardize Regulations for Manure and Litter Storage, Transport and Use,” however this recommendation was not further expanded upon (Delmarva Land and Litter Work Group, 2015). The most elaborate cooperative effort of the DLLC so far was an attempted mass balance study in 2019 which sought to identify to what extent, if any, available poultry litter nutrients exceeded local crop demand for fertilizer at a county level on the Delmarva Peninsula. This study may have served to inform litter management policies, like determining which counties merit prioritization in poultry litter transport programs by identifying which counties are in need of nutrients. However, the final report was never fully agreed upon, and a comparatively brief report with methods, assumptions, and notes on unresolved issues was released instead (Mulkey et al., 2019). The last publication relevant to this study is a document on model poultry litter transport program attributes which may be helpful to policymakers to an extent and contains thoughts on improving litter management policies more broadly (Delmarva Land and Litter Challenge, 2017). Other than these reports, DLLC has produced few potential policy-influencing publications. Rather, the organization has hosted numerous educational events to bring together relevant stakeholders.

DLLC’s stakeholders may have connections to policymakers individually, however these individual strengths may not translate into collective influence on policy. In short, DLLC is not a decision-making forum. While it is a laudable effort that certainly has a bright future in Delmarva litter management stakeholder collaboration, DLLC may not currently be the best vehicle to harmonize the policy landscape of Delmarva poultry litter management through direct influence on policy debates. This group can be a potential forum for building consensus around solutions, but its scope of influence and function in affecting policy change may be limited.

### *Chesapeake Bay Program (CBP)*

The CBP is a collection of federal and state agencies, local governments, non-profit organizations and academic institutions with the express mission of protecting the Chesapeake Bay. This regional partnership formed from the Chesapeake Bay Agreement of 1983 in which the Governors of Maryland, Virginia, and Pennsylvania, the mayor of Washington DC, the

Administrator of the EPA, and the Chair of the Chesapeake Bay Commission agreed that a cooperative policy approach was necessary to tackle pollution problems that face the Bay (The Chesapeake Bay Agreement of 1983, 1983). CBP has a wide-reaching mission with many successes over the years. However, its mandate is broad and highly nuanced issues like those presented with poultry litter management policies on the Delmarva Peninsula have not been addressed.

The CBP now includes 19 federal agencies, nearly 40 state agencies in Delaware, Maryland, New York, Pennsylvania, West Virginia, Virginia, and Washington, DC, as well as 1,800 local governments, more than 20 academic institutions, and over 60 NGOs (Chesapeake Bay Program, 2021b). One challenge of such a broad platform is simply that it contains all of the states within the Chesapeake Bay watershed. As such, its scope of pollution issues is quite wide and competing interests exist throughout its program. Efforts are often bogged down by the states who have unenthusiastically engaged in Bay protection efforts, like Pennsylvania, because of the small cultural and economic relevance of the Bay to these states. This may affect policies which govern nutrient management in Delmarva and beyond because states in the wider watershed may be less inclined to act. Despite this natural dynamic, its capacity as a forum for important stakeholders of the region is advantageous to collaboration. As for how CBP may affect Delmarva poultry litter management policies, options exist.

Firstly, it is possible for a specific element of Delmarva poultry litter issues to be raised during a meeting of the Agriculture Workgroup. This workgroup is composed of agriculture experts from academic institutions, federal and state agencies, interstate organizations, environmental non-profits, and agriculture industry representatives. The workgroup reports to CBP's Water Quality Goal Implementation Team and is charged with the development and implementation of policies, programs, and research to reduce pollutant loads delivered from agricultural lands and animal operations to upstream waters and the Chesapeake Bay (Chesapeake Bay Program, 2022). The Agriculture Workgroup meets once a month, and Delmarva poultry litter management issues such as storage, transport, and utilization policies are certainly relevant topics that may find an eager audience here.

Another option is a workshop of the Scientific and Technical Advisory Committee (STAC). STAC is composed of scientific and technical experts from academia, state and federal agencies, environmental NGOs, and private industry. STAC serves as a source of scientific and

technical expertise to CBP through technical reports and position papers, discussion groups, assistance in organizing merit reviews of CBP programs and projects, and technical workshops. STAC is considered the liaison between the Chesapeake Bay watershed scientific community and the CBP (Chesapeake Bay Program Scientific and Technical Advisory Committee, 2021). STAC holds workshops throughout the year that serve as forums for creating recommendations from the scientific community on information needs, opportunities for regional collaboration on particular issues, and further management actions. A STAC workshop may be a good venue for discussing the scientific merits of solutions to Delmarva poultry litter management policy issues.

Discussions through either of these two venues within CBP may generate ideas and enthusiasm for tackling the policy issues regarding poultry litter storage, transport, and utilization. The work of both the STAC and Agriculture Workgroup are tied to the rest of CBP, with regional policymakers found throughout its structure including the CBP Executive Council composed of the Governors of each Bay watershed state, the mayor of Washington DC, the Administrator of the EPA, and the Chair of the Chesapeake Bay Foundation.

### *Ideal Forum for Affecting Policy*

After looking at both of these existing regional collaboratives that may affect policy and address current issues, CBP is the clear venue for voicing and refining the recommendations that are presented in the next section.

DLLC is a laudable private effort by stakeholders across the Delmarva Peninsula in particular, but at this time it does not have as large of a potential impact on policymaking as that of CBP. DLLC may in the future become the preferable venue, but currently CBP is a more direct link to policymakers at this time. Additionally, CBP has an organizational structure suited to address these policy issues in multiple concrete ways. CBP's vast bureaucracy may inhibit swift action to discuss these issues, but it is currently the ideal venue for forming interstate collaboration on policy action related to Delmarva poultry litter management.

## **Recommendations to Address Policy Barriers**



The recommended actions to improve Delmarva poultry litter management policies are as follows:

### **1. Harmonize outdoor poultry litter storage requirements to the best extent possible**

Across all Delmarva states, the requirements for outdoor poultry litter storage referred to as “field staging” range from the highly prescriptive timing and post-application management practices of Delaware to absent maximum storage times, stockpile cover requirements, and post-application management practice regulations in Virginia. Maryland’s regulations are closer to Delaware on the policy spectrum but still somewhere between Delaware and Virginia with more flexible maximum storage times and post-application management practices. This range of policies from highly prescriptive to highly flexible is not conducive to the mobility of poultry litter on the Peninsula, as farmer access to litter may be limited to certain times of the year when they don’t need it, some areas may be moving litter more frequently than others to the detriment of local areas with distinct nutrient needs, and other mobility issues that may arise from general confusion over disparate requirements.

As such, any form of policy standardization should be sought out that fosters the following outcomes: a) flexibility for poultry producers and haulers looking to move litter to areas that it needs to go and b) appropriate structure in requirements that provides greater regulatory certainty for reliable litter mobility throughout the Delmarva Peninsula. This may take the form of relaxing or strengthening maximum storage times, requiring stockpile covers, improving required post-application management practices, or loosening consecutive stockpile year limits.

### **2. Establish a litter transport program price premium for the transport of litter to phosphorus-deficient Delmarva destinations**

With such an abundant resource on the Peninsula, the nutrient needs of Delmarva farmers who may choose to responsibly utilize poultry litter with respect to environmental health should be prioritized over farmers outside of Delmarva. As such, one way to incentivize this prioritization may be to offer a premium on the transport of poultry litter to a destination on the

Delmarva Peninsula itself using the respective litter transport program of each Delmarva state. With an appealing funding premium, producers or haulers looking to transport litter will seek out suitable Delmarva destinations before looking outside of the Peninsula. This may naturally increase the number of Delmarva producers meeting nutrient deficiencies with local poultry litter, if they choose to use it. Additionally, it may discourage unnecessarily use of synthetic inputs or sending litter outside of the Peninsula to other locations in the Chesapeake Bay watershed.

### **3. Harmonize transport distance and destination requirements**

Each Delmarva state's litter transport program has different transport distance and destination requirements with perhaps unintended negative consequences. One potential negative consequence may be that Delmarva farmers are deprived of litter if they are outside of a certain distance or area.

In Delaware, there is no transport requirement for litter in terms of distance or destination so long as it meets the soil fertility requirements of their program. In Maryland, litter must travel at least 7 miles from its source to access program funding. While in Virginia, Delmarva litter transport that receives program funding must travel to select counties in eastern and southeastern Virginia from Delmarva poultry producers. In the case of Delaware and Maryland, litter can be transported to locations within the Peninsula, but it is not required or prioritized in the application. In the case of Virginia, transport program funding can only be accessed if litter is sent outside of the Delmarva Peninsula to other Virginia counties.

To better meet the nutrient needs of Delmarva farmers with eligible soils and relieve any confusion for poultry producers or farmers caused by these various requirements, transportation and destination requirements should be made more complimentary for litter transport on the Delmarva Peninsula. This could be accomplished by allowing the Virginia poultry litter transport program to be used for transport within the Delmarva Peninsula or modifying all three states' program regulations in a way that gives preference to transport to Delmarva destinations.

### **4. Agree on common soil fertility requirement nomenclature in Delmarva litter transport destinations**

In each Delmarva state, there are soil fertility requirements for fields that litter may be applied to if the litter is transported with funding from the state litter transportation program. In Delaware and Maryland, these requirements are expressed on program literature and websites in terms of Fertility Index Value (FIV), which indicates the general level of a particular nutrient. In Virginia, these are indicated by lbs. nutrient per acre. With poultry litter, phosphorus is the most closely monitored soil nutrient. These requirements ensure that litter is not applied to a field that is already excessively saturated with phosphorus and at risk of becoming a source of phosphorus pollution into the Bay. In fact, there are not just three slightly different soil fertility requirements. Maryland and Delaware have just one each, but Virginia has multiple depending on the destination county if the litter is transported using the Virginia litter transport incentive program. The current situation is a landscape of different destination soil fertility requirements, expressed in different units, using different calculation methods in each state for poultry producers and farmers who would like to access their state's respective poultry litter transport program for cost reduction purposes. This situation is confusing and may discourage Delmarva producers or haulers from using the transport programs to meet the nutrient needs of Delmarva farmers that are not far away but happen to live in the borders of another state. This endangers the economic and environmental goals of the litter transport programs as well as the mobility and ease of access to poultry litter on the Peninsula. As such, Delmarva states should agree on common soil fertility standards and nomenclature for litter transport program funding applications whose destination is on the Peninsula.

## **Implementation of Recommendations**

### *Authority to Implement*

As mentioned in the previous section on Political Realities and Decision-Making Dynamics, each Delmarva state has a regulatory agency with statutory authority to regulate agricultural nutrient management. Poultry litter management policies fall well within the bounds of agricultural nutrient management policies.

For recommendations 1, 3, and 4, this authority is clear because the recommended changes are matters of program requirements, application preference, and other items that are administrative in nature. However, recommendation 2, which proposes to establish a Delmarva litter transport program premium, is more complicated due to the potential budgetary implications of such a policy change. In Delaware, the Nutrient Management Commission may establish the guidelines for a \$2 premium on top of their existing \$18 per ton litter transport program payment because nutrient management funding laws dictate that payments “shall not exceed \$20 per ton of poultry or nonpoultry waste” (3 D.E.C. § 2249 2002). In Maryland it is unclear and subject to market conditions whether a premium can be paid on top of the existing maximum payment of up to \$28 per ton. This uncertainty is caused by the current state nutrient management law which states that “the state shall provide up to 87.5% of the transportation and handling costs, as determined by the Department, per ton for livestock manure” (1 M.D.C. §8–704.2). In Virginia, the uncertainty of price premiums is even more exaggerated, with the original authorization statute for the Virginia litter transport program making no mention of economic incentive specifications (3 V.A.C. § 62.1-44.17:1.1). Thus, the Virginia DCR’s authority to establish a price premium for inter-Delmarva litter transport program funding may or may not be at the discretion of Department leadership.

With these considerations in mind, the regulatory authority by which Recommendations 1, 3, and 4 can be implemented are clearly at the discretion of the respective regulatory bodies in each state. However, for Recommendation 2, the budgetary implications of this policy change may or may not require legislative approval in Virginia and added scrutiny in Maryland.

### *Implementation Process*

The implementation process may proceed in the following manner:

1. Discuss, debate, and agree upon potential policy changes at a mutually respected forum
2. Conduct the regulatory process in each Delmarva state
3. Evaluate policy change outcomes after a certain period of time
4. Consider options for improvement

These recommendations are meant to affect storage, transport, and utilization of poultry litter across the *entire* Delmarva Peninsula, thus the first step of this process is to discuss these proposed recommendations at a mutually respected forum. As noted previously, the Chesapeake Bay Program is the preferred forum for this type of interstate policy collaboration. Within CBP, the two options in terms of venue for this collaborative process are a meeting of the Agriculture Workgroup or a workshop of the Scientific and Technical Advisory Committee (STAC). Each venue has its particular strengths. The Agriculture Workgroup focuses on agricultural nutrient issues more generally and has broad membership with individuals from academia, environmental non-profits, agricultural producers, interstate organizations, and, most importantly, state agency representatives. With this in mind, the Agriculture Workgroup would be the ideal venue to discuss Recommendations 1, 2, and 3 due to their policy focus and social dynamics. However, Recommendation 4 regarding standardizing nomenclature for soil fertility requirements of utilization in litter transport programs is more technical in nature. This type of discussion may benefit from the wealth of technical expertise on the STAC during a workshop and have their findings communicated among state agency representatives of the Agriculture Workgroup.

If the recommendations form into concrete policy proposals that each Delmarva state agrees to act upon, the rulemaking process in each state will commence to begin regulatory implementation. Through rule drafting, public notice and comment, revision, and final notice, each Delmarva authority may form appropriate regulations to adopt these policies.

Implementation does not necessarily stop at the adoption of new regulations. The effect of these policies should be monitored and evaluated over time to see if the desired outcomes have indeed been achieved in at least partial capacity. As such, upon agreeing to the proposed policy changes, continuous improvement of the poultry litter management policy environment should be an essential part of implementation moving forward. CBP would be the appropriate forum to reconvene the appropriate stakeholders in the previous venues within the Program to discuss the status of this policy environment and concurrent outcomes. Should there be any improvements to be made based on the lessons learned through the initial implementation, this process will have set up a clear process for collaborative dialogue between the Delmarva states on these policy issues.

## **Obstacles to Implementation and Options to Overcome them**

Throughout any policymaking process, obstacles and pitfalls abound. Any policymaker, policy professional, or interested stakeholder knows that even the soundest policy proposals can languish in obscurity despite their obvious merits or noble intentions. Simply put, there is no perfect policymaking process in practice. These recommendations are no different, and there are numerous obstacles present. The following setbacks may occur during implementation. Additionally, suggestions or perspectives are presented to overcome them.

### *Failure to agree upon common policy particulars*

Recommendations which seek to unify the Delmarva states behind common policy particulars may be more difficult than others to implement. For example, a policy like standard nomenclature for soil fertility requirements of Delmarva litter transport destinations may be more difficult to negotiate than something like giving preference criteria to eligible Delmarva farmers in litter transport programs. Not only is this nomenclature a technical issue debated among the academic institutions in each state, but unit terms like FIV versus lbs. P/acre are specified in other agricultural regulatory contexts and programmatic literature across the state. This type of inconsistency in how units are expressed across regions within each state under the same regulatory authorities may be undesirable for regulators and regulated individuals alike. With this issue in mind, discussions should be deliberate in specifying how certain policies may be most respectful of each respective state's broader regulatory context.

### *Failure to agree upon Delmarva-wide action*

These recommendations are meant to harmonize poultry litter management policies across the entire Delmarva Peninsula. This is ineffably an ambitious goal whose success is based on the accord of parties across political boundaries and different policy contexts despite their geographic unity. It is entirely possible that these recommendations may not be implemented among all three Delmarva states. However, a scenario in which just two of the Delmarva states succeed in harmonizing their poultry litter storage, transport, and utilization policies to the fullest extent possible is an objective improvement to the status quo.

### *Resistance to the disruption of current litter flows*

In increasing the mobility of litter within the Delmarva Peninsula it is likely that areas outside of the Peninsula which benefit from current negative policy incentives to move litter outside of the region may resist these changes. Practically speaking, if more litter is circulating and distributed within the Peninsula, less litter may be leaving it. These areas and constituencies include the western shore regions of Maryland and Virginia as well as Pennsylvania mushroom growers, and they depend on reliable Delmarva litter flows outside of the region. These areas are a significant existing market for Delmarva poultry litter and have legitimate nutrient needs. As such, regulators may be loath to implement policies based on these recommendations that too heavily disrupt moving litter outside of the Peninsula to areas that both need and desire it. With this question of fairness in mind, policymakers discussing implementation of these recommendations should be mindful to prioritize Delmarva's internal litter demands and mobility while allowing for sufficient litter movement outside of the Peninsula. An ideal outcome for policymakers would be one in which litter can satisfy Delmarva nutrient demands in regions that need it to the greatest extent possible while maintaining viable external markets for litter flows.

### *Non-prioritization at regulatory agencies after negotiations*

The final obstacle to any policy being implemented is simply bureaucratic inertia. The agencies which regulate poultry litter storage, transport, and utilization in each state have a wide range of priorities, and Delmarva harmonization on these issues simply may not be an appealing undertaking. This is commonplace in any bureaucracy and this situation is no different. With this in mind, raising these issues at a respected forum like CBP with the appropriate regulatory agency representatives present may elevate their current prioritization, or lack thereof.

## **Conclusions**

The Delmarva Peninsula is a region with a noble agricultural tradition and a strong history of continuous improvement within this sector. Poultry production is the largest industry within the Delmarva agricultural sector, generating large economic contributions to the area.

Currently, the nutrient-rich poultry litter generated from the industry is inefficiently distributed across the Delmarva Peninsula. Some farmers that desire to use poultry litter to amend phosphorus-deficient soils cannot easily access this resource, while other areas' soils are rich in phosphorus but cannot effectively move litter outside of those places. The current policies which govern poultry litter storage, transport, and utilization on the Peninsula across each respective state are uncoordinated in a way that inhibits the mobility of this valuable regional resource. In this study, recommendations are presented to ameliorate the poultry litter management policy landscape of this region in a way that improves farmer access to litter and more effectively distributes this resource among appropriate areas of the Peninsula.

The recommendations of this study are not necessarily new or innovative solutions to the current situation. Rather, these recommendations are based on existing regulatory authority and refined from perspectives and ideas put forth in regional scholarly and stakeholder-driven literature spanning over 20 years. These recommendations may serve as a starting point for policy coordination among regulatory authorities in each state to allow for stakeholders in poultry litter management to participate in the Delmarva agricultural tradition of continuous improvement to achieve environmental and economic goals.



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