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# Comparing Participation in Nutrient Trading by Livestock Operations to Crop Producers in the Chesapeake Bay Watershed

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## What Is the Issue?

Despite decades of recuperation efforts, the Chesapeake Bay's water quality has not met desired goals. This has prompted the U.S. Environmental Protection Agency (EPA) to adopt a limit on the amount of pollutants that the watershed can receive and still meet water-quality goals, called a total maximum daily load (TMDL). Specific pollutants of concern in the Chesapeake Bay include nitrogen and phosphorus, nutrients that can lead to adverse effects on public health, recreation, and ecosystems if present in excess amounts. The EPA estimates that the application of commercial fertilizer and manure to agricultural land contributes at least 39 percent of nitrogen and 57 percent of phosphorus loadings to the Chesapeake Bay. Of those agricultural loadings, approximately half are due to applications of commercial fertilizer, while half are due to manure.

Two highlights of States' TMDL implementation plans are greater oversight of discharges from animal feeding operations (AFOs) and nutrient trading. AFOs are livestock operations that raise animals in confinement. Certain AFOs, called confined animal feeding operations (CAFOs) are regulated under the Clean Water Act (CWA). However, CWA regulations do not fully satisfy water-quality goals, in part because many AFOs fall outside of regulatory purview. To address potential runoff from these operations, Federal, State, and local governments offer outreach, education, and financial assistance to encourage adoption of practices that are less polluting. But recent studies have shown that agricultural operations do not implement these practices to the extent necessary to satisfy water quality goals.

Nutrient trading is a system in which polluters with higher costs of pollution reductions (e.g., wastewater treatment facilities) pay those with lower costs (like agricultural producers) to limit discharges. Before they can generate pollution reduction credits for sale, agricultural producers must first meet baseline requirements, including shipping any excess manure nutrients off-farm. The literature on nutrient trading in the Chesapeake Bay almost exclusively considers crop agriculture, overlooking several factors that may affect livestock producers' participation in nutrient trading.

This report builds on the June 2014 USDA, Economic Research Service report, *An Economic Assessment of Policy Options To Reduce Agricultural Pollutants in the Chesapeake Bay*, by providing a more detailed examination of nutrient-management complexities and participation

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in nutrient-trading, according to farm type. It addresses the extent to which AFOs are implicated in Chesapeake Bay nutrient pollution and compares nutrient-trading participation in AFOs versus crop-only farms and by AFOs of different sizes.

## What Did the Study Find?

AFOs (of which CAFOs are a subset) are responsible for the majority of manure acreage in the Chesapeake Bay, and just over a quarter of these operations produce more recoverable manure nutrients than can be used on a given farm.

- In 2012, an estimated 46 percent of recoverable manure nitrogen and 60 percent of the recoverable manure phosphorus in the Bay was produced on farms without enough crop and pastureland assimilative capacity to accommodate the manure nutrients.
- Though they constitute only 15 percent of agricultural operations and cover only 30 percent of crop and pastureland in the Chesapeake Bay watershed, AFOs controlled 63 percent of the acreage to which manure is applied (manure acreage) in 2012.
- AFOs are more likely than other types of farms to apply manure, but not all of them do. Only 60 percent of AFOs report applying manure to crop or pastureland, although 92 percent of them have such land.
- Twenty-six percent of Chesapeake Bay AFOs produce (via manure) more nitrogen than can be assimilated on the farms where it is produced. Forty-six percent of AFOs produce more phosphorus than can be used on the farms.

The CWA CAFO regulations and other differences between livestock and crop-only farms may create differences in the likelihood and benefits of participating in nutrient trading.

- To meet baseline requirements for nutrient trading, producers must satisfy all regulations. Actual or perceived regulation may deter livestock operations from approaching the trading authority.
- In many nutrient-trading schemes, an aspect of meeting the baseline is a nutrient management plan (NMP) requiring that nutrient applications do not exceed onfarm needs. Operations producing more manure nutrients than can be agronomically assimilated may incur costs for shipping nutrients off-farm in order to meet an NMP. Crop-only producers utilizing commercial fertilizer do not generate nutrients onsite, so they will not face these additional costs.
- Agricultural producers may generate nutrient reduction credits to sell when they lower nutrient discharges below the level allowed in an NMP. This reduction may require operations that generate manure to ship nutrients off-farm at an additional cost. Operations relying solely on commercial fertilizer can actually reduce an expense by lowering nutrient applications. An added cost for manure producers compares with a saved expense for crop-only producers.

In this report, we simulate trading whereby producers generate credits by reducing their onfarm applications of manure and fertilizer below the agronomic rates required to participate. Simulation results using a \$20 per credit price show that AFOs without excess manure nutrients are as likely to participate as large-scale, crop-only producers. AFOs with excess manure nutrients are much less likely to be able to participate and, even if able, to find it cost-beneficial.

- Thirty-five percent of small AFOs with onfarm excess manure nutrients have no nutrient uptake capacity on cropland. In the modeled trading program, farmers generate credits by reducing applications to cropland. Because they cannot reduce applications to cropland, these producers are not potential trading participants. Around half of medium and large AFOs with excess manure nutrients also have no cropland (48 and 51 percent, respectively).

- Among AFOs with excess nutrients that are potential participants, only 35 percent of small AFOs would find it cost-beneficial to participate. In contrast, more than half of medium AFOs and 59 percent of large AFOs with excess nutrients would find participation cost-beneficial.
- AFOs with onfarm excess nutrients have relatively little cropland (when they have any at all). These farms, therefore, cannot generate as many credits from reduction of nutrient application to cropland; this means they cannot generate as much revenue from participating in nutrient trading as operations with more cropland.

## **How Was the Study Conducted?**

This report describes livestock agriculture in the Chesapeake Bay using 2012 Census of Agriculture data. (The 2012 Census of Agriculture is the most recent one, conducted by the U.S. Department of Agriculture's National Agricultural Statistics Service in 2012, with the first data results released in mid-2014. The census is conducted every 5 years.) Next, measures of nutrient uptake and generation for every farm in the Bay watershed are estimated, using USDA Natural Resources Conservation Service (NRCS) methods, which account for animal type, region, crop yield, and production facility size. The effects of Clean Water Act regulations on livestock operations' participation in nutrient trading is discussed, and a numerical simulation model of agricultural operations' participation in nutrient trading via reduction of nutrients to cropland is constructed, accounting for yield reductions, manure-shipping costs, and multiple other factors. Finally, participation is predicted across types of producers, and sensitivity analyses are conducted by varying model parameter assumptions.