Center For Agricultural & Natural Resource Policy

RESEARCH BRIEF

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Water Quality Credit Trading

Can aggressive pollution reduction in one sector compensate for continued pollution in another? Pollution credit markets are designed to make this trade-off work. But is the time ripe for water quality credit trading systems to serve as an effective means of reducing pollution from farmland? Dr. Doug Parker of the University of Maryland is skeptical.

AT A GLANCE

- Agricultural by-products are the greatest source of pollution in many of the nation's waterways.
- Economists believe that enabling point source polluters to purchase pollution rights from agricultural non-point source polluters can reduce the costs for point source polluters to meet increasingly strict permit requirements.
- Over the past couple decades, a range of market-based water pollution reduction programs have been tried and many have failed—some were short-lived, while others resulted in little cost savings.

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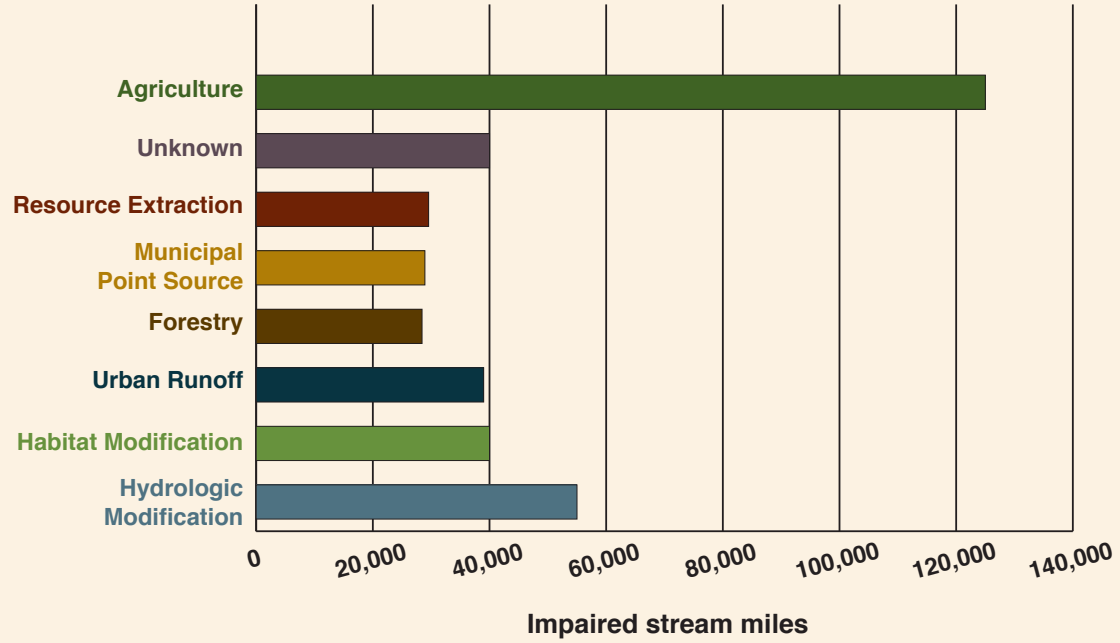
Stormwater runoff from cropland and livestock farms carries nutrient-laden manure, chemicals (such as fertilizers, herbicides, and insecticides), sediment, and bacteria. People refer to this runoff as "non-point source" (NPS) water pollution because it comes from many different sources spread over a wide area. These agricultural by-products make their way into our rivers and streams, where they can cause significant harm. In fact, they are often cited as the top source of pollution in United States waterways. Agricultural runoff is a potent problem not because specific farmers pollute in huge quantities, but because agriculture occupies such a large percentage of land—relatively small emissions per acre can add up to considerable cumulative amounts.

Economists have long promoted market-based solutions to pollution control. Policymakers are now turning to the idea of pollution credit markets for reducing agricultural runoff. There is debate, however, over whether the time is yet ripe for this type of approach. Dr. Doug Parker at the University of Maryland Department of Agricultural and Resource Economics grapples with this question. Parker researches the complexities confronting water clean-up efforts and the challenges of using pollution credit markets as a policy tool. He has assisted with the development of a water quality credits trading program currently active in Pennsylvania and helped develop methods for evaluating such programs.

Parker has also been very active in the development and implementation of Maryland's NPS water quality credits trading program. While generally optimistic about its trajectory and Maryland's advantages over other programs, Parker cautions that important questions remain about the effectiveness of this approach. In a recent analysis with colleagues Charles Abdalla, Tatiana Borisova, and Kristen Saacke Blunk, Parker cautions policymakers that these programs are still nascent and should be viewed as preliminary experiments that will help create workable credit market systems in the future.

Leading Sources of Impairment in Surveyed Rivers and Streams in the United States



Source: U.S. EPA, National Water Quality Inventory: 2000 Report, No. 841R02001, August 2002.

How to Curtail Water Pollution?

Farmers of course have no particular desire to pollute. In fact, many farmers think of themselves as good stewards of the natural environment, actively seeking to maintain the surrounding ecosystems. Runoff is simply an undesirable by-product in the production of agricultural goods that consumers value. While most agricultural producers could probably reduce their polluted runoff, doing so is costly. Thus, reductions in these pollutants are likely to cause higher food prices. In addition, for those agricultural producers operating with a small margin of profit, it may not be possible to independently reduce runoff without going broke. Given the costs, few farmers are likely to voluntarily reduce pollutants without some extra incentives.

Regulation is one way to create such incentives. The imposition of fees on polluters who surpass acceptable levels of undesirable emissions would likely reduce total pollution of factories and sewage treatment plants. In the case of agricultural runoff, however, monitoring and measuring emissions is difficult and expensive. While the cumulative effects of runoff are observable via water quality, it is often impossible to identify specific farms as the culprits. Both regulators and farmers have difficulty determining pollution amounts coming from a specific field. Even if runoff amounts from each farm could be accurately measured, monitoring emissions flows from large areas of farmland could result in regulation costs that exceed the benefits of cleaning up the pollution.

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- The greatest challenges for a well-functioning water quality credit trading system are specifying numeric thresholds for each pollutant, setting baselines for unregulated sources, ensuring an active supply of pollution credits, minimizing transaction costs, streamlining regulations and communication, and avoiding countervailing actions that may be induced in other areas.

Many argue that imposing strict environmental regulations would make United States agriculture less competitive globally. Farms that are forced to lower their pollution must pay the cost of pollution avoidance. The resulting increase in their production costs may make them less competitive compared to other nations with more lax or non-existent standards.

Given the obstacles to regulation, some policymakers have attempted to curb runoff through incentive payment programs. These entail government payments to farmers who voluntarily adopt environmentally friendly "best management practices." These payments are expensive, however. Due to limited budgets and low enrollment, incentive payment programs have had little success in resolving the runoff problem.

PHOTO: TARA DAVIS

Best Management Practices can be used to prevent pollution runoff. This picture shows mulched banks and vegetated soil lifts which will eventually be unrecognizable under a lush riparian buffer. Riparian buffers provide important ecological functions, such as providing wildlife habitat and filtering agricultural runoff.

Can Pollution Credit Markets Help?

Where does this leave us? What is the best approach to reducing water pollution? Could markets through which firms can buy and sell the right to exceed mandated pollution levels help resolve the problem?

Economists generally favor market-based approaches over regulatory approaches to resolve environmental problems. The idea is that, with the proper incentive system, private individuals will make voluntary choices which, when taken as a group, maximize the total benefits for everyone affected by the decisions. This spontaneous action through a market mechanism is presumably both more sustainable and much less costly than a "command and control" regulatory approach—all while achieving the same (or better) outcome.

Pollution credit markets have long been pushed by economists and are gaining traction in policy circles. Through these systems, pollution-emitting firms that can reduce their pollution at a lower cost than another firm may choose to cut their pollution beyond the required levels and sell the difference to the higher-cost firm. For example, one firm might decide to decrease its emissions by a certain specific amount below its maximum level permitted, and then sell the right to pollute that same amount to another firm that is having difficulty lowering its emissions to the required level. A system such as this not only creates costs for those surpassing their limits (negative incentives to promote pollution control), but also rewards producers who proactively reduce their pollutants. It also allows the participants to find the most efficient way to lower total emissions of the group as a whole (which is the end goal, after all).

Pollution credit markets, where successful, thus offer the promise of more effective pollution reduction and lower overall cost. The cap and trade program to limit sulfur dioxide

Recent Moves towards Water Quality Credit Trading Systems

Federal Level

2003 – The U.S. Environmental Protection Agency (EPA) issued a trading policy allowing industrial and municipal point sources to buy credits from farmers who implemented measures to improve water quality. These credits could be used by point source polluters to help them attain their own maximum allowed discharges.

2006 – The U.S. Department of Agriculture (USDA) reached an agreement with the EPA to promote water quality credit trading.

2007 – The USDA stated that it views market-based solutions as an important tool in federal environmental protection efforts in agriculture.

State Level

By 2009 – Maryland, Oregon, Idaho, Michigan, Ohio, Pennsylvania, and Virginia all passed legislation or created programs to promote water quality trading.

A range of market-based water pollution reduction programs have been tried over the last two decades and many have failed. Some were short-lived, while others resulted in little trading of credits. A few successful examples of water quality credit trading systems do exist, though their impact on water quality is unclear. Parker and his colleagues therefore suggest a more measured approach to exploring the ways in which a water quality credits trading system might work in the context of agricultural water pollution. They also advocate viewing current and future programs as experiments to help policymakers, analysts, and stakeholders learn how serious challenges can be met and overcome.

emissions in the United States of the early 1990s is often cited as one of the most successful types of such programs.

Too Early to Work for Agricultural Water Pollution?

The question is whether or not pollution credit markets can be used to address agricultural water quality concerns. Credit trading is useful under certain conditions, but is the time ripe for water quality credit trading systems to serve as an effective means of reducing agricultural runoff pollution?

Many economists have argued the benefits of enabling point source (PS) polluters, such as urban wastewater treatment plants, to purchase pollution rights from agricultural NPS polluters. A successful program would provide PS polluters flexibility in how to achieve the pollution limits set for them. This flexibility would in turn free up their resources for discovering better pollution abatement methods in their own industries. At the same time, PS polluters would make payments to farmers that would finance agricultural best management practices and help the PS polluters meet their pollution caps. Maintaining individual flexibility enables both PS and NPS polluters to collectively find the most cost-effective way to reduce the overall flow of water pollution.

Sounds great, right? To this end, there have been several recent policy moves at the federal and state level towards implementing pollution credit markets to improve water quality. But how well does this approach really work?

Challenges for Water Pollution Credit Trading Systems

Parker explains that, in order for a water pollution rights trading system to function successfully, several key challenges must first be overcome. (For a more comprehensive description of the critical elements required for a water quality trading program, see "Water Quality Credit Trading and Agriculture: Recognizing the Challenges and Policy Issues Ahead," Choices, 22(2), 2007).[1] One of the most important requirements is specifying actual numeric thresholds for each pollutant. This poses substantial difficulty in the case of agricultural water quality, as it requires translating broad public water quality goals (such as having a healthy fish habitat) into specific numeric thresholds for each pollutant. It may be difficult to accurately estimate

1 Available online at http://www.choicesmagazine.org/2007-2/grabbag/2007-2-06.htm.

How Farmers Obtain Sellable Credits in the New Maryland Program (in a Nutshell)

STEP 1: Select the Nutrient for Which to Sell Credits.

A farmer must first decide which nutrient (phosphorous or nitrogen) they will reduce in order to receive and sell credits.

STEP 2: Determine Baseline Requirements for a Given Nutrient.

Farmers go to a website (www.mdnutrienttrading.org), where they enter information about the portion of their farm operation they will use to generate credits. A baseline level is calculated, depending on the watershed in which the relevant field, pasture, or animal area is located.

STEP 3: Determine Whether Additional Best Management Practices are Required to Meet Baseline.

The farmer inputs the current pollution-reduction strategies employed on the farm. If this is enough to achieve the baseline, the farmer is told that additional practices will earn him credits he may resell. If he is still above the baseline, he can try entering practices to see the type and number that will bring him below the baseline and make him eligible to participate in the market.

STEP 4: Implement a Pollutant Reduction Strategy and Receive Sellable Credits.

Once the baseline is met, tradable credits can be generated from any existing or planned agronomic, structural, or land conversion practice that further reduces nutrients.

the amount of pollution reduction needed to meet specific water quality goals. Not only must a "cap" be set on each emission type, but the cap must be consistently enforced for the water quality goal to be met.

It is also important to ensure an active supply of pollution credits. In order to participate in the market by earning and selling credits, farmers must reduce their own pollutant loads below a proscribed baseline level, usually through the implementation of best management practices. Farmers can then earn credits through the use of additional best management practices. Setting this baseline too low may eliminate farmers' desire to participate in the market. The costs of dropping below the threshold may not be worthwhile and perhaps not even technically feasible. Setting the baseline too high (so that it is easy to obtain credits) may increase credits supply and increase the likelihood of an active market, but result in little to no pollution reduction by NPS polluters. If this happens, when PS buys credits in order to pollute more, the overall pollution level is likely to rise instead of fall.

"Maryland's non-point source program is one of the better ones out there, in terms of promoting innovation."(D. Parker)

Setting pollution limits also forces policymakers to confront questions of fairness. Whoever has the most restrictive limits incurs costs in order to achieve them—whether by buying credits or reducing their own pollution levels. Whoever has the least restrictive limits may catch a windfall in profits if they can lower their emissions below the threshold level at a small cost and then sell pollution credits.

Transaction costs—the time and energy required for a seller and buyer to find each other, verify the credits, and negotiate a trade—are another impediment to a well-functioning water quality credit trading system. These costs can be very high when NPS parties are involved in the market. This stems from the fact that NPS polluters are widely scattered across a watershed and can each provide only a few credits—a PS buyer may have to find and buy from many NPS sellers. If transaction costs are too high, the parties may simply decide trading isn't worth the trouble, and the market will not function.

The complexity of programs can also add transaction costs. Unclear, complicated, and non-uniform rules regarding such things as credit certification, credit resale, and credit lifespan can substantially increase the time and energy required to participate in a water quality credits market. Streamlining rules and improving communication to potential traders might reduce these costs.

The Genesis of Water Quality Credit Trading in the Chesapeake Bay Region

After years of nutrient and sediment pollution in the Chesapeake Bay, the significant impairments to water quality led partners in the regional Chesapeake Bay Program to set ambitious targets for nutrient pollution reduction by 2010.

By 2003, teams in Maryland developed strategies—including pollution caps—to decrease nutrients entering all major tributaries and the bay. Given these caps, Pennsylvania needed to reduce the nutrients flowing across state lines. In 2006, Pennsylvania's nutrient trading policy included point source to nonpoint source trades. Virginia also established a trading program between point sources with the intent to eventually include nonpoint sources in trades.

Maryland announced its own trading program in 2008.The West Virginia program is still in development.

It is much too soon to judge how successful water quality credit trading will be in meeting the collective reductions necessary for improving and restoring the Chesapeake Bay.

Courtesy of the Integration and Application Network (ian.umces.edu/symbols/)

Countervailing actions induced in another area by a trading program (known as "leakage") may also neutralize some gains from a water pollution credits trading program. It is therefore important to design the program in such a way that minimizes the potential for inducing negative effects in other watersheds and that prevents trades which might actually result in a net increase in pollution. This could occur due to unintended side effects of a credit trading program. For instance, a farmer might implement a best management practice in order to earn and sell credits, but he must reduce the size of his cropland in the process. He may compensate for the loss by expanding his productive acreage in a different location and increase runoff in another area.

While the challenges confronting implementation of effective water quality credit trading systems are significant, a few programs have met them with a degree of success. Several trading programs appear to have successfully brought in both PS and agricultural NPS polluters. Trading programs in the Miami Watershed of Ohio; the South Nation River Basin in Ontario, Canada; Beet Sugar Cooperative and Rahr Malting Pollutant Offsets in Minnesota; and Red Cedar River in Wisconsin combine elements of market-based trading programs and government-managed tax and subsidy schemes. These programs address some of the challenges confronting water quality credits trading with intermediaries between buyers and sellers. The intermediaries reduce transactions costs of finding buyers and sellers, verifying credits, and monitoring pollution levels. They also bear some of the liability for delivering actual pollution reductions, relieving potential buyers from some of the burden and increasing the buyers' willingness to participate in the system.

The Future of Water Quality Credit Trading Programs: Maryland and Beyond

Parker notes that Maryland's water quality credit trading program is one of the best and most flexible programs for promoting farmer innovation in runoff

PHOTO: EDWIN REMSBURG UNIVERSITY OF MARYLAND

Josh McGrath of UMD studies poultry manure runoff from corn tillage plots at the Wye Research and Education Center.

reduction. But he points out that the current program is more geared towards addressing growth than promoting trades. Caps on PS polluters have been intentionally set to account for growth trends, assuming the pollution levels of PS polluters will continue to increase. Thus, most PS polluters are currently below their caps. The question is whether, when they reach their cap, they will implement new technology to reduce their pollution or instead purchase credits from NPS polluters. If there are no trades because PS polluters find new technologies that reduce their pollution better, this may be a policy success, even if the credits market falters.

The other question for Maryland's program is whether the baseline pollution limit that farmers must meet to participate in the market is properly set. If farmers can obtain credits too easily, the supply of credits to the market may not result in meaningful pollutant reductions.

Market approaches are attractive in part because they may reduce reliance on government intervention for reducing pollution. While some have promoted water quality credit trading as a substitute for regulating agricultural runoff, a certain level of regulation and some government involvement is required for these markets to function.

In general, policymakers' expectations for the usefulness of trading as a tool to address NPS water pollution now may be too high. The necessary physical and regulatory conditions for widespread trading simply do not exist in the context of NPS pollution. Furthermore, without properly set caps, trading by itself may not improve pollution outcomes. Since most agricultural sources do not face an enforceable cap, it is hard to know whether even a very active credit market will actually improve water quality to measurable degrees.

Water quality credit trading in agriculture still has too many remaining challenges and unresolved questions to serve as a reliable pollution reduction tool. While it should continue to be explored and empirically tested as

PHOTO: BOB-RJ BURKHART

USDA-CRP Natural Snowfence Buffer Strip.

an effective tool for the future, it is important to recognize that credit trading is still very much in its infancy. Current trading programs should be studied for the design insights they can bring to future programs. Greater resources should also be brought to designing future experiments, involving input and analysis from economists, physical scientists, policymakers, farmers, community members, and other stakeholders. This will help build a better understanding of the physical, economic, social, legal, and policy dimensions of water quality credit trading programs in order that it may develop into a more effective pollution reduction tool. ■

For more information about this research, contact Dr. Doug Parker at ***(510) 987-0037*** *or* ***dparker@arec.umd.edu.***

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