

**Take Home Quiz #2**  
**DUE AT THE BEGINNING OF CLASS ON WEDNESDAY, MARCH 9**

This quiz is intended as an individual take-home quiz. Each student is expected to hand in their own work. While you are free to consult with me for any questions you may have, you may not discuss the quiz with other students. E-mail questions about the quiz should be sent to my personal e-mail address ([dcpopp@syr.edu](mailto:dcpopp@syr.edu)), rather than the class listserv. This is an open-book quiz. You are free to consult your notes and the readings from the class to complete the quiz.

Take the time to think before you write. Well-thought out, well-written answers will be rewarded. A direct, concise explanation is better than a five-page treatise. I am not just looking for how much you know, but how well you are able to communicate what you do know, which includes filtering through information to highlight the most relevant points. In addition, pay attention to the target audience. For this assignment, your memo should be accessible to someone with limited economics expertise. Such memos should be written in a professional manner and avoid the use of economic jargon. The assignments page of the class web site links to an article with suggestions for effective professional writing.

***The quiz is due AT THE BEGINNING OF CLASS on WEDNESDAY, MARCH 9. Late exams give you an unfair advantage over other students in the class. As a result, late exams will be marked down one grade for each day late, starting AT THE BEGINNING OF CLASS on WEDNESDAY, MARCH 9. If you will not be in class on Wednesday, it is your responsibility to get the exam to me BEFORE CLASS. Do not just leave the exam in my mailbox, as I need to know when you hand the exam in. There is a sign-in sheet at the front desk of CPR for this purpose.***

## Best Policies for Best Practice Management

New York State's Department of Conservation (DEC) is seeking your advice to improve water quality in the Finger Lakes region. Concerned about increased wastewater runoff from agriculture, the DEC is looking for new ways to encourage best management practices (BMP) in agriculture. Best management practices include simple changes to crop management to more complex management of fertilizer and related runoff. Examples of BMPs include:<sup>1</sup>

- *Conservation Tillage* - leaving crop residue (plant materials from past harvests) on the soil surface reduces runoff and soil erosion, conserves soil moisture, helps keep nutrients and pesticides on the field, and improves soil, water, and air quality;
- *Crop Nutrient Management* - fully managing and accounting for all nutrient inputs helps ensure nutrients are available to meet crop needs while reducing nutrient movements off fields. It also helps prevent excessive buildup in soils and helps protect air quality;
- *Pest Management* - varied methods for keeping insects, weeds, disease, and other pests below economically harmful levels while protecting soil, water, and air quality;
- *Conservation Buffers* - from simple grassed waterways to riparian areas, buffers provide an additional barrier of protection by capturing potential pollutants that might otherwise move into surface waters.

The DEC is considering four different policy options. Each is described below:

### **Reverse Auction**

In a reverse auction, sellers offer to sell a product at a specific price, allowing the buyer to choose the seller offering the lowest price. As described in class, one such reverse auction took place in the Conestoga Watershed in Lancaster, Pennsylvania in 2006. To bid, a farmer offers to implement a BMP project, providing the environmental agency with both the amount of phosphorus reduced by the project and the amount of money the farmer would accept to implement the project. Note that the amount a farmer would accept could exceed the cost of the project itself. Environmental technicians from the Lancaster County Conservation District helped farmers calculate the phosphorus savings that would result from a project. Bids were ranked by the cost per unit of phosphorus reduction. Based on this ranking, officials established a cut-off price at the point where their budget of \$450,000 would be exhausted. All bids with a price per pound of phosphorus reduction below this cut-off won funding from the government.

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<sup>1</sup> Source: [https://cfpub.epa.gov/watertrain/moduleframe.cfm?parent\\_object\\_id=1362](https://cfpub.epa.gov/watertrain/moduleframe.cfm?parent_object_id=1362), last accessed February 28, 2022.

## **Effluent fees**

The Netherlands provides an example where effluent fees were used to manage non-point source pollution. Farmers pay a tax on the annual net balance of nutrients in excess of a levy-free minimum. The annual net balance of nutrients is calculated using the Dutch Mineral Accounting System (MINAS). Each farmer must account for the nitrogen and phosphorus content of their inputs and outputs. Nitrogen and phosphorus may come onto the farm in many forms, including feed, livestock, fodder, manure, and chemical fertilizer. It leaves the farm in the form of things such as livestock, forage, manure, grain, milk, and eggs. Farmers record the amount of nitrogen and phosphorus that comes onto their farm and the amount that leaves it. The difference between these is the farm's mineral loss or surplus. For example, if the nitrogen contained in a farm's inputs exceeds the nitrogen contained in the farm's outputs by 100 kilograms (kg), it is assumed that the farm released 100 kg into the environment. Farms are charged 9 Euros per kg for phosphate releases above a set limit and 2.3 Euros per kg of nitrogen above a set limit.

Calculating the net balance of phosphorous and nitrogen requires detailed information. While the Dutch mineral tax relies on self-reporting by farmers, basic information is made available to them through the government. Feed suppliers are required to send annual feed and feed supplement purchase reports to the Tax Office of the Dutch Ministry of Agriculture. MINAS returns must be accompanied by documentation, such as receipts for livestock and manure shipments, as well as the results of laboratory tests of nutrient content in manure. The Ministry of Agriculture carries out audits of farms and other agricultural establishments with reporting requirements.

Completing the annual net balance of nutrients is time consuming. Representatives of Dutch farm organizations note that most farmers hire a consultant to assist them in preparing the report. Analysts report that the paperwork burden is comparable to filing farm income taxes, with similar paperwork and documentation requirements. The Dutch extension service provides assistance and training on working with the accounting system.

## **Tax credits<sup>2</sup>**

The state of Pennsylvania provides tax credits to support BMP through their Resource Enhancement and Protection (REAP) program. The state has a fixed budget designed to support BMP projects, which typically is about \$10 million per year. Successful applicants receive tax credits that cover between 50-90% of BMP project costs. Credits are awarded to eligible applicants on a first-come, first-served basis. REAP tax credits may be used to pay Pennsylvania state income tax for up to 15 years. The tax credits are transferable, so that farmers who do not owe taxes can sell the credit to someone else to use. Farmers may also recruit sponsors to help finance the BMP project. The sponsor pays the project installation costs and receives the resulting tax credits.

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<sup>2</sup> Much of this information comes from [https://www.agriculture.pa.gov/Plants\\_Land\\_Water/StateConservationCommission/REAP/Pages/default.aspx](https://www.agriculture.pa.gov/Plants_Land_Water/StateConservationCommission/REAP/Pages/default.aspx), last accessed February 28, 2022.

## **Fertilizer tax**

Given the challenges of monitoring non-point source pollution, other states simply choose to tax fertilizer, as it is a major source of nitrogen and phosphate runoff. For example, the state of Colorado charges a \$1.10/ton fee, of which \$1 is designated for groundwater protection.

You have been asked to prepare a 3-5 page memo that consider the effectiveness of each of the above policies and recommends a path forward for the DEC. *As officials have little background in economics, you have been asked to explain the benefits and concerns of these programs in an intuitive, non-technical manner.* Your memo should explain the need for policy by saying why farmers are less likely to implement BMP without such policies in place. For each policy, your memo should discuss the following points:

- Briefly describe how each program encourages farmers to implement best management practices.
- How well does each program encourage farmers to choose the most cost-effective BMP projects?
- Environmental policies can have various uncertainties, such as the final level of reductions or the costs of compliance. What is uncertain in each of the programs above?
- What challenges to implementing these policies should regulators be aware of?
- Which program would you recommend be adopted in the Finger Lakes region? Why?