Thematic Week: Water Economics and Financing

Thematic Axis: Water Markets

Title: Water Quality Trading and Pollution from Agriculture: Lessons from a Policy Research Initiative's Research Project

Authors: Bernard Cantin, Ph.D.

Director, Policy Research Initiative, Government of Canada, Ottawa, Ontario, Canada.

Abstract:

This paper builds on the results of a policy research project examining the use of market-based instruments (MBIs) for water management that concluded in 2006. We concentrate more particularly on the use of water quality trading (WQT) to address pollution from agricultural sources (see PRI, 2006, for the Project Report).

To answer questions asked to panelists by organizers, we review the following themes: the biogeochemical considerations that are key to designing WQT systems; the regulatory context allowing (or not disallowing) WQT to be implemented; administrative requirements; 4- social acceptability of trading systems.

Based on this analysis, we suggest that WQT are a potential solution to agricultural issues but they are not easy to implement, and not applicable to all situations/contexts. There are potential issues with the geographical concentration of pollution in watersheds, and solutions have been tested, but it may be too soon to evaluate their effectiveness.

WQT systems can be tailored to regional (watershed) circumstances, and thus can be compatible with emerging forms of water governance. However, the implementation of WQT can face resistance, both from stakeholders and also from public administrations that may have relied mostly on more traditional regulatory approaches.

Keywords: Water management; Pollution Trading; Market-Based Instruments; Pollution From Agriculture; Integrated Water Resources Management; Governance

Water Quality Trading and Pollution from Agriculture: Lessons from a Policy Research Initiative's Research Project

Abstract

Tradable emission permit systems, often referred to as water quality trading (WQT) systems in the context of water pollution, can be useful policy instruments in the toolbox of policy-makers. They have to be considered in the context of, and as part of, a suite of instrument. An interesting aspect of WQT systems is that they can be compatible with watershed-based management systems, which are emerging across the world, and the determination of ambient pollution objectives.

While experiences so far might indicate that WQT systems are difficult to implement, this may be due to the fact that they have for the most part been tried to address agricultural sources of water pollution, which are difficult to address in any circumstance. Our work in the Canadian context has shown that there are no strong legislative barriers to their implementation. WQT systems however require a very good understanding of the specific form of pollution being addressed, which allows preventing the creation of hot spots; more generally, they are information intensive and require good monitoring. Assuming the context in which they are proposed would allow the possibility of trading, it appears that the main barrier to their implementation may be of a social nature. WQT systems can help reduce pollution, but may not be appropriate in all circumstances.

Introduction

This paper builds on the results of a policy research project examining the use of market-based instruments (MBIs) for water management that concluded in 2006. We studied the use of MBIs to control water demand, as well as those used to address water pollution, more particularly the use of water quality trading (WQT) to address pollution from agricultural sources (see PRI, 2006, for the Project Report). Our general conclusions were that the relationship between governance systems and instrument choice should be better understood, and that it is more useful to think about the implementation of suite of instruments than about the discrete choices between single instruments. Although we do not offer here concreted guidance on these broad issues, we provide insights about them throughout the document.

The focus of this paper is The Institutional framework for Transferable Emission Rights, this session's theme, in the context of WQT to address agricultural sources of water pollution, with a view to discuss a series of questions the organizers are asking from panelists (these questions are reproduced in the discussion section at the end).

We cannot realistically cover all the design issues related to the implementation of WQT systems in a short paper, and we expect that those not covered here will be by other presentations. We concentrate on what seems more relevant given the questions we are asked to examine, giving also consideration to some issues we think are not well covered in the literature. This paper will thus first provide a brief description of what WQT systems look like, and the context in which they have been implemented. We will then follow the logic of our study on WQT and explore: 1- the biogeochemical considerations that are key to designing WQT systems; 2- the regulatory context allowing (or not disallowing) WQT to be implemented; 3- administrative requirements; and 4- social acceptability of a trading system. We will then be in a position to discuss the questions raised above.

1- Pollution trading, WQT and the Regulation of Pollution from Agriculture Sources

This section is not for the purist in that this particular application of trading for environmental purposes is messy. But it has often been tried, and, what is interesting, it is our understanding that it has been tried more often to address agricultural sources of pollution such as nutrients than for other sources of water pollutants. It is also noteworthy that it has been tried almost exclusively in the United States. There is one example in Canada that is not explicitly referred to as trading in the province where it is taking place. There are ongoing discussions in Australia and New-Zealand to pilot trading systems for nutrients. Overall, it appears that most of these systems are not working. On the bright side, it would be more precise to say that these systems are not meeting expectations, but may still help to reduce pollution. In addition, the only Canadian example seems to be providing results.

In considering how a market-based instrument such as pollution trading can be used to address pollution of water bodies, it is important to note that it is also possible to design trading systems to address other pollutants than those directly emitted into water bodies. The Manure Quota System in the Netherlands, which includes a trading component, is a case in point. One could also envision a cap-and-trade system for pesticides, although we are not aware of specific attempts of that sort.

Water quality trading to address agricultural pollution is a specific form of pollution trading adapted to address a specific set of problems. The classic example is a watershed where municipalities through their wastewater treatment plants (WWTPs) and farming operations discharge (among other things) significant amounts of nutrients, such as phosphorous.

Under a traditional regulatory approach, municipalities would have to invest in technology (often of a specified type) to reduce the amount of nutrient discharged and to meet a regulated effluent concentration typically expressed in terms of milligrams of phosphorous per litre (mg/L). After a certain point, the level of investment required to control additional phosphorous discharges (due to city growth, for example) can be very high, so there might be clear economic advantages in looking for other options, keeping in mind the environmental objective being pursued. Such options can be found by looking at other sources discharging phosphorous within the same watershed. If others in the watershed could reduce an equivalent amount of phosphorous discharge at lower cost, and if the overall environmental effect of doing so is equivalent or better, it might be advantageous for the municipality to pay those dischargers to reduce pollution instead of doing so itself. Farming operations can thus receive payment from municipalities to adopt practices that reduce, in this example, P discharges. Different options are available to the farmers, each with potentially different costs and environmental benefits.

Water quality trading has much of the features of an offset system but can also have some features of a cap-and-trade system where economic sectors such as agriculture collectively face a cap, which is not allocated to individual enterprises. WQT systems have often been applied where an environmental objective – an ambient goal – has been defined for a given water body.

In the US and Canada, as well as in Australia, agricultural sources are not regulated while municipalities are. In other words, participation from agricultural sources is usually voluntary. This might change since increasingly large agricultural operations are facing more stringent regulation. Note also that in the US and Canada, environmental aspects of agricultural activities can be regulated by states or province, and that both national states, to a different degree, can enact regulation to address water quality. In Canada, the national government's approach has been to set standards for a number of industrial sectors. The existing WQT system in Canada is a provincial initiative, but requires collaboration with some federal departments that regulate municipal effluents.

2- Biogeochemical Considerations for WQT in the Canadian Context

The first step we took in examining if WQT could be a useful instrument in Canada was to invite Canadian specialists of water pollution, from government and from academia, to a workshop. The basic question that was asked from them was whether we could envisage, from a biogeochemical standpoint and in the Canadian context, trading systems for water pollutants coming from agricultural sources. If so, we also asked if certain pollutants[1] were more appropriate for trading. This included consideration of whether there would be enough potential trading partners for any given pollutant.

To summarize, the experts came up with a list of science-related factors that may facilitate the implementation of WQT as an option for pollution management:

- the existence of a clearly documented pollution problem (e.g., manifestation of ecological effects, violation of water quality standards or water quality objectives);
- well-developed best or beneficial management practices (BMPs) or abatement technologies for pollution reduction in the farming sector and the ability to quantify pollution reductions (which implies an understanding of the pollutant and the biogeochemical conditions of the watershed where the BMP is to be implemented);
- historical monitoring data within the affected watershed including hydrological, water quality and point source discharge date for pollutants;
- fundamental understanding of pollutant behavior and watershed dynamics for determining critical load and trading ratios; and
- a watershed that is well understood and well monitored will prove to be a good candidate for WQT, especially compared to a watershed where there is little information.

It should be clear from this that implementing a trading system is information intensive: the scientists told us that it is better to try it where there is knowledge about the water body identified, as well as knowledge about the way in which pollutants and their sources affect that water body.

The availability of good biological/geochemical information, and the lack of scientific understanding of some pollutants, meant that WQT would most likely be possible in Canada for Phosphorous, Nitrogen and Sediment.

The issue of hot spots (geographical concentration of pollution) and trading ratios was given particular attention in the discussions. This issue is very important given the need to find ways to account for uncertainties related to the environmental effectiveness of specific BMPs that could be adopted by farmers as part of a trading program, and the fact that pollution affects a watershed in different ways depending on where it is coming from.

Remember that what is traded by farmers in these systems are expected reductions in pollution coming from the implementation of varied BMPs. These expectations can only come from experimentation. In the best case scenario, there will still be some uncertainty about the long term environmental effectiveness of BMPs. Most WQT systems deal with this uncertainty by posing that 1 unit of P discharged by a municipality is equivalent to 2 or more such units from agricultural sources. Said differently, to be allowed to release one additional unit of P, a municipality has to buy reductions of agricultural discharges of 2 units of P or more.

In addition, all watersheds will have some degree of heterogeneity with respect to the biogeochemical characteristics (e.g., vegetation, soil type, flow rate), which will influence how a pollutant behaves at any given location. For example, a pollutant released at the mouth of a river will be more rapidly diluted than when released at the head of the river, which may affect water quality downstream. Consequently, the location of trading partners may affect the environmental impact of otherwise similar BMPs.

[1] Even though nutrients released by farming operations in water body are not pollutants stricto sensu we will consider them as such for simplicity, given that excess nutrient loading is the environmental objective to be addressed.

With a basic understanding of watershed and pollutant dynamics, trading ratios can also be used to ensure some degree of environmental equivalence of trades by accounting for the influence of the given landowner's locations (e.g., upstream, downstream, topography, proximity to waterway). For example, the Lower Boise River trading system in the United States was proposing location-based trading ratios, which were established against a standard geographical reference point to prevent localized impacts or hot spots, and to reflect the water quality equivalence of the reductions made at different locations in the watershed.

In this example, trading ratios were also adjusted to account for a source being located along a tributary as opposed to along the Boise River itself, as well as the distance from the source to water, as these characteristics influence the impact of the reductions (Schary and Fisher-Vanden, 2004).

Another possibility is to define trading zones, restricting the direction of trades into predefined zones of a river system or its tributaries. Adding restrictions, however, possibly limits the potential of trading, and thus runs the risk of making it less cost efficient.

In short, the possibility of hot spots is a very serious concern in any trading system. There are ways to address this - such as with trading ratios - that seem to have provided possible solutions. It is still probably too soon to know whether these approaches meet their stated objectives. In any event, any approach will require good monitoring of trades and of the environment.

3- Regulatory Context

Pollution trading is closely linked to the legislative and regulatory systems in place. The trading systems (permits trading or offset regimes) are only possible if some type of overall cap or standard is in place. In the case of offsets, the application of the standard needs enough flexibility so that in can be relaxed at certain sites to allow compensation elsewhere.

In the course of our work, we examined if Canadian regulatory systems[2] and the policy frameworks at the time supported or hindered the development of WQT. Nine questions were examined by consultants:

1. Are there enabling provisions within the legislation that allow for the use of tradable permit systems?
2. Are there policies, programs, regulations, or any other documents that facilitate the development and use of tradable permit systems?
3. Are there legal provisions requiring that emitters monitor their discharges to the environment and report to public authorities?
4. Are there any legal, regulatory, policy, or any type of documents that relate to the capacity to determine water quality criteria/objectives of water bodies or the soil's assimilative capacity of certain types of nutrients?
5. How are these criteria/objectives being met?
6. Is a watershed-based approach being used to adopt and implement policies and regulations, or issue permits? Are institutions dedicated to implementing integrated watershed management?
7. How do the legal/regulatory agri-environmental provisions of the various jurisdictions interact with WQT?
8. More generally, how do the legal/regulatory water quality provisions of the various jurisdictions affect the possibility of adopting a WQT trading system?

[2] We examined the regulatory systems of 10 provinces and of the federal government, but we did not examine the three territory systems.

9. Has there been a major initiative, at the government level, to promote the use of economic or market-based instruments in environmental management?

It was found that in general, existing frameworks allowed for the development of WQT trading programs, including through the development of watershed-based governance models. There were barriers found around the lack of flexibility to relax some standards in two jurisdictions.

Interestingly, even though frameworks allowing the development of trading systems are often in place, most Canadian jurisdictions still relied mostly on technology-based command-and-control regulation. One of the main barriers from that standpoint may be cultural, in the capacity to make the institutional changes necessary to implement systems based on ambient goals.

4- Administrative Requirements

Water Quality Trading can represent a significant departure from existing administrative practices, as we alluded to in the preceding paragraph. Two examples that can illustrate this issue are the question of recognizing trades as valid means to meet environmental obligations, and the issue of reducing administrative costs.

With respect to the recognition of trades, it should be reminded that one main goal of WQT programs is to provide flexibility to those being regulated in the choice of method to meet some regulated objective. At a minimum, for this to occur participants need some certainty with respect to the acceptability of trades to meet their goals or obligations. In many trading experiments trade approvals were relatively cumbersome, as decisions were made on a case-by-case basis. Uncertainty with respect to the acceptability of trading has limited the attractiveness of the instrument.

A number of options have been developed to address this difficulty, but the point is that it resulted from a clear mismatch between the intention behind trading and the regulatory system that was in place (and not modified) when trading was introduced.

Concerning costs, trading is often presented as a lower cost option of achieving environmental objectives. This can be true but making such an evaluation requires the inclusion of administrative costs. It must be acknowledge that monitoring and enforcement costs are among the most important administrative costs of a trading program. Here also methods have been designed to limit those costs (See PRI, 2006: 23-24).

Because the implementation of a trading program does not happen in an administrative vacuum, it is important to be aware of the potential opportunities and barriers that established practices may pose. Achieving the goal of reducing pollution in a cost effective way requires to examine this question seriously and to plan for it.

5- Social Acceptability of Trading Systems

Trading compared to other regulation or even subsidy programs involves changes in the pattern of interactions between agents. From a bilateral relation between a state agency (or a number thereof) and farmers or municipalities, a shift occurs in a trading program where a number of potential trading partners have to be involved. Not only does this change the nature of the enforcement and compliance process, which may partly occur through private contracts, but it may also involve sustained relations between stakeholders who may not have needed to work together before.

In an examination of how local factors affect the uptake of MBIs in Northeastern US, Feitelson and Lindsey (2001:203-204) found that a "fairly well defined set of factors, including local culture and politics, drives the use of economic instruments at the local level." These factors include: the simplicity of the instrument; the capacity of the local jurisdiction and its experience in dealing with similar instruments; the adoption of economic instruments facilitating higher growth, where the development industry might be able to take advantage of them; instruments that reward rather than punish are more attractive; and local political culture.

Research in Alberta (Canada) support such results: it was found that the main barriers to the application of such instruments are the lack of awareness of these systems, the lack of science, and no trust. To address the trust issue, it was found that a useful approach would be to bring in not-for-profit brokers/clearinghouses. There is also a need to quantify the economic benefits for farmers (Haugen-Kozyra, 2005).

The rural-urban divide is another important limit to the development of WQT programs. In some programs involving municipalities, farmers were reluctant to participate as they saw their participation as an indirect way to fund urban growth. Municipalities also had their issues (Kramer, 2003: 14). To begin with, although an important consideration, compliance costs may not be the primary concern of local water treatment plant managers. They might want to make sure they make the right choice to enhance water quality for their community. They might fear criticism if they are seen to be paying for pollution reductions outside of their communities. Finally, they might also resent the fact that the agricultural sector does not face as stringent regulatory requirements as they do.

On the other side, farmers may resent the fact of being portrayed as polluters. As O'Grady (2005: 28) contends, many farmers view themselves as stewards of the land and have a strong conservation ethic. Much of the time, however, they cannot afford to do the conservation work, even if they would "rather voluntarily put in a few dollars of their own than have the government force them to implement BMPs [best management practices]" (O'Grady, 2005: 28).

Finally, Breetz et al. (2005), in a study examining mechanisms to increase farmers' participation in WQT programs in the United States, reviewed options based on existing experiences. The authors examined three main options for breaking the initial barriers that affect participation, including the mistrust farmers have of regulators or other actors such as environmental groups. These options are communication mechanisms, such as education and outreach; third-party facilitation; and the use of existing networks. Each instrument has its strengths and weaknesses, and their use is conditioned by a specific program's objective and local conditions. The point here is that strategies to address the initial reluctance of farmers to participate in WQT systems have to be developed, taking into account local circumstances, if such programs are to be effective. The authors also noted that none of the strategies can necessarily guarantee the expected results.

Social factors are an essential element in the development of any policy tool, even those said to be market based. More research is needed to better understand these factors, and to address them.

6- Discussion

Panelists were asked to answer three questions, reproduced here:

1- *Would tradable permits be a better tool to reduce water pollution and to improve quality than control of emissions and emission standards? Would there be problems of spatial distribution of pollution (and hot spots) that may reduce their effectiveness?*

We believe it is not yet possible to answer the first question, since all countries still face difficulties addressing sources of water pollution from agriculture, whatever the instrument being chosen. We also think that comparing one instrument to another may be counterproductive, in that instruments are necessarily implemented in a specific context (biophysical, regional, regulatory, social, etc..). In fact, experience suggests that instruments have to be looked at as elements of a suite, and that there is enough practice to be strategic about how they can be applied. For example, in some countries, since voluntary instruments (education and training) have been tried, it might be time to move to more stringent approaches, looking at a mix of market-based and appropriate regulations (e.g. ambient-based). However, any approach needs to be tailored to local circumstances.

With respect to spatial distribution of pollution, or "hot spots", while there are a number of approaches that have been tried, it might still be too soon to evaluate their effectiveness. As we indicated earlier, good monitoring of trades and of environmental conditions is essential in that it provides added confidence about the capacity to change course if needed.

2- Could tradable emission permits become a universal market-based instrument for water quality control or there are important limitations for its use? Are there important changes in the institutional and regulatory context that may be required and will prevent its implementation?

In a context of Integrated Water Resources Management (IWRM), finding solutions to pollution requires a closer look at regional circumstances, as well as the broader policy forces that shape the choices of actors at the regional level. IWRM involves the establishment of partnerships at the regional level, which may be in itself the first limitation to the use of a new instrument. But effective partnerships may also provide means to better address implementation challenges.

With respect to WQT, we have found that one of the most important limitations is not of a regulatory nature, but a cultural one. Policy-makers and planners need to factor in a transitional period, from an administrative perspective, and ensure that the main potential traders are on board. In the Canadian context, the only example took five years to be implemented, where the main hurdle was the resistance of farmers. But the system was finally implemented. It may not be the perfect trading system, but it has generated environmental benefits, which at the end is what really counts.

References:

Breetz, H.L., K. Fisher-Vanden, H. Jacobs, and C. Schary. 2005. "Trust and Communication: Mechanisms for Increasing Farmers' Participation in Water Quality Trading." Land Economics.

ÉcoRessources Consultant. Sauvé, C., J. Nolet, C. Whyte, and R. Sanchez, April 2006, Water Quality to Address Water Pollution from Agriculture Activities: Assessing the Adequacy of the Canadian Legislative and Policy Contexts . PRI Working Paper No. 018.

Feitelson, E., and G. Lindsey. 2001. "Local Use of Economic Instruments in the Chesapeake Bay Critical Area Programme", Journal of Environmental Planning and Management 44, no. 2: 187-206.

Haugen-Kozyra, Karen, Alberta Agriculture, Food and Rural Development. 2005. Comments made at the PRI Workshop on Water Quality Trading in Canada, September 19-20, 2005, Cantley, Quebec.

Kramer, J.M., Resource Strategies Inc. 2003. Lessons from the Trading Pilots: Applications for Wisconsin Water Quality Trading Policy. Prepared for Fox-Wolf Watershed Alliance.

Morin, A. 2005. Biogeochemical Considerations for Water Quality Trading in Canada. PRI Working Paper Series No. 005.

O'Grady, D. 2005. "Lessons Learned from Point-Nonpoint Source Trading. Case Study: Phosphorous Trading and Water Quality – The Total Phosphorous Management Program." Pp. 22-28 in Forum Report. July 11-12, 2005 National Forum on Synergies Between Water Quality Trading and Wetland Mitigation Banking. Environmental Law Institute.

Policy Research Initiative, 2006, Can Water Quality Trading Help to Address Agricultural Sources of Pollution in Canada? Project Report. PRI Project: Sustainable Development. Available at: http://www.policyresearch.gc.ca/doclib/PR_SD_WQT_200605_e.pdf

Schary, C., and K. Fisher-Vanden, December 2004. "A New Approach to Water Quality Trading: Applying Lessons from the Acid Rain Program in the Lower Boise River Watershed." Environmental Practice 6, issue 4: 281-295.

Tri-Star Environmental Consulting, April 2006, *Water Quality Trading to Address Pollution from Agricultural Activities in Canada: A Legislative Review*. PRI working paper No. 019.