Penn State Environmental Law Review

Volume 14 | Number 2 Article 2

1-1-2006

Putting the Market to Work for Conservation: The Evolving Use of Market-Based Mechanisms to Achieve Environmental Improvement in and across Multiple Media

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Articles

Putting the Market to Work for Conservation: The Evolving Use of Market-Based Mechanisms to Achieve Environmental Improvement In and Across Multiple Media

Robert B. McKinstry Jr.*

The articles in this symposium edition address the widening use of market mechanisms, or trading, to achieve environmental improvement. These articles were produced from some of the presentations made in an April 2005 forum sponsored by Penn State's Maurice K. Goddard Chair in Forestry and Environmental Resources Conservation entitled Putting the Market to Work for Conservation: An In-depth Examination of Traditional and Nontraditional Market-Based Mechanisms for Achieving Environmental Improvement.[1] While many conference programs have

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1. This was the Fifth Goddard Forum. Goddard Fora are outreach efforts of Penn State's Maurice K. Goddard Chair in Forestry and Environmental Resources Conservation. Goddard Fora focus on emerging issues in environmental and natural resources policy. They are intended to be educational and seek to promote dialogue among decision-makers, enabling them to work towards consensus in the use and management of natural resources. The fora seek to facilitate cooperation at several levels

included sessions examining trading in one media or another, this conference sought to examine the use of trading across a variety of media and, employing a cross disciplinary approach, to evaluate the strengths and limitations of the use of market mechanisms in contrast to other regulatory tools. The articles collected here provide a sample of some of these presentations.

I. Evolution of the Theory of Environmental Trading

The concept of using market mechanisms to control environmental problems such as pollution by creating property rights in environmental media is not a new one, having been introduced by the Nobel laureate economist Ronald Coase, in 1960.[2] In economic theory, the existence of pollution, like many other environmental problems, is viewed as a market failure caused by the fact that environmental quality is frequently a common good not owned by anyone. If there is no restriction on the public's ability to use a commons, such as the use of a river or the air to discharge pollution, it will be used without limitation and overused.[3] The solution to this problem is to create limitations on the use of commons. This can be accomplished by a variety of mechanisms, including use of a permit that limits use or provision of subsidies to encourage limitations on use. Ronald Coase suggested that the environment could be protected by creating property rights to discharge pollution, limiting the amount of property rights created and then allowing the property rights to be freely traded.

Although the first wave of modern environmental laws enacted in the 1970s included a wide suite of tools to protect the environment, market mechanisms involving the creation of property rights and their exchange on the market were not among them. These laws established pollution discharge limitations, subsidy and public works programs to

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and ultimately contribute to the improvement of our economy, environment, and quality of life. The Forum giving rise to the articles in this symposium was sponsored by the Goddard Chair, the Pennsylvania Department of Conservation and Natural Resources, the Pennsylvania Department of Environmental Protection, the Pennsylvania Department of Agriculture, PPL Corporation, Ballard Spahr, Andrews & Ingersoll, LLP, Drinker, Biddle & Reath, LLP, Wolf Block Schorr & Solis-Cohen, the Penn State College of Agricultural Sciences Environment and Natural Resources Institute, and the American Bar Association Section on Environment, Energy and Resources.

The Goddard Chair was created to honor Maurice K. ("Doc") Goddard. Doc Goddard served as Secretary of the Pennsylvania Department of Environmental Resources for 25 years under four governors. In that role, he created a state park system that put a park within 25 miles of every citizen of Pennsylvania. He also helped create the modern system of environmental regulation in the state, recognizing that a clean environment and a sound economy are mutually dependent.

2. Ronald Coase, *The Problem of Social Cost*, 3 J. LAW & ECON. 1 (1960).

3. Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243 (1968).

encourage construction of plants and development of technologies to protect the environment, research programs to determine the causes and solutions to environmental programs, a variety of educational and technical assistance programs to encourage voluntary private implementation of measures to improve the environment, and planning programs to coordinate these efforts.[4]

To limit pollution, these laws would most frequently rely upon the establishment of discharge limitations that limited the amount of pollution that could be released from each pollution source[5] or technical standards for construction and location of buildings and activities.[6] The discharge limitations were imposed either through regulations applying to all discharges[7] or through requirements for permits that applied rules to establish individual limitations and requirements for each facility based on general rules. The general rules for establishing limitations themselves typically employed two methods—technology based limitations and environmental quality based limitations. In establishing technology based limitations, the Environmental Protection Agency (EPA) was charged with determining what degree of reduction could be achieved by application of the best applicable technology[8] and

4. For example, water quality planning under section 208 of the Clean Water Act, 33 U.S.C. § 1284, was primarily intended to educate and coordinate a variety of measures, such as the employment of voluntary best management practices to reduce non-point source pollution. The regulatory program of the Clean Air Act was premised upon the establishment of State Implementation plans that identified and coordinated a variety of regulatory and non-regulatory measures to achieve National Ambient Air Quality Standards ("NAAQS"). 42 U.S.C. § 7410.

5. This mechanism is employed in both the federal Clean Air Act and federal Clean Water Act. Standards for the discharge of pollutants from both mobile and stationary sources are created by the Clean Air Act. *See, e.g.*, 42 U.S.C. §§ 7521 (mobile sources), 7411 (new or modified sources). The Clean Water Act requires National Pollution Discharge Elimination System ("NPDES") permits or dredge and fill limiting the amount of pollution discharged by a plant to a water body, 33 U.S.C. §§ 1342, 1343, and establishes pretreatment limits for pollutants discharged into publicly owned treatment words (*i.e.* sewage treatment plants). 33 U.S.C. § 1317(b).

6. This system is employed for hazardous waste facilities under the Resources Conservation and Recovery Act, 42 U.S.C. §§ 6901-6992k, and most land use laws.

7. Examples of regulatory limitations are presented by the mobile source emissions standards under the Clean Air Act, 42 U.S.C. § 7521.

8. Technology based standards are derived from an entire lexicon of terms that mean application of the best technology appropriate for nature of the pollutant and facility involved, including, by way of example, best practicable technology, best available technology, lowest achievable emission rate, and maximum available technology. *Compare* 33 U.S.C. § 1311(b)(1)(A) (best practicable technology), 33 U.S.C. § 1311(b)(2)(A) (best available technology economically achievable), 42 U.S.C. § 7411(a)(1) ("best system of emission reduction which . . . has been adequately demonstrated"), 42 U.S.C. § 7502(3) ("lowest achievable emissions rate" or LAER for nonattainment areas), 42 U.S.C. § 7412(d)(2) (maximum degree of reduction in emissions of the hazardous air pollutants).

establishing numerical limitations based on that technology.[9] Environmental quality based limitations were created by establishing air or water quality standards and developing individual rules to assure that no facility's discharge would cause a violation of those standards or consume too great of an increment of the assimilative capacity available before the quality was degraded. This complex system, together with the rules established for providing the states a role in these programs and mechanisms for enforcement, has often been referred to under the rubric "command and control."

Early critics of these environmental protection programs focused, in particular, on the establishment of technology based standards. By creating a uniform limit, application of technology based standards across the board can create economic inefficiencies, since achieving pollution reductions can be much more expensive at one plant than another. For example, in a 1974 book on the Clean Water Act and the Delaware River Basin Commission program on which the CWA's approach to technology based standards was based,[10] Professor Bruce Ackerman and other legal scholars criticized the use of technology based standards. They suggested that pollution reduction goals could be better achieved, with a greater degree of economic efficiency, by setting a cap on pollution and allowing polluters to trade the rights to discharge increments of water pollution. Later works suggested similar programs for air and other media.[11] It was not until the enactment of the 1990 Amendments to the Clean Air Act that pollution trading became a significant part of federal environmental law.[12] The trading program established by the 1990 Amendments set a cap on emissions of sulfur dioxide from power plants in the eastern half of the United States and allowed trading of a limited number of emissions credits to reduce acid rain.[13] The credits were initially allocated by granting a limited number

9. *See, e.g.* 33 U.S.C. § 1317 (water toxics standards), 42 U.S.C. §§ 7411, 7412.

10. BRUCE A. ACKERMAN, SUSAN ROSE ACKERMAN, JAMES W. SAWYER JR., & DALE W. HENDERSON, THE UNCERTAIN SEARCH FOR ENVIRONMENTAL QUALITY: A CASE STUDY IN THE FAILURE OF MODERN POLICY MAKING 223-27, 260-81 (1974) (collecting sources at 226 n.6, and discussing the relative strengths and weakness of the pollution charge [tax] versus pollution right [cap and trade] at 260-81).

11. *See also* Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COL. J. ENVTL. L. 171, 180-81 (1988) (suggesting system involving sale of tradable air emissions permits that would generate government revenue).

12. This is not to say that the sulfur dioxide trading program was the first foray into trading. The program was preceded by successful offsets "trading" on a case by case basis under the Clean Air Act and a broader program for trading under the lead phase-down program.

13. 42 U.S.C. §§ 7651-7651o.

to existing power plants and auctioning the remainder.[14] Additional credits could be created by unregulated facilities who opted into the program and reduced their emissions.[15] The program was enormously successful and achieved the reductions of emissions of sulfur dioxide, an acid rain precursor, at a cost far below that estimated at the time that Congress was considering the legislation.[16] The pH of rain has also increased significantly (i.e. become less acidic), although the program has not succeeded in solving that problem.

In light of the success of the acid rain program, use of trading has expanded to include other air pollutants and other media. Trading programs have been established for air pollutants in a variety of contexts. For example, a regional program for trading nitrogen oxides has been established in the ozone transport region[17] and California South Coast Area Air Quality Management District in California has established the Regional Clean Air Incentive Markets ("RECLAIM") trading program to reduce air pollution in the Los Angeles Basin.[18] EPA has promulgated regulations establishing a cap and trade program for the utility industry[19]

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14. *Id.* § 7651b.

15. *Id.* § 7651i.

16. Brian J. Mclean, *Evolution of Marketable Permits: The U.S. Experience With Sulfur Dioxide Allowance Trading*, 8 INT'L J. ENVTL. & POLLUTION 19 (1997), *available at* http://www.epa.gov/airmarkets/articles/mclean/index.html; Environmental Business International, Inc., *Markets For Emissions Credits Showing Strength On All Fronts*, 18 ENVTL. BUS. J. No. 5/6 (2005), *available at* http://www.ebiusa.com/News/ArtV18N05.htm; *see also* Joseph Goffman, *Title IV of the Clean Air Act: Lessons for Success of the Acid Rain Emissions Trading Program,* 14 PENN ST. ENVTL. L. REV. 177 (2006).

17. 42 U.S.C. § 7511(c)(a); Supplemental Notice for the Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone, 63 Fed. Reg. 25,902 (May 11, 1998); Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone, 62 Fed. Reg. 60,318 (proposed Nov. 7, 1997). On April 29, 1998, EPA proposed a supplemental rulemaking detailing a model regional cap and trade program to consider in implementing the Ozone Transport Rule. Details of the program are incorporated in the final rule. *See* Supplemental Notice for the Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone, 63 Fed. Reg. 25,902 (proposed May 11, 1998). For the Ozone Transport Rule itself, *see* Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone, 62 Fed. Reg. 60,318 (proposed Nov. 7, 1997). The 22 states included in the transport region are Alabama, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Michigan, Missouri, North Carolina, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, Wisconsin, and West Virginia.

18. *See* California's South Coast Air Quality Management District (SCAQMD) website on the RECLAIM program, http://www.aqmd.gov/reclaim/reclaim.html.

19. 70 Fed. Reg. 25,162 (May 12, 2005).

and a cap and trade program for regulation of mercury emissions.[20] Cap and trade has also been widely discussed as an appropriate medium for limiting greenhouse gas ("GHG") emissions. A group of states has joined in a Regional Greenhouse Gas Initiative ("RGGI") that has promulgated a draft rule for capping and trading GHG emissions from the utility industry.[21] The McCain-Lieberman bill would establish a federal cap and trade program for limiting GHG emissions.[22]

The EPA has published guidance on water pollutant trading[23] and wetlands mitigation banking[24] under the Clean Water Act. A number of wetland banks have been established for satisfying mitigation programs under the federal dredge and fill program and parallel state programs.[25] Water pollutant trading programs have also been established in a variety of contexts. These include programs for the Long Island Sound,[26] the Kalamazoo River in Michigan, and the Conestoga River in the watershed of the Chesapeake Bay.

Trading has also been employed in programs to protect biodiversity. The U.S. Fish and Wildlife Service has established guidance for habitat banking to support mitigation requirements for issuance of incidental take permits under the Endangered Species Act.[27] Habitat banking has

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20. Supplemental Notice for the Proposed National Emission Standards for Hazardous Air Pollutants; *and* Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 69 Fed. Reg. 12,398 (Mar. 16, 2004) (codified at 40 C.F.R. pts. 60, 72, & 75).

21. A copy of the draft rule, published on March 23, 2006, can be found on the RGGI website, http://www.rggi.org (last visited Apr. 15, 2006).

22. The Climate Stewardship Act of 2003, S.139, 108th Cong. (2003), and the Climate Stewardship and Innovation Act of 2005, S.1151, 109th Cong. (2005). *See* Summaries of the Acts, *available at* http://www.pewclimate.org/policy_center/analyses/s_139_summary.cfm, *and* http://www.pewclimate.org/policy_center/analyses/s_1151_summary.cfm.

23. EPA, Office of Wetlands, Oceans, and Watersheds, Final Water Quality Trading Policy (Jan. 13, 2003), *available at* http://www.epa.gov/owow/watershed/trading/finalpolicy2003.html (last visited Apr. 15, 2006); EPA, Office of Water, Wetlands, Oceans, and Watersheds, Water Quality Trading Assessment Handbook: Can Water Quality Trading Advance Your Watershed's Goals?, *available at* http://www.epa.gov/owow/watershed/trading/handbook/ (last visited Apr. 15, 2006).

24. EPA, Federal Guidance for the Establishment, Use and Operation of Mitigation Banks, 60 Fed. Reg. 58,605 (Nov. 28, 1995).

25. JEFFREY ZINN & CLAUDIA COPELAND, AGRICULTURAL WETLANDS: CURRENT PROGRAMS AND LEGISLATIVE PROPOSALS (Jan. 4, 1996) (Cong. Research Serv. [CRS] Report 96-35, Env't & Natural Res. Pol'y Div.), *available at* http://www.ncseonline.org/nle/crsreports/wetlands/wet-4.cfm; Jeffrey Zinn, Wetland Mitigation Banking: Status and Prospects (Sept. 12, 1997) (CRS Report 97-849, Env't & Natural Res. Pol'y Div.), *available at* http://www.ncseonline.org/nle/crsreports/ wetlands/wet-8.cfm.

26. *See* Ann Powers, *The Connecticut Nitrogen Exchange Program*, 14 PENN ST. ENVTL. L. REV. 195 (2006).

27. Endangered Species Act § 10, 16 U.S.C. § 1539. *See* U.S. FISH & WILDLIFE SERV., GUIDANCE FOR THE ESTABLISHMENT, USE, AND OPERATION OF CONSERVATION

been widely used under California state programs to conserve threatened and endangered species, with more than fifty habitat banks established in that state.[28]

Trading has also been widely authorized in zoning and land use ordinances. Most states authorize transfer development rights (TDR) programs where more intensive development is authorized in some "receiving districts" that must buy development rights from landowners in environmentally sensitive districts slated to remain in a more natural state. A TDR program was used to conserve environmentally sensitive habitats in the New Jersey Pinelands.[29] In light of the success of that program, a similar program has been authorized in the New Jersey Highlands region.[30] Many TDR programs have been authorized at the municipal level.[31]

Recently, some have been investigating the opportunities for multi-media and cross media trading. For example, one of the speakers at the Goddard Forum has proposed focusing upon preservation and enhancement of areas that could produce credits for sale in multiple areas.[32] In a potential application of multi-media trading, reforestation of some stream corridors and their preservation might create credits in a water pollution program, carbon sequestration credits for a greenhouse gas trading program, habitat banking credits and transfer development rights.

These trading programs have many advantages. Most notably, they have allowed pollution reductions to be achieved at a lower price than

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BANKS (2003) (available from the Environmental Law Reporter Guidance & Policy Collection, ELR Order No. AD04868). The application of this mitigation banking guidance to protect habitat for the federally threatened bog turtle is described by Derald Hay in this edition. Derald J. Hay, *When Sealing the Leaks of Habitat Conservation Banking, Multiple Gaskets are Needed: The Case for Bog Turtle in Pennsylvania,* 14 PENN ST. ENVTL. L. REV. 299 (2006). *See also* Melinda E. Taylor, *Moving Away From Command and Control: The Evolution of Incentives to Conserve Endangered Species on Private Lands, in* BIODIVERSITY CONSERVATION HANDBOOK 441 (Robert B. McKinstry Jr., Coreen Ripp & Emily Lisy eds., Environmental Law Institute, forthcoming 2006); Marybeth Bauer et al., *Landowners Bank on Conservation: The U.S. Fish and Wildlife Service's Guidance on Conservation Banking*, 34 ENVTL. L. REP. 10717 (Aug. 2004).

28. CAL. RES. AGENCY & DEP'T OF FISH & GAME, A CATALOGUE OF CONSERVATION BANKS IN CALIFORNIA: INNOVATIVE TOOLS FOR NATURAL RESOURCE MANAGEMENT (1996), *available at* http://ceres.ca.gov/topic/banking/banking.html.

29. N.J. STAT. ANN. §§ 13:18A-30 to -55 (West 2005).

30. *Id.* § 13:20-13.

31. For example, Pennsylvania creates a specific property right in TDRs and authorizes their use as a regulatory tool in municipal zoning ordinances. 53 PA. STAT. ANN. §§ 10603(c)(2.2), 10619.1.

32. John Rogers, Bill Wallace & Elise Bacon, *Using Multi-Credit Trading Markets to Improve and Maintain Biodiversity, Watershed Quality, and Other Environmental Protection Goals, in* BIODIVERSITY CONSERVATION HANDBOOK 425 (Robert B. McKinstry Jr., Coreen Ripp & Emily Lisy eds., Environmental Law Institute, forthcoming 2006).

incurred in more traditional regulatory regimes. For example, the acid deposition trading program under the Clean Air Act achieved the required reductions at a much lower price than predicted. The lower projected cost of trading also induced Congress to establish a lower cap on emissions than it might otherwise have established. Trading programs have also frequently reduced environmental conflicts, by creating what is perceived to be a carrot rather than what is perceived to be a stick. They also reduce regulatory oversight and the delays incident to such oversight. They can also reduce the opportunity for the exercise of regulatory discretion, which is as often applied to relax environmental controls as to impose more stringent controls.

II. Limitations and Difficulties in Establishing Trading Programs

Nevertheless, trading programs have remained controversial and there are clear limitations on where trading mechanisms can and should be employed. Some environmental groups criticize the very idea of creating a property right to pollute. While this criticism is based more on perception than substance and would equally apply to any permit system, other criticisms go to real limitations to the use of trading. At the other extreme are those who argue that trading mechanisms can overcome all of the perceived deficiencies in the so-called "command and control" mechanisms that they replace.

In fact, trading programs and traditional environmental control programs bear many common attributes and are complementary to one another. No market can exist without laws that define, measure and protect property rights. Most trading programs therefore require some permit system to create limits on the general public's right to use common goods. Monitoring and reporting are required to measure how much of the common good each person is using in order to assure that each user of a common good does not use more than the user has a right to use. The Clean Air Act acid rain cap and trade program relied upon existing monitoring, reporting and permitting systems that had been created under the Clean Act during the two decades of regulation that preceded that program. Any trading program also requires some determination of the "cap" on the quantity of the resource that may be used and traded. This cap will ultimately be based on determinations that will include consideration of what technology can achieve, the cost of the limitation and impacts on human and environmental health. These are the same considerations that apply to the establishment of discharge limitations under traditional environmental regulatory statutes.[33]

33. *See, e.g.*, 33 U.S.C. § 13429(a) (designating limitations to be included in permits), § 1311(b) (limitations based on technological and economic considerations),

Moreover, cap and trade systems are frequently blunt instruments that may require more traditional regulatory programs to protect sensitive receptors.

There are significant difficulties in applying trading programs to situations where the environmental goods being traded are not readily fungible. For example, in the case of emissions trading, a discharge of one ton of a toxic pollutant at one place might not be equivalent to the discharge of a ton at another place. Similarly, in habitat banking, not all habitat is equivalent. Trading regimes are more readily applicable to situations where there is a total cap or where there are technology based limitations where an equivalent cap can easily be calculated. These limitations on trading are highlighted by the contrast between EPA's latest two rules, the Clean Air Interstate Rule ("CAIR"),[34] which has the potential to achieve real reductions over existing regulatory programs, and the Mercury Rule,[35] which many see as creating the potential for allowing toxic hot spots and slowing rather than speeding reductions in that toxic pollutant. Although the process may be complicated, trading regimes can be crafted to address situations where the environmental goods being traded are not fungible. For example, one can give varying weights to the amount of the pollutant discharged according to the location of the discharge or by weighing habitat according to its quality.

The design of a trading program often presents many of the same difficult scientific and economic decisions that come into play in establishing limitations under traditional so-called "command and control" systems. To design any cap and trade program requires consideration of scientific and economic issues. For example, a cap for discharges of water pollutants would require consideration of the environmental capacity of the stream. It is interesting that Maurice K. ("Doc") Goddard, whom the Goddard Fora honor, in testimony on the then proposed Clean Water Act, criticized the use of technology based limitations because he believed we could establish the type of water quality based total maximum daily loads—caps—that are proving very difficult to establish today. Ultimately the caps established for sulfur dioxide under the 1990 Amendments to the Clean Air Act were based upon political horse trading based on considerations of science and cost; and although there have been reductions in acidity of rainfall, additional reductions are needed to protect soils and waters from the effects of acid rain.

Differences in quality of various environmental goods can also

§ 1302 (effluent limitations based on water quality standards).

34. 70 Fed. Reg. 25,162 (May 12, 2005).

35. Clean Air Mercury Rule (CAMR), 70 Fed. Reg. 28,606 (May 18, 2005).

complicate the design of a trading program. It is often very difficult to determine exchange rates for different types of land or habitat. For example, one of the most difficult tasks in the development of a pilot habitat banking program for the federally threatened bog turtle (*Clemmys muhlenbergii*) is the calculation of the exchange rates for various types of habitat. Calculation of exchange rates will require construction of a matrix giving weights to core breeding habitat, buffers and recharge areas, connective habitat, and supporting landscape and further subdividing these categories into low, medium and high quality habitat. Creation of an effective trading regime for toxic pollutants that is also protective of health will require consideration of how pollutants will disperse, so as to prevent toxic hot spots. While trading regimes that do not include these considerations may not be protective of health or the environment, technology based emissions limitations will suffer from the same failure.

Creation of a trading program that is equitable, particularly with regard to the initial assignment of entitlements, also creates significant difficulties.[36] For example, one might argue that it is unfair to allocate preferential rights to a common good, such as the environment, to any particular group. Such an argument would award everyone an equal number of credits. On the other hand, those who have made significant investments in plants and equipment that emit pollutants might argue that it would be unfair to deprive them of the value of the investments by creating a program that did not grant them a greater number of permits than granted to a member of the general public. In many senses, these same issues are presented by the allocation by permits under traditional environmental regulatory programs. These traditional programs, in effect, grant existing facilities rights to pollute that are preferential, while granting the general public no rights. Thus, these equity effects simply become more obvious in trading programs. While this greater transparency may result in the creation of a more equitable system, considerations of equity still present difficulties in designing an initial structure of these programs.

III. Presentations at the Goddard Forum and Articles in this Symposium Edition

The Goddard Forum, represented by the articles that follow, examined these issues and the application of environmental trading programs in all of their manifestations. The Forum started with a panel

36. Adam Rose, Brandt Stevens, Jae Edmonds & Marshall Wise, *International Equity and Differentiation in Global Warming Policy: An Application to Tradeable Emission Permits*, 12 ENVTL. & RESOURCE ECON. 25 (1998).

examining the underlying theory and the limitations on trading. Tom Tietenberg, the Mitchell Family Professor of Economics at Colby College, whose article appears here, addressed the theory from an economist's point of view. David Driesen, a Professor at Syracuse University College of Law and a Member Scholar of the Center for Progressive Regulation, whose article also appears here, discussed the limitations on trading. In the next panel, Denny Ellerman, Joe Goffman, and Karl Hausker examined how trading has been most widely applied, which is in the area of trading in air programs. That panel discussion is represented by Joe Goffman's article examining trading under Title IV of the Clean Air, the acid rain cap and trade program. In the third panel Adam Rose and Thomas D. Peterson, an economist and climate change policy expert, respectively, examined the use of trading to address greenhouse gas emissions. In their article appearing here, they, with ZhongXiang Zhang of the East-West Center, address the regional greenhouse gas trading programs that have emerged in the United States. In the fourth panel at the Forum, Ann Powers of Pace Law School Center for Environmental Legal Studies, James Shortle of Penn State, and Kenneth Warren discussed the growing number of the programs that have attempted to utilize trading in the control of water pollution. That panel discussion is represented here by Ann Power's article addressing water pollutant trading in the Long Island Sound. In the fifth panel, Michael Bean of Environmental Defense, George Kelly, who is in the business of wetlands banking, Lori Lynch, and John Theilacker of the Brandywine Conservancy discussed how trading has been used in land and habitat conservation—specifically habitat banking, wetland banking and use of transfer development rights. Although no member of that panel has an article in this symposium edition, the Student Comment by Derald Hay in this edition discusses the development of a pilot habitat banking program for the bog turtle under the Endangered Species Act. In the sixth and seventh panels, Baird Brown, Andrew McElwaine and John Rogers addressed some of the newest innovative programs for multi-media and cross media trading and David Mandelbaum and Bonnie Barnett looked at some of the difficult ethical issues presented by trading. Although neither panel is represented by an article here, the multi-media trading program discussed by Messrs. McElwaine and Rogers and some of the property concepts underlying Baird Brown's discussion of use of cross-media trading appear in a recently published book of articles from the Third Goddard Forum, addressing biodiversity.[37]

37. *See* John Rogers, Bill Wallace & Elise Bacon, *Using Multi-Credit Trading Markets to Improve and Maintain Biodiversity, Watershed Quality, and Other*

In *Tradable Permits in Principle and Practice*,[38] Tom Tietenberg reviews a variety of applications of trading programs with the aim of identifying lessons that can be learned about the design and applicability of trading programs. His review focuses on the "three main applications of tradable permit systems—air pollution control, water supply and fisheries management—as well as some unique programs" such as wetlands mitigation banking in the United States, "the program in the Netherlands to control the damage to water pollution from manure spreading," and a program to allocate grazing rights on federal land in the United States.

Dr. Tietenberg evaluates the results of the use of these trading programs on the basis of three criteria: implementation feasibility, environmental effectiveness and economic effectiveness. With respect to implementation feasibility, Dr. Tietenberg states that conventional wisdom has suggested that a tradable permits approach usually is only accepted after the failure of other more familiar approaches, although this is not always the case. Trading often does not produce lower costs or significant trading initially, but may achieve this result as those involved become more familiar with the tradable permit programs. Dr. Tietenberg notes that using a free distribution approach to the initial allocation of permits is essential in building the political support for successful implementation of the approach. The desire of administrative agencies to put restrictions on transferability to protect environmental effects also can reduce feasibility, at least with respect to trading. Based on the criteria of environmental improvement, Dr. Tietenberg finds mixed results. While theory suggests that implementation of trading may allow a more stringent (environmentally protective) limit to be established, this has not always been the case in practice. Protectiveness frequently varies according to the enforcement design. Similar mixed results are evident from consideration of the direct effect on the resource controlled by the permit program and the effect on other resources. With regard to the third criterion, economic effects, tradable permits appear to increase the value of the resource (*e.g.*, water and fisheries) or lower the cost of compliance (*e.g.*, emissions reduction), if adequate enforcement is in place.

Based on the experience in the programs that he evaluates, Dr. Tietenberg draws a variety of useful lessons for program design, program

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Environmental Protection Goals, *in* BIODIVERSITY CONSERVATION HANDBOOK 425 (Robert B. McKinstry Jr., Coreen Ripp & Emily Lisy eds., Environmental Law Institute, forthcoming 2006); C. BAIRD BROWN, *The Economics of Biodiversity*, *in* BIODIVERSITY CONSERVATION HANDBOOK 377 (Robert B. McKinstry Jr., Coreen Ripp & Emily Lisy eds., Environmental Law Institute, forthcoming 2006).

38. 14 PENN ST. ENVTL. L. REV. 251 (2006).

effectiveness, and performance. He finds that resource context matters. Specifically, the characteristics of the resource being controlled by tradable permits significantly affect program evaluation, design and effectiveness. In particular, where spatial and temporal variation can affect the protectiveness, greater attention must be paid to program design and greater administrative attention may be required during implementation.

In the second article, *Trading and Its Limits,*[39] Professor David M. Driesen explores the limits of trading. Trading only works well when the pollutants can be well monitored, when there are minor equitable concerns about geographic tradeoffs, and when an existing fungible unit can be devised to adequately measure the value of disparate actions to deliver environmental benefits. The presence or absence of these conditions determines the usefulness of trading and its utility varies in its application to different environmental problems. Nevertheless, the effectiveness of trading can be optimized with good design. Professor Driesen questions the underlying assumption that supports trading, *viz.* that the best approach to meeting any regulatory goal involves choosing the least expensive method. He suggests that, in some cases, programs whose short term, quantifiable costs may be higher, may be the better solution in the long run. For example, in the case of the transition from fossil fuels to renewable energy resources, Professor Driesen suggests requiring initially expensive measures that would lead to a technological transformation may create greater long term benefits than a program leading to implementation of measures with greater short term cost effectiveness (*i.e.* the lower cost program). Alternatives to trading might better achieve long term goals. For example, elsewhere, the author has suggested constructing a regime where competitors are charged for a party's reduction of pollutants beyond a certain threshold.

In *Title IV of the Clean Air Act: Lessons for Success of the Acid Rain Emissions Trading Program,*[40] Joseph Goffman evaluates the characteristics of the Clean Air Act Title IV program for controlling acid rain deposition which made that program a success. In so doing, he also evaluates the proposals of the Clear Skies Initiative, implemented through the CAIR and mercury rules,[41] in light of these lessons. The sulfur dioxide trading proposal generated significant cost savings and

39. 14 PENN ST. ENVTL. L. REV. 169 (2006).

40. 14 PENN ST. ENVTL. L. REV. 177 (2006).

41. In the Clear Skies Initiative, President Bush proposed establishing a cap and trade program for nitrogen oxides, sulfur dioxide and mercury in lieu of existing Clean Air Act programs through amendments to the Clean Air Act. No legislation has been passed and most of these proposals were implemented through rulemaking through the CAIR and mercury rules.

advances in environmental protection for several reasons. First, the program was a success because it was structured to be "faster, cheaper and greener." It established a cap that would result in 10 tons of reductions rather than 8 in return for allowing greater flexibility through trading. It also allowed banking of early excess emissions to encourage earlier reductions. Second, the proposal "kept it simple," establishing a uniform cap and allowing utilities to meet it in any way they deemed fit, by making changes to reduce emissions or buying excess emissions from others. This removed the high degree of administrative discretion in earlier programs, where administrative review both restricted the choices that regulated parties could make and often resulted in less environmental control when discretion was exercised to relax standards or deadlines.

These characteristics that made the program so successful were made possible by two factors. First, the nature of acid rain generation made it possible to reduce the acidity of rain by allowing reductions across a broad area where one pound of reduction in one area was fungible with a pound elsewhere. More importantly, this SO_2 trading program was established as a complement to, not as a replacement for, the existing authorities of Title I of the Clean Air Act. The existing legislation, which was left intact, provided protection to assure that local concentrations would not exceed health and welfare based standards, and thus did not undermine existing provisions for improvement of air quality in all current nonattainment areas and the preservation of air quality in airsheds where air quality was better than current standards.

Mr. Goffman notes that the failure of the Clear Skies initiative to provide for excess and early reductions and its proposal to supplant existing protections substantially depart from the characteristics that made the Title IV program a success. Mr. Goffman also notes the importance of the opportunity for long range and advanced planning in making that program a success and suggests that the failure of the Clean Skies proposal to include carbon dioxide emissions would undermine its logic. Specifically, the failure to establish a simultaneous cap on carbon dioxide, as well as sulfur dioxide, nitrogen oxides and mercury, deprives the regulated community of the flexibility to anticipate this control in the planning for capital improvements.

Although the federal government has eschewed the establishment of limitations on greenhouse gases ("GHGs"), many states have proceeded to establish GHG control programs and some have established requirements for controlling four pollutants, including carbon dioxide, in power plants.[42] In *Regional Carbon Dioxide Permit Trading in the*

42. *See, e.g.*, Robert B. McKinstry Jr., *Laboratories for Local Solutions for Global*

United States: Coalition Choices for Pennsylvania,[43] Dr. Adam Rose, Dr. ZhongXiang Zhang, and Thomas D. Peterson discuss the growing number of regional associations in which states have entered into voluntary arrangements to limit GHG emissions. In particular, in the Regional Greenhouse Gas Initiative (RGGI), a number of northeastern states have joined to create a regional GHG cap and trade program, beginning with the utility industry. In the paper, the authors analyze five key issues relating to these current and potential climate action associations: (1) the extent of the total and individual state mitigation cost-savings across all sectors from potential emission permit trading coalitions; (2) the size of permit markets associated with the various coalitions; (3) the relative advantages of joining various coalitions for swing states such as Pennsylvania; (4) the implications of the exercise of market power in the permit market; and (5) the total and individual state/country cost-savings from extending the coalitions beyond U.S. borders.

After describing the evolution of the RGGI program from the New England Governors and Eastern Canadian Premiers Climate Action Plan and several state proposals of GHG cap and trade programs, the authors analyze these questions, using the results of economic modeling of interregional and international permit trading of six combinations of states in the Northeast United States and the European Union. The simulation shows that overall efficiency gains from trading with a system of flexible state caps, with greater overall cost savings increasing with increasing geographic scope. However, costs vary considerably according to who takes part in the trading program and the identity of the participants can affect whether some states are net permit buyers or sellers.

In *Connecticut Nitrogen Credit Exchange Program,*[44] Professor Ann Powers describes the implementation a trading program in a context where many of the characteristics that make trading programs most successful do not apply—the achievement of water quality based standards. The Connecticut Nitrogen Credit Exchange Program is a program implemented by the State of Connecticut providing for trading

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Problems: State, Local and Private Leadership in Developing Strategies to Mitigate the Causes and Effects of Climate Change, 12 PENN ST. ENVTL. L. REV. 15 (2004) (describing state programs and the four pollutant strategy in Massachusetts and New Hampshire); *see also* ROBERT B. MCKINSTRY JR. & THOMAS D. PETERSON, *The Implications of the New "Old" Federalism in Climate Change Legislation: How to Function in a Global Marketplace When States Take the Lead,* PAC. MCGEORGE GLOBAL BUS. & DEV. J. (forthcoming 2006) (providing a more up to date description of state climate change programs).

43. 14 PENN ST. ENVTL. L. REV. 203 (2006).

44. 14 PENN ST. ENVTL. L. REV. 195 (2006).

of nitrogen water pollution discharge credits to meet a total maximum daily load established under the Clean Water Act for nitrogen in the Long Island Sound. This is a complex program that deviates significantly from the classic market model. The State sets each plant's discharge limit and establishes trading ratios based on the distance of the plant from the principal area of concern, an anoxic "hot spot" in the Sound. The State sets the number of credits for each year, administers the credit exchange and buys any excess credits that are created. It also determines which plants qualify for loans and grants for upgrades that will be necessary to improve water quality in the Sound. Based on trading in 2002 and 2003, the program has been initially successful, in that the plants' combined discharges currently are in compliance with the Nitrogen General Permit, the price of credits has remained at a modest level, and both the Connecticut Department of Environmental Protection and state legislators are pleased with the program. However, the author emphasizes the success of the program has to be judged by the water quality improvement in the Sound and, in the initial years, credit prices remained low because the major plant upgrades that will be necessary have not been made.

A number of factors should be considered by any person looking to the Long Island sound trading program as a potential model for other water pollution trading programs. This is part of a long-term effort to restore Long Island Sound, where extensive monitoring and modeling exist, a TMDL has been established and the existence of a significant knowledge base allows trading ratios to be reliably determined for each plant. In addition, Connecticut is a small state, and the Sound is very important for its economy, so that financial resources can be devoted to absorb substantial expenses. Moreover, there are concerns about the future of the program since physical factors, such as weather conditions, may change and the grant and loan funds from the State may not be available if economic conditions change.

Finally, in a Student Comment appearing in this edition, Derald Hay examines some of the difficulties encountered in structuring a habitat banking regime for the bog turtle in Chester County, Pennsylvania, and New Castle County, Delaware.[45] Habitat banking has been authorized under the Endangered Species Act to replace individual mitigation projects with larger habitat conservation areas that will provide better functional habitat while facilitating more rapid review and approval of incidental take permits. Like the wetlands mitigation banking program,

45. Derald J. Hay, *When Sealing the Leaks of Habitat Conservation Banking, Multiple Gaskets are Needed: The Case for Bog Turtle in Pennsylvania,* 14 PENN ST. ENVTL. L. REV. 299 (2006).

it does not provide large liquid markets, but has the potential for improving environmental results while reducing costs associated with delay.

IV. Conclusion

The Note and articles in this volume provide a cross section of experience gained in the implementation of environmental trading programs. These programs present the opportunity to achieve greater environmental performance across a variety of media while reducing costs of compliance, reducing delays and increasing flexibility. Trading is not a solution by itself, but works best as one of a number of regulatory tools. The creation of a market, in fact, depends upon a supporting and supplementing regulatory structure. Moreover, trading is not a one-size-fits-all tool. A trading program must be carefully constructed in light of the resource at issue and the supporting regulatory program. The articles in this volume provide a variety of models that can be used and appropriately modified to gain the environmental and economic advantages that can be achieved through properly constructed trading mechanisms.