

Are Markets the Solution to Water Pollution?
A Sociological Investigation of Water Quality Trading

Dissertation

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Abstract

The management of environmental pollution has traditionally been accomplished via the regulatory power of the state, but more recently we have witnessed the rise of a new, market-based form of governance. Its most visible manifestation is the trading of pollution credits, in which one polluter purchases credits to offset its own pollution output at lower cost than actually remediating the pollution on-site. This form of commodification has rapidly expanded and now includes markets for greenhouse gas, wetlands, and surface water nutrient credits. I focus on water quality trading and its specific institutional form in which point source “end-of-pipe” dischargers purchase nutrient credits from nonpoint sources such as farmers. I argue that the best way to understand this complex form of environmental governance is through a Polanyian framework.

Polanyi's notion of a “double movement” illustrates the unique relationship between market and state that underlies water quality trading programs. While it seems that the commodification of water quality shifts market oversight from the state to the private sector, there is simultaneously a move towards increased participation by regulatory agencies to counter market uncertainties. I argue that such regulatory oversight is in fact required for the proper functioning of this market sector. I then

conduct an extensive literature review of scholarly work on water quality trading and demonstrate that the literature consistently rests on a number of flawed assumptions, notably that the supply of water quality credits simply follows demand and that farmers behave as rational economic actors in regards to implementation of conservation practices. I argue that this understanding of water quality trading is hampered by the dismissal of social factors, particularly the social embeddedness of economic actors and the trust relations between them.

I use a telephone survey of participants in all active water quality trading programs nationwide as well as site visits to a subset of programs to test these competing bodies of scholarship. The basic question is, What accounts for differences in success rates both between and within trading programs? The use of a local, trusted, embedded intermediary as the link between programs and farmers emerges as the most important explanatory variable for program success. I further illustrate the specific causal mechanisms by which these embedded relationships result in more farmer participation. Finally I examine several negative social and environmental consequences that result from orienting a program towards a more free-market approach.

It appears doubtful that the desire for cost efficiencies on one hand and the need for embedded relations with farmers on the other can be resolved while expanding the market scope of water quality trading. The key may lie in reconfiguring the end goal of trading from cost-effective water quality improvement to the implementation of agricultural best management practices.

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Table of Contents

Abstract	ii
Acknowledgements	iv
Vita	v
List of Tables	xiii
List of Figures	xiv
List of Abbreviations	xv
Introduction	1
Chapter 1: Commodification of Nature and a Double Movement in Environmental Governance: The Case of Water Quality Trading	14
1.1 Capitalism and the Ecological Crisis: Setting the Stage for a Market Approach.....	16
1.1.1 The State's Response to the Ecological Crisis	19
1.2 To Deal In Nature You Have To Deal With Nature: The Problematic Commodification of Environmental Services.....	24
1.2.1 Commodification of Nature: The Contribution of Critical Social Science.....	26

1.2.2 Understanding the Contradictions: Polanyi’s Double Movement.....	32
1.3 Before You Can Trade, You Must Cap: The Clean Water Act and the Regulatory Creation of Demand.....	37
1.3.1 Point Sources Versus Nonpoint Sources.....	37
1.3.2 The Mechanics of Capping: TMDLs and the NPDES.....	40
1.4 Empirical Evidence of the Double Movement: State Oversight and a Functioning Water Quality Trading Market.....	46
1.4.1 State Authority.....	47
1.4.2 Prohibitions.....	49
1.4.3 Unit of Trade.....	51
1.4.4 Geographic Restrictions.....	52
1.4.5 Credit Duration.....	53
1.4.6 Credit Verification.....	56
1.4.7 Final Authority.....	59
1.5 Discussion. Markets, Uncertainty, and Environmental Harm: Explaining the Double Movement.....	60
Chapter 2: The Farmer as Rational Actor and the Assurance of Supply: A Sociological Critique of the Market Approach to Water Quality Trading.....	66
2.1 Program Evaluation: The Good, The Bad, and The Assumptions.....	68
2.2 Economic Principles and the Market Approach to Water Quality Trading.....	72
2.2.1 Property Rights and the Creation of Demand.....	73

2.2.2	Freedom of Market Action.....	76
2.2.3	Transaction Costs and Market Efficiency.....	79
2.2.4	Minimize Government.....	86
2.2.5	Reliable Information and the Reduction of Uncertainty.....	91
2.3	Propping Up the Market Approach: Three Flawed Assumptions.....	95
2.3.1	Does Supply Follow Demand in Water Quality Trading?.....	98
2.3.2	The Farmer as Rational Actor? A Deeper Understanding of Farmer Decision-Making	101
2.3.3	Market Primacy and the Exclusion of Social Relations.....	104
2.3.4	Going Beyond Assumptions: Insights from Adoption Studies.....	106
2.4	Social Embeddedness and Agriculture.....	110
2.4.1	What is Social Embeddedness?.....	111
2.4.2	Embeddedness and Conservation.....	114
2.4.3	Disembeddedness and Embeddedness in Water Markets: Empirical Evidence From the Literature.....	118
2.5	Discussion. Water Quality Trading: Means To What End?.....	124
	Chapter 3: Methodological Issues and Procedures.....	131
3.1	Research Questions.....	131
3.2	Methodological Approach.....	133
3.2.1	Data Limitations.....	134
3.2.2	Tools to Deal With Data Limitations.....	136

3.2.3 Data Gathering and Analysis.....	141
3.2.4 Operationalization of Variables.....	149
3.3 The Path Ahead.....	152
Chapter 4: Differential Success Rates Among Water Quality Trading Programs:	
Market Factors and Social Embeddedness.....	154
4.1 The Role of Economic, Institutional, and Social Variables in the Success of Trading Programs.....	155
4.2 Investigating Geographic Disparities of Program Success.....	161
4.2.1 The Good, the Bad, and the Ugly: Three Programs From Wisconsin	162
4.2.2 A Tale of Three Counties: Differential Success Rates in the Kalamazoo River Program.....	168
4.2.3 Scaling Up: Differential Success Rates in the Great Miami Program	175
Chapter 5: Communication and Trust: Embeddedness and the Question of Social Mechanisms.....	
5.1 Fine-Grained Information Transfer.....	186
5.1.1 Personal Contact.....	189
5.1.2 Tapping Into Existing Relationships.....	191
5.1.3 Evidence-Based Word of Mouth.....	195
5.1.4 Familiarizing the Program.....	196
5.2 Problem Solving.....	199
5.3 Trust.....	203

5.3.1 Trust, Credibility, and Advocacy.....	204
5.3.2 Knowing Agriculture.....	207
5.3.3 The Moral Consequences of Pollution.....	210
5.3.4 Trust as Risk Management Strategy	212
5.4 Is All Trust the Same?.....	216
Chapter 6: Consequences of Increased Marketization in Water Quality Trading.....	219
6.1 Explicitly Market-Oriented Programs.....	222
6.2 Explicitly Non-Market-Oriented Programs.....	225
6.2.1 Control Over Price.....	225
6.2.2 Caps On Farmer Reimbursement.....	227
6.2.3 De-Emphasizing Market Efficiency.....	228
6.2.4 Equity as a Specific Goal	228
6.3 Consequences of a Market Approach.....	230
6.3.1 Disparities in Farmer Participation.....	230
6.3.2 Extrinsic Incentives and Market Exploitation.....	235
6.3.3 Self-Sacrifice by the Local Intermediary.....	239
6.3.4 Severing the Link Between Trading and Water Quality Improvement...	242
6.3.5 Diluting the Larger Meaning of Conservation.....	246
Final Discussion and Conclusion	253
References	270

Appendix A: Literature Review of Water Quality Trading: Observations, Critiques, & Suggestions for Improving Program Design	287
Appendix B: Survey of Program Participants.....	291

List of Tables

Table 1.1 State and Federal Water Quality Trading Rules.....	48
Table 3.1 Functioning Water Quality Trading Programs in North America.....	143
Table 3.2 PS-NPS Programs Involving Farmers	144
Table 3.3 Number of Interviews by Program and Role Category	148
Table 4.1 Correlation Between Institutional Economic Variables and Program Success	156
Table 4.2 Previous Correlations Including Social Embeddedness.....	159
Table 4.3 County Agricultural Statistics for Kalamazoo River Watershed.....	170
Table 4.4 County Agricultural Statistics for Great Miami River Watershed.....	177
Table 6.1 Degree of Market Orientation of Functioning Water Quality Trading Programs.....	220

List of Figures

Figure 3.1 Water Quality Trading Programs Nationwide (Proposed, Past Functioning, and Presently Functioning)	142
Figure 4.1 Wisconsin and Three Water Quality Trading Initiatives.....	163
Figure 4.2 Kalamazoo River Watershed and Relevant Counties.....	169
Figure 4.3 Great Miami River Watershed and Relevant Counties.....	176

Abbreviations

BMP:	Best Management Practice
CD:	Conservation District (Pennsylvania only)
CRP:	Conservation Reserve Program
EQIP:	Environmental Quality Incentives Program
GHG:	Greenhouse gas(es)
LCD:	Land Conservation District (Wisconsin only)
N:	Nitrogen
NPDES:	National Pollutant Discharge Elimination System
NPS:	Nonpoint source (water pollution)
P:	Phosphorus
ppm:	Parts per million
PS:	Point source (water pollution)
SWCD:	Soil & Water Conservation District
TMDL:	Total Maximum Daily Load
USEPA:	United States Environmental Protection Agency

Introduction

All human activity produces waste. The first law of thermodynamics is ironclad. At the micro level, individuals generate waste from their own metabolic activity and consumption patterns. At the macro level, the output from millions of individuals aggregates into multiple waste streams which governments at all scales must constantly process (Fischer-Kowalski, 1997). And then there are the industrial processes of resource extraction, production, and distribution which produce their own unique trails of waste. All told, these diverse forms vary from solid waste sent to landfills, to the emission of greenhouse gases and particulate matter into the atmosphere, to the discharge of excess nutrients and other pollutants into surface water systems.

Until the last half century, the human waste stream was considered a policy issue, a public health issue, and perhaps an aesthetic issue, but rarely an environmental issue (Strasser, 1999). That began to change with the dawn of the environmental movement in the 1960s. Indeed, the various environmental crises facing global society can be broken into two broad categories: problems of overconsumption (e.g., depletion of forests, fisheries, or freshwater) and problems of pollution, which is nothing more than the improper disposal of waste. Global warming, arguably the greatest

environmental threat ever to face our species, is the direct result of the production of certain kind of waste – greenhouse gases, the byproducts of fossil fuel combustion – without the technical or social infrastructure suitable for its proper disposal (Pearce, 2008). This problem of environmental pollution has increased considerably since the industrial revolution, and by many accounts it has reached or will rapidly reach crisis proportions in our own lifetimes (cf., York et.al., 2003; Pearce, 2008), leading some to ask a jaundiced question: “Is modernity ecologically irredeemable?” (Dryzek, 1995: 231).

Consider the case of surface water pollution. Reviews of the scientific literature list the variety of problems that result from excess nutrient inputs into aquatic ecosystems, including loss of habitat, depletion of oxygen, fish kills, and impairment of drinking water quality (Carpenter et.al., 1998; Smith et.al., 1999). Perhaps the most troubling outcome is the Gulf of Mexico’s eutrophic “dead zone,” an area of over 20,000 square kilometers stretching from the mouth of the Mississippi River into the Gulf in which nearly all marine life is snuffed out from a chain reaction beginning with excess nutrients flowing into the river from thousands of upstream tributaries (Rabalais et.al., 2002).

Until recently the state’s response to this challenge has been primarily the “command-and-control” strategy: the enactment of legislation imposing limits on the quantity of pollutants that may legally be emitted by dischargers, with violators facing stiff financial penalties. The standout example in the realm of water pollution is the 1972 Clean Water Act, which gave the US Environmental Protection Agency (USEPA) broad

authority to set water quality attainment goals, conduct extensive biological and chemical monitoring of water bodies, and, most importantly, enforce water quality standards by requiring industrial and municipal dischargers to reduce their emissions of certain chemicals.

The goals of the Act were nothing short of ambitious: to achieve a level of water quality across the nation sufficient for healthy fish habitat and recreational use by 1983, and to *eliminate* the discharge of pollutants into navigable waters by 1985 (US Congress, 2002: 3). Bolstered by a faith in the power of regulations to affect behavior and an assumption that the large majority of water quality degradation stemmed from factories and wastewater treatment plants, the government was optimistic that it could reverse a century of deterioration in water quality by taking charge of the problem from the top. However, the political and logistical reality of accomplishing their goal proved far more difficult. Three decades after passage of the bill, some 40% of surface water in the US remained at least partially impaired. “Most of the evidence suggests that we are moving further from [the] goal, rather than closer towards it” (Faeth, 2000: 9).

The most notable aspect of this trajectory is the change in attribution. The major sources are no longer the industrial and municipal dischargers identified as culprits in the 1970s – they have in fact been brought under control by the strict standards of the Clean Water Act. During this same span of time industrial agriculture has become increasingly intensive, leading to a steady rise in the use of chemical fertilizers and the accumulation of huge quantities of livestock manure as animal production has shifted

towards large-scale confined feedlots. The result has been the application of nitrogen and phosphorus – the two nutrients most responsible for water quality impairment – in concentrations well in excess of what agricultural soils can absorb (Gollehon et.al., 2001). There are 3,456 waterways in the US classified as nutrient-impaired, and the bulk of this problem emanates from agricultural sources (Faeth, 2000) – a fact paralleled throughout the developed world (Russell and Clark, 2006). In Ohio, the USEPA’s Water Quality Inventory lists two activities as the most significant sources of stream degradation: non-irrigated crop production impairs 10,672 waterway miles statewide, while agricultural channelization impairs an additional 8,541 miles (USEPA, 2002). By all accounts “the familiar arsenal of policy instruments for pollution control,” when applied to agricultural pollution sources, is “of very dubious value” (Russell and Clark, 2006: 18).

Clearly the longstanding regulatory approach requires restructuring if we are to make additional progress towards meeting water quality objectives, and the last decade has seen the gradual rise of a new approach that trades in the stick for the carrot. There has been a slow shift from top-down strategies to a reliance on privatization, commodification, and price signals – what is commonly called the market approach to pollution remediation. In the realm of water pollution this approach is called water quality trading or nutrient trading, and it boils down to a simple transaction: one pollutant discharger, in lieu of reducing its own level of pollution output to required levels, is given the right to purchase “offset credits” from another discharger in order to meet its permit obligation. The underlying economic principle is that by avoiding the

costly bureaucratic meddling that characterizes a command-and-control approach, water quality trading can accomplish the same water quality improvements at reduced cost, because market actors respond to price signals nimbly and innovatively rather than reacting to top-down regulations with dull acquiescence.

The market approach to water quality attainment is only the latest permutation of a string of market-based strategies for tackling other forms of environmental pollution. In the 1970s the USEPA utilized a system of tradable permits which allowed the gradual phaseout of two ingredients then in common use by industry: lead in gasoline and chlorofluorocarbons (Stavins, 1998). Into the 1980s, the USEPA continued to take steps towards more permissive trading by allowing pollution credits to be traded within individual factories (see Solomon, 1999: 372-3). However, it was the growing threat from acid rain caused by sulfur dioxide (SO₂) in the late 1980s that propelled pollutant trading to a national scale (see Likens, 2007).

An amendment to the Clean Air Act passed by Congress in 1990 allocated annual SO₂ allowances among a group of 110 electric utility plants and permitted them to trade these allowances with one another. Those plants which could reduce their actual emissions to a level below their regulated level could trade the excess allowances to a plant which could not, thus creating an income flow for the former plant and a cost-effective means of meeting permit requirements for the latter. The result of this nationwide program has been striking. Not only were SO₂ emissions reduced well past the intended level, but at a cost savings of \$780 million per year (Carlson et.al., 1998).

Environmentalists and public health administrators also took note: atmospheric concentrations of SO₂ declined, acid rain has been reduced, and even the reduction in mortality rates from exposure to sulfates could be quantified (Burtraw et.al., 1997; Burtraw and Mansur, 1999). It appeared that environmental emissions could be quantified, commodified, and traded, resulting in a “win-win” for both environmental quality and economic efficiency. In the first large-scale experiment for a market approach to pollution remediation, economists’ theoretical models on trading efficiency were vindicated (Stavins, 1998).

Around the same time, a number of studies appeared by ecological economists that attempted to quantify for the first time the economic value of the services provided to humankind by ecosystems (see Dalton and Cobourn, 2003 for an overview). The most widely cited of these works was co-written by 13 prominent scientists and gave a conservative estimate of the full value of all the world’s ecosystems to human society at \$33 trillion, nearly two times the global GNP (Costanza et.al., 1998). If theoretical economists had provided proof of the efficacy of pollutant trading, ecological economists now provided a model for quantifying and commodifying additional ecological services. The stage was set for expanding the SO₂ market model to other environmental sectors.

Since that time we have seen the birth and expansion of ecosystem service trading markets for wetlands mitigation credits (Bishop, 2003; Wilkinson and Thompson, 2006), biodiversity offsets (Zwick, 2008a), and, most spectacularly,

greenhouse gas emissions. The latter sector, often called the carbon credit market, has grown at a frenzied rate that reached \$64 billion in global transactions in 2007 (Capoor and Ambrosi, 2008).

The water quality trading market is tiny in comparison and suffers from a lack of comparable vigor, a condition that continues to frustrate its proponents. Several studies from the early 1990s found that the cost of reducing nutrient output for agricultural entities could be 65 times lower than for industrial or municipal sources (Bacon, 1992), resulting in a net savings as high as \$15 billion if the latter were allowed to purchase offset credits from the former in lieu of costly capital upgrades (USEPA, 1992). The federal EPA signaled its encouragement of water quality trading by publishing a charter set of trading rules in 2003 and predicting that flexible market approaches could save \$900 million of taxpayer money each year compared to the least flexible command-and-control approach (USEPA, 2003). Yet the sector is anything but booming. Currently there exist a handful of functioning programs in which industrial/municipal dischargers can trade credits with one another, and twelve additional programs in which dischargers can purchase credits from agricultural sources (Breetz et.al., 2004; USEPA website; author's own research). Many of the early water quality trading programs proved moribund, with no trades at all taking place, and more recent programs have continued to suffer from low trading volume caused by both insufficient supply and demand (King and Kuch, 2003).

Why would this be the case? The idea of water quality trading is theoretically sound and seems to be bolstered empirically by the success of the SO₂ market. The shift to a market approach was meant to bring entrepreneurial instincts and cost savings to the governance of water quality. The incorporation of trading was supposed to result in a flush of new agricultural conservation in order to generate water quality credits. Why have trading programs been so slow to get off the ground and so anemic once established?

As I will argue in the chapters that follow, the transfer of a market approach from traditional commodity sectors to this new realm of ecosystem services encounters two broad hurdles. The first is based in physical reality: Commodifying the elusive concept of a water quality credit is more complex and fraught with uncertainty than its early proponents envisioned, requiring a continuing degree of regulatory oversight that belies the claim of market freedom. The second hurdle is more social in nature: a robust water quality trading market requires the acceptance of and participation by farmers, a group of actors that has not historically conformed to expectations of rational economic behavior in regards to the incentivized adoption of conservation practices. In short, the water quality trading market features pronounced differences from the sulfur dioxide or even greenhouse gas markets, as both the pollutant in question and the primary set of credit generators differ in ways that have significant effects on market outcomes. My intent in this dissertation is to explore these differences in order to arrive at a deeper

understanding of the variables that have the strongest effect on the success or failure of water quality trading initiatives.

* * * * *

Analysis of environmental services trading has largely been the province of economists and policy analysts. Empirical investigations of success rates and explanatory variables are typically framed in the language of neoclassical economic theory or institutional analysis. However, the invocation of the market as a tool for remediating environmental pollution also opens space for sociologists and related scholars to contribute to our understanding of not only how these markets function but how they emerged, how they operate, who benefits from them, and how they ultimately affect the environment. I will briefly enumerate four reasons for a specifically sociological approach to the question of water quality trading.

First, sociologists, along with political scientists and critical geographers, are uniquely equipped to analyze water quality trading within an *institutional* context. Nutrient trading is not merely another technocratic tool to manage pollution but a qualitatively new form of environmental governance. It represents the development of new institutions for managing environmental resources, engaging a diverse assortment of watershed stakeholders, and involving farmers in the implementation of environmentally-friendly practices. The market approach exists in a state of contestation

between economists who believe it to be the optimal solution to longstanding environmental problems, institutionalists who counter that it only works when embedded in a strong rule-making governmental structure, and social scientists who argue additionally for the importance of social relations between market actors (Lemos and Agrawal, 2006). In truth, the newest iteration of environmental governance structures is a hybrid between all three sectors – state, market, and civil society – so it marks the creation of whole new institutional forms and linkages designed to enhance environmental governance.

Second, as an example of the larger phenomenon of ecosystem service trading, water quality markets expand capital's reach into previously uncharted territory. This development at the present stage of late capitalism is of inherent interest to political economists. Will the commodification of nature help our attempts to ameliorate environmental damage, or only further the cycle of exploitation and depletion? Is it even possible to commodify something as stochastic and contextual as nature? And does a market approach encroach upon or alter the social relationships that are needed for such a complex endeavor to succeed?

Third, the lack of attention paid to these social relationships stands out in the literature on water quality trading. Many authors pay lip service to the idea of social forces, but empirical investigations of the role they play are almost entirely missing. Breetz et.al., one of the rare exceptions, argue that "the literature on trading lacks a comprehensive investigation of how the social context affects trading outcomes" (2005:

173). Particularly glaring for its absence is a focus specifically on the role that farmers play in the development of water quality trading programs. There would seem to be a natural link between farmer participation and the large body of literature on the adoption of agricultural innovations, but to the author's knowledge no scholarly piece has yet made the connection.

Finally, to the degree that we now begin to focus on environmental remediation from a sociological as well as a technical point of view, it further challenges the social sciences to integrate the theoretical and the applied. This is in keeping with the general thrust of environmental sociology, which has moved from a focus on more abstract questions during its first two decades to a new focus on the actual response to environmental crises by states, industries, and civic society (Buttel and Gijswijt, 2001). Pollution trading, far from being simply a market phenomenon, is the result of a web of scientific, regulatory, ecological, and cultural forces – a casebook example of what Elinor Ostrom and colleagues call social-ecological systems. And as they note, “The study of the governance of social-ecological systems . . . is an applied science like medicine and engineering, which aim to find solutions for diverse and complex problems” (Ostrom et.al., 2007: 15177).

This is particularly apropos for my field of rural sociology, which tends to favor pragmatism over pure theory. William Freudenberg asserted during his presidential address to the Rural Sociological Society several years ago that as our discipline develops we will need to break apart the traditional barrier between basic and applied

research and target our efforts towards the development of actual solutions to real-world problems (Freudenberg, 2006). This dissertation is written in that spirit.

* * * * *

The remainder of the dissertation is organized as follows. Chapter 1 is the most explicitly theoretical chapter, in which I examine the implications of the commodification of water quality credits from a Polanyian perspective. I frame the shift from a top-down to a market approach as an example of Polanyi's double movement thesis applied to environmental markets, which helps us understand why water quality trading takes the particular institutional form that it does. Chapter 2 provides an extensive review of the literature on water quality trading, both the bulk of it dominated by economics as well as the smaller contributions from other social science disciplines. I also introduce the concept of social embeddedness, which has played a nearly negligible role in the literature on trading to date. Taken together, this allows us to see which factors have been deemed most critical to the success of trading programs and which factors stand out for their silence. Chapter 3 introduces the reader to the status of water quality trading programs nationwide and details the methodology used to gather data for the analytical part of the study.

Chapters 4-6 comprise the "results" portion of the dissertation, divided into three chapters in order to answer three distinct research questions: What is the role of social embeddedness in explaining differential outcomes of water quality trading programs

nationwide? (Chapter 4) What are the major causal mechanisms by which social embeddedness affects market outcomes in the water quality trading sector? (Chapter 5) What are the consequences of moving towards a more explicitly market-based approach to water quality trading? (Chapter 6) Finally, in the concluding chapter I speculate on the future trajectory of water quality trading and summarize the two major hurdles to the increased marketization of trading programs as suggested by my research.

Chapter 1:
Commodification of Nature and a Double Movement in Environmental Governance:
The Case of Water Quality Trading

If this [production] process is to be organized through a self-regulating mechanism of barter and exchange, then man and nature must be brought into its orbit; they must be subject to supply and demand, that is, be dealt with as commodities.

-Karl Polanyi

Introduction

Federal policy instruments always bear the imprint of the epistemological assumptions of their time, and this is no less true of the Clean Water Act. In the late 1960s, the public and political imagination was captured by images such as the Cuyahoga River catching fire, which was clearly the product of industrial discharge spewing into the river directly from pipes. Factories were usually located in industrialized urban areas, and usually at downstream locations on major rivers. Thus when water pollution reached this crisis point, all eyes turned to what were thought to be the main culprits. It has taken several decades for attention to be refocused on rural areas, on non-industrial activities such as agriculture, and on small tributary streams that lie higher in the watershed.

This slow shift in emphasis underscores one of the themes that will reappear throughout the dissertation. Pollution has two distinct though interwoven dimensions: a biophysical dimension and a sociopolitical dimension. Pollution exists as a material phenomenon in the form of an actual, measurable (if not always tangible) waste stream. But this pollution stream is as much the result of the cultural, political, and economic structures unique to any given society as it is the technical production processes that actually produce it. O'Connor captures this idea succinctly: "sustainability is an ideological and political, not an ecological and economic, question" (1994: 153). This is an important point for at least two reasons. First, it shifts the scholar's task away from identifying the immediate technical sources of pollution, which has largely been the province of the physical sciences, and towards the more pressing question of how to deal with this pollution. Second, it forces us to examine the history of societal attempts to reduce or remediate pollution in a new light – not merely as a response to a technological challenge but as an outcome of ongoing contestation between market and state. And on this score the historical record is not kind, for as Schnaiberg points out, "societal efforts to inhibit [resource depletion and pollution] are hampered by the existing political-economic institutional arrangement that the history of economics has generated" (2005: 703).

In the following chapter I will lay out two broad bodies of theory that address the societal governance of environmental pollution. The first, centered in the field of environmental sociology, seeks to identify the political economic roots of the pollution

problem and makes some predictions about how a society governed by an industrial-capitalist economic mode will react as the problem grows. The second derives from Karl Polanyi's thesis of a "double movement" in the social regulation of market activity. It focuses our attention more specifically on the recent shift to a market approach to pollution control. The review of these two bodies of theory is accompanied by an overview of empirical research on the consequences of commodifying nature's services. I then link this theoretical and empirical work to water pollution by illustrating the double movement at work as it manifests in the various rules and protocols that comprise the US water quality trading sector. I close with a discussion of the roots of the double movement and the possibility that a regulatory hand may be a necessity in the proper governance of the environment.

1.1 Capitalism and the Ecological Crisis: Setting the Stage for a Market Approach

A generation of engineers, technicians, and economists has chimed in about the sources and consequences of the persistent problem of environmental pollution, but some of the most trenchant observations come from an overlooked corner: environmental sociology. This subfield formed in the early 1970s as an outcome of the wider environmental movement. Only a few years after its formation the Marxist theorist Alan Schnaiberg released a penetrating sociological critique of the structural roots of the environmental crisis (Schnaiberg, 1975), and he has since been followed by a handful of additional theorists who have written commentaries about environmental

degradation that provide insights into the nature of water pollution and the ways the state and industry might try to combat it.

Schnaiberg (1975) begins with the basic notion that the industrial-capitalist economic system has a tendency to sap its own natural resource base and degrade the environment. Citing both the first law of thermodynamics and the empirical history of societies since the industrial revolution, he uses Marxist terminology to frame the issue as a “societal-environmental dialectic.” On the one hand, economic expansion is a necessary component of social progress – the engine that drives production, consumption, and wealth. However, economic production requires the extraction of natural resources as the raw ingredients of the production process; some degree of environmental drawdown or deterioration is inevitable. This deterioration in turn threatens to slow the very economic expansion which gave rise to it in the first place as natural resource extraction becomes more costly (e.g., rising production costs for petroleum drilling) or even reaches a natural limit (e.g., the East Coast cod fishery). Hence Schnaiberg lays out a basic quandary facing all industrialized societies: how to continue economic expansion without degrading the resource base so completely that expansion comes to a halt.

Catton (1980) refers to this as the tendency of industrialized society to “overshoot” its ecological carrying capacity, a problem exacerbated by the time lag between the actual moment of ecological overshoot and the repercussions. More recently, a new wave of critical scholars have picked up this thread. Benton points out

that the trend towards ecological destruction exists because of the internal structure of capitalism itself. Capitalists have always sought to externalize whatever production costs they can in the name of profits, so what may be “ecologically irrational” is in fact “economically rational” – what Benton calls the “naturally mediated unintended consequences of production” (1991: 266).

O’Connor (1994), in a widely-cited essay, updates a fundamental feature of traditional Marxist analysis with what he calls capitalism’s “second crisis.” According to O’Connor, the fundamental contradiction marking capitalism that has occupied so much Marxian scholarship – the overexploitation of workers to the point where they are no longer able to afford the very products they are producing – is only capitalism’s first crisis, a demand-side crisis. By contrast, environmental deterioration presents a supply-side crisis: Capitalism needs natural resources to thrive, but its spiraling search for profits leads to overexploitation of the environment, eventually endangering the very resources upon which its continued growth depends. “When individual capitals attempt to defend or restore profits by cutting or externalizing costs, the unintended effect is to reduce the ‘productivity’ of the conditions of production, and hence to raise average costs” (O’Connor, 1994: 165). Or to use Dickens’ (2002) memorable words, capitalism becomes “its own gravedigger.”

Schnaiberg continued to write on the subject, and in a later work he expanded his observations on the contradictory role of the state in managing environmental degradation (Schnaiberg, 1994). On one hand, because of its explicit role in maintaining

the economy, government is obliged to support capital's desire to produce and expand (cf. the current financial crisis and the rationale for bailing out large banks and insurance corporations: they are "too big to fail"). From this point of view the state, like capital, sees the environment in terms of its market *exchange value*: how can surplus value be extracted from nature so as to produce and distribute commodities for profit? On the other hand, the state must also be responsive to its citizens' health, welfare, and recreation concerns. From this point of view it sees the environment in terms of its *use value*: how can natural amenities be conserved so as to maximize public benefit?

Schnaiberg's argument is simply that exchange values tend to dominate over use values in public policy and society at large. Examples cited by Schnaiberg (2004) include firms successfully arguing against environmental regulations on the grounds of increased costs to business, or exchange values flourishing even in contexts where use values traditionally dominated, such as the markets that have sprung up around natural amenity recreation (hiking, camping, rock climbing, etc.).

1.1.1 The State's Response to the Ecological Crisis

As the mountain of scientific evidence of environmental degradation grows and confirms the predictions made by the sociological theorists above, the question becomes: What can the state do about the situation? Government's primary role has never been environmental protection, but providing security, building basic infrastructure, and fostering economic productivity. Returning to Schnaiberg's earlier work (1975), the

conventional resolution to the societal-environmental dialectic is the *economic synthesis* – deprioritizing the environmental problem and carrying on with the status quo of economic production. The assumption is that environmental problems will rectify themselves via the operation of the basic laws of supply and demand – for example, as a natural resource (e.g., petroleum) becomes increasingly depleted its cost will rise, either allowing previously cost-prohibitive areas to be opened up for exploration (e.g., oil mining from tar sands) or spurring the innovation of new products which do not require the resource (e.g., ethanol for automobile fuel). Under this ideological framework the state can essentially ignore the issue of environmental depletion since the self-regulating phenomenon of supply and demand will allocate environmental resources to their socially optimal uses (Smith Jr., 2001).

As it becomes increasingly clear that pollution and resource depletion actually threaten the sustainability of industrial production, environmental regulations shift from protecting the environment to protecting industry itself. At this time, argues Schnaiberg (1975), society is forced to employ the *managed scarcity synthesis*, in which tighter controls are placed on production in order to bring the problem under control. Government takes power away from the self-regulating market to ensure that market externalities in a time of resource scarcity do not result in severe deprivation or inequality. However, such measures are only meant to last until the crisis passes and are only needed in relation to the specific problem or resource in question rather than across the entire sphere of economic production. The classic example of the managed scarcity synthesis is

the response to the Arab oil embargo of the 1970s, a singular event that inspired gas rationing, a series of new policy measures, and increased public recognition of our unstable dependence on foreign oil. When the embargo was lifted so too were these extreme measures; the long lines at gas stations dissolved, and along with them any sense of crisis. The question of note more than three decades later is how the state will respond if the managed scarcity mode must be prolonged indefinitely.

Schnaiberg (1975) also notes a third possibility: the *ecological synthesis*, consisting of a wholesale change to society's approach to the environment that prioritizes environmental health over economic production. This would involve deeper changes to the ways citizens and governments conceive of and interact with the environment, a societal shift of consciousness. Schnaiberg notes that this form of state-environment relationship has never existed and is unlikely to exist in the near future. In essence we swing back and forth between the economic and the managed scarcity syntheses, the former for long stretches of time and the latter during moments of crisis.

In the absence of a wholesale reconfiguration of the relationship between capitalism, the state, and the environment, what are other viable options for dealing with the environmental crisis? O'Connor (1994) predicts that capital will overcome barriers imposed by natural shortcomings by appropriating and altering nature itself through the increased use of technological force. Nature will be physically restructured in order to make it more amenable to exploitation, what O'Connor calls "remaking nature in the image of capital." Examples include the clearing of native forests and their

replacement with monocultural tree plantations, or the laser leveling of agricultural fields until they are perfectly flat.

Dickens (2002), somewhat less caustic, believes that capital will find a way to “restructure its way out of its environmental crisis” by rewriting the rules governing private property, commodification, and commodity transfer. Resource inputs which were formerly free, commonly held, or seen as too abstract to privatize (e.g., fish in the ocean; the flora of rainforests; the genetic makeup of new breeds of plants) will now be commodified and turned into fungible and excludable private property (fish quotas in certain fisheries; proprietary rights placed by pharmaceutical companies on discovered botanical compounds; patents on the genetic building blocks of life). The “mental” will be made “material,” and the material will be privatized (Godelier, 1988).

One resource which Dickens (2002) does not mention is the absorptive capacity of natural “sinks” such as surface water bodies or the atmosphere – what we now call ecosystem services. Schnaiberg makes the connection in one of his most recent publications, explicitly placing the commodification and trading of ecosystem services within the framework of the managed scarcity synthesis. He argues that in times of mounting environmental crisis the state may force the issue of ecosystem service commodification “by imposing *anticipatory restrictions* to create an *imposed scarcity of access to ecosystems*” (Schnaiberg, 2005: 706; emphasis in original). With privatization and imposed scarcity comes a rise in exchange values and a distinct shift of the burden of environmental governance from the public to the private sector. The

commodification of nature thus serves a highly useful function for capital, allowing it to escape, at least for the moment, the consequences of the environmental degradation it has wrought. It “offers firms, state bodies, and sympathetic stakeholders a range of ‘environmental fixes’ to the endemic problem of sustained economic growth” (Castree, 2008a: 146).

Such comments come just as we begin to see a rapid increase in the interest being paid to environmental service commodification and marketization. In the last half decade the rise of policies and initiatives to commodify and trade offsets related to various environmental services has been extraordinary, as described in the introductory chapter. Legislation placing caps on nutrient emissions into water bodies or greenhouse gas emissions into the air is the first sociopolitical step in the trading of environmental commodities, as the state follows the market’s lead. The recent creation of an Office of Ecosystem Services and Markets within the USDA suggests that the trajectory is already moving from policy to bureaucratic administration.

It would appear to the casual observer that the theorists’ predictions above are coming true. The use values inherent in all services provided by nature – filtering of pollutants, nutrient cycling, etc. – are being rendered into exchange values much as land was commodified under the English system of enclosure in the 18th century. Whether capital has found a viable and sustainable way to restructure itself out of the environmental crisis remains to be seen, but we can say with certainty that it is betting its money on the commodification of natural resources.

1.2. To Deal In Nature You Have To Deal With Nature: The Problematic

Commodification of Environmental Services

In a short span of time and across multiple sectors we have witnessed the commodification of environmental services, the creation of markets for their exchange, and the active attempt to widen the sphere of commodities to encompass more diverse forms of environmental remediation. A good example is the attempt to include “avoided deforestation” – i.e., simply doing nothing to a forest that may have otherwise been logged – as a (non)activity eligible for greenhouse gas credits. Nature, already in many ways a “product” of social and political forces (Smith, 1984; Demeritt, 1994), is now being additionally “converted into a form of capital and commodity” (Prudham, 2003: 637). It appears that the free market system has indeed restructured the very rules of the game – “remade nature in the image of capital” – in order to turn a growing problem (environmental degradation) into a growing opportunity (environmental credits) (O’Connor, 1994).

Natural resources have been the product of capitalist appropriation for centuries, but this is something qualitatively different: the appropriation not of the raw, tactile material of nature but of its very essence, the intangible “services” it provides. How does this process occur? Drawing on Harvey’s (1994) conceptual outline of commodification, Robertson (2000) uses the empirical example of the wetlands mitigation market to demonstrate the process at work. As a first step, an environmental

entity is abstracted into a functional category using scientific research for validation.

In Robertson's example, the diverse and complex spectrum of wetlands, in which no two are precisely the same, is reduced to a set of discrete wetland "types" defined by broad function (e.g., filtration; wildlife habitat) and differentiated by arbitrary boundaries. Second, the categories are imbued with monetary value, often by appealing to certain social uses – for example the promotion of intact wetlands as "duck factories" by groups such as Ducks Unlimited. Already at this stage in the process the act of valuation is premised on a discrete set of functions that are useful to capital or certain interest groups. Concepts such as biodiversity or aesthetic beauty are excluded unless they can be monetized.

Third, the process of abstraction extends across space. For example, the acres of all wetlands lost or gained within a state are estimated, implying that the different types and place-specific ecological functions of different wetlands may be glossed together. Finally, the commodity is bought and sold on the market. In the case of wetlands, even though the science of wetland restoration is imperfect enough to be questioned by wetlands ecologists themselves, once the market has placed its seal of approval on the commodification process exchange takes place and supply and demand begin to build. The process must move to this inevitable end, for, as Marx pointed out, there can be no commodities without exchange (Robertson, 2000).

But the story is not as straightforward as an orthodox Marxist interpretation implies. Commodification may lie at the heart of capitalism, and capitalism may be the

philosophical force behind the appropriation of environmental services, but bringing the market to environmental remediation results in a different form of governance than that found in more traditional goods and service markets. The strong arm of capital must contend with the strong arm of the state, and the result is a market form marked by contradiction as much as by cooptation.

1.2.1 Commodification of Nature: The Contribution of Critical Social Science

There has been very little empirical social science research specifically on the trading of ecosystem *services* outside the field of economics, which I will cover in detail in the next chapter. However, a closely related literature on the commodification of nature more generally offers a number of penetrating insights that will prove useful to understanding the present study. This body of work has largely been the provenance of critical geographers, who are by and large unsympathetic to the free-market model and its treatment of nature. These scholars assess the topic by adopting an “institutional political economy approach to the biophysical world” consisting of case studies of particular market strategies in particular ecosystem contexts (Castree, 2008a: 133). They acknowledge the problematic nature of the commodification process, but their work calls into question any linear account of market hegemony on the part of capital.

The literature is only moderate in size, but one of its impressive features is the breadth of its coverage. Major topical studies include the commodification of natural entities ranging from wetlands (Robertson, 2000, 2004, 2006) to fisheries (Mansfield,

2001, 2004) to forests (Prudham, 2003) to water itself (Bakker, 2004, 2005) (see Castree, 2008a, 2008b for excellent overviews). Assessing the body of work as a whole, three insights stand out.

First is the observation that natural entities present capital with a number of constraints to market penetration owing to their unique biological, chemical, and physical properties. The diversity and dynamism of ecological forces mediate against rapid conversion into an easily defined, measured, and reproducible commodity. Boyd et.al. (2001) cite five particular characteristics of natural resources that pose challenges to capitalist accumulation: their idiosyncratic and highly variable physical properties; the time required for (re)production after an initial harvest or extraction; their extent across space; variation in quality across space; and the site specificity rather than ubiquity of most natural resources. In a word, nature is neither fungible nor substitutable.

This point was recognized by Marx himself in *Capital*, where he refers to suspensions in production time for a number of natural resource sectors, notably agriculture and forestry. The manufacture or marketing of certain products in these sectors is effectively put on hold during periods when “capital . . . is abandoned to the sway of natural processes” (Marx, 1967: 246). Bunker (1989) has made similar points in regards to the metal and ore extraction industries, while Mann and Dickinson (1978) kickstarted a long debate in rural sociology with their thesis on the biophysical constraints that historically limited the appropriation of the agricultural labor process (see also Mann, 1990; Goodman and Redclift, 1991; McLaughlin, 1998).

Within natural resource sectors examples are as varied as the ecosystems under study. Prudham (2003) points to the long turnover time of replantation and regrowth and the difficulty in propagating new saplings as factors holding up the appropriation of the Douglas fir tree in the northwest US. Mansfield (2004) cites the widely dispersed habitat and the peculiar life cycle of Pacific halibut as obstacles to the full privatization of the halibut fishery. And Bakker (2005) argues that the difficulty and expense of its transportation and the differentiation of its purity across space make water problematic as a privatized commodity. In short, “biophysical nature, while targeted and transformed by the twin pressures of science and capital, is at the same time inscribed into the very institutional economy of nature’s social production” (Prudham, 2003: 638).

The second insight presented by this literature turns our attention to the effects that these constraints have on market formation. Because biophysical nature blocks, limits, or redirects efforts at appropriation, the markets that result illustrate certain contradictions as commodification is extended into the environmental realm. Rather than a coherent, hegemonic ideology that shapes all market sectors in a consistent fashion, “neoliberalism takes on specific forms when it engages with natural resource industries” (Mansfield, 2004: 565). For example, because of the tremendous challenges posed by propagation of pure varietal stock, the Douglas fir industry in the northwest US relies on tree improvement research carried out cooperatively between large firms and the state university system. This strategy, characterized by “open property regimes” with regard to varietal improvement, “does not allow individual firms to take

hold of forest-tree varieties and the biology of their reproduction as bases of proprietary competition and innovation” (Prudham, 2003: 648). Robertson (2007) focuses on the supply-demand curve, demonstrating that the “invisible hand” pricing mechanism that lies at the core of the free-market approach is dispensed with almost entirely in the case of the wetlands mitigation credit market. Prices for wetlands credits are frequently derived from arbitrary decisions and seat-of-the-pants guessing unrelated to actual supply or demand.

Mansfield’s study of the Pacific pollock fishery illustrates how a putative form of rationalization or deregulation is in fact a case of “reregulation.” A certain set of rules regarding limits on fish catches and distribution of co-op memberships had to be instituted and indefinitely overseen by a state agency in order to make the privatization of the fishery work. Rather than resulting in a self-regulating market, this act of liberalization manifests as a kind of facilitated competition “still fundamentally marked by government regulation of both the macro-context and the micro-details of access and power relations in a competitive market” (Mansfield, 2004: 579).

The third point of interest is made most forcefully by Mansfield, who notes that these seeming contradictions may only be contradictions relative to the fictitious ideology of the free market itself, for in fact the forms of government oversight she and her peers detail are *needed* in order for the privatization of nature to function properly. In the realm of the environment, the “free market actually requires certain kinds of political involvement to be sustained” (Mansfield, 2004: 571). Here she echoes

the more general argument of Fred Block: “The vitality of capitalism has *always* rested on a particular mix of markets and limitations on markets” (Block, 1991: 86).

Though Prudham (1999) invokes the Polanyian term “fictitious commodities,” his and others’ work actually focuses on the commodification of tangible, visible, measurable entities such as trees, fish, and water. With only one exception, critical social science scholars have yet to turn to an entity that is fictitious in a far more literal way: environmental pollution credits. That exception is Morgan Robertson, who picks apart the complex ways that the commodification of environmental services represents both a capitulation to the logic of the market as well as a constraining force applied to the market. Robertson investigates the wetlands mitigation banking sector in a series of articles (2000; 2004; 2006) and translates many of the authors’ points above into this particular ecosystem sector.

He points out, for example, that the commodification process is problematic in part because of the complex and place-specific nature of ecosystems themselves. Ecosystem services cannot be fabricated in a factory, nor can they be produced in any location. And yet ironically, this very complexity is desired by entrepreneurs, who can sell a whole suite of services from a single ecosystem (e.g., wetlands mitigation credits, biodiversity credits, and nutrient filtration credits, all from the same wetland) to multiple buyers (Robertson, 2004). This in turn pulls scientists and environmental consultants in two competing directions: on one hand they should provide rigorous ecological assessments so that multiple ecosystem services can be specified, while on the

other hand they should keep their assessments generic enough that such services can be verified and monitored cost-effectively (Robertson, 2006).

As a result of these added complexities, the process of ecosystem service commodification has not been hegemonic or unilateral. Although propelled by market forces and abetted by governmental imperative, it “bears no resemblance to a simple fiat of capital, or a simple directive from the federal coordinators of a hegemonic project of environmental governance” (Robertson, 2004: 364). It is, rather, a socio-political process involving contestation and negotiation by multiple parties. “Nature moves towards commodity form, not automatically, but through political struggle” (Robertson, 2000: 485). This underscores O’Connor’s more fundamental point that “sustainability is an ideological and political, not an ecological and economic, question” (1994: 153).

Robertson also addresses the nature of the regulatory institutions that must be involved in order to make ecosystem service trading viable. The institutional functioning of the ecosystem service market rests upon a complex web of protocols, contracts, regulations, memoranda of understanding, and written legislation. The implementation of ecosystem service projects also requires the development of institutions spanning geographic boundaries (some regional, others global) and operating simultaneously in governmental (e.g., the Kyoto Protocol or Clean Water Act), economic (e.g., establishing trading platforms, defining verification indicators), and cultural spheres (e.g., engaging with farmers or indigenous groups to promote the adoption of conservation practices or reforestation). In short, though we speak of the

shift in the governance of environmental degradation simply from a regulatory to a market approach, the process is in fact “a novel institutional form” – “an attempt to coordinate the institutions of capital, the law, the state and of science across many scales” (Robertson, 2004: 371).

1.2.2 *Understanding the Contradictions: Polanyi’s Double Movement*

The body of works just cited has a common thread winding through it. There is a single theoretical framework – explicitly named by many of the above authors – that helps explain ecosystem service commodification and its ongoing regulatory relationship with the state: Karl Polanyi’s notion of the “double movement.” Polanyi was a political and economic historian whose 1944 work *The Great Transformation* has proven to be both of longstanding scholarly value and remarkably prescient given the financial crisis presently gripping the world economy. The book describes the transition from the mercantilist and protectionist world economy of pre- and early industrialism to the capitalist economy that came to dominate the global economy in the early twentieth century. Writers such as Mill, Ricardo, and Adam Smith had begun the philosophical argument for unfettered markets in the eighteenth and early nineteenth centuries, and this ideology soon came to dominate the Western economies to such a degree that, as Polanyi argues, society itself underwent a transformation. We transitioned from a situation in which the economy was merely one element of society, embedded within the social fabric, to one in which social relations were subordinated to economic

imperatives. The economy became disembedded from society and began to assume the status of independent entity, shorn from any link to social mores. By the turn of the twentieth century and into the 1920s, the market imperative seemed all-consuming:

Nothing must be allowed to inhibit the formation of markets. . . . Neither must there be any interference with the adjustment of prices to changed market conditions. . . . Neither price, nor supply, nor demand must be fixed or regulated; only such policies and measures are in order which help to ensure the self-regulation of the market by creating conditions which make the market the only organizing power in the economic sphere (Polanyi, 2001: 72).

Polanyi's great achievement is in making the case that when a market becomes disembedded from social relations and allowed to assume top priority—when it is freed from social fetters and assumed to regulate itself—the results can be disastrous. As the market cares not for social or environmental welfare except when such things are profitable, we end up with what are blandly called “negative externalities”: inequitable distributions of wealth, oppressive working conditions, the robotic Taylorization of the labor process, and the exploitation and spoiling of nature through excess resource extraction and the dumping of pollutants. As Polanyi wrote: “To allow the market mechanism to be sole director of the fate of human beings and their natural environment . . . would result in the demolition of society. . . . Nature would be reduced to its elements, neighborhoods and landscapes defiled, rivers polluted. . .” (2001: 76).

Eventually, as in Marx's account of the organic rise of socialism due to the unwillingness of the working class to tolerate oppressive conditions, unrest grows over such externalities and the state erects legislation to constrain the market in order to protect social welfare. "The liberal movement, intent on the spreading of the market system, [is] met by a protective countermovement tending towards its restriction" (Polanyi, 2001: 151). The slow and steady move towards increased liberalization of markets throughout the nineteenth and early twentieth century was countered by a second movement towards the creation of certain social protections by the state. Thus the *double* movement:

The one is the principle of economic liberalism, aiming at the establishment of a self-regulating market . . . and using largely laissez-faire and free trade as its method; the other is the principle of social protection aiming at the conservation of man and nature as well as productive organization . . . and using protective legislation, restrictive associations, and other instruments of intervention as its methods" (Polanyi, 2001: 138).

Returning to the authors above, we can see the lineage stretching back to Polanyi, including their correction of the sociological theorists cited earlier. That the commodification of natural processes is happening is indisputable – it is the very foundation of any environmental service trading market. But the process of commodification is not as straightforward as predicted, nor is it directed by a simple free-market ideology. It is more contradictory, owing to the complexity and ambiguity

of the entities being commodified; more contested, owing to the mix of stakeholders involved and their sometimes conflicting goals; and more mediated by state intervention than a more typical commodification process might be. Environmental services do not behave like traditional commodities. They are “uncooperative commodities” and they require a new approach to market governance (Bakker, 2004). “Regulation becomes necessarily more complex as capital becomes able to appropriate and transform nature... more deeply” (McCarthy, 2004: 335). To restate Polanyi’s thesis in the environmental context: **When the process of commodification moves to the realm of environmental services, state regulatory intervention is necessary in order for markets to function without failure or environmental harm.**

In the remainder of this chapter I will take up the empirical case of water quality trading and make three related points: First, water quality trading is not only an excellent empirical example of the double movement in environmental governance, it represents perhaps the most extensive version of the double movement among all sectors of environmental service trading.

Second, this double movement is not the same as the conventional version articulated by Polanyi over half a century ago. In the case of water quality trading what we witness is not the conventional double movement of a series of social protections following a period of market expansion, but a series of legally binding environmental protections *preceding* and then *accompanying* a move to markets. I term this the *preemptive double movement*. The state is not relegated to catching up to fast-moving

markets with protective legislation, but the other way around: the state already possesses the authority to regulate environmental pollution, and it slowly and reluctantly gives over portions of this authority to the market mechanism, all the while maintaining oversight. Whether the preemptive double movement is a feature of environmental governance under advanced capitalism due to a general trend towards “reregulation” or simply a feature of water quality governance due to the pre-existing regulatory capacity of the state, I will address in the concluding chapter.

Third, the existence of the preemptive double movement and its particular form result from two intertwined forces: certain *biophysical characteristics* of the actual nutrients being traded and the agricultural practices that produce them, and certain *sociopolitical characteristics* of the relationships between the main stakeholders involved in water quality trading.

Data for this chapter come from three principal sources: First, a reading of the scholarly literature on water quality trading, including several case studies, a comprehensive 2004 report on the entire water quality trading sector, and online documents associated with individual trading programs; second, the author’s own interviews with program participants (outlined in greater detail in Chapter 3); and third, a textual analysis of published statewide trading rules in the eleven states which have drafted them to date. The purpose is to illustrate in empirical detail the nature and extent of the preemptive double movement in the sector of water quality trading.

1.3. Before You Can Trade, You Must Cap: The Clean Water Act and the Regulatory Creation of Demand

To begin the description of the state's involvement in the move to water quality markets it is helpful to return to the story of the Clean Water Act and witness how and why it evolved into the tool of nutrient trading. As stated in the introduction, the intent of the Act was not just to regulate discharges but to eliminate the flow of pollutants into US waters. However, from the beginning the legislation made a crucial distinction that has hampered success to the present day: the differential treatment of point source (PS) pollution and nonpoint source (NPS) pollution.

1.3.1 Point Sources Versus Nonpoint Sources

PS pollution is simply effluent that exits directly from a pipe into a water body. Typical examples include industrial facilities with direct discharges and municipal wastewater treatment plants. It is easily monitored and measured, and thus it is easy to regulate. NPS pollution is more diffuse in origin and in most cases does not exit into a water body at any one, easily measurable spot. It is typically induced by a rain event and referred to as "runoff" – examples include lawn runoff, which may contain high concentrations of nutrient-loaded lawn fertilizer, and runoff from farm fields, which in addition to excess fertilizers can also contain quantities of sediment and manure. The key point is that the Clean Water Act gave the USEPA the explicit authority to monitor PS effluent nationwide through a federal permitting system known as the National

Pollutant Discharge Elimination System (NPDES); however, it gave them virtually no power to regulate NPS pollution, leaving the threat posed by agricultural, lawn, and even parking lot runoff virtually unchecked.

In this regulatory distinction we get the first sense of the politicized nature of environmental governance. Thinking back to the environmental context of the early 1970s it is easy to understand why the government narrowed its scope onto industrial point sources. The Cuyahoga River had caught fire in 1969, bringing an already emerging environmental consciousness exploding onto the cover of *Time* magazine. If a body of water could actually ignite because of the levels of oil and industrial debris present, clearly any self-regulating capacity exercised by private industry was coming up woefully short and federal action was needed. The immediate cause of the pollution buildup in the Cuyahoga and thousands of other rivers nationwide was not farms and lawns but pipes running directly from factories to the river system, so point sources were the clear and obvious target of any federal legislation. Even though Rachel Carson's *Silent Spring*, one of the sparks that ignited the modern environmental movement, was chiefly concerned with agricultural pesticides, farming was still not viewed as an environmental threat on par with industrial sources. The regulatory bias was still urban- and downstream-oriented. So, in the original Clean Water Act and in every revision since, upstream agricultural sources of water impairment have by and large escaped regulatory oversight.¹

¹ Out of roughly 1.1 million working farms in the US, only 10,000, or just over 1 percent, are permitted dischargers under the provisions of the CWA (Adler et al., 1993). These are for the most part large-scale

From the outset, two observations stand out. First, the persistence of the problem of water degradation arises from both the biophysical nature of the pollutant itself and the sociopolitical nature of the stakeholders and the governance process. Biophysically, NPS pollution is so nefarious because it is so difficult to measure and monitor (Russell and Clark, 2006). Detecting NPS pollutant flows from farms requires an extensive scientific literature documenting the contribution of various soils and agricultural practices to nutrient flows and a highly complex (and prohibitively expensive) system of monitoring just to arrive at an *estimate* of the overland flows. Part of the problem here is conceptual: PS pollution is discrete and observable and was named first; NPS pollution is not discrete either as a form of pollution or even a semantic category. It is, in a sense, anything that is *not* point source; it is the category of “other.”

Sociopolitically the problem is exacerbated by the strong political power wielded by the farm bloc (out of proportion to the percentage of the population it represents), the fierce resistance much of the farming community feels towards any impingement on its property rights, and general reluctance by the non-farming public to persecute what it perceives as the innocent family farmer. Added to this is the logistical complexity of trying to monitor land use practices on a vast network of individual farms dispersed across the nation’s countryside (Russell and Clark, 2006). In fact, one of the reasons EPA

confined animal feeding operations (CAFOs). Because they store huge quantities of animal manure in manure lagoons they are treated as point source emitters, and in most cases they are required to treat, land-apply, or carry off-site *all* of their manure; in the language of water quality regulation, they are allowed zero discharge.

has no jurisdiction over farms is because they literally do not know where they are.

“The U.S. Department of Agriculture has this information, but they are prohibited from using the data for regulatory purposes” (Griffiths, 2003).

The second observation is the role played by the Clean Water Act. It is the contours of this piece of legislation that brought about the problem in the first place by essentially giving a free pass to agricultural NPS pollution, which now accounts for the majority of nutrient impairment of water bodies. Yet it is the language of the Act itself which gives the state the justification for turning to a market approach and the power to do so by pressing down harder on the one set of actors over whom they do have regulatory leverage: PS emitters. Because the Act still does not have provisions for regulating NPS emissions the state must turn to other tools, and the prospect of nutrient credit trading seems to hold great potential: point sources can achieve their reduction requirements at lower cost and nonpoint sources can finally be prevailed upon to reduce their own pollution. And it is precisely here, as the act of water pollution governance steps towards a greater engagement with the market, that we see the first indications of a preemptive double movement.

1.3.2 The Mechanics of Capping: TMDLs and the NPDES

The market approach begins with a form of state involvement that, while fairly heavy-handed, is the acknowledged *sine qua non* of trading: a water quality credit market will never come into existence without a *regulatory driver* creating demand. Any

market needs some force driving demand, of course, but in the case of water quality markets that driver must by default take a single, statist form: a strict and legally binding limit on the quantity of nutrients that a PS discharger may emit into a body of water.

This regulatory underpinning is a characteristic shared by all environmental offset markets. The exemplary sulfur dioxide market which served as the empirical justification for all offset markets to follow was based on legislation passed in 1990 which required coal-burning power plants to reduce total emissions by the year 2010 (McLean, 1997). While some portion of the global carbon market consists of the voluntary sector – i.e., the discretionary purchase of greenhouse gas credits by entities who are not legally bound to offset their emissions – most of its future potential lies with the regulated sector, i.e., entities responding to the binding objectives of the Kyoto Protocol (Capoor and Ambrosi, 2008). Similarly, both wetlands and biodiversity mitigation markets only exist because certain firms or agencies are required by law to offset the degradations they have caused to flora, fauna, or wetlands.

In the case of water quality markets, the regulatory limit derives from a combination of two government protocols overseen by the USEPA: the National Pollutant Discharge Elimination System (NPDES) and the Total Maximum Daily Load (TMDL). The NPDES is the longer-lived and more familiar system of permits issued to PS dischargers that require them to maintain pollutant loadings at or below a designated threshold. For example, a NPDES permit may require a municipal water treatment

plant or a food processing firm to keep its phosphorus output below 1 part per million (ppm). The NPDES permitting system came into being with the creation of the Clean Water Act, and every PS emitter in the country whose total outflow of water meets a minimum level is issued a permit and monitored by its state's environmental protection agency. To give an indication of the breadth of the state's involvement in this market precursor, at present there are over 200,000 operating NPDES permits across the fifty states (PDEP, 2009).

Originally the nutrient levels specified in NPDES permits were derived from technology-based standards: a facility was required to meet a pollutant output level based on what could reasonably be accomplished according to the technologies available at the time. When permits came up for renewal (typically every five years), if more effective technology had been developed the facility would be required to push their output downwards to this new, lower level. An obvious problem occurs, however: just because a facility is able to meet a given limit technologically does not necessarily mean that that pollutant level, aggregated cumulatively across all the emitters in the watershed, is sufficiently low to maintain acceptable water quality standards. At present, technology-based standards are giving way to water quality-based standards, which, as the name suggests, are limits based not on technological feasibility but on the maximum amount of pollutant that a water body can absorb and still meet designated water quality goals.

Water quality based standards thus open the door to the state's second major enforcement tool: the Total Maximum Daily Load (TMDL). The TMDL is the total quantity of pollutant that a water body (i.e., a particular stream or stretch of stream; a lake; an estuary) can receive each day and still meet water quality standards for its designated use (e.g., drinking water; industrial; recreational). Describing the process for developing a TMDL is fairly straightforward, though the actual act of doing so typically requires rigorous and expensive scientific testing and stakeholder involvement, not to mention a fractious political process of allocating a discharge cap among various emitters in the watershed. First, states are required by section 303(d) of the Clean Water Act to identify waters within their boundaries that do not meet established water quality standards and to identify the pollutant(s) of note that are causing non-attainment. States then prioritize the list by removing water bodies whose non-attainment is due to naturally occurring pollution. Finally comes the core of the TMDL process: establishing a maximum quantity of the given pollutant(s) that the water body can handle and allocating this quantity among the major point sources that discharge to the water body (CTIC, 2008).

Separate TMDLs are required for each pollutant that exceeds water quality standards, and there are 28 different categories of pollutants, including predictable ones such as mercury, biological pathogens, phosphorus and nitrogen, and chlorine, as well as far less common ones including trash, radiation, and grease (USEPA, 2008). There are currently 41,757 impaired water bodies in the US, each of which in theory requires a

separate TMDL(s) to address the problem. The process of drafting and submitting TMDLs is lengthy and burdensome, so the growth in TMDL numbers was at first very gradual. Though the language of the Clean Water Act allowed for the creation of TMDLs as far back as the early 1970s, the first one was not issued until 1996, during which year a total of 112 were created. By the end of 2007, 27,287 TMDLs had been developed in total. However, as officials have become more familiar with the process it has picked up steam. 2008 saw a near doubling of the prior year's total (9,137 compared to 4,310 in 2007). At present, 36,678 TMDLs have been developed, leaving just over 5,000 impaired water bodies without this protocol in place (USEPA, 2008).

To underscore the basic point of this chapter it is worth elaborating on the full scope and involvement of the TMDL process. To give a sense of comparison, let us briefly consider the carbon market. The market for greenhouse gas (GHG) emissions is both far larger (by orders of magnitude) and less constrained by regulatory imposition than the water quality trading market. A GHG market comes into being with a single cap on GHG emissions across an entire nation. This in a sense mimics the TMDL phenomenon (i.e., the carbon emissions cap implies an amount that the atmosphere can absorb without leading to further global warming), but the sense of scale is quite different. Theoretically it is possible for a single GHG cap to exist for the entire world, an emissions limit that could then be allocated to different nations, and within nations to

different emitters. Such a global cap does not yet exist in the strict sense,² but even emission limits spread over smaller geographic scales will never get as small as the area treated by a single TMDL. For example, in the US the recent passage of the first Regional Greenhouse Gas Initiative places a legally binding GHG emission cap on an area encompassing ten states in the northeast.

By contrast, a TMDL is sometimes developed not even for individual watersheds, but for individual *bodies* of water within watersheds – as small as a single stretch of stream. Further, the actual development process is long and tedious and requires tremendous outlays of labor and scientific documentation. To cite an example, the TMDL report for a single pollutant class (bacteria) in a single watershed in northeast Ohio runs 113 pages, including descriptions of the results of bacteriological testing in 14 different reaches of the stream (OEPA, 2007). And all this merely to establish a baseline figure *prior* to the assignment of individual PS effluent caps.

To summarize, the extent of government involvement in the regulation of surface water emissions is vast. The entire TMDL process is overseen by state environmental protection agencies, with additional guidance provided by federal authorities. This means an agency-initiated and agency-led effort to determine water quality, measure the state of degradation, quantify the maximum amount of pollutant, and, most importantly, assign emission caps to every PS polluter that discharges to a water body – repeated for over *forty thousand* separate bodies of water nationwide. And yet this

² The Kyoto Protocol comes close, but it is not a true global cap – it does not apply to all countries, participation by individual countries is at their discretion, and its enforcement mechanisms remain somewhat ambiguous (Alfsen and Holtmark, 2005).

highly state-mediated process is the first step in the creation of a market for water quality credits.

1.4. Empirical Evidence of the Double Movement: State Oversight and a Functioning Water Quality Trading Market

The USEPA does not only have the authority to set limits on emissions point sources. The statutory language of the Clean Water Act also gives them the power to authorize a trading protocol wherein these dischargers can purchase nutrient credits from other entities in order to offset some portion of their effluent flow. These trading partners could be other PS dischargers who were discharging at levels below their limit and thus had surplus credits to sell, or they could be NPS entities such as farms who could implement certain best management practices (BMPs) in order to reduce their levels of nutrient discharge and thus create credits to sell. In the present study I focus on the latter scenario, what is called PS-NPS trading.

The two fundamental ingredients would seem to be in place to bring a market into being: the commodification of pollution emissions and the establishment of a platform for their exchange. If the role of the state in facilitating water quality trading markets were limited to creating demand for credits by imposing an effluent cap, this could still be argued to be in keeping with the neoclassical market model. Such is the position taken by most conventional economists who write about water quality trading: “Regulatory staff must be less of an engineer working to solve the dischargers’ pollution

control problems and more of an environmental detective and police officer to protect the public's interest in water quality" (Shabman and Stephenson, 2007: 1083).

Instituting an upper limit on the quantity of nutrients a facility may emit is simply the creation of a new set of private property rights, and property rights are a critical precursor to the formation of *any* market. Indeed, the enforcement of property rights is one of the few functions of government that free market champions condone in their ideological system.

This is not, however, the only role the state has to play. For a number of reasons both biophysical and sociopolitical, the double movement towards more regulatory involvement continues at a more fine-grained level and incorporates additional elements of the market process. Perhaps nowhere is this more evident than in the language of the various sets of rules that the federal as well as a number of state governments have created to facilitate and oversee water quality trading markets. I will describe below seven different mechanisms evident in federal and state trading rules that illustrate how the preemptive double movement manifests in the market for water quality credits.

1.4.1 State Authority

In 2003 the federal EPA published their long-anticipated water quality trading guidelines. The USEPA rules are advisory rather than legally binding, because the language of the Clean Water Act delegates authority over water quality standards and permitting to the individual states. The document was meant to serve as a guideline to

help states write their own trading rules, which would be binding for any programs within their borders.

**Table 1.1: State and Federal Water Quality Trading Rules
(Chronological Order)**

State	Authoring/Enforcement Agency	Date Published
MI	Dept. of Environmental Quality	Nov. 2002
USA	Environmental Protection Agency	Jan. 2003
ID	Dept. of Environmental Quality	Nov. 2003
CO	Dept. of Public Health and Environment	Oct. 2004
OR	Dept. of Environmental Quality	Jan. 2005
VA	State Water Control Board	Nov. 2006
FL	Dept. of Environmental Protection	Dec. 2006
PA	Dept. of Environmental Protection	Dec. 2006
OH	Environmental Protection Agency	Jan. 2007
MD	Dept. of the Environment	Apr. 2008
WV	Dept. of Environmental Protection	May 2008
MN	Pollution Control Agency	Jul. 2008

One state (Michigan) had published statewide rules prior to the USEPA's 2003 document, and since then ten more states have published their own independent rules (see table 1.1). One additional state has a set of rules that applies to a single trading program in a single watershed (Connecticut), and four others are in the rule-writing stage (Delaware, Iowa, Massachusetts, and Wisconsin). The take-away point evident in table 1.1 is the unique form of oversight this market is subject to. It is not just that the environmental agencies set an emissions cap to create demand; they single-handedly author the rules which set the basic operational constraints of the programs themselves. In every market sector there will be some degree of intermixing between pure market forces and protectionist state forces, as Polanyi informs us (Block, 1991), but in the move

to *ecosystem* markets it is not departments of trade or commerce or development that oversee the structure of the market: it is departments of environmental protection. And it is not that the markets were created and then their oversight handed over to these agencies; the agencies themselves authored the rules of the markets *so that* the markets could come into existence.

1.4.2 Prohibitions

A key constraining force on the water quality market comes in the form of outright prohibitions on what may be traded and what trading's biochemical outcomes may be. For example there are provisions in nearly all statewide rules, as well as within individual trading programs, addressing "anti-degradation" and "anti-backsliding." The former refers to the demonstrable worsening of water quality in one locale that might occur if a PS emitter ended up discharging a higher quantity of nutrients than before because of the new ability to purchase offsets elsewhere in the watershed. The latter refers to a PS emitter failing to meet a permit obligation they had formerly met as a result of being able to purchase offsets elsewhere. Similarly, a third prohibition in the federal and all the statewide rules states that PS emitters may not use trading as a substitute for meeting technology-based discharge requirements. To give a real-life example: The regulated maximum limit for phosphorus levels in a PS discharge in Ohio is 1 ppm. In the Alpine Cheese Trading Program in Holmes County, Ohio, the PS factory (credit buyer) is required by the state environmental protection agency to reduce

the phosphorus load in its effluent to the rate of 3 ppm using on-site technology; they are then allowed to purchase phosphorus credits that offset the final 2 ppm needed to bring their discharge level down to 1 ppm. They may not, however, purchase any offset credits to help them get to 3 ppm in the first place. This would be considered backsliding. *Even if surplus credits are available for purchase*, if they do not achieve a discharge level of 3 ppm through on-site filtration they are considered to be in violation of their discharge permit.

Finally, there are prohibitions on the trading of certain compounds. Nitrogen and phosphorus are by far the most common nutrients traded; sediments, dissolved oxygen, and temperature are also commodified in various trading programs across the country. In theory, there are many tens of additional nutrients or pollutants that could be traded, depending on the subject matter of a given TMDL. However, the USEPA expressly forbids the trading of “persistent bioaccumulative toxins,” a prohibition repeated by several (but not all) of the statewide programs. Michigan’s rules more specifically outlaw trading of certain heavy metals and inorganic compounds.

In these various prohibitions we see a particularly clear expression of the double movement, since a number of them are expressly designed to ensure that no deterioration in water quality occurs as a result of trading – that is, that the form of social welfare over which these agencies have jurisdiction (the environment) is properly shielded from market externalities. The prohibitions in particular illustrate the *preemptive* nature of the environmental double movement, because in each case they are

based on the state's pre-existing authority to regulate PS discharges. Trading occurs in order to meet regulatory permit obligations, thus conferring on the writer of those permits the power to explicitly constrain the market in pollutant offsets.

1.4.3 Unit of Trade

As the ongoing global financial crisis well illustrates, one consequence of unfettered markets is the ability to create new commodities from whole cloth. Though ample regulations already existed over financial markets, innovative traders were able to stay one step ahead of the law and construct new products such as mortgage-backed securities and collateralized debt obligations that proved as lucrative as they were vulnerable to collapse. State environmental agencies take careful steps to ensure this does not happen in water quality credit markets.

In keeping with their preexisting authority over water quality, agencies stipulate in their rules exactly how pollutant credits may be packaged for exchange. The unit of trade must be expressed in mass per unit time, most typically "pounds per year" of nitrogen or phosphorus. This closes off any loophole that might be created by an entrepreneurial PS or NPS entity looking to use the general framework of trading to devise a new nutrient commodity that skirts the rules and bears the potential to harm rather than improve water quality.

1.4.4 Geographic Restrictions

Generally within the world of commerce a commodity produced in one location can be sold in virtually any other location. Corn produced in Iowa, a car manufactured in India, or the services of a software engineer residing in London can be sold anywhere in the world. In some cases import tariffs limit the economic viability of trading across borders and in other cases the transportation of commodities across certain borders is restricted due to political or ethical concerns, but such restrictive rules are the exception rather than the rule. Indeed the liberalization of trade that has been the hallmark of the world economy for a half century means precisely the rolling back of such prohibitions.

The most prominent ecosystem service market sector – carbon – also bears no geographic constraint. GHGs are by their nature global in their effects; a ton of carbon dioxide emitted in Ohio affects atmospheric concentrations of CO₂ for the entire planet. So too the trading of GHG credits. The emitter in Ohio wishing to offset his emissions is free to purchase carbon sequestration credits from a methane capture project in China, a wind farm in Denmark, or a no-till corn farm just down the road. This is due in part to the fact that carbon is a global pollutant, but equally to the fact that the market for carbon credits has rapidly outpaced the global regulatory infrastructure designed to oversee it. There are as yet only a handful of laws stipulating where a given emitter may purchase GHG credits from, and they only apply to a handful of states or countries.³

³ The only operational GHG offset market in the US that is geographically restricted is the Regional Greenhouse Gas Initiative, which caps greenhouse gas emissions for electric power utilities in 10 northeast states. These electric facilities may buy and sell greenhouse gas allowances among one another.

Water pollutants are an entirely different story. In the first place, the deleterious effects of nutrient or sediment overload are not spread over the entire Earth's watershed, but manifest at localized scales. Equally importantly from our point of view, the regulatory apparatus for overseeing pollutant discharges is a step ahead of the market rather than the other way around. The end result is that the trading of water quality credits is highly restricted geographically: "All water quality trading should occur within a watershed or a defined area for which a TMDL has been approved" (USEPA, 2003: 4).

Several individual states' trading rules feature a similarly generic limitation to watersheds (Colorado, Michigan, Oregon, Pennsylvania). Minnesota explicitly limits trading areas to watersheds of a stipulated size, while Virginia states that the PS buyer and the NPS seller must be in the same tributary – a word that is typically used for small streams that feed into main stems of rivers. In contrast to the liberalizing trend in global flows of goods and services that has marked the world economy for most of the past century, the state has placed a fairly stringent geographic constraint on the flow of nutrient credits in water quality markets.

1.4.5 Credit Duration

One of the key components underlying the idea of all ecosystem service markets, from carbon to wetlands mitigation banking, is the idea of "additionality," which in turn involves the idea of a baseline. Additionality refers to the fact that the remediation

efforts being undertaken by the credit seller must generate *surplus* credits relative to the status quo. In other words, financial payment to the credit seller must be for the production of a credit that would not be generated without the payment. Credits must be in “addition” to business-as-usual. And business-as-usual is what is referred to as “baseline” – the quantity of pollutant emitted by the credit seller prior to participation in the trading program. For example, if a farmer wanted to generate nutrient credits and sell them in a trading program, he would first have the baseline nutrient flow from his farm calculated. If he were then to install a grass buffer strip that had the effect of preventing 40 pounds of phosphorus from reaching the stream annually, the buffer would be said to generate 40 phosphorus credits. A complexity that arises, however, is that some practices, including manure storage facilities, cow exclusion fences, and milkhouse waste filters, may continue to function for 20 years or more. In such a case, for how long would these structures be generating credits? At what point does the new, improved state of affairs simply become the new baseline?

Most programs, including the USEPA rules, state that any practice may continue to generate credits for as long as it is functioning. If a manure storage facility were still to be preventing manure-borne nutrients from entering a stream 20 years after installation, then the same number of nutrient credits would be attributable to it as the year it was installed. This seems straightforward enough, and indeed the state would risk resistance from farms if they were to return the surplus generation of credits to the status of a new baseline after x number of years, for then farms would be caught in a

kind of “treadmill of conservation,” constantly needing to add more BMPs just to keep generating the same number of credits. Interestingly, however, there is more varied opinion on the question of banking credits.

Banking, as the name implies, refers to the idea of buying credits and holding them for a period of time in order to sell them at a later date. Purely from the point of view of market function this would be unproblematic – a seller/broker of houses or shoes or frozen fish can accumulate as much of the commodity as desired and sell whenever she wishes, as long as the seller is still interested. Problematic cases (food spoilage or material deterioration) would not be mediated by the law but by the buyer’s own disinterest. From the point of view of water quality, however, the idea of banking raises a red flag. If a buyer needs nutrient credits it is because the state has determined that he is presently out of compliance with a discharge permit; his actions have caused an impairment of water quality in the present moment. If he were to purchase credits generated several years prior and banked by the credit broker, they may be valid credits in the sense of actually having been generated by a real practice, but they would hardly serve to offset the buyer’s surplus emissions. Their remediatary effect on the stream would have long ago passed. At the same time, however, to disallow banking altogether runs the risk of stifling entrepreneurial activity that could result in more practices being implemented by an ambitious farmer or credit broker.

The USEPA rules do not mention banking at all, and neither do those of a number of specific states. At least one state (Colorado) writes that it is up to its

regulatory agency to decide the fate of banking on a case-by-case basis. Of the states that mention banking, the majority (four: Maryland, Pennsylvania, Virginia, West Virginia) only allow credits to endure for one year, after which time they are “retired.” A single state (Michigan, perhaps not coincidentally the state with the oldest rules) allows banking for a 5-year period, after which the credits are retired. In the interest of maintaining water quality, these states stipulate for how long a commodity may remain a commodity. This may be sound public policy in terms of the maintenance of environmental standards, but it is a far cry from a market as conventionally understood.

1.4.6 Credit Verification

In addition to the question of duration, another complex issue faced by program authorities is that of credit verification, or how to ensure that a credit-generating practice on a farm was properly implemented and is being properly maintained. Recall some of the logistical and political difficulties inherent in regulating agricultural practices to begin with – one of the core reasons NPS pollution has been given a free pass in the Clean Water Act. If these practices are generating credits that actually produce valued commodities that are sold to buyers whose discharge permits are loosened in exchange, it stands to reason that the state will demand stringent protocols to ensure that purported BMPs are actually implemented and functioning.

USEPA rules give a clear directive to the states on this matter: “States and tribes should establish clear enforceable mechanisms consistent with NPDES regulations that

ensure legal accountability for the generation of credits that are traded. . . . Mechanisms for determining and ensuring compliance may include a combination of record keeping, monitoring, reporting and inspections” (USEPA, 2003: 10). And the states are emphatic too, one of the clearest examples of the regulatory preservation of power to be found in this entire discussion. Some (e.g., Oregon) repeat the USEPA’s language verbatim in their rules. Others go even a step further. Ohio rules explicitly state that its environmental protection agency can request at any time all documents pertaining to a given program or trade, and that once requested they must be presented by the relevant conservation expert in a timely fashion. Idaho’s rules even have the sound of tax regulations: “Trading parties must retain copies of trading records on site for a five year period after completion of a trade contract” (IDEQ, 2003: 6).

The rigor demanded by this level of verification places additional burdens on program participants and generally adds to the transaction costs associated with a trading program. Several empirical examples taken from interviews with program personnel will illustrate this. In Minnesota, one of the oldest trading programs in the country involves the practice of winter cover cropping by sugar beet farmers as a way of reducing sediment loss. The rules for this particular program require documentation, not just of every farmer or every farm, but every single field on which cover crops are planted. And documentation includes not just taking field samples of the germinated cover crop to confirm that the stand meets thickness criteria, but photographs of every field, all of which is submitted to the state authorities in the program’s annual report.

In Ohio, the soil conservation agents who are the main coordinators of the Alpine Cheese Trading Program must ensure that BMPs meet the stringent engineering specifications set forth by the USDA Natural Resources Conservation Service (NRCS). Adding to their task is the fact that they are dealing with Amish dairy farmers, with whom conversations are far more effective (and sometimes only possible) face to face. The result is a long series of no fewer than eight separate steps to take a BMP from initial expression of interest by the farmer all the way to post-implementation monitoring. The end result of this rigor is a full-time agent on staff just to coordinate a program involving a single PS emitter and roughly 25 farmers.

Returning to statewide rules, Colorado takes the unprecedented step of actually being able to adjust the number of credits downward *after* the trade has taken place: “After a transaction is completed, the Division retains the right to review reduction performance periodically and adjust the number of credits or credit allowances awarded to point sources based on actual performance with appropriate notification to the buyer” (CDPHE, 2004: 15). Such power does the state possess over the commodity that it can demand documentary proof of its existence even when its buyer demands no such thing, and can declare after the fact that the commodity did not actually fulfill the requirements for proof of its existence.

1.4.7 Final Authority

In the end, the simplest but most effective way to understand how closely the water quality trading market is tied up with regulatory oversight is the fact that the state has the final authority to give any trade the stamp of approval or denial. Most states set forth detailed requirements in their trading guidelines that order potential programs to submit proposals for intended trades. These proposals typically include a long list of required elements, such as the identification of buyer(s) and seller(s) of credits; location of participants within the watershed; a description of the intended BMPs; a description of the protocols to be followed to verify credits and conduct follow-up monitoring; etc.

Several states require an official Water Quality Trading Management Plan to be submitted in order for the approval process to move forward. Pennsylvania requires a different sort of plan: according to their state rules, every farm which wishes to participate in a program must meet the minimum requirement of having a nutrient management plan or, for farms without livestock, a conservation plan on file with the local soil and water conservation office. And just in case there was any question, where the individual *states* leave off, the ultimate *State* steps in. The USEPA does not and cannot have actual control over individual programs since the structure of trading programs is in the hands of each state, but its trading guidelines end on a somewhat ominous note: “Where questions or concerns arise, EPA will use its oversight authorities to ensure that trades and trading programs are fully consistent with the Clean Water Act and its implementing regulations” (USEPA, 2003: 11).

The statement embodies well the nature of the preemptive double movement. The mere existence of the USEPA's trading guidelines and its pro-market language leave no doubt that they are in support of a move to market activity as a means of achieving water quality improvements. Yet just as the state steps towards the market, they also use the power stature conferred on them by the Clean Water Act and their jurisdiction over tens of thousands of discharge permits nationwide to retain extensive authority over the structure of the trading market. From the point of view of the agency this seems perfectly in keeping with their imperative to maintain quality standards in the waters of the nation, but from the point of view of market ideology it is contradictory. At the same time as the language of the market allows water quality credits to be commodified and traded between anonymous actors, the language of state regulations constrains their movement by enacting legislated safeguards and market limitations.

1.5. Discussion. Markets, Uncertainty, and Environmental Harm: Explaining the Double Movement

The invocation of a preemptive double movement in water quality trading is more than just an abstract conceptual argument; it has very applied consequences for the governance of environmental pollution. To understand how, it is worth taking a moment to consider why the preemptive double movement exists in the first place. Why does the environmental arm of the state maintain such deep control over what is putatively a move to markets? The market impulse having been unleashed, why

not simply leave the governance of water quality to its powers of self-regulation? The answer is two-fold.

First is the more straightforward response and the one more often acknowledged in the literature: water quality trading is fraught with uncertainty. It is a highly complex and difficult form of market activity, with regulated buyers purchasing a product that has been created by regulatory fiat from skeptical sellers whose participation bears the risk of bringing down further regulations upon them. Many of the rules which govern its internal structure are still being worked out iteratively by both federal and state bodies. Trading ratios, monitoring requirements, and punitive measures for noncompliance differ from state to state, demonstrating how hard it is to craft a market structure involving such a diverse assortment of stakeholders, incentives, and market goals. This form of market action is so untested, and the variables involved so complex, that to let it function under the guise of self-regulation would run the risk of having it collapse altogether.

The second reason is deceptively simple yet rarely broached in the literature. King comes close in a 2002 article in which he contends that environmental commodity markets are pervaded by “quality uncertainty,” or an inability for buyers and even sellers to differentiate high-quality from low-quality credits. Unlike in many commodity markets where the quality is largely self-evident (e.g., clothing; food; cars), water quality credits are intangible and subject to measurement error. A typical credit buyer will never see or touch – that is to say, *inspect* – the very commodity he is buying. More

importantly, not only are buyers unable to tell whether a credit is good without the help of scientific models, but fundamentally *they do not care*. A PS discharger has no vested interest in whether or not a farmer's BMP actually removes a certain quantity of phosphorus from a stream, he only has an interest in whether the state says that it does. What matters is not the credit itself but getting *credit* for the credit. "There is no 'natural' demand in regulation-driven markets; demand always depends on what regulations are in place and how they are enforced" (King, 2005: 73). In other words, we have a market in which buyers are only interested in the credit they are buying because they are obligated by law. "Buyers in these markets want to minimize the price of purchasing an offset credit, and sellers want to minimize the cost of producing them. Both are only as 'quality conscious' as third-party trade regulators require them to be" (King and Kuch, 2003: 10353). And this is the crux of the problem, the reason that the double movement is necessary: due to internal incentive contradictions, the market *by definition* will not be self-regulating.

This brings us back to a basic point made by Polanyi. Let us recall the two driving forces behind his original specification of the double movement in *The Great Transformation*. The first is "the principle of economic liberalism, aiming at the establishment of a self-regulating market," which is countered by the second – "the principle of social protection aiming at the conservation of man and nature *and of productive organization itself*" (Polanyi, 2001: 138; emphasis added). It is self-evident that the state's protections are meant to preserve the welfare of its citizens and the natural

environment. Polanyi's great insight was that the state must also help protect the welfare of the market itself, for without external oversight the market would fall prey to the consequences of its own depredations. "Not human beings and natural resources only but also the organization of capitalistic production itself had to be sheltered from the devastating effects of a self-regulating market" (Ibid).

In the realm of ecosystem service markets, this outcome takes on a particular tone because of the unique goals that underlie these markets. In many conventional market sectors exchange is an end in itself, but not so in ecosystem markets. The point of the water quality market is not simply to see trading occur, or to increase cost effectiveness, or to spur innovative solutions to effluent overload; it is to achieve the attainment of water quality standards. The purpose of a market approach to water pollution remediation is that trades "*result in an equivalent or better level of environmental protection than would be achieved via a conventional approach*" (ODEQ, 2005: 13; emphasis added). Trading is not an end in itself; this market form has a higher social goal, and it cannot be achieved through atomized self-interest.

King is one of the few to openly recognize this critical distinction between market forms. Unlike traditional commodity markets, "Environmental markets are different [because] they involve three-way trades where the economic interests of buyers (credit seekers) and sellers (credit providers) are not so much aligned against one another as against the interest of the third party, the trade regulator. This is important

because the role of the trade regulator in these three-way trades is to protect the public interest” (King, 2002: 11317).

And here he has hit on the crucial point. Because of the mismatch between the interests of buyers, sellers, and regulators, in the case of water quality trading a market liberalism would likely turn into a market failure, which would be undesirable not for its economic impacts but for its environmental impacts. The mismanagement of a water quality trading market would stem from failed BMPs or fraudulent transactions or poorly estimated nutrient reduction models, which would lead to a decline in environmental quality – which is the very reason the markets were created to begin with. The preemptive double movement exists, then, not just as a move by the state to maintain power over water quality standards, nor as a means of propping up market activity per se, but as a way of ensuring that the market approach does not dismantle the very agency goals which led to its embrace in the first place.

Bakker points out that the supposed deregulation that accompanies a market approach to pollution remediation “is constituted by (and constitutive of) processes of reregulation that may result in improvements in environmental quality” (2005: 560). Her comment is in part a challenge to scholars who argue that commodification always results in negative environmental consequences, but it is also a reminder that the possibility of environmental improvement rests not on the commodification process itself, but on the “reregulation” that accompanies it – on the state’s attempt to oversee this form of market movement even as it allows it. As the commodification of nature

has turned from tangible natural commodities to intangible credits, the result has been the rise of a complex and problematic market form. It trades in a commodity whose demand is artificially created by regulatory decree and which cannot be seen or felt or even measured with precision. If the governance of that commodity were left entirely to market forces, the quest for profits and cost efficiencies would lead to a “race to the bottom” – not of wages or working conditions but of the rigor of environmental quality standards. The environmental protection arm of the state by its very charter bears a responsibility to the public welfare, and it would be shirking that duty were it to relinquish regulatory authority to the market itself.

Chapter 2: The Farmer as Rational Actor and the Assurance of Supply:
A Sociological Critique of the Market Approach to Water Quality Trading

Changing farming practices is as much a social and political change as a technical one.

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Introduction

The thrust of my argument so far has been that the putatively market-oriented sector of water quality trading is in fact shot through with multiple, *necessary* layers of government intervention and oversight. It is thus representative of all forms of ecosystem commodification which embody the “contradiction between what is called deregulation and the active role of political intervention in creating and maintaining deregulation” (Mansfield, 2004: 570).

It stands to reason that scholars of water quality trading take into account this peculiar articulation between pollution remediation and market ideology when they write prescriptive articles about developing water quality trading programs. This assumption, however, does not hold. It is not that the prescriptive literature is devoid of nuance or acknowledgement of complexity, but by and large it does not stray far from the neoclassical view of free markets. Literature on the topic is dominated by ecological economists and policy analysts, with a small handful of contributions by sociologists.

The following chapter is broken roughly into two parts. In the first, lengthier part I present a detailed examination of the academic literature on water quality trading. I will argue that the conventional view of trading is based on a set of three flawed assumptions. First, that it ought to conform to free market-like conditions and that its success should be measured in terms of the trading volume of water quality credits. Second, that the supply of nutrient credits responds automatically to the demand for credits via the invisible hand of the price signal. Third, that farmers in their role as producers and sellers of nutrient credits are rational actors who respond to these price signals according to a basic utilitarian decision making process.

In the second part of the chapter I turn to an entirely different literature to present a counter-argument to the rational actor model. Drawing from both the scattered body of studies on farmer adoption of conservation practices and a body of literature on what is called social embeddedness, I argue that farmer behavior in water quality trading programs may not conform to rational actor assumptions for a variety of sociocultural reasons. This then leads to an examination of the handful of studies that take a sociological view of water quality trading, which though small in number provide empirical support for the counter-argument. Finally I finish with a discussion of the question of means and ends in a sector that claims the twin goals of environmental improvement and market efficiency.

2.1. Program Evaluation: The Good, The Bad, and The Assumptions

The literature on water quality trading is almost entirely concerned with a single broad question: What are the key ingredients that account for successful trading programs, and what are the key flaws that hinder unsuccessful ones? The first thing that strikes a reader upon reading through this body of work is the odd disjuncture between analysts' hopes for water quality trading in the future and their assessment of how trading has fared up to the present. Despite a tremendous amount of enthusiasm for trading from the economic and regulatory communities, including explicit statements from the USEPA about its environment-enhancing and cost-saving potential (USEPA, 2003), the basic consensus is that it has failed to live up to its billing.

King and Kuch's (2003) widely-cited article entitled "Will Nutrient Credit Trading Ever Work?" sums up the general consensus as of six years ago: "Despite widespread support . . . years of research and discussion . . . and the establishment of many prototype nutrient trading programs in the United States, very few nutrient trades appear to have actually taken place," in large part because "supply and demand conditions have not been adequate to support any trading at all" (King and Kuch, 2003: 10352, 10360). Faeth (2006) specifically compares the water quality trading sector to sulfur dioxide markets, in which emissions declined by 40 percent in less than a decade, and to carbon markets, which are booming despite a patchy and geographically inconsistent regulatory underpinning. The contrast with these success stories in his mind is clear: "Have we made much progress since EPA issued its draft framework for

watershed based trading in 1996, or its water quality trading guidance in 2003? There are some bright spots, but overall I think real progress has been spotty. There's some good news in a few places, but it's not clear that trading has actually resulted in significantly improved water quality yet" (Faeth, 2006: 1) As recently as two years ago, Boisvert et.al. asserted that "the promise of the significant cost savings for nutrient trading programs has never materialized. With the exception of an extremely limited number of oft-mentioned successes, very few trades have actually occurred" (Boisvert et.al., 2007: 2). And in a news release put out only last autumn, Zwick wrote that "the only real successes [in ecosystem markets] have come in cap-and-trade emissions schemes . . . and the massive carbon markets (Zwick, 2008b).

From the outset, two anomalies appear in relation to these claims. First, the evidence used to underscore the assertions of failure is based on two sources that are by now over five years old: USEPA data circa 2003 and an exhaustive report commissioned by the USEPA and researched in 2003 and 2004 (Breetz et.al., 2004). While relatively recent by academic standards, in the fast-moving world of ecosystem service trading this is already outdated. My own research reveals, for example, that several of the programs which Breetz et.al. (2004) list as not trading are now trading (e.g., Great Miami, Ohio; Kalamazoo, Michigan), and a number of successful programs have appeared since the publication of the report (e.g., Alpine Cheese, Ohio; Chesapeake Bay, Pennsylvania). It is understandable that articles from 2003 (King and Kuch) or 2004 (Tietenberg and Johnstone) would have used data from the Breetz et.al. report, but use of the same

data in articles several years later proves inaccurate and cries out for the collection of a new round of data.

This is not to make the claim that water quality trading is doing brisk business. It is true that many programs have seen little or no trading at all and are essentially moribund. However, the second anomaly in the claims made above is that, even at the time they were made there appear to be programs that were in fact trading but were not recognized as such. For example, the Southern Minnesota Beet Sugar Cooperative program was initiated in 1999 and resulted in the planting of winter cover crops on over 35,000 acres of cropland in 2000 and 2001 (Breetz et.al., 2004), yet the King and Kuch (2003) article lists it as having achieved no trades (p. 10364). The Red Cedar Basin program in northwest Wisconsin had obtained 5000 pounds of phosphorus through contracts with farmers by July 2001 (Breetz et.al., 2004), yet it too is listed as not trading in the King and Kuch (2003) article. And the Piasa Creek program in Illinois began in 2000 and was described in the comprehensive Breetz et.al. (2004: 117) report as being “ahead of schedule with sediment reductions already exceeding the halfway point” less than halfway into the program, yet it is nowhere to be found in King and Kuch (2003).

Why did one of the most-cited pieces on water quality trading from the mid-decade period – an article on which many later articles based their own claims of a stagnant trading sector – seem to under-report the number of trades actually happening? It is possible that the sources used by King and Kuch (2003) were simply

not up to date and had not accounted for these trades that were at the time only 2-3 years old. But another contradiction from their article points to a different conclusion.

According to a detailed case study (Fang et.al., 2005; see also Breetz et.al., 2004), the Rahr Malting trading program in Minnesota had achieved four separate trades with four different NPS entities by 2001 – what Fang et.al. (2005) refer to as “major trades.” Yet the King and Kuch (2003) article lists the program as having achieved only a single trade. Here it cannot be the case that the sources used by King and Kuch (2003) were outdated, because all the trades had occurred by 2001, so if they listed one trade they should have listed all four. The answer, I will propose, lies in how one defines a “trade,” that is, how one defines whether or not a water quality *trading* program is functioning. This in turn rests on the even more fundamental question of how one defines a market approach to environmental remediation in the first place. King and Kuch (2003) do not count certain program successes as actual “trades” because, though they may have resulted in the implementation of BMPs according to trading program rules, they were merely the result of a PS discharger offsetting its emissions via a bilateral agreement rather than the actual buying and selling of a commodified credit in a water quality credit “marketplace.” They were more akin to barter arrangements than the purchase of an actual commodity. Falling short of the neoclassical understanding of market activity, they are not thought of as trades and thus the programs are not thought of as successes.

A careful review of the literature on water quality trading reveals that the purpose to which trading is put, the tools used to achieve it, and the methods used to assess it all depend on the way in which it is framed. This theme of different lenses through which to view trading will form the backdrop to the entire chapter. From a market point of view it may be technically correct to refuse to refer to the successful transactions above as trades, but, as I will illustrate in this chapter, such a stance has consequences for how future programs are structured and future successes are measured. The neoclassical approach emphasizing market efficiencies and trading volume may actually be at odds with the conservation approach that underlies a simultaneous emphasis on environmental improvement.

2.2. Economic Principles and the Market Approach to Water Quality Trading

There is no disagreement on the fact that water quality trading is a “market-based” approach to the remediation of water pollution. There is some debate, however, on what exactly constitutes a market approach. Drawing on King and Kuch’s (2003) distinction between forms that are more and less market-based, Shabman and Stephenson (2007) emphasize that neither trading alone nor financial incentives alone are sufficient to define a market approach. For example, a regulator could allocate pollution allowances to a set of PS dischargers based on a feasibility study, then at a later time reallocate those allowances based on new criteria, effectively forcing “trades” among the PS sources – but this would not qualify as a market-based policy. Similarly,

the mere provision of financial incentives to NPS polluters does not make a program market-based – for example, the longstanding government programs which have been subsidizing BMPs for decades have never been thought of as market approaches to agricultural conservation.

But while the exact constitution of a market approach to pollution abatement remains unspecified, the water quality trading sector is consistently evaluated using a basic set of economic criteria. If we want to understand how water quality trading has been conceptualized and understood to date, we have to view it through the lens of these widely-accepted market principles. I will discuss and illustrate the five major principles which repeatedly characterize the discussion of water quality trading success and failure: property rights; freedom of action; efficiency; minimal government involvement; and risk management.

2.2.1 Property Rights and the Creation of Demand

The single most fundamental criterion for the creation of any market is the existence of the supply and demand for a product. One can have demand without supply (think empty store shelves in the former Soviet Union) and one can imagine supply without demand (the current subprime mortgage fiasco comes to mind), but a true market can only exist when these two come together.

As discussed in the previous chapter, in the case of water quality trading demand for nutrient credits is essentially created *de novo* by the regulatory imposition of

limits on pollutant levels from point sources. As one surveys the literature on water quality trading programs, the most frequently cited source of the sluggishness attributed to trading is weak or nonexistent effluent caps, which translates to stifled demand. Boisvert et.al. call effluent limits “the first corner stone of the market” (2007: 4), while King and Kuch (2003) claim that the most fundamental element required to make trading more robust is to increase pressure on PS dischargers by lowering their permitted effluent levels. Smith (2004) cites a regulated cap as the most important factor accounting for the success of a watershed salinity trading program in Australia.

Shabman and Stephenson (2007) go even further and argue that in order for water quality trading to approach true market conditions TMDLs should place legally binding restrictions not only on PS dischargers but on NPS emitters as well. I will return to this point later, for the unequal constraints placed on PS and NPS manifest in the form of another market inefficiency. Shabman and Stephenson (2007) attempt to tone down the stringency of their suggestion while at the same time opening up more space for market action by proposing that TMDLs not be divided among individual emitters but left as a group cap in emulation of the Tar-Pamlico and the Neuse River trading programs from North Carolina, both widely viewed as successes. This point is echoed in a more technical economic analysis by Sohngen et.al. (2003), who refer to “collective enforcement agreements” among small groups of farmers in which the participants would receive an up-front payment for implementation of a given BMP, followed by an additional payment or debit based on an ex-post evaluation of the BMP’s

effect on water quality. Because the cap is placed on a group of farmers with similar operations, water quality measurements could be taken at a single point downstream from all the farms, rather than the cost prohibitive task of measuring runoff effects from individual farms.

At a more fundamental level what is being created in these programs is not just demand in the abstract sense, but a totally new form of *property* (see Hanna et.al., 1995). Citing Dales' (1968) seminal work that is arguably the philosophical touchstone for all emissions trading, Boisvert et.al. write that "tradable permit programs are about the exchange of *property rights*," and that "the success of a trading program will depend greatly on how these rights are defined. The most successful trading programs appear to be those that most closely correspond with private rights regimes" (2007: 22, emphasis added; see also Devlin and Grafton, 1998; Grafton et.al., 2004). Schary and Fisher-Vanden (2004) draw on the successful air emissions trading program from the 1990s to argue that the creation of discrete and tradable water quality commodities is one of the critical components for making a robust trading market. This is entirely in line with the neoclassical approach to any market, which posits creation and enforcement of property rights as one of the few key roles for government (Smith Jr., 2001; Harvey, 2005).

One can see here, however, an early sign that the assumptions underlying perfect market conditions and the on-the-ground realities that characterize trading programs do not interface easily. Many of the statewide trading rules cited in the last chapter emphatically state that PS-NPS trading is *not* about the transfer of property rights.

Florida's rules, for example, state that "water quality trading in Florida does not involve—and does not imply—the trading of pollution 'rights.' It is, instead, a market-based exchange of pollution reduction 'credits' among pollutant sources with the objective of achieving lower net costs or more practical alternatives for meeting water quality standards" (FDEP, 2006: 5). To the environmental regulatory agencies this stance hinges on a critical distinction that upholds their right to patrol environmental pollution, because the right to trade is not the same as the right to pollute.

2.2.2 Freedom of Market Action

A second principle of free markets is that market actors have the freedom to buy, sell, and work as they please with no external restrictions imposed upon them. Individuals and firms should have the liberty to choose their course of market action within the confines of the law. An economics textbook neatly sums this principle as follows: there should be "no legal restriction on the goods that any person may buy or sell, or on the job that any person may do" (Craven, 1990: 134).

In the context of water quality trading markets, this would amount to PS dischargers having the flexibility to choose whether or not to remediate a certain quantity of their effluent limit by purchasing offset credits. The discharger could meet their permitted discharge level with a certain balance between technological remediation and offset purchases, and this balance could change over time as the respective costs fluctuated. For example, if a wastewater discharger is required to meet a limit of 1 ppm

phosphorus, in months when water flow is high or phosphate levels in the inflow are low, the facility may be able to bring their level down to 3 ppm using on-site technology and have to purchase credits to make up for the other 2 ppm. In summer months when water flow is at its lowest, the discharger might only achieve a level of 5 ppm in its own outflow, thus having to purchase double the offset credits for those months.

Additionally, if a new technology became available that allowed the facility to cost-effectively reach 1 ppm without the need for purchased offsets, they would have the freedom to purchase that technology and cease buying offsets altogether.

Though this would seem a natural desire in ecosystem service trading markets just as in any other free market, in the large majority of trading programs nationwide these conditions do not hold. Because the right to trade is typically written into a discharger's NPDES permit, the level of effluent allowed is fixed for five years at a time. For example, the discharger in the previous example would not be allowed to fluctuate its level of *achieved* reduction between 3 ppm and 5 ppm depending on the season; it would always be expected to meet 3 ppm and would face the possibility of a punitive fine if it exceeded 3 ppm – even were it able to locate sufficient credits to offset the difference. Similarly, once the ink has dried on a NPDES permit that contains a trading provision, even if a technology more cost-effective than trading comes along the discharger is obligated to purchase a certain quantity of credits for the duration of that permit cycle.

Shabman and Stephenson (2007) lament this lack of freedom for trading entities, citing it as one of the two most important impediments to a more robust water quality trading market (the other being the lax enforcement of property rights identified above). To their eyes polluters should be granted the freedom to choose if, when, how much, and with whom to trade. Only then will water quality trading markets imitate more pure markets. Similarly, they call for a reallocation of regulatory agency priorities away from identifying best control technologies for individual emitters and towards monitoring actual effluents, thus leaving emitters to work out the best way to achieve effluent reductions themselves. Dunn and Bacon are even more biting in their summary of the situation: “Under semivoluntary or nonvoluntary approaches, regulators implicitly ask – or explicitly attempt – to force point sources to take on patently inequitable additional pollutant-reduction obligations in ‘exchange’ for the privilege of trading” (2005: 44). The ultimate effect of this obligatory situation is a stifling of the market.

Many of the suggestions on this topic are based on observations of PS-PS markets, which are arguably not as complex as PS-NPS markets. Stavins, for example, assesses the SO₂ trading program and notes, “In regard to flexibility, tradeable permit systems should be designed to allow for a broad set of compliance alternatives, in terms of both timing and technological options” (1998: 79). After their assessment of the same sector, Schary and Fisher-Vanden (2004) propose their own novel interpretation of discharger freedom: not only should they be free to choose the form of remediation

over time, but the permit limit under which they operate should also be dynamic. It should be allowed to fluctuate upwards or downwards relative not to their on-site remediation but to the number of verified remediation credits they have purchased from NPS sources. Similarly, Smith (2004) argues that the ability for participants to choose the method and degree of trading they would engage in was a key factor in the success of a trading program in Australia. It should be noted, however, that both the SO₂ trading program and the Australian program profiled by Smith (2004) were programs in which the trading partners were exclusively PS emitters. As will become increasingly clear, as we shift our focus from PS-PS markets to PS-NPS markets, the rules for understanding market action also shift.

2.2.3 *Transaction Costs and Market Efficiency*

The “free” in “free markets” refers not only to the freedom of participants to act as autonomous agents, but the free flow of goods and services with minimal (or ideally, zero) disturbance or friction. The philosophical justification for capitalism rests on the notion that it fosters the production, transaction, and consumption of goods in the most *efficient* manner possible. All costs not directly related to the procurement of raw materials and the production process are to be avoided where possible and, where unavoidable, reduced through policy action (e.g., removal of tariffs), technological improvements (e.g., automated packaging), and organizational innovations (e.g., direct marketing). “In mechanical systems we look for frictions: do the gears mesh, are the

parts lubricated, is there needless slippage or other loss of energy? The economic counterpart of friction is transaction cost: do the parties to the exchange operate harmoniously, or are there frequent misunderstandings and conflicts that lead to delays, breakdowns, and other malfunctions?" (Williamson, 1981: 552). As should be evident, such frictions are not looked on kindly. Arrow's seminal statement from 1969 is still the dominant viewpoint among ecosystem service analysts: transaction costs "in general impede and in particular cases completely block the formation of markets" (Arrow, 1969: 48).

As a very young sector of the economy, ecosystem service markets still struggle with high transaction costs due to persistent uncertainties in credit generation, a morass of market regulations, and the lagging standardization of certain protocols such as credit registries, retirement, and banking. This is arguably more true in the water quality trading sector than in any other. In the previous chapter I outlined a number of reasons why the water quality trading market is burdened by high transaction costs and inherent inefficiencies owing to restrictive rules on market activity. Some of these inefficiencies are being streamlined over time, while others seem inherent to the market unless the state loosens its own oversight capacity. Nevertheless, this does not prevent analysts from citing high transaction costs as one of the prime elements dragging down water quality trading markets. In fact, it is the single most widely-cited variable across the entire body of literature on why water quality trading lags so far behind other ecosystem service sectors.

In their widely-cited 2003 article, King and Kuch state that water quality trading markets are being held back by a stifling of supply and demand owing in part to elevated transaction costs associated with identification, implementation, tracking, and monitoring of NPS BMPs. Leatherman et.al. (2004) echo the same assessment: the reason for market stagnancy despite so much effort poured into it by government “generally boils down to the difficulties of creating an effective and smoothly-operating market place for buyers and sellers to find information, engage in negotiations, and structure enforceable agreements.” Crucially, from this observation it does not follow that water quality trading would best be carried out via something other than a market approach; the assumption of market superiority is retained in their next sentence, in which they conclude, “Considerable research and applied experience in constructing such markets is yet needed” (Leatherman et.al., 2004: 7). Shabman and Stephenson (2007) actually remake the very definition of market success by naming transaction costs as the basic criterion. Success should not be defined relative to the volume of trading, as is often the case in a conventional commodity market, but in terms of “the ease of making trades” (Shabman and Stephenson, 2007: 1081).

Woodward and colleagues draw up a typology of four different market forms that water quality trading can take, including exchanges, clearinghouses, bilateral negotiations between a single PS and a handful of NPS, and the sole-source offset model in which a PS discharger does not so much purchase credits as subsidize off-site activities which remediate a given quantity of effluent-based nutrients (Woodward and

Kaiser, 2002; Woodward et.al., 2002). Schary and Fisher-Vanden (2004) blame high transaction costs on the fact that the majority of PS-NPS trading programs follow the single-source offset model instead of a true market trading model. They characterize trading's track record as one of "questionable success" because of "the considerable investment in time and resources to negotiate the terms of the trade within the context of [each individual] NPDES permit" (Schary and Fisher-Vanden, 2004: 82).

Other authors go even further. King and Kuch note, "The existence of a few bilateral offset agreements in some watersheds, although they may reduce costs to one party and generate net income to the other, is not evidence that market-based trading is viable in those watersheds or anywhere else" (King and Kuch, 2003: 10356). Likewise, Faeth stated at a 2006 conference, "There have been a few 'trades', which really are more like offsets and are largely based on permits. Are there any functioning markets up and running? The answer is no" (Faeth, 2006: 2).

The solution to all of this, of course, is to assess and then eliminate unnecessary costs. As Selman et.al. (2008) write, "Necessary costs should be held to the lowest possible level without jeopardizing the integrity of the program, and unnecessary costs should be avoided or eliminated." This is in one sense a truism – of course programs operate optimally when no unnecessary costs are incurred. The question is, what is unnecessary? What counts as "the integrity of a program"? It is at this point that different definitions of program success become critical.

Many articles on this topic are content to leave their comments at a generalized level, but a few have offered specific, technical suggestions for how to enhance the market efficiency of trading programs. One is to employ a market tool known as a reverse auction, in which it is the sellers who do the bidding and the buyers who assess the bids and settle on one. In the case of PS-NPS trading, a farmer provides a technical synopsis of his farm, a description of the BMP(s) he would like to implement, and the price he is willing to receive for doing so. The buyer is typically a watershed oversight body which reviews all the bids and then allocates the available money to the projects it deems most suitable.

There are two reasons why the reverse auction appeals to trading technicians. First, it allows the credit buyer to apportion a limited pot of money in the most expedient manner possible. "The [buyer] would buy as many credits as it could, cheapest ones first, until the budget for that program was used up" (Faeth, 2006: 3). In this way the buyer gets the most "bang for its buck." The obvious danger, however, is that in choosing projects to fund based solely on a cost-benefit analysis the buyer risks passing over projects which may offer other positive externalities, such as creating a better fit with the farm family's goals or achieving environmental benefits in addition to nutrient remediation. By choosing the projects which quantitatively return the most nutrient credits for the least cost, a program risks "mining for nutrients" rather than rewarding more substantial ecological stewardship. Second, the reverse auction ties buyers and sellers into a more anonymous marketplace rather than forcing

bilaterally negotiated contracts for every trade. In fact, several of the attempts at running a reverse auction have used an internet program called NutrientNet (see Faeth, 2006; Greenhalgh et.al., 2007) to solicit bids from farmers and allow the analysis and awarding of bids by program administrators. The direct link between buyer and seller is severed by the virtual intermediary, thus more closely approximating market conditions. This, too, carries the potential for negative externalities or even fraud – a point I will return to in Chapter 5.

A second specific suggestion from the literature on how to lower transaction costs concerns who will handle the credits themselves. In the majority of programs to date, the tasks of identifying NPS participants, evaluating BMP proposals, and overseeing BMP implementation have fallen to the regulatory agency. In some of the early programs this extraordinary burden, to which regulatory agents were unaccustomed, proved so time-consuming that the resulting transaction costs effectively stopped the program in its tracks before a single trade had occurred (see King and Kuch, 2003 or Breetz et.al., 2004 for general comments; see Feng et.al., 2005 for a specific case). A number of voices now argue that this task would more profitably be left to a third-party intermediary, usually called a credit broker. If at first there was concern that brokers would not be a good fit in ecosystem service trading markets, Stavins evaluated the SO₂ trading program of the 1990s and concluded that “the private sector can fulfill brokerage needs, providing price information and matching trading partners, despite claims to the contrary when the program was enacted” (1998: 80).

Brokers could in theory be public sector or private – in a number of current trading programs, for example, a local Soil and Water Conservation District (SWCD) office (a county-based quasi-governmental agency dedicated to agricultural conservation) serves as the broker, although in most cases they do not technically buy and then re-sell credits but simply shepherd the whole process of BMP implementation from beginning to end. Shabman and Stephenson (2007) make the case for private-sector brokers, with the government in place only to establish and enforce minimum criteria for credit validity. Hall and Raffini specifically argue that brokers “can lower overall transaction costs by helping overcome the inefficiencies associated with having to individually negotiate and secure credits from multiple nonpoint source credit suppliers” (2005: 41).

Here again we witness the tension between private-sector activity for the purpose of market expansion and enhanced state oversight for the purpose of environmental protection. In serving as a broker or intermediary, the state may have to sacrifice some amount of economic efficiency for the sake of environmental rigor, whereas a private broker may do exactly the opposite. Despite Stavins’ admonition to government agencies to “avoid creating regulatory barriers (such as requirements for government preapproval of trades) that drive up transaction costs and discourage trading” (1995: 145), Feng et.al. (2005) found in their analysis of two trading programs that the state purposely kept transaction costs high as a means of maintaining control over the process of credit verification. In both cases, “preapproval of trades was a

central if not the most emphasized component” of the trading process because the state pollution control agency “was more concerned with the environmental accountability of the projects than with realizing efficiency gains” (Feng et.al., 2005: 656). Whether this order of priorities would be flipped with the mass entry of private-sector brokers into the market is a provocative question.

2.2.4 Minimize Government

Perhaps the most widely recognized neoclassical principle is its insistence that government action in the marketplace be kept to a bare minimum (Harvey, 2005). To quote a standard economics textbook, in an idealized marketplace “government activity is restricted to basic functions of maintaining law and order and its activities have no effect on prices, wages, [or] rents” (Craven, 1990: 134). We have already witnessed how much more the government does to prop up water quality trading markets than merely making and enforcing the rules, and how much effect it has on price – indeed, in many cases the government literally determines the price of a nutrient credit by fiat. But, argue some, it is precisely this market presence on the part of the state that has caused such negligible market activity – particularly in comparison with a booming market such as that for carbon credits, in which the state’s role is more or less confined to the textbook statement above. An overabundance of caution on the part of environmental agencies results in overly restrictive trading rules that create disincentives to participation, information asymmetries, and price distortions.

Naturally the topic of government involvement is closely tied to the previous topic of cost effectiveness. Most free market champions have nothing against governments per se, but conclude that government oversight gums up the fluid market mechanism, and when the state acts as a market agent itself its overbloated bureaucracy and focus on equity introduce inefficiencies. Hence Schary and Fisher-Vanden (2004) assert that the best way to minimize transaction costs in water quality trading markets is to “minimize the government’s role” in overseeing the day-to-day operations of trading. The government should be limited to setting up the structure of the market at the outset, i.e. setting effluent caps, determining what may be traded, determining what counts as a credit, etc. (Shabman and Stephenson, 2007).

How exactly does a government slow down the optimal functioning of a water quality trading market? It has less to do with the role it plays as an active market agent and more to do with the specific rules it creates. A good example is the question of liability – who is legally responsible for fixing the gap created if a BMP fails to produce its intended results, either through poor maintenance, unforeseen weather events, or outright breach of contract by the NPS agent? Surprisingly, it is not the farmer himself. In large part because NPS entities are not regulated by Clean Water Act statutes, in nearly every existing trading program liability for credit production lies with the *buyer*. If a BMP fails to perform as intended, it is up to the PS discharger to identify an alternate set of credits, have them properly verified, and purchase them. In some programs a backup “insurance pool” of credits is created for this purpose, which might consist of a

certain quantity of credits actually diverted and held in escrow as “reasonable assurance” against the possibility of BMP failure. Even under this scenario, however, from a legal standpoint liability remains in the hands of the PS discharger.

In one of the earliest analyses of nutrient trading, Jarvie and Solomon argued that assigning liability for BMP failure to point sources would inhibit trading. “Regulators will not encourage trading by holding threats of fines for failure of nonpoint source reductions over the heads of point sources” (1998: 155). They proposed that if a discharger has paid for the BMP implementation itself as well as ongoing monitoring, then they have fulfilled their side of the bargain. In the case of BMP failure or nonimplementation, it should be up to the public agency to work with the NPS (not the PS) to find a solution to the problem. They even suggested that this liability burden will ultimately shift over to third-party brokers.

Dunn and Bacon draw a similar link between disparate liability stemming from government policy and program effectiveness: “A trading program should not squeeze certain sources to put them in the position of taking responsibility for substantially more than their fair share of a pollutant load. If this occurs, the net result will be a trading program ultimately set on a course for economic and environmental failure” (2005: 48). They also point out that the burden posed by unequal liability extends beyond economic disincentives: “If any party to a trading program seeks to capitalize on the inherent inequities – either by asking too much from another party or by trying to force a

particular result – the trading program is likely to crumble under its own weight” (Dunn and Bacon, 2005: 43).

This brings up an obvious question: should NPS be held legally liable for the credits they are being paid to generate? There is no clear consensus on the issue. Some analysts feel that increased liability for NPS is the only way to make the playing field more even, while others point out pitfalls. Selman et.al. (2008) discuss a basic jurisdictional constraint: “From a legal standpoint in most cases it is simply not possible to transfer liability from a regulated entity to an entity that has no regulatory obligation to remediate pollution.” Others claim that increased regulations would simply raise the ire of farmers and make them less reluctant to participate (Luke, 2008). The coordinator of what is regarded as a highly successful trading program concurs based on experience, insisting that transferring liability from dischargers to farmers would result in farmers pulling out of the program altogether (Zwick, 2008c).

Another criticism of state oversight relates to the question of geographic scale. The limitation of most trading programs to individual watersheds stands in stark contrast to the general thrust of free markets, which are premised on the free flow of goods, information, and capital across borders. A recent feasibility study on the prospect of expanding water quality trading from individual watersheds in the Midwest to the entire Ohio River Basin gave this assessment of current programs: “small-scale trading efforts have resulted in fragmented markets, high transaction costs, expensive program development, and limited trades” (EPRI, 2008: 1). Economies of scale are

stifled when trading is limited to bilateral trades but liberated in a clearinghouse structure between multiple, anonymous actors. As Faeth put it: “There are some 3,500 waterways and water bodies impaired by nutrients. If we tried to develop a trading program for each one of these, it would be labeled *reductio ad absurdum*” (2006: 2).

As far back as 2000, when only a small handful of trading programs were operating, Faeth recommended expanding trading markets outwards to encompass the entire Chesapeake Bay and Mississippi River basins. He repeated this sentiment in a 2006 address in which he praised the rapid progress in implementing a 10-state greenhouse gas trading program in the northeast US, stating that in order for water quality to replicate the carbon and SO₂ markets, “you need a big, deep market” (Faeth, 2006: 3).

A final criticism specific to the role of government restrictions is not widely voiced but is worth noting for how it sheds insight onto the way that farmers are viewed within the literature. King and Kuch (2003) cite competition from other conservation programs for BMP implementation as a constraint holding back the potential of water quality trading markets. Traditional government conservation programs such as the Conservation Reserve Program (CRP) and the Environmental Quality Incentives Program (EQIP) are widely known within the farming community and are likely to attract more attention than the relatively unknown and unconventional idea of water quality trading. The money being offered as a subsidy for BMP implementation by a traditional conservation program may also be viewed as less risky by farmers because it

is guaranteed in the five-year Farm Bill. Even if a farmer decides to engage in trading, if he has already implemented some conservation practices under a government program they were likely the easiest or most cost-effective BMPs, meaning that the ones remaining for trading are riskier or more costly. Thus, while there is broad consensus within the environmental movement and the soil conservation community that government conservation programs should be expanded across the board, King and Kuch (2003) make the unusual call for reducing government conservation programs so that water quality trading becomes in essence a farmer's only option.

2.2.5 Reliable Information and the Reduction of Uncertainty

The final market condition broached by trading analysts in relation to water quality trading's stagnancy is the elusive element of *uncertainty*. An idealized market situation possesses what economists refer to as perfect information: "Each person and firm has all the information that it wants to make economic decisions" (Craven, 1990: 134). This is obviously an unrealistic assumption made only for the purpose of defining an idealized market, but it allows an economist to identify when market conditions have veered from the ideal and what may be done to bring them back in line. Typically the kind of information being referred to is information about prices – buyers know what prices will be charged by sellers, sellers know what prices are desired by buyers, and sellers know what prices their competitors are charging. But information also refers to attributes of the product itself. In many markets the commodities themselves have

become so standardized that the question of attributes is largely irrelevant (think #2 corn, or pork bellies, or 18/10 stainless steel), but in those cases where attributes vary the chief function served by information comes down to risk management. Fast, unimpeded, and reliable flow of information about any commodity translates into certainty, which helps buyers, sellers, and even brokers alleviate risk. And it is precisely here where water quality trading markets run into trouble.

If trading remained between point sources only the question of uncertainty would be largely irrelevant, for effluent levels can be measured at the point of discharge with great precision. When NPS agents enter the equation, uncertainty becomes the predominant concern for several reasons. First, whether BMPs are properly installed and then properly maintained is a question that must be constantly confirmed via inspection. In the case of some existing programs (e.g., the SMBSC trading program, MN) field-level measurements of cover crop thickness must be taken in order to qualify a planting as having achieved the necessary level of sediment retention. Second, it can never be ascertained with complete accuracy whether a given BMP, even if properly installed and maintained, results in the purported level of nutrient remediation (Russell and Clark, 2006). Hence the reason for trading ratios, delivery ratios, insurance credit pools, and other instruments: they add an arbitrary level of certainty to a highly uncertain process of commodification. In other words, here we have not so much an issue of government action or property rights to throw off the market mechanism, but characteristics inherent to the act of PS-NPS trading itself (Hall and Raffini, 2005;

Boisvert et.al., 2007). Third, there exist “uncertainties about how sources will behave under various market structures” (Easter and Johansson, 2006: 67). Asymmetric information may create incentives for buyers or sellers to misrepresent their efforts or otherwise cheat the system.

In comparison to the previous obstacles, there seems to be less that can be done about uncertainty from a design or public policy point of view. Aside from trading ratios and the like, the tools one encounters most frequently in the literature are rigorous monitoring (both of BMPs and of water quality) and the strict enforcement of rules, even to the point of punitive action for breach of contract (see King, 2002). Stavins’ (1998) assessment of the SO₂ program notes that the insistence by environmental groups on continuous-flow monitoring as well as the stiff penalties for noncompliance were two key ingredients in the program’s high rate of success. Smith (2004) confirms that constant monitoring of pollutant levels and communication with stakeholders were key to the success of an Australian watershed program.

The issue of information flow is closely linked to that of efficiency, but here again we witness the tension between economic and regulatory imperatives. Increasing the quantity and quality of information may provide great benefit to market participants and allow for a more robust trading platform, but it comes at a tremendous logistical and financial cost. As King and Kuch (2003) point out, the sheer complexity of the NPS question mitigates against the use of a standardized credit scoring index that would facilitate easy commodification of credits. On the other hand, to consider each trade in

its context and score credits using ad hoc criteria would raise a program's transaction costs to unsustainable levels. Similarly with rule enforcement. Kieser and Feng (2008) specify two critical ingredients of successful trading programs: "minimizing transaction costs and making sure there's an enforcement mechanism so that promised environmental benefits are, in fact, delivered." The trouble is, their two suggestions are directly at odds with one another. Strict enforcement mechanisms by their very nature raise transaction costs, while minimization of transaction costs would necessitate the relaxation of mechanisms to ensure that environmental goals are being reached (Robertson and Mikota, 2007). This is the careful balancing act that environmental trade regulators must constantly strike: if trading criteria are made too loose in order to stimulate the market then they lose their environmental integrity, but if they are made too strict in order to maintain environmental rigor then they potentially stifle the entire market (King, 2002: 11317).

Consider the case made by the most ardent market supporters, who contend that monitoring will largely take care of itself in a true free market context. Shabman and Stephenson (2007) argue that a market-like trading structure would help resolve the persistent problems of noncompliance that have hounded conventional permitting systems. The ability to buy and sell pollution allowances would provide a firm with a kind of safety net while they tried out different technological strategies. If a given strategy were to fail, rather than being assessed a fine they could simply buy allowances until they corrected the problem. More importantly, trading under a strict allowance

cap would actually encourage self-monitoring and self-enforcement by emitters, because it is in every emitter's self interest to ensure that the pollution commodity retains its integrity. If one emitter gets away with exceeding its allowance cap, then the value of the allowances is reduced for all other emitters. In other words, argue these authors, despite the many complexities and uncertainties inherent in the trading of nutrient credits, the state can retreat from this market sphere and allow it to function according to a natural tendency towards self-regulation.

Note: Appendix A presents in a single table a summary of the major scholarly articles on water quality trading and the main variables each one posits as necessary for the success of trading programs.

2.3. Propping Up the Market Approach: Three Flawed Assumptions

At the most basic level, there is a single theme common to all of the literature cited above: a persistent belief in the market approach to water quality trading, and indeed to ecosystem services trading more generally. Much of the literature offers constructive criticism of programs and trading rules that have been implemented to date, but the purpose is to fine-tune trading in the future through these "lessons learned" rather than critique the market approach itself (e.g., Woodward, 2003). As Dunn prosaically puts it, "All trading programs are rooted in the concept that market-

driven systems can yield environmental improvement more cost-effectively than traditional 'command and control' regulatory approaches" (2002: 137; emphasis added).

This is not to say that analysts believe that water quality trading will or even should move towards a pure, idealized market form such as a credit exchange, nor even that one particular market structure should characterize all trading programs. King and Kuch (2003), whose article is one of the most forthright in calling attention to the deficiencies of the trading framework, still conclude, "There is no reason to assume that any particular market structure will or should dominate the national nutrient trading picture" (King and Kuch, 2003: 10355). Similarly, Woodward and Kaiser (2002) review in detail the four types of market structures that trading programs fall into. Despite different types of transaction costs and efficiencies associated with different market structures, the authors conclude that "there will, in the long run, be a variety of structures for the trading of pollution credits" (Woodward and Kaiser, 2002: 380).

Nevertheless, no one is actually calling for a move away from market principles. It is simply a matter of adapting those market principles to the peculiar constraints of this complex form of environmental commodification. As a stakeholder working on one of the more ambitious regional trading initiatives put it, "The entire Chesapeake Bay restoration effort will happen within markets. Markets are the framework for everything that we do in our society – so we'll do it with markets, or we won't do it at all" (quoted in Zwick, 2008d).

This unflagging belief in markets stands in sharp contrast to the fact that water quality trading to date is widely thought to have been a failure. According to the conventional view, trades have been few and far between and there have been more failed programs than successful ones. Many authors respond to this seeming contradiction by arguing that water quality trading has failed precisely because it has *not* approximated market conditions. Hence the push to make the newest round of scaled-up programs (e.g., Chesapeake Bay; Ohio River Basin) more market-like.

I contend that this position is problematic for at least two reasons. First, as laid out in the previous chapter, the water quality trading market needs a high degree of state involvement in order to achieve its stated goals; the double movement is not a peculiarity but a necessity. Second, I will now build an argument that the key variable accounting for success or failure of water quality trading programs is not related to property rights or transaction costs at all but to *social relations* between market participants. The best place to begin constructing this argument is by *deconstructing* the set of arguments laid out in detail above. I will describe three flawed assumptions upon which the conventional model of water quality trading is based, each of which will bring us a step closer to understanding the social nature of trading success.

2.3.1 Does Supply Follow Demand in Water Quality Trading?

A recent article on water quality trading is entitled “The Demand Dilemma” (Luke, 2008) in reference to PS dischargers’ need for credits, but one rarely sees analysts write of a “supply dilemma” in reference to farmer participation. Indeed, one rarely reads of a supply dilemma at all. The reason for this is the first flawed assumption of the neoclassical understanding of water quality trading: that *supply follows demand*.

The idea that supply rises or falls with demand is central to neoclassical macroeconomic modeling. In some sense it is the phenomenon that drives the entire free-market economy. We do not need central planning or price controls because production will ebb and flow as needed to fill the desires of consumption, guided by Adam Smith’s famous “invisible hand.” If there is demand for a product or service and money to be made in providing it, then someone will emerge to supply it. This assumption holds in so much economic modeling because in most sectors of the economy it proves true. However, it falls flat in a sector in which *supply* stems from agricultural conservation practices. We cannot speak of the supply of nutrient credits without taking into account that the suppliers are farmers for whom the implementation of conservation practices has as much to do with cultural symbols and social relationships as it does with market signals (Vanclay and Lawrence, 1994).

Interestingly, if we go back to King and Kuch’s (2003) seminal article which first broached the issue of water quality trading failure, one of their central concerns was that a restricted supply of nutrient credits acted as a bottleneck and prevented trading from

reaching its full potential. However, a careful reading of their assessment turns up no mention of social relations. They sum up their sentiments as such: “The supply of nutrient credits by nonpoint sources depends on their nutrient management costs, and also on how the baseline for producing valid nonpoint credits is established” (p. 10361). In other words, supply is a phenomenon determined by price and marginal availability, not by any kind of social considerations. “If the rights to clean water are properly defined and when these rights are tradable, a market equilibrium [occurs] between buyers and sellers of pollution permits” (Easter and Johansson, 2006: 62).

Some of the best examples of this attitude come from more recent papers. Obropta and Rusciano (2006) conduct a theoretical feasibility study that lays out a series of variables that most strongly affect whether trading is a viable option in a given watershed. Items include land use patterns, PS effluent levels, cost of on-site remediation, availability of nutrients from agricultural sources, costs of BMPs, etc. They do not ignore the agricultural element, but the same economic logic pervades their entire analysis: if the proper cost mechanism is devised to create a sufficient price incentive, farmers will be on board and will generate nutrient credits. They write, “It will be important to demonstrate that point-nonpoint source trading can . . . provide funding to owners of agricultural lands to help them become more sustainable,” as if the availability of funding were the only important factor (Obropta and Rusciano, 2006: 1305). Similar in tone is Zwick’s (2008d) description of an initiative in the Chesapeake Bay. An autonomous body was created to serve as the administrative hub of the

program and to seek out PS polluters who would want to participate. All of the planning is directed towards attracting dischargers who recognize that they should enter the game before basin-wide regulations become law. Scant mention is given of how farmers will be engaged to actually produce these credits. Their participation, it seems, is simply assumed.

In an ambitious paper laying out a proposed trading protocol between water treatment plants and farmers in the state of Maryland, Hanson and McConnell (2007) provide an even more specific example of this assumption at work. They quantitatively model the efficacy of a trading program based on a single BMP: the planting of winter cover crops to reduce nitrogen flow from farm fields. They carefully parse the differences between upgrading low-cost treatment plants versus high-cost plants and the differences between intra-tributary trading and inter-tributary trading. But when it comes to adoption of cover crops by farmers, they simply take it as a given in order to calculate abatement efficacy. In their summary of the program they write: “The trading works as follows. Within a given trading region, we minimize the cost of meeting the aggregate cap by not upgrading high-cost POTWs. We upgrade POTW’s beginning with the least cost, until the aggregate cap is met. *With the savings, cover crop acreages are increased*” – like magic, apparently (Hanson and McConnell, 2007: 5; emphasis added).

It is perhaps not accurate to state that such authors truly assume that the adoption of a given BMP is as straightforward or unproblematic as their models imply, yet they give no attention to the question of farmer incentives or willingness to adopt.

This is problematic at the very least because these studies are based on efficiency-maximizing economic models, and the act of interacting with and incentivizing farmers carries transaction costs that will affect program efficiency.

2.3.2 The Farmer as Rational Actor? A Deeper Understanding of Farmer Decision-Making

This deficiency in grasping the importance of reaching out to farmers stems from a simple but far-reaching scholarly misunderstanding. Recall that technical accounts of water quality trading are largely the province of ecological economists – not agricultural economists or rural sociologists. This subfield typically studies topics such as the market forces affecting natural resource extraction, the effects of environmental policies on firm behavior, and the marginal pollution abatement costs for point sources. Discussions involving agriculture other than at the macro level of the entire farming industry are largely absent. It stands to reason, then, that the very group of economists making recommendations and predictions about trading programs actually have a very poor understanding of farmers, farmer culture, and farmer decision-making.

Some of the proposals for how to structure trading programs made a decade ago when trading was largely untested reveal the unrealistic assumptions about the way in which farmers will act in these markets. In considering the issue of who carries the liability for credit failure, for example, Faeth (2000) proposed two options for dealing with a failed BMP: the farmer could “accept the regulatory obligations of the [PS discharger] for that amount of the load,” or the PS discharger could give the farmer a

loan to be paid back in credits or cash. Surveying the landscape of trading today these two proposals seem mildly absurd, as every single program but one has the same approach to liability: if a BMP fails it is up to the PS discharger to find the credits elsewhere; the farmer is off the hook. The one exception is in Pennsylvania, where a private-sector third-party broker is liable for BMP failure once he has contracted to buy credits from a farmer. In no case is the farmer held liable for credit generation.

This reasoning stems from a key tenet of neoclassical economics, what is sometimes called the *homo economicus* model. Potential NPS participants (i.e., farmers) are seen as operating from the same set of motivations as all market participants: as *atomized rational actors responding to price signals and the potential for economic reward*. Shabman and Stephenson (2007), for example, cite several successful nutrient trading projects in which NPS polluters were engaged as market actors rather than cost-share partners or voluntary adopters. Given the right program structure, they argue, farmers have the financial incentive to act as innovators and generate nutrient credits entrepreneurially. They become competitive bidders rather than passive receivers of subsidy-type arrangements.

This assumption of the farmer as rational actor is a key building block of the current push for expanding the scale of trading programs to larger watersheds. Ribaudo et.al. (2005) conduct an economic analysis of the cost savings potential of nitrogen credit trading within the entire Mississippi River Basin, and in order to estimate supply and demand for nitrogen credits they make two key assumptions about farmer decision-

making. First, they build into their model the assumption that farmers *will* produce and sell nitrogen credits so long as the price is right. To cite their economic terminology: “As one moves along the nitrogen reduction demand curve, agriculture will be willing to implement nitrogen reduction practices as long as the price offered by point sources is greater than the cost of supplying the next unit of nitrogen reduction” (Ribaud et.al., 2005: 165). Note their use of the abstraction “agriculture” rather than the more accurate term “farmers” – a telling indication of the presumption of a homogenous group reacting to a uniform motivational impulse.

Their second assumption is that farmers will produce these nitrogen credits by choosing BMPs based on what is most cost effective and profitable. Their hypothetical farmers seeks “the most efficient combination of production practices for maximizing profits, including the sale of nitrogen reduction credits to point sources” (Ribaud et.al., 2005: 164). The authors do not take into account the transaction costs associated with identifying willing farmers or implementing BMPs or conducting follow-up monitoring, nor the reluctance to participate that may exist on the part of some farmers, nor farmers’ preference for certain BMPs based on factors other than profitability. For example, in their model farmers achieve most of their nutrient reductions by reducing nitrogen fertilizer use, but in fact there is anecdotal evidence that farmers feel reluctant to even conduct spring nitrate tests because of a perceived risk of not having enough nitrogen in their soils as the crop matures (R. Moore, pers. comm.; Dinnes et.al., 2002).

2.3.3 *Market Primacy and the Exclusion of Social Relations*

The third assumption is more abstract yet arguably the most far-reaching: If water quality trading is truly a market-based approach, and if it functions most effectively as a market, then we may view it entirely through a market lens with no need for additional criteria. In other words, *water quality trading is analyzed using a narrow set of economic and institutional variables that do not account for the full story of trading program success*. There is a critical ingredient missing from nearly every manuscript cited in the pages above: the *social relations* among the participants in trading schemes. Particularly lacking is any indication of the importance of the relations between a program's administration and its participating farmers. As I will argue shortly, this lack of focus on farmers and the relationships needed to engage with them is an Achilles heel of the conventional interpretation of PS-NPS trading.

A number of examples stand out in the literature. A recent long report written as a guide for trading practitioners features a section on "participants and communications" which identifies "the correct organizations and individuals . . . [who] should be considered in establishing a trading program." The list includes "local/state and federal permit writers; water quality planners; local dischargers; environmental groups; and political/civic leaders" – but no mention of farmers (IES, 2006: 66). Is their approval and participation simply assumed?

Greenhalgh and Selman (2006) take stock of the literature on water quality trading and distill a list of seven key variables: (1) effective market design; (2) fungibility of credits; (3) appropriate and accurate baselines; (4) clear assignment of liability in case of BMP failure; (5) engagement with all groups of stakeholders; (6) appropriate administrative infrastructure; and (7) rigorous and ongoing monitoring. Their list may appear accurate and comprehensive, but notice what is missing: any substantive mention of social relations apart from the inspid advice in point #5 to “include stakeholders in the formation and rule discussions of programs” (Greenhalgh and Selman, 2006: 178). Who are these stakeholders, and does their inclusion end when the rules for a program are drawn up? In fact, there is some evidence that a broad “stakeholder engagement” approach is actually not as effective as often assumed in the creation of watershed governance projects (Weaver and Moore, 2004).

At the risk of belaboring the point, even the USEPA’s website upholds this pattern. In a section entitled “Where will water quality trading work?” the agency notes that trading is most effective where four conditions hold: (1) there is an economic or regulatory driver motivating PS behavior; (2) sources within the watershed face differential costs for pollution control; (3) discharge regulations are not so strict as to wipe out any surplus reductions to buy or sell; and (4) watershed stakeholders and the state agency are open to innovative approaches to trading and remediation (USEPA, 2008). Their fourth item hints broadly at a kind of social variable, but it is nowhere near a specific articulation of the nature of social relations – not to mention that, like

Greenhalgh and Selman (2006), it does not even stipulate who the “watershed stakeholders” are. They could just as easily be referring to local environmental groups or county conservation agencies as to farmers.

2.3.4 *Going Beyond Assumptions: Insights from Adoption Studies*

The economic view of farmers’ role in water quality trading is best summed up by proponents of “free market environmentalism,” who write that “good resource stewardship depends on how well social institutions harness self-interest through individual incentives” (Anderson and Leal, 2001: 5). It is likely true that firms with PS discharges who have been dealing with the issue of pollution remediation for decades view trading simply as a way of finding the most cost-effective solution to a problem. Farmers’ decisions regarding implementation of conservation measures, however, are not usefully described as being driven by “incentives to exploit differences in relative marginal environmental impacts” (Shortle and Horan, 2001: 275). The decision to adopt a given BMP is more complex and contingent than most economic modeling allows for.

In particular, the decision *not* to adopt conservation practices is as or more common than the positive decision to adopt, even in the face of specific economic incentives. There are a host of psychological and cultural factors which may cause a farmer not to participate in a program such as nutrient trading. “A strong pride in private property, a history of tensions with industrial actors, or a desire to be recognized for land stewardship are just a few of the attitudes and values that can establish

powerful norms of behavior discouraging trades” (Breetz et.al., 2005: 172). In one study, for example, Edwards-Jones et.al. (1998) show that psychological factors, which they counterpose against economic variables, account for 20-30% of variation in farmer decisions towards the environment.

These are not just temporary attitudes either, but the result of a history of relationships between actors. Mistrust or animosity between farmers and environmental groups or even between different groups of farmers can continue to hinder cooperation, even when their interests are aligned on a present-day issue, as Lewotsky (2002) demonstrates in a study from Oregon. To cite several anecdotal examples from water quality trading programs: A beet sugar company in Minnesota wanted to purchase nutrient offsets from local cattle ranchers, but the ranchers refused to participate because of longstanding land disputes with the sugar beet growers who are the primary beneficiaries of the company’s operation (Breetz et.al., 2005). Similarly, a trading program in Idaho has been stalled in the developmental stage for years because of strong disagreements between small and large aquaculture operations over the issue of water use rights (C. Schary, pers. comm.).

A number of studies centered in rural sociology and agricultural economics stretching back to the 1970s have demonstrated that the adoption of conservation practices does not follow the same patterns as the adoption of more economically-oriented production practices. As Pampel and van Es stated in the first substantive study on the topic, “farmers appear to be innovative either with respect to commercial

practices or with respect to environmental practices, but not both" (1977: 67). The ostensible reason for non-adoption is straightforward: it does not pay. Long-term benefits such as increased soil fertility or the reduction of nitrogen fertilizers over time are difficult to incorporate into a short-term planning horizon in which the farmer must pay implementation costs right now. Though one result of conservation may be environmental protection for the public good, the market mediates against these costs being passed on to the consumer (van Es, 1983). Additionally, economic pressures may mitigate against adoption of practices that alter a farm's basic production regime due to limited financial flexibility (Munton et.al., 1989; Pannell et.al., 2006).

In terms of tactile perceptions, many outcomes of conservation practices are largely invisible over the short term. Farmers can quickly perceive the outcomes of production-oriented practices in the form of increased milk or crop yields, but they may find it difficult to perceive a causal relationship between tillage methods, nutrient loss, and decreased crop yield. This feeble link between cause and effect creates an "epistemic barrier" that hinders an appreciation of the deeper value of conservation (Carolan, 2006).

Vanclay and Lawrence (1994) argue that the very use of the concept of rationality to describe adoption behavior is misleading, because non-adoption decisions are no less rational than adoption given the particular context in which farmers are operating. Applying this point to water quality trading, King and Kuch (2003) note that farmers may be reluctant to participate in trading programs for several reasons, all of them

rational from their own point of view. If they begin receiving conservation subsidies through a market-based program, it may cause the government to reduce or even eliminate other green payment programs. More insidiously, once the links between BMPs and nutrient credits are quantitatively established it would be easier for the government to mandate such practices rather than leaving them voluntary. Breetz et.al. (2005) add the observation that farmers typically see themselves as stewards of the land and find it uncomfortable to face the fact of their own contribution to the pollution of waterbodies. Hence even if it is in a farmer's *financial* economic interest to engage in nutrient credit trading, the act may not mesh with his *moral* economic point of view – and as the scholar James C. Scott has shown in numerous monographs, the power of a moral economic framework on the actions of farmers and peasants should not be understated (e.g., Scott, 1976). Kramer (2003) found empirical support for this whole set of reservations in studying a water quality trading program in Wisconsin that never got past the planning stage, in large part because of farmer resistance.

In sum, the conventional market approach to water quality trading is too narrowly articulated. As Parker et.al. write, “Studies of farmers’ attitudes toward conservation within a watershed context focus little attention on social variables” (2007: 815). When we are speaking of the adoption of conservation practices in exchange for some kind of financial reward, as in the case of water quality trading, we must consider the *social context* of the act in addition to the economic context. It is a truism that PS-NPS trading will go nowhere without active farmer buy-in, yet a farmer’s

decision to participate in any conservation scheme is not just influenced by economic drivers or market signals but by social relations. To use the terminology of economic sociology, the act of participation in a water quality trading program is *socially embedded*.

This brings us to the second part of this literature review, in which we turn to a body of scholarship sociological and anthropological in its origins. In the remainder of the chapter I will elaborate on the idea of social embeddedness, then relate it conceptually to the adoption of agricultural conservation practices, and finally return to the water quality trading literature to examine the small handful of studies which take an explicitly sociological view of trading.

2.4. Social Embeddedness and Agriculture

The sociologist Mark Granovetter published an article in the *American Journal of Sociology* in 1985 that almost single-handedly relaunched the subfield of economic sociology after decades of inattention (Swedberg, 1997). The piece has been cited 2,806 times in the academic literature, a huge achievement for an article from a sociological journal (Web of Science search, Feb. 20, 2009). Over 20 years later the field has expanded and taken on an increasingly wide range of topics, but it remains dominated by the basic guiding framework broached by Granovetter: social embeddedness. The existence of embedded social relations between economic actors is a phenomenon which has a powerful effect on economic decisions and patterns, including the realm of ecosystem service markets.

2.4.1 *What is Social Embeddedness?*

To understand embeddedness one must first look to the framework which serves as its chief foil: the theory of economic behavior offered by neoclassical economics. The standard view that has guided economics throughout the twentieth century is rational actor theory, or the idea that human beings are guided in their economic decisions by a utilitarian mental calculus in which choices are made in order to achieve the greatest economic gain for the least economic cost. Individuals are assumed to act atomistically (i.e., a decision is made in relation to how it will affect the actor alone); to behave rationally (i.e., economic choices are evaluated using a rational, internal logic rather than based on emotions or other nonrational criteria); and to be propelled by the desire for personal gain (i.e., people act so as to benefit themselves, their families, and their firms, rather than altruistically or for the greater good). Granovetter sums up this view in a short sentence: "Much of the utilitarian tradition, including classical and neoclassical economics, assumes rational, self-interested behavior minimally affected by social relations" (1985: 481). The key phrase for Granovetter is the final one, for it sets up the contrast he is seeking: "At the other extreme lies what I call the argument of 'embeddedness': the argument that the behavior and institutions to be analyzed are so constrained by ongoing social relations that to construe them as independent is a grievous misunderstanding" (Ibid.: 482).

Here he was explicitly drawing inspiration from the man who first brought the idea of embeddedness into popular use, none other than Karl Polanyi. Perhaps the single most fundamental accomplishment of Polanyi's *The Great Transformation* was breaking apart the myth of classical liberal economic epistemology that the sphere of economic activity is separate from the sphere of social or cultural activity. This philosophy, which by the early twentieth century had installed itself as the preeminent worldview of the political and economic elites of the industrialized world, was the precursor to the rational actor model. It held that "exchange is entirely driven by the optimizing, economizing behaviour of pre-constituted rational individuals who have pre-given and stable preference functions and are solely oriented to the price mechanism" (Jessop, 2001: 196). In other words, the economy was thought to function optimally when *disembedded* from social relations. We may note here the link between embeddedness and Polanyi's thesis of the double movement that drove the previous chapter, for it is precisely the attempt to "subordinate the substance of society itself to the laws of the market" that leads to "the devastation of neighborhoods, the denudation of forests, the pollution of rivers, . . . and the general degradation of existence" that in turn necessitate the enactment of protectionist regulations (Polanyi, 2001: 75, 139).

The conceptual point that Polanyi, Granovetter, and others make is that disembeddedness in its purest form is not only destructive, but in fact impossible. The economic sphere cannot be considered without attention to the social sphere. The two cannot even be separated for analytical purposes, as they are always bound together for

the simple fact that all economic activity takes place between human beings in a social context mediated by human understanding and cultural symbols. The “human economy . . . is embedded and enmeshed in institutions, economic and noneconomic. The inclusion of the noneconomic is vital. For religion or government may be as important for the structure and functioning of the economy as monetary institutions or the availability of tools and machines” (Polanyi, 2001: 34). Similar points have been made by scholars working in the substantivist tradition for nearly a century (see Chayanov, 1966; Sahlins, 1972; Scott, 1999). The embeddedness framework does regard the market economy as operating according to a set of external rules created by economic elites, but it is “nonetheless socially embedded and somehow needful of complex forms of social regulation” (Jessop, 2001: 192). The point is not to reject economic explanations entirely but to synthesize them with a sociological perspective, as all actors evince both “simultaneous economic and non-economic motives” (Granovetter, 2005: 38).

The empirical literature on social embeddedness is generally concerned with either mapping the social networks that undergird or result from certain market sectors (e.g., Gulati and Gargiulo, 1999; Johannisson and Ramirez-Pasillas, 2002) or charting the economic outcomes of embedded relations on firms and other market actors (e.g., Uzzi, 1999; Mizruchi and Stearns, 2001). The study of embeddedness has benefited greatly and makes frequent use of network analysis (see Rauch and Casella, 2001), though one consequence of this can be an over-emphasis on the quantitative mapping of economic

networks to the exclusion of actually measuring how those networks affect economic outcomes (e.g., Johannisson and Ramirez-Pasillas, 2002). Assessing the literature as a whole, a more significant gap appears relative to the present study. The body of scholarship on embeddedness is almost exclusively concerned with traditional economic topics and spheres of action, ranging from industrial and financial firms to consumer transactions to labor markets (for an excellent though short review, see Granovetter, 2005). Almost entirely absent is anything pertaining to agriculture, farmers, or conservation – indeed even the natural environment hardly merits a mention. And yet the turn to a market approach to water quality surely demands an economic sociological appraisal: not only does it involve individuals in newly created environmental markets trading commodities steeped in uncertainty, but it requires engagement with farmers, a group of actors that has historically proven resistant to participating in programs in which money changes hands in exchange for the implementation of conservation practices.

2.4.2 Embeddedness and Conservation

If so few existing studies have linked embeddedness to environmental or agricultural themes the question might be asked, What does embeddedness have to do with conservation practices, or more specifically with water quality trading? To answer that question we should first turn to attempts by scholars to operationalize the concept of embeddedness.

Despite the import of Granovetter's (1985) article, the flurry of pieces which followed remained at the theoretical or conceptual level for years. It was a full decade later that Uzzi (1996) attempted to operationalize and measure the mechanisms by which embeddedness manifests in the economic sphere and facilitates the enhanced performance of firms. Uzzi's research was carried out among clothing design and manufacturing firms in New York, and he made a simple distinction between "embedded ties" – which are characterized by longstanding working relationships and deep connections through either family, mutual friends, or time spent together – and "arms' length ties," which are characterized by little prior knowledge of one another and a purely market-oriented approach to the business relationship. According to Uzzi (1996), embedded ties enhance the short-term performance and long-term success of firms via three different mechanisms of economic facilitation:

1. The fine-grained (and often tacit rather than explicit) *transfer of information* resulting from established ties and long periods of time spent interacting. In Uzzi's research, a good example is when a manufacturer adjusts production schedules or formats based simply on having seen a certain design pattern come from a designer with whom he has a long relationship, and knowing that something about the pattern differed from the norm. In other words, the conveyor through which an actor receives information matters as much or more than the information itself.

2. *Joint problem-solving* between actors that allows for more rapid, spontaneous troubleshooting and solution-building than do traditional market signals, which may take days or even weeks to reach the intended audience. Feedback is more direct, more explicit, and more detailed in an embedded relationship.
3. *Trust* among actors that facilitates risk-taking and the willingness to strike deals rather than a reluctance to engage and move forward with ideas. Trust results in the extension of extra benefits to business partners that might not be extended to partners in arms' length relationships.

Interestingly, if we examine a very basic definition of a market we see that it has to do primarily with the transfer of information and the existence of trust. For example, Boisvert et.al. write: "From an economic perspective, a market is a predictable social and legal arrangement that facilitates the interactions among buyers and sellers to communicate and share information efficiently and to carry out voluntary exchange" (2007: 4). The marketplace is characterized by predictability, communication, information-sharing, and voluntary transactions, which bear a strong resemblance to the mechanisms of embeddedness just laid out. But there is a crucial point to remember when we bring farmers into the equation: Given the generally skeptical attitude of farmers towards both conservation and regulatory authorities, combined with the many uncertainties and risks inherent to this particular market form, ecosystem service markets do not simply take care of themselves. They are not self-regulating.

This leads to Uzzi's (1996) other major finding, in which he reveals the importance of *how* a set of actors comes into contact with each other in the first place. Specifically, "third-party referral networks were often cited as sources of embeddedness. Such networks operate by fusion: One actor with an embedded tie to each of two unconnected actors acts as their go-between by using her common link to establish trustworthiness between them" (Uzzi, 1996: 679). In contrast to the conventional economic understanding, optimal market conditions here do not occur when actors are unknown to each other and operate in an anonymous marketplace; rather, economic relationships prove the most solid when they are initiated via a trusted third-party intermediary.

It is here that we see the most direct link between embeddedness and agricultural conservation, though it is rarely mentioned in the literature on water quality trading. Hall and Raffini (2005) provide one of the few published pieces that broach it when they discuss the promise held by third-party brokers to serve as mediators between PS and NPS actors in order to solve the historical lack of cooperation between PS dischargers and farmers. The point is echoed by several other analysts (Stavins, 1998; Shabman and Stephenson, 2007), though they specifically call for the entry of private-sector brokers in the name of optimizing market efficiency.

Juntti and Potter, meanwhile, are not writing of water quality trading but they specifically discuss the role of intermediaries in the realm of agricultural conservation more generally: "The role played by these actors, and the knowledge systems they

deploy, is likely to be particularly influential in [a conservation scheme] dependent for its success on enrollment in often complicated land management schemes which must be negotiated with individual farmers and tailored to local conditions” (Juntti and Potter, 2002: 217). There are strong links here to Brown’s “supply-side” view of the innovation diffusion process, with its emphasis on the infrastructure mechanisms by which agency actors help propagate new technologies or programs (Brown, 1981). Given the peculiarity and newness of the water quality trading mechanism, could the success of trading programs depend on something as overlooked as who is chosen to interface with farmers?

2.4.3 Disembeddedness and Embeddedness in Water Markets: Empirical Evidence from the Literature

Very few studies on water quality trading, or indeed ecosystem service markets in general, reference embeddedness at all, even indirectly. Interestingly, two of the most substantive exceptions are from programs abroad, though neither uses the embeddedness framework explicitly. Bauer (2004; 2005) presents a detailed empirical analysis of the failings of an almost purely disembedded/*laissez-faire* approach to water markets in Chile (note that this is a water *rights* trading program rather than a water *quality* trading program, though the principles are largely the same). Water rights were defined so that most of their oversight and administration was handed over to the free market rather than embedding it in the hands of local communities. These markets have

succeeded on a few counts, such as ensuring the legal security of private property rights and encouraging the development of the hydroelectric sector, but actual market activity has been far less than predicted by the program's early proponents, a fact which Bauer attributes to the lack of a robust institutional structure and the disembeddedness of the market sphere from the social sphere. Although the security of water rights has been made tighter for individuals, their actual definition has been left vague, making it difficult to carry out market transactions when it is unclear exactly what form of water right is up for sale. Further, the traditional water rights upheld by community custom were not incorporated into the program's rules, making it nearly impossible to transact such rights. In a nutshell, the creation and maintenance of the market for water rights was left up to the market itself, but lacking a proper support infrastructure it proved highly inefficient and mostly inactive. Further externalities resulting from this laissez-faire structure include the inability to coordinate water allocation on a watershed scale and the lack of attention given to environmental issues such as water pollution (Bauer, 2005).

Turning to a more positive example, in the most high-profile instance of water quality trading internationally a French firm needed to safeguard the quality of the aquifer from which it pulled its mineral water for bottling. The aquifer was threatened by high nitrate and bacteria infiltration rates due to intensification of farming practices in the watershed. The firm spent 10 years working out the details of an initiative to compensate farmers living in their catchment area for implementing nitrate-

and bacteria-remediating conservation practices. It is widely viewed as a success by both stakeholders and observers. In fact, the rate of participation is unprecedented: By 2004 when the negotiations had finally given way to implementation, *all* of the eligible farmers in the watershed had signed up for the program, 92% of the subbasin was protected, and all of the farmers had entered into the longest contract available (30 years).

According to a detailed report on the program, the keys to its success are not economic or institutional but social. Perrot-Maitre (2006) outlines four elements that contributed to its success. (1) The creation of a local intermediary helped disseminate scientific findings and optimize communications between the company and the farming community because they established *trust* between the two parties (Perrot-Maitre, 2006: 19). (2) Geographic proximity between the intermediary and the farmers further facilitated the sense of a shared understanding and a shared social context. (3) The program targeted long-term farming practices rather than short-term BMPs, and it ensured the continuity of payments via long-term contracts with guaranteed annual subsidies instead of payments that had to be renewed each year. (4) The most abstract element was a deep understanding of local farming culture, in particular the constraints faced by farmers as they contemplated various decision tracks regarding production and conservation. The main operational constraint in the community was the high debt rate faced by the youngest, largest, most modernized farmers, further exacerbated by French

inheritance laws. With an understanding of this situation it was possible to craft a set of rules and protocols that fit with farmers' financial situations and long-term farm plans.

The conclusion reached by the director of the program's intermediary agency is emblematic of embeddedness more generally: "even with all the scientific knowledge accumulated, the program would not have been possible without the effort made to understand farmers, establish a permanent dialogue with them, and recognise their perspectives – not only in terms of farming practices but also in terms of life choices" (Perrot-Maitre, 2006: 19). The author adds his own conclusion: "generous financial incentives and scientific knowledge are far from sufficient to ensure the success and adoption of such a program. . . . Money alone cannot provide a sufficient incentive when systems are complex and risk to the farmers is high" (Perrot-Maitre, 2006: 20-21).

Returning to the domestic context, Breetz et.al. (2005) provide the only full-length article to examine water quality trading from a sociological point of view, and certainly the only piece that explicitly uses the lens of social embeddedness theory. Their basic concern is the same as the more market-oriented piece by King and Kuch two years earlier: to explain why water quality trading had been so stagnant to date. As the authors outline, there are a number of "attitudes or values" that cause farmers to be leery of conservation initiatives that involve industrial actors, government regulators, or any hint of having to give up cherished property rights, leading to slow adoption of conservation measures even when there is financial incentive to do so. As a result, many trading programs languish with little or no trading, not because of insitutional

deficiencies or a lack of demand for credits, but because of an inability to engage with precisely that group of individuals whose involvement is critical for the program to generate trading activity. Thus for the purposes of their article the authors redefine “success” for a trading program, shifting it from a focus on cost efficiency and nutrient remediation to “the program’s ability to bring farmers to the table and implement BMPs for the purposes of trading” (Breetz et.al., 2005: 179).

With this new definition, they use embeddedness theory to single out three particular strategies for overcoming farmers’ reluctance to participate: (1) engaging in more education and outreach among farmers; (2) employing a trustworthy and neutral third party to negotiate between the farming community and environmental regulators; and (3) building on existing ties that certain local organizations already hold with farmers in order to secure their trust. They find that the particular strategy that will prove successful depends on a number of additional institutional factors, such as the size of the program, the speed with which it must secure credits, and its own objectives. As one example, for small programs with flexibility or minimal time constraints, an education-and-outreach approach is more effective than the use of existing social ties. Overall their conclusion is consistent with the wider literature on social embeddedness: the ties between actors in nutrient trading programs are not just important but could play a critical role in determining the difference between a successful program and a failed one.

Interestingly, just in the last year the USEPA commissioned a thorough review of water quality trading programs nationwide in which evaluation was based not on economic modeling as in so many of the studies cited earlier in this chapter, but on conversations with participants in existing trading programs. The study cites a host of factors as critical to the success of water quality trading, including economic factors such as weakly enforced discharge limits as well as institutional factors such as lack of state funding or incoherent forms of support from the federal EPA. What stands out in the report is its finding on the importance of local social relations between agricultural producers and program administration. The report refers to “non-point source ‘link’ organizations,” or “field-level organizations with established connections to the agricultural community” as key stakeholders whose participation is essential to making trading happen. In particular they point out the role for county conservation districts, which “not only garner the trust of farmers, but can supply vital technical expertise in planning and implementing best management practices” (Industrial Economics, 2008: 3-6). In other words, roughly a decade after the substantive scholarly literature on water quality trading began in earnest, we see the first publication broach the topic whose importance was highlighted by Uzzi’s (1996) work on embeddedness: the role played by “third-party referral networks” in making the link between those who produce nutrient credits and those who need to buy them.

2.5. Discussion. Water Quality Trading: Means To What End?

One must be careful when making a point such as that being made in this chapter not to construct a facile straw man out of the unwitting ecological economist. It is not that he completely misreads the phenomenon of water quality trading or makes no acknowledgement of the how closely the sector is bound up with an institutional and legal underpinning. In regards to the regulatory aspect, for example, King and Kuch recognize that “the role of trade regulators in emerging nutrient credit markets is far more complex and important than the role of trade regulators in established air emission offset credit markets” (2003: 10355; see also Boisvert et.al., 2007: 4).

I am also not implying that these scholars are unaware of the unique set of market constraints that demand a different approach to environmental commodities. In fact, in a pithy piece published in *Nature* two economists acknowledge the accusations leveled at their field over how it views the environment. Fullerton and Stavins (1998) lay out and then deconstruct the “myth” of the universal market – the idea that “the market solves all problems” and that market problems require only market solutions. Neoclassical economists, including ecological economists, do learn the conventional theory of welfare economics, which teaches that markets alone are capable of distributing goods with perfect efficiency provided that certain key conditions are met. Government simply needs to create and enforce property rights and, in the case of environmental pollution, provide punishment for negative externalities that are significantly higher than incremental pollution abatement costs. However, it is widely

recognized by this same set of scholars that “in the environmental domain, perfectly functioning markets are the exception rather than the rule” (Ibid: 433). In the absence of perfect market conditions or in the presence of elevated levels of risk, uncertainty, or asymmetric information, oversight agents are required to step in and correct for market failures because “market instruments do not always provide the best solutions, and sometimes not even satisfactory solutions” (Ibid: 434).

If ecological economists are aware of the flaws in the neoclassical approach to pollution remediation, it begs the question: What should the role of the market be in the attainment of environmental standards? It brings us back to the basic question driving the whole literature in the first place: What is the optimal institutional structure of the water quality trading sector? I will attempt to shed new light on this question by recasting it in terms of means and ends. Before we get to the role of the market, we need to understand the purpose the market plays in the environmental realm in the first place. Trading is a means, but to what end?

In the literature as a whole, trading is typically cast as a means to one of two ends. In the more narrow, strictly neoclassical interpretation, trading is viewed as an end in itself. Revisit the arguments summarized at the beginning of the chapter about the stagnancy of the whole sector: they are framed using trading as the metric for success. Markets are viewed as failures because “very few trades have actually occurred” (Boisvert et.al., 2007: 2) or “conditions have not been adequate to support any trading at all” (King and Kuch, 2003: 10360). Shabman and Stephenson take this

argument a step further, arguing that the criterion for a successful market should be not the volume of transactions, but the “ease of making trades” (2007: 1081). Trading *qua* trading is the measure of a successful market. These writers presumably do not believe that the trading imperative actually trumps the environmental imperative, but that the connection between the two is implied. Others prefer to make that link explicit rather than implicit, viewing trading as a means to the attainment of certain water quality standards (Faeth, 2006).

Much of the literature – like the state trading rules highlighted in the previous chapter – actually lists both goals in quick succession. A good example is Swift, who first frames trading as “primarily an economic instrument that reduces compliance cost by providing sources with greater flexibility as to where and how to reduce emissions” (2005: 3). Then he looks beyond cost effectiveness to a wider environmental goal, writing that “when linked with strong regulatory frameworks, with a standard such as an emissions cap, the combined ‘cap and trade’ program is one of the most effective ways to reduce pollution” (Ibid). The USEPA similarly champions the promise of trading to achieve “environmental benefits greater than would otherwise be achieved under more traditional regulatory approaches” (USEPA, 2003). These might include improved flood control, erosion and sediment deposition reduction, habitat enhancement, and riparian and wetlands restoration (Hall and Raffini, 2005).

Intuitive as this basic goal of environmental improvement may seem, however, it may prove insufficient to turn water quality trading into a more robust sector for at least

two reasons, both related to themes from Chapter 1. First, the link between NPS nutrient reductions and water quality standards will always remain elusive. Water quality improvements cannot actually be isolated at an individual farm scale due to monitoring constraints and the multiple possible pathways for nutrient reductions to occur (Russell and Clark, 2006). Second, the twin economic and environmental goals may continue to cancel each other out. The foregoing literature review hints at the idea that the water quality trading market, perhaps unique among ecosystem services, may simply be unresponsive to a market approach as conventionally understood. The nature and extent of market uncertainties, the risk factors, the mismatched liabilities, and the invisibility of the commodity being traded result in a sector that cannot conform to conventional market assumptions, no matter how much tinkering is done with trading ratios or property rights.

The contemporary attempt to transcend some of these market limitations by essentially skipping right over them – for example, by expanding to larger watersheds or utilizing web-based credit registries and reverse auctions among farmers – may be a solution, but an imperfect one. It may bring the kind of market coherence and even trading robustness desired by economists, but at the expense of the environmental rigor that currently characterizes the sector. As the authors of a case study of two trading programs write, “it may well be appropriate to look beyond cost effectiveness when water quality trading programs are designed to solve environmental issues in particular social and economical settings” (Fang et.al., 2005: 657). Because of the inherent

constraints posed by the commodification of nutrient credits, the quest for a market form that simultaneously achieves water quality benefits and cost efficiencies may be utopian.

In place of that quest, what we see in a handful of successful PS-NPS trading programs, usually driven by unorthodox program coordinators rather than economic advisors, is the emergence of a third goal: Trading is not an end in itself nor even a means to achieving water quality per se, but *a means towards the goal of agricultural conservation*. When water quality trading moved from the form of PS-PS to the form of PS-NPS, it shifted away from being merely a new tool for controlling direct discharges from pipes and brought a whole new set of actors onto the stage. When we bring farmers into the ecosystem market sector we usher in an entirely new problematic, but also a new potential source of conservation and environmental improvement.

Apart from a few isolated and fairly vague references in the scholarly literature (e.g., Schary and Fisher-Vanden, 2004: 281-282), the articulation of this third goal is mostly buried in the secondary stratum comprised of technical reports, annual updates from individual programs, and government white papers. Here trading is viewed not as a way of establishing a functioning ecosystem service market, but as a new entrée into the persistently recalcitrant world of conservation.

In part we may attribute the relative invisibility of this goal to the fact that the literature has been dominated by economists and policy analysts. But as the focal point of trading has come to center on farms and BMPs as the primary generators of nutrient

credits, agricultural interests including the USDA have begun to enter the discussion. A report released just last year makes their point of view explicit: “EPA and USDA approach the involvement of the agricultural community in water quality trading from very different perspectives, consistent with the different functions of the respective agencies. EPA sees trading as a cost-effective way of delivering clean water, while USDA views trading as a means of offsetting farmers’ BMP costs” (IEI, 2008: 4-6).

By shifting the fundamental aim of water quality trading from one of cost-effective achievement of water quality standards to one of implementing agricultural conservation practices, we resolve the dilemma that environmental agencies find themselves in. Responsibility for assuring program rigor can be handed over to local agricultural conservation offices rather than remaining in their own hands and thus impeding market activity. But rather than burdening local conservation officials with the task of monitoring the unmonitorable, it would be playing right into their strengths: existing ties to the local farming community and a longstanding emphasis on the implementation of conservation measures.

One might argue that disconnecting trading from economic and even explicitly water quality-based goals and connecting it merely to the goal of conservation runs a grave risk: since the exact quantitative connection between a given BMP and its associated environmental benefit can never be established with certainty, would we not run the risk of eroding the environmental integrity of a program? Would we not raise

the possibility of proclaiming a program successful because of its BMPs all the while that those BMPs actually failed to generate the requisite number of nutrient credits?

I contend that this argument is spurious for at least two reasons. First, changing the end goal of trading to the implementation of conservation measures does not alter the fundamental rules of trading programs, one of which is a specific quantity of nutrient credits needed by a PS discharger in order to fulfill a permit requirement. That would remain. There would be no loophole for dischargers to exploit. Second, programs would also retain basic protocols such as trading ratios and insurance pools to make up for the uncertainty inherent to BMP implementation. In short, all that is being switched around are the stated goals of trading. Before, water quality was the end goal and BMPs were the means; now, BMPs are the end goal and water quality trading is the means by which that goal is achieved. The *mechanism* by which the goal is accomplished has not changed; it remains rooted in a TMDL, scientific modeling, outreach to farmers, the use of trading ratios, and strict follow-up monitoring. What changes is our perception of the success of these programs, which may make the difference between a robust market and one stifled by unrealistic economic expectations.

Chapter 3: Methodological Issues and Procedures

3.1. Research Questions

In keeping with the literature on social embeddedness, I will examine the concept in the context of water quality trading using three broad modes of social science inquiry: correlation, causation, and consequences. Each corresponds to a separate research question, and each will take up its own chapter of results and analysis.

The first question will attempt to fill the sociological gap in the existing literature, as described in Chapter 2, by investigating the basic correlation between social embeddedness and trading program outcomes. This question will drive the next chapter:

Research Question #1: What is the role of social embeddedness in explaining differential outcomes of water quality trading programs nationwide?

The trouble that a researcher encounters is that social embeddedness, while intuitive as a topic of conversation, proves abstract and elusive as a topic of scholarly research and more or less demands a qualitative form of investigation. In addition, I encountered a numerical constraint peculiar to the present study: the total set of

functioning water quality trading programs nationwide is twelve. With rigorous statistics thus an impossibility we are left with an investigation that, even if convincing in its narrative analysis, still demands more in-depth treatment. As repeated so often in the social sciences, correlation is not causation – so even if a correlative link can be shown it still begs the question: what exactly is the mechanism by which social embeddedness gives way to certain results? Can we tease out specific causative pathways for *how* embeddedness affects program success? This question will form the basis of Chapter 5:

Research Question #2: What are the major causal mechanisms by which social embeddedness operates to affect market outcomes in the water quality trading sector?

This question will provide a much fuller picture of social embeddedness and its importance in ecosystem service markets than merely determining its absence or presence in a given program. However, it is possible to push even one step further. Recall from the foregoing literature review that embedded relationships are counterposed against *disembedded* relationships – what Uzzi (1996; 1997) refers to as “arms’ length” relationships or what we may more generally think of as economic or market-based relationships. If we are interested in the causal link between social embeddedness and program outcomes, the analysis will benefit further if we also

examine the consequences of embeddedness's foil, marketization. Think back to the conclusions from Chapter 1: regulatory oversight is needed because of the possible market failures associated with a purely market-based approach. The set of existing water quality trading programs follows a continuum from less to more market-based, so a specific examination of those on the latter end of the continuum should provide empirically-grounded insights into the consequences of the market approach to water quality governance. Chapter 6 will seek to answer the following question:

Research Question #3: What are the consequences for the environment and for the market itself of moving towards a more explicitly market-based approach to water quality trading?

3.2. Methodological Approach

The methodology used in any social science study is constrained by the quantity, quality, and general nature of the available data, and my research is a case in point. Before I describe the methodological procedure I used it is necessary to address a number of data limitations that shaped my choice of methods for data generation and analysis. Three qualities of the data in particular limited my methodological options.

3.2.1 Data Limitations

The data for this study come from a review of every PS-NPS water quality trading program in the US and Canada, or a total of fifteen cases (N=15) – three of which are non-functioning programs. While it represents the entire population of trading programs rather than a sample, this number is not large enough to permit sophisticated statistical analysis yet not quite small enough to qualify as a “case study” approach, a term typically reserved for studies where $1 \leq N \leq 10$ (Feagin et.al., 1991). This middle ground places the study in a fairly rare niche in sociology occupied by institutional analyses and comparative case studies. Given the relative rarity and the recent provenance of such studies, the discipline lacks the robust toolkit of devices routinely available for analyzing large-N quantitative or small-N case study data.

An interesting tangential note is that, while these constraints may be relatively rare in sociology, in the body of work on water quality trading they are the norm. The whole literature faces the same basic limitation. For example, note the use of the singular case in the titles of typical peer-reviewed articles:

“Designing a Nonpoint Source Selenium Load Trading Program” (Austin, 2001)

▪

“Lessons About Effluent Trading from a Single Trade” (Woodward, 2003)

▪

“Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin” (Feng et.al., 2005)

A second data limitation is the difficulty, or at least arbitrariness, encountered in trying to operationalize the dependent variable. Broadly speaking, and in keeping with the vast majority of works on the subject, I am interested in what accounts for the *success* of water quality trading programs. For reasons outlined in the previous chapter, I have chosen to define “success” as whether or not a program has resulted in the implementation of agricultural BMPs as a direct result of the subsidy from a nutrient trade. Although this definition does have a precedent in the academic literature on nutrient trading, it is still possible to ask whether a more fine-grained definition is possible. The problem becomes that if we wish to define success more specifically, different definitions are directly at odds with one another. For example, to define success in terms of cost efficiencies, such as the ratio of overhead costs to BMP implementation costs, would result in one particular ranking of programs; to define success in terms of number of farmers or number of acres or average number of BMPs per farmer would achieve a different ranking; and to define success in terms of long-term environmental impact would result in yet a third.

Which is more correct? The answer depends on one’s philosophical orientation towards trading itself, a topic I discussed in the previous chapter and which I will broach again in Chapter 5. It is not a question that can be answered with an epistemologically neutral response, so I am choosing to remain with the more generic definition, which, at the very least, few could argue against as an indication of a positive program outcome. From this point forward I will refer to program success and “BMP

implementation” interchangeably. As I hope to demonstrate in the next chapter, using this broad definition of the dependent variable need not hinder a deep and substantive understanding of water quality trading from a sociological point of view.

3.2.2 *Tools to Deal With Data Limitations*

In the broadest terms, the antidote to such methodological constraints is in-depth narrative analysis and reporting: to use the available data precisely, judiciously, and neutrally and to look for telling details that lie behind the numbers and categorical tables. Qualitative research based on interviews provides the potential for this kind of analysis because individuals speaking of their own experiences and opinions leave a rich body of data in their responses; the challenge to the qualitative researcher is to use these responses to uncover patterns and relationships rather than merely isolated stories. A number of other scholars have grappled with similar methodological constraints, especially in recent years as “small-N” studies have become more widely accepted within various social science fields (Bennett and Elman, 2006), and they have developed methodological and analytical tools to circumvent some of the pitfalls inherent in working with a limited data set. I will single out three that helped bolster my own data analysis.

3.2.2.1 *Triangulation* Two of the major methodological issues one encounters when dealing with a qualitative dataset are the problems of validity and generalizability. In the absence of rigorous statistical methods that allow one to control

for certain variables or mathematically identify spuriousness or collinearity, how can a researcher feel confident that his results are really reporting what they seem to be reporting and not simply reflecting the opinions of one respondent? How can he be sure that his data are valid? And how can he feel confident that the results can be extrapolated and applied to a broader set of cases than just the one from which the data came?

One tool to help with these problems is triangulation, or the utilization of multiple viewpoints to provide a more accurate or complete picture of a phenomenon. Triangulation most often refers to the use of multiple methods – typically a combination of quantitative and qualitative approaches (Jick, 1979) – though Denzin (1978) identifies three additional types: data triangulation, investigator triangulation, and theory triangulation. The most common argument for triangulation is that it reduces the probability of drawing an erroneous conclusion, because the use of multiple methods “reduces the risk of systematic distortions inherent in the use of only one method” (Maxwell, 1998: 93). It seems an intuitive procedure, though it is not without its critics, who claim that it can have the tendency to magnify rather than reduce error and bias (see Kelle, 2001). Kelle (2001) helps bridge the proponents and critics of triangulation by pointing out that there are at least two, noncomplementary means to which triangulation may be put: *validating* one’s research results by having them ring true across multiple methods (e.g., Campbell and Fiske, 1959), or *deepening* one’s results by adding greater scope and richness to the concept under study (e.g., Flick, 1998).

I use both data triangulation and respondent triangulation. In regards to the former, data for the study are derived from three source categories: the primary source of information was interviews with program participants, as I will describe in detail below; two additional sources include document analysis of the substantial body of technical reports and trading rules that has built up for most trading programs, and a limited amount of participant observation at a subset of trading programs – also described below.

More important than the mixed methods approach, I use triangulation in the sense of investigating multiple points of view on the same phenomenon. For each trading program, I attempted to interview individuals from at least two different role categories: program coordinators, intermediaries, and in some cases regulatory agents as well. True to the potential of triangulation, I discovered that an individual serving in one role (e.g., a regulatory agent) had not only a different point of view on water quality trading, but different pieces of data to transmit than a person serving in a different capacity (e.g., a program administrator). In particular, the local intermediaries serving as liaisons between administrators and farmers had a set of observations quite unique, not to mention under-reported in the scholarly literature. My interview experience confirmed Decrop's observation that "information coming from different angles can be used to corroborate, elaborate, or illuminate the research problem" (1999: 158).

3.2.2.2 *Comparative case study approach* One of the most renowned small-N research strategies was popularized by Charles Ragin in the 1980s beginning with his

book *The Comparative Method* (Ragin, 1987). As the name implies, Ragin's approach was primarily meant for comparative social scientists, a term which traditionally has meant sociologists and political scientists interested in change and differentiation among large-scale social units, e.g. transitions to capitalism or peasant uprisings within nation states. It provided a way to maneuver around the statistical limitations imposed by having only a handful of cases, as would often be the case for researchers studying whole nations. This is accomplished by converting all variables, independent and dependent, into dichotomous binomial form, constructing a "truth table" that places the variables in columns and all possible permutations of the different variable combinations in rows, and using simple Boolean algebra to find those variables or combinations of variables that most frequently account for a given outcome in the dependent variable. Thus Ragin finds a way to mimic Mill's Method of Agreement and Indirect Method of Difference without relying on sophisticated statistics such as multiple regression (Ragin, 1987: 36-42).

Ragin's approach is by no means a perfect fit with the present study, as my research does not investigate the "macrosocial units" or "significant historical outcomes" that are Ragin's intended target (1987: 5; 11). However, there are a number of distinct methodological tools contained within the comparative strategy that still prove helpful to a researcher investigating a limited number of cases, regardless of scale. First, the use of binary data categories matches my own data set, as a number of my independent variables already exist in yes/no categorical form, and the ones that are in

interval form are easily converted. In particular, for the purposes of this study the dependent variable is most appropriately represented as the presence or absence of implemented BMPs. Second, the construction of a “truth table” inspired the form of quasi-quantitative analysis that appears in the next chapter, in which each trading program is listed in a row with the independent and dependent variables arrayed in columns. The result is both visually intuitive and logically precise. Finally, when one combines binary variables with the truth table the result is an effective way to evaluate the relative contribution of each independent variable, as well as the various combinations of variables, to the dependent outcome. The setup of the table allows a simple count of the presence or absence of the various independent variables and a visual representation of the correlation between these variables and BMP implementation.

3.2.2.3 *Disaggregation* For all its strengths, Ragin’s comparative case study approach actually magnifies one of the problems with data such as mine by simplifying all phenomena of interest into dichotomous categorical variables. To take my own study as an example, how can we arrive at a substantive and helpful understanding of social embeddedness as it manifests in water quality trading markets if all we are looking at is its presence or absence? How do we study such a phenomenon at a greater level of detail than that afforded by conventional evaluations of covariance?

Steinberg (2007) offers a helpful suggestion with what he calls disaggregation. As the name implies, disaggregation refers to breaking dependent variables down into

their component parts and studying them at a greater level of specificity, which might mean looking at the different *attributes* which comprise a concept such as embeddedness, or looking at the ways that different independent variables affect those attributes. In particular, Steinberg recommends this strategy for dealing with situations in which “the description of the outcome [is] in dichotomous terms” (2007: 194).

In the present study disaggregation will not be a general strategy used throughout, but a targeted strategy used to tackle research question #2. If we wish to know not only what are the effects of social embeddedness on water quality trading but what are the *mechanisms* by which embeddedness operates, we need a fine-grained unpacking of the actual concept. We need to “dissect not the outcome itself but the mechanisms through which antecedents influence that outcome” (Steinberg, 2007: 194). Using previous research on embeddedness as a guide, in Chapter 5 I will break the phenomenon of embeddedness within water quality trading programs into three primary constituent parts in order to shed light onto the way it operates and the reasons for its importance.

3.2.3 *Data Gathering and Analysis*

The procedure followed to acquire and analyze data was straightforward. Using internet and published sources, I began by compiling a list of all water quality trading programs nationwide. The most comprehensive published resource listing programs was researched over five years ago (Breetz et.al., 2004), so I relied on the internet as well

as emails and phone calls to primary contacts affiliated with certain programs in order to classify which programs are still functioning. The set of water quality trading programs nationwide is finite and small to begin with. When we limit it to those programs where trading is exclusively PS-NPS *and* where the NPS participants are farmers it is reduced even further.

Figure 3.1 displays all water quality trading programs nationwide (including one in Canada) that are either currently functioning, functioned at one time in the past, or are still in the development phase, and table 3.1 lists the programs as well as whether they are PS-PS, PS-NPS, or a combination of the two.

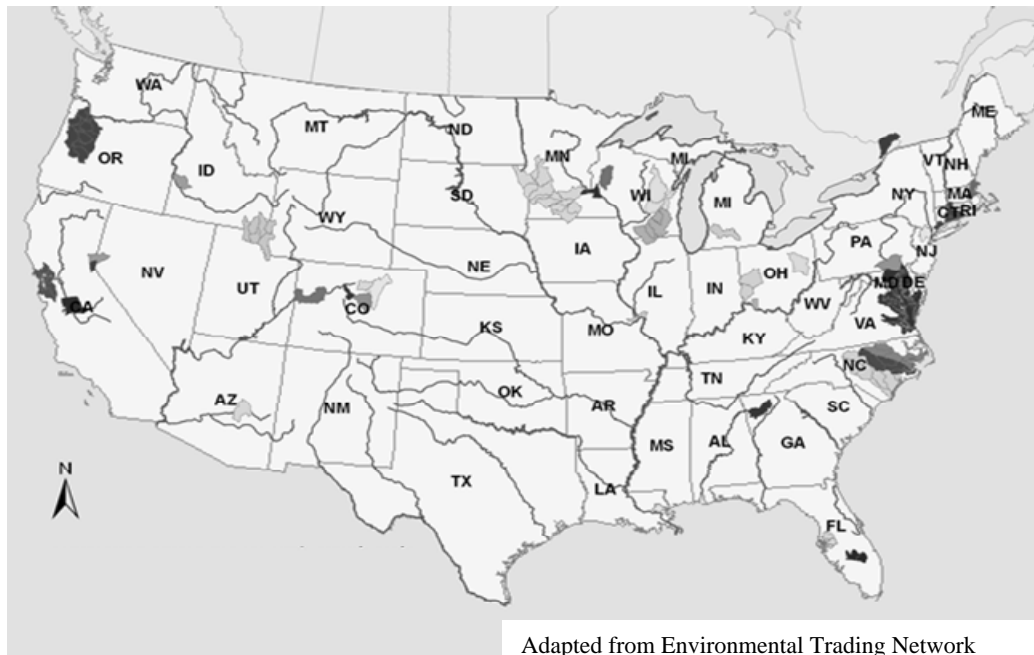


Figure 3.1: Water Quality Trading Programs Nationwide (Proposed, Past Functioning, and Presently Functioning)

Table 3.1. Functioning Water Quality Trading Programs in North America

State	Trading Program	Watershed/Basin	Trading Agents
AZ	Carlota Copper	Pinto Creek	PS-NPS
CA	Grassland Area Farmers Tradable Loads Program	Lower San Joaquin River Watershed	PS-PS
CO	Bear Creek	Bear Creek Watershed	PS-PS
CO	Chatfield Reservoir	Chatfield Reservoir	PS-NPS
CO	Cherry Creek	Cherry Creek Watershed	PS-NPS
CO	Lake Dillon Reservoir	Lake Dillon Reservoir	PS-NPS
CT	Connecticut Nitrogen Credit Exchange Program	Long Island Sound Watershed	PS-PS
DE	Pinnacle (Vlasic Foods)	Delaware Inland Bays	PS-NPS
GA	City of Newnan	Middle Chattahoochee Watershed	PS-PS
GA	Cobb County	Upper Chattahoochee Watershed	PS-PS
ID	Lower Boise	Lower Boise River Watershed	PS-NPS
IL	Piasa Creek	Piasa Creek Watershed	PS-NPS
MA	Charles River Watershed	Charles River Watershed	PS-PS
MA	Wayland Business Center	Sudbury River Watershed	PS-NPS
MI	Kalamazoo River Watershed	Kalamazoo River Watershed	PS-NPS
MN	Minnesota River	Lower Minnesota River Watershed	PS-PS
MN	Rahr Malting Co	Lower Minnesota River Watershed	PS-NPS
MN	Southern Minnesota Beet Sugar Cooperative	Lower Minnesota River Watershed	PS-NPS
NC	Neuse River Compliance Association	Neuse River Basin	PS-PS
NC	Tar-Pamlico Basin Association	Tar-Pamlico River Basin	PS-PS
NM	Taos Ski Valley	Rio Grande River Basin	PS-NPS
NY	NYC Phosphorous Offset Program	Croton Watershed	PS-NPS
OH	Alpine Cheese	Sugar Creek Watershed	PS-NPS
OH	Great Miami River Watershed Trading Pilot	Great Miami River Watershed	PS-NPS
ON	South Nation Phosphorus Trading Program	South Nation River Watershed	PS-NPS
OR	Clean Water Services	Tualatin River Basin	PS-NPS
PA	Conestoga Watershed	Conestoga Watershed	PS-NPS
PA	Chesapeake Bay Trading Program	Chesapeake Bay (in PA)	PS-NPS
WI	Red Cedar River (Cumberland)	Red Cedar River Watershed	PS-NPS

Once I had compiled the full list, I narrowed it down to those programs fulfilling both of two criteria: they had to engage in PS-NPS trading (they could also engage in PS-PS trading, though most do not), and the NPS portion of their trading had to involve agricultural BMPs. In every program but one (Rahr Malting), in fact, the NPS portion consisted exclusively of agricultural BMPs. The final list contains fifteen programs, as displayed in table 3.2. Note that not all of these programs are currently trading: One in Idaho is still in the development stage (and from anecdotal reports the Lower Boise program appears to be locked there because of ongoing conflicts between stakeholders as well as the failure of binding discharge caps to be handed down by the USEPA); two in Wisconsin were proposed but stalled during the process of program development and were never implemented; and in three programs all the trades involving

Table 3.2. PS-NPS Programs Involving Farmers

State	Trading Program	Year Established	Current Status
ID	Lower Boise	1997	In development
IL	Piasa Creek	2001	Ongoing
MI	Kalamazoo River	1996	Ongoing
MN	Rahr Malting	1997	All trades have occurred
MN	SMBSC	1999	Ongoing
NC	Tar-Pamlico	1990	All trades have occurred
OH	Alpine Cheese	2005	Ongoing
OH	Great Miami	2004	Ongoing
ON	South Nation	2000	Ongoing
OR	Clean Water Services	2004	Ongoing
PA	Conestoga River	2005	All trades have occurred
PA	Chesapeake Bay	2008	Ongoing
WI	Fox River	2000	Never past development stage
WI	Red Cedar	1998	Ongoing
WI	Rock River	1997	Never past development stage

agricultural BMPs have occurred and the programs are now simply tracking the credits annually without adding any new ones. In sum, the table lists fifteen programs; if we limit ourselves to currently functioning programs, the total in North America is twelve.

Using written and internet sources, I identified the major contacts for each program. My intent was to interview at least three individuals from each program, including the primary program coordinator and at least one program intermediary. For a number of programs I also interviewed an individual at the state regulatory agency who was principally involved in either the creation or the oversight of the program, though this proved to be a data source of limited utility. I had originally sought out regulators on the assumption that they would have particular insights into trading; however, as social embeddedness took center stage and the regulatory/administrative aspect receded in importance interviews with these individuals began to yield declining returns. In a number of cases I also interviewed the point source discharger itself, but this was only in instances where the discharger, as credit buyer, was also involved in the administration of the program (e.g., Clean Water Services; SMBSC; Rahr Malting). Finally, in cases where the trading watershed crossed county boundaries and multiple county conservation agencies were involved as co-intermediaries, I attempted to interview an agent from each county.¹

¹ I should note that the idealized pattern of interviewing one coordinator, one intermediary, and one regulatory agent was more the exception than the rule. Every trading program across the country is structured a little bit differently, and these different contexts called for different interviewing strategies. For example, in the case of multiple programs within the same state (e.g., SMBSC and Rahr Malting, both in Minnesota), a single individual at the state's Pollution Control Agency was the chief government

The interviews just described only apply to the twelve functioning programs. In the case of the two non-functioning programs from Wisconsin (Rock River and Fox River), the development stage happened so long ago that there are no longer relevant interviews to conduct; for information about these two programs I relied on internet sources and written documentation, which actually end up playing an important role in the analysis itself. The non-functioning program from Idaho (Lower Boise) still holds the possibility of turning into a functioning program and has featured more recent development activity. I interviewed a regulatory agent intimate with the entire 10 year history of the program's development, but there were no further coordinators or intermediaries to interview because the program has not created any. Again published documentation aided the small amount of analysis I conducted on this program.

In addition to the interviews described above there were two other sources of primary data generation. First, I conducted informal interviews with a number of individuals connected to water quality trading though not affiliated with any one program. These included USEPA administrators closely connected to the development of water quality trading rules, as well as individuals associated with various initiatives

official involved with both programs. I did not interview him twice (once for each program), but rather tried to frame my questions so they could be answered for each program respectively within the same interview. As a second example, the Pennsylvania Chesapeake Bay program does not feature a program coordinator per se. It could be argued that the credit broker (a private-sector brokerage firm) is simultaneously the coordinator, in the sense that they helped put the administrative pieces of the program into place and then proceeded to go into the field and procure credits from farmers. In this case, I interviewed two regulatory agents and the broker, but no one else who could be called a coordinator. To give a third example, in the case of the Clean Water Services program in Oregon, there is also not an independent coordinator – the role is filled by a dedicated staff member at the PS discharger, a regional water utility. I interviewed several individuals who work for this discharger, each of whom is closely involved with the program.

that could potentially be considered for water quality trading but currently are not. Second, I conducted five site visits to five different programs – four included in the study and a fifth where trading was proposed but never went beyond the proposal stage. The four functioning programs which I visited were chosen to represent particular points along a continuum from least marketized to most marketized. Respectively, they were: South Nation (Ontario); Alpine Cheese (Ohio); Great Miami (Ohio); and Chesapeake Bay (Pennsylvania).

The intent of both the supplemental interviews and the site visits was not so much to gather hard data for direct analysis, but to provide contextual knowledge of the on-the-ground operation of actual trading programs and some of the policy and administrative decisions that take place in the background as programs are created. They helped flesh out my understanding both of water quality trading in general and the particular details of how different programs operate. Such direct observation lends a great deal of insight and allows the researcher to speak with more confidence about a topic that would otherwise only be known through written words and faceless telephone interviews.

Between all sources I conducted a total of 48 interviews and five site visits, beginning in October 2008 and culminating in April 2009. The final number of cases (15) is not a statistical sample but represents the entire population of trading programs. The enumeration of interviews by program is given in table 3.3. A list of the questions asked during all recorded interviews is provided in Appendix B.

Table 3.3: Number of Interviews by Program and Role Category

State	Trading Program	# interviews conducted			Program Totals
		Regulator	Coordinator	Intermediary	
ID	Lower Boise	1	0	0	1
IL	Piasa Creek	0	1	2	3
MI	Kalamazoo River	0	1	3	4
MN	Rahr Malting	1	1	0	2
MN	SMBSC	1	1	1	3
NC	Tar-Pamlico	0	2	0	2
OH	Alpine Cheese	1	1	3	5
OH	Great Miami	0	1	9	10
ON	South Nation	0	2	1	3
OR	Clean Water Services	0	2	1	3
PA	Conestoga River	0	1	1	2
PA	Chesapeake Bay	2	0	1	3
WI	Fox River	0	0	0	0
WI	Red Cedar	1	2	1	4
WI	Rock River	0	0	0	0
--	<i>Other Individuals</i>	N/A	N/A	N/A	3
Interview Totals		7	15	23	48

With the respondents' permission, all telephone interviews were recorded directly onto a computer using audio recording software. Audio files were converted to MP3 format for ease of transfer and playback. All interviews were then transcribed in March and April 2009. In place of standard qualitative data analysis software such as NVivo, I constructed my own database using spreadsheet software which served the same function: I tracked "nodes," patterns, data categories, and emergent themes by directly transcribing interviewees' responses into various columns. Cross-referencing was handled through the use of color schemes. Missing data were also noted, and where it was crucial to the analysis I returned to the relevant interviewee via email or

telephone to request a missing piece of information.

3.2.4 Operationalization of Variables

The quantitative portion of the data analysis stems directly from the literature review of Chapter 2. It uses as its set of independent variables the main institutional factors deemed critical for the success of water quality trading programs as posited in the economics literature, as well as an additional variable of social embeddedness as posited in the sociological literature. In keeping with Ragin's (1987) approach, each independent variable is operationalized as a binomial, bivariate (yes/no) item. I will briefly discuss the logic behind operationalization:

- Regulatory driver: The simplest and most straightforward of the independent variables. Does a regulatory driver exist to drive demand for credits? This could be a TMDL, individual NPDES permit, or other binding regulation but it must be an extant driver, not an anticipated one.
- Freedom of market action: Does the PS discharger (the credit buyer) have the legal right to enter into and exit from the trading program at will? A negative answer indicates that once they have signed onto the trading program they are obligated by law to purchase a given quantity of credits each year for the duration of the program contract, regardless of how much nutrient remediation they are accomplishing on-site.

- Cost efficiency: I operationalize the variable by calculating the following for each program: 'Total program expenditures to date' divided by 'Total nutrient credits generated to date' divided by 'Number of years in operation.' I then insert a cutoff line at the halfway mark and divide all programs into a "high cost" or a "low cost" category. Exact calculations are not possible for all programs because in some cases information about total costs are either unavailable or withheld for proprietary reasons. In such cases an annual average can be derived from available information. I use the combination of two ratios in order to avoid bias against either newer programs (who will have recently spent funds on program development without seeing a large number of credits generated yet) or older programs (who may be generating fewer credits as the program winds down). The calculation is designed to give a rough "annual average" of money spent per credit generated, and it is meant to incorporate *all* expenditures (i.e., including overhead and administrative costs). It is an admittedly crude measure that could be refined with more privileged access to program data, but it does allow for programs to be compared to one another using an internal metric rather than needing an external reference of what might constitute "efficiency."
- Minimal government interference: Measuring the degree of government oversight is problematic. All programs face a high degree of oversight, as discussed at length in Chapter 1. In a sense, every program fails the test of minimal government interference because the need for all programs to meet rigorous state guidelines is ubiquitous. However, I contend that this particular economic principle finds its proxy in the form

of price: is the price of a good or service manipulated by administrative personnel or is it determined by market forces? In the present case this is operationalized simply as the answer to this question: does the price of a credit fluctuate over time? A negative answer implies that the price is artificially pegged by program administrators.

- Minimization of uncertainty: Since there are a number of tools used to accomplish this goal, I have broken it into two separate columns, each representing a separate independent variable. The first involves the trading ratio: Is the ratio less than or equal to 2:1 (2 pounds of nutrient to be remediated by NPS seller for every 1 pound claimed by PS buyer)? The second involves verification of BMPs after implementation: is follow-up monitoring/verification voluntary according to program rules? In both cases, a negative answer indicates elevated program oversight for the purpose of risk management, presumably leading to greater market interference, while a positive answer indicates a more laissez-faire approach in which program authentication is left more to market self-regulation.
- Social embeddedness: Using Uzzi (1996; 1997) as a guide we can narrow in on one particular element of embeddedness that is a close proxy for the concept itself as well as being amenable to measurement. I define a program as socially embedded when it uses as its chief intermediary (the credit broker or liaison between program administration and farmers) a group or agency that is directly involved in agricultural conservation *and* that claims pre-existing ties to the local farming community. This could be a public agency, such as a county-based Soil and Water Conservation District,

or a private-sector broker such as a local agricultural consulting firm. The key is that they are not entering the community for the first time as part of the trading program, but have pre-existing ties to the farmers.

- Finally, recall from previous discussion that the dependent variable is operationalized broadly as a program having achieved some level of BMP implementation on farms as a direct result of trading activity.

3.3. The Path Ahead

In the entire literature on water quality trading, there is only a single peer-reviewed scholarly article that explicitly broaches the issue of social embeddedness in relation to farmer participation in trading schemes (Breetz et.al., 2005), as well as two additional reports that bring up the concept indirectly but do not name it as such (Perrot-Maitre, 2006; IEI, 2008). However, none of the three documents goes far enough in its exploration of embeddedness. The IEI report, commissioned by the USEPA, essentially just mentions the fact that relations with farmers are important. The assertion is based on interviews with program participants, but the report does no actual evaluation or analysis of existing programs or outcomes (in the sense of causal and dependent variables). Perrot-Maitre (2006) makes a forceful case for the importance of social relations between programs and farmers, but he confines himself entirely to the case study of a single program in France and does not generalize his findings, nor couch them in the embeddedness framework per se. Finally, Breetz et.al.

(2005) offer a sociological analysis of program outcomes across the entire water quality trading sector that explicitly uses social embeddedness as a framing device. However, the data were collected a half decade ago in a sector that has experienced significant change since then; the authors concentrate exclusively on the act of communication as their independent variable, leaving out a more in-depth exploration of the role that trust plays; and they speak of communication in the abstract and do not mention the importance of specific communicators such as local agricultural agencies.

These gaps in the empirical literature indicate the need to both widen and deepen the sociological analysis of water quality trading. In the chapters that follow I will attempt to update and improve on the existing evaluative literature, notably the sociological investigation by Breetz et.al. (2005), in a number of distinct ways. (1) I will more carefully describe how social embeddedness manifests in the form of local conservation agents serving as program intermediaries, and the connections between this embeddedness and program outcomes. (2) I will parse the meaning of embeddedness and the mechanisms by which it operates in water quality trading programs. (3) I will look more closely at the potentially negative consequences of switching to a more market-based approach to water pollution governance – a perspective almost universally ignored in the empirical literature, dominated as it is by the market-friendly field of environmental economics.

Chapter 4: Differential Success Rates Among Water Quality Trading Programs: Market Factors and Social Embeddedness

Introduction

The existing literature on water quality trading is premised on the idea that once the basic institutional and financial parameters are in place to generate demand for nutrient credits, the production of those credits will follow in short order by farmers eager to get paid to install conservation measures. However, price incentives alone have historically been insufficient to spur widespread conservation adoption, for a variety of reasons that seem puzzling from a rational-actor point of view but are understandable given farmers' symbolic value systems and perspectives on risk and reward. The economic position consistently overlooks the role that social proximity and trust play in relations between market actors, including farmers.

Even if a trading program successfully navigates the initial institutional hurdles and gets a workable set of rules in place, it must then deal with the challenge of soliciting farmer participation. Program administrators are unlikely to have pre-existing trust relations with the farming community, so a critical question becomes who will take on the task of intermediary – reaching out to farmers, disseminating information about the program, and helping to take conservation practices from idea to implementation on

individual farms. Does it matter who this intermediary is? Does it matter whether they have socially embedded ties with the farming community? Does the social embeddedness of this actor play a role in the success of trading programs?

4.1. The Role of Economic, Institutional, and Social Variables in the Success of Trading Programs

If we assume that chance alone accounts for program success or failure, then the probability of achieving twelve successes out of fifteen attempted programs can be calculated using the binomial probability function:

$$P_{(k \text{ out of } N)} = \frac{N!}{k! (N-k)!} (p^k) (q^{N-k})$$

Where:

N = total number of trials;

k = number of successes;

p = probability that any one trial will result in a success; and

q = probability that any one trial will result in a failure

Substituting, we get:

$$P = \frac{15!}{12! (15-3)!} (0.5^{12}) (0.5^{15-12})$$

$$P = 0.0139$$

There is a 1.4% chance of twelve successes out of fifteen programs occurring by chance alone, so we may safely assume that some specific variables, rather than random chance, account for the distribution of success rates.

Table 4.1 Correlation Between Institutional Economic Variables and Program Success

Trading Program	State	Reg. driver	Market freedom	Low costs	Price compet.	Tr. ratio $\leq 2:1$	Volun. monit.	Totals	Success?
Lower Boise	ID	-	N/A	N/A	N/A	N/A	N/A	0	-
Piasa Creek	IL	+	-	+	-	+	-	2	+
Kalamazoo River	MI	-	N/A [†]	-	-	+	-	1	+
Rahr Malting	MN	+	-	-	-	+	-	3	+
SMBSC	MN	+	-	+	-	-	-	2	+
Tar-Pamlico	NC	+	-	-	-	-	-	1	+
Alpine Cheese	OH	+	-	-	-	+/-*	-	2	+
Great Miami	OH	-	N/A [†]	+	+	+/-**	-	3	+
South Nation	ON	+	-	-	-	-	+	2	+
Clean Water Serv.	OR	+	+	-	-	+	-	3	+
Conestoga River	PA	-	N/A [†]	+	+	+	+	4	+
Chesapeake Bay	PA	+	+	+	+	-***	-	4	+
Fox River	WI	-	N/A	N/A	N/A	N/A	N/A	0	-
Red Cedar	WI	-	+	+	-	+	-	3	+
Rock River	WI	-	N/A	N/A	N/A	N/A	N/A	0	-
Totals		8	3	6	3	8	2		12
Binom. Correl.		0.53	0.25	0.41	0.25	0.53	0.20		

[†] Since these three programs are not driven by binding effluent restrictions, the question of entering and exiting the trading program is moot. All of the purchasing of nutrient credits is done voluntarily.

* The Alpine Cheese program has several trading ratios: most BMPs fall between 2:1 and 8:1. However, milkhouse waste is considered a direct discharge (i.e., a "point source") and trades involving milkhouse waste retention received a trading ratio of 1:1.

** The Great Miami program features multiple trading ratios, depending on whether the discharger is discharging into attaining waters or not, and on whether the relevant BMPs are fully implemented or not. Of the four possible permutations, the only trading ratio greater than 2:1 is for those dischargers discharging into impaired waters and buying credits based on BMPs that are not fully implemented/verified yet.

*** In Chesapeake Bay, the trading ratio is actually a "delivery ratio" that changes according to how far a given BMP is from a major water body. Thus it cannot be said with certainty that it is always greater than 2:1. However, based on my data it is nearly always the case.

We begin the data analysis by returning to the key economic and institutional variables described at length in Chapter 2 and operationalized into independent variables as described in Chapter 3. Table 4.1 presents six independent variables matched with the dependent variable for each of the fifteen water quality trading programs. For the purpose of providing a numerical snapshot of the relationships, the final row lists binomial correlation coefficients between the dependent variable and each respective independent variable. However, these are to be read with a grain of salt, because the fact that there are only fifteen cases makes any statistical calculation of very limited utility.

The standout result from the table is that not a single of these independent variables, which are supposed to play a critical role in the proper functioning of a market-based approach, appears to be *necessary* in order to generate a successful program. Although of limited utility, the binomial correlation coefficients bear this out: so poor is the match between any independent variable and program success that only two have a correlation value above 0.50. In certain circumstances this correlation coefficient would be respectable, but not in the case of variables which are supposedly critical for program success. Note that the two independent variables most closely associated with the market approach – freedom of action within a marketplace and price competition/fluctuation – feature the second-lowest coefficients of correlation.

The presence of a regulatory driver comes closest to being a critical variable. In every case of an outright program failure one of the conspicuous missing elements has

been a binding pollution cap that would force PS dischargers to seek trading as an option. This is all the more true when one takes note of the fact that those cases where a regulatory driver is not present are not actually exceptions to the rule. In each of those cases (Kalamazoo River; Great Miami; Conestoga River), while it is true that a *regulated* cap on emissions does not exist for the watershed, the credit buyers are not actual PS dischargers but administrative bodies who have been awarded grants to implement water quality trading. In other words, the demand for credits in these three cases is artificially created by an entity using grant money to incentivize BMP adoption. The point is that we cannot argue based on the data that a regulatory driver is *not* necessary for a program to succeed – and therefore of all the independent variables listed, it appears to be the only one that can still be argued to be critical.

Table 4.2 replicates the preceding table but adds a new column to accommodate the final independent variable: social embeddedness. In comparison with the previous six independent variables, the link between embeddedness and program success stands out. The correlation coefficient of 0.83 gives some indication, but again this figure is skewed downwards by the small number of cases. A better indication can be had by visually comparing the two rightmost columns.

Table 4.2 Previous Correlations Including Social Embeddedness

Trading Program	State	Reg. driver	Market freedom	Low costs	Price compet.	Tr. ratio ≤2:1	Volun. monit.	Embedd. intermed.	Totals	Success?
Lower Boise	ID	-	N/A	N/A	N/A	N/A	N/A	-	0	-
Piasa Creek	IL	+	-	+	-	+	-	+	2	+
Kalamazoo River	MI	-	N/A	-	-	+	-	+	1	+
Rahr Malting	MN	+	-	-	-	+	-	-	3	+
SMBSC	MN	+	-	+	-	-	-	+	2	+
Tar-Pamlico	NC	+	-	-	-	-	-	+	1	+
Alpine Cheese	OH	+	-	-	-	+/-	-	+	2	+
Great Miami	OH	-	N/A	+	+	+/-	-	+	3	+
South Nation	ON	+	-	-	-	-	+	+	2	+
Clean Water Serv.	OR	+	+	-	-	+	-	+	3	+
Conestoga River	PA	-	N/A	+	+	+	+	+	4	+
Chesapeake Bay	PA	+	+	+	+	-	-	+	4	+
Fox River	WI	-	N/A	N/A	N/A	N/A	N/A	-	0	-
Red Cedar	WI	-	+	+	-	+	-	+	3	+
Rock River	WI	-	N/A	N/A	N/A	N/A	N/A	-	0	-
Totals		8	3	6	3	8	2	11		12
Binom. Correl.		0.53	0.25	0.41	0.25	0.53	0.20	0.83		

In every instance of program failure, there was no embedded intermediary as part of the program structure. That being said, program failures in the case of PS-NPS trading are not a very reliable measure, as typically they fail before the program even gets off the ground. Whether the existence of an embedded intermediary played any role is difficult to gauge; I will discuss this in more depth shortly. The more important point is that in every case of program success except one, there *was* an embedded intermediary interfacing with farmers. And note that in the one exception, the Rahr Malting program in MN, only 1/4 of all implemented practices are agriculturally-related, compared to all the other programs in which nearly 100% of BMPs are agricultural. In terms of program outcomes social embeddedness, defined as the existence of an embedded intermediary, appears to be more important than any of the variables posited

in the literature on water quality trading with the possible exception of a regulatory driver.

* * * * *

The analysis provided by tables 4.1 and 4.2 is helpful for getting an initial grasp of the differential roles played by the respective independent variables, but it does not provide a rich enough or robust enough analysis to allow for reliable conclusions. For one, as already discussed at length, the data are exclusively operationalized as categorical bivariate variables. From the point of view of analytical sophistication such variables present a clumsy, blunt instrument. Second, the number of cases is too low to allow for substantive contrasts to emerge. Third, when you couple the low number of cases with the fact that no two programs are quite alike in their sets of rules, protocols, and stakeholders, there can be no “control” cases to serve as a reference point for confirming or negating the basic hypothesis.

Finally, defining the dependent variable of “success” unilaterally for entire programs turns out to be problematic. Among a handful of programs which span multiple counties and use multiple county-based intermediaries, the success of the program varies from county to county in ways that appear to be nonrandom. What might account for this variability across space? Given that a program has only one set of rules and one administrative core, why would a multi-county program not experience

the same degree of success across its geographic extent? Data gathered from interviews and program spreadsheets allow us to answer these questions, and in fact this phenomenon, rather than being an analytical hindrance as it first appears, actually affords a unique window of opportunity to explore relationships at greater depth.

4.2. Investigating Geographic Disparities of Program Success

A subset of programs within the fifteen being studied present this unique opportunity. First, Wisconsin is a single state with a single set of trading rules that gave rise to three simultaneous initiatives to create trading programs in three different watersheds beginning in the late 1990s; two of them failed and one succeeded. Second, the Kalamazoo River trading program spans three counties in southwestern Michigan: one has experienced the lion's share of trades, a second has had only a handful, and the third has had none at all. Finally, the Great Miami program spans 15 counties in southwestern Ohio and features a pattern similar to Kalamazoo: a widely differing number of trades by county that cannot be attributed solely to geographic, demographic, or agricultural characteristics.

I will examine each of these cases in turn, focusing on the role of embeddedness in explaining the divergent outcomes. In addition to giving us a more detailed version of what program success means, how it manifests, and what factors most strongly influence it, investigating geographic disparities in these programs will help counter the problems mentioned above. For example, using qualitative data and interview extracts

allows us to move beyond binomial variables and see the emergence of richer data. Examining individual programs as case studies makes the low-N problem a moot point. And looking at differential success rates *within* a single program rather than between programs effectively allows us to control for inter-program variation that results from each program having its own unique set of rules and incentives.

4.2.1 The Good, the Bad, and the Ugly: Three Programs From Wisconsin

Wisconsin is the only state that features three distinct trading programs (see figure 4.1), which would be exceptional were it not for the fact that two of the three are also two of the three national failures – Fox River and Rock River (the third failed program is the Lower Boise program in Idaho). In some sense, to call them “failures” is something of a misnomer, as it implies that they set up shop, opened for business, and then failed to achieve any trades. In truth they never even opened for business. Both programs were proposed, developed by task forces and groups of stakeholders, and exhaustively researched in terms of economic and logistical feasibility, and both then failed to materialize.

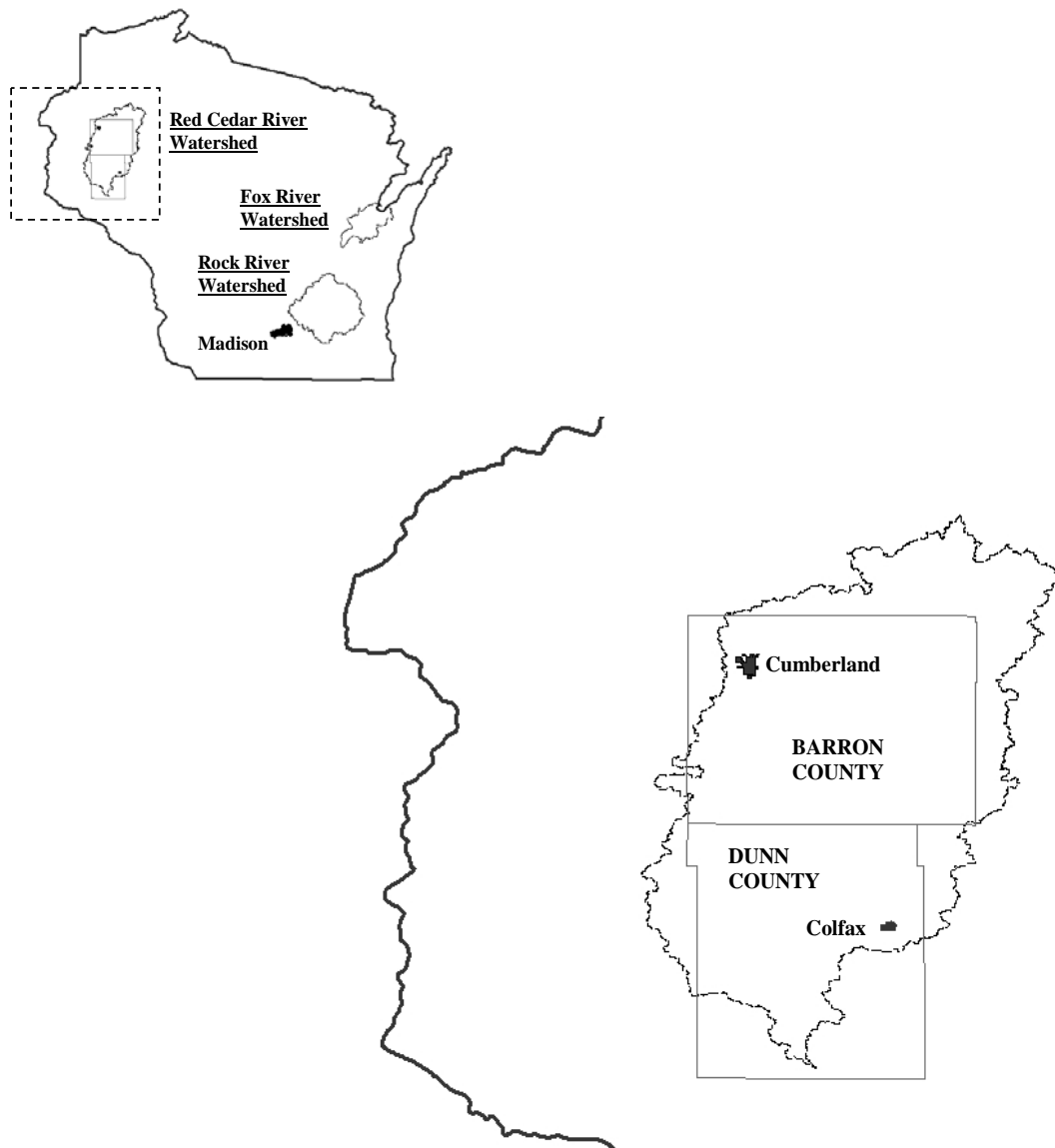


Figure 4.1: Wisconsin and Three Water Quality Trading Initiatives

As for the reason why neither program got off the ground, the literature is succinct: a lack of economic or regulatory incentive to drive demand. In the case of the Fox River program, point sources concluded that it was less expensive to remediate their pollution on-site than to engage in trading, plus dischargers facing “economic hardship”

were granted higher permitted discharge levels than others. Thus “the program has been held up by the lack of regulatory drivers and economic incentives” (Breetz et.al., 2004: 269). The case of the Rock River program was quite similar: authorities reported that existing discharge limitations were not stringent enough to act as a sufficient regulatory driver, while economic analyses carried out by potential PS credit buyers indicated that trading “did not prove to be as cost-effective as anticipated” (Ibid: 282).

This general assessment is surely correct as far as it goes, but it does not tell the whole story. It overlooks another factor: in both cases of failure to generate a trade, there was either a lack of participatory interest on the part of the local agricultural conservation office or a difficulty in identifying farmers to participate. For example, other (less often cited) reports on the Fox River program cite poor communication among stakeholders and resistance from farmers as additional reasons for program failure (Kramer, 2003). Similarly, a Wisconsin Department of Natural Resources report on the Rock River program identified difficulty reaching farmers and identifying a pool of NPS participants sufficient to sustain trading as obstacles in addition to driver issues (WDNR, 2002). These are precisely the kinds of issues that an embedded local intermediary helps overcome through their existing ties to the farm community and their trust relationships with farmers. I will explore this claim in considerable detail in the next chapter, but it can be witnessed here in an official state report, which noted “the difficulty point sources experienced when trying to contact nonpoint sources and identify potential opportunities for trades. *It is evident that a facilitator (or broker) is*

needed" (WDNR, 2002; emphasis added).

A counterargument could be offered: is not the importance of an embedded intermediary still secondary compared to the more primary economic criteria? Must one not have an adequate driver first, and then worry about the intermediary later? This is certainly the implication of the Breetz, et.al. (2004) report, the still-definitive guide on water quality trading programs nationwide. I am not arguing that the social embeddedness of a program is *more* important or a higher priority than the driver. My argument is that they are of equal importance, that both are necessary conditions for trading program success – a point almost entirely unacknowledged in the scholarly literature. And turning to the third program in Wisconsin – its only success – will help illustrate this.

The successful program is the Red Cedar Basin trading program from the western edge of the state (see figure 4.1). What is particularly interesting in the Red Cedar is that within the same watershed, though in two different counties, two small municipalities initially expressed interest in trading. Both conducted feasibility analyses, but the city of Cumberland went on to produce one of the longest-running trading projects in the country while the village of Colfax never managed to get a program up and running. Why was this so?

Again the main reason given in the literature is economic: Cumberland determined that it was cost-effective to implement trading in lieu of on-site remediation of the 4,400 pounds of phosphorus per year that their wastewater treatment plant

needed in order to comply with its discharge permit. Colfax, meanwhile, “determined that water quality trading was not economically feasible” (Breetz et.al., 2004: 275). But as with the two failed programs above, this economic reasoning is inextricably intertwined with a social factor. The city of Cumberland had direct support from its county Land Conservation District (LCD) (Barron County), which took an active role in identifying farmers and setting up and monitoring BMPs on farms. The village of Colfax, meanwhile, did not receive interest or support from its own county LCD (Dunn County). Because the Dunn County LCD was unwilling to shoulder some of the administrative burden, all transaction costs fell on the municipality and made the program too expensive to justify implementation. In the case of Cumberland, Barron County LCD took on the role of intermediary with no additional compensation, making the program’s transaction costs lower and its cost efficiency much higher.

Responses from my telephone interviews bear out this more nuanced story. A regulatory official closely affiliated with the watershed said of the Cumberland program: “I think what makes it successful is Barron County staff does the legwork, does the money. . . . Whereas other counties, the first thing they said was, ‘We need a staff person or a half a person or we need some salary,’ you know, and that’s what hurts [program potential].”

The key conservation agent from the Barron County LCD goes a step further. He not only contrasts the Cumberland program with the two failed programs elsewhere in the state, he also frames his office’s participation in terms of their overall conservation

mission:

I think when the legislature in Wisconsin put some money towards a pilot trading project, there was 3 or 4 locations in Wisconsin that were eligible for the pilot. My counterparts around the state, when they were faced with this thing, said basically 'We can do this, if the municipality [PS] pays us to do it. . . We can do this but there's gonna be an administrative fee.' And that's where it fell apart. Because the municipality that needed to do this looked at the administrative fee and said, 'Boy it's not hardly worth it to do this.' Our approach was that, we're here as a county department, an agency of county government, our task in life is soil and water conservation. We've got this thing set up so it takes a minimum of time – it's not like we're spending thousands of staff hours every year. Why should we charge extra money when we're already here, and our objective is to get conservation on the land? And I think that's one of the big reasons why it has gone well, because we're not expecting payment for our time from the city of Cumberland.

A second regulatory official referenced an even more basic and critical point, which is that the social factor of embedded relationships between intermediary and farmers cannot be simply reduced to the economic criterion of cost-effectiveness. He implies here that one of the obstacles leading to the cost hurdle in Colfax's case was his own agency's rigorous trading standards, but that with the participation of a local intermediary this standard might have been made more flexible in order to make the program work.

[One] of the barriers there was the unwillingness for the county to play the same role that Barron County played. And then also there was some concerns about the way that the crediting was going on at the time, with the Cumberland proposal – there was an inability to come up with a better number that we felt more comfortable with from an agency [perspective]. . . . But I think one of the big factors was the lack of having that partner from the county, 'cause I think if the county had been more accepting, [my] department would have just come up with a number for them to use.

On a final note, it is necessary to point out that Barron County LCD's strategy of not being reimbursed is not necessarily an optimal way to run a program, nor is the simple matter of not being paid any kind of guarantor of the successful participation of an embedded actor. Indeed, several agents affiliated with trading programs elsewhere in the country expressed disbelief at this (non)payment structure. But in this particular case, the decision by the most relevant local, embedded intermediary to participate was the key not only to overcoming efficiency hurdles but to subsequently overcoming the barrier that stymied further development of the Fox River and Rock River programs: reaching out to the farm community and securing a supply of credits. The cost-effectiveness argument is inarguably true in and of itself, but it is not *sufficient* to explain the difference in success between the two municipalities. The mere participation or lack thereof by the county agency results not only in a reduction in transaction costs, but in an enhancement of a program's relational capabilities thanks to a trusted and socially embedded third-party facilitator.

4.2.2 A Tale of Three Counties: Differential Success Rates in the Kalamazoo River Program

The Kalamazoo River watershed crosses into parts of ten different counties in southwest Michigan, though only through substantial portions of three of them (see figure 4.2). A nutrient trading program developed for the entire watershed was designed to interface with farmers and, by extension, the Soil and Water Conservation Districts in these three counties – Allegan, Kalamazoo, and Calhoun. In the end, the

lion's share of trading has taken place in Allegan County, a much smaller number of BMPs have been implemented in Calhoun County, and there have been no trades at all with farmers in Kalamazoo County (see figure 4.2).

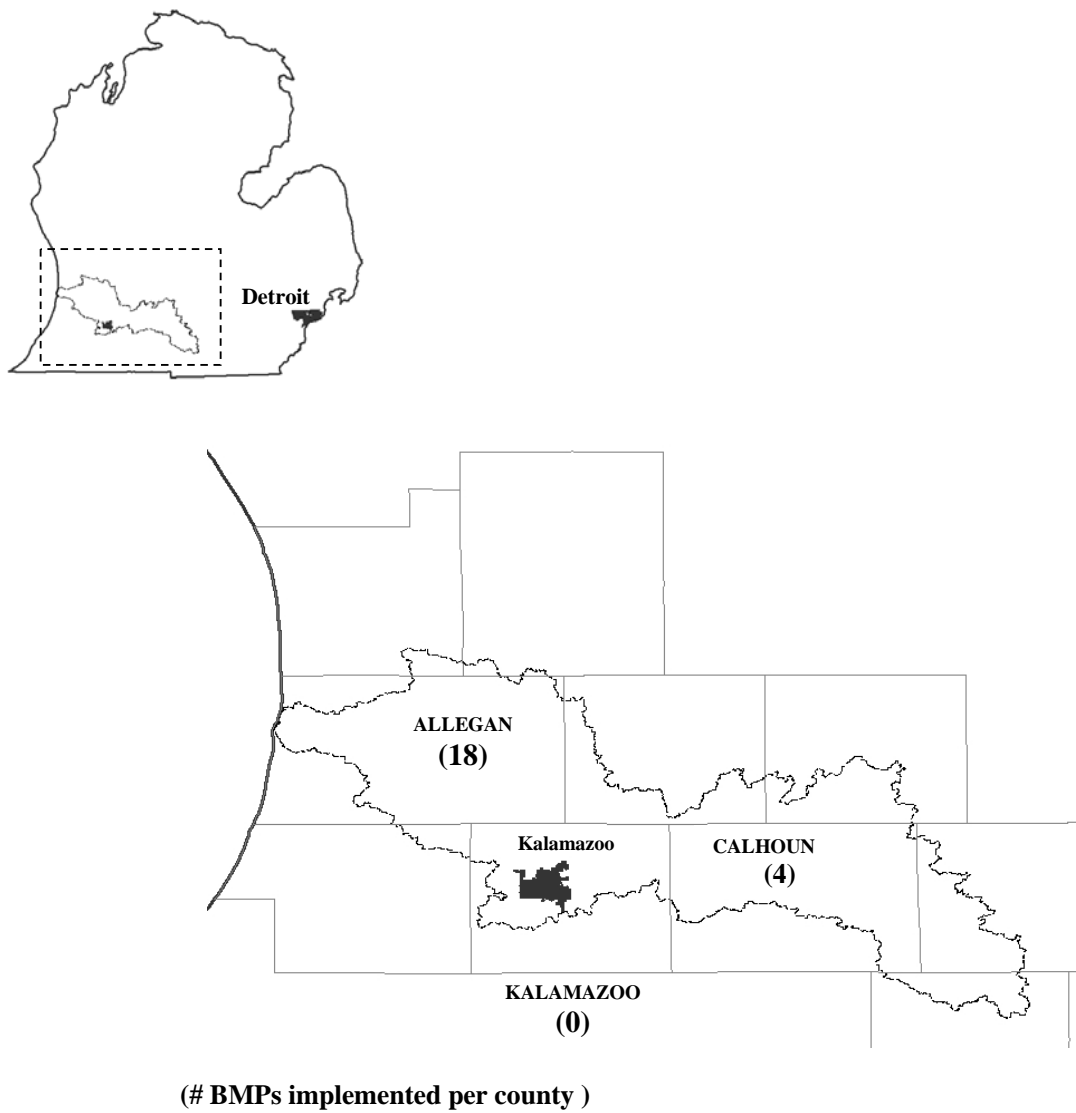


Figure 4.2: Kalamazoo River Watershed and Relevant Counties

Why this disparity in trading volume by county? It cannot be attributed to different agricultural context by county, as table 4.3 indicates. Indeed, Allegan County has fewer farms, smaller farms, and less than half the amount of land already in conservation than Calhoun County. The zero-order correlation figures would seem to indicate a strong relationship between number of farms or amount of farmland or head of cattle and the number of BMPs implemented, but this is largely a product of the small number of cases (N=3). I have included them mainly to be consistent with table 4.4 from the Great Miami program.

Table 4.3: County Agricultural Statistics for Kalamazoo River Watershed

County	# BMPs	% county in watershed	Acres farmland	% county that is farmland	# Farms	Avg farm size (ac)	Acres CRP	% CRP	Acres corn or soy	Head cattle
Allegan	18	25-50%	275,120	52.0%	1,595	172	3,303	1.2%	155,554	44,971
Calhoun	4	50-75%	227,944	45.6%	1,178	194	7,188	3.2%	132,087	14,819
Kalamazoo	0	50-75%	144,873	39.9%	854	170	1,465	1.0%	89,742	10,560
Zero-order correlation with # BMPs	--	-0.98	0.89	0.96	0.97	-0.23	0.01	-0.23	0.89	1.00

Neither can the differences between the three counties be attributed to their respective geographic areas that lie in the watershed – in fact, as the map shows, Kalamazoo County has more of its landmass inside the watershed than either of the other two. The answer also will not be found in some institutional aspect of the program, because by definition all program aspects (trading rules, trading ratio, price incentives for farmers, etc.) are the same across all the counties. The answer, then, must

lie in the one area that can and does differ across counties, the same as it did in the Red Cedar program in Wisconsin: the degree of participation by the local SWCD intermediaries.

Let us begin with the two counties that had some success getting BMPs installed on farms: Calhoun (less successful) and Allegan (more successful). Each county's involvement in the trading program was coordinated by a single agent at the respective SWCD office. From the beginning a connection seems to exist between the time spent on the trading program and the number of BMPs implemented. The agent from Allegan County has been involved with the trading program for over two years, while the agent from Calhoun County was only brought onto the project during summer 2008. The results seem to speak for themselves.

It may seem self-evident that the longer an agent is promoting a program, the more farmers will sign on, but recall that the program itself existed the entire time. That is, farmers in both counties were eligible to sign up to sell credits from the moment the program began. In economic parlance, the "price signal" was present throughout. But without an embedded intermediary, that price signal goes unnoticed or unheeded. As the Calhoun agent said in reference to the period prior to his arrival:

Early on in the project, they kind of put [the program] out to all the conservation districts, but there wasn't any reason for [taking it on] – I mean, if you came across someone who had heard about the project, you may guide them in that direction, get them to talk to someone, but there wasn't anyone out here that, that was their job to go out and specifically target the farmers on a one-on-one basis, like I have.

All of their implemented BMPs have occurred since he was brought on board specifically for the purpose of promoting the trading program. As he summed up of the time before he came: “I think there was a bigger potential there had we actually had technicians out on the ground that their job was to drive this project at the local level.”

These observations are buttressed by the trading program coordinator for the entire watershed, who has viewed the development of the program across all the counties. Two of her observations stand out. First, she relates that among all the eligible counties in the watershed, the one that jumped out ahead of the pack (Allegan) was the one that had received a prior USEPA grant for implementing BMPs for improved water quality on farms. Why would this have made a difference? Because of the enhanced relations it established between the county’s primary conservation agent and the farming community: “We found out that we had the most success with the conservation district that had a 319 grant that had similar goals. So that 319 coordinator was already out in the field, already knew a lot of people.” Adding to this is her second observation, in which she contrasts these efforts in Allegan County with those of other counties in the watershed. “In [other counties] we had similar advertisements but didn’t have that person on the ground going to the farm. . . . what was most helpful was when he was actually at the farm.”

Turning away from the success cases, based on the linkage just spelled out between agent participation and BMPs implemented one might reason that the Kalamazoo County SWCD must have spent *no* time promoting the trading program –

and this intuition is basically correct. It is not clear why different counties were not able to fund their agents at the same level as one another, but the Kalamazoo County SWCD administrator states that her office did not have the money to pay someone specifically to work on outreach for nutrient trading. They initiated various media advertisements, but without a dedicated individual to follow through via person-to-person contact the advertisements yielded little interest and zero BMPs implemented. Here is her explanation of the difference between counties:

I would say our [problem] was a budget situation with the lack of personnel. I don't have a 319 person on hand. I mean, he [the aforementioned agent from Allegan County] could spend a certain amount of time working on [trading] projects. And he's been there a long time, he's very knowledgeable, and had the time to do much more outreach than me sending brochures.

I asked if it was the case that her office had received less funding for personnel than the neighboring county's office. Note in particular in her response the number of times that she contrasts the one-on-one nature of the interactions the successful neighboring SWCD had with their farmers versus the relatively impersonal communications her office initiated:

No, no, I think any of us could have had funding. It was just that they had a 319 [project.] I'm a little envious, I wish I'd have had a [agent's name] in my office, instead of using existing programs to do the outreach, or someone comes to the counter and you tell 'em about it. We could have sent them out in the field with NRCS or had them do an 'inventory and evaluation,' more than looking at a map and knowing producers' names. . . . I think the one-on-one [would have been more effective], rather than a brochure or an article in the paper about it. . . .

We approached producers who came in, but I didn't make a lot of follow-up calls or do a survey myself driving around the [watershed]. So for us, I would say, not having someone dedicated to finding those producers [was critical].

The story of Kalamazoo County, especially when compared to the other counties in the same trading program, is emblematic of the chapter's basic thesis: Because (1) there was an unfamiliarity with the program to begin with, combined with (2) a certain background level of caution on the part of the farmers, who (3) the intermediary did not have the means to offer more face-to-face interactions with, and (4) advertisements through traditional media channels did not work – the program never got a toehold. It was not the program rules, for they were the same across counties. It was not for lack of an adequate demand driver, for there existed a pot of grant money earmarked specifically for agricultural BMPs. If there is any institutional variable that can be blamed it may be an unclear or confusing protocol for how individual SWCD offices were to access and spend the administrative funds available through the program. But the bottom line is that the county that spent these funds to pay an agent to work specifically on the program for the longest period of time conducting one-on-one outreach with farmers experienced the most success, while the counties that did not have such an individual dedicated to the outreach process experienced less or none.

By going beyond the statistics and examining a single trading program in more detail, an important point is revealed: the mere existence of a locally embedded and trusted intermediary is not sufficient to guarantee farmer participation. The

intermediary's role must extend beyond simply disseminating information about the program through media channels to the use of trust relations with individual farmers, building program credibility one farm at a time.

4.2.3 Scaling Up: Differential Success Rates in the Great Miami Program

The story of the other multi-county initiative, the Great Miami program from southwest Ohio, is quite similar to that of the Kalamazoo River program. Like Kalamazoo, Great Miami got its start not from a binding regulatory cap on point source dischargers but from a federal grant designed to stimulate nutrient trading. Also like Kalamazoo, the Great Miami River watershed crosses multiple county lines (fifteen in all) and the trading program is administered on a county-by-county basis by SWCD offices (see figure 4.3). One important difference is the determination of the price of phosphorus credits. Kalamazoo operates on the federal model in which all BMPs are subsidized at 75% of cost according to standard NRCS estimations, while Great Miami is one of only two programs nationwide that uses a reverse auction bidding system, in which farmers place bids with their county SWCD offices and the most cost-effective bids win (lowest price per pound of phosphorus). The most important similarity, however, may be the disparities across space of program success rates.

Figure 4.3 displays a map of the watershed and all the counties it traverses along with the number of BMPs that have been implemented per county. As with the Kalamazoo program, the distribution is heavily skewed: the top county (Darke) has

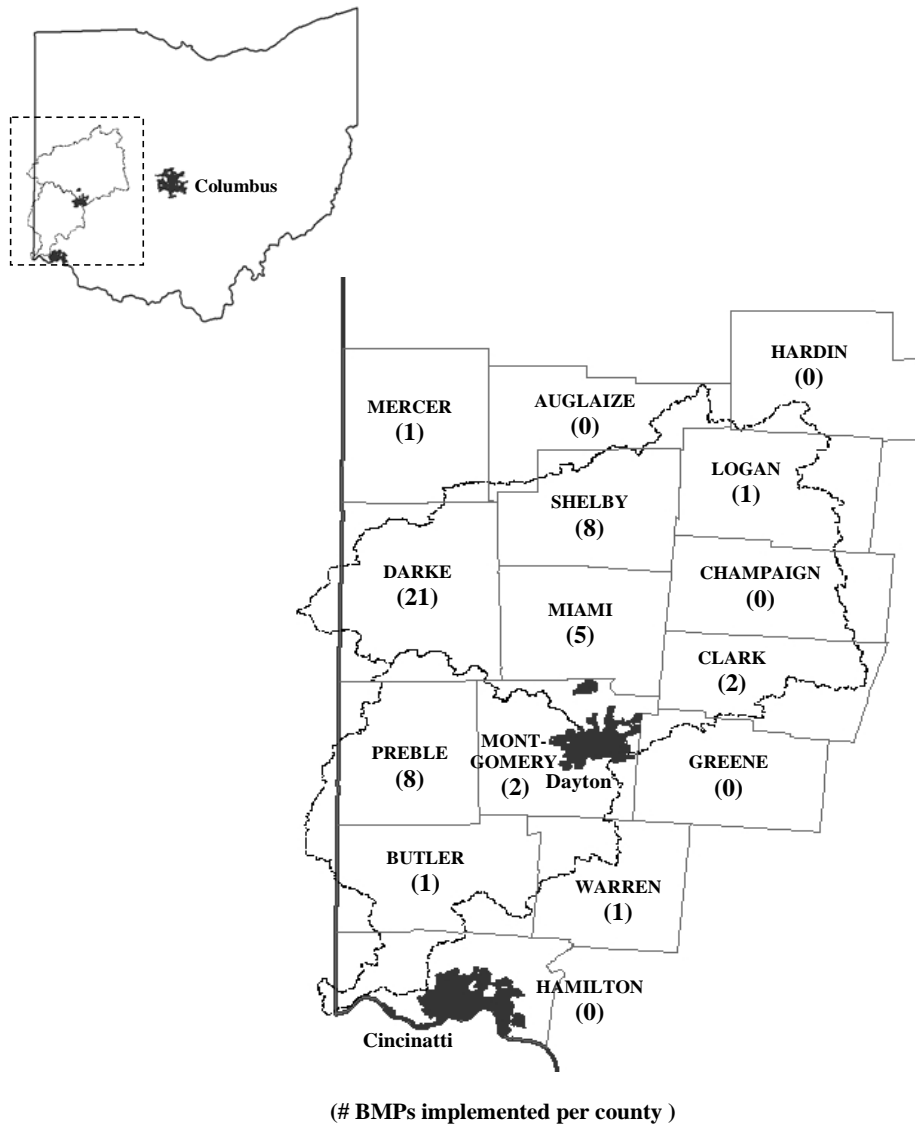


Figure 4.3: Great Miami River Watershed and Relevant Counties

nearly three times as many BMPs implemented as the second-highest counties (Shelby and Preble), while a number of counties have only a handful or none at all. To put it differently, out of fifteen eligible counties, a single county accounts for nearly half of all implemented BMPs. What explains this disparity?

Again it cannot be attributed in a consistent fashion to differences in agricultural context. Table 4.4 displays basic agricultural statistics for each of the counties. The zero-order correlations indicate a mildly strong relationship between BMPs implemented and total acres of farmland, as well as BMPs and total number of farms. But the numbers cannot account for certain inconsistencies, such as the fact that Champaign County has over 75% of its landmass inside the watershed and over 200,000 acres of farmland yet has accounted for zero BMPs to date. Neither can the discrepancies be attributed to the

Table 4.4: County Agricultural Statistics for Great Miami River Watershed

County	# BMPs	% county in watershed	Acres farmland	% county that is farmland	# Farms	Avg farm size (ac)	Acres CRP	% CRP	Acres corn or soy	Head cattle
Auglaize	0	<25%	213,296	83.1%	1,059	201	8,797	4.1%	148,127	20,055
Butler	1	>75%	127,194	42.5%	949	134	1,195	0.9%	72,203	15,771
Champaign	0	>75%	204,901	74.7%	931	220	5,080	2.5%	154,450	8,051
Clark	2	50-75%	177,335	69.3%	744	238	1,522	0.9%	137,247	19,800
Darke	21	>75%	350,450	91.3%	1,772	198	5,348	1.5%	274,960	36,595
Greene	0	<25%	162,533	61.2%	776	209	1,263	0.8%	124,808	3,092
Hamilton	0	25-50%	21,290	8.2%	291	73	73	0.3%	6,144	831
Hardin	0	<25%	256,822	85.3%	847	303	11,535	4.5%	196,129	15,185
Logan	1	50-75%	201,306	68.6%	956	211	12,266	6.1%	135,393	7,432
Mercer	1	<25%	293,026	98.8%	1,302	225	4,712	1.6%	217,147	79,058
Miami	5	100%	196,943	75.6%	1,048	188	1,460	0.7%	158,580	11,685
Montgomery	2	>75%	111,000	37.6%	804	138	691	0.6%	84,480	8,707
Preble	8	>75%	230,616	84.8%	1,181	195	3,442	1.5%	182,134	16,133
Shelby	8	>75%	217,969	83.2%	1,050	208	6,683	3.1%	158,395	27,498
Warren	1	<25%	94,348	36.9%	896	105	634	0.7%	55,614	2,631
Zero-order correlation with # BMPs	--	0.43	0.58	0.39	0.75	0.06	0.03	-0.11	0.61	0.28

portion of a county that is in the watershed, for some counties with zero BMPs have as much of their landmass in the watershed as the highest-ranking county, while the county that is entirely within the watershed's border ranks fourth. As with Kalamazoo, when one peers beneath the surface of the program and speaks with individuals at the county level, the story becomes more clear.

I conducted interviews with participants in the Great Miami program after having interviewed most other programs, and one of the things that surprised me the most was the lack of enthusiasm I encountered on the part of some of the SWCD agents – a first in my interviews. Every SWCD conservation technician I had spoken to from other programs, with one exception, had evinced enthusiasm and support for the program and very few had indicated any lack of success in recruiting farmers. Some even stated that it had brought more conservation to their district than any other program they had administered. By contrast, many of the respondents in the Great Miami program were decidedly more ambivalent, and, most notably, all of these ambivalent responses came from counties with low implementation rates. A few sample quotes give an indication of this sentiment:

We just haven't been able to generate that much interest.

▪

I guess our experience with the program here wasn't as good as maybe some of the others.

▪

Interviewer: Have you had any difficulty getting farmers interested in it?

Agent: Um, I would say some.

▪

Interviewer: Would you say from your perspective and the perspective of [your agency], at least in terms of landowner participation, that it's working?

Agent: Well it's -- [long pause] -- yes to some degree. I don't want to oversimplify it. I mean we've had a few folks in here not an earthshattering amount by any means.

▪

Interviewer: Do you anticipate much action on the future round [of funding]?

Agent: No, not here.

A mere lack of enthusiasm, of course, does not single-handedly explain a lack of success at implementing BMPs, but it does give an indication that the story is more complex than a simple metric of program-wide implementation indicates. A lack of enthusiasm on the part of the intermediary stems more fundamentally from a lack of *engagement* with or participation in the program in general, which may occur for a variety of reasons including simple shortages of staff or time, as we saw in the Kalamazoo program. A lack of engagement in turn leads to poorly distributed or insufficient communications with potentially eligible farmers, which hinders development of the program. Consider the basic analytical logic: when we switch the level of analysis from the program-wide scale to the individual county scale, which variables remain constant and which are subject to differentiation? All of the economic/institutional variables highlighted in Chapter 2 remain the same between counties, e.g. trading ratios, bidding system, rules for credit duration, verification, monitoring, etc. These factors are held constant across all geographical units of a program because they apply to the entire program. The key variable that can vary from

county to county, *within* the structure of the program's rules and restrictions, is the mode and degree of intermediary involvement.

To take the simplest example first, in a situation highly reminiscent of the Kalamazoo program, an agent from one of the counties with zero BMPs chalked up their lack of success to limited staffing resources. The county SWCD office has only two staff members, and both have their hands full administering government programs such as CRP and EQIP. As the agent summed up in regards to the trading program, "We just knew we don't have the manpower to do it." Bear in mind that the trading program continues to exist on paper in this county. Farmers would be eligible to submit bids and be subsidized to implement conservation practices. But without the active participation of the intermediary as an information conduit between program and farmer, there is no action at all.

This county was the exception rather than the rule, however. Most counties did make attempts to communicate with farmers. What accounts for their low BMP rates? Interestingly, the key variable appears to be something as prosaic as the *form* of communication. In line with longstanding results from Everett Rogers' innovation-diffusion studies, an insight suggested by the data is that face-to-face contact with farmers returns better results than impersonal communications such as newsletter articles or other mailings (Rogers, 2003). Consider the following responses to the question of how the agents got word out to the community about the potential to participate in the trading program:

We did not advertise. They [the Conservancy District] sent out flyers, we did not put an ad in our newsletter. (0 BMPs)

▪

There's some newspaper articles on it usually. . . . And if they come in looking for funds to rectify a problem. (1 BMP)

▪

Interviewer: Did you do a lot of word-of-mouth advertising when you were out on farms, just talking to folks? Agent: [Pause]. No, I can't say that we did. (5 BMPs)

▪

Interviewer: How did you get word out to the farmers? What were the main channels? Agent: Well, the Conservancy District gave us promotional materials, and we put it in our newsletter, and uh – that's what we did. And probably a press release. . . . We only got a couple [responses]. It was disappointing. (2 BMPs)

After admitting difficulty recruiting farmers, one agent framed his lack of success as the consequence of being less proactive about recruitment than other counties in the program:

My philosophy on things too is – I don't know if you've talked to ___ County, but one year they had 70 applications. And we only had, like, four. And how I look at it is, I get the word out and it's a voluntary program, and if you wanna volunteer – hey, I'm here and I'll help you out. I think a lotta counties go out there and push it and push it and, you know, 'We'll help you, we'll help you.' I do everything on a volunteer basis – if you wanna do it, great, I'm here, but I'm not gonna come to your door every week and pressure you to do something.

This may be admirable as a philosophy of non-coercion, but from the point of view of getting farmers on board it appears to be unsuccessful.

Now compare all of the above with the story told by the agent from the most successful county. When asked how his farmers hear about the program, his response contained no mention of advertisements, newsletters, or brochures, but of a personal

visit paid to a farmer he had never even met before:

One I'm working with right now, a year ago when they announced the signup, I told another [agent], 'Let's go up and see this guy.' He goes, 'What are you gonna tell him?' I says, 'I don't know what I'm gonna tell him, we'll just get up there and see how things ring out once we get in the door.' And he kinda opened up the door, [he said] 'Come on in here,' and I told him what was all up and everything, [by the time] we were leaving he was pattin' me on the back and said, 'Hey we'll stay in touch.'

To extrapolate to a more general point, what is highlighted here is not just communication as a particular strategy, but the degree to which a local intermediary is enabled to tap into embedded relations that may already exist with the farming community. For a variety of reasons, individual county SWCD offices in the majority of counties in the Great Miami program were not fully participating or advocating for the trading program. Some were uneasy with the reverse auction bidding format and reluctant to push it on their farmers; in some there was a miscommunication or a misunderstanding about which BMPs were eligible for nutrient credits; in still others, the primary means of communicating the program's existence was newsletter briefings and newspaper advertisements rather than on-the-ground, in-person contact. Whatever the reason, these offices did not capitalize on their trust relations with the farming community, choosing instead a path of outreach more akin to what Uzzi calls "arms' length" relationships. A single county bucked this trend, fully embraced and understood the inner workings of the trading program, and, most importantly, used face-to-face interactions with farmers to spread the word. They approached the program as an opportunity to target specific farmers who had conservation problems,

rather than serving as an information relay to the farming community in a more generic fashion. The results speak for themselves: the latter county implemented nearly as many BMPs as the fourteen remaining counties put together.

These results should not be taken to represent the definitive picture of what transpired in the respective programs. My analysis would be greatly bolstered, for example, by a precise listing of each BMP implemented and the form of communication used to relay information to the respective farmer. Only then could a quantitative comparison be performed that might confirm or counter the claim being made about the causal importance of embeddedness and one-on-one communication. However, such precise data were impossible to procure, so in their absence we are left with the more suggestive data provided by interviews.

With this caveat in mind, we may draw the same take-home point as from the Kalamazoo River program. Embeddedness matters – perhaps as much as any other variable – but it is not enough for a program simply to use an embedded actor; the specific nature of the relations and lines of communication the actor chooses makes the difference between success and failure. The fifteen counties encompassed by the Great Miami trading program presumably do not vary much in terms of their embeddedness within their respective farming communities. But embeddedness alone is not sufficient.

To give one example, one of the fifteen counties pursued two strategies that one would expect to have yielded benefits: in addition to quarterly newsletters, annual farmer workshops on Farm Bill programs, and a presentation by an administrator of the

trading program, this county presents the program at Cattlemen's Association meetings (targeted and in-person). In addition, by coincidence their first BMP was implemented by an influential farmer in the community. As the agent said, "The word really got out when the gentleman was accepted. . . He's the guy at the coffee shop. He got out there, and about a week or two after that I got about five calls – 'How do I get me one of them things?'" Yet, despite these embedded communication practices, that BMP turned out to be the only one they have implemented. Indeed, the SWCD only received bidding applications from a total of four farmers. So an embedded relationship alone is not sufficient to explain differential success rates. There may be even more fine-grained elements of localized farmer culture that serve as an additional hindrance or aid to program acceptance and development.

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The analysis to this point is intriguing and provides narrative evidence of the importance of embeddedness, but it still begs a critical question: *Why?* If embeddedness plays a positive role in program development and success, how and why does it do so? What is so important about social embeddedness in the realm of water quality trading, or of agricultural conservation more generally? If I am making an implied claim of causality, then what is the causal *mechanism* by which embeddedness works? I turn now to this broader question.

Chapter 5: Communication and Trust: Embeddedness and the Question of Social Mechanisms

Introduction

Drawing on Granovetter (1985), Uzzi argues, "If economic action is embedded in networks of relations, then a logical first step is to specify the dimensions of embedded relationships and the mechanisms by which they influence economic action" (1997: 61). Over several articles, Uzzi (1996; 1997) elaborates on three specific causal mechanisms, three *means* by which the socialized variable of embeddedness results in the *end* of optimized economic outcomes: (1) the fine-grained transfer of information between actors; (2) the solving of problems extemporaneously and cooperatively; and, most importantly, (3) the existence of trust. He examines these three in detail from within the context of a very specific market sector – the fine apparel industry in the metropolitan area of New York. Other scholars have elaborated on one or more of these mechanisms too, though their research also takes place in a non-agricultural context (e.g., Gulati, 1995; McEvily and Zaheer, 1999; Hansen, 2002). Interestingly, a recent study of the transmission of agricultural conservation schemes from the policy level to the implementation level makes no mention of economic sociology or any of its framing devices yet finds that extension agents play a key role for reasons that mirror Uzzi's

language: “Good communication, the cultivation of trust bonds with policy recipients and the delivery of relevant knowledge hold the key to effective extension of [conservation] measures in the field” (Juntti and Potter, 2002: 228).

If the first goal of my research was to delineate the existence of embeddedness within the institutional structure of water quality trading programs, the second goal is to unpack the concept at a greater level of detail. The purpose is twofold: both to shed more insight on how and why embeddedness has resulted in the success outcomes described in the previous chapter, and to explore the distinct ways in which embeddedness manifests differently in the context of an agricultural conservation incentives program than it does in the far more commonly researched context of conventional economic firms. I will take each of Uzzi’s causal mechanisms in turn and examine them for more detailed insights into the ways in which they play (or do not play) a role in the success outcomes of water quality trading programs across the country.

5.1. Fine-Grained Information Transfer

The first of Uzzi’s posited mechanisms is the idea that embedded ties between economic actors facilitate the transfer of crucial business-related information in a manner superior to the transfer of information through more anonymous market channels. Agents with longstanding trust relationships pass information to one another at a level of detail and specificity that gives them a market advantage. “Information

exchange in embedded ties is more proprietary and more tacit than the information exchanged at arm's-length. It includes strategic and tacit know-how that boosts a firm's transactional efficacy and responsiveness to the environment . . . and reduces problems in ways that are difficult when arm's-length ties are used" (Uzzi, 1996: 678).

An example cited by Uzzi is when a manufacturing firm's sole source of information for how to manufacture a certain garment is the design firm's pattern. Problems are likely to arise in the manufacturing process because of certain inconsistencies or questions raised by the pattern, but they are unlikely to be solved through person-to-person contact; rather, the manufacturing firm must devise a solution extemporaneously, likely resulting in an inferior product. By contrast, a manufacturing firm with a preexisting relationship with a design firm will, according to Uzzi's respondent, "see the problem when the garment starts to go together. They will know how to work the fabric to make it look the way we intended" (1996: 678). The embedded information source, while perhaps causing an initial slight rise in transaction costs, in the end maintains the existing relationship between the two firms and leads to a superior product that gives both firms a market advantage.

We need to be careful about translating this mechanism directly from Uzzi's conceptualization scheme to our own. The primary information channel of interest in the case of water quality trading programs is not that between two actors at the same conceptual level who both have an economic stake in the outcome of the information exchange (i.e., profit-seeking firms offering a good or service in the marketplace); rather,

it is between an intermediary who is most often a public-sector agency, interacting with a private-sector farmer interested in participation in a peculiar kind of market scheme. Furthermore, the latter is not seeking a profit per se, but an implementation subsidy – a relationship whose contours and motivations are different from the types of relationship described in Uzzi's research.

Nevertheless, evidence from the adoption/diffusion literature in rural sociology has long indicated the importance of information channels and communication partners in fostering adoption of agricultural conservation (see Rogers, 2003). In one study of voluntary conservation programs in Switzerland, Schenk et.al. (2006) find that the particular way information about conservation programs is transferred proves very important. Not every information channel is equally effective. For example, mass media channels such as newspaper and radio often do not reach farmers to the extent anticipated or are not particularly effective when they do reach the farmer. Public meetings are also not as successful as one might expect. The most successful means of transferring information to farmers in their study is one-on-one meetings, in large part because of the ability to consider a conservation scheme within the context of the farmer's particular operation.

Turning back to my study, a close reading of the interview transcripts reveals that the issue of information dissemination proves critical in distinguishing the advantages of embedded ties from the disadvantages of arm's-length ties.

5.1.1 *Personal Contact*

The first observation of note that emerges from interviewees' responses is the number of occasions in which intermediaries tried to disseminate information about the trading program through traditional media channels such as newspapers, newsletters, and radio airtime, all to no avail. A conservation agent in one county in the Kalamazoo program relates the incredibly low rate of return he received on his advertising efforts:

I think we did a five-county area with radio broadcasts on farm radio to bring folks in the door, and we did a mailing through five counties to 4,000 different producers. . . . You know, we send newsletters out – they go to actors on different subjects all the time and we never get a really great response. . . . These producers actually got three mailings to their homes, they had an initial big postcard, a week later another one came saying 'Hey, last week you received this,' and then we sent another one. You know, we thought we'd just be slammed. . . . and I was absolutely amazed, I think out of all that advertising dollars, I think we had about five folks come to talk about water quality trading. . . . The producers that walk in the door and get into these programs will jump on all of 'em, but getting them in the door and getting that knowledge into them is pretty difficult.

A key message in his statement is implied in the final sentence: it is not that farmers are not interested in conservation programs, for they "jump on all of 'em" when they hear about them through person-to-person contact; it is the mode of communication that matters.

Particularly telling is the Conestoga program in Pennsylvania, which actually switched advertising tactics in between two successive rounds of funding, the first of which was undersubscribed and the second of which was oversubscribed by farmers. I

asked the program coordinator what accounted for the jump in farmer interest between the two rounds. He noted a “more aggressive marketing effort” including advertisements in a local farming newspaper, as well as a longer time window for farmers to post bids, and then he finished by saying:

And the Conservation District technicians, as part of their regular rounds in interacting with farmers, they were pitching and pushing our auction among their other conservation programs. It was really working through the Conservation District and their professional staff in implementing the auction. . . . They’re the main conveyor of federal and state conservation grant money, and then this program really had to be woven into that same delivery system, so the Conservation District, I can’t emphasize enough, their expertise, and as importantly or more importantly, the trust and familiarity they have with the ag community was essential for the success we had. I mean, we could not have done the project without their direct involvement.

The coordinator’s phrase “woven into that same delivery system” is particularly apt to describe the mode of information transfer taking place. To contrast it with the type found in Uzzi’s (1996) study, we are not talking about trade secrets or tacit information – what is being exchanged is neither secretive nor proprietary, nor even information that enhances competitiveness. But within the context of agricultural conservation it is still a form of market information, because it proves essential to ensuring farmer participation in a market-based conservation scheme. And the information conduit only opens up when it is piped directly from person to person.

The same agent from the Kalamazoo program who saw such a poor response to his media advertisements contrasted them “versus if I’m out in the field and, you know, just drive around and I stop and talk to a producer, that seems to pull ‘em in.” The

information is not sufficient in and of itself; it must be transmitted along an embedded tie. “You have to be able to have somebody go out to those landowners and say, ‘Here’s what we wanna do, and you’ve got this situation here and we’d love to have at it.’ I mean, if you can’t get out there and contact people, nothing’s gonna happen” (Minnesota regulator).

5.1.2 Tapping Into Existing Relationships

If farmers are largely unresponsive to media communications, even targeted ones, and are generally known for a conservative cultural mentality that mitigates against quick adoption of technology that does not have obvious production benefits, how can information agents help spread the word about a new program? Is it enough to simply stop at randomly chosen farms and engage in conversation? When delving into the details of how they address this challenge, many agents reveal a particular strategy: to target not just any farmers, and not even those farmers with the most obvious environmental problems on their farms, but farmers with whom they have existing relationships. As Uzzi writes, “From a sociological perspective, fine-grained information exchange cannot be explained as a special incident of information asymmetries or asset specificity because the identity of the individuals and the quality of their social ties are as important as the information itself. Social relations make information credible and interpretable, imbuing it with qualities and value beyond what is at hand” (1996: 678).

Previously known producers prove more open to considering the newest trend in conservation. When asked how she went about the process of farmer recruitment, a county agent with the Conestoga program responded:

A lot of it was just farmers that we already had working relationships with, that we knew were looking for some kind of cost-share . . . there's always a list of names of people that come to mind. . . so that's kinda how a lot of people got pulled into that program, they were already operators that the Conservation District or NRCS folks had been working with, and through our relationship we knew they were trying to do some practices and trying to figure out which practices tied into that particular program, and then, you know, going out and just kinda presenting it to those operators. If it's somebody we haven't talked to in a little while it might just be a phone call to say 'Hey, just lettin' you know this program's comin' across, this is what it's offering,' trying to give them a little bit of details.

And she continued, making the even more important point that these pre-existing relationships smooth the way towards program acceptance *even when farmers are initially skeptical*:

As far as this program being successful and projects getting recruited – definitely it's the relationships with the farmers, because a lot of the projects that went through – and I can speak from my experience – were the farmers that I worked with the most frequently, that I had regular contact with and knew they were looking to do something, so when it came down to it, even though they weren't really sure about the program or weren't totally 100% knowing how it worked, you know, they were willing to take my word for it and give it a shot.

An agent with the Great Miami program used the same theme to argue that this actually presents a certain advantage for nutrient trading programs, which, despite their own set of rules and stipulations, may offer more freedom of action than traditional

government programs. They may thus have a more immediate appeal to a farmer who is interested in conservation but put off or made ineligible by the rules associated with a federal program.

The ones that we've had [in the trading program] have kind of been – I hate to use the term hand-picked, but a lot of the ones that we've had, that I've been successful in getting in have been projects that, had it not been for a set of criteria in CRP or EQIP, we probably would have used EQIP or CRP for the first choice. But the Farm Bill programs a lot of times have some goofy stipulations with 'em or some criteria that not all farms meet . . . and that set of criteria doesn't exist in the water quality credit trading program. So what we do here in this office is basically maintain a list of good projects that we can't get to go through EQIP or CRP, and when they open up the signup on water quality trading we'll mention to these folks when we're talking to 'em, 'Hey, I've got another program, would you be interested in this?' And that's how we got a lot of 'em.

Much of this strategy is premised on the question of uncertainty. Water quality trading is a new approach to conservation that is quite unusual from a farmer's perspective. A number of intermediaries pointed out during interviews that one reason for the slow growth of the sector until recently was the simple fact that farmers were unfamiliar with and therefore skeptical of the program. A trusted intermediary helps to smooth over this reluctance. As Simpson and McGrimmon write, "as the uncertainty inherent in the purchase of some good or service increases, so does the tendency for actors to rely on social relations" (2008: 1).

In the case of the Alpine program in Holmes County, Ohio, nearly all of the participating farmers are Amish dairymen, calling for a very particular approach. The ability to use existing relationships was limited by the fact that very few farmers in the

watershed had participated in formal conservation programs before. How then to find traction within this deeply traditional community? The conservation office's strategy was twofold: first, they relied on one particular agricultural agent who had developed very strong relationships with the Amish after more than 20 years working with them. More importantly, when he went into the community seeking participants, he targeted not just farmers he happened to know, but critical community leaders whose opinion holds sway among other farmers. As another agent describes it:

We worked pretty hard at identifying key leaders, or at least key people in three or four different communities. And [he] went and talked with them, and then we prepared little flyers for them to pass out, that there was going to be an information meeting in their neighborhood at this particular house. Most of the people that actually ended up being in the program attended one of those.

An agent from the Kalamazoo program shows that this key-leader approach is not limited to the Amish, either. Community leaders are not only a lynchpin of community opinion, but a validator of community information as well:

Probably the biggest key to building success is to go out and find projects with some of your key farmers – may be some of your biggest farmers, it may just be a key farmer that's on your local Farm Bureau or something like that – and work with them. There's key ones that we know to go to, and they will be out and about really being your word of mouth – they'll spread the word and they'll either give you a list of their neighbors that they need you to talk to, or they'll talk to their neighbors and tell them they need to get in and talk to you.

5.1.3 Evidence-Based Word of Mouth

As the last two quotes indicate, it may not even be the initial contact between embedded intermediaries and producers that results in the most effective dissemination of program information. That initial contact may be the spark, but what really fans the flames in many cases is word-of-mouth dissemination among the farmers themselves.

A conservation agent with the Cumberland program noted that, like the Kalamazoo program, they began by posting pieces in newsletters and the local newspaper but soon found they could scale back such efforts: “I think now it’s primarily word of mouth.” The most powerful means of communication has proven to be the actual implementation of BMPs, as echoed by the coordinator of the CWS program in Oregon: “Initially the SWCD did a little bit of outreach and let people know about this new program, and then eventually it just kind of took off on its own through word of mouth. As soon as there were a couple of projects underway and they were going well, people started coming in and seeking enrollment.”

So to deepen the concept even further, it is not just that the information chain begins with a local intermediary, and not even that it is magnified by passage through the mouth of a farm community leader; farmers tend to be deeply pragmatic individuals, and the surest way to spread enthusiasm for a program is to show that it *works*. As the coordinator of the Conestoga program put it:

I think farmers sort of have a wait-and-see attitude. If other farmers start doing it and having success then other farmers are more and more likely to adopt that same practice, whatever it is – whether it be no-till or streambank fencing or doing CREP tree plantings. So the cultural issue cannot be understated. . . . Until the farmers

really understand and trust whatever it is you're proposing, you're not gonna get a lot of buy-in. And then until some of them actually do it and demonstrate some success and profitability doing it, you're not gonna see widespread adoption of the practice.

Over and above the embeddedness of a county conservation agent or other local intermediary, no relationship is more socially embedded than that between farming peers. Speaking of a cover crop BMP program in Minnesota, an agent stated, "Guys see a neighbor's field that looks like an oat field, then it turns to sugar beets – they're obviously gonna notice that. So it's spread by word of mouth." And even more powerful if a farmer can highlight the financial subsidy: "Those producers . . . in that carbon trading market and in that phosphorus market and talking to fellow producers saying, 'Hey, you know, this is easy to get into, I got some cost share, I made a buck or two.' I think that's one of the better ways of spreading the news." Returning finally to the Amish farmers mentioned in the last section, the same technician picked up where he left off discussing his peer with deep roots in the farming community: "The recruiting part, and actually getting 'em in, it probably took a direct contact from [him] or exposure at the meeting. . . . The word of mouth is probably more important after we actually do something, meaning actually put [a BMP] in."

5.1.4 Familiarizing the Program

The final aspect of communication that emerged from my interviews was the role that local intermediaries play in translating the unusual concept of commodifying and

trading nutrient credits into terms more familiar to farmers. Schenk et.al. (2006) argue that farmers are not interested in theoretical or academic information about farming practices, but rather information which relates to their particular farming or lifestyle situation. Similarly, Vanclay (1992) finds that farmers are suspicious of information from academic and government sources, reporting they feel that “city” ideas are being forced on them. Bearing in mind that one of the key hurdles to farmer buy-in to any program, including water quality trading, is a sense of skepticism towards new and seemingly complex schemes, it was necessary for agents to cast nutrient trading in terms more familiar to farmers – which typically meant framing it relative to conventional government conservation programs such as EQIP or CRP.

It's that old change-management thing, especially when you're dealing with farmers, right? They never want to be part of a pilot, they never want to be part of something new. And so you just try to give 'em what they've always had, and up here we've always had some type of grant program for farmers. So we well this as a BMP program, and . . . they are aware that they're part of a trading program, [but] we never go out there and say 'Hi we're part of a trading program.' We say 'Hi, we've got some money for manure storage, do you want it or not?' (Coordinator, South Nation program)

Or as the coordinator of the Great Miami program more prosaically put it, “We built the program in a way . . . that essentially it looks, walks, talks, and feels like other conservation incentive programs. So by the time you go to the market with a request for project proposals, you've got another source of funding which is endorsed by ag leadership.”

Again we witness some variation in this strategy across programs depending on the particular social context. In the case of the Amish farmers of the Alpine program, casting nutrient trading in the same terms as a government conservation program carries little weight because few if any of the farmers participate in the latter. In fact, to do so would have been counterproductive, because Amish skepticism towards all conservation programs stems from their reluctance to take any government money. How did the agent most closely associated with the Alpine program overcome this barrier?

I've tried to explain to them at some of the meetings and then on an individual basis that you have something out here that a cheese plant or a wastewater treatment plant needs, and they're willing to pay for that. So you can, you know, you can compare that to selling corn or selling something else. And I think that helped them get over some of the reservations they may have had as far as taking money.

By casting nutrient trading not as a form of subsidy, but as getting compensated for a service that is genuinely desired by the buyer – in other words, participating in a classic supply-and-demand market – the agent was successful in overcoming farmer resistance. Whether dealing with Amish or non-Amish farmers, the underlying strategy is the same: embedded relationships and personal contacts open the door, using key contacts in the farm community spreads the word, and packaging communications in a format that is not foreign or excessively complex assures familiarity and farmer buy-in. An intermediary helps bring farmers into a new form of conservation initiative by appealing to their moral economic framework (Scott, 1976).

5.2. Problem Solving

The second of Uzzi's mechanisms is what he calls "joint problem-solving arrangements," in which the relationship between two actors results in a pragmatic ethos "that enables actors to coordinate functions and work out problems on the fly" (1996: 678). This kind of fine-tuned problem solving results from embedded rather than arm's length relations for two main reasons: embedded ties involve feedback loops by which both parties receive regular updates, verbal or otherwise, about the other party's satisfaction with a given relationship or contract; and embedded ties encourage both parties to work through problems together and "accelerate problem correction." By contrast, arm's length ties typically involve a shortened feedback loop often consisting of little more than what economists term "exit" – one actor abruptly terminates the relationship with no attempt to work on problems cooperatively, leaving the other actor to infer reasons for the exit.

Again we must be careful in translating Uzzi's firm-to-firm scale to the intra-program scale in the context of water quality trading. Yet the relationship between embedded brokers and farmers has a clear analogue, for what they are in fact often working on together are environmental or agronomic "problems" such as soil erosion, overnutrification, manure seepage, etc. To get at this variable I asked questions regarding when and why farmers approach intermediaries with specific problems and the types of technical expertise the intermediaries lend in return.

Some evidence of this joint problem-solving does emerge from my interviews, but it is not as well-defined as in Uzzi's study. For the most part problem-solving is not an emergent property of the embedded relationship per se, and certainly not of the trading program itself. Rather, it is simply what goes into the daily working lives of local conservation agents. Solving problems is just part of their job. An agronomic consultant associated with the SMBSC program in Minnesota attributes this to the particular role they play in farmers' lives:

We do a lot of the same functions as a consultant. The farmers will call us out and ask what they should do about a particular problem – if they see a problem with their beets they wanna know if it's insects or weeds or what's going on. And we're trained to do that. And the other part is because we're not paid by a fertilizer [company] or anybody else, we're unbiased as far as giving them that advice.

However, this may be more attributable to the particular technical expertise that such agents possess than to their embedded ties per se. For example, the technical assistance that at least one SWCD does for each project that comes along is both extensive and intensive: an agent goes to the farm, does an initial survey of the operation, and sends the information to the program coordinators. If the practice is approved, the agent returns to do a full-blown survey, sends a cost estimate for the construction project back to the coordinators, then arranges for the construction project itself. The agent does all of the design engineering – there are no other engineers involved, only construction contractors for excavating and installation of drainage lines. I asked an agent what the success of this program would be without the assistance of the SWCD. His response:

Probably a lot, lot less of [the projects] would be done, and those that would be done would be done very poorly. 'Cause I don't think there are too many people – contractors, landowners – that are capable of properly designing a lot of the things we do so it'll last. They would throw up a lot of half-assed things. I can see that happening and then having them wash out.

We should be careful not to stretch this idea too far, however. The above program is the exception rather than the rule – in most cases SWCD personnel do not take the place of certified engineers. They may do an initial farm consultation and then pass on the engineering itself to a more qualified NRCS employee (e.g., Alpine program); they may contract out the BMP implementation to a private firm (e.g., CWS program); or in the case of field-based practices such as no-till (e.g., Cumberland program) or cover crops (e.g., SMBSC program) they may do little more than sign off on the farm plan and allow the farmers to cover the major implementation steps themselves.

In many cases the question of the intermediary helping farmers solve problems cooperatively was a moot point, because the farmers do not actually do the work themselves but contract it out to specialists. The two main exceptions are for field-based practices such as no-till and cover crops (almost always performed by the farmers) and the unique cultural case of the Amish, who tend to install their own BMPs, even including structural practices such as concrete retaining walls, exclusion fences, and milkhouse waste tanks. More typical is a situation such as the Fairview program, in which piles of poultry manure are trucked away by a private trucking company; or the Piasa Creek program, in which erosion control structures are installed by engineering

firms; or the CWS program, in which independent forestry consultants install riparian shade plantings.

If there is a particular aspect of problem-solving that illustrates the close working of two embedded actors within nutrient trading programs, it is the simple act of negotiating the various bureaucratic steps required to take a BMP from idea to design to implementation to verification. In this sense, the expertise brought by local intermediaries is primarily an administrative expertise. The case of the Alpine program in Ohio is illustrative: SWCD personnel go through no fewer than eight separate steps in helping farmers conceive and install conservation measures from start to finish

One reason the issue of problem-solving does not stand out as clearly here as it did in Uzzi's research is that the boundaries between it and Uzzi's other mechanisms are more blurred. Helping to solve problems is closely tied to both trust and interpersonal communications within the farming community. In a sense one could argue that conceptually speaking, problem-solving dissolves into the concept of information transfer. In keeping with the basic mission of resource conservation agencies, the "problem" being solved by the embedded relationship is the problem of farmer reluctance, farmer skepticism, and farmer ignorance about the program itself. Fine-grained information transfer and joint problem-solving are combined as a single mechanism. The best evidence comes from a conservation agent from the Kalamazoo program, who responded to the question of how farmers hear about the program in the first place:

As far as the conservation side, we've had a lot of people come just to deal with a personal problem. Say they've got a gully, they've got erosion in their fields. You have the big storm event. . . . And so those events create problems that maybe have only happened once, or maybe never on a farm, and they're usually on a grand scale, and so this would be the first place that they'd come. . . . When it comes to the bigger problems, a lot of farmers are gonna come here not only to look for what to do and how to do it – because we base everything on USDA NRCS standards and specifications, so . . . you're pretty assured that if you follow that you're not gonna have those problems down the road. And we can provide them with that engineering assistance, we can provide them with that technical assistance, and many times even program dollars – cost share assistance to help correct that problem. How big it needs to be, how wide it needs to be, what grasses you need to plant for their type of soils – all of those technical things that go along with it. So they come here for that kind of guidance.

5.3. Trust

The most important mechanism by which embeddedness operates is trust, the “governance mechanism of embedded relationships” (Uzzi, 1996: 678). Of all the social characteristics of markets understudied by neoclassical theorists, trust stands out as the central pillar of the whole modern revival of economic sociology. Granovetter, for example, in his influential 1985 article casts market action as one response to the Hobbesian problem of social order and posits trust as the primary social mechanism that prevents higher levels of “malfeasance” in our economic relations.

The basic point is not just that trust is important, for no one will deny that, but that it provides a particular market advantage to the actors involved in an embedded relationship. It “promotes voluntary, nonobligating exchanges of assets and services between actors” that may give these individuals or firms a leg up on competition, a

much-needed infusion of capital, or some other time-sensitive advantage (Uzzi, 1996: 678). Jones et.al. (1997) and Dyer and Singh (1998) both use the language of security, framing trust as an “informal self-enforcing safeguard” that enhances competitive advantage by making information more secure and thus trustworthy. Trust lubricates the day-to-day relationships of actors and firms, helps alleviate risk, lowers inhibitions and reluctance, and helps ensure the retention of close ties over time by cultivating relationships that incorporate friendship and mutual aid.

In order to translate this insight to the context of nutrient trading, one must recall that the American farmer remains on the whole highly distrustful of almost any form of interference in his farming operation, particularly interference by government (Moore et.al., 2008). The problem of distrust is a significant one and has arguably stood in the way of more widespread adoption of conservation measures (Vanclay and Lawrence, 1994). One of the recurring themes of the present research project is that within the agricultural sector, and particularly within the act of BMP adoption, the role of trust takes on a unique form. The questions that arise in the present research are twofold: in the implementation of a nutrient trading program, how important is trust between farmers and programs in terms of program success, and why is it so?

5.3.1 Trust, Credibility, and Advocacy

The answer to the first question can be discerned fairly quickly. The word “trust” was mentioned by at least one respondent in every single program except Rahr

Malting – the one program that does not have a local intermediary and does not deal explicitly with agricultural BMPs. The other word that frequently crops up in conversations with program intermediaries is “credibility” – a critical precursor to trust when it comes to the farming community. A case in point is the choice by the Alpine program to turn to one particular local extension agent to spearhead the effort to reach out to the Amish farmers in their area.

Conservation Agent: I mean he was 20 years in Extension. So he started roughly 20 years ago with Extension, he saw the need to do some outreach with the Amish. And he started pasture walks, he'd go out in the community and hold meetings. He had an Amish advisory committee to help give feedback. So he kind of got that ball rolling. . . . I know that he made a very concerted effort to get those programs out into the Amish, so that helped us build our relationships.

Interviewer: Can you guess what the Alpine program would have been like if [he] hadn't been around?

Coordinator: I think we could have done all right on our own, but his involvement made it a lot easier. I think it sped it up tremendously.

Conservation Agent: It's a little doubtful that we'd be at the stage we're at now. We'd have got it done eventually, but . . . without [him], it would have taken 2-3 years to generate as much interest from farmers as we got in just the first year.

Coordinator: He instantly brought credibility to the project. It would have taken us several years to build up the credibility he had. . . . So that's key, who you have out there in that community talking to these people.

Interestingly, the same sentiments were expressed about one of the few programs that does not use a local conservation agency as the intermediary. The SMBSC program in Minnesota features staff agronomists at the PS discharger, a sugar beet processing cooperative, as the chief individuals interacting with farmers. Said one of these agronomists:

It's a matter of credibility, and each of our guys is trying to establish credibility with our growers by giving them sound advice all along. . . . They trust us because they know we're not on somebody else's agenda – our goal is to get every nickel back to the grower that we can, because if the growers are strong, the co-op is strong, and our jobs are secure.

The SMBSC program has been oversubscribed in every year of its operation, in large part because of the trust ties these staff agronomists have established by working with the producers to increase the productivity and quality of their crop.

The above quotation hints at another component of trust that proves crucial to overcoming the innate skepticism that farmers bring to a new program such as nutrient trading. Uzzi sums up this component as “the belief that an exchange partner would not act in self-interest at another’s expense,” and it manifests as “a predilection to assume the best when interpreting another’s motives and action” (Uzzi, 1997: 43). In other words, the idea of credibility translates to a perception that the agent in question is on the farmer’s side. Both parties benefit from the implementation of BMPs, what Dyer and Singh refer to as the “alignment of incentives by alliance partners” (1998: 666). Conservation agencies are not there to regulate or obligate, or even to turn in farmers displaying “malfeasance” to other regulatory authorities; they gain farmers’ trust by positioning themselves as their advocates.

Interestingly, the best articulation of this viewpoint comes not from a public-sector intermediary but from a private-sector, for-profit broker:

We are not an enforcement agency. From the Chesapeake Bay Foundation’s point of view, and from Penn Future, another large environmental organization, we’re kinda seen as a watchdog to make sure that these farms are doing the right thing. From the

farmer's point of view, we're the ones that are putting these plans in place and helping them if something bad actually happens. . . . [The] farmer . . . doesn't have an advocate if something really goes bad. And quite often we've been the ones that have helped them design the manure storage, or we've done the design on the waterway or something like that on the environmental part of their farm, but we've also been the ones at the township meeting getting that hog barn through the township.

5.3.2 *Knowing Agriculture*

One element closely related to trust that may be more unique to the agricultural sector than others is the importance of an intermediary being familiar with agriculture as an act and a livelihood. The nature of agriculture as an occupation differs markedly from most other jobs throughout the economy, plus there has been a steady decline in the number of farmers for most of the last century, so farm operators often feel that they are conducting a livelihood that very few outsiders understand or appreciate. Key to gaining their trust is a sense that someone attempting to interface with them – bankers, salesmen, conservation agents, government employees – knows agriculture or at least has a familiarity with it. Jones et.al. refer to this as “macroculture” – “a system of widely shared assumptions and values, comprising industry-specific, occupational, or professional knowledge, that guide actions and create typical behavior patterns among independent entities” (1997: 929). As simple as the notion seems, it is all but absent in the literature on water quality trading, and yet it proves to be a critical part of forming an embedded trust relationship:

People don't trust people that's not from a farming background. Farmers feel relaxed with people that they know locally, that they know is not coming from the city. You

know, when you show up and you know what they're talking about, you know what corn and soybeans are, you know what a corn planter is, you know the dimensions, you know the tillage, you know the soil loss, you know fertilizers, you know everything they're doing. Because we're farmers too, basically. The people in our office, we're actually from a farming background too. (Conservation Agent, Piasa Creek program)

Some programs seemed to grasp this intuitively, while others had to learn it through trial and error. The coordinator of the CWS trading program in Oregon recounts an early hurdle in the development of their relations with farmers:

Part of what we learned in trying to set up the program was farmers didn't really want to talk to city folks. They didn't want to be regulated. And so we thought, rather than having one of our employees being in there trying to negotiate with them, why don't we use the Soil & Water Conservation District as our agent. . . . That way, you know, they knew the farmers, they had that relationship. . . . It wasn't us, kinda the wide-eyed city environmentalists going out and telling a farmer how to plant something, it wasn't gonna work. The guy who did this work originally was a guy named _____ – you talk about your yuppie from downtown Portland, that was him. He would have never fit in with the farmers. He came with the money, they were happy that he had the money, but that was as far as they wanted him involved! [laughing].

The most extreme version of this strategy is that employed by the South Nation program from Ontario, which does not use any agency staff at all as intermediaries. The program employs actual farmers from the community to be their field representatives. As a member of the advisory board and a farmer himself put it, the program “purposely, as much as possible, avoided using their own office staff to be the liaison or the extension people that were going out and answering the farmers' questions. In almost all cases they would pay the [farmer representatives] a basic fee for the time that they

put in on it. . . . They were farm people as opposed to South Nation staff. . . . That was very important.” In fact, so important are trust relations that the coordinator of the program even draws a distinction between older and younger farmer representatives:

You send out a couple of aggies who just got out of school and the farmer’s saying ‘Oh crap, who are these kids coming up my driveway?’ Whereas our farmer field reps, you know, we cherry pick ‘em, we ask around in the community . . . We cherry pick these guys and ladies, so when they seem ‘em coming up the farm lane, then they know that they’re getting somebody who knows what’s going on in the real world. And that has been in my opinion the most critical part to our success.

The coordinator of the Piasa Creek program claims that this same relationship holds for other water quality projects besides nutrient trading: “I’ve talked with other watershed managers, and the really successful programs are managed by people that came from farm backgrounds – that are from that same community.”

An important note here is that this is more than merely an emotional or parochial sentiment on the part of farmers. This precursor of trust has a pragmatic side to it as well, particularly in cases where conservation structures are being installed in farmers’ fields with real effects on their production systems. A case in point is the Piasa Creek program, one of whose conservation agents actually drafts the engineering plans for such structures:

You know, I can go out and lay out five basins, five terraces, or five dry dams and make it very farmer-friendly, where they can farm it but not take land out of production. You get somebody that’s not from a farming background, they’re probably gonna build stuff that’s not farmer-friendly. It’ll work, but they’ll probably over-build, and it’ll probably be a lot more expensive to install, compared to something that NRCS or Soil and Water Districts have a tendency to design.

He continued with the surprising statement that even trained and certified engineers might not be trustworthy in such situations:

Most public engineers don't know anything about how to put farm-friendly stuff on farmers' ground. You know, they don't teach you that in engineering school. I mean, they know how to build everything but usually they don't have the standard specs like NRCS does – we've been doing this for 75 years, so we've got proven records on how to build stuff, and we're farmer-friendly.

Note too the recurrence of an earlier theme: these actors are “farmer-friendly,” on the side of and acting in the best interests of the farmer.

5.3.3 The Moral Consequences of Pollution

Because the large bulk of research on social embeddedness in markets has been focused outside of the agricultural sector, there has been little reason to consider the specific context of farming and conservation. As a result, one of the reasons why trust plays such an important role has been completely overlooked: it is because we are dealing with the issue of pollution. The polluting of a public natural resource carries consequences which spread far beyond issues of mere economics.

I have mentioned farmers' strong aversion to regulatory agencies and the ways that localized non-regulatory agencies help assuage that fear. Farmers may not always know if and when they are contributing nonpoint source pollution, but they know it is a bad thing. When they know they are guilty of it there is a complex reaction, part of which concerns who, if anyone, they should inform of their problem. This is well captured by a long statement from the coordinator of the South Nation program in

Canada, who weaves in the way in which an embedded intermediary helps provide an outlet for the worried farmer:

When you talk to a bureaucrat, I don't care you are, you don't tell 'em everything. The interesting thing that a lot of our field reps are telling me is that they're almost like the local psychologist. You know, farmers, they don't like to go out and say, 'Well I'm stupid here.' They don't like to go out and say 'Well I really screwed up' – you know – 'Geez, I got 10 dead cows here behind my barn, if anybody finds out about that I'm screwed.' You know, they're no different than you and me. So what the farmer field reps are telling me is that they'll go out there and the farmers will show them stuff that they will never, ever show anybody else, including another farmer. They will talk to them about the problems they've got, and the farm communities that are under stress. They're able to vent, and because of the stature that these guys have in the community, because people know who they are – these guys have been farming and they know their way around the bureaucracy, so they're able to sort of be a little bit of a counselor to some of these guys. . . . They're talking to a peer, and they're able to say 'Yeah, you're right, I should fix this up.' Whereas if you're talking to an aggie, some of the younger people, now you're not going to tell them anything, just 'Get in here' and fill out the forms and go away again.

This moral element expands into the element of public perception. Farmers are not regulated by Clean Water Act legislation and can actually get away with some forms of pollution that would not be tolerated by point sources (direct discharges by herds of cows into streams, for example). But this does not mean that they do not take seriously their charge as land stewards, or that the community's opinion of their farming practices is not important. Here is how an agent from the Kalamazoo program puts it:

You know, the average Joe lives in a house and has their yard and do whatever they do, but the farmer is kind of looked at as, you know, they own all that land out there and many times somebody just sees a farmer out there spreading manure or spraying the fields with whatever – everyone assumes that it's bad, they assume that it's gonna have a negative effect on the environment or them.

Another agent associated with the same program made a similar comment but broadened the linkage to include the demographic changes affecting rural communities as increasing numbers of urban and suburban families move to the country, bringing their lack of familiarity with agriculture and their value systems with them: “Some of it’s a level of trust – we had a lot of discussion because of public scrutiny on the agricultural community, misperceptions of ag practices, the perception of [being seen as] polluters, as [people] move out into the country and come face to face with a cow.”

Hence the increased comfort level farmers feel with agents who know and understand the reality of agriculture, and their tendency to work through those agents rather than disembodied actors. They allow the farmers to engage with the act of conservation without feeling they are being judged for their environmental problems. Without the trust factor, they may remain in their comfort zone, removed from the public but also removed from environmental improvement initiatives.

5.3.4 Trust as Risk Management Strategy

Farmers on the whole tend to be risk-averse, at least in comparison with conventional entrepreneurs (Moschini and Hennessy, 2001; Pannel et.al., 2008). When it comes to adoption of conservation practices their inherent skepticism is even more elevated. There is the risk of productivity decline if the conservation practice is poorly conceived, poorly implemented, or poorly managed – and this is rarely matched by the possibility of a productivity *increase* no matter how well the practice is implemented, at

least in the short term. According to the coordinator of the SMBSC program, it is not that farmers are opposed to conservation measures on principle or even on the basis of cost; what they are wary of is any threat of yield loss. The farmer

doesn't necessarily want to see the return [on his investment in a conservation practice] so much as no loss. Everybody's willing to participate if there's no damage. What causes problems, at least in my experience in working on these projects, is, ok we'll put in a pattern tile and, what if I lose 10 bushels an acre, or what if I lose part of my crop in that area? It's not so much 'What does it cost me? What's my return on investment? How quickly can I pay this off?' It's 'do no harm.' I don't wanna lose bushels or pounds per acre because I'm participating in something that's different. That's what you have to overcome to get people to commit to do these types of projects. . . . Farmers like to see numbers, they like to see who's done it. Am I the cutting edge – I don't wanna be the cutting edge. I know that if I plant exactly the same way my grandpa planted, if I run this farm exactly the same way daddy ran the farm, I know exactly what I'm gonna get. And as long as you don't interfere with that, I'm game.

The role of the mediating agent, therefore, becomes one of reassuring the producer that this risk is minimized, or that it is offset by sufficient financial incentive. This reassurance will fall flat unless there is a pre-existing trust relationship.

Even more important than the risk of a decline in output is the risk of being caught in a regulatory net. A barrier to more widespread adoption of conservation stems from farmers' fear that adoption will lead to the conversion of a voluntary scheme into a mandatory one – that participation will serve as the "Trojan horse" by which regulations will be brought down on them through the back door (C. Schary, pers. comm.). Recent work by Moore et.al. (2008) has highlighted how a severe distrust in environmental regulatory authorities can almost single-handedly stifle the adoption of

conservation practices in certain social contexts. More importantly, it can lead to a shift in program oversight from a regulatory agency to a local group of stakeholders and conservation officials in whom farmers have a great deal more trust, in turn resulting in enhanced adoption of conservation (Parker et.al., 2009).

As an example from water quality trading, individuals associated with both trading programs in Ohio referred to the Ohio EPA's initial desire to retain the right to enter farms in order to verify BMPs as a "deal-breaker." An agent from the Kalamazoo program in neighboring Michigan elaborated:

When you're working from the EPA or the Department of Environmental Quality at the state level, when you're working at that [level of] 'Hey if we find it, you're going to start the \$10,000 a day fines,' I mean, who's going to work with you? Who's even gonna turn in their neighbor to some system like that?

Embedded local agents serve as a safer guide around the potential pitfall of regulatory entrapment. Because they know agriculture and because their mission statements position them as farmer advocates, farmers trust that they will help guide them through the conservation process without the threat of increased regulation. For starters, they are simply not enforcement agents; they have no legal capacity to do so. In the South Nation program, for example, farmers look on agricultural officials "with a neutral-to-positive point of view, whereas the Ministry of Environment was, because of their predominantly and almost totally regulatory nature rather than extension or consultative nature, sort of like the police coming in." And this sentiment is explicitly backed up by the farmers themselves, one of whom told a technician from the Alpine

program:

'We were concerned that you were going to tell us how to run our farms.' They were concerned that there would be so many strings attached that we were gonna tell them how to run their farm. That seems to be where the reservation was. And they did not dream that up – they've had other experiences where that was the case. And so they just lumped this [trading program] in with that and we had to get past that.

Second, they fight for the farmers, such as the agents of the Alpine program who had to negotiate with the Ohio EPA and promise to use the highest NRCS standards for the design of all BMPs and keep a thick file history on each practice in return for the environmental agency's promise to stay off farms.

Finally, conservation agents approach farmers not just with open ears but with solutions. Their role in the relationship is to bring a suite of tools from which a farmer can choose the most appropriate solution to his environmental problem.

When it comes to working with agriculture, we're not a regulatory agency. If you work with us it's completely voluntarily – no one says you gotta work with us. So we go out when people ask us to come out. We don't go knockin' on doors or anything like that, telling 'em that we're coming and you gotta do this. . . . When we go out to a site we're there because they've requested us to be there, and we usually have in our bag of tricks all these government programs that we try to help people with.

This voluntary aspect is critical: it engenders farmers' trust because in the hands of the local technician rather than state or federal agents, these conservation options can be considered and implemented with little of a regulatory follow-up, and indeed with the possibility of a financial subsidy.

5.4. Is All Trust the Same?

A final word is in order before we wrap up the discussion on trust. As noted before in regards to the mechanisms of information transfer and problem solving, we need to be careful in pushing too far with the direct parallels between research on trust from the wider scholarly world and the present research. Certainly the trust component is a significant factor among the actors involved in water quality trading programs, but it is of a slightly different sort than the form of trust typically examined in economic sociology studies. It is not between two actors or firms operating at the same institutional level. We do not speak, for example, of the trust between farmers as sellers of credits and PS dischargers as buyers. In fact, there is typically no relationship at all between the sellers and buyers in a nutrient trading market. It is the intermediary that is so critical to the entire equation, and it is the trust relations between farmers and intermediaries that prove so crucial to the question of ensuring the supply of nutrient credits.

Notice, however, that the related notion of *reciprocity* is not a significant factor here – the farmers trust in the intermediaries to look out for their best interests and not assume the role of regulators, but it is not necessarily a reciprocal relationship in the same way that reciprocity emerges between firms in a marketplace. County conservation agencies extend a helping hand to farmers and prove to be the crucial link between them and the program’s administrative structure, but the farmers do not return the favor. It would be a stretch of the concept of reciprocity to say that farmers’ mere

participation in nutrient trading is a reciprocal exchange for the services they receive from the broker.

Nevertheless, this means only that the nature of the trust relations in water quality trading are contextually different than those in a more conventional commodity or service market. Trust is no less *important*, it simply manifests in a different, less symmetrical form. If we look at one of Uzzi's basic descriptions of how trust operates, we see that fundamentally his conceptualization still holds. Part of the economic power of trust is that it "promotes voluntary, nonobligating exchanges of assets and services between actors" (Uzzi, 1996: 678). Most fittingly, this is entirely in line with the very institutional mission of SWCDs. Because they do not possess any regulatory or enforcement capacity, and because they do not offer any economic incentives themselves but rather serve as the administrator of funds appropriated through other entities, in a sense the *only* form of exchange they are left with is "voluntary, nonobligating" exchange. One might say that the need to build trust relations with their client base is structured into the very DNA of conservation agencies, because it is only through trust – not through coercion, regulatory enforcement, or direct payments – that they will accomplish the relationships with farmers that are necessary to implement BMPs.

This is an example of what Gulati calls "deterrence-based trust," in which "trust can arise when untrustworthy behavior by a partner can lead to costly sanctions" (Gulati, 1995: 93). The relationship between conservation agents and farmers may be asymmetrical, but it is an asymmetry that can uphold the integrity of a conservation

initiative. Consider the phenomenon from both sides of the relationship. In order for farmers to participate in (and benefit from) a conservation scheme they must trust the local agents not to report any environmental problems to a regulatory agency.

Overcoming this trust barrier is a significant task. But the conservation agency in turn must uphold the basis of this trust out of self-interest, because if they act opportunistically or paternalistically they could rupture the relationship with the farmer, lose his participation, and ruin an opportunity for more conservation – which is, after all, their very *raison d'être*.

Chapter 6: Consequences of Increased Marketization in Water Quality Trading

Introduction

In the economic sociology literature one can hardly discuss social embeddedness without also discussing its antithesis: marketization, or the degree to which economic relationships are characterized by the removed, rationalistic, profit-driven calculus of neoclassical theory. In Uzzi's (1996, 1997) work, these are referred to as "arm's-length" relationships between economic actors, in which "self-interest motivates action, and actors regularly switch to new buyers and sellers to take advantage of new entrants or avoid dependence" (Uzzi, 1997: 36).

In most economic sociological work arm's-length relationships and socially embedded relationships exist on opposite ends of the same continuum. They are the two possible manifestations of a single dichotomous variable. However, when we are dealing at the program/institutional level rather than the individual/firm level, as in the present study, we have to modify this logic on two grounds. First, we are not dealing with relations *between* nutrient trading programs but between actors *within* programs. In other words, a program is "embedded" not to the degree that it features close-knit ties with other programs, but to the degree that the ties between its own internal actors are

close-knit – namely the intermediaries and the credit sellers. Second, it is possible for a program to be simultaneously embedded *and* market-like in its orientation. That is, in the present study we are not dealing with a single dichotomous variable, but with two closely linked but distinguishable variables: degree of embeddedness and degree of market orientation. The analogue to Uzzi’s arm’s length ties in the sector of water quality trading is how market-oriented a program is, or to what degree the rules which structure the program attempt to mimic the conditions of an idealized free market. It is important to note how closely the two are tied. While it may be true that a program can simultaneously use locally embedded relationships (i.e., a county SWCD as intermediary) and evince a market orientation, what is under scrutiny here is the degree to which the latter affects the former’s ability to result in program success.

Table 6.1: Degree of Market Orientation of Functioning Water Quality Trading Programs

Trading Program	State	Price market-based?	Farmers compete?	Intermed. private sector?	Compen. market-based?	Credits calc. online?	Link betw. buyer-seller severed?	Score
Piasa Creek	IL	-	-	-	-	-	-	0
Kalamazoo River	MI	-	-	-	-	+	-	1
Rahr Malting	MN	-	-	+	-	-	-	1
SMBSC	MN	-	-	+	-	-	-	1
Tar-Pamlico	NC	-	-	-	+ / - *	-	-	0.5
Alpine Cheese	OH	-	-	-	-	-	-	0
Great Miami	OH	+	+	-	+	-	+	4
South Nation	ON	-	-	-	-	-	-	0
Clean Water Services	OR	-	-	-	-	-	-	0
Conestoga River	PA	+	+	-	-	+	-	3
Chesapeake Bay	PA	+	-	+	+	-	-	3
Red Cedar	WI	-	-	-	-	-	-	0

* In the Clean Water Services program, several positions are directly funded by the credit buyer, which is not considered market-based; however, there is now an additional financial incentive whereby the intermediary gets compensated based on the percent of implemented projects that are successful - this is considered partially market-based

Table 6.1 lists the twelve functioning water quality trading programs along with the six most relevant data categories that together form an index of market-orientation. The first column asks whether the price of a nutrient credit fluctuates according to market forces. The second asks whether farmers compete with one another to secure a BMP contract for a lower price. The third asks whether the intermediary is a private- or public-sector entity. The fourth asks whether the intermediary's compensation is based on a fluctuating criterion or whether it is a flat rate or fixed percentage. The fifth asks whether nutrient credits are calculated and/or tracked through an online registry. And the sixth asks whether the attempt is made to make nutrient credits "anonymous" by severing the link between any one credit and the farm that generated it. Each variable is rendered as a dichotomous factor such that a positive answer indicates a market orientation while a negative answer indicates a less- or even non-marketized approach.

The results break programs into two broad categories: three programs have scores of 3 or higher and thus stand out as being market-oriented (Great Miami; Conestoga; Chesapeake Bay), while the remaining nine do not score higher than 1 and can be classified as non-market-oriented. I also point out that this categorization has a certain amount of face validity: one could argue whether some of the variables in and of themselves are true indications of a market orientation (for example, an online credit registry), but there is one particular characteristic that is the most indicative of a free market philosophy. In neoclassical economic theory, the efficient-market hypothesis rests on a single element that regulates the supply, demand, and distribution of goods

and services: price. In the pure neoclassical model “exchange is limited to price data, which supposedly distill all the information needed to make efficient decisions” (Uzzi, 1997: 36). Note that the three market-oriented programs are also the only three in which price fluctuates according to market forces. In the case of the Great Miami and Conestoga programs, price is determined by a reverse auction bidding system in which farmers compete to put in the lowest bid for installing a given BMP; in the case of Pennsylvania’s Chesapeake Bay program, the price is determined through one-on-one negotiations between the credit broker and the credit buyer, much as it might be in a more conventional business deal.

My purpose in this chapter is not to quantitatively operationalize this variable of market-orientation and link it statistically to program outcomes. The same data constraints as before would plague such an effort. Rather, my purpose is to provide a more substantive analysis of the concept of market orientation within water quality trading, for it effectively ties together many of the themes broached in the dissertation so far. As I will illustrate below, it has a mitigating effect on the power of embedded relations to achieve program success, and it serves as a test case for the more abstract, theoretical models of how a nutrient trading market should operate.

6.1. Explicitly Market-Oriented Programs

It is important at the outset to briefly establish the point that the three market-oriented programs are not so by accident but by explicit intent. All belong to the latest

generation of nutrient trading programs and were created in order to counter some of the problems that plagued earlier programs (see King and Kuch, 2003) by switching to a more consciously market orientation.

The Conestoga reverse auction program in Pennsylvania was devised and overseen by World Resources Institute, a Washington DC environmental think tank that developed NutrientNet, the “online credit estimation tool and marketplace” for ecosystem service commodity credits. The market logic underlying the choice of a reverse auction pricing system is overt: “The very nature of reverse auctions makes them cost-effective as they allow auction administrators to identify and purchase the lowest cost environmental outcomes” (Greenhalgh et.al., 2007: 1) The day-to-day administrator of the Conestoga program was a staff member of the Pennsylvania Environmental Council, who stated, “What we were interested in was to see how using an online tool like Nutrient Net could maximize the cost-effectiveness of conservation dollars, in terms of reducing phosphorus runoff. . . . We wanted it to be like a real open market where a farmer could bid whatever he wanted to do the BMP.”

The Great Miami trading program in southwestern Ohio is also based on a reverse auction bidding system. The competitive nature of this approach to conservation can be seen in the statement of one of the county SWCD agents who helped implement the program. Here he discusses the choices that a farmer faces when deciding how high to bid his BMP:

Some of them guys will put in their bids – like one guy, he put in a bid at \$1.29. And on his \$1.29, if he would have put in at another dime [i.e., raised his bid to \$1.39 per

lb.] it would have come out to be another \$10,000. I said, 'You gotta be careful. Is it going to be worth trying for ten extra thousand and not get it, somebody underbids you, compared to losing ten thousand there, or to put your bid in higher and lose your whole eighty thousand worth of cost share?'

The program's market focus is demonstrated more explicitly by its coordinator, who works for the watershed-wide Miami Conservancy District. I asked him if he anticipated or had experienced any difficulties recruiting farmers for the program. While not rejecting the importance of having a local intermediary, his response was reminiscent of the responses by Uzzi's (1996) arm's-length respondents: "Of course [farmers] are gonna come to the table. Once you start writing checks, everybody is in the room."

Finally, the Chesapeake Bay in Pennsylvania program is not characterized by a reverse auction scheme, but features the only instance nationwide of a private-sector, for-profit credit entity serving as credit broker. A number of different statements by the head of the firm illustrate the market-oriented or arms' length approach, such as when he explained how he leverages the buyer's contract against the seller's contract for maximum advantage:

This is the big [company] secret. We do this [contract], and we hold these certifications. . . . So we've got two contracts, one with the farm and one with [the buyer]. The trigger with the farm is when we sell the credits we implement that BMP on the farm. But [our company] retains the rights to those credits. . . . It really is a futures market. So what we've done is we've set it up so that we've got all of these contracts in place that we can flood the market and say 'We're ready to go.'

We can leverage these contracts to say we're ready to sign these kinds of long-term agreements.

The focus on BMPs and conservation that emerges from any conversation with a SWCD is replaced by a focus on market parameters and other business concerns disembedded from social relations.

6.2. Explicitly Non-Market-Oriented Programs

While the three programs just described can be classified as explicitly market-oriented, it is not the case that the remaining programs exist in a state of ambiguity, or that they strive to be market-oriented but fail in some regard. Rather, most of these programs contain features and even philosophies that are explicitly *non*-market-oriented by design. The orientation away from a market model manifests in the form of four particular program characteristics.

6.2.1 Control Over Price

As discussed above, the fluctuation of the price of a good or service is one of the most fundamental criteria for classifying the marketization of any economic sphere. True to form, in many of the non-marketized trading programs the coordinating body sets a price per nutrient credit that never fluctuates over the life of the program. Some of the programs set the price so that it is equivalent to the price a farmer would receive from a traditional government conservation program (e.g., Piasa Creek; Red Cedar;

South Nation). Others set it at some percentage of that level, reasoning that farmers should have to pay for some of the practice out of pocket so they have more of an ownership stake in it (e.g., Kalamazoo). In some form or another, in all of these programs the price is pegged and does not change. This stands in sharp contrast to a market-oriented program such as Chesapeake Bay, in which the credit broker here refers to sharp fluctuations in price owing to PS dischargers having to offset their surplus emissions at year's end: "There's gonna be the spot market at the end of the year so they don't get fined – well you better believe that these phosphorus [credits] that I'm sitting on, the price has just tripled, because the need, the demand has just tripled."

In some non-market-oriented programs there is even left open the possibility of outright manipulation of the price in order to accomplish certain goals, such as spreading the money out across more farms or meeting a certain remediation goal more quickly. The coordinator of the South Nation program makes this explicit:

[We] can alter the grant rate or the grant maximums to change the market conditions. So right now, for instance, manure storage: we'll offer a 50% grant up to a maximum of \$10,000. Well, a manure storage is gonna cost you 30,000 by the time you're done -- well the guy gets ten, he's pretty happy to get that. And our Clean Water Committee says, 'That's enough – ten thousand, that's enough.' . . . But if we got to a point where we were running out of phosphorus credits and we needed to alter the market, they could increase either the grant maximum or the percentage . . . so that might entice a few more people to get into the game. *So we think we could manipulate the market to alter the supply and demand of phosphorus credits.* (Emphasis added)

6.2.2 Caps on Farmer Reimbursement

Some programs have rules, either explicit or informal, prohibiting full cost-share for any project: they may subsidize up to a certain percentage of the total implementation cost, but never as high as 100% (Alpine; Red Cedar; Piasa Creek; South Nation). The main reason for this is exemplified by the Piasa Creek project, “We won’t go 100% on any project, we want the landowner to have a certain amount of buy-in just to make sure that they’ll take care of it for the long run.”

These views stand in sharp contrast to a market-oriented pricing scheme in which theoretically there is nothing preventing a farmer from being subsidized at the full rate. There is even the possibility that a farmer could put in a winning bid for more than the actual cost of implementing his BMP and thus profit from the scheme. In fact, this exact scenario transpired in the Conestoga project, causing one of the few instances in which the primary intermediary associated with a program hesitated to call the program a success: “By giving them the opportunity to go for 100% cost share – that’s great on their part if nobody else puts in, but . . . a lot of the other programs, the reason they don’t cost-share up to 100% is they want to have that operator have some of his own money in it to make him have some responsibility and some reason to want to upkeep it.”

6.2.3 De-Emphasizing Market Efficiency

Transaction, administrative, and production costs loom large in any neoclassical economic analysis. The focal point of market efficiency demands that such costs be diminished in order to boost the overall profit margin. The language of trading documents linked to market-oriented programs makes this clear, as evidenced by a World Resources Institute report on reverse auctions (Greenhalgh et.al., 2007). Non-market-oriented programs evinced no such philosophy however. Indeed, the coordinator of the South Nation program all but bragged that PS dischargers in his program face a stiff rate of \$400/kg – any discharger in the watershed is required by law to purchase offsets, and since his agency is the only trading broker they do not have to make their price more competitive. Or as a conservation technician for the Alpine program stated: “One of the things that made this program work is, we decided not to go out there and get the most practices for the cheapest. I’m not sure if it will work if you’re trying to get as many credits as cheap as you can.”

6.2.4 Equity as a Specific Goal

In traditional economic logic, market efficiencies are the guiding impetus for action and considerations of distribution or equity are of little interest. A direct outcome of the preceding point, however, is that in non-market-oriented trading programs equity rises to the forefront as a concern. We see here a theme that will emerge again later: the guiding philosophy of the county conservation offices is to serve as many farmers as

possible and to bring a conservation ethos to as many farms as possible. Distribution concerns explicitly overshadow production concerns. It is more important to the core mission of conservation offices that a BMP is adopted on fewer acres but more total farms, than adopted by a handful of very large farms across large acreages. Note that this distinction also characterizes certain conservation programs directed by the federal government. The widely-known EQIP conservation program, for example, “considers various social equity concerns that are not represented in the reverse auction, such as being a low-income farmer” (Selman et.al., 2008: 5).

A direct outcome of this philosophy is the desire to downplay rather than stress the competitive side of BMP adoption. The statement from a government regulator affiliated with the Cumberland trading program in Wisconsin is typical. Referring to the price that participating farmers receive per acre for the adoption of no-till practices, he states, “In [this] county, you sign up for conservation tillage, you get x. The reason for that was they didn’t want some farmer in the next county doin’ the same thing and getting a lesser rate or getting more.” The Cumberland program also sets a cap on the number of acres any farmer may enroll in the program, driven by the same logic of equitable participation. The same individual continues:

[You] don’t wanna turn away a farmer ‘cause he gets mad, he’ll never come back, he’ll tell all other farmers and they’ll get mad, you know – so we try and bring everybody in, give ‘em a little. There is a limit on how much each farmer can have [in the program]. So we try to spread it around, just so we get more interest – that’s critical. I mean, you could do one farmer, enroll his whole farm, let’s say, and shut off the other 30 – that wouldn’t be very smart.

6.3. Consequences of a Market Approach

If the embeddedness of a program in the form of a dedicated intermediary with local roots has a positive outcome on program establishment and success, then how does an explicit market orientation affect a program's success? Recall that it is possible for a program to both use a locally embedded intermediary and adopt a market approach, so the question is not about one versus the other, but rather the interaction effect that a market orientation may have on any program. In my discussions with various program participants as well as an examination of program outcomes, a number of themes emerged that speak to the potential consequences of a market approach when applied to water quality trading. A key theme underlying these observations links us back to Chapter 1: the tension between an efficiency-oriented market approach and the oversight needed to ensure environmental improvement. As a program gradually sacrifices some of the latter in favor of the former, the data indicate at least five potentially negative outcomes.

6.3.1 *Disparities in Farmer Participation*

The basic measure of a successful PS-NPS trading program that I have adopted is the number of BMPs ultimately implemented on farms, but this leaves open two questions: which BMPs, and which farms? Consider the trend of using reverse auctions to solicit bids from farmers. The Great Miami program boasts some of the lowest overhead costs of any program nationally, but one effect of such an efficiency-

oriented approach is that the BMPs sought are not necessarily the most sustainable ones or the ones that best fit into a farm's long-term nutrient management plan. Rather, they are chosen by an advisory committee on the grounds of cost-effectiveness: which practices return the highest number of credits for the lowest cost. As the coordinator of the program claims, "The bid process is just about the numbers, and not what type of practice is being implemented. Our primary focus is how many credits the agricultural project will generate, and how much money the producers want" (quoted in Zwick, 2008c). Standardization of the commodity in the form of a fungible nutrient credit allows any notion of ecological ranking or prioritization to be dispensed with in the name of efficiency.

Another example comes from the Chesapeake Bay program, which is administered by a private broker. A number of poultry farms in the watershed are faced with a burdensome nutrient problem: the huge piles of chicken manure that build up but cannot be applied to their fields because of phosphorus saturation in their soils. The sole practice that generates nutrient credits in this program is not any on-field technique or storage structure on the farm; it is simply hauling the manure out of the watershed in trucks and applying it to fertility-depleted sites in other river basins. This very cost-effective maneuver is a business-like transaction with the farmers that allows the generation of nutrient credits without effecting any change in the industrial farm practices which led to a surplus nutrient problem in the first place. The credit broker himself refers to the practice as going after the "low-hanging

fruit.” It may very well remediate a nutrient problem and generate nutrient credits which can be sold to a buyer, but its wider effects on farm ecology and farm sustainability are questionable.

Another consideration, hardly addressed in the literature, is the relationship between water quality trading and farm scale: do farms benefit differentially when a more market-like approach is used? From the point of view of cost-effectiveness the answer should be clear. A single large farm, particularly a livestock operation, could account for the same number of remediated nutrients as tens of smaller farms. And because trading requires individual relationships with each individual farmer, the difference in transaction costs could be significant. Jarvie and Solomon are some of the few authors to speak of this issue, and their conclusion is not surprising: “Too many nonpoint source participants may result in a trade that is difficult to arrange and enforce. The cost of educating and financing many small nonpoint BMPs is larger and requires more monitoring than would one large nonpoint source” (1998: 145). The Chesapeake Bay program again provides evidence of this fact. The program’s broker readily admits that it is far easier and more rational for him to deal with the large poultry farmers in the area than the diffuse network of small-scale operators who might offer only a fraction of the possible nutrient credits. And by his own admission, from an environmental point of view the opposite trend ought to prevail: it is the small operators who individually showcase the most degraded farms with the greatest sediment loss to water bodies and who collectively comprise the greatest discharge of

NPS nutrients into the watershed.

A related issue concerns how a program's structure affects who is likely to participate in the first place. In the Conestoga program, the reverse auction was structured in such a way that farmers could go online and see how their bids stacked up against competing bids and change theirs accordingly. There is a certain irony to the fact that a pricing system which required internet access in order to participate was used in Lancaster County, home to the second-highest concentration of Amish farmers in the country. Except in rare cases, Amish farmers do not have access to the internet, meaning the program's structure automatically favored more digitally-sophisticated farmers, which are likely to be the county's larger, more capitalized farms. Several affiliates of the program raised this point and conceded that the farmers who ultimately participated were large farms able to bid on large-scale BMPs that would return a high credits-to-cost ratio.

Lancaster County is also a part of the Chesapeake Bay program, which features a similar disparity regarding farmer participation. An administrator of the program noted that the county's agricultural base consists of a handful of very large, intensive farms and a larger number of dispersed, small, mostly Amish farms. He estimates that 80% of agricultural production takes place on only 20% of the farms – and because the most productive farms are also the largest and the most nutrient-intensive, they are also the most likely candidates for trading: “Those little Amish farms, trading isn't for them right now.”

This disparity is in part a consequence of regulatory restrictions – small Amish farms frequently do not meet the baseline status for nutrient management set by the state and thus are not eligible to produce credits – but it is also a product of basic market forces. Consider the incentives to a credit broker when faced with two distinctly different farming populations:

My 750,000 pounds of nitrogen only represent 26 farms. They're the biggest, regulated farms in the state. And it's because they're producing the most manure, I'm getting the biggest bang for the buck, because I don't wanna have to sign 50 different contracts to get 24,000 pounds of nitrogen. I wanna sign one contract with a farmer to get that many.

In the cases of both the Conestoga and the Chesapeake Bay programs the issue is not one of poor efficiency, for it is true that the programs fund a larger quantity of nutrient credits when they target larger farmers. A research report on the Conestoga program, for example, found that the average bid price dropped considerably over the course of two auction rounds, from \$10.32 per pound P in the first round to \$5.06 per pound in the second round, implying that cost efficiencies were already appearing (Greenhalgh et.al., 2007). A later report noted that the program was seven times as cost-effective as EQIP, a government conservation program (Selman et.al., 2008).

Rather, the issue is the underlying philosophy of conservation. A county agent who served as one of the primary intermediaries between the Conestoga program and Lancaster County farmers expressed some amount of reservation when I asked her opinion of the program and explained, "The thing is, do you cost-share a project at 100% just because they rank out at price-per-pound and get, you know, five people with

projects funded, or is it more efficient for us as an overall group to spread that money out and help more operators? . . . I definitely think that more people could have been assisted if it was more of a typical cost-share-type program.”

Interestingly, even the pro-market literature recognizes this disparity. A report written by the organization that created the Conestoga trading program notes that, while the program was far more cost-efficient than EQIP in terms of pounds of P remediated per dollar spent, “EQIP considers various social equity concerns that are not represented in the reverse auction, such as being a low-income farmer” (Selman et.al., 2008: 5). To be fair, it is not the charge of a market model to consider “social equity concerns.” But this raises the troubling question of who gets left out as a sector moves from an explicit equity orientation – “Our money gets spread out over many, many more farmers. We could suck it all up into a couple of big storage projects, but we say ‘No, no, that’s enough’ – to an explicit market orientation, in which the focus is on getting the “most bang for your buck” or choosing BMPs by “picking the low-hanging fruit.”

6.3.2 Extrinsic Incentives and Market Exploitation

The recent popularity of behavioral economics has brought to light an understudied line of research on intrinsic versus extrinsic motivations and what several authors call “crowding out.” Intrinsic motivations refer to feelings of pride or altruism that inspire action regardless of extrinsic motivations, which might include carrots

(economic gain) or sticks (regulations). Inspired by a number of economic articles from the early 1970s (Titmuss, 1970; Solow, 1971; Arrow, 1972), Frey and Oberholzer-Gee construct a theory that “intrinsic motivation is partially destroyed when price incentives are introduced” (1997: 746). They argue that these altruistic or public motivations are “crowded out” by private incentives, which fundamentally alter the decision-making calculus used by individuals.

In a fascinating psychological experiment Reeson and Tisdell (2005) found that an initial willingness on the part of study participants to contribute to a public good was further enhanced when a financial incentive was introduced, but then dropped to well below its initial level when the financial incentive was subsequently taken away. When the incentive was introduced, “People who had been making voluntary contributions in the initial stage were now seeking to profit from contributing” (Reeson and Tisdell, 2005: 18). When the incentive was then removed, the initial voluntaristic incentive did not reappear. Rent-seeking did not just temporarily replace altruistic behavior, it permanently crowded it out. “It appears that introducing the market-like institution has triggered a ‘market instinct’ – people attempt to maximize their self interest, as they have learned to do in other markets. In many ways this is a good thing as markets have a proven ability to reveal information and allocate resources efficiently. However any pre-existing spirit of volunteerism is likely to be lost” (Ibid: 19).

The authors speculate on how these results might influence environmental policy, and one wonders whether there are parallels between their findings and the

introduction of a similar market instinct in the case of water quality credits. If payment for conservation practices is turned from a simple subsidy, the amount of which farmers have no control over, to a competitive bidding system, will this change the decision-making matrix that farmers use? In particular, what happens if a competitive bidding system is combined with a geographic limitation that leaves a very limited set of farmers eligible to participate? This is what happened in the case of the Conestoga trading program in Pennsylvania.

The Conestoga administrators hired an engineering firm to conduct follow-up audits on projects that were installed by farmers. Having done consulting with many of these same farmers in the past, and with unique access to their records for the purposes of the program audit, the head of the firm discovered something the program administrators never knew: the farmers had essentially formed a cabal and manipulated the program by banding together to over-inflate their bids in order to profit from the BMP subsidies. His lengthy account is worth quoting in full:

Those farmers figured out the reverse auction. Those farmers ended up making about \$50,000, plus the implementation of the projects on the ground. . . . They gamed the system. . . . What those farmers did is, 'Okay, if I'm gonna get money from the reverse auction, I am gonna jack up what the construction costs are gonna be.' PEC [the program administrators] had no idea what the construction costs were. So the farmers jacked up the construction costs, came in with this number, and then when we were designing these projects we're like, 'These projects are coming in \$75,000 under budget.' And the farmers are like, 'Yep.' But they got the money, 'cause they did it on the reverse auction – the lowest cost. There was no checks and balances in it. There was no competition, basically. It was five guys, they all got together and said 'We're gonna do the same BMPs, we're gonna put in poultry stacking structures, and we're gonna dictate what the price is'. . . . These five guys basically got into the

know and were the only ones doing the reverse auction. It sucked up all the money from the reverse auction and each of 'em made between 50 and 75,000 dollars.

It is necessary to clarify several elements of this situation. First, this was the first round of the Conestoga bidding and not many farmers knew of its existence at the time. The program also went through a second round that did not result in any gaming of the system, so the exploitation by those farmers can be chalked up to a lack of competition among the sellers as much as it can to the market structure itself. Second, from a pure market perspective there is nothing inherently wrong with what the farmers accomplished; it was not illegal or even contrary to program rules per se. But the larger point is that when BMP implementation moves from a cooperative effort between actors for the purpose of natural resource conservation, to a more competitive structure between a state agency and a set of farmers they do not know, the mentality of the actors moves from one characterized by trust, reciprocity, and goodwill to one characterized by self-interest and rent-seeking. To a market purist the latter are positive forces that help achieve market efficiencies, but to a conservation enthusiast they prevent an optimal outcome from occurring.

In contrast to program exploitation, consider how in some circumstances the social/community embeddedness of an intermediary might act as a check on possible program fraud. The coordinator of the South Nation program informed me that there is no follow-up monitoring of BMPs for verification of credits generated, but he was quick to add:

The farmer field reps, we've got 'em scattered throughout, and these guys, you know, they live in the community, they go to the local dance halls, the local bars – if somebody's trying to screw the system, that's tough to keep that a secret out there. . . . A lot of it's based on trust and our knowledge of the farmer field reps and their knowledge of the area they're out there working with, so it's not an issue we have to spend a lot of time on.

6.3.3 *Self-Sacrifice by the Local Intermediary*

One of the more interesting interaction effects between market competition and embeddedness involves the compensation available to the local intermediary for the time and resources they provide to the program. In one rare case (the Red Cedar program in Wisconsin) the intermediary receives no compensation at all; in all other cases compensation ranges from an hourly rate to an administrative fee to an annual stipend. When programs are organized along non-marketized lines the question of compensation appears unproblematic, because the intermediary's compensation is merely a line item in the overall administrative budget and does not affect the amount of money that goes towards BMP implementation. In a marketized program, however, agency compensation becomes a transaction costs that drags down program efficiency. Specifically, what happens when the intermediary's compensation actually adds to the total bid price being advanced by a farmer in a competitive bidding system? The intermediary, whose goal is to get the most conservation on the ground as possible, is now paradoxically acting as an impediment to the implementation of more BMPs.

Due to the small number of cases in this study, there is only one program nationwide to which this question applies: the Great Miami program, which is the only

program whose market approach takes the form of competitive bidding not by farmers themselves but by county SWCD offices on behalf of farmers. The program's coordinator admits that conservation offices will be tempted to lower their own costs in order to make their bids more competitive:

We have some SWCDs that actually fund a portion of their involvement in the program through their bids, and others that don't because they wanna be as competitive in the process as they can be. . . . They may want to make sure that [a BMP] makes a certain price point cut, so they don't add any [of their own personnel] costs. Others might come in super-aggressive on the producer side and have some leeway. If anyone studies what gets funded and what doesn't – they might have a shot if they come in at 2 bucks, but they're gonna have a better shot if they come in at a buck-eighty. So that's just what's happening.

His observation was then borne out by county-level agents. One agent began by pointing out that when they are dealing with a large, capital-intensive project, the subsidy amount for the farmer over 15 years is typically tens of thousands of dollars, compared to which an agent's time represents only a small fraction of the total cost. But then he noted:

Agent: Now if you get some that you see it's really gonna skew 'em, you just gotta flat out back down.

Interviewer: You mean you're gonna pull off your own hourly [rate], or you're gonna tell [the farmers] that they need to come down on their [bid]?

Agent: No, we can back down on our hourly, we take a hit – like we got some that'll put no-till in, they're not real intensive, where you might only put in \$200 for your time, 'cause it's not gonna take a lot of time doin' this.

This sentiment was echoed by agents from several other counties. I asked another county agent how his office factors its own time into a farmer's bid and he responded

simply, “We don’t. . . . From right out of the gate I perceived that that would not be seen well by landowners, that I could theoretically knock them down by charging my own time.”

A third agent honed in on the underlying issue: whether a competitive bidding system may actually reduce the agency’s own performance outcomes. In the first round of funding his county submitted a number of bids but did not get a single one funded, owing in part to a miscommunication about eligible BMPs. In the second year, “We actually ended up lowering what our administrative costs were gonna be a good bit from the previous year’s, and we actually probably didn’t have enough in for administrative costs for what all it requires out of our office as far as workload, getting the project going.” Most tellingly, in the most recent round of bidding they decided not to submit any bids because of these previous experiences, and he indicated that in the forthcoming round he was unsure whether they would submit any either.

From a market perspective where efficiency considerations are top priority transaction costs are to be reduced at every turn, but given the peculiar social arrangements characterizing the world of agricultural conservation it seems that some amount of administrative costs are required in order to secure a sufficient level of intermediary participation. As the coordinator of the South Nation program artfully put it in regards to the level of compensation he pays his agents, “The old adage up here is, ‘If you pay peanuts, you get monkeys.’”

6.3.4 Severing the Link Between Trading and Water Quality Improvement

The fourth risk posed by a market approach to pollution remediation is potentially quite serious, for it represents a complete reversal of the very logic that undergirds the market approach in the first place: the idea that commodification and trading of pollution credits will result in a greater environmental benefit than the traditional regulatory approach. As I argued in Chapter 1, the environmental arm of the state has only signed on to the concept of water quality trading on the assumption that it will result in environmental improvement, their single most fundamental goal. But is this necessarily the case?

The danger is that as a market approach comes to dominate, the value of a commodity moves from one of inherent worth as measured through standard protocols (i.e., use value – the validity of a nutrient credit as determined by scientific modeling, approved by an environmental agency, and used by a PS discharger to meet its permit obligation) to one of mere perception (exchange value). In the larger economy the selling price of a given commodity is determined by supply and demand – in essence, an item's value is whatever the customer is willing to pay for it. The whole premise of water quality trading, on the other hand, is that trading should result in the same or greater environmental improvements than no trading. The environmental agencies which are charged with approving and overseeing water quality trading markets must ensure that the "value" of a unit of pollution is fixed at a quantity sufficient to ensure environmental benefit, not just buyer satisfaction.

In markets for normal goods and services, this link between quality and value is largely enforced by the invisible hand of self-regulation. If buyers perceive low quality in a given product, the supplier will typically be punished with declining sales. As a rule of thumb buyers desire a high-quality product and can tell whether they are getting one or not; the question of quality has an intrinsic meaning to both buyer and seller. One of the negative consequences of trading for pollutant credits is that this intrinsic motivation no longer exists. The commodity in question exists purely so that a PS discharger can meet its regulated effluent limit; the discharger's "desire" for the product is a forced desire borne of regulatory impetus. "The very good that is transacted in water quality trading markets has no meaning outside of the legal context; it is a legal right that is being exchanged" (Woodward et.al., 2002: 970)." So buyers and sellers are not motivated to purchase or produce credits of any particular quality, they are merely interested in the transaction taking place. They are motivated entirely by economic concerns: "Buyers in these markets want to minimize the price of purchasing an offset credit, and sellers want to minimize the cost of producing them. Both are only as 'quality conscious' as third-party trade regulators require them to be" (King and Kuch, 2003: 10353).

How do market-oriented programs deal with this mismatch between environmental goals and participant motivation? One approach, as detailed in Chapter 1, is to fall back on state oversight to counter the results of market pressure. "Since neither buyer nor seller of credits has any interest in whether the trade actually

achieves the reduction in pollution, it is essential to have a public representative, such as a governmental agency, representing the public interest to ensure that the contract terms of the trade are reasonable and are met" (Hanson and McConnell, 2007: 2). The problem with this approach is that governmental oversight adds transaction costs and inefficiencies to the operation of the market.

A second approach is to rely increasingly on the authority of science to validate nutrient credits. So long as the state trusts the modeling that underlies credit verification, science can stand in for the state and obviate the need for oversight of each and every trade. This approach brings its own set of problems, however, for in the case of ecosystem services the market and science meet at an uneasy interface. Science is a useful handmaiden when it allows the value of a commodity to be sustained or even increased, but the high costs of achieving scientific rigor can in turn bog down the market (Robertson, 2004).

When we are dealing with a market for NPS remediation credits so steeped in risk, the role of science is to provide a modicum of certainty by making commodities consistent and trustworthy. What happens when science's environmental efficacy interferes with market efficiency? For example, the scientific models underpinning the link between BMPs and nutrient credits are based on the best available knowledge at the time the models were created. What happens when new scientific data shows that a certain model was overestimating the number of nutrient credits being produced by a BMP? Past buyers would now be shown to have purchased too few credits to warrant

the language in their permit. Should they then be required to purchase more in order to retroactively remediate?

A case in point is provided by the Great Miami trading program. The program's coordinator states, "An offset is a commodity, and when wastewater treatment plants buy a commodity, they expect it to be a commodity, and they expect it to be a commodity tomorrow and ten years from now. That won't be the case if we have a clause that says this [contract] can change if we get new information" (quoted in Zwick, 2008c). The program's solution to this dilemma is found in a section of their trading rules that stipulates that scientific models may be revised in the future, but revisions will not be applied retroactively. The coordinator continues: "Everybody just has to say this is how we define the commodity, and it will be what it is forever – even if we change the definition down the road" (Ibid.). His use of the term "commodity" is fitting and underscores the point being made here: as the market approach gains ground it slowly encroaches on the tools by which environmental rigor is maintained in trading programs.

The important thing to note is that this watering down of environmental rigor is done explicitly for the sake of attracting more market demand. The Great Miami program was conceived and created prior to the implementation of any TMDLs in the watershed but with the expectation that binding restrictions were coming soon. However, these nutrient caps have since failed to materialize, leaving the program in a limbo state: regulatory caps are still believed to be imminent, but in the meantime how

can they attract credit buyers if there is no regulatory impetus to buy credits? In fact it is precisely this scenario – the lack of binding effluent restrictions – which left many of the early trading programs withering on the vine (King and Kuch, 2003; Hall and Raffini, 2005; Shabman and Stephenson, 2007).

The Great Miami program came up with a novel way of enticing demand that involves modifying the trading ratios which buyers are subject to. Program literature refers to it as an “incentive ratio.” The regular rules of the program state that a credit buyer operates under a 2:1 ratio when discharging into attaining waters and a 3:1 ratio when discharging into non-attaining waters. However, a new provision gives early buyers discharging into attaining waters the chance to lock in a 1:1 ratio, not only in the first year but every year after on the number of credits they originally purchase (Luke, 2008). As the coordinator of the program states, “It’s like buying your way into the country club and getting cheaper greens fees after you’re a member” (quoted in Zwick, 2008c). As a means of spurring market activity this is a clever solution, but it comes at a cost of diluting the very market constraints meant to ensure that environmental goals are met.

6.3.5 Diluting the Larger Meaning of Conservation

All of the preceding discussion leads to a concluding point about the market approach to conservation, and one that links back to a point made in Chapter 2: is trading an end in itself, or a means to a different end? The economists and market

analysts cited in earlier chapters are fairly unanimous: trading itself is the end goal, for it is *assumed* that robust trading will achieve more environmental improvements at less cost. Actual program participants, however, and particularly those involved at the local level, are almost unanimously in the opposite camp: trading is merely a tool to accomplish the larger goal of conservation, and its utility is measured against that metric.

The Red Cedar program in Wisconsin is an excellent example. Their approach has already been highlighted for its consciously equitable distribution of money among farmers; a second interesting element is that they limit any farmer's participation to three years on the grounds that this will allow more farmers to cycle into the program than if the same farmer signed a contract for five or ten years. A pure market logic would want to lock in the largest farmers for the longest period of time in order to get the most credits for the least cost, but here the opposite approach is overtly taken in order to privilege participation over cost efficiency. As a program administrator put it:

You get someone to adopt the practice, and then you move on and get somebody else to adopt, so you're hopefully building up that cumulative effect, which could offset any of your uncertainties in how well you're really quantifying your actual savings on each field. You've got a cumulative effect that's hopefully taking care of that.

Additionally, rather than targeting farmers who have tried no-till practices in the past and thus are more familiar with them and more likely to generate reliable credits, program rules give preference to farmers who have never tried no-till before in hopes of pulling more new farmers onto the conservation bandwagon.

An administrator of the Alpine program in Ohio refers to the real value of a trading program, what she calls “getting your foot in the door” with the community of farmers. She elaborates:

We now have relationships with these farmers, and when [the point source’s] permit’s up in 5 years, we’re not just gonna ever not talk to ‘em again. . . You’re gonna get more benefits, and hopefully they will continue to add conservation practices as they can, or if they have questions they now feel comfortable asking, they’re keeping their records, they’re adding less nutrients by their management practices.

Another agent with the same program then added, “I think that’s huge, the awareness out there now compared to when we started this program, is way different. They now are aware of what’s, I don’t know if I wanna say right or wrong, but they’re aware of conservation issues.” As Gulati writes in regards to the power of embeddedness in the world of business, “interfirm trust is incrementally built as firms repeatedly interact” (1995: 92).

This is what we may call the larger goal of conservation, the underlying philosophy of the entire soil and water conservation movement: to spur the diffusion of not only conservation practices but a conservation *mentality* to as many acres and farmers as possible across the nation. If Uzzi’s arm’s-length economic relationships serve to make economic action more impersonal, less mutually helpful, and more self-serving, albeit more efficient, does a market approach to nutrient trading have a similar effect on this conservation philosophy? The interview data point to such a conclusion.

Much of the reason comes back to the basic focal point of any market scheme: price. When price takes precedence over all other considerations it dilutes other value

systems, both social and environmental. The question of a program's environmental integrity then becomes tightly defined: "the expected reduction in phosphorus runoff associated with a BMP." By contrast, a government conservation program "considers more environmental resource concerns than just the ability to reduce phosphorus runoff when scoring each application. For example EQIP applications are also scored according to their ability to improve wildlife habitat and control for pests." The end result is a divergence of means and ends. The same authors continue: because EQIP by design "awards more points to applicants who agree to implement more BMPs, applications that included multiple practices tended to rank higher and are funded. Of the 13 funded EQIP applications [in their study], 6 included more than two practices, whereas none of the bids in the reverse auction included more than two practices" (Selman et.al., 2008: 3-7).

Examples of this value shift emerged from my interviews. I asked a county agent in the Great Miami program how the central coordinating agency evaluates the bids that county offices submit on behalf of their farmers, and he replied, "Basically what they've looked at is, one, is there a discharge? and, two, does it fall under the \$2.00 mark that we don't wanna pay over per pound? That's their biggest thing." In and of itself such an approach is not problematic, for cost considerations have to be taken into account in any economic initiative. What is more troubling is the trickle-down effect it has on the mentality of farmers themselves, for whom conservation has now become a game of chicken with their own peers. This is on display in the response of a conservation agent

to a question about whether farmers were drawn to the reverse auction format or not:

I don't know how much they like it, on lines of the guessing game. Because it's just like playing a hand of cards, it's just like playing poker – ok, who's gonna be doin' what? But, they're getting smart . . . I lay out a chart for them and I say, Here's what you can get at \$1.00, \$1.10, 20, 30, 40, 50, up to \$2. . . . Well like one said, 'Man, I gotta be smart about this. I wanna go \$1.29, he says, I wanna – just in case someone goes at \$1,30, he says I wanna beat him by a penny, I wanna get in. So some of these guys are thinkin' when they do these things. So the guys that don't think a lot about it, they're just throwing in, like, \$1.50, \$1,60 – but the guys that really think about it seriously – they're really thinking, 'Ok what's gonna put me over the edge of the next person and make sure that I get mine?'

Another consequence evident in the data is the development of a distinct division of labor within market-oriented trading programs. In non-market-oriented programs the intermediaries typically serve multiple roles as arbiters of conservation – they are not only conduits of information, but also money handlers, auditors, engineers, and credit verifiers. In a more marketized approach, however, many of these roles are parceled out to separate entities. This is well illustrated by a statement from the coordinator of the Great Miami program:

Our project application form basically says, 'Bring us your project idea, do it by the book,' and then – the one thing that you have to be careful about here – we don't buy projects. We pay farmers to generate credits, and basically the SWCDs are the ones that say 'Yep, this farmer can generate this many credits using this practice, and this farmer is willing to generate these credits for this much money.' That's about it. So at that point, other than the fact that the applicant, which is the SWCD, says, 'Yeah, all the i's are dotted and all the t's are crossed and this is consistent with standard practices' – you know, we just leave it up to them. We're not gonna become experts and we're not gonna oversee that.

Of course there is not an automatic connection between a division of labor and a loss of program integrity. But one of the key features of SWCD participation is the way in which they put their basic mission of conservation front and center, over and above even claims to market efficiency. When the process of nutrient trading is separated into a number of independent roles, the goal of efficiency can take precedence over the more fundamental goal of conservation, since the larger mission is now divided into individual tasks.

Continuing along this line of reasoning brings us to perhaps the most troublesome consequence of a market approach. Staying with the Great Miami program, witness what its coordinator had to say about the fact that nonpoint sources such as farmers are currently not regulated by Clean Water Act regulations – a fact that even many economists lament:

It could be that these markets are just gonna go away within a matter of months. . . I can assure you that if the USEPA moves on non-CAFO farms that these markets are just gonna go away. 'Cause [farmers will] have to do this stuff, there's nothing they can do voluntarily that can be used on a credit market, they have to do it to comply, and at that point it's just – the wastewater plants are gonna have to do what they have to, and farmers are gonna have to do what they have to do, and whether any of it is efficient will be left for somebody else to study 10 years from now and say 'Wow, that was a huge mistake.'

What he is saying is in one sense a truism: if farmers become obligated by new regulations to implement the very sorts of BMPs they are now installing voluntarily, the entire sector of PS-NPS trading could dry up because those practices would no longer be motivated by a price incentive and thus no longer “additional.” But in another sense the

statement is quite remarkable. Remember that one of the fundamental goals of PS-NPS trading is agricultural conservation. If such practices were mandated by federal legislation, it would be the biggest triumph imaginable for advocates of conservation and SWCD offices nationwide. Yet the coordinator here speaks of that possibility with alarm and disdain. The market orientation has taken such precedence over the conservation orientation that if anything happens to spoil that market, including the mandated installation of conservation projects themselves, it is seen as a negative outcome.

Final Discussion and Conclusion

The foregoing analysis of embeddedness and the mechanisms by which it operates is more than just an academic exercise. It leads us back to a more fundamental point that bears on the themes of the second chapter: the insufficiency of market forces alone to explain economic action or the outcomes of economic arrangements. In particular, it reveals the deficiency of an over-reliance on price as the arbiter of economic behavior. “Neoclassicists argue that social arrangements of coordination among firms are unnecessary because the price system directs self-interested maximizers to choose optimally adaptive responses” (Uzzi, 1997: 54). In other words, the price signal ensures that supply and demand curves always cross at the optimal level. Price drives demand, which in turn ensures supply. Hence economic analyses of a nominally market sector such as nutrient trading can concentrate entirely on economic and institutional variables and ignore social variables, because as long as the market platform is institutionally robust social considerations should not play a part.

What the prolonged discussion of embeddedness reveals, however, is the inadequacy of the price signal alone for securing the supply of credits in markets for agricultural BMPs. A Kalamazoo conservation agent broached the issue in regards to a

different sector: the carbon credits market.

Right now we have a new . . . carbon trading market, where producers that are already doing no-till or minimum-till tillage practices in their fields can get paid for their carbon sequestering. So they don't even have to do anything additional to get these carbon credits – you know, we thought farmers would be flying into the office and signing up to the program – you know, it's free money – and it's amazing, . . . we're one of the largest agricultural counties in the state and we probably have no more than 3,000 acres in the program right now. And you'd think every farmer that no-tills would be in the door, you know, but they're really not.

Miller (2009) has conducted research on non-participation in carbon markets and found empirical evidence to support the agent's claim. According to the rules of the Chicago Climate Exchange, in the case of no-till agriculture carbon credits can be claimed not just for converting to no-till now or in the future, but for having no-tilled fields anytime in the last five years. Yet in Miller's study, only four out of 228 surveyed farmers who were *already practicing* no-till chose to apply for carbon credits, an adoption rate of less than 2% for something that requires nothing more than a 2-page application. Her data indicate that two main factors account for this seemingly irrational economic behavior: a perception that participation might lead to more enforcement of other conservation measures, and skepticism towards global warming. In other words, a market exists for a product these farmers are already producing, participation in the market would have no effect on current productivity levels or farm operations, and the price signal is clear and simple – and yet farmers display almost complete disinterest.

Returning to water quality trading, if the price signal in and of itself is not sufficient to bring farmers on board, what else is needed? This is a rhetorical question,

of course, since the entirety of this dissertation supplies the answer. One of the most interesting threads to emerge from my interviews is the idea that, were it not for the existence of an embedded intermediary, many farmers may not participate in the trading program. This is more than just the issue of conveying information about the program – even with all the information in hand, without the trust factor brought by a credible local agent the farmers may opt out.

It's very much a trust issue. If somebody new had come in and tried to go sell it to 'em it may not have happened. (Conservation agent, Conestoga program)

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If we did not have the belief, the trust, our farmers would never have gone into any program that affects how they manage their fields. (Coordinator, SMBSC program)

And in response to a question about what would happen if the people coordinating the programs were not local or not from farm backgrounds:

Well I just don't think they'd have much success, I don't think that the farmers have much respect for them, I don't think there's as much buy-in. (Coordinator, Piasa Creek program)

Note the economic import of such phrasing: if someone other than a local, trusted agent approached them, bearing the same information about the same program, with the same incentives, the same rules, the same eligible BMPs, and the same pricing structure, farmers would participate in lower numbers. The price message is not as important as the messenger.

Prior accounts of ecosystem commodification have also problematized the over-reliance on price, but for different reasons. Inspired by Polanyi's notion of the "fictitious

commodity,” some scholars argue that “under the self-regulating market of liberal capitalism, market signals alone are *necessarily* insufficient in governing the allocation of nature to meet economic and competing social demands (e.g., for clean drinking water) because nature in its various forms is not a commodity, that is, not produced for sale” (McCarthy and Prudham, 2004: 281). This is a partially correct but overly deterministic account of the inadequacy of the market model: the price signal is indeed inadequate to ensure supply in water quality trading markets, but not merely because of the “fictitious” nature of the commodity itself. It is inadequate because of the complex social relations involved in the project of ecological commodification and trade.

None of this is to suggest that the price signal is not important. Financial considerations will always play a role in a farmer’s decision about whether to adopt a given BMP or whether to join a particular conservation program. The point is simply that price alone is not sufficient to guarantee farmer participation in a new, complex market initiative that appears unfamiliar relative to the traditional conservation subsidies they are used to. As the coordinator of the South Nation program pithily put it, “Farmer is not an economic man, farmer is a social man.”

As sometimes happens in studies heavily reliant on qualitative responses, an interviewee inadvertently summed up the themes of the entire research project. At the tail end of one of the lengthier interviews I conducted, a program coordinator framed the whole issue of trading and farmer participation using a number of pop-sociology theories and ended by pointing out the inadequacy of purely economic logic to explain

adoption of conservation practices:

If you look at some of the theory – change management theory, and communication theory, and public participation theory – they all say the same thing: You gotta put people in charge of their own destiny. So we've got farmer field reps dealing with farmers. That's part of public participation [theory]. Change management – well people have to, like alcoholics anonymous, they've gotta be informed all the way, they've gotta feel as though they're part of the decision-making and not just thrust upon them. And communication theory – how do you communicate? Well, you've gotta speak the same language. You know, words have meanings and phrases have meanings, and bureaucratic language has – one word has one meaning, and a farmer uses that same word in a different way. If you're talking two different languages, then you're not gonna have any communication. . . . you've lost it, you're nowhere near any success. So the economics is there, but the economics gets thrown out the window if you haven't achieved this social stuff.

* * * * *

What lies ahead for water quality trading? Nearly every trading program up to the present has been a standalone program limited to a single watershed and has operated under the close scrutiny of state authorities. Many of the programs currently in the planning or development stages, however, feature a greatly expanded scale. The long sought-after trading program encompassing the entire Chesapeake Bay watershed – already operating in Pennsylvania but awaiting state approval in neighboring states – will incorporate an area of 64,000 square miles across more than 100 counties in six mid-Atlantic states and the District of Columbia (MARWQP, 2008). An electric utility industry group is pursuing a PS-NPS trading protocol for the entire Ohio River Basin, an

area of more than 200,000 square miles across fourteen different states, or over 5% of the total US land mass (EPRI, 2008). And in the most recent round of the USEPA's Targeted Watershed Grant program, one of the 10 awards went to a group investigating the feasibility of expanding trading to not only the Ohio River Basin but both the Upper and Lower Mississippi River basins as well (USEPA, 2009).

Such initiatives will dwarf existing programs, the largest of which currently is the Great Miami trading program which encompasses a mere 15 counties in southwest Ohio. It is true that the other nine USEPA Targeted Watershed Grants are not for such large-scale attempts but are limited to one or a handful of regional watersheds, but enthusiasm at the policy level clearly lies with expansion. As Bayon writes, "If a large-scale scheme can be created to prove that water quality trading is viable and effective, it could capture the global imagination and serve the same sort of catalytic role that the EU Emissions Trading Scheme did for carbon markets" (2008b: 1).

The implications of Bayon's analogy are more profound than at first appear. The greenhouse gas emissions sector is not just large in scale and robust in trading volume; it is also a far more free market sector than is water quality trading. Bilateral agreements between a small set of stakeholders – the status quo in water quality trading – are virtually unheard of in the carbon market. Instead, sellers of carbon credits independently implement carbon sequestration projects, contract with private-sector project verifiers to certify their credits, and then sell them in an open, anonymous marketplace reminiscent of a stock exchange.

For a number of reasons, the trajectory of water quality trading looks as if it will head in a direction similar to the carbon sector, which is to say it will become more bound up with markets and price signals and less with governance institutions and regulatory oversight. First, the institutional knowledge is nearing a turning point in terms of “lessons learned” – theorists and practitioners now know enough thanks to earlier failures and missteps that rules can finally be codified and extrapolated rather than requiring the state to approve each and every program. Second, the desire to reduce transaction costs creates pressure to further marketize in order to capitalize on the cost efficiencies of the private sector. Enthusiasm at the policy-making level may wane if programs continue to be burdened by long development phases and high overhead costs. Third, the move to larger scales practically demands a more market-based approach for simple logistical reasons. When programs are standalone, circumscribed by a single watershed, and limited to only one or a handful of predetermined credit buyers, the state plays a critical supporting role. Individual states must sanction trading programs and the specific rules by which they operate, and in the absence of national binding legislation state regulatory agencies are the only entities that can legitimately claim oversight capacity over the validity and additionality of water quality credits. But when programs trade across state lines and buyers and sellers are dispersed across a wide geographic area, the regulatory authority to exercise oversight becomes far less clear. By default more of this authority is ceded to the market.

To trading advocates this trajectory towards more articulation with the market is a positive development. Despite some early analysts' admonitions that nutrient trading would not and even should not move towards one market type (Stavins, 1998; Woodward and Kaiser, 2002), more recent analyses evince a more idealistic tone. Easter and Johansson envision a sector that converges on a single market model closely mirroring the idealized free market: "It is not unrealistic to envision a permit-trading structure beginning as a bilateral mechanism . . . After adaptive management iterations, the bilateral trading structure could evolve . . . [into] a clearinghouse. . . . Lastly, after further adaptive management iterations and experience of the market participants, the clearinghouse could evolve into a pure exchange" (2006: 76). Another proponent gets right to the point: "Markets are the framework for everything that we do in our society – so we'll do it with markets, or we won't do it at all" (Zwick, 2008d).

If there is a take-home message relevant to policy makers and scholars that emerges from this research project, it is a cautionary warning against such outright enthusiasm for a market approach to water quality trading. I will conclude the dissertation by offering two broad reasons why a move to a more market-oriented structure for nutrient trading may be unadvisable, if indeed it is even possible. The first has to do with the internal functioning of the market itself, while the second concerns its outcomes for environmental health.

The first reason emerges in summary form from the three empirical chapters (4, 5, and 6) based on my interviews with trading practitioners. As we have seen, when an

economic approach to credit trading dominates, the key variables are cast entirely in institutional and economic terms. A successful trading program is seen as a function of demand drivers, low transaction costs, and tools for minimizing uncertainty or asymmetric information. But what of the overlooked variable of communicating with and securing the participation of farmers? If we see farmers merely as one set of rational actors responding to market signals we can safely assume that the only important factors are price and risk management. However, the evidence presented in this study demonstrates that these assumptions do not hold, and that there is an entire set of social variables that matter a great deal, including trust, credibility, and embedded relationships. The danger presented by a move towards larger geographic scale and greater market orientation is that it will hamper the ability of localized, embedded intermediaries to perform the critical function of information transfer by a trusted agent. Regardless of the strength of the price signal, the supply of credits will remain bottlenecked behind a wall of farmer distrust and reluctance.

The risk does not lie with the relationship between intermediaries and farmers per se, but with the link between trading programs themselves and intermediaries. If a program expands to a river basin encompassing 100+ counties across multiple states, or if it operates primarily via an online bidding system and credit registry, how can program administrators reasonably expect to communicate in a consistent or effective manner with localized intermediaries distributed in hundreds of county seats across thousands of square miles? Assuming that the intermediaries of choice continue to be

public offices of soil conservation, as even recent reports recommend (e.g., IEI, 2008), the likely outcome of such a dispersed distribution will be exactly what we see on a smaller scale in the Great Miami and Kalamazoo trading programs: a core group of intermediaries equipped with proactive agents and sufficient staffing resources will broker the lion's share of nutrient credits, while on the periphery will remain counties that will not participate or benefit from the flow of subsidy funds or the positive outcomes of BMP implementation. My data suggest that one of the critical components to a successful water quality trading program is the strength of localized embedded relationships; how can a program maintain these local ties if it is expanding well beyond the local scale?

There are several possible answers to this question, but none looks promising. Rather than contracting with soil conservation districts in order to secure farmer participation, programs could employ a partner increasingly common in the carbon credit arena: private-sector "credit aggregators," who travel from region to region proselytizing the virtues of the program, signing contracts with multiple farmers, and bundling all their credits together to sell on the exchange market. The trouble with this approach should be obvious: completely gone are the embedded relations that such a figure needs to have with farmers in order to gain their trust. Indeed, anecdotal evidence from the carbon market indicates that even in this sector that has always been more market-oriented, aggregators traveling through farm country achieve frustratingly low levels of farmer buy-in (M. Miller, pers. comm.).

Another possible solution to the intermediary problem is to engage local conservation offices with more of an arms'-length relationship, thus allowing the communication of a simple program structure to a wide network of intermediaries without the need for time-consuming personal relationships with each one. As we saw in the reverse auctions pioneered by the Conestoga and Great Miami programs, however, such an approach carries a number of possible negative consequences, including program fraud as the farmer's own relationship to conservation is switched from one of intrinsic motivations to one of pure economic interest, and self-sacrifice by the intermediary in order to make BMP bids more competitive – surely not a sustainable strategy. In short, it is not clear whether the tension between the desire for market efficiencies and the need for embedded relationships with farmers can be resolved while expanding the market scope of water quality trading.

The second reason for remaining ambivalent about the prospects for a greater market orientation stems from the fundamental goal upon which water quality trading is premised in the first place: the attainment of environmental standards. An increasingly market-oriented approach to water quality trading will have the outcome, whether intended or not, of reconfiguring the balance of power between market and state, with uncertain outcomes for the environment.

The steady creep of a free market ideology has produced similar structural outcomes across economic sectors and geographic regions: a wider variety of products commodified, goods and services shorn of constraints to their movement, and social

protections whittled away. In the face of an increasingly globalized market the state's role in overseeing economic activity diminishes, even as it may erect certain social protections to counter the most extreme externalities. The advent of water quality trading, though, gives us the opportunity to witness the state's response to a market sector over which it wields more power from the outset.

Unlike the Department of Commerce or the Federal Trade Commission, environmental regulators have not had much direct bearing on market activity during the course of their existence. But given the legal authority to place a cap on PS discharges and to modify their permits to allow the purchase of offset credits, state environmental agencies are suddenly given the power to create a market where none existed before. This effectively places environmental agencies in the same bind faced by the larger state of which they are a part. Like any arm of the government they are tasked with creating rules and regulations that achieve their mission but still give priority to economic growth. Yet as McCarthy and Prudham (2004: 275) assert, "environmental concerns also represent the most powerful source of political opposition to neoliberalism" to emerge under late capitalism. Thus the USEPA becomes the embodiment of the Polanyian double movement, caught between the conflicting pressures of environmental markets and environmental protection (Keudel, 2007).

The advent of tradable pollution credits can be seen as the result of a decades-long tug-of-war between these two forces. On one hand, the rise of ecosystem service markets clearly lies on the trajectory towards greater market power. Years of command-

and-control tactics by environmental agencies failed to achieve desired improvements in water quality, so they have gradually turned to a more market-based approach. Though in some respects long resistant to the incorporation of market forces as a regulatory tool, “it is also true that environmentalism and neoliberalism have each incorporated elements of the other during their now decades-long engagement” (McCarthy and Prudham, 2004: 279). So for example the federal trading guidelines list economic goals such as reduced compliance costs before they list goals related to environmental benefits, and most of the individual states’ guidelines follow suit. Note the semantic order of this mission statement: “The objective of a water quality credit trading program is to facilitate economic exchanges that demonstrably reduce pollution and clean up impaired surface waters more quickly” (FDEP, 2006: 4). It is a subtle but far-reaching distinction: the goal is not to improve surface waters in a market-like way, but to facilitate markets that happen to improve surface waters.

On the other hand, these same authorities have simultaneously inserted into the structure of the market a number of constraints, restrictions, and prohibitions that dictate what may be traded, when it may be traded, who may do the trading, and how trades must be documented. More importantly, they leave ultimate oversight of all such provisions not to third-party actors or the non-profit sector, and certainly not to the trading partners, but to themselves. While using the language of the Clean Water Act to bring trading to bear on a recalcitrant environmental problem, they use their authority

to enact numerous protective measures that ensure the reliability, validity, and enforceability of the market mechanism.

So the question is, if market expansion slowly encroaches on the state's oversight capacity, where will that reliability, validity, and enforceability come from? As I discussed in Chapter 1, it cannot be left up to market participants themselves under the guise of self-regulation, because at the fundamental level of intrinsic motivation these participants do not care about the quality of environmental credits (King and Kuch, 2003; King, 2005). But if they maintain the full force of their regulatory power then the market continues to expand at a snail's pace, which ironically prevents it from fulfilling its potential for environmental improvement.

Even the literature from trading proponents embodies this tension. Kieser and Fang (2008) acknowledge in one paragraph that "for water quality trading to work as some believe it can, it will be necessary to formally engage, incentivize and/or *restrict* nonpoint sources of water pollution" (emphasis added), while only a few paragraphs before they caution that restrictive action "works against the creation of the sort of wide-ranging, free-trading, national water quality credit market envisioned by economic theories." In other words, the double movement towards more market regulation may be self-limiting, as summed up by Karl Polanyi: "Vital though a countermovement was for the protection of society, in the last analysis it was incompatible with the self-regulation of the market, and thus with the market system itself" (2001: 136).

In light of this seemingly intractable bind I return to a point hardly visible in the literature but brought to light in Chapter 2: the reconfiguration of the means and ends of nutrient trading. The dilemma I have sketched for the environmental state may not be so much an intractable logistical conflict but simply a semantic one. The state's traditional response to problems of water pollution was regulation-centric, and this approach failed. The new strategy is market-centric, but this only places the state in a tug of war between market efficiency and environmental efficacy. But there may be a third way: trading can be recast as a *conservation-centric* strategy. Though the actual outcomes of any particular credit transaction may be precisely the same, i.e. a BMP gets implemented on a farm and a PS discharger claims the offset credits as his own, the way of getting there may be less fraught with conflict. And by altering the language of trading's basic aim from cost effectiveness or the attainment of environmental standards to the implementation of BMPs, three interesting outcomes result.

First, we can now add a new set of analytical criteria to our attempts to evaluate the success of trading programs. Whereas farmers, participation, and conservation have hardly been mentioned in the literature on trading to date, we may now expand the analytical lens to include these variables, which may ultimately prove to be more helpful in designing programs that work. Second, this new criterion conveniently avoids the Achilles heel of the current setup – that water quality improvements *cannot be quantitatively linked* to specific nonpoint source reductions. Nutrient flows from nonpoint sources are simply too diverse, diffuse, and stochastic to be precisely tracked

from any one farm field, making the determination of success perpetually dependent on faith in scientific modeling and perpetually hostage to the risk of measurement error.

BMPs, on the other hand, are easily monitored, easily modeled, and easily documented.

Demonstrating the success of a program can be as simple as driving by a farm field, with no additional equipment or routine sampling required.

Finally and most profoundly, we can at least partially sever this new metric from strictly economic goals. A program may not be maximally efficient or feature low transaction costs or even result in a PS discharger meeting its regulated limit more cost-effectively than under a permit scheme, yet it may still be called a success. It is not that economic criteria are not important, but when trading is removed from its implied role as a market-oriented activity and placed within a more holistic context of agricultural conservation and sustainability, they no longer take top billing. It may take a large expenditure of time and resources to interface with farmers and get BMPs planned and implemented, but such transaction costs are seen as inherent to the newly realized goal rather than impediments to maximum efficiency.

This sentiment, though almost entirely absent from the scholarly literature, emerged in nearly every one of my interviews with conservation agents. This should not come as a surprise, given the very reason for the existence of their agencies. From their perspective trading is not an end in itself but merely a tool to aid the higher prize of “getting BMPs on the ground.” If under the direction of this new goal programs begin to spread to more watersheds, engage with more farmers, and result in a flush of

new conservation practices across the agricultural landscape, water quality trading may finally achieve the public embrace and the track record of success it has sought for so long.

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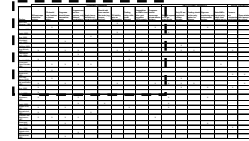
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Appendix A: Literature Review of Water Quality Trading:
Observations, Critiques, & Suggestions for Improving Program Design

Citation	ECONOMIC VARIABLES										
	Effluent caps should be stricter	PS should have freedom to choose action	Programs should lower transaction costs	Programs are not true markets, only bilateral negotiations	Need clearer definition of property rights	Should add more market-like tools (e.g., reverse auction)	PS liability acts as disincentive	Trading ratios stifle credit demand	Competition for BMPs from other gov't programs stifles supply	Programs should encourage private-sector brokers	
Jarvie and Solomon, 1998							X				
Slavins, 1998		X								X	
Faeth, 2000							X				
King, 2002					X						
Woodward et.al., 2002			X								
Griffiths, 2003											
King & Kuch, 2003	X		X	X			X	X	X		
Leatherman et.al., 2004				X							
Randall, 2004	X							X			
Schary and Fisher-Vanden, 2004		X	X	X	X						
Smith, 2004	X	X									
Breetz et al., 2005											
Dunn and Bacon, 2005		X									
Hall and Raiffini, 2005	X		X				X			X	
King, 2005	X										

(Portion of table represented)

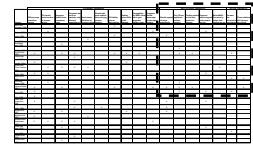


ECONOMIC VARIABLES										
Citation	Effluent caps should be stricter	PS should have freedom to choose action	Programs should lower transaction costs	Programs are not true markets, only bilateral negotiations	Need clearer definition of property rights	Should add more market-like tools (e.g., reverse auction)	PS liability acts as disincentive	Trading ratios stifle credit demand	Competition for BMPs from other govt programs stifles supply	Programs should encourage private-sector brokers
Swift, 2005	X									
Easter and Johansson, 2006	X			X						
Faeth, 2006				X		X				
Abdalla et.al., 2007	X		X					X		
Boisvert et.al., 2007	X				X					
Shabman and Stephenson, 2007	X	X	X	X						X
Kieser and Fang, 2008			X							
Luke, 2008										
Roberts et.al., 2008				X						
Selman et.al., 2008			X							

(Portion of table represented)

Citation	INSTITUTIONAL VARIABLES						SOCIAL VARIABLES	
	Should expand to larger watersheds	Only PS are regulated -- creates inequity	Trading should be the only option for farmers	Rigorous monitoring and enforcement are key	Make BMPs first priority rather than trading per se	Farmers are reluctant to participate	Close relations with farmers are critical	
Jarvie and Solomon, 1998								
Stavins, 1998				X				
Faeth, 2000	X							
King, 2002								
Woodward et.al., 2002								
Griffiths, 2003		X						
King & Kuch, 2003		X	X			X		
Leatherman et.al., 2004								
Randall, 2004								
Schary and Fisher-Vanden, 2004					X			
Smith, 2004				X				
Breetz et.al., 2005						X	X	
Dunn and Bacon, 2005		X						
Hall and Raffini, 2005	X	X	X				X	
King, 2005		X		X		X		

(Portion of table represented)



Citation	INSTITUTIONAL VARIABLES						SOCIAL VARIABLES	
	Should expand to larger watersheds	Only PS are regulated -- creates inequity	Trading should be the only option for farmers	Rigorous monitoring and enforcement are key	Make BMPs first priority rather than trading per se	Farmers are reluctant to participate	Close relations with farmers are critical	
Swift, 2005								
Easter and Johansson, 2006	X			X				
Faeth, 2006	X							
Abdalla et al., 2007	X							
Boisvert et al., 2007								
Shabman and Stephenson, 2007								
Kieser and Fang, 2008				X				
Luke, 2008						X		
Roberts et al., 2008								
Selman et al., 2008								

(Portion of table represented)

Appendix B: Survey of Program Participants

Date	Name	Affiliation	Position

1. PROGRAM BACKGROUND & BASIC STRUCTURE

- 1.1. When was the program started:
- 1.2. Pollutant(s) of focus:
- 1.3. Size of trading area (watershed):
- 1.4. Market structure: (Exchange; Clearinghouse; Bilateral; Third-party broker ; Offsets):
- 1.5. Major economic driver (TMDL; grant; voluntary):
- 1.6. Major participants (names):
 - 1.6.1. PS buyers:
 - 1.6.2. PS sellers:
 - 1.6.3. NPS sellers:
 - 1.6.4. Others:
- 1.7. Number of buyers (currently):
 - 1.7.1. More buyers joining program in foreseeable future?
 - 1.7.2. Pounds of pollutant buyer(s) need(s) to fulfill permit(s):
- 1.8. Number of sellers:
 - 1.8.1. More sellers coming online in foreseeable future?

- 1.9. Trading ratio:
- 1.10. Who has legal liability for ensuring credits are actually produced:
- 1.11. What technical specifications are used to design/implement/verify BMPs:
 - 1.11.1. Is this stipulated in the rules or is it informal protocol:
- 1.12. [If applicable]: Why, in your estimation, has the program failed to result in any trades to date:

2. ECONOMIC VARIABLES

- 2.1. How is the price of a pound of pollutant determined (e.g., market fluctuation; bidding by buyers; reverse auction by sellers; pre-set price; etc.):
- 2.2. How is the value of the conservation agents' time factored into the price of credits:
- 2.3. If such a thing can be estimated or averaged, what is the going rate for one credit:
 - 2.3.1. What is the range of price fluctuation since the start of the program:
 - 2.3.2. Total payout by buyer(s) since start of program:
- 2.4. If the buyer were to install a technological solution instead of entering into the trading program, what is the estimated cost per lb. he would face:
- 2.5. How many *trades* have taken place since the start of the program:
- 2.6. How are the funded BMPs ultimately chosen, assuming the program has the choice to fund several? E.g., First-come-first-served, or a technical advisory board, or a lowest-cost formula, etc.:
 - 2.6.1. By what process was the initial list of possible BMPs chosen:
- 2.7. Can you describe to me the way that payments to farmers work? (How much paid up front versus divided into increments over time):

- 2.8. How does the trading program's subsidy compare to the subsidy offered by other cost-share programs:
- 2.9. What verification or monitoring is required for the annual payments:
- 2.10. Are payments to farmers capped at a certain maximum amount:
- 2.11. If a given BMP is already being funded by a 319 grant or CREP or EQIP, etc., can it also be subsidized by the nutrient trading program:
- 2.12. Do buyers have their choice of remediation strategies (i.e., can they *choose* to buy credits as one possible option of several):
- 2.13. What percentage of the total funds in the program go towards water quality monitoring:

3. ENVIRONMENTAL VARIABLES

- 3.1. Remediation goal (lbs. of pollutant):
- 3.2. Pounds actually remediated to date:
- 3.3. Number of BMPs implemented:

4. SOCIAL VARIABLES

- 4.1. The literature on nutrient trading is split into two camps: institutional/economic versus social variables [briefly elaborate]. Do you fall somewhere between these two camps?
- 4.2. Is there a chief third-party intermediary, such as a broker or non-profit agency:
- 4.3. Years intermediary has been operating in community:
- 4.4. How are relations between [the intermediary] and the farming community? Do they have close relations with farmers?
- 4.5. How would you classify the level of trust between the farming community and [the intermediary]?

- 4.6. Do farmers generally think that [the intermediary] is looking out for their best interests:
- 4.7. Would you say there is a good “fit” between the farming community and the type of agriculture, and the program itself (i.e., buyer) [elaborate on Alpine example]:
- 4.8. How do farmers hear about the trading program:
- 4.9. Has it been difficult to recruit farmers:
 - 4.9.1. Are there currently farmers waiting to join the program:
- 4.10. Is there a typical type of farmer or landowner that is participating in the program:
- 4.11. Do farmers receive one-on-one technical assistance while implementing or installing their BMPs? How much, and from whom:
- 4.12. Lastly, a philosophical question. Do you think of trading as a means to installing more BMPs, or do you see BMPs as the means to establishing trading: