Ecosystem Marketplace

State of Watershed Payments
An Emerging Marketplace

FOREST TRENDS

Acknowledgments:

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State of Watershed Payments

An Emerging Marketplace

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Ecosystem Marketplace

Ecosystem Marketplace, a project of the non-profit organization Forest Trends, is a leading source of information on environmental markets and payments for ecosystem services. Our publicly available information sources include annual reports, quantitative market tracking, weekly articles, daily news, and newsletters designed for different payments for ecosystem services stakeholders. We believe that by providing solid and trustworthy information on prices, regulation, science, and other market-relevant issues, we can help payments for ecosystem services and incentives for reducing pollution become a fundamental part of our economic and environmental systems, helping make the priceless valuable.

Forest Trends' mission is to maintain, restore, and enhance forests and connected natural ecosystems, life-sustaining processes, by promoting incentives stemming from a broad range of ecosystem services and products. Specifically, Forest Trends seeks to catalyze the development of integrated carbon, water, and biodiversity incentives that deliver real conservation outcomes and benefits to local communities and other stewards of our natural resources.

List of Acronyms

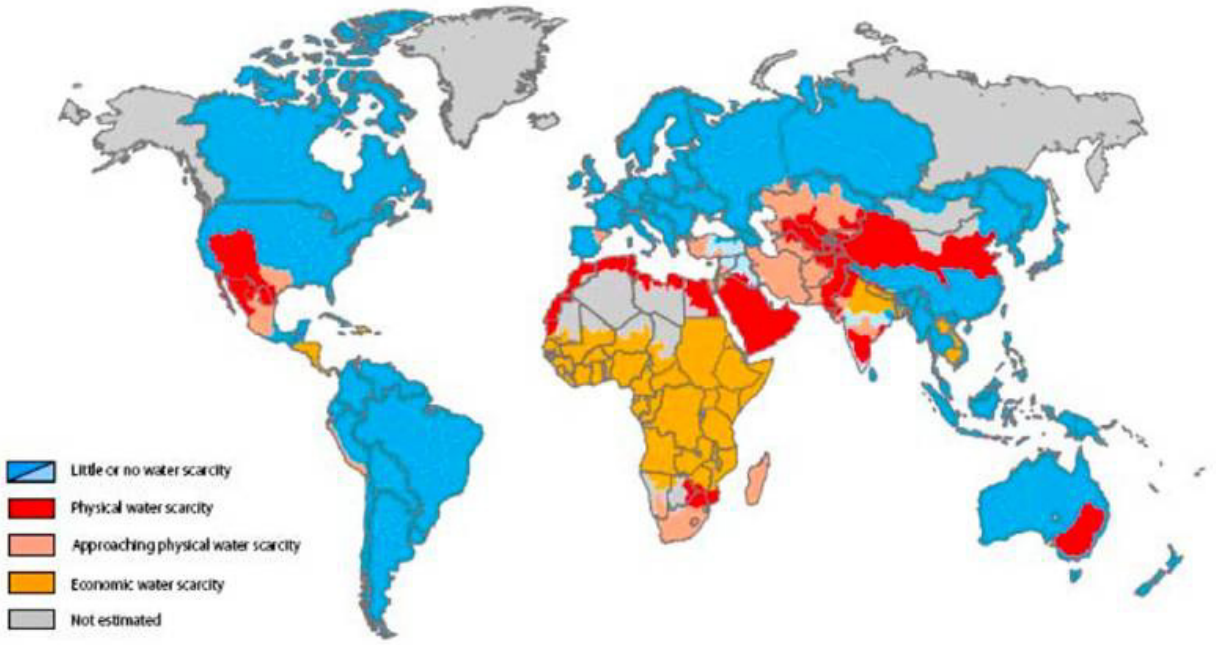
BEF	Bonneville Environmental Foundation
BMP	Best Management Practice
CIFOR	Center for International Forestry Research
CONAFOR	Mexico National Forest Commission
CWA	Clean Water Act
EPA	Environmental Protection Agency
EU	European Union
FONAFIFO	Fondo Nacional de Financiamento Forestal
FONAG	Quito's Water Trust Fund
GEF	Global Environment Facility
ICRAF	International Center for Research in Agroforestry
IIED	International Institute for Environment and Development
INRA	French National Agronomic Institute
MES	Market for Ecosystem Services
NGO	Non-Governmental Organization
NPDES	National Pollutant Discharge Elimination System
OEM	Office of Environmental Markets
POTW	Publicly Owned Treatment Work
PES	Payments for Ecosystem Services
PWS	Payments for Watershed Services
REC	Renewable Energy Certificates
RISAS	Red De Interesados en Servicios Ambientales
RUPES	Rewarding Upland Poor for Environmental Services
TMAL	Total Maximum Annual Load
TMDL	Total Maximum Daily Load
UNEP	United Nations Environment Programme
USDA	US Department of Agriculture
WQT	Water Quality Trading
WRC	Water Restoration Certificate
WRI	World Resources Institute
WWF	World Wildlife Fund

Preface

Water, water, everywhere, but... We pay it lip-service as one of the most (if not *the* most) essential chemical substances on the planet, but the truth is that most of us take it entirely for granted. We use it, misuse it, and waste it, as if it weren't precious. Water has so little perceived value that in many parts of the world, people don't even pay for it. Even in places where people do pay for water, they sometimes pay so little that they rarely give it a second thought. For many, turn on the tap and there it is. Only in places where it is scarce, hard to get, or costly do people really appreciate water. Scarcity drives not just price, but perceived value.

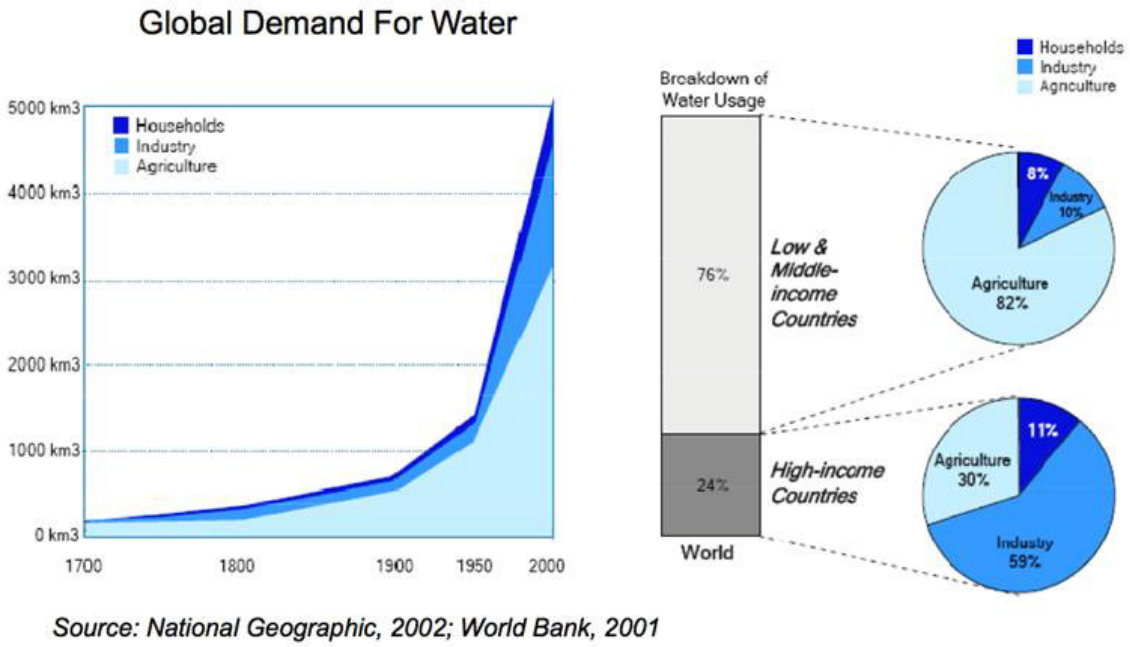
By this measure, the value of water looks set to continue rising. Look at bit more closely, and you will see that most parts of the world suffer from water problems. Water may make up more than two-thirds of our planet (and three fourths of the human body), but the truth is that the problem with water has never been solely about water quantity (i.e., how much water can be found in any given place), but rather has been mostly about economic access to water and water quality (about how much water can actually be used). The vast majority of the planet's water is found in the form of essentially unusable saltwater. Only about three percent of the water on Earth is freshwater, and most of that is locked up in ice.

Areas of Physical and Economic Water Scarcity



Source: International Water Management Institute (IWMI), 2006

And the problem isn't just that we haven't found a way to economically and efficiently desalinate water. Cast your eyes across the globe and you will see a wide variety of water problems emerging. In parts of Africa, Asia and Latin America, the problem isn't so much about physical access to water as it is about economic access to freshwater. People can't afford to pay for clean water. Go to parts of Australia, the Middle East, and the Southwestern US, on the other hand, and the problem is very much about physical water scarcity and drought. Even for people who can pay for it, water can't be found. Then look at most of the world's major river systems—at places where water shouldn't be a problem—from the Mississippi to the Mekong, and you begin to see a pollution problem: Water is being used as a convenient, liquid conveyor belt for waste. Whether the pollutant is sewage and storm water runoff from our cities, chemicals from our industries, or excess fertilizers from agriculture, we are straining the planet's water resources past the breaking point.



Courtesy of Aquillian Investments.

As with climate change, when it comes to water, we are on an inevitable collision course with global disaster. Before we go too far down this dangerous path, however, we would do well to remember why water is so special. After all, it is no accident that when scientists search for extraterrestrial life, one of the first things they look for is any sign of water. Life as we know it would not be possible without water. Not only does it make up three-fourths of the human body, but it accounts for as much as 90 percent of most plants, and even a stunning 98 percent of some forms of life (e.g., jellyfish). To say that water is life is much more than an overused cliché.

Without belaboring high-school chemistry, suffice it to say that the chemical properties of water are such that they enable plants to take up energy from the sun and store it as the carbohydrates we use as food and ultimately as energy. Indeed, the word carbohydrate itself refers to a "hydrate" of carbon, chains of carbon molecules each attached to their very own molecule of H_2O. At the chemical level, water is part of the biological energy that all plants and animals use. In other words, it is the essential component of the living batteries that are our ecosystems. It is these same carbohydrates that can, over

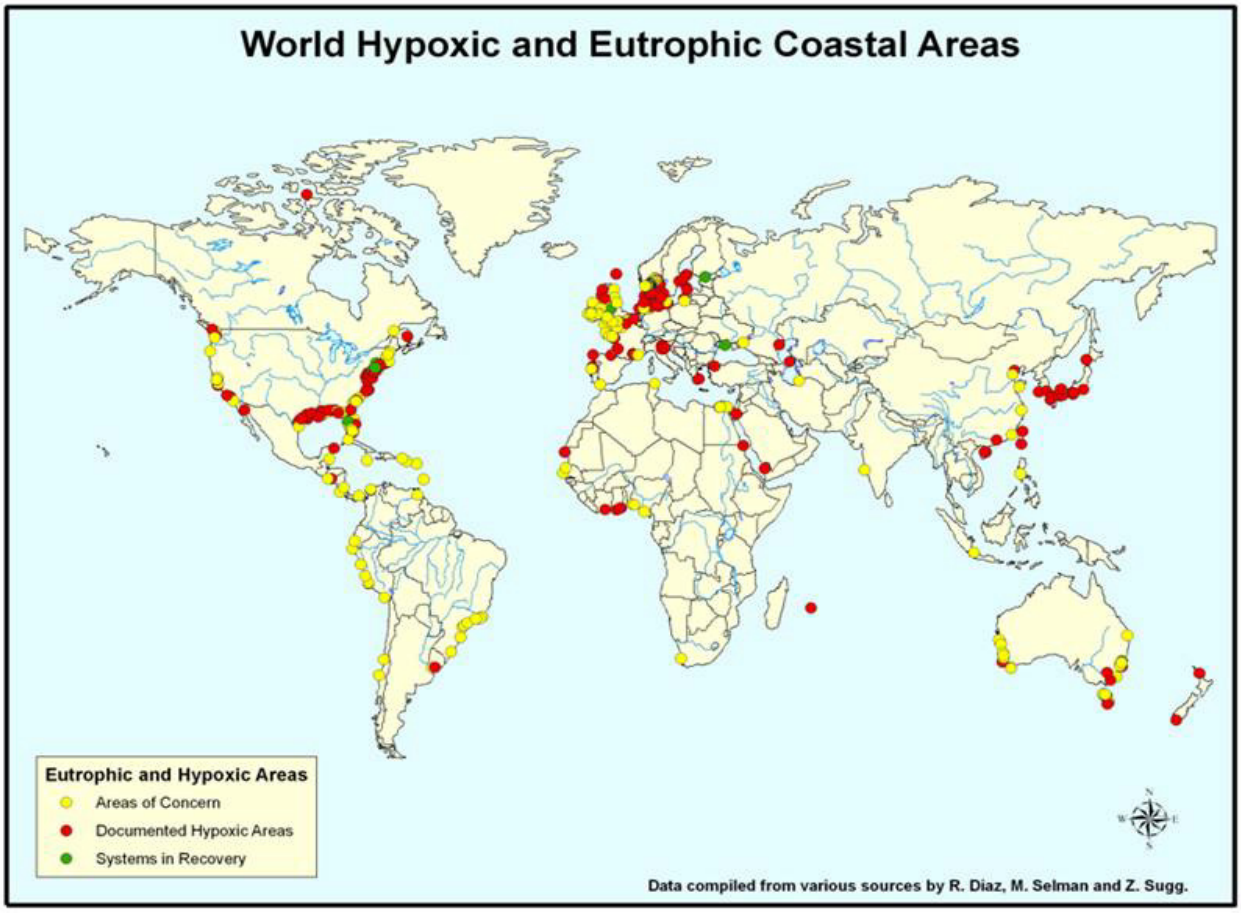
time, eventually lose their oxygen and become the hydrocarbons that run our cars, planes, factories, and industries. And it isn't just about biology; many traditional forms of energy generation—whether they be hydroelectric dams, coal-fired generators, biofuels, solar or gas refineries—rely on water in various ways, shapes and forms. At a time when most countries are obsessed with energy and energy policy, we should remember the role that water plays in our planet's biological and fossil-fuel energy systems. Without water, nothing of what we do or who we are would be possible.

Beyond its role as a lubricant for biological (and mechanical) energy systems, water also has several chemical properties that make it essential to all life on earth. In basic chemistry classes, where we learned that water is the universal solvent; it mixes well. This property can be a good thing if what you are trying to do is suspend the components of a cell or keep enough oxygen in the oceans to maintain marine life. But it becomes a problem when we talk about pollution. The fact that water will dissolve most anything means we can easily dump our trash into it and feel as if it will somehow, magically, go away. We expect this universal solvent to dissolve away all our filth.

But the problem is that it doesn't really go "away"; it just gets spread out. It goes elsewhere. And the polluted water becomes unavailable for other, more useful, purposes. Just as bad, the pollution problem simply flows downstream to cause problems in our gulfs, estuaries, bays, and oceans. Take nitrogen, for example. Normally, nitrogen is an essential nutrient, a component of the amino acids that make up living beings. Farmers and gardeners worldwide spend millions upon millions of dollars to buy enough nitrogen to fertilize their plants. But when nitrogen is misused and overused, it becomes a problem. The excess nitrogen ends up fertilizing algal blooms in our world's oceans, blooms that can sometimes be toxic to humans. These overgrown algae not only block sunlight; but when they decompose, they use up all the available oxygen leading to so-called hypoxic conditions. In other words, they create large "dead zones" where little or no marine life can live. The recent oil spill in the Gulf of Mexico is unfolding to become one of our planets most serious environmental tragedies, but every year—stealthily, quietly, without causing many newspaper articles or magazine stories—the excess use of fertilizer up and down the Mississippi generates a massive dead zone in the Gulf of Mexico that can be the size of a small US state. Water, it turns out, doesn't put an end our pollution problems; it just dissolves them, moves them, and makes them more widespread.

So what is the answer? How can we as a society address the many problems that plague the waterfront? How do we get people to be more mindful about their water use? How do we regulate pollution flowing into our waterways? How do we put a stop to the growing number of dead zones around the world? And how do we ensure that humans—and the plants and animals on which we depend—have access to the quantity and quality of water that they need to survive?

This question—at its core—is what this publication is about. It is about one of the tools that can (and will increasingly) be used to resolve our water problems: Payments for Watershed Services (PWS). While PWS may not be *the only* solution, this document shows that in some parts of the world it can be part of the solution. In some cases it can help change the way we value water, and it can generate the resources needed to remediate and protect our watersheds.



Source: World Resources Institute (WRI).

Here, for the first time ever, we have an attempt at cataloguing the use of PWS across the world connected to the amount of money being transacted. The emphasis here is on the word "attempt." By its own admission this catalogue is not exhaustive. By means of online searches, interviews, questionnaires, emails, and phone calls, the Ecosystem Marketplace team has tried to get a sense of how this tool is being utilized: what is out there, who is doing what, and how much money is changing hands. But some pieces of the story were likely missed due to lack of or inconsistently reported information or oversight. Like all pioneering works, or better yet, like a first draft, this report (this story) is a work in progress.

Getting information on schemes that range from the massive to the tiny in countries as different as Australia and Ecuador is not easy. But if there is one thing that we have learned from previous Ecosystem Marketplace publications such as the "State of the Voluntary Carbon Markets" report, it is that sometimes beginning the process of cataloguing can in and of itself be a radical step; it can help in uncovering hidden information and can ultimately influence how and what information is reported. When Ecosystem Marketplace first put out the "State of the Voluntary Carbon Markets" report, it, too, was missing large swaths of data. But that publication set the ball rolling and as a result, people began sending in news of initiatives that had been missed. Now in its fourth year, each subsequent edition was

more complete than the last. This report will undoubtedly follow a similar trajectory, and we can look forward to improved sets of data on this important subject in subsequent years.

And yet, despite the difficulty, despite the lack of data, despite the nascent nature of this emerging marketplace, there are many insights here. For instance, the first thing that strikes you as you read this document is that we are not really talking about one tool, but rather about at least three variations on a common theme. First, there are the government payments for watershed services such as those that can be found in places like China, Mexico, Costa Rica, and the US. These are, in dollar terms, the largest PWS systems documented by this report, and they are in some ways the least radical. After all, they are just new variations on the old theme of using government money and tax revenues to pay for conservation. This is not to say that they are not important. Indeed, they may well be the most important applications of this tool in the short run, since they can be used and are being used regularly in developing countries. Besides, the way the government distributes its revenue, along with the sheer scale of payments (by creating a demand for watershed services) can have some pretty radical implications.

According to this report, the biggest programs of this type (in dollar terms) are those in China and the US. But that is not the real story here. While the Chinese and American payment systems may be big, the most interesting insight from this report is that the emerging leader in terms of experimentation with government payments for watershed services is Latin America. That is where some of the real innovations are to be found, both in terms of how the payments are made, as well as in how their effects are measured, monitored, perfected, and replicated. In particular, the use of trust funds to channel money that is coming from both public and private sources is one Latin American innovation that could usefully spread not only throughout that continent, but to many other parts of the world, including developed countries such as the US and in Europe.

The second form of payment for watershed services identified in this report relates to cases of the private sector payments for watershed services. These are fewer and far between. The report identifies cases of this in France, Ecuador, and Tanzania, among others. While relatively speaking this type of payment is still small, or so it seems, that this is perhaps one of the areas where we are likely to see tremendous growth in the years to come. After all, if the private sector does not start paying for watershed services, then we are missing an important potential solution to this problem. Also, I suspect that future updates of this report will see people submitting more examples of these types of payment systems with much more complete transaction data than captured in this first pass.

Already, we are seeing mainstream names entering this field: A few years ago, Coca-Cola announced that it would be working in various parts of the world to better understand, monitor, and help pay for the watershed services it utilizes. If they live up to this commitment (and if their leadership is followed by other companies of that size), future iterations of this report will see vast increases in the numbers reported under this rubric.

Finally, this report talks about trading regimes, and in particular water quality trading regimes (usually those aimed at curbing nitrogen pollution). In some ways, this is the most interesting potential area for true market growth. After all, the world has seen pollution trading regimes operating on a massive scale (i.e., in carbon via the European Emissions Trading Scheme) and there is no reason why these shouldn't

also work for watersheds. We know how to set them up, we know the role governments can play and the role the private sector can play, and the potential, the perils, and the pitfalls of this approach; now we just need to see how these can be transposed into the realm of regional or watershed markets.

Naturally, water pollution is not the same as air pollution, and nitrogen is not carbon, so the parallels will not be exact. For instance, carbon is a global problem, so the carbon markets can be (and likely will be) quite large. They can span a country, a continent, and, at least in theory, the globe. Water quality problems, however, are more bound by the watersheds they affect, so they are usually dealt with at a watershed scale. This means that the markets for water quality trading are likely to be smaller (both in geographic scope, and possibly in dollars) than carbon. Still, watersheds can be pretty large (think the Mississippi, the Rhine, the Mekong, the Nile, or the Amazon), so the markets might eventually be quite sizable. So, pilot projects are desperately needed.

And experimentation through pilot projects is exactly what has been happening—most notably in the US. It is interesting to read in this report that there are some 72 trading schemes spread across four countries with 66 of those in the US. It is even more interesting to find out that of these 72, only 14 recorded transactions in 2008 totaled somewhere on the order of $10.8 million dollars. It begs the question: Are the pilots failing? Is there something inherently wrong with the program design or at the implementation level?

The answers are as complex as the water quality challenges themselves, but can be boiled down to a few key issues. First and foremost, many of the pilot projects suffer from lack of demand due to inadequate regulatory drivers. Programs were developed in anticipation of water quality standards that have never been enacted. Second, transaction data is not necessarily a reporting priority for the entities implementing trading programs. This created numerous data gaps among even a few of the programs known to be actively trading. Perhaps future iterations of this report will be able to fill those gaps with better and more complete information leading to a more complete picture of trading activity.

Another thing that is worth noting is that by design, this report does not look at the quite sizable markets that exist around the world for water quantity, markets that are perhaps several orders of magnitude greater than the markets and payments schemes documented here. Although this omission is intentional—opting to focus on the payment mechanisms affecting water quality—in some ways it leaves us with an incomplete picture of how markets and payment schemes are being used to address water issues on the whole. Perhaps the Ecosystem Marketplace team will tackle this market next, thus telling the rest of the story.

Still, the picture we get from this report—even with all the acknowledged challenges—is compelling: We are beginning to see payments for watershed services leave their mark on aquatic resources worldwide. Inevitably, people will focus on the numbers and dollar-figures provided by this report, but that would be missing the point. The truth is that these numbers are more like approximations than actual measurements, and their true value is offering an “order of magnitude of effort” in combating a large and complex problem. After all, this market is so new and there are so few complete sources of data (not to mention that many participants in early markets are loathe to share pricing/cost information) that we cannot expect anything more than approximations. No, the numbers are not the story here. The story is that the use of payment for watershed services is no longer a series of isolated incidents. Thanks

in no small measure to the work of this report and the Ecosystem Marketplace, it is becoming a global movement.

And it comes none too soon; unless we learn to better use and manage the precious substance that makes up more than two-thirds of both our planet and our bodies, we could be in for some real problems. After all, what use is it to look for water and life throughout our universe and solar system, if we can't even protect the almost magical bit of both we have here on Earth?

Ricardo Bayon
Chair, Ecosystem Marketplace Advisory Board
EKO Asset Management Partners

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Executive Summary

Overview of the Report

A global research effort conducted by Ecosystem Marketplace identified a total of approximately 288 payments for watershed services (PWS) and water quality trading (WQT) programs in varying stages of activity over the past 30 years. In 2008, the baseline year, about 127 programs were actively receiving payments or transacting credits. The total transaction value from all programs actively engaged in 2008 is estimated at US$9.3 billion. Over the entire time span of recorded activity, total transaction value is estimated at slightly more than US$50 billion, impacting some 3.24 billion hectares.

Objectives and Scope of the Report

This report aims: 1) to use project-level data to estimate the overall size and scope of the payments directed to protect or restore watershed services; 2) to account for the full spectrum of watershed services activities and track changes going forward; and 3) to look ahead at the opportunities and challenges based on the current level of transactions, experimentation, and lessons learned.

The scope of this report encompasses a wide view of watershed payments to include all efforts where an entity makes payments to a beneficiary for management practices that address impacts on watershed services in both upstream and downstream areas of the watershed. Our research focused on two leading instruments for watershed protection:

- **Payments for Watershed Services** (PWS): initiatives driven primarily by voluntary action at the national, regional, and local levels, used to provide financial or in-kind incentives to land managers and land stewards to adopt practices that can be linked to improvements of valuable watershed services.

- **Water Quality Trading** (WQT): initiatives driven by regulated standards and implemented at state/regional and local levels where water quality goals are met by trading pollutant reduction credits. These programs are developed as an alternative—and often more cost-effective—approach to meeting traditional command-and-control water quality standards or in anticipation of regulatory requirements.

Analysis of transactions are not strictly limited to cash payments or the exchanges of pollution credits, but also include other types of in-kind compensations supporting a range of activities from adjusting land management practices to improving and protecting water quality, flow and storage, poverty alleviation, institutional capacity-building, technical assistance, and overall community development.

Overall Numbers

We identified a total of 288 payment for watershed protection programs overall in varying stages of activity. Of the programs identified, 127 were actively engaged in transactions in 2008. The 161 inactive programs include those "in development" and not yet actively making payments or selling credits and others that, while once active, are no longer making payments or exchanging credits due to a variety of factors (lack of funding, lack of demand for pollution credits, having met program objectives or other reasons that could not be determined). Overall, the number of programs has continued to grow in recent years; from 51 to 288 between 2000 and 2008.

The bulk of programs, 216, identified are PWS. Such programs vary widely in structure and are located in 24 different countries. Our inventory includes payment for environmental services programs with an emphasis on water, such as national programs in Costa Rica and China. Separating such programs, where water payments are bundled with other environmental services, the total number of exclusively PWS programs drops to around 200.

Across the globe there are far fewer, 72, WQT programs and only 14 of the programs were classified as active in 2008. The use of this payment tool is much newer with the first program launched in the mid to late 1990s. Currently, the geographical range of WQT is quite limited with most programs based in the United States and a handful in Australia, Canada and New Zealand.

Looking at both PWS and WQT, program implementation is orchestrated by various sectors: governments, the private sector, non-governmental organizations (NGO), and community groups or some combination of these players. However, as illustrated by Figure 3 governments manage over half of programs and, by far, are the source of the bulk of payments.

Table 1. Summary of Transaction Data 2008 and Historically

	Programs Identified	Active Programs	Transactions 2008 (US$ Million)	Hectares Protected 2008 (million ha)	Historical Transactions through 2008 (US$ Million)	Hectares Protected Historically
Latin America	101	36	31	2.3	177.6	NA
Asia	33	9	1.8	0.1	91	0.2
China*	47	47	7,800	270	40,800	270
Europe	5	1	NA	NA	30	0.03
Africa	20	10	62.7	0.2	570	0.4
United States	10	10	1,350	16.4	8,355	2,970
Total PWS	216	113	9,245	289	50,048	3,240
Water Quality Trading	72	14	10.8	NA	52	NA
Totals	**288**	**127**	**9,256**	**289**	**50,100**	**3,240**

* Note: We separate China from the rest of Asia given the level of activity.

Figure 1: PWS vs. Trading (Number of Programs)

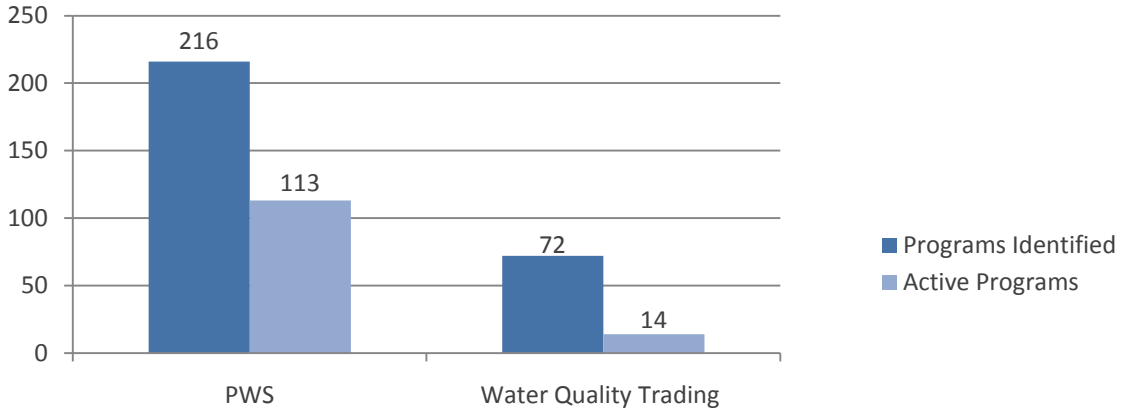
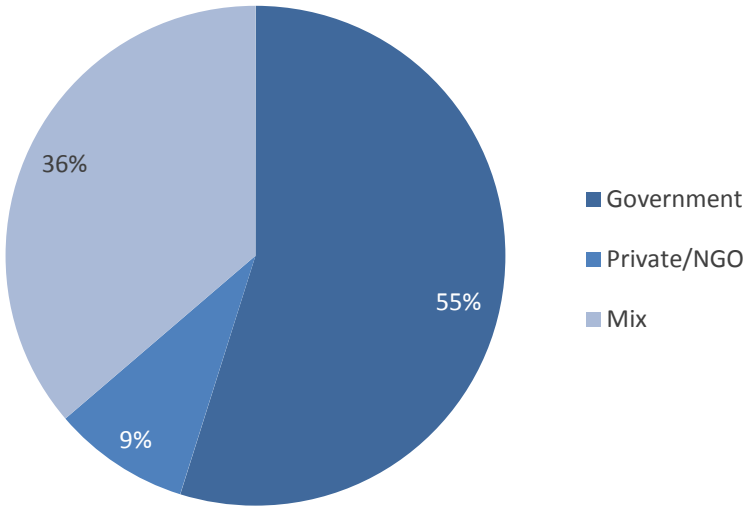


Figure 2: PWS Programs 2008



The total transaction value from all programs actively engaged in PWS and WQT in 2008 is conservatively estimated at US$9.3 billion. Unfortunately, there were many programs where transaction activity could not be determined for 2008 or historically. That said, based on available data over the entire time span of recorded activity, total transaction value is estimated at just over US$50 billion.

Much of these payments are part of PES programs emphasizing water. Programs solely focused on PWS are much lower with at least $8.1 billion in total and $1.3 billion in 2008. In 2008, the value of transactions from WQT registers at US$10.8 million compared to US$9.25 billion from all other PWS.

When compared to other environmental markets, the total value of PWS and WQT payments in 2008 is the second largest market in value, albeit dwarfed by the size of the regulated carbon market as shown in Table 2.

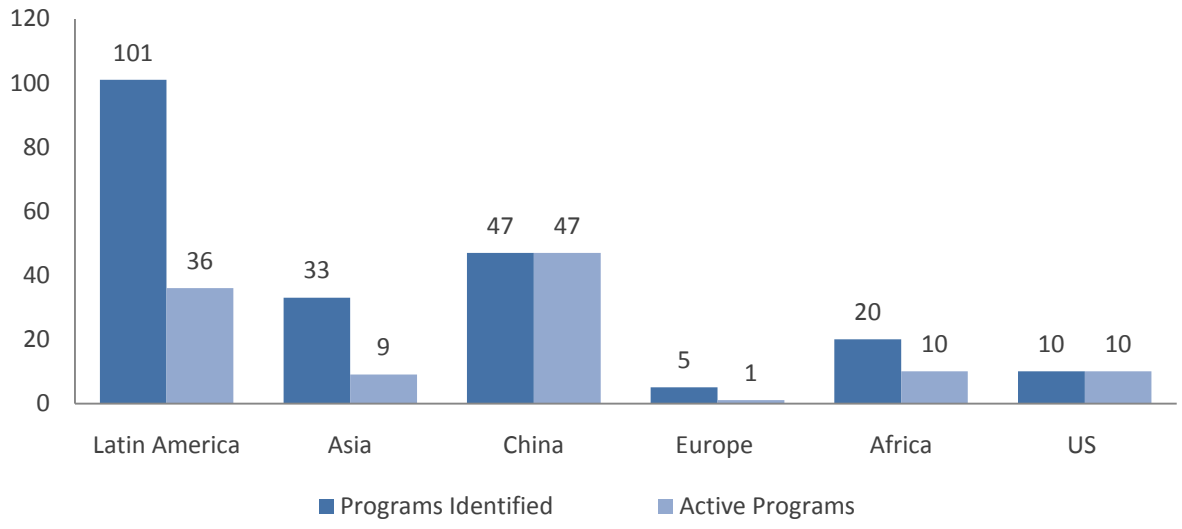
Table 2. Market Value of Environmental Markets	
Environmental Market	Market Value (2008)
Regulated Carbon	$117,600,000,000
Water Quality	$9,250,000,000
Biodiversity	$2,900,000,000
Voluntary Carbon	$705,000,000
Forest Carbon	$37,100,000

Sources: Ecosystem Marketplace Reports: "Building Bridges: State of the Voluntary Carbon Markets 2010" and "State of Biodiversity Markets: Offset and Compensation Programs Worldwide".

Key Findings by Geography

From our global investigation of all **Payment for Watershed Services** programs**, Latin America** is the home of the highest number of indentified programs, contributing some US$31 million to watershed-conservation measures impacting 2.3 million hectares. PWS programs grew steadily in Latin America from seven in 2000 to 36 active programs in 2008. Anchored by the development of Water Funds first in Ecuador, then Colombia, Brazil, and now Peru, the use of this tool to fund upstream conservation by downstream users is poised to spread in other parts of the region and serves as a model for replication in other ecosystem markets around the world.

Figure 3: PWS by Region[i]



[i] China and the US are listed specifically because of the large number of programs in these countries.

The number and variety of PWS schemes in **China** have escalated in recent years, from around 8 in 1999 to more than 47 in 2008, with an estimated transacted value of roughly US$7.8 billion, impacting some 290 million hectares. Payments in China have grown from just over US$1 billion in 2000 to an estimated US$7.8 billion in 2008. In 2008, China's major forestry programs account for over 90 percent of total PWS payments. Current watershed payment schemes in China are almost exclusively government-mediated, and many programs have been created in response to the central government's call to promote the development of and innovation in "eco-compensation mechanisms." For example, from 2002 onward, around 50 percent or more of total transactions by value are under the Conversion of Cropland to Forests and Grassland program. Another potentially significant boost to PWS at both the provincial and national levels could come from a new water pollution emissions trading system. Activities on the ground, including the establishment of a pollution-permit trading platform, suggest that such a system may soon debut in various locations across the country.

The picture in the rest of **Asia** is much less robust, although research identified a total of 33 programs, with 9 classified as active in 2008, and some program activity dating as far back as the mid-1980s. Payments register US$1.8 million in 2008 impacting nearly 110 thousand hectares. PWS activity across the region is anchored by projects created and supported by Rewarding Upland Poor for Ecosystem Services (RUPES), a research effort whose mission is to develop practical environmental services schemes throughout Southeast Asia.

PWS schemes totaled 20 in **Africa** with roughly 10 identified as active in 2008, yielding a total payment value of US$62.7 million on nearly 200 thousand hectares Historical payments from these programs between 2000 and 2008 are estimated to total US$507.7 million with a significant portion attributed to the Working for Water program supported by the government of South Africa. In most cases, watershed management activities in Africa are part of national ecosystem conservation programs that include investments in watershed service enhancement and rehabilitation, and in improvements of the capacity of local communities to identify, formulate, and implement integrated ecosystem management activities. In the future, we look for an increase in payment activity with new initiatives such as those funded by the World Wildlife Fund (WWF) through the Table Mountain Fund in South Africa and the Green Water Credit program in Kenya.

In **Europe** we identified five potential programs, none of which reported actual transactions in 2008. A private sector driven set of payments by Vittel (Nestlé Waters), initiated in 1992, registered the majority of payments, some US$30 million, in the first seven years of operation (1992-1997). Little payment information is known beyond 2004, with no transaction activity found for 2008. While not active as of 2008, the World Wildlife Fund's Danube Carpathian Project is one to watch for future activity in Europe.

The **US** sports significant government-driven PWS activity in water quality initiatives through five key federally funded conservation programs, one infrastructure grant program and four local/municipal programs protecting drinking water sources. Over the past decade sources of payments have shifted. PWS contracts from the federal government to farmers in the US Wetland Reserve Program (WRP) actually declined from 808 in 2000 to 485 in 2008. However, in the US Conservation Reserve Program (CRP), contracts grew from 591,261 in 2002 to 766,723 in 2008. Overall, payments in the United States have increased from US$629 million in 2002 to US$1,350 billion in 2008. In 2008 the concept of PES was

given a boost with the creation of the Office of Environmental Markets within the US Department of Agriculture.

The US accounts for more than 85 percent of the total water quality trading programs, and while this may make the US appear as the trend setter, many programs are currently stuck in neutral, awaiting implementation of water quality standards that set much needed limits on nutrient loads. Absent this key driver of demand for water quality credits, transaction activity has tapered off since it peaked in 2006.

We did not identify any PWS programs in **Oceania**. However, the region was home to 5 WQT programs. Australia is the home of four of these efforts including two unique salinity trading programs for the Hunter River and the Murray-Darling Basin. New Zealand's Lake Taupo Trading Program is part of an initiative to reduce nitrogen flowing into the lake by 20 percent through a mix of land retirement, land conversion, and purchasing allowances that result in permanent reductions of nitrogen.

Conclusion, Trends, and Outlook

This ***water quality marketplace*** is comprised of a myriad of payments for watershed services and protection on the part of government, NGOs and private organizations. Our aim is that, despite many gaps, this research will provide a baseline of data from which to track activity going forward, a vital step in the development of any market, as well as contribute to understanding the role of these market-based tools in addressing watershed management challenges.

Research yielded rich information about ground-level experimentation. Considering the growth in both number of programs and payment values over the past decade, the global trends point to continued expansion of these market-based mechanisms for use in the management of water resources and ever-threatened watershed services. Those working to promote and document the efficacy of these tools are all the while grappling with issues of quality, transparency, improved accounting, and reporting methodology, as well as with the need for performance-based metrics to demonstrate real improvements in ecosystem health. These fundamental features are sure to influence program design, implementation and funding and thus how this marketplace will evolve in the coming decade.

Much of the work documented in this report—and a major factor going forward in addressing water quality and overall watershed management—rests at the doorstep of government and with the policies needed for these market tools to develop and flourish. The fact that water quality trading registers transactions at just under US$11 million dollars in 2008 is attributable to two key factors: 1) trading schemes flourish when driven by effective water quality standards. In the absence of those standards, trading programs will flounder and fall short of performance requirements and market expectations; 2) transaction data from trading programs is not routinely or transparently reported, making the task of tallying transactions, such as for this report, a monumental job. **Government policy**, driven by strong political will, could and should work to remedy these and other issues affecting market-based tools for watershed management in the immediate future.

On the horizon is a growing constituency arguing for valuing water-related ecosystem services in the context of overall ecosystem health. That expanded lens would incorporate watershed services with

other ecosystem services such as biodiversity, carbon sequestration, as well as those provided by coastal and marine environments, increasing the opportunities for markets to work for conservation, communities, and people.

I. Introduction: Why Watershed Payments

Background

A clean and abundant water supply requires healthy ecosystems whose complex interactions of soil, water, vegetation, and climate ensure valuable watershed services. These services include filters for water quality, flow regulation, water supply, and aquatic productivity.

Watershed Services Provided by Forests [1]

- Water quality: Forests act as natural filters and can provide high water quality supplies that have low levels of both nutrients and chemicals.
- Flow regulation: Forest cover helps regulate surface and groundwater flow, providing a natural buffer to the flooding and landslides often linked to heavily deforested land.
- Water supply: Forests act as a regulator of water during both dry and wet seasons, leading to an increase in minimum flows during dry seasons.
- Aquatic productivity: The quality of fisheries is closely linked to the conditions of adjacent upstream watersheds.

There is a growing chorus of voices expressing concern over the health and sustainability of these watershed services.[ii] For example, the Millennium Ecosystem Assessment highlighted the loss of forests and hydrologically important habitats along with the unsustainable rate of freshwater consumption, dropping rates of freshwater recharge, and the growth and severity of "dead zones" throughout the globe (as referenced in the Preface). Such dead zones are caused by increasing levels of nitrogen flowing from freshwater sources into bays, estuaries, and oceans.[2] In concert with the concern over the quality and quantity of the earth's freshwater resources, economists, policy makers, and conservation organizations have been experimenting with capturing "willingness to pay"[iii] for watershed protection and restoration as a tool for conservation. The use of financial and market-based mechanisms to protect water-related ecosystem services is commonly known as Payments for Watershed Services (PWS) along with water quality trading programs. This conservation financing tool has gained global attention among policy makers, researchers, the private sector, and the conservation community.

In some cases, interest in these payment mechanisms is driven by the desire for more cost-effective, politically feasible conservation tools. Environmental markets and market-like payment mechanisms such as Payment for Ecosystem Services (PES) and PWS have demonstrated the potential to help solve environmental problems more cost-effectively compared to, or in combination with, regulatory-based approaches. Moreover, these tools serve a vital role in the protection and restoration of watershed

[ii] Watershed or ecosystem service generally refers to the benefits people receive from natural ecosystems. These are defined as direct services, often called provisioning services (i.e., food and water) or regulating services (i.e., control of floods, erosion, and water filtration) or indirect services, such as those associated with ecosystem processes (i.e., nutrient cycling; pollination, soil creation, and photosynthesis) (MEA, 2005).

[iii] A term used in economics and environmental economics to represent the amount a consumer is willing to pay or exchange for a good or service.

services, where regulatory frameworks are lacking. As such, there is an interest in developing a better understanding of the different payment mechanisms that are being implemented in different contexts and with what level of financial investment necessary to address real-life water resource management challenges. Thus, the genesis of this report.

Over the past decade, we have seen this vision come to life in the global carbon market, the most widely recognized environmental market that has emerged and aims to mitigate the effects of climate change. The creation of the carbon commodity, which began with bilateral, voluntary transactions, has spurred a US$120-billion marketplace.[3] Despite the current challenges befalling carbon markets, the evolution of this market may be illustrative of the development of other potential ecosystem service markets such as those related to watershed services.

In the case of payments for watershed services, the transactions are driven by different factors such as the need for more sustainable watershed management practices and in some cases the need to meet a permitted or regulated standard, as is the case for water quality trading programs. By providing an incentive mechanism or payment, whether in the form of cash or the exchange of a credit, proponents hope to change unsustainable land-use practices that are degrading valuable watershed services. The idea is that a carrot rather than a stick, can be, at times, a more effective way to reach the end environmental goal.

Defining Payments for Watershed Services

Deciding what fits under the PES and PWS umbrella is not an exact science and similarly, the terminology used to describe watershed services transactions covers a wide spectrum of activities. Markets—environmental or otherwise—in the strictest sense are defined by transactions between parties voluntarily coming together and exchanging goods and services at a price that is determined freely by market forces, namely supply and demand. A strict adherence to market transactions would eliminate most watershed protection programs and even some trading programs from our study. We have chosen the broadest definition of PWS to include any transaction where there is a payment or exchange of credits between a buyer and seller to affect some improvement of a watershed service.

For this report, we classify watershed services payments by two broad types of payment mechanisms:

- Payments for Watershed Services: private or government-driven payments where those paying are aiming to protect or improve watershed services and those receiving payments are engaged in activities to ensure continued provisioning.
- Water Quality Trading: an offset framework where an overall limit is established for pollutant levels, and regulated entities may purchase offset credits to meet permitted obligations.

In order to determine the overall state of watershed payments, this report analyzes both types of payment mechanisms as described below.

Table 1: Classification of Payment/Transaction Types			
Payment Types	**Description**	**Payment Mechanism**	**Examples**
Government PWS	Publicly administered programs that use public funds to make direct payments to a private landowner, for the protection and stewardship of ecosystem services on their property or under their stewardship.	Payments take the form of economic incentives and subsidy payments, cost-share arrangements, land purchase deals, direct transfer payments, and subsidized public/private funds.	• US government water quality improvement programs via the Farm Bill • China's Sloping Lands Forest Conservation Program • Tungurahua Fund in Ecuador • NY City's Watershed Protection Program
Private PWS	Private entity develops its own payment mechanism in protection of a vital watershed service for either business or philanthropic interests.	Privately funded transfers that take the form of direct payments from one private entity to another and the purchase of land or development rights to land.	• Vittel in France • Uganda Brewery Wetland/Watershed program in Uganda
Water Quality Trading	Government sets a water quality standard on the total amount of pollution flowing into a body of water or watershed.	Polluters collaborate to meet the standard by trading (buying and selling) pollution credits to maximum economic benefit.	• Long Island Sound Nitrogen Credit Exchange Program in Connecticut, USA • Salinity trading programs in NSW, Australia • South Nation RiverTrading Program in Ontario, Canada

While this report takes a broad view of watershed payments, a variety of other programs could fit under the umbrella of water markets or watershed payments that are not discussed here. The transactions related to permitted water rights or water allocation or re-allocation markets, which operate under a distinct body of laws and environmental objectives, are beyond the scope of this report. We acknowledge that those transactions, and the programs they represent, may hold valuable lessons for the professionals working to build the water quality related ecosystem markets, but we hold those for future examination.

Objectives and Scope of this Report

There are three main objectives of this report: 1) to use project-level data to estimate the overall size and scope of the payments directed to protect or restore watershed services; 2) to use that data to establish a baseline to track changes going forward; and 3) to look ahead at the opportunities and challenges based on the current level of transactions, experimentation and lessons learned.

We limited the scope of analysis to those programs that we could determine were "active" in any year and focused in 2008, the baseline year, defined as:

> A program is considered active, if it has *facilitated payments between entities seeking to improve watershed services* including, in some cases, watershed conditions related to flow regulation. The key to the transaction is the exchange of money, or property (i.e., credits) from one entity to another. Having received funding to develop a program or trading platform, policy, or rules, does not qualify a program as active.

Taking a payment-based view of activity, especially for the trading programs, enabled us to distinguish *market potential from market activity,* which allowed for differentiation between programs that had successfully exchanged pollution allocations and those that simply allow for trading but had not transacted credits.

What distinguishes this report from previous reports is the focus on project-level payment data and our intention to shed light on the potential of market-mechanisms to serve as effective tools in the management of water resources and watershed services. Tracking the money that is being invested and the prices that are being paid along with the impacts helps measure the potential interest or demand in this emerging marketplace. Highlighting the specific approaches that are being developed contributes to the overall understanding of the current challenges surrounding water quality and flow regulation in freshwater and estuarine systems. It is our hope that providing this information will facilitate a deeper understanding of how these payment mechanisms have worked, in what context, and at what scale, and to what benefit to those working to find more innovative and cost-effective ways to protect and restore watershed services.

II. Methodology for Collecting and Standardizing Data

Key Resources

This report is based on data collected from a global review of payment for watershed services programs and water quality trading programs. As mentioned above, one of the key objectives of the report is to create a full inventory of the various market-based programs across all regions of the world. As noted earlier, we take a broad view of PWS to include any type of payment related to the improvement of a watershed services. The overall inventory of projects and concepts discussed pull from a variety of several seminal resources:

For Payment for Watershed Protection Programs:

- Landell-Mills, N., and Porras, I. (2002). Silver Bullet or Fools' Gold? A Global Review of Markets for Forest Environmental Services and their Impact on the Poor. London: The International Institute for Environment and Development (IIED).
- Porras, I., Grieg-Gran, M., and Neves, N. (2008). All that Glitters: A Review of Payments for Watershed Services in Developing Countries. London: The International Institute for Environment and Development (IIED).
- Watershed Markets website: **http://www.watershedmarkets.org/casestudies.html**
- EcoDecision: **http://www.ecodecision.com.ec**
- RISAS: **http://www.redrisas.org**.

For Water Quality Trading Programs:

- Selman, M., S. Greenhalgh, E. Branosky, C. Jones, and J. Guiling. (2009). Water Quality Trading: An International Overview. Washington, DC: World Resources Institute.
- United States Environmental Protection Agency's webpage on Water Quality Trading: **http://www.epa.gov/owow/watershed/trading.htm**.
- Dartmouth College Report: Water Quality Trading and Offset Initiatives in the USA: Comprehensive Survey: **http://www.dartmouth.edu/%7Ekfv/waterqualitytradingdatabase.pdf**.

Data Collection: Standardizing the Data and Establishing the Baseline

After developing the full inventory of projects, our aim was to develop a database of project-level transaction information that would yield the best possible picture of the overall size and scope of watershed payments focusing on the following key aspects:

- *Project information*: project name, location, contact person, year started, project cycle, and project website.
- *Transaction information*: type of buyer, type of seller, intermediaries, service category (type of watershed service), driver of demand, amount paid, units of pollutants reduced, service area, status of program, transaction volume by year.
- *Monitoring, reporting and evaluation information*: impact indicators, monitoring and verification methodologies.

We then set out to populate the database (and conduct the analysis) using the following methods:

- Research from both published and unpublished documents including reports, articles, and general and targeted Internet searches;
- A questionnaire sent to roughly 25 project implementers of water quality trading programs in Australia, Canada, New Zealand, and the US.
- Direct contact with 60+ plus practitioners or project developers (either by phone interviews or email) implementing both trading and watershed payment programs mainly in Asia, Australia, Canada, Latin America, New Zealand, and the US.

It is important to emphasize that at some level, this is a comparison of “apples to oranges”; the structure and implementation of programs vary widely, and program attributes don't always fit into established categories. In several cases, especially in Costa Rica, China and the United States, the programs identified as part of the overall inventory target multiple ecosystem services including, but not restricted to, watershed services. In particular, many of these programs encompass policies for developing frameworks of cooperation between various levels of government for the financing and sharing of costs of both PES and PWS that involve direct payments from the government to individual and community-level suppliers of multiple ecosystem services. As such, we have attempted to use the information collected, despite gaps, inconsistencies, and known overlapping ecosystem benefits, to offer a snapshot of the overall scope of this emerging marketplace for watershed protection. While this is by no means a comprehensive view of transactions, and readers should view these estimates through that filter, this is nonetheless a valuable and needed attempted to begin to better quantify and categorize these activities.

III. Payments for Watershed Services Programs

Payments for watershed services is a mechanism used to provide financial or in-kind incentives to land managers and land stewards to adopt practices that can be linked to improvements of valuable watershed services (those outlined in Table 1 in the Introduction). Programs are driven both by private interests (though their number is few) and government entities aimed at influencing land-use practices that affect water quality and flow. The difference between these schemes and water quality trading is that tradable credits or offsets are not created.

This report takes a wide view of PWS to include all efforts where an entity makes payments to a beneficiary for land management practices that address impacts on watershed services in both upstream and downstream areas of the watershed. The specific payment used to complete the transaction are not strictly limited to cash payments, but include other types of in-kind compensations, as well as land purchases or financing of protection activities.

These payment mechanisms are designed to improve land management practices and in some cases provide technical assistance, education and overall watershed management planning, as summarized in Table below. As with Water Quality Trading (WQT) programs, the design of these programs varies widely, both within and across regions.

Program Structure: How Programs Work

So how do the players link up over the protection of watershed services? That answer, and thus the design of the program, depends almost entirely on who perceives there to be a problem that can be solved by a watershed protection program. The two most common drivers are: 1) Those that are *demand-driven,* where there are perceived water quality or flow problems affecting downstream users thought to be caused by land-management practices upstream. Payments act as incentives to landowners to change land-based practices; and 2) those *driven by supply,* where payments from water users are utilized to pay for improvements to watershed management practices that were otherwise threatening watershed services.[4]

Payment mechanisms and financial management of resources becomes more sophisticated and complex as the size of the program increases. For small local initiatives, resources may be managed through a simple checking account administered by the local government or an NGO.

Table 1: Summary of Watershed Protection Payment Mechanisms, Activities Funded, and Program Participants		
Payment Mechanisms	**Activities Funded**	**Program Participants Involved**
Government-driven: • Subsidy payments funded by general taxes or user fees • Land purchases • Conservation easements • Transfer of development rights *Private Sector-driven:* • Subsidy payment from private sources • Required fees for watershed protection	1. Improving Land Management Practices through Implementing Best Management Practices Including: • Planting trees as buffers along rivers and streams • Reducing fertilizer use • Managing manure • Fencing farm animals out of streams and key recharge areas • Planting cover crops to slow siltation and runoff • Improving forestry management including agro-forestry practices • Managing existing ecosystems using adaptive conservation and restoration management practices • Avoided deforestation practices 2. Technical assistance, outreach, and education 3. Development of watershed management plan 4. Protected area enforcement 5. Income-generating activities to reduce deforestation pressure or fund work to remove invasive species 6. Verification and monitoring	• *Buyers/Funders*: Governments, Private Interests, NGOs, Individual Users • *Sellers/Beneficiaries*: private landowners or informal stewards, government reserves or land trusts, private reserves and NGOs who have title and management responsibility of protected areas • *Administrators*: The primary role of administrator is to establish the specifics of the transaction and facilitate any negotiation between the buyers and sellers. These may also perform monitoring and performance evaluations following transactions. • *Intermediaries*: An intermediary can be defined as any party other than the buyer or seller who helps facilitate some aspect of the transaction or implementation of the overall program. This role is commonly played by NGOs, consultants, or academic institutions. • *Funders*: In addition to the funds invested by the buyers, many of the entities developing watershed protection programs receive funding from government and donors (multi-lateral banks, NGOs, and private interests all with an interest in promoting protection of the watershed for various reasons).

Since watershed protection and management are long-term activities, endowments can be an effective way to ensure the sustainable and transparent use of resources. To this end there has been a growing interest in creating endowments or water protection trust funds, as is the case in Ecuador, Colombia and now Peru, inspired by the Quito Water Fund FONAG model (described in the Latin America section). This same wide range of program models similarly describes the programs in Africa, Asia, and generally across all regions.

Usually, the resources are paid to the landowners based on a signed contract, using a standard legal format. Contracts stipulate the conditions that landowners have to abide by and the amount, timing and form of payments. They are established for a specified period of time and can be renewed. In some cases, contracts will establish sanctions for non-compliance, which entail a gradual evolution from an initial admonishment, to a reduced payment, to withholding of a payment, to a final separation of the landowners from the PES program, depending on the severity of the non-compliance and the frequency of occurrence.

Program Participants: Who's Playing?

Watershed protection programs most often involve a party that buys or funds the transaction and a party that sells or provides the watershed service (beneficiary). Common to many programs is an administrator who helps design, promote, negotiate, track and monitor the transactions, as summarized in Table 1above.

Who Makes Payments?

Key players, supporters, or funders of payment for watershed protection initiatives have been municipal governments responsible for protecting sources of drinking water, drinking water companies and hydroelectric generators (both public and private) that have come to realize that investing in conservation of the habitat surrounding their catchment makes good business sense. The protection of a watershed's forest cover has demonstrated to be, in many cases, a highly cost- effective way to guarantee ample and good quality water. Those paying to restore soils and vegetation, thus minimizing siltation running into reservoirs, are opting for a "prevention is good policy" approach to managing watershed services.

NGOs and decision makers in municipal governments have begun working together to protect sources of drinking water through improved land management practices. Examples include small municipalities in Mexico and Ecuador (Pimampiro, Celica, El Chaco, Espindola), which have worked with local NGOs to assign a portion of their water tariff to buy land at the source, pay landowners to protect land and promote alternative sustainable measures. These efforts mirror those undertaken by the municipalities of New York City and Dar es Salaam, in efforts to lower the cost of downstream filtration by working with upstream communities to improve land management practices.

The more sophisticated a payment program becomes, the more variety there is among the participants involved. For those programs newly forming, no matter who is driving the process, it is vital to involve all the relevant stakeholders early in the negotiation process to ensure long-term success of the watershed payment program.

Who Receives the Payments?

The recipients of the payments are predominantly upstream landowners or those serving as informal stewards of the land. These may be individuals, indigenous groups, or rural communities. In a few cases, protected areas (national parks or private reserves) receive payments. Table 1 above summarizes the types of best management practices and other supportive activities for which payments are made.

Overall Global Numbers for Payments for Watershed Services Programs

A total of 216 programs were reviewed for this report. In Latin America alone, this includes a list of more than 100 programs. The table below summarizes the total number of watershed protection programs identified overall and the transaction details for 2008 and historical data, where available, from programs deemed to be active. As mentioned earlier, a program qualified as "active", if it had facilitated payments to improve valuable watershed services in both upstream and downstream areas of the watershed.

Table 2: Summary of Transaction Data 2008 and Historically

	Programs Identified	Active Programs	Transactions 2008 (US$ Million)	Hectares Protected 2008 (million ha)	Historical Transactions through 2008 (US$ Million)	Hectares Protected Historically
Latin America	101	36	31	2.3	177.6	NA
Asia	33	9	1.8	0.1	91	0.2
China	47	47	7,800	270	40,800	270
Europe	5	1	NA	NA	30	0.03
Africa	20	10	62.7	0.2	570	0.4
United States	10	10	1,350	16.4	8,355	2,970
Total PWS	216	113	9,245	289	50,048	3,240
Water Quality Trading	72	14	10.8	NA	52	NA
Totals	**288**	**127**	**9,256**	**289**	**50,100**	**3,240**

Overall, at least US$50 billion has been spent on PWS and PES programs that incorporate watershed services across 3.2 billion hectares. About US$9.2 billion was spent in 2008. Much of this investment was from PES programs that emphasize but are not exclusive to watershed services. Nearly US$1.3 billion was invested in exclusively PWS programs influencing some 16 million hectares.

Latin America

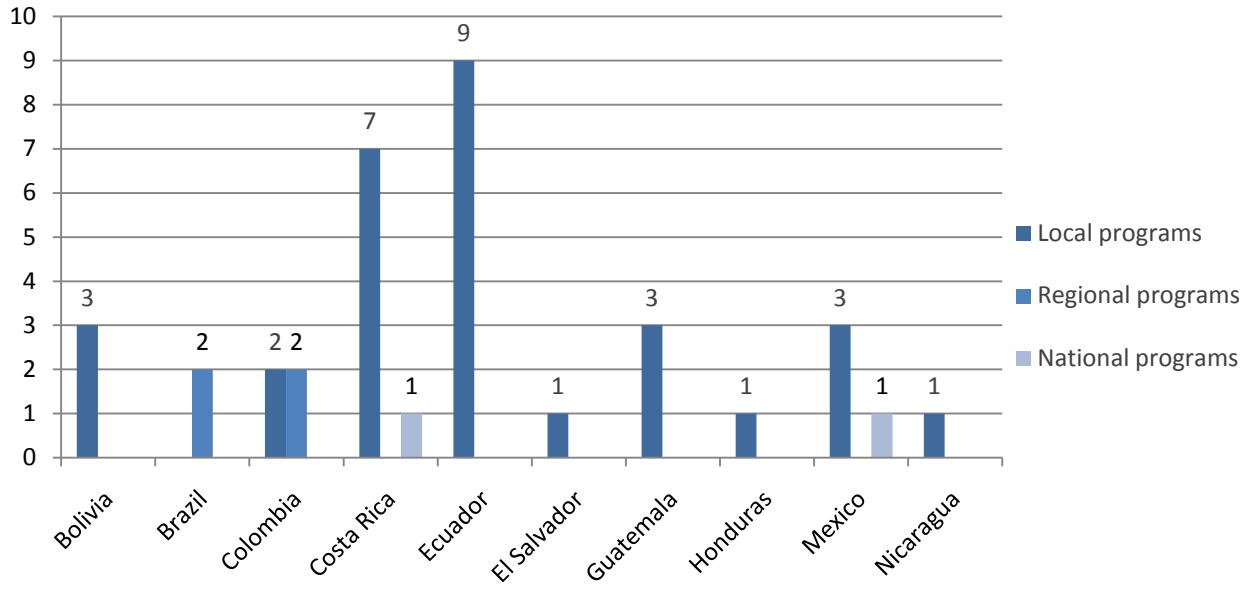
Summary Details

- Total number of programs identified: 101
- Total number active in 2008: 36
- Total value transacted in 2008: roughly $30.9 million
- Total area protected or restored by 2008 activity: 2.4 million hectares
- Total historical transactions from 1997 to 2008: $177.6 million

Regional Overview

Of all regions, Latin America has the longest running and most robust experience in the application of PWS mechanisms. Of the total 216 PWS programs identified for the preparation of this report, 101 were located in the region. Of that total, 36 were found to be active programs in 2008, representing a range of local, regional, and national programs in ten countries (see Figure 1 below for countries found to have PWS programs and the distribution of programs by country).

Figure 1: Active Programs in Latin America in 2008

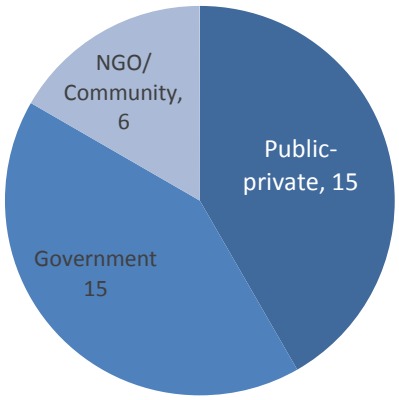


PWS programs have been in operation in Latin America since the early 1990s, with several of the original projects in Colombia and Costa Rica still in operation today. Of the 101, 23 were proposals that were abandoned, 28 proposals in development, 7 programs that were not focused on hydrological services, and 7 cases in which information was not available. In Latin America in general, transaction-level data is difficult to access because it is only sporadically documented online, in reports, or in academic sources, or program participants are not able to provide it easily. Some information for this report was gathered from presentations at national and regional conferences. Research determined 36 programs to be active in 2008, but only 25 programs provided transaction-level data.

The scope of the programs analyzed range from local bilateral transactions for a micro watershed, to regional or provincial watershed programs, to national, countrywide-level protection programs. In 2008, national initiatives were identified in Costa Rica and Mexico.(Ecuador's program began in 2008 as a forest protection program; in 2009 it expanded to include a watershed protection component).

Regional or provincial/statewide programs are underway in Brazil, Ecuador, Colombia, and Costa Rica. Local efforts are being implemented in Mexico, El Salvador, Nicaragua, Costa Rica, Colombia, Ecuador, and Bolivia.These local programs are driven by private entities, such as local environmental foundations and local companies. The figure below shows the distribution of implementation agency by sector of the 36 active programs in 2008.

Figure 2: Implementing Agency by Active Programs in Latin America in 2008



The prevalence of PWS programs in Latin America responds to several reasons. First, established conservation organizations have been seeking innovative financing for their projects. Second, there has been a critical mass of leaders in key positions interested in economic instruments that can effectively influence decision-making processes at different levels of government. Third, environmental organizations and overseas development organizations have been active in disseminating experiences and networking among practitioners, making PWS instruments accessible and applicable from one country to another.

At the same time, although boasting a long history of institutional and legal framework for environmental protection, governments across the region have limited and weak enforcement capacity. Given this weakness, the conservation movement throughout the region has been driven to innovate and find alternatives to command and control measures and views economic incentives as available alternative to protecting watershed services.

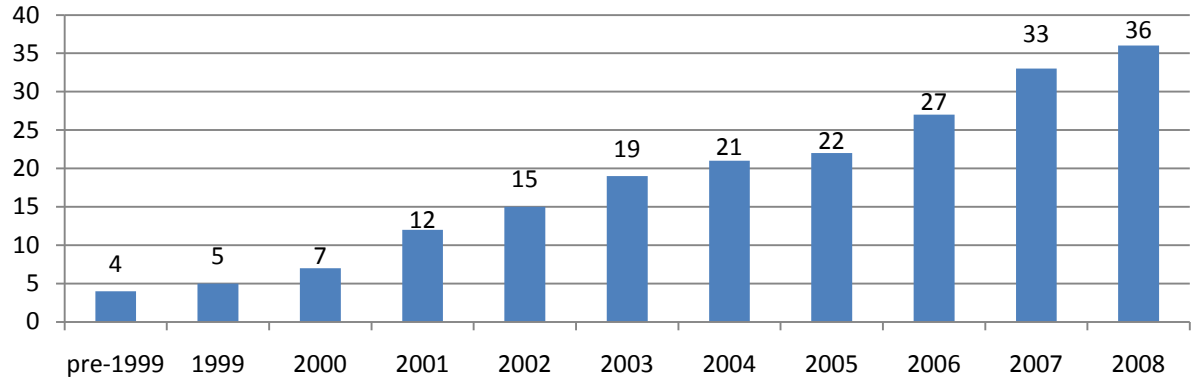
Efforts to control deforestation with outright prohibition have been ineffective. In the 1990s, conservationists and other stakeholders interested in protecting forests and the watershed services they provide instituted voluntary payments to landowners for maintaining forest stands. The expectation was that by maintaining the forest cover, infiltration would be ensured and water quality and flow enhanced and protected.

Costa Rica, in particular, pioneered the emerging market of PWS in the late 1990s.Since forest areas were being transformed for cattle-raising, water users—particularly for hydroelectric generation—were

concerned about the effects on their water sources. Thus, the idea arose of creating an economic incentive to landowners for protecting their forest lands. The PWS program was instituted in 1997 by the newly created Ministry of the Environment and monitored by a public-private partnership Fondo Nacional de Financiamento Forestal (FONAFIFO).

The Costa Rican experience catalyzed the growth of other private and government driven programs throughout the region. Local payment programs promoted by NGOs and private companies were established in Colombia, Ecuador, Brazil, Guatemala, El Salvador, Nicaragua, and Bolivia. Regional and national government incentive programs have developed in Brazil, Mexico, and most recently, Ecuador. The following chart illustrates the number of programs in existence by year from across the region.

Figure 3: Active Programs in Latin America per Year



Transaction Activity

Research for this report focuses on current and historical data on the programs identified. We estimate that in Latin America between 1997 and 2008, over $177.6 million dollars were spent on PWS. Excluding Costa Rica's national PES program, which emphasizes but is not exclusive to PWS, payments solely for watershed services equaled $51.6 million. This payment figure is inclusive of transaction costs for some programs and is intended to represent a general order of magnitude of overall historical transactions.

The amount of money spent by programs on PWS varies significantly. For example, Costa Rica's Payments for Environmental Services Program has spent $126 million from 1997 through 2008, with funding coming from the national budget (fuel tax and water tariffs), loans from multilateral organizations, as well as Overseas Development Assistance (ODA).Mexico's National Hydrological Payments Program, supported by the national budget, paid a total of $36.4 million to landowners from 2003 to 2008.Total investment for the locally driven watershed protection activities paid through Quito's Water Fund, FONAG, was $9.3 million dollars between 2000 and 2008.In contrast, the Los Negros program in Bolivia paid $7,000 dollars from 2003 to 2008.

In 2008 alone, close to $31 million dollars was paid to landowners or for protected areas impacting almost 2.4 million hectares of land, including forests, riparian zones, reserves, and other natural landscapes.

Table 3: Summary of Transaction Data for 2008 and Historically Latin America						
		Data for 2008		Historical Data		
	Numbers of Programs	Payments	Hectares Protected	Payments	Hectares Protected	Time Range
Active Programs						
Bolivia	3	$20,130	3,933	$7,000	NA	2007-2008
Brazil	2	$254,949	6,450	$150,000	NA	2007-2008
Colombia	4	$4,026,844	9,886	$29,751	NA	2006-2008
Costa Rica	8	$15,096,405	691,956	$111,035,334	599,061	1997-2008
Ecuador	9	$2,280,464	15,266	$8,403,354	NA	2000-2008
El Salvador*	1	$612,000	NA	NA	NA	2008
Guatemala	3	$75,000	140,355	NA	NA	2008
Honduras	1	$1,218	74	NA	NA	2008
Mexico	4	$8,612,868	1,514,986	$27,764,447	545,576	2003-2008
Nicaragua	1	$- 248	13	NA	NA	2008
Totals	**36**	**$30,980,125**	**2,382,919**	**$147,389,886**	**1,144,637**	

**The investment was in park surveillance but the area protected was not reported.*

The bulk of payments in the region have come from two national programs (Costa Rica and Mexico). As will be discussed in later sections on China and the United States, because of a central government's capacity to respond, national government programs can scale up more quickly and provide more significant investment. In 2008, the Payments for Ecosystem Services Program of Costa Rica and the National Hydrological Services Program of Mexico accounted for 70 percent ($21.5 million) of the total payments made and 90 percent of the total area (or close 2.4 million hectares) protected across the region.

While payments from the two national programs currently dominate the scene in Latin America, it is important to highlight that PWS payments can begin as voluntary, locally driven programs that over time inspire the creation of larger government programs at the regional or national levels. Such is the case in Costa Rica, where some of the pioneer programs were funded by hydroelectric generators, and over time the program received financing from the central government. Similarly in Ecuador, the first PWS program was established in the town of Pimampiro and was initially funded by an international donor and local water tariffs. As of 2009, it has been incorporated into the central government's program, Socio Bosque.[iv] Overall, the evolution of these programs has not been linear—each case seems to have

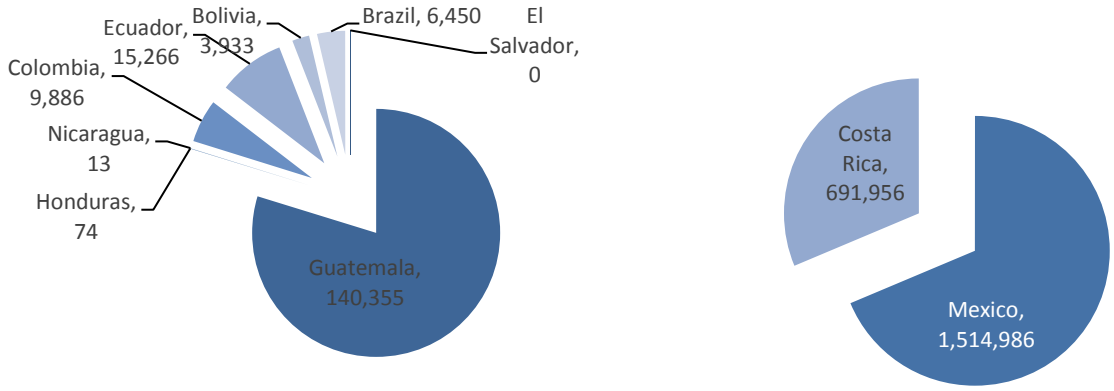
[iv] Data on the Socio Bosque Program from Ecuador was not included because it was initially instituted as a forest protection incentive program. As of 2009, Socio Paramo is investing in the maintenance of Andean grasslands for their hydrological importance.

developed depending on particular circumstances within a watershed, often driven by leadership at local levels. However, as in the carbon market, voluntary bilateral programs do seem to provide effective learning and experience to inform large-scale public policy decisions.

Beyond the national programs of Costa Rica and Mexico, the largest programs in terms of payments in 2008 are in Colombia and Ecuador. Colombia's investment involves 2 regional and 2 local programs, totaling an investment of $4 million. Ecuador has 9 local programs in the region with $2.3 million invested. El Salvador and Brazil follow in expenditure.

Guatemala, Ecuador, and Colombia have the more significant programs by area protected, as seen in Figure 4 below. It is important to note that Guatemala has a large area under protection with a small amount of investment because the program involves a protected area that requires fewer resources to protect (compared to a payment scheme with individual landowners).

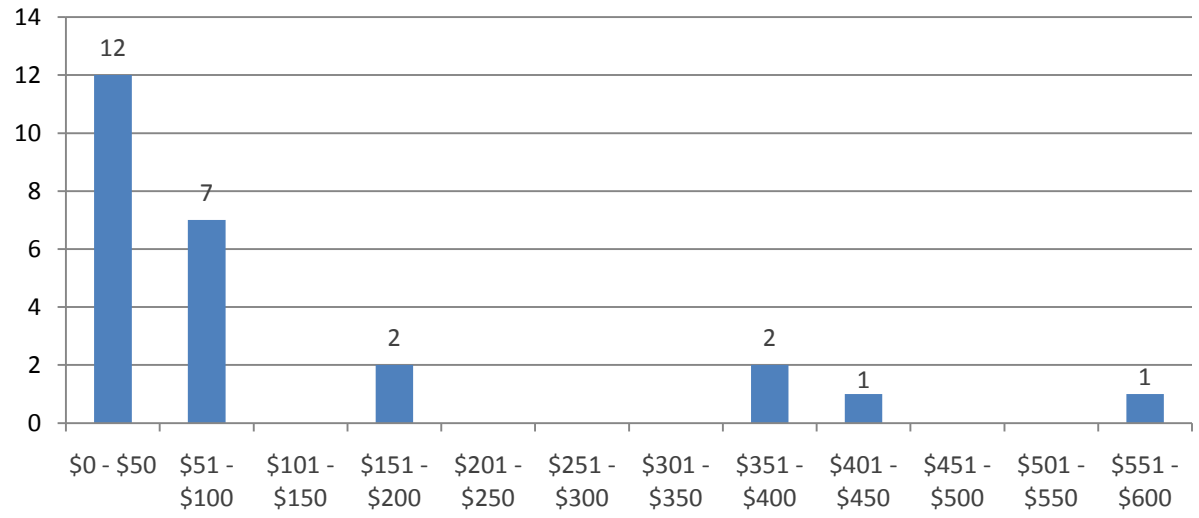
Figure 4: Area Protected/Restored in Latin America in 2008



Price per Hectare

The payment per hectare varies greatly between programs and countries. In some cases, the value paid per hectare responds to the differing opportunity cost of land and labor, which has very different prices per country. For example, in Mexico, payments in the National Hydrological Payments Program were set factoring in the opportunity costs of corn production, while in Costa Rica payments were based on cattle pasture use. (However, opportunity cost is not the only force behind price determination. In Ecuador's new National Forest Protection Program, established in 2009, per hectare calculations are in line with a recent national anti-poverty subsidy to provide a "just" income to poor communities). Alternatively, Los Negros program, in Bolivia, based payment on a survey of willingness to pay from downstream users.[5]

Figure 5: Number of Active Programs by Payment Range (Average) in Latin America in 2008

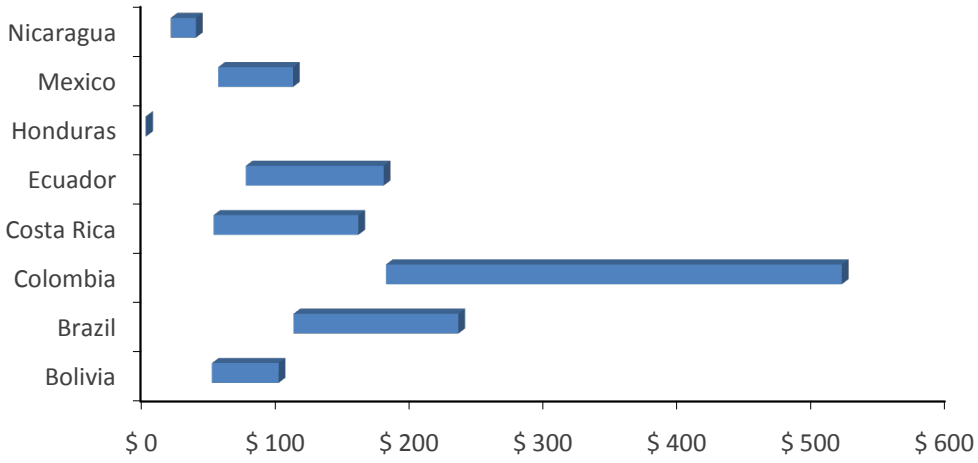


Payments also vary depending on the land management requirement. Protection (or non-use) may receive a lower payment than land management alternatives, such as reforestation or restoration, which entail investments on the part of the landowner. Values range from US$0.02 per hectare per year for natural forest protection to close to $952 for reforested areas, respectively, with a regional average of$100 dollars per hectare per year. Central America averages $56 per hectare per year, while in South America the average is $154. If programs are grouped by payment range, the majority of the programs pay below $100 dollars per hectare as seen in the bar graph below.

Overall, another key variable of payments per hectare lies in whether or not programs are local, where payments may be lower than in national and regional programs. Payments in such cases may be determined by the individual relationships between and requirements of landowners and the party interested in protecting the forest.

At the same time, national government programs may incorporate poverty alleviation goals into their agendas, leading to higher payments. Colombia and Ecuador are paying the highest prices, with Central American countries providing significantly less financing. This generally reflects the relative position of each country in terms of its income per capita. Ecuador is an exception—a poor country that is willing to pay a higher value ($30 per hectare per year) due to the integration of social goals (poverty alleviation) in their program.

Figure 6: Range of Payments of Active Programs by Country in Latin America - 2008



Box 1: Water Producers Program in Espirito Santo State, Brazil

As of 2009, the state of Espirito Santo in Brazil approved the Water Producers Program, which aims to compensate landowners—dairy producers—who own remnants of native forest (standing forest) in strategic hydrological areas and thus conserve and increase water quality and flow. These dairy producers are compensated based on the number of liters of milk they are not able to produce by closing off areas to pastures.

The Water Producers Program is a partnership between several state agencies, such as the State Department of Agriculture (SEAG), the Development Bank of Espirito Santo (BANDES), the National Water Agency (ANA), and the Institute BioAtlântica (IBIO). Since March 2009, the project is benefiting farmers from five cities in Espirito Santo (AfonsoCláudio, Alfredo Chaves, Alto Rio Novo, Brejetuba, and Mantenópolis) in three river basins (Benevente, Guandu, and São José). The contracts are signed for three years and can be renewed for up to ten years. After one year of compliance, landowners receive an average of $74 dollars (R$135) for each protected hectare per year.

Resources for this statewide program come from water tariffs, as well as royalties from oil exploration (3 percent), natural gas (10 percent), and hydroelectric power production. Sixty percent of these resources are used to make the payments to landowners.

Source: Water Producers Program: Fernando Veiga, The Nature Conservancy Brazil.

Program Structure

Who pays? The key supporters of these initiatives have been the drinking water companies and hydroelectric generators (both public and private) who have come to realize that investing in conservation of the habitat surrounding their catchment makes good business sense. In some cases, the protection of a watershed's forest cover has proven to be the most cost-effective way to guarantee ample and good quality water; therefore, a conservation approach is the best policy.

NGOs and decision makers in municipal governments across the region have begun working together with the water companies to protect sources of drinking water through improved land management practices. Examples include small municipalities in Mexico and Ecuador (Pimampiro, Celica, El Chaco, Espindola) that have worked with local NGOs to assign a portion of their water tariff to buy land at the source, pay landowners to protect land, and promote alternative sustainable measures with investments in 2008 of around $54,000 and $37,464 respectively. The Boyaca Funds in Colombia, with total payments of $1.78 million in 2008, is an example of drinking water consumers funding forest landowners for source water protection via water tariffs captured by a regional public entity.

Box 2: Water Trust Funds in Ecuador, Colombia and Peru

Most urban water users in Latin America, as in many other watersheds across the globe, are not aware where their drinking water comes from and the rural communities that live in these areas. Such a disconnect can be reversed by creating sustainable mechanisms to link water users with landowners and natural ecosystems .Urban and industrial water users in the Andean region have proven quite willing to take action by creating Water Trust Funds, entities bound by a legal contract among founding members, generally institutions or companies representing key water users.

Such a contract designates an independent financial institution to manage the trust, including managing investment capital and ensuring that returns are spent on watershed protection activities in compliance with the Fund's contract or statutes. A Governing Board, made up of representatives from all the contributing organizations, provides oversight on compliance and guidance on resource use through an annual budget and operating plan. The leading operational entity is a Technical Secretariat, designated by the Governing Board, and is in charge of strategic and business planning and project management. Activities to improve land management are implemented through third parties to create local capacity and accountability.

The Quito Water Fund (FONAG) is an example of a water trust fund. The municipal drinking water and electrical utilities, a private brewery, and a water bottling company commit resources through a long-term financial mechanism, or 80-year trust fund, as defined by local financial regulations. The returns from this investment leverage donations from international and local NGOs, governments, and Overseas Development Assistance. These funds in turn are invested in critical conservation projects that involve strengthening parks and protected areas, supporting rural families to restore degraded lands and adopt sustainable farming practices, reforestation, and educating children about sustainable water management.

Results to date: FONAG has generated an endowment of more than $6 million from its members, which has allowed it to invest $2.3 million and leverage an additional $7 million to spend in key conservation activities. Watershed protection activities financed through FONAG from 2000 to 2008 amounted to $9.3 million. The Quito model is now being replicated for many Andean cities, such as Palmira, Cali, Bogotá, Medellín, and Cartagena (Colombia); Lima (Peru); and Zamora, Espíndola, Ambato, Riobamba, and Cuenca (Ecuador). 2008 was a landmark year for making operational several funds in Ecuador (Cuenca-FONAPA, Tungurahua province, and Espindola) with a total seed capital of over $1 million.

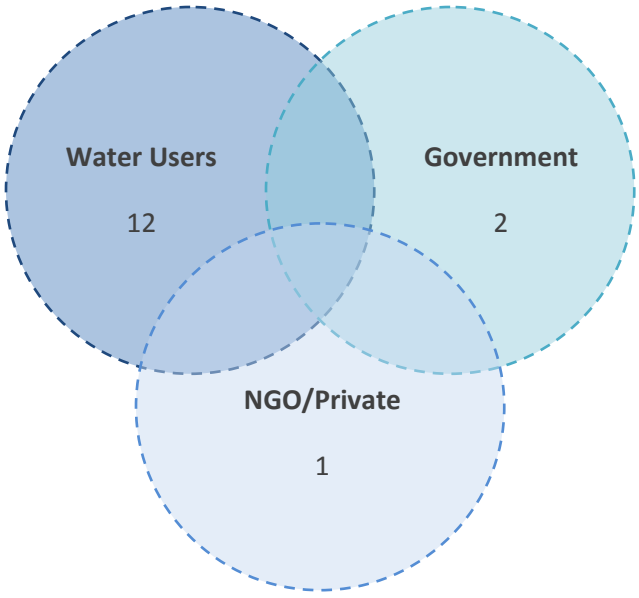
Source: Marta Echavarria, EcoDecision.

Who receives payments? The recipients of the payments are predominantly upstream landowners, which in 2008, totaled close to 3,799 beneficiaries. These represent payments to individuals, indigenous groups, rural communities, and in a few cases, protected areas such as national parks or private reserves. In 2008, the national programs had 1,103 contracts signed in Costa Rica and 1,890 contracts in Mexico. For the sub-national programs, where not all programs reported, the number of beneficiaries identified totaled 806.

Endowment funds, such as Colombia's Boyaca Fund, are a mechanism by which cities in Ecuador and Colombia have brought together water users, leveraging multiple funding streams to invest in source-water protection. In 2008, these endowments were established with a seed capital investment of around one million dollars. As suggested earlier, funds have proven to be effective tools to ensure the sustainable and transparent use of resources over time. To this end there is a growing interest in creating endowments or water protection trust funds, as is the case in Ecuador, Colombia, and now Peru, inspired by the Quito Water Fund FONAG model described in Box 2.

Financing for programs in Latin America comes from a range of sources. The chart below highlights how the different programs from across the region are funded by more than one source. For example, the PROCUENCA program in Colombia receives resources from a percentage of the city's water tariff, as well as regional and municipal government resources and international cooperation funding (FAO project); Sierra de las Minas Biosphere Reserve Water Fund in Guatemala is partially funded by Coca-Cola and Agua Pura Salvavidas, and World Wildlife Fund; and Tungurahua's Fund to "Fight Poverty and Manage Paramos" in Ecuador receives payments from two hydroelectric companies (Hidropastaza and Hidroagoyan).

Figure 7: Sources of Funding in Latin America - 2008



Regional Outlook

Growth of the number of watershed protection programs over the past decade is one indication that decision makers, whether from drinking water utilities, electrical generators, or local or regional government authorities, are seeing watershed protection payments as part of their policy options to prevent further deterioration of critical watershed resources. In 2009, six more PWS programs began operation in Latin America.

Also noteworthy is the evolution of the scale of programs, as seen in the cases of Mexico and Ecuador where local initiatives have been incorporated into larger, more comprehensive national conservation policy objectives, giving the local participants a more sustainable source of funding. The numbers for Ecuador and Brazil are expected to increase radically in 2009 as the Socio Bosque and the Water Producers Programs get underway.

While national government driven programs currently dominate the scene in Latin America, their evolution seems to be influenced by the particular circumstances at local levels.Voluntary, bilateral programs can provide learning to inform public-policy decisions at different decision-making levels, as seen by the water trust fund model being replicated in different countries or the water producer's model in different regions of Brazil.

Across Latin America and beyond, there is a fairly uniform call for improving monitoring and evaluation of PWS programs in order to measure the performance of specific watershed protection activities and better understand the overall ecological results. Many cases in Latin America can demonstrate increased forest cover based on field inspections and some use of Geographic Information Systems capabilities. While Mexico has invested resources in evaluating their environmental results, the initial evaluation of the national program found that investments went to areas that were already under protection leaving unprotected the most threatened and vulnerable areas. Going forward, investments will be redirected to cover those areas at greatest risk of deforestation. Without such vital monitoring data, project implementers in Mexico would not have been able to adjust project design and implementation specifications.

General understanding of cloud forests and Andean grasslands demonstrate that improved cover can mean increased flows. According to several studies done in Costa Rica, there is a positive relationship between forest cover and water flow. CEDERENA, the implementing organization of the local programs in Pimampiro, Celica, and El Chaco in Ecuador, has measured and monitored humidity in soils as a proxy indicator of hydrological improvements at the micro watershed level.

The Nature Conservancy (TNC), in collaboration with various non-government agencies, universities, and public partners, among others, is now developing and implementing impact measures as part of their role in PWS schemes in Brazil, Colombia, and Ecuador. For example, in Guandu, the watershed that supplies water to Rio de Janeiro, Brazil, TNC is piloting a monitoring program to ensure that services being paid for by the water producer program are being delivered.TNC, with partners, is monitoring landowner engagement, successful implementation of restoration practice, land-use changes, birds (abundance and richness as a means to assess habitat connectivity critical for biodiversity conservation), and various water quality and quantity indicators—e.g., volume, rate of flow, sediment levels, pH,

dissolved oxygen, nutrient concentration, temperature, and fish (abundance, richness, and community composition), among others. Similar impact measures are being implemented at sites for water trust funds in Colombia's East Cauca Valley and near Cuenca in Ecuador. Beyond the biophysical indicators, measures of socioeconomic condition, via surveys, and effective governance and financial arrangements will be tracked in order to ensure these PWS approaches are structured effectively, ensuring long-term collaborative decision-making and adaptive management. These types of monitoring and impact assessment efforts can measure performance over time to insure the efficacy of PWS programs.

South and Southeast Asia

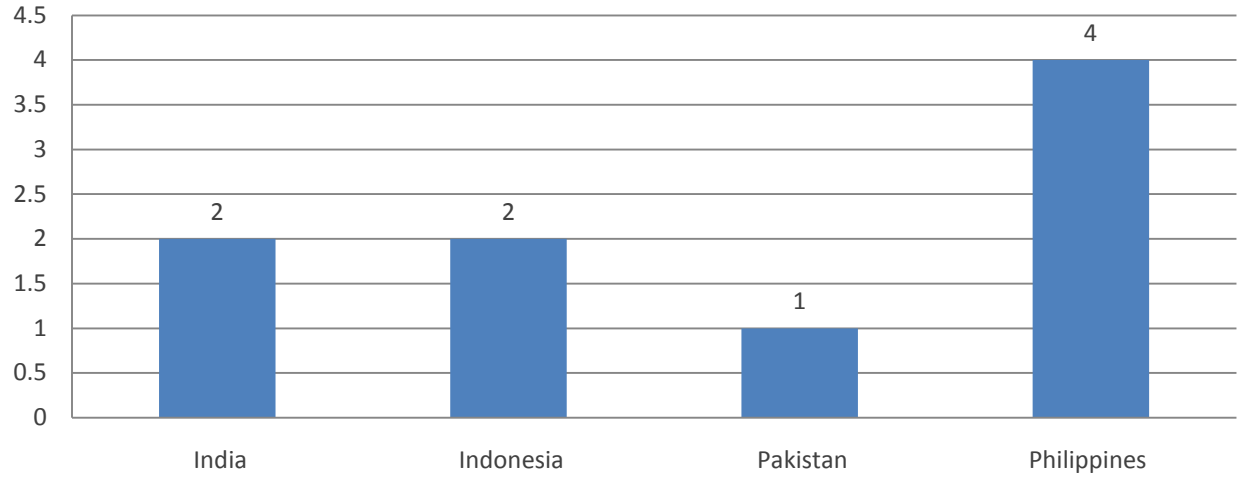
Summary Details

- Total number of programs identified: 33
- Total number of active programs: 9
- Total value of payments in 2008: $1,814,000
- Total area protected in 2008 (in hectares): 139,720
- Total value of historical payments (1982-2007 across 16 programs): $89,159,150
- Total area protected historically: 170,270

Regional Overview

PWS programs in South and Southeast Asia have been in operation for more than 25 years with several projects in India and Indonesia having started in the early 1980s. Many of these programs are still in operation today, although transaction-level and operational information is only sporadically documented online, in reports, or in academic sources. Thirty-three programs were identified for this report across six countries (Figure 8), although only nine of these are said to have been active in 2008, according to available online sources and via email communication.[6] We classified seven programs as "inactive" based on the lack of current transaction activity and the remaining 17 as "in development" (for a total of 33).

Figure 8: Distribution of Active Programs by Country in South and Southeast Asia in 2008



Geographically, South and Southeast Asia is a broad, diverse landscape, covering a myriad of countries, cultures, and ecological regions. The countries that have programs in this region include India, Indonesia, Nepal, Pakistan, the Philippines, and Vietnam. They all have two things in common that pose a challenge for PWS design and implementation: high economic growth rates and high population densities. Indeed, Southeast Asia's and India's population densities (126 people/km^2 and 356 people/km^2 respectively) are many times greater than those found in Latin America (28 people/km^2) and Africa (33 people/km^2).[7]Some research indicates that the high population density in the region has the potential to greatly increase the complexity and costs associated with implementing PWS programs.[8]

Transaction Activity

For nine programs that were deemed to be active in 2008, payments totaled just over $1.8 million, protecting nearly 110,000 hectares. Historical payments for those 16 programs, both active and inactive at some point in time from the early 1980s until 2007, totaled roughly US$89 million in investments in water quality, water storage, and flow regulation improvements, protecting some 170,000 hectares. All of the programs listed are exclusively PWS .

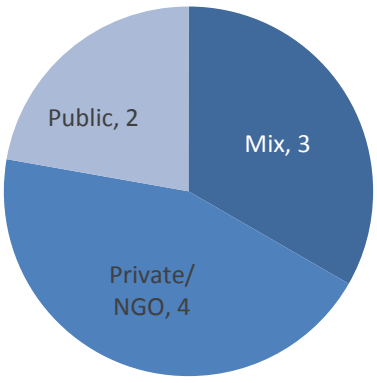
Table 4: Summary of Transaction Data for 2008 and Historically South and Southeast Asia

Country	Number of Programs	2008 Payments	Hectares Protected	Historical Payments	Hectares Protected	Time Period
ACTIVE Programs						
India	2	NA	NA	NA	NA	1970s-2008
Indonesia	2	$14,000	22,660	49,150	22,600	2004-2008
Pakistan	1	NA	NA	10,000,000	3,100	1990s-2008
Philippines	4	$1,8000,000	87,100	8,860,000	NA	1995-2008
Sub Totals	**9**	**$1,814,000**	**109,760**	**$18,909,150**	**25,700**	**1970s-2008**
INACTIVE Programs						
India	2			2,625,000	NA	1986-2007
Indonesia	3			64,000,000	144,570	1982-2005
Philippines	2			3,625,000	NA	1998-2003
Sub Totals	**7**			**$70,250,000**	**144,570**	**1982-2007**
Totals	**16**	**$1,814,000**	**109,760**	**$89,159,150**	**170,270**	**1970s-2007**

Program Structure

Similar to Latin America and other regions, program implementation is driven by various sectors with local community groups playing a prominent role. For the nine active programs in 2008, two programs were implemented by government agencies, while four were driven by private entities, including NGOs, and three by a mix of public and government, though the government is not the key implementing agency, such as those implemented by the Rewarding Upland Poor for Environmental Services (RUPES) program projects (described below). A cross-section of the different programs structures is highlighted below in Box 3.

Figure 9: Number of Programs by Implementing Agency -- South and Southeast Asia in 2008



Box 3: Program and Payment Structures in South and Southeast Asia

The Rewarding Upland Poor for Environmental Services program (RUPES), Indonesia:
Eleven of the thirty-three programs reviewed for this report involve the coordinating efforts and expertise of RUPES, although information on the current status of most of these programs is not readily available. RUPES is a research program coordinated by the World Agroforestry Program (ICRAF) based in Bogor, Indonesia, whose mission is to develop practical environmental services schemes throughout Southeast Asia.[9] *In the first phase of the RUPES-I program, from 2002-2007, six research "action sites" were developed in Indonesia, the Philippines, and Nepal, as well as twelve additional learning sites (those scoping the design and implementation strategy for a PWS scheme).The majority of these projects were geared toward defining watershed ecosystem service schemes and the reward structures for the beneficiaries of these schemes. In 2008, the RUPES-II program started the second phase of its work, building on the successes and lessons learned from the first phase of the program, which would include the establishment of independent national stakeholder networks in Indonesia and the Philippines on PWS. The RUPES approach is a good example of how civil society can help fill an important gap in the governance of watersheds through capacity building with local communities, addressing institutional and legal constraints at the project level, and building up a toolkit of lessons learned that can be applied in different countries and contexts in other regions of the world.*

MYRADA, Karnataka State, India:
MYRADA is an NGO that manages a range of rural development projects in three districts in South India: Karnataka, Tamil Nadu, and Andhra Pradesh. MYRADA's work related to PWS involves water quality improvement activities in the Gulbarga watershed in Karnataka State. Specifically, this works involves "self-help affinity groups" (SAGs) composed of local community members, that consult with local farmers about regenerating their land or leaving their land fallow to improve water quality. Payments for watershed protection programs are given in the form of low-interest loans, through contracts for cash payments and some in-kind contributions such as labor. In 2005 alone MYRADA managed more than 126,000 hectares of land in their water conservation efforts in Karnataka District, and in 2008-2009, MYRADA spent more than US$50 million across all of its programs. However, this large budget includes many projects other than water conservation initiatives, and precise transaction information for water conservation efforts is not available, so both payment information and geographical area impact data for MYRADA's work is excluded from our totals for 2008 or in the historical figures given.[10]

Mangla Dam, Pakistan:
The Mangla Dam project covers an area of approximately 3,107 hectares. The project was initiated in the early 1990s by the Ministry of Water and Power in Pakistan and is presumed to still be active today.[11] *As another example of a government mediated PWS scheme, the goal of the program is to control sedimentation in the Mangla and Tarbela Dams via direct payments to farmers located in the watersheds, who in turn implement a variety of land management techniques, including terracing, tree planting, and other soil conservation initiatives. Available transaction data from 2004 to 2007 reveals that more than US$10.1 million was spent on sedimentation control during this period. Transaction data for 2008 was not available.*

Regional Outlook

Our research suggests that five additional projects have been under development since 2008. NGOs such as RUPES and MYRADA have been an important force behind the growth of PWS schemes in the region, both as an implementer of PWS schemes and also as an intermediary serving more the role of "technical advisor" to local government agencies, a role they will hopefully continue to play going forward. Vietnam may set the pace for future development in PWS, as it has taken the bold step of passing a national-level policy in support of PES programs that are sure to provide new incentives for watershed protection and conservation.

China

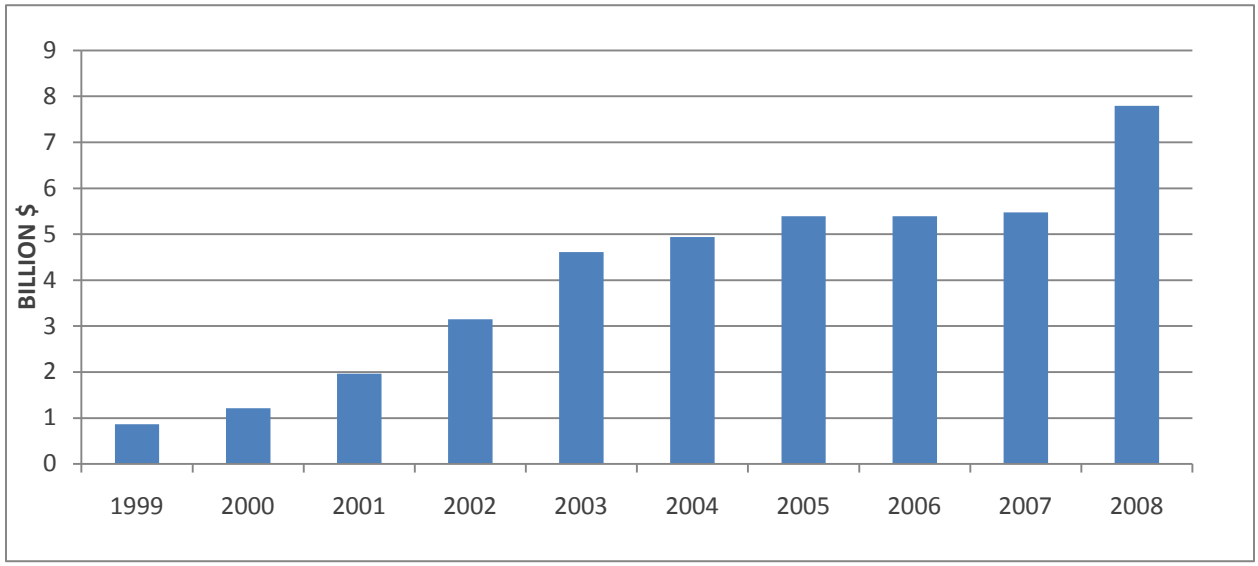
Summary Details

- Total number of programs identified: 47
- Number of active programs: 47
- Total value of transactions in 2008: $7.8 billion
- Total area protected or restored (in hectares) in 2008: 270,223,009
- Total value of historical payments: $40.8 billion (1999-2008, across 47 programs)

Regional Overview

We tracked more PWS and PES programs with an emphasis on water in China than any other country in Asia. The number and variety of PWS schemes in China has taken off in recent years, from around 8 in 1999 to more than 47 in 2008. This is not surprising, given the significant pressure that economic growth is placing on the country's already strained water resources; though ranked fifth in the world in terms of total freshwater resources, per-capita freshwater resources (2,258 m^3) are less than a third of the world average, and the area north of the Yangtze River basin has one fourth the per-capita water endowment of the south, and one-tenth the world average.[12,13]Throughout China, 400 of the country's 640 major cities face water shortages, and 700 million people lack access to safe water.[14]

Figure 10: Annual PWS Transactions in China



Transaction Activity

As shown in Figure 10 above, we estimate that PWS program annual expenditures increased from roughly US$860 million in 1999, to US$7.8 billion in 2008.[v] Most of these expenditures are from general

[v] While numbers for annual expenditures on China's key forestry programs are generally available in statistical sources, those for the range of other PWS programs identified -- especially local programs -- are difficult to obtain, as are the form of transactions (e.g., direct payments to individual households or communities, financial transfers between different levels of regional governments, or a combination of these) for both local and national programs. Best estimates were created from available, and sometimes spotty, data.

'eco compensation' funds with an emphasis, but not exclusive to, watershed services. It was not possible to separate program funding specifically for watershed services. However, based on available estimates, the earliest expenditures were from the Natural Forest Protection Program, which made up more than half of total transactions, by value, during 1999-2001. From 2002 onward, around 50 percent and up of total transactions by value are under the Conversion of Cropland to Forests and Grassland program. In any given year during this period, China's major forestry programs account for more than 90 percent of total transactions by value leaving "pure" PWS values at roughly $780 million in 2008 and $4.08 billion historically.

Figure 11 below provides a rough estimate of the number of PWS programs in China by year since 1999. China has seen a steady increase in programs since 1999, with a significant jump occurring between 2004 and 2005.[vi] The Chinese government began developing watershed-related payment schemes as early as the mid- to late1980s, when the first water emissions trading pilots were tentatively launched. Following that, the Water and Soil Conservation Law of the P.R.C.(1991) allowed for land in small watersheds to be auctioned and leased to farmers or other private investors for development, with the leaseholder in return being obligated to protect against soil erosion and degradation.[15]However, it was not until after 1999 that PWS programs really began to take off, with the number and variety of programs growing steadily, especially since 2005. The year 1999 marks the launch of the government's preeminent PES scheme—the Conversion of Cropland to Forests and Grassland Program—which is now one of the largest land conversion programs in the world.[vii]The sheer scale of the program—it currently covers more than 9 million hectares, extending to all corners of China—has constituted an important central government policy signal, generating significant momentum and local capacity-building, and catalyzing vigorous discourse amongst policymakers, experts, and officials regarding the use of innovative payment methods to achieve conservation objectives. It has thus provided abundant fuel for the country's ongoing development of PES and PWS schemes.

In 2008, total area directly protected or managed under these programs totaled at least 270,223,009 hectares. More than 95 percent of this area is from four national forestry programs and the sum of a common provincial-level program. These are as follows:

(1) The Natural Forest Protection Program (38.35%);
(2) The Forest Ecosystem Compensation Fund (FECF) (16.48%);
(3) The "Three Norths" Shelterbelt Program (9.06%);
(4) The Conversion of Cropland to Forests and Grassland (3.43%); and
(5) The sum of all provincial-level FECFs (28.38%).

Watershed services are of central importance for all forestry programs included in this report. A recent survey of the FECF, for example, found that some 80.1 percent of total area enrolled is watershed or

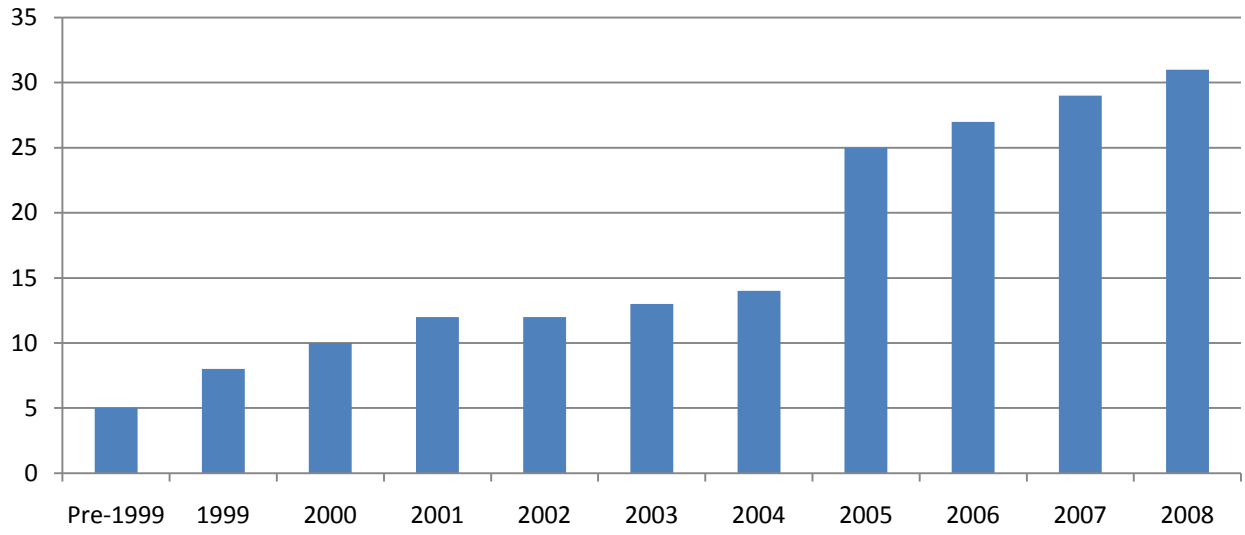
[vi] An additional 16 provincial-level forestry programs were not included in this figure, since no starting years were available. However, it is likely that they started roughly between 2003 and 2008.

[vii] Though labeled a PWS scheme for the purposes of this report, since it indeed targets key hydrological services such as sediment control and flow regulation, the Conversion of Cropland to Forests and Grassland also encompasses other services such as biodiversity, scenic beauty, carbon sequestration, and timber, and so is not exclusively PWS. This is true for many of the programs identified in China, and those in other regions, where PWS is but one of the ecosystem service benefits.

soil-conservation related: headwater forests make up 4.8 percent, forests along watersheds make up 23.6 percent, wetlands and reservoirs make up 5.1 percent, desertified areas suffering from severe soil erosion make up 46.6 percent. Around 44 percent of FECF-enrolled forest area is in the Yangtze River watershed, 29.4 percent in the Yellow River watershed, 11.3 percent in Heilong River watershed, 6.7 percent in the Pearl River watershed, 1.6 percent in the Huai River watershed, 1.55 percent in the Liao River watershed, and 3.77 percent in the Min River and Tai Lake water system in Southeast China.[16]

Total value invested or transacted under these programs in 2008 is estimated to be roughly US$7.8 billion. Around 40 percent of this is from subsidies paid to participating farmers under the Conversion of Cropland to Forests and Grassland program, while an estimated 25 percent comes from the Natural Forest Protection Program, 20 percent from the national FECF, and around 10 percent from the provincial FECFs.

Figure 11: Growth in PWS Programs in China



Note: This excludes 16 provincial-level forestry programs, for which no data on starting year is available, but which began sometime since 2001.

Program Structure

Current watershed payment programs in China are almost exclusively government-mediated. Many of these are being created in response to the central government's call to promote the development of and innovation in "eco-compensation mechanisms". The term "eco-compensation" encompasses both PES-like policies that involve direct payments from the government to individual and community-level suppliers of ecosystem/environmental services, as well as policies that develop frameworks of cooperation between various levels of government for the financing and sharing of costs of environmental protection and restoration. Deputy Director Pan Yue of China's Ministry of Environmental Protection stated in 2007 that eco-compensation policy is "not only an environmental and economic, but also a political and strategic need. Eco-compensation policy that focuses primarily on instruments that transfer implementation and financial costs between developed and undeveloped regions, between urban and rural areas, between rich and poor, between lower and upper watershed areas, between

those benefiting from the environment and those suffering from environmental degradation, and between high-polluting high-energy industries and 'green' industries, needs to be improved".[17,18]

The growing emphasis on "eco-compensation" in China is indicative of greater focus not only on developing innovative financing mechanisms for environmental policy, but also on resolving equity and property rights and issues surrounding the use and protection of natural resources. These PES/PWS programs serve as platforms for negotiation between the relevant stakeholders—households, communities, or regional governments—in the creation of management arrangements that clarify rights and responsibilities and develop targets and associated monitoring and verification regimes.

China thus appears to be following international trends, since eco-compensation policy development has consisted of exploration into how to use fiscal incentives and structure conservation financing in a way to better incorporate the value of ecosystem services within economic activities. While ongoing since before the current eleventh 5-year plan (2006-2010), emphasis on eco-compensation programs has gained significant momentum in recent years. The National Development and Reform Commission has recently completed a draft of national regulations governing eco-compensation policy, and will begin to solicit public opinion and input later in 2010. It is estimated that finalization of these regulations will take three years.

Regional Outlook

The pace of development of programs and policies for watershed management in China has been quickening, and many of the newer PWS programs have yet to be documented for this report. Furthermore, given the government's emphasis on the development "eco-compensation mechanisms," especially for watersheds, the next few years will likely see a flurry of new provincial and national programs. A number of provinces have already announced the drafting of pilot blueprints for new programs, but implementation of the pilots has yet to begin.

Another exciting potential future development for China could be in water pollution emissions trading systems. Though the country has been piloting these since the late 1980s, it has yet to implement a formal program. However, activities on the ground suggest that formal implementation could come soon, since a number of pollution permit trading platforms have been established recently or are in the process of being established in various locales around China. These include the Jiaxing City Emissions Quota Reserve Trading Center in Zhejiang Province, the Tianjin Emission Rights Exchange, the Beijing Environmental Exchange, and the Shanghai Environmental Energy Exchange.

According to news releases from within China, these various centers hope to trade a range of both water- and air-emissions permits for major pollutants, green technology stocks, energy-use permits under China's energy-saving and renewable energy laws, and China-based carbon credits. Though the policy development process in China is often quite opaque, the establishment of these centers is a strong indication that the government is sending internal signals that it is committed to putting into place regional and possibly national level water emissions trading systems.

Finally, a central issue to watch for the future of PWS in China is property rights. Though water resources are state-owned according to both the current and previous Water Law of the P.R.C. (1988, 2002), with the state responsible for allocating resources through government orders and water quotas,

this system has in reality resulted in poorly defined water-use rights and artificially low water prices, creating a de facto open-access system characterized by conflict and inefficient distribution of resources.[19,20] Overall, many of China's developing watershed eco-compensation and water-use rights transfer programs fall within an evolving set of both the central and local government policy frameworks aimed, in part, at addressing the need to resolve these rights issues. Thus, these experiments have both the promise of influencing and the risk of being adversely impacted by future reforms—or lack thereof—to China's legal structures for water rights.

East and Southern Africa

Summary Details

- Total number of programs identified: 20
- Total number of active programs: 10
- Total value of payments in 2008: $62,754,000
- Total area protected (in hectares) in 2008: 200,000
- Total value of historical payments: $507,667,600 (2000-2008, across 10 programs):
- Total area protected historically: 230,000

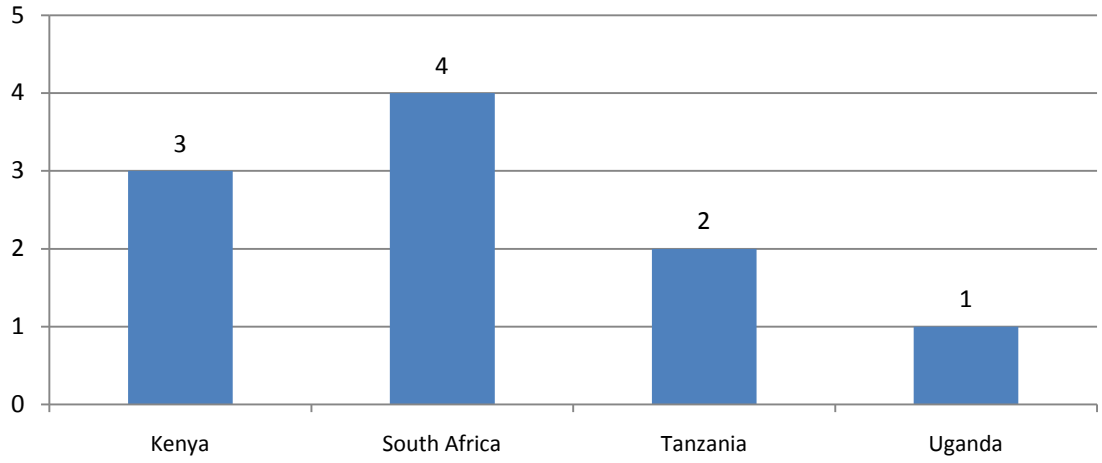
Regional Overview

Overall, the continent of Africa has seen at least 20 PWS programs concentrated in East and Southern Africa. About ten of these programs are currently active, yielding a mix of participation from the private sector, NGOs, and governments. Of the remaining programs, nine are in varying stages of development and one program is classified as inactive. The structure of PWS programs in Africa varies significantly, and like other developing countries, especially as noted in South and Southeast Asia, a common theme across the diversity of programs is the integration of a strong social component.

Conservation efforts in this region of Africa have been dominated by its charismatic species—elephant, buffalo, lion, leopard, and rhino and the resulting nature-based tourism sector, which contributes substantially to the economies of the countries in the region. The resulting approach has historically focused on protected areas that are managed by state wildlife agencies. Yet, while protected areas are playing a significant role, the current rates of land-use change and environmental degradation outside of protected areas are contributing to significant stress on the area's already stressed water resources.

According to our research, the countries in Africa currently implementing PWS are concentrated in East and Southern Africa. Specifically, research identified programs in five countries including Kenya, Tanzania, Uganda, South Africa, and Malawi (which is not depicted in Figure 12 as it accounts for one "inactive" program).

Figure 12: Distribution of Active Programs by Country in East and Southern Africa in 2008



Programs are comprised of investments in: enhancing and rehabilitating watershed services; improving the capacity of local communities and institutions to identify, formulate, and implement integrated ecosystem management activities at micro-catchment level; establishing community leadership structures (at micro-catchment level) to coordinate the implementation of ecosystem management interventions, and in-depth training of Community Own Resources Persons (CORPs) to better ensure long-term sustainability of the established micro-catchment management system. All of these investments result in watershed services such as increased water supply and improved water quality; therefore, they are included as PWS. In most cases, these activities are part of national ecosystem conservation programs, as is the case in Tanzania and Kenya.

Transaction Activity

For ten programs that were deemed to be active in 2008, payments totaled $62.7 million dollars, protecting some 200,000 hectares. Historical payments for these 10 plus 1 inactive program (which did not report any transaction data) between 2000 and 2008 are estimated to total $507,668 million in investments in water quality, ecosystem restoration, flow regulation improvements, and poverty alleviation, protecting some 230,000 hectares, as summarized in Table 5 below.

Table 5: Summary of Transaction Data 2008 and Historically East and Southern Africa

	Number of Programs	2008 Payments	Hectares Protected	Historical Payments	Hectares Protected	Time Period
ACTIVE Programs						
Kenya	3	NA	NA	4,572,000	10.5	2004-2008
South Africa	4	$62,684,000	NA	502,437,000	NA	2000-2008
Tanzania	2	70,000	200,000	658,000	230,000	2006-2008
Uganda	1	NA	NA	NA	NA	2004-2008
Sub Totals	**10**	**$62,754,000**	**200,000**	**507,668,000**	**230,011**	**2000-2008**
INACTIVE Programs						
Malawi	1			NA	NA	?-2002
Totals	**11**	**62,754,000**	**200,000**	**507,668,000**	**230,011**	**2000-2008**

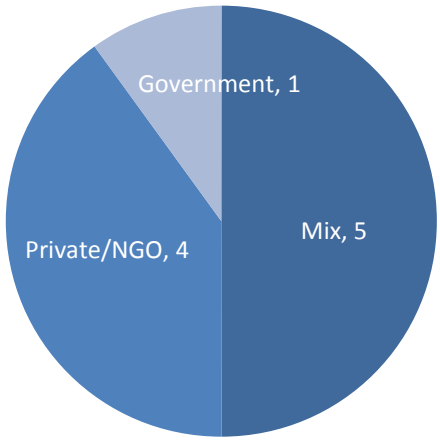
Program Structure

Program design in Africa often incorporates a strong social component, focused on a host of issues such as poverty alleviation and community development. For example, the Working for Water Program (see Box 4 below) is actively funding poverty relief with a government-supported program. Similarly, USAID and Coca-Cola's Water and Development Alliance (WADA) is applying an integrated river basin management approach, which includes water and health education and knowledge-sharing exhibitions to address water-related challenges in Uganda, Tanzania, and South Africa. The activity complements and builds on the efforts of a longer term USAID ecosystem conservation program in these countries.

Similarly, PWS projects in the region also have a strong focus on capacity building and institutional development—important to note because it underscores one of the main pre-requisites of PES. Even though most of these schemes do not start out with a focus on creating markets for ecosystem services, they actively engage in activities that would be required for a successful ecosystem service market such as institutional development. This is evident in almost all of the projects in Africa: the Working for Water program as described below, the Green Water Credits project in the Tana basin of Kenya, and the Western Kenya Ecosystem Management project.

Program implementation is similarly varied as in other regions drawing in government agencies, private entities, NGOs, international donors, or a mix of these players, as represented in the graph below.

Figure 13: Number of Active Programs by Implementing Agency in East and Southern Africa – 2008



PES schemes supporting watershed management in Africa tend not to monitor the actual change in water quality or quantity, but instead verify and reward the adoption of the land management options that are considered (scientifically) likely to deliver the expected environmental benefits. One example of such a scheme is the Equitable Payments for Watershed Services Program in Tanzania (also described in Box 4 below).

The buyers of PWS in Africa are not easy to organize, especially if there are not already associative bodies in place. Even when there are, it is often difficult to engage investment for improved watershed management in addition to existing water use fees. However, as the EPWS example shows, in situations where water users are already bearing heavy costs associated with the degradation of watershed services (to DAWASCO), the demand and willingness to pay for watershed services may be substantial. Beneficiaries may become increasingly aware of the importance and cost-effectiveness of improved management in the upper parts of watershed for the maintenance of water provision downstream. Another example is the WWF Water Neutral project in South Africa that works with large water-intensive users (such as SAB Miller) to offset their water deficit by investing in the release of the equivalent amount of water through the clearing of alien invasive trees in key catchments that are important to them.

Box 4: Programs and Payment Structures in East and Southern Africa

PWS and Poverty Alleviation: Working for Water in South Africa

Working for Water (WfW) program in South Africa is a government-led watershed rehabilitation project aimed at alleviating poverty through the provision of temporary work and skills development on watershed enhancement projects, involving mainly the removal of invasive alien plants. WfW trains teams to remove alien invasive plant species and thereby improve water supply. The program also trains the team leaders to cost the work and develop quotes for buyers. A monitoring program is in place for follow-up work. Although most of the funding comes from the government's poverty relief fund, water users also contribute either through the government's water management fees or through individual regular donations. As noted in the Katoomba Group PES inventory for South Africa, costs per "job" created are also the most efficient of all of the poverty relief programs of national government.[21]

Rewarding Land Management Approaches That Result in Watershed Services: The Equitable Payments for Watershed Services Program (EPWS) in Tanzania

CARE International in Tanzania, in partnership with World Wildlife Fund (WWF), International Institute for Environment and Development (IIED), and the Poverty Reduction & Environmental Management Program (PREM) initiated a new project in 2006, Equitable Payment for Water Services (EPWS). The program is based in the Uluguru and East Usambara mountains, focusing on Ruvu and Sigi River basins, which are the major sources of water to the cities of Dar es Salaam and Tanga, respectively. The City of Dar es Salaam provides water to some four million inhabitants and roughly 80 percent of industries. The public water utility, Dares Salaam Water Supply and Sewerage Corporation (DAWASCO), currently spends nearly two million US$/year in water treatment costs due to increased sediment load in the Ruvu river, which feeds the city.

The Equitable Payments for Watershed Services (EPWS) program aims to improve the quality and flow of water for downstream users by compensating upstream farmers to engage in various land-use practices to control soil erosion brought on by unsustainable farmland expansion and irrigation practices, deforestation, and Illegal mining activities in river systems and within forest reserves. The project aims to establish long-term financial investment in modifying land use to conserve and improve watersheds for reliable flow and quality of water, to establish a compensation mechanism that recognizes the needs and priorities of marginalized and poor people, and to improve quality of life of communities through substantial benefits to the rural poor hence contributing to poverty reduction. As of 2008, DAWASCO and the Coca-Cola Company had enrolled more than 450 farmers.

Regional Outlook

The developments outlined in this section show that there is a future for PWS in Africa. The investments in watershed management approaches and the institutions to implement them have laid the necessary groundwork for expanded use of these market-based tools, which bodes well for the nine programs currently in development. High start-up costs for designing and implementing PWS programs in Africa is certainly a factor in why so few programs are up and running and in why those that are functioning are either dependent on donor funding or government support (Working for Water, EPWS). There tends to be a pattern where schemes begin with a trial phase over a smaller area, hoping to prove the concept to prospective buyers, though this approach has not yielded much scaling up thus far. A review of PWS schemes carried out by the Katoomba Group between 2005 and 2006 and revisited in 2008 found that

many of the initiatives identified in 2005 were still not operational by 2008, partly due to lack of start-up funds.[viii]

The increasing interest of businesses to invest in ecosystem services provides inspiring examples that can be emulated across the region. Issues to address going forward include the lack of start-up funding, resulting in reliance on external resources;[ix] lack of awareness of the benefits of improved watershed management; lack of technical capacity to assess feasibility and design of the market mechanisms; legal and institutional frameworks that can facilitate the required partnerships and funds transfer; unclear use and property rights over land; and difficulties in monetizing economic values of improved provisioning.

[viii] A similar study by IIED identified the same issue.

[ix] Most of the projects above are either funded by donors or government.

Europe

Summary Details

- Total number of programs identified: 5
- Total number of active programs: 1
- Total value of payments in 2008: NA
- Total area protected (in hectares) in 2008: NA
- Total value of historical payments: $30 million (roughly 1992-1999)
- Total area protected historically: 3,900 hectares

Regional Overview

For our purposes, the transaction activity related to PWS in Europe is grounded in the historic, privately driven Vittel PWS program in northeastern France. We identified a few government mediated watershed payment programs in development at the time of data collection, called Agri-Environmental Schemes,[22] found in the Netherlands, Ireland, and Austria and one NGO driven scheme under the direction of the World Wild Fund. The country-based government programs fall under the Rural Development Framework of the EU, which identified water quality protection as a key aspect of the program, and are comprised of direct subsidy payments aimed at giving incentives to farmers to adopt more sustainable and ecosystem- and watershed-friendly farming practices, similar to those in various portions of the US Farm Bill (discussed in the US PWS section below).

Since 2000, the overarching developments regarding protection of watershed services and water quality in Europe have been guided by the European Union Water Framework Directive (WFD), which set an explicit timeline to achieve "good" water quality benchmarks across the continent's freshwater resources by 2015. The directive impels member nations to establish river basin management plans—where necessary in cooperation with neighboring states—and outlines both the management actions (i.e., point-source reduction technology) and the environmental objectives that constitute "good" water quality.

In addition, member states are obligated to implement true-cost pricing for residential and commercial water users, ensuring that the price at the tap reflects the full cost of the abstraction and distribution of fresh water and the collection and treatment of wastewater. While member nations are responsible for meeting the requirements of the WFD timeline, the policy methods used to achieve these benchmarks are left to each nation's discretion. Even as the bulk of this decade (2000-2010) has been focused on laying the framework for future freshwater protection in Europe, PES has gained the attention of both member states and NGOs as a viable alternative to traditional command and control policies as potential tools to meet the WFD benchmarks.[x]

[x] See **http://www.unece.org/env/water/meetings/payment_ecosystems/seminar.htm** for a partial list of responses for member states concerning their experience with PES from a 2005 UNECE seminar. The Netherlands has a particularly relevant history of PES in the form of compensation for "blue water" services **(http://www.lei.wur.nl/NR/rdonlyres/2A3C9F9F-BAD0-4BB3-8769-53B40EABC049/95376/LEINota08021.pdf).** Also, the World Wildlife Fund has identified this transition period in Europe's water policy as one that "may have opened a window of opportunity to mainstream PES as a major conservation tool." (**http://www.panda.org/what_we_do/where_we_work/black_sea_basin/danube_carpathian/our_solutions/nature_and_prosperity/pes/**)

It's worth noting the differing terminology used to describe ecosystem or watershed services in Europe than found in other regions. These are summarized as "green services" for terrestrial or land-based services; "blue services" for those generated by water. This terminology seems to have originated in the Netherlands.[23]

Transaction Activity

Given the paucity of PWS transaction activity to report in Europe, payment information is rooted in the private Vittel program. While still functioning in 2008, total payment amounts have tapered off dramatically in recent years. According to sources familiar with the program,[xi] this is as to be expected given that all 26 farms in the strategic area of the catchment had transitioned to more sustainable practices in the first seven years of the program (roughly 1992-1999). Total payments to farmers for all activities related to the program during that time period were approximately $30 million, covering an estimated 3,900 hectares of the catchment (92 percent of the total area).These payments were made through negotiated contracts valid for 30 years, with all 26 farmers participating in the program. We were not able to determine specific payment amounts for any given year since the program began making payments in 1992, nor for the 2008 baseline year.

There is no annual payment information to report for the other three EU programs identified (described below), though according to online data sources, each of the programs suggests budget allocations for the period 2007-2013 for rural landscape improvements (including some focused on water quality and watershed services) such as reducing fertilizer and pesticide applications, habitat protection, and general improvement of water quality.

Program Structure

Of the five programs identified in Europe, the Vittel program was driven and implemented by private sector interests, three others by national governments and one by an NGO.A summary of each program below offers an overview of their structure, the players involved, and functionality.

Vittel PES - This case is one of the best known, and is widely regarded as one of the most successful examples of a privately initiated PES system. Nestle Waters, owner of the Vittel brand of bottled water, entered into long-term (30-year) contracts with the 26 largest farm operations in the watershed, agreeing to abolish the farmers' land-ownership debt, cover the cost of all new farm equipment and modernization up to 150,000 euros per farm, and pay an annual subsidy of 200 euros for the first five years of the program (roughly 1992-1997). In return, the farmers agreed to follow the management plans proscribed by Agrivair, the environmental consulting firm established by Vittel to oversee the program. By 2004, after 12 years of operation, the program had succeeded in enrolling 92 percent of the basin's hectares and reduced the baseline nitrogen load of the spring's source waters.[24] As mentioned earlier, according to sources familiar with the program, the value of direct payments to farmers was concentrated in the first seven years of operation and payments have decreased thereafter as the program reached its goal of enrolling all farms in the target watershed service area.

[xi] Daniele Perrot-Maitre, personal communication, February 2010.

It has been noted that one of the key features of success of the Vittel program was Agrivair, the intermediary organization created by Vittel to negotiate with farmers, implement the key payment features, and oversee all aspects of the program. Another key player providing critical scientific and research support was the French National Agronomic Institute (INRA).From the beginning, these players made an effort to understand the motivations of farmers from the short to the long term and were able to design the program to fit Vittel's objectives along with the life choices of those in the farming community.[25]

Threats to water quality in the catchment have shifted from the rural to the urban areas, and Agrivair is shifting its focus accordingly to programs targeting pollution loadings from storm water and wastewater management.

North Ireland – Countryside Management Scheme (NICMS)[26] - The NICMS is an agri-environment scheme that began in 2008 under the European Agriculture Fund for Rural Development. It is a voluntary program that provides financial support to farmers and landowners for adopting farming practices that enhance the countryside to: improve biodiversity; improve water quality; mitigate against climate change; improve soil quality; and enhance the landscape. Annual payments vary according to farm size and specific farm natural attributes. The program aims to have 50 percent of agricultural lands under enhancement agreements by 2010. A total of 219 million pounds has been allocated to this program for 2007-2013. It is not known how much was paid to farmers in 2008 or how much of the total funding is being used for the protection of watershed services.

The Netherlands – Farming for Nature Pilot Program[27] - Based on the precept that in rural areas there are ways to unite agriculture, nature, and landscapes, farmers are compensated for managing their land for the benefit of ecosystem services and the natural landscape. In one online document, it was reported in October 2008 that water quality was noted as one of the objectives of the pilot project though it is not clear if this program will evolve into a fully functioning PWS program. As of the publication of this report, there were two operational sites for consideration bringing together researchers, farmers, civil servants, local residents, and regional planning experts.

Austria – OPUL Program[28] - The Agri-environmental Program ÖPUL 2 007, which serves as Austria's overarching rural development legislation, provides for direct payment "to promote agricultural production methods compatible with the requirements of: 1) the protection and improvement of the environment and countryside; 2) extensive agricultural production; and 3) maintenance of the countryside to promote the improvement of the environment and the countryside. This structure includes payments for reducing fertilizer and pesticide application and water protection. Some € 5.67 billion has been allocated for these payments between 2007 and 2013. Information is not readily available on the specific amounts of payments for watershed services.[29]

The WWF's PES in the Danube Basin - The World Wild Fund's Danube-Carpathian Program has been at the forefront of efforts to promote PES as a river basin management policy framework in Europe linked directly with the EU's WFD. Starting in about 2002, WWF began building its capacity in the Danube and using PES as one tool to conserve the rural environments and improve rural livelihoods in the Danube Basin, with a focus on the lower Danube and the Danube Delta (Bulgaria, Moldova, Romania and Ukraine). After a multi-year and multi-stakeholder process, project activities began in 2007.Actual

transactions were not reported for 2008.The program is being closely watched by researchers and decision makers for lessons on how to bring PES programs to scale such that they deliver actual conservation benefits and economic improvements to the stewards of the regions invaluable ecosystem services.[30]

Regional Outlook

WWF identified this transition period in Europe's water policy (assumed to be 2000-2008) as one that "may have opened a window of opportunity to mainstream PES as a major conservation tool."[31] Given the country-level implementation deadline of 2015 as outlined in the EU WFD, it is expected that experimentation with PWS and potentially with nutrient trading in areas such as the Danube and the Black Sea will lead to actual program implementation over the next five years.[32]

We will be tracking WWF's efforts, in collaboration with the UNEP, GEF, the European Commission, and the International Commission for the Protection of the Danube River, and their PES program in the lower Danube Basin (focused on Romania and Bulgaria), launched in May 2010.[33]

In addition, we will be following the developments of water emissions trading (WET) in Europe. To date, only a few studies have been done or are in progress in Belgium, Sweden, Northern Ireland, Germany, Italy, Finland-Baltic countries (research on nutrient trading for the Baltic Sea), and the Netherlands (several studies, including water quality–nutrients and cooling water, and water quantity–both surplus and shortages). This may change imminently as the Swedish EPA is working on a hybrid trading system, combined with nutrient emission from agriculture. Lastly, after years in the making, there is a detailed proposal for implementing a trading scheme for nutrients for the Baltic Sea region.[34] We hope to include actual transactions in subsequent reports.

United States

Summary Details

- Total number of programs identified: 10
- Total number of active programs: 10
- Total value of payments in 2008: US$1.35 billion
- Total area protected (in hectares) in 2008: 16.4 million
- Total value of historical payments: (roughly 1992 – 2008): US$8.4 billion
- Total area protected historically:2.97 billion hectares

Regional Overview

The Unites States is the home not only to water quality trading but also significant payments for watershed services. These PWS programs are funded and implemented largely by the federal government, through the far-reaching efforts of the federal Farm Bill. State governments also play a role in facilitating payments to protect watersheds with funds allocated by US EPA Clean Water Act (CWA) Section 319 program. A small number of local governments implement PWS programs for the protection of drinking water sources.

The scope of research on US PWS programs for this report is on six voluntary subsidy payments or grants by the federal government (**Farm Bill** and CWA **Section 319** programs), and four programs administered by state and local level environmental or health agencies for the **protection of drinking water sources**. As non-point source impacts to water quality are not regulated under the US Clean Water Act, voluntary incentives are a major component of PWS in the US in addressing pollution loading from these sources.

The US Congress passes **Farm Bill** legislation every five years, providing hundreds of billions of dollars in subsidy payments to farmers and foresters—including payments for watershed protection and conservation activities. Farm Bill conservation programs, which include payments, cost-sharing, technical assistance, and tax incentives, addressing impacts to water-related ecosystem services from non-point sources along with payments from EPA Section 319 and source water protection programs totaled some $1.35 billion dollars in 2008 alone and covered roughly 16.4 million hectares.

Of the six federal government programs, five are funded through the Farm Bill and administered by the Natural Resources Conservation Service and Farm Service Agency, and one is funded through US EPA, Section 319 Program.[35] All of these programs work to address overall impacts to water quality, wildlife habitat, and ecosystem services in general; impacts specifically from soil erosion and nutrient loadings; and wetland and habitat loss and flooding. The benefits of these transactions extend beyond reducing impacts to ecosystem services, including enhanced natural resources that help sustain agricultural productivity and environmental quality, continued economic development, recreation, and scenic beauty.

Another key part of the government-driven PWS story in the US is played out in the protection of drinking water sources through four programs administered by state- and local-level environmental or health agencies. This payment for watershed service tool was famously utilized by New York City (NYC) starting in the early 1990s in the protection of its drinking water source in the forested and mostly rural Catskill watershed. In this case, a local government downstream (NYC) pays landowners upstream for

protection of valuable watershed services funded, in part, by the downstream users. Using tools such as conservation easements, riparian restoration, and outright land purchase, the city has protected about 35 percent of the watershed and has so far avoided the cost of building expensive water treatment facilities (originally estimated at more than $6 billion). The beneficiaries of this conservation approach are the consumers of high-quality drinking water in NYC at a more affordable price than if the city had needed to invest in new filtration facilities.

Transaction Activity

The amount of money paid by the US Federal Government to private land owners, mainly farmers, to improve land management practices for the benefit of water-related ecosystem services is staggering and plays a vital role in addressing impacts to water quality and overall watershed services from non-point sources not regulated by other statutes, mainly the CWA. The amount and scope of payments has grown steadily over time. For example, Farm Bill conservation program funding (from our targeted list of watershed protection programs) has grown from a baseline of $628 million in 2002 to $1.35 billion in 2008.Additionally, the number of contracts (transactions) has increased over time. In the Wetlands Reserve Program (WRP), for example, there were 229 contracts in 1992 and 485 contracts in 2008.Funding for the WRP program was fairly steady between 2002 and2008, averaging roughly $246 million per year. Both total payments and total contracts were reported at roughly $405 million and 1,109 respectively in 2009 (though these totals are not included in our overall analysis). Given the mounting challenges in managing water quality and watershed services from non-point sources, voluntary incentives are sure to continue increasing.

The Farm Bill subsidy programs represent payments for bundled environmental services which include watershed services; excluding these conservation payment programs from the total transaction values yields a different picture. The total transaction value in 2008 for exclusively PWS programs (EPA 319 and Drinking Water) is just over $435 million. Between 2002 and 2008, the total transaction value from PWS only programs totaled roughly $3.2 billion covering some 1.1 million acres.

Table 6: Summary of Transaction Data 2008 and Historically United States by Program

Program Name	# of Contracts 2008	Payments in 2008 (US$ Million)	Hectares Impacted in 2008 (millions)	# of Contracts Historically (2002-08)	Payment Value Historically (2002-08)	Hectares Impacted Historically (2002-08)
WRP	485	149,546,480	31,326	5,007	1,721,339,753	386,701
AMA	276	5,689,246	13,431	2,693	35,112,081	151,231
EQUIP	48,116	735,100,466	381,404	276,893	2,901,739,523	2,859,251,752
CSP	1,967	20,834,357	852,968	21,258	483,866,003	7,089,632
CRP	766,723	1,927,200	14,002,620	4,870,811	12,772,019	99,191,970
EPA 319	618	200,900,000	NA	7,171	1,524,800,000	NA
Drinking	NA	236,200,000	1,107,492		1,674,143,000	1,107,492
Totals:	**818,185**	**$1,350,197,749**	**16,389,241**	**5,183,833**	**$8,353,772,379**	**2,967,178,778**

The transactions in Table 6 represent a wide view of PWS where the parties have agreed, in many cases by contract, to a recognized value for land management practices that minimize impacts on watershed services in both upstream and downstream areas of the watershed. Through the Conservation Reserve Program alone, in 2008 impacts to water quality were significant as summarized by the following: across a total of 34.6 million acres enrolled through 766,723 contracts, reductions to sediment totaled 221 million tons, nitrogen totaled 615 million pounds, and phosphorus totaled 123 million pounds.[36]

The sixth federal PWS program, the EPA's Section 319 program, is a voluntary program that provides grants to states and tribes to implement non-point source projects and programs in accordance with section 319 of the Clean Water Act (CWA) specifically to protect source-water areas and the general quality of water resources in a watershed. The program records 618 contracts in 2008, down from 1,274 in 2002. Payments also declined from $237.5 million in 2002 to just over $200 million in 2008.

For those programs using PWS in protection of drinking water, we were able to find 2008 transaction data for four of the six major programs as noted below in Table 7. These programs are: the Catskills/Delaware watershed in New York state providing drinking water to NYC, the Quabbin and Wachusett Watersheds in Massachusetts serving the city of Boston, the Hetch Hetchy Watershed in California serving San Francisco, and the Cedar River Watershed in the state of Washington serving the city of Seattle and part of the surrounding county.

Table 7: Summary of Transaction Data 2008 and Historically Source Water Protection Programs in the United States

Watershed	Year FAD* issued	2008 Transactions (US$ Million)	Historical Transactions (US$ Million)	Hectares Protected [Public]	Description of Activities
Catskills/Delaware Watershed, NY	1991	208.7	1,500 (1997-2008)	510,745 [50,990]	Land acquisition, water quality monitoring, maintenance/upgrading wastewater treatment plants
Quabbin and Wachussets Watersheds, MA	1989, 1999	13.6	121 (1985-2008)	52,486 [39,284]	Land acquisition, wildlife management, construction, maintenance and operations of watersheds, reservoirs, wastewater management
Hetch Hetchy Watershed, CA	1993	3.2	14.5 (2004-2008)	507,637 [507,637]	Patrol and enforcement within the park, wildlife management, visitor education services, managing facilities to prevent water contamination
Cedar River Watershed, WA	1992	10.7	38.7 (1992-2008)	36,624 [36,624]	Road decommissioning and improvements, tribal relations, security, habitat restoration, planning, research and monitoring, maintenance, public education, administration etc.
Total		**225.6**	**1,674**	**1,107,492 [634,535]**	

**The FAD, or filtration avoidance determination, refers to an exemption from regulation that is granted to a drinking water supplier if the water quality within a watershed meets a certain quality.*

In total, more than $236 million was spent across these four programs in 2008, ensuring that the natural ecosystems continue to provide clean water of such a high quality that they remain exempt from filtration.

Program Structure

The descriptions of the programs below highlight the details of how these payments are structured between the participants.

The Environmental Quality Incentive Program provides technical assistance for conservation planning, design and implementation of conservation practices for eligible participants, and financial assistance for implementation of structural and land management practices. Cost-share payments may be made to implement one or more eligible structural or vegetative practices. Incentive payments can be made to implement one or more land management practices. Fifty percent of the funding available for technical assistance, cost-share payments, and incentive payments shall be targeted at practices relating to livestock production, which are known to have significant impacts on water quality.

Agricultural Management Assistance Program (AMA) provides cost-share assistance and incentive payments to agricultural producers to voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation into their farming operations. Producers may build or improve water management structures or irrigation structures; plant trees for windbreaks or to improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming.

Conservation Security Program, known as the Conservation Stewardship Program since 2009, is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands. The program offers participants two possible types of payments: 1) annual payment for installing and adopting conservation activities, and improving, maintaining, and managing existing activities; 2) supplemental payment for resource-conserving crop rotations that reduce soil runoff into water bodies, among other benefits.

Conservation Reserve Program provides participants with annual rental payments, incentive payments, and cost-share assistance or other incentive mechanisms to place highly erodible or other environmentally sensitive land into a 10-15 year contract. Essentially, this is a program providing incentives to farm areas that would be the most damaging to ecosystem services. In consultation with the local conservation district, participants implement a conservation plan that includes planting a vegetative cover, such as perennial grasses, legumes, fobs, shrubs, or trees that act as buffers to runoff laden with sediment, nitrogen, and phosphorus.

The Wetlands Reserve Program is a voluntary program offering landowners an opportunity to establish long-term conservation and wildlife protection in exchange for retiring eligible land from cultivation. The USDA Natural Resources Conservation Service (NRCS) provides technical and financial support via three mechanisms: 1) permanent easement with USDA providing 100 percent of the easement value and up to 100 percent of the restoration costs; 2) 30-year easements with USDA paying up to 75 percent of restoration costs; and 3) restoration-cost share agreement where no easement is put in place and USDA

pays up to 75 percent of the restoration costs. The NRCS goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program.

EPA's 319 Program is a voluntary program that provides grants to states and tribes to implement non-point source projects and programs in accordance with section 319 of the Clean Water Act (CWA). Non-point source pollution reduction projects can be used to protect source-water areas and the general quality of water resources in a watershed. Examples of previously funded projects include installation of best management practices (BMPs) for animal waste; design and implementation of BMP systems to protect water quality in stream, lake, and estuary watersheds; basin-wide landowner education programs; and lake projects previously funded under the CWA section 314 Clean Lakes Program.

Setting the stage for using ***PWS tools to protect drinking water*** was the 1986 Amendment to the 1974 Safe Drinking Water Act (SDWA), together with the 1989 Surface Water Treatment Rule (SWTR), which established major changes in drinking water regulations in the US. Under the SWTR if the water quality within a given watershed meets a certain quality it can be issued a permit exempting the watershed from filtration requirements typically enforced by the EPA, known as a filtration avoidance determination (FAD) or alternative to filtration (LAF).

Since 1989, six major cities in the US have received FAD or LAF permits, including New York City. According to sources at US EPA[xii], there are more than 60 smaller systems that do not have filtration as part of their treatment regime for drinking water; however, EPA does not track these programs and could not provide any data on their activities.

The main differences between the structures of these programs are the size and land tenure arrangements. The Catskills/Delaware Watershed serving New York City is slightly larger than the Hetch Hetchy Watershed outside San Francisco, yet in the New York case only 10 percent of the land is owned by the city, while the rest is jointly managed and conserved through agreements with private landowners. In the Hetch Hetchy Watershed, 100 percent of the land falls within Yosemite National Park, so the land is already owned and protected by the government and thus management costs are only a fraction of New York's. Management costs are similarly low in comparison to those in NYC in Washington State's Cedar River Watershed, which is nearly 100 percent owned by Seattle Public Utilities (as of 1996). A more complex tenure arrangement exists for Boston where the Quabbin and Wachussetts Watersheds are 75 percent under the jurisdiction of the local government while the remaining 25 percent is managed through public-private agreement. Watersheds where the majority of the land is under the jurisdiction of government authorities cost much less to manage and maintain than those managed under public-private tenure arrangements. As was noted in the Latin America section of this report, this is also true for PWS programs in protected areas in Guatemala.

Regional Outlook

On the horizon are a number of promising opportunities and pilot projects to expand the reach of current payments for watershed services tools in the US.

[xii] EPA press office, personal communication, February 2010.

First, the 2008 Farm Bill included language that catalyzed the establishment of the **Office of Environmental Markets** (OEM) within the USDA. Section 2709 of the 2008 Farm Bill (the Food, Conservation, and Energy Act of 2008) directs the Secretary of Agriculture to "establish technical guidelines that outline science-based methods to measure the environmental services benefits from conservation and land management activities in order to facilitate the participation of farmers, ranchers, and forest landowners in emerging environmental services markets."[37] OEM's agenda includes developing science-based metrics, protocols for reporting, and the establishment of registries to "collect, record and maintain" information on environmental benefits.

OEM will also serve as a key coordinating body of the various efforts within numerous federal agencies to use market-based approaches to address the declining health of ecosystem services, including a prominent role in the implementation of the new strategy for restoring the Chesapeake Bay Watershed, which calls for the creation of multiple environmental markets across the watershed.

Other new agricultural incentive programs for PWS include **funding for specialty crop farmers in California's San Joaquin Valley** for implementing water quality improvement projects, with $2.6 million of USDA funds available over the next five years. USDA is also funneling $320 million over four years to projects targeted at **water quality impacts from agricultural runoff in the Mississippi River basin**, representing the first water quality program to specifically target agricultural runoff. While scientists and policymakers have long known that runoff from farms throughout the Mississippi River basin feeds the "dead zone" in the Gulf of Mexico, this initiative marks the first time that the government has directed funding specifically toward nonpoint pollutant sources. The funding will go toward projects in 12 Mississippi and Ohio River states. USDA will prioritize farms along streams and tributaries that have been shown to contribute the highest amounts of nutrient pollution.[38]

Another source of funding for non-point source pollution control is contained in language in the federal guidance for the Section 319 non-point source grant program. The **Clean Water State Revolving Fund Program** (SRF), under Title VI of the Clean Water Act, is currently providing more than $200 million annually to control pollution from non-point sources and for estuary protection. However, most states have under-utilized this resource to date. EPA believes that the SRF is particularly well-suited to assisting in the implementation of non-point source projects requiring large-scale capital investment.[39]

For those programs focused on **the connection between clean drinking water and ecosystem services**, the examples noted above clearly demonstrate the efficacy of the PWS approach in pure economic terms, while connecting downstream ecosystem benefits with upstream ecosystem health. One official within the US Forest Service considers the use of PWS tools ripe for expansion, noting that, "in many ways, sustaining the provision of clean drinking water may be an arena more fertile for PES/PWS even than water quality restoration."[40]

The US Forest Service has been working on the connection between forested land and watershed services through a number of initiatives. Their Forest to Faucets[41] project is an expansion of the assessment work began in *Forests, Water and People,* where researchers showed the connection between forests and water quality by illustrating how closely land use is linked to clean and abundant drinking water.[42]

This connection is at the heart of a new pilot project in **Santa Fe, New Mexico,** where the drinking water authority has embraced PWS in protecting the city's drinking water source. As in many cities the world over, the water supply in Santa Fe is dependent upon forest health and protection from harmful influences. In the arid western US, wildfires can negatively impact drinking water sources by burning up the vegetation that would normally slow down and uptake water in its downhill course, spiking sedimentation and requiring reservoir dredging. Motivated by research by other municipalities affected by severe wildfire, Santa Fe realized that it costs much more to clean up after a fire than it does to manage the forest to avoid catastrophic wildfires. When Santa Fe's Water Division created a 20-year watershed plan, they included a new financial mechanism that taps water users to help pay for the management of the forest to ensure future supplies of high quality water.

The typical municipal water user pays for the services of capturing, treating and delivering water but is not charged for the ecosystem services that produce and naturally filter the water. By attaching an economic value to these ecosystem services, based on the true cost of maintaining the environments that support them, water districts can generate the revenues to cover the actual costs of the land management actions.

As noted earlier, Seattle, San Francisco, Boston, New York, and a few other cities have already adopted the PES model for the capital outlay and annual operating costs associated with the provision of clean drinking water, but Santa Fe is the first city to use PES/PWS to fund the maintenance of forest restoration activities *as an insurance policy against future threats to the water supply*. The city has received a five-year watershed restoration grant from the state to begin payments for watershed treatments, ecological monitoring, and public outreach about PWS. During this phase (beginning in 2009), the water user billing statement will show the PES project as a credit. Beginning in 2014, a fee will be assessed to each water user amounting to roughly $6.50 per year for the average household. The city has established a collection agreement with the US Forest Service to transfer the payments, which will cover about 50 percent of the actual forest management costs.[43]

Another innovative PWS model to watch (albeit focused more on water quantity and flow) is the Water Restoration Certificate (WRC) program launched in August 2009 by the Bonneville Environmental Foundation (BEF), known for its pioneering work with renewable energy certificates (REC). The process works much the same for the new WRCs as it does for RECs: Step one allows businesses and individuals to take responsibility for their water consumption by calculating water use; and step two offers them the opportunity to return to the environment an amount of water equal to what they have used through the purchase of WRCs, each of which represents 1,000 gallons of water. BEF has teamed up with the National Fish and Wildlife Foundation to help certify the impact of the restored water and with Markit Environmental to register the water offsets credits.

Lastly, one other interesting PWS idea to watch out for in coming years is beavers. Practitioners are starting to think about the reintroduction of beavers (and their industrious dam-building) as a solution for reduced downstream sedimentation in terms of water quality, and capture and slow release in terms of water quantity. Our research has not confirmed any active beaver-related PWS projects, but momentum is building, with conferences held in 2009 and 2010 bringing advocates together to discuss the benefits of such an approach.[44]

Box 4: The New Frontier in the Marketplace: Creating Market Opportunities for Marine and Coastal Conservation Ecosystem Services

The Problem:

Despite the obvious continuing downward trend of marine and coastal ecosystem health, conventional management measures have failed to reverse this trend, in part because of insufficient funding. Continued coastal population growth and ever-increasing reliance on marine resources mean continuing and increasing stress for coastal and marine ecosystems.

Opportunity:

New tools, such as marine and coastal Payments for Ecosystem Services (PES) and associated market mechanisms have the potential to achieve significantly better and more cost-effective conservation outcomes than currently result from projects that seek to isolate and protect coastal areas from human encroachment. By clarifying the linkages between ecological function, ecosystem service delivery, and market incentives, market-based conservation mechanisms can lower risk and increase efficacy of management. Moreover, market-based conservation can generate much-needed, new sources of revenue to fully implement the integrated management that is necessary for protection of marine and coastal resources.

Current State of Play:

While market-based tools have been used mainly for protecting fisheries, the use of market-based mechanisms can be extended to other marine and coastal ecosystem services, such as coastline stabilization, beach maintenance and production, provision of fish nursery habitats, coastal water quality, and marine carbon sequestration.

Current State of Market-based Mechanisms for Marine and Coastal Conservation:

Various fisheries have developed markets through catch shares systems that allocate a limited amount of fish annually. Fishermen are granted rights that specify the quantity of a fish species they are allowed to harvest of the total allowable catch, based on scientific assessment of what levels are sustainable over the long term. Fishermen can trade their rights to maximize efficiency and profit. Such systems have been developed in Australia, Canada, Iceland, New Zealand, the US, and elsewhere. Smaller schemes have also been developed between individual communities and ecotourism actors. These schemes often involve a hotel or tourism operator either paying or providing in-kind payment (e.g., building of schools and roads) to communities in exchange for decreased resource use, such as reducing fishing or mangrove harvesting, that improves the overall health of the marine ecosystem.

Next Steps:

Many countries and stakeholders are beginning to investigate payments for ecosystem services (PES) and other market-based mechanisms as another tool for marine and coastal conservation. The Marine Ecosystem Services (MARES) Program at Forest Trends (parent of Ecosystem Marketplace) through the Katoomba Group network is working to build a community of practice around market-based mechanisms for marine and coastal conservation. The goal is to develop ideas and concepts, to share lessons learned, and to further test the use of PES, involving different sectors and ecosystem services, in various marine and coastal settings worldwide.

What to Expect in 2010-11:

As understanding of the value of marine ecosystem services continue to increase, the next two years will likely see an explosion of marine and coastal PES projects around the world. The MARES Program is actively working with partners in Mexico, Colombia, Vietnam, and Tanzania to develop projects on mangrove carbon sequestration, biodiversity conservation, and beach production and maintenance. Beyond Forest Trends, the World Bank and IUCN are developing projects to test mangrove carbon sequestration. The Nature Conservancy is developing water fund projects in Colombia and Mexicoto include coastal water quality. Small marine PES projects are springing up elsewhere as well. In the US, both marine spatial planning policy and wider use of fisheries catch shares programs will expand market-based incentives for promoting sustainable harvesting.

Conclusions and Overall Outlook for Global PWS

The PWS examples and numbers presented in this section provide an interesting story, yet there is more to analyze behind the data. At its most basic level, PWS is a mechanism for collaborative action and change as the process entails a policy decision requiring negotiations with multiple stakeholders: providers/donors, beneficiaries/landowners, and intermediaries. This kind of negotiation among the different players often leads to more effective and sustainable agreements to the various resource-management strategies that are so vital to better land use and planning and to the benefit of watershed and ecosystem services. These engagements also serve to provide more awareness among all parties of the inherent value provided by ecosystem and watershed services. Even though there has been demonstrable growth in the implementation of PWS programs in the last decade, these efforts are marginal when compared to the level of investment needed to protect natural landscapes. Particularly when compared to other social investment, watershed conservation continues to be of marginal interest to most governments, companies, and water users.

The **characteristics of successful programs** have been those that adopt an all-inclusive approach in terms of identifying the stakeholders; those that have been able to evolve over time and adapt for more effective and comprehensive resource management (the Vittel case), including adapting the institutional and financial mechanisms needed to ensure overall program effectiveness; and those that have been flexible enough to take advantage of linkages between local, private bilateral programs and the larger national incentive programs such as suggested in Brazil and Ecuador.

In the Costa Rican National PES scheme, for example, agroforestry measures were incorporated so that payments are made for a wider range of land-use practices, including reforestation and natural regeneration, providing continuity that ensures broader and longer term impact. These adaptive management strategies are evident from Mexico's National Program, across many PWS programs in the US conservation incentive programs, and in Africa's upstream-downstream schemes.

The issue of reliable, transparent information and specifically **the lack of performance and impact data is a recognized weakness** of the majority of PWS programs. The Equitable Payments for Watershed Services (EPWS) example from Africa shows that by establishing a rapport between upstream land managers and downstream water users, PES schemes can mobilize funds to create or improve existing information and technical capacity for improved land management. This case also serves to advance the potential for more engagement with the private sector by providing transparent and reliable information about the costs and benefits of PWS, thus making a strong "business case" to justify investment. This same sort of attention to transparency and increased reporting of information to all interests will serve to provide better overall data on the use and efficacy of PWS tools.

Related to the issues of private sector investment, another interesting development that bodes well for the future of PWS is tentative experimentation in instruments to tap into funding for forest carbon credits with co-benefits, including watershed services, biodiversity, and poverty alleviation. For example, one indicator under the Climate Community and Biodiversity Standard, a project design standard, is addressing the "impact of likely changes in water, soil and other locally important ecosystem services."[xiii]

[xiii] http://www.climate-standards.org/standards/pdf/ccb_standards_second_edition_december_2008.pdf

It has been argued that for those PWS programs which focus on poverty alleviation, the implied social targeting increases the transaction costs, which means continued dependence of PWS programs on general tax revenues or donor financing, rather than direct payments from beneficiaries. This is especially true of PWS program in Africa. Furthermore, investments in social improvements without links to land management commitments do not ensure compliance, which is a requirement for any private investor aiming to receive the expected returns on investment.[45]

On the horizon, in addition to the numerous new ideas and opportunities emerging from across the globe discussed in each of the regional sections above, one new market development is generating much interest, as described in the Box below.

Finally, as writing of this report was winding down, two different sources made mention of whether Ecosystem Marketplace had come across any PWS programs related to groundwater recharge with specific references to the rapidly depleting Ogallala aquifer, which covers a vast area of the upper Midwest section of the US and the aquifer supplying fresh water to the middle of Mexico's Yucatan Peninsula. We found no such programs during research for this report but added the idea to the growing list of ways in which PWS tools are playing an increasingly vital role in addressing the current and future state of watershed services.

IV. Water Quality Trading Programs

Summary Details

- Total number of programs identified: 72
- Total number of active programs: 14
- Total value of payments in 2008: US$10.8 million
- Total value of historical payments (roughly 2000 – 2008): US$52 million
- Total amount of phosphorus credits transacted historically: 331,139 pounds
- Total amount of nitrogen credits transacted historically: 42,261,620 pounds

Overview of Water Quality Trading

While PWS programs are driven mainly by voluntary actions, this section of the report focuses on watershed payment programs where water quality compliance goals are met by developing and trading pollutant reduction credits. These programs are developed as an alternative approach to meeting traditional command-and-control water quality standards or in anticipation of regulatory requirements. The terms *water quality trading,*[46] *nutrient trading,*[47] and *effluent and offset trading*[48] are all used to describe these trading programs. Within this report, we utilize the term "water quality trading."We identified 72 programs in preparation for this report, with the majority (66) located in the United States. Five programs are located in Australia, one in Canada, and one in New Zealand.

Trading programs have targeted water quality improvements in four service categories: nitrogen, phosphorus, salinity, and temperature. As is the case with PWS programs, the trading programs discussed herein operate at the watershed level as degradation of water quality occurs on a local scale. This simply means that, unlike the global carbon markets where an offset has the same impact regardless of geography, pollutant levels such as in the Chesapeake Bay of the eastern United States have little bearing on those of the Hunter River Watershed of New South Wales, Australia. Hence, water quality trading programs are generally quite fragmented and collectively do not amount to a cohesive market. Each watershed, municipality, or in some cases state establishes its own trading rules, policy, or guidance and serves its own set of constituents.

Predicated on the assumption that trading is a more cost-effective approach to meeting a regulatory-based standard, industrial and municipal facilities may purchase pollutant credits as a means of complying with government-mandated water quality standards, pollutant load caps, or individually established discharge limits. Credits are generated by facilities that reduce pollutants beyond required levels or by paying non-regulated entities to initiate activities that reduce nutrient pollution. In many ways, such programs have as much in common with carbon market cap-and-trade programs as non-trading, purely voluntary, payment-for-watershed-services programs.

All programs described in this section were designed to meet a stipulated water quality standard (or the anticipation of regulation) limiting the levels of nitrogen, phosphorus, salinity, or temperature in a water body. As described above, the entity facing regulation gains the right to pollute a specified amount through a permit or other allowance agreement and chooses to meet that authorized level of pollutant discharge by trading for another's permitted right or voluntarily paying non-regulated entities to reduce pollution discharge in exchange for the pollution credits their actions generate.

The Regulatory Framework

Regulation provides a common denominator for all 72 trading programs identified in this report. The 66 programs based in the United States are driven by the Clean Water Act (CWA).Originally passed in 1972, the CWA established the National Pollutant Discharge Elimination System (NPDES) permit program. NPDES permits control water pollution by regulating point sources defined as discrete conveyances, such as pipes and man-made ditches. These permits specify discharge limits for individual entities, most commonly municipal and industrial facilities. Today, NPDES permits serve as the blueprint for compliant-driven water quality trading schemes. Currently, EPA has delegated authority to implement the NPDES permit program to 45 states but retains authority over five states: Massachusetts, New Hampshire, New Mexico, Idaho, and Alaska.

In conjunction with NPDES permits, the CWA's Total Maximum Daily Load (TMDL) requirement also limits pollutant loads in a watershed. Under the Clean Water Act Section 303(d), TMDLs are developed for impaired waters, or those that are too polluted or otherwise degraded to meet designated uses and/or water quality standards. While NPDES permits apply to individual facilities, TMDLs specify the maximum amount of pollutant that a water body can receive and still safely meet water quality standards.

The Clean Water Act theoretically established these regulatory tools in 1972; however, it was not until the 1990s that TMDLs took effect.[49] In response to tighter regulation and increasing cost of compliance, point sources began exploring the concept of improving water quality more cost effectively, in some cases, by paying others to reduce their pollutant loads beyond already established discharge limits. In 2003, the EPA acknowledged this emerging market opportunity with the announcement of its Water Quality Trading Policy.[50] The new policy set out to achieve "cleaner water, at less cost, and in less time."[51] Under this policy, facilities meeting basic technology control requirements could use pollution "credits" to further their progress toward water quality targets.

Similar regulatory drivers have motivated trading outside of the United States. In Australia, for example, in New South Wales in 1996, the Environmental Protection Authority made provisions for an emissions trading scheme allowing three participating sewage treatment systems to adjust their individual discharges, provided the overall load limits for nitrogen and phosphorus were not exceeded. Trading was spurred by mandated limits requiring an 83 percent reduction in total phosphorus and a 50 percent reduction in total nitrogen between 1996 and 2004 when compared to conventional abatement scenarios. Also in New South Wales, the 1997 Protection of the Environment Operations Act (POEO Act) spurred the development of the Hunter River Salinity Trading Scheme. The POEO Act established a load-based licensing scheme, placing limits on pollutant loads emitted by holders of environment protection licenses. The legislation is still in place today and covers 23 coal mining and power generation facilities.

In the Murray-Darling Basin Salinity Credit Scheme, the *Water Act of 2007* ensures a basin-wide approach to trading, which will be incorporated into the Basin Management Plan due out this year (2010). The Murray-Darling Basin Agreement governs trading (such as the salinity credit scheme mentioned above) in conjunction with existing legislation in each of the Basin states and at the commonwealth level.

In New Zealand's Lake Taupo Trading Program, the Waikato Regional Environmental Authority, which has regulatory jurisdiction over water quality in the Lake Taupo watershed, implemented rules in its regional plan (Regional Plan Version 5) capping nitrogen from all properties in the catchment. These new rules aim to reduce nitrogen flowing into the lake by 20 percent through a mix of land retirement, land conversion, and purchasing allowances that result in permanent reductions of nitrogen.

Across the globe in Ontario, Canada, the South Nation Conservation Authority's Total Phosphorus Management Program is motivated by guidelines of the Provincial Ministry of Environment (MOE), the body responsible for water quality and sewage treatment plant incensing. Under the MOE's Water Quality Objective Section 3, Policy 2, requirement, no new pollutants can be added to a watershed where water quality guidelines are already exceeded. In the case of the South Nation River, the 0.03 mg/L phosphorus has been exceeded every year. Wastewater dischargers wishing to upgrade or undergo new construction must therefore offset additional discharges by purchasing credits from non-point sources.

Program Participants: Who's Playing?

At the most basic level, trading activities involve a buyer, seller, an administrator/regulator and are predicated on the PES principle that the transaction is legally binding and involves a defined and valued ecosystem service.

Participants can generally be grouped into the following categories:

Buyers: Municipal and industrial dischargers are the primary buyers for pollutant credits. Buyers may also include pre-compliant dischargers who expect abatement costs to increase in the future.

Sellers: Most markets look to unregulated non-point sources of pollution such as farms and animal-feed operations for the supply of low cost, pollutant-reduction credits. Sellers may also include point sources that have generated excess reduction credits or have reduced pollutants prior to regulation. Credits can be created via a range of land-based best management practices (BMP), including planting trees as buffers along rivers and streams, reducing fertilizer use, managing manure, fencing farm animals out of streams, and planting cover crops

Administrators: The primary role of administrators and regulators is to establish and enforce trading rules. In areas where rules do not exist, these bodies approve individual trades. Regulators and administrators also perform monitoring and performance evaluations following transactions.

Infrastructure Providers: Infrastructure providers increase the efficiency and transparency of transactions in the marketplace. The most common type of infrastructure provider is a registry, a tool for tracking transactions (the buying and selling of pollution credits).To date, the majority of trading

programs is using internally created databases and accounting tools rather than listing transactions on external or commercial registries.

Intermediaries: An intermediary can be defined as any party other than the buyer or seller who handles the transfer of pollution reduction credit. Intermediaries include those buying credits with the intention of resale, third-party brokers, and platforms through which buyers and sellers transact credits.

Funders: In addition to the funds invested by the buyers, many of the entities developing water quality trading activities receive government funding. For example, in the United States, the Environmental Protection Agency's Targeted Watershed Grants, and the National Resources Conservation Service's Conservation Innovation Grants provide the majority of funding for the establishment of these compliant-driven programs. For more information on the granters, see section on Funding below.

All programs studied include buyers, sellers, and administrators. Several also incorporate infrastructure providers, intermediaries, and outside funders. In numerous cases, consultants and universities have also played a significant role in identifying and developing trading opportunities. For example, the University of Massachusetts partnered with the Massachusetts Executive Office of Environmental Affairs to develop improved wastewater management plans—including nitrogen trading programs—in southeastern Massachusetts. In Ohio, the Alpine Cheese Company partnered with Ohio State University to conduct research and facilitate program design and monitoring. Finally, the Passaic River trading efforts in New Jersey were facilitated by Rutgers University.

Program Structure: How Does Trading Work?

Market structure dictates how transactions work and how credits move from one player to the next. In its 2009 report, the World Resources Institute proposed four market structures, as described in the textbox below. These structures "define how trading will occur and the infrastructure used to support the water quality trading program."[52]

This classification system describes four ways a credit can move from one player to the next; in reality transactions rarely fit neatly into one category. In fact, among the 20 programs with which we conducted interviews, no two programs followed the same process of exchanging credits.

Box 1: Market Structures as Defined by the World Resource Institute

- ***Bilateral trades****: defined as one-on-one negotiations where the price is set by bargaining and not by observing a market price.*
- ***Sole-source offsets****: defined by regulated sources being allowed to increase discharges at one point if offset elsewhere.*
- ***Clearinghouses****: defined by the presence of an entity linking buyers and sellers of credits. These function most efficiently where there are many regulated entities and economies of scale, which lowers both transaction costs and risk.*
- ***Exchange Market****: defined by buyers and sellers meeting in an open forum with all commodities equivalent and all prices transparent.*

Box 2: Program Structures for Water Quality Trading in the United States

Southern Minnesota Beet Sugar Cooperative

The Southern Minnesota Beet Sugar Cooperative program is designed on the basis of a sole source offset. In 2003, the Minnesota Pollution Control Agency authorized the Southern Minnesota Beet Sugar Cooperative (SMBSC) to build a wastewater treatment plant, provided it offset new discharges with non-point source phosphorus reductions. SMBSC was required to establish a trust fund of $300,000 to implement these reductions. SMBSC now pays farmers—all members of the cooperative that supplies product to the SMBSC—$5 per acre to plant cover crop, which not only reduces phosphorus loads but also improves beet yield. SMBSC accrues credits by issuing payments to farmers planting cover crop.

Hunter River Salinity Trading Scheme

The Hunter River Salinity Trading Scheme combines exchange market and bilateral trades. The program monitors and caps the discharges of 23 coal mining and power generation facilities. These facilities each hold a total of 1,000 salinity credits, representing a share of allowable discharge. The initial credits—allocated free of charge—have different life spans, with two hundred expiring every other year from 2004 to 2012.To replace those that have expired, two hundred additional credits have been auctioned every other year since 2004.While these auctions occur on a two-year cycle, trading may occur bilaterally at any time.

Connecticut Nitrogen Credit Exchange

In response to hypoxic conditions in Long Island Sound, Connecticut authorized the issuance of a Nitrogen General Permit and established a Nitrogen Credit Exchange (NCE).The permit regulates the nitrogen discharge from 79 public-owned sewage treatments plants. In order to meet compliance, the treatment plants must either reduce their loads or buy nitrogen credits from the NCE. Nitrogen reductions are highly dependent on funding from Connecticut's Clean Water Fund, which offers grants and low-interest loans for nitrogen removal processes at treatment facilities. The NCE serves as a clearinghouse, responsible for the buying, selling, and registration of nitrogen credits.

As evidenced by these three examples, market structure varies from program to program in order to accommodate unique objectives, participants, and regulatory requirements. While these examples showcase three successful market structures, programs looking to design a trading program should use these structures as models rather than molds.

Transaction Activity through the Years

Our research identified a total of 72 water quality programs based on previous reports by Environomics (1999), Dartmouth University (2004), the World Resources Institute (2009), and EPA's Water Quality Trading website. While many of these 72 programs have explored the possibility of trading, far fewer have completed actual transactions of pollutant reduction credits.

In order to emphasize the transactions-based approach to market analysis taken in this report, we developed the following definition to distinguish programs that have successfully exchanged pollution allocations from those that simply allow for trading but have not transacted credits:

A program is considered active if it has facilitated payments between entities seeking to meet a water quality standard. Having received funding to develop a trading policy or platform does not qualify a program as active.

According to this definition, of the 72 programs we identified, only 27 programs qualified as active at any point in time, with 14 programs actively trading credits in 2008.We identified 31 programs that have not transacted offsets, including those that are still in development. We were unable to determine activity in the remaining 14 programs due to a lack of response or contact information.

Figure 1: Program Status in the US as of 2008

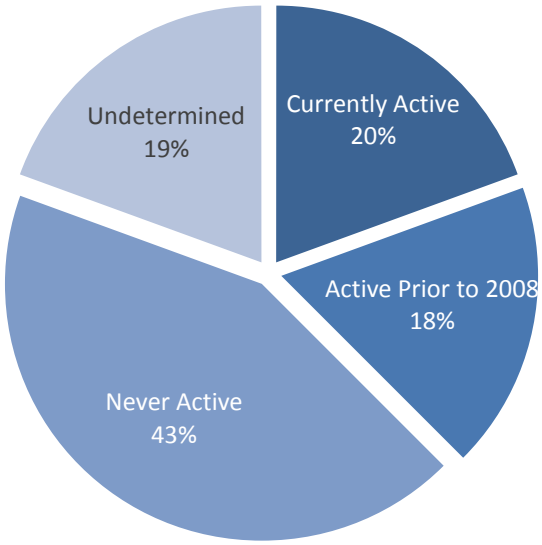
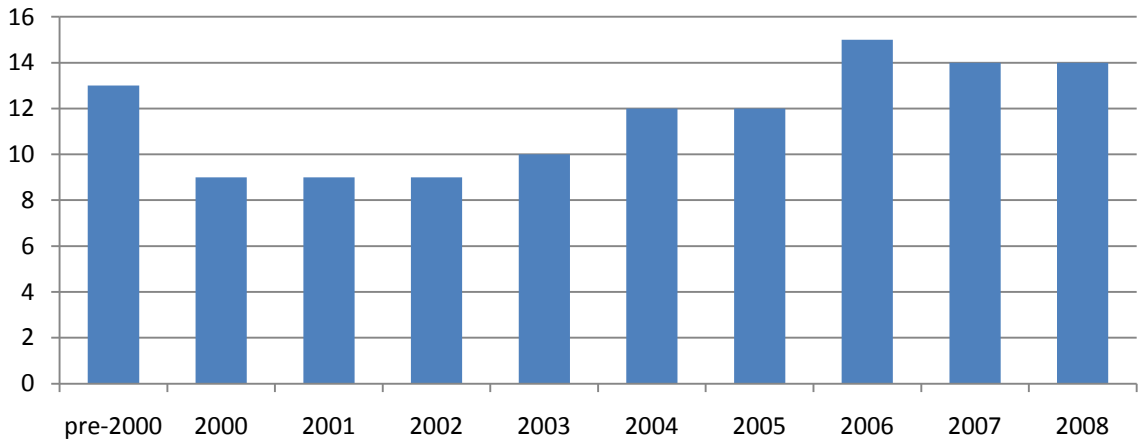


Figure 2: Number of Active Programs in the US by Year



In the process of determining program activity, we tracked the years in which the 27 active programs experienced transactions. The chart below illustrates the number of programs that actively transacted credits each year. For example, a program that transacted credits from 2003 to 2005, for example, was counted once in 2003, once in 2004, and once in 2005.Programs that were active anytime in the 1980s and 90s are represented in the pre-2000 category. Program lifespan, or the number of years during which a program actively traded, ranged from 1 to 15 years, with an average of 6.2 years.

Table 1: Active Water Quality Trading Programs in the US in 2008

Program	Location	Service Category	Total Volume Reductions (lbs, other)	Total Value Transactions (US$)
1. Alpine Cheese Company/Sugar Creek**	State of Ohio, USA	Phosphorus	NA	NA
2. Bear Creek	State of Colorado, USA	Phosphorus	137.72	$6,197
3. Chatfield Reservoir Trading Program**	State of Colorado, USA	Phosphorus	NA	NA
4. Clean Water Services/Tualatin River	State of Oregon, USA	Temperature	Kilocalories NA	$3,208,800
5. Long Island Sound Nitrogen Credit Exchange Program	State of Connecticut, USA	Nitrogen	7,300,000	$8,806,500
6. Great Miami River Watershed Trading Pilot	State of Ohio, USA	Nitrogen Phosphorus	N – 318,031 P – 91,217	$591,970
7. Hunter River Salinity Trading Scheme	New South Wales, Australia	Salinity	NA	$167,149
8. Minnesota River Basin Trading Program	State of Minnesota, USA	Phosphorus	10,955	NA
9. Murray-Darling Basin Salinity Credits Scheme**	New South Wales, Australia	Salinity	NA	NA
10. Neuse River Basin Total Nitrogen Trading Program	State of North Carolina, USA	Nitrogen	5,906	$207,886
11. Pennsylvania Water Quality Trading Program**	State of Pennsylvania, USA	Nitrogen Phosphorus	NA	NA
12. Red Cedar River Nutrient Trading Pilot Program	State of Minnesota, USA	Phosphorus	12,091	$14,908
13. Southern Minnesota Beet Sugar Cooperative Program	State of Minnesota, USA	Phosphorus	10,633	$425,320
14. South Nation River Phosphorus Management Program	Ontario, Canada	Phosphorus	1,157	$20,822

**Transaction data not available

Active Programs: Crunching the Numbers

We collected data on both the volume of nutrients reduced and the payments made to achieve these reductions. Due to inconsistent reporting for older transactions, our data include transactions exclusively from ten programs that were active in 2008 (note that four additional programs were found to be active in 2008 but transaction values could not be verified so as to include these in our analysis). A large number of the once active programs stopped transacting credits before 2000, leading us to believe that we have captured a significant share of market activity over the past ten years. Table 1 above lists all 14 actively trading programs.

Transacted Volume

As mentioned earlier, trading programs target water quality improvements in four service categories: nitrogen, phosphorus, salinity, and temperature. Of the ten active programs for which we collected data, six traded phosphorus, three nitrogen, one salinity, and one temperature. A few programs traded both nitrogen and phosphorus.

In terms of nutrient credit trades, reductions in nitrogen have far exceeded those of phosphorus, due almost entirely to the Connecticut Nitrogen Credit Exchange Program. Since its first year of trading in 2002, the Connecticut program has accounted for more than 99 percent of the reported volume of nitrogen reductions. For most programs, reductions in nitrogen occur on a similar scale as those of phosphorus. The inclusion of the Connecticut program, however, brings the volume of nitrogen reductions to 200 times that of phosphorus. The Figures 3 and 4 below illustrate transaction volume for the two service categories, nitrogen and phosphorus.

Figure 3: Pounds of Nitrogen Reduction

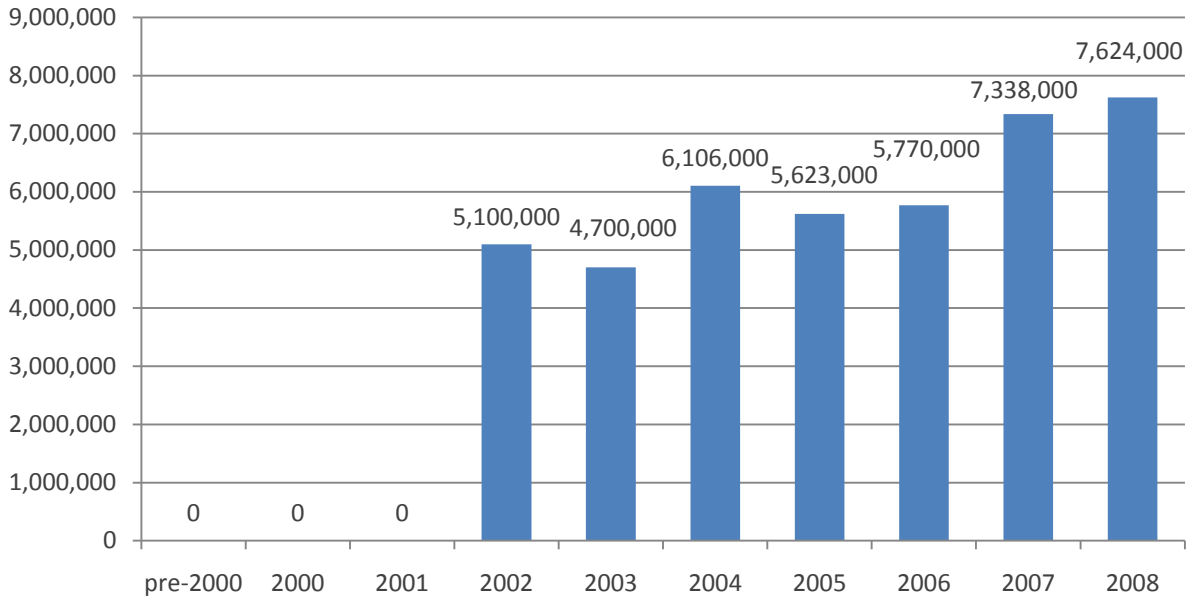
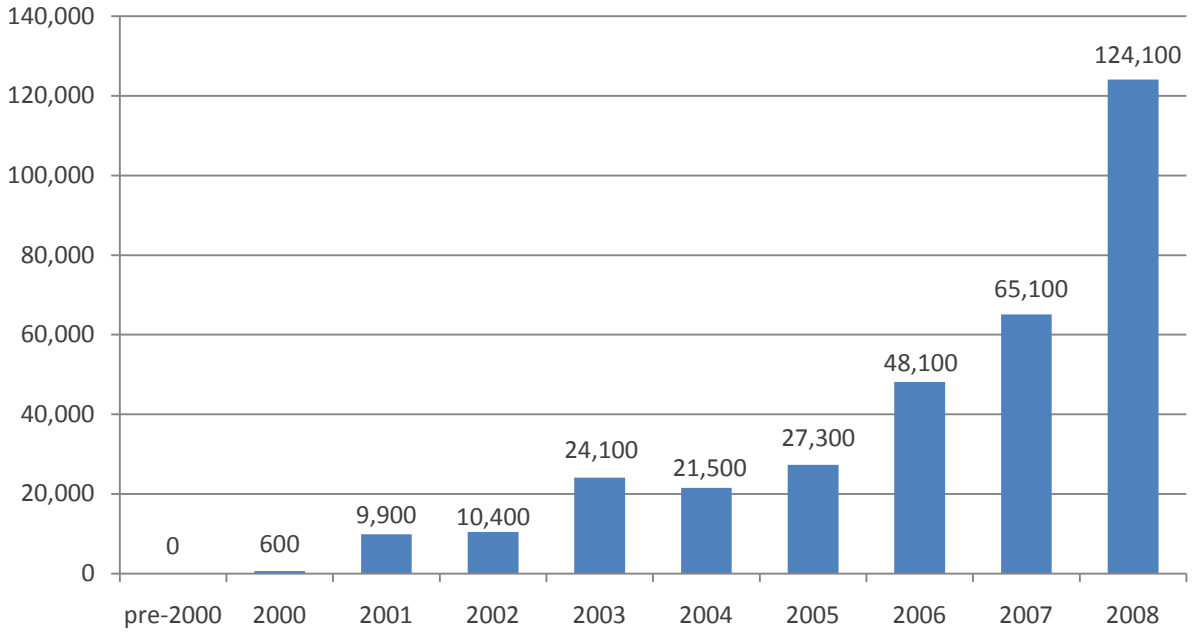


Figure 4: Pounds of Phosphorus Reduction



Phosphorus reductions have increased consistently since the start of trading in the South Nation Phosphorus Program in 2000.The most significant spike in transaction volume occurred in 2008, when reductions increased 91 percent above 2007 levels. Growth in Red Cedar River Nutrient Trading Pilot Trading Program, the Great Miami River Watershed Trading Pilot, and the Minnesota River Basin Trading Program drove this surge, with volumes in the latter two programs more than doubling. The Southern Minnesota Beet Cooperative did not experience a significant change in volume from 2007 to 2008, while transaction volume in the South Nation Phosphorus Program actually dropped over this period.

Trading volumes have not experienced much volatility, mostly because of the size of the Connecticut Nitrogen Credit Exchange Program. Whereas total trading volume in other programs may reflect individual transactions, the Connecticut program includes 79 potential buyers and sellers, all operating under one General Permit. While uncertainties at the project level may make or break smaller programs, project-specific obstacles have little bearing on a larger program.

This isn't to say that the Connecticut program has not experienced change. For example, a dip from 6.1 million pounds in 2004 to 5.6 million pounds in 2005 can be explained by two factors: lower than anticipated financing from Connecticut's Clean Water Fund (CWF) and unusually high levels of rainfall. The CWF provides "financial assistance to municipalities for planning, design, and construction of wastewater collection and treatment projects."[53] The implementation of nitrogen removal projects relies on the infusion of funds from bonds to support the CWF. In 2005, however, the CWF did not receive enough funds, causing project delays. In addition, total rainfall in 2005 measured 25 percent higher than average, creating a greater pollution baseline than expected. Because the emissions cap is based on average weather conditions, the program needed to generate even more credits than usual to meet

permitted requirements. Similarly, favorable weather conditions in 2004 meant that fewer reductions were needed to meet the cap, allowing many projects to generate surplus credits.

For the one program that involves temperature as the credit commodity, not much variability is expected as Clean Water Services (CWS), which implements the program along the Tualatin River in Oregon, has acquired temperature credits from 25 farmers with a 30 year life span, meaning that CWS will not need additional credits for roughly 25 more years from existing sources.[54]

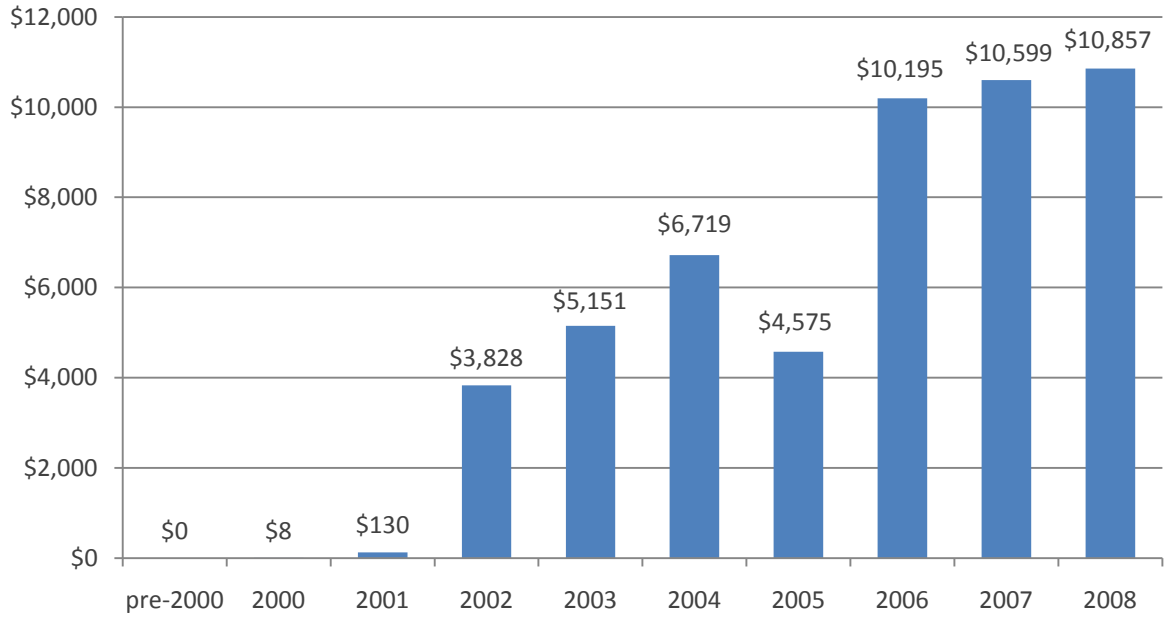
Variations in salinity reductions in the Hunter River Salinity Trading Scheme are influenced by water flow levels that determine when the facilities (23 mining and industrial facilities) are allowed to discharge into the river in order to maintain overall salinity concentrations below the desirable level.

Transacted Value

In the nutrient trading marketplace, there are numerous factors that influence the price and cost associated with transactions. Key factors in discrepancies between price and costs are grant funds on the buyer side or subsidies on the seller side. *In this report, we define transacted dollars as the amount received by those generating pollutant reductions.*

Over the past decade, the ten active programs from which we collected transaction data have generated $52 million in payments for nutrient reductions, with annual totals ranging from $8,000 in 2000 to $10.8 million in 2008.The chart below illustrates this growth trend. None of these ten programs completed transactions before 2000.

Figure 5: Transacted Dollars by Year



Overall, transaction values have continued to grow. The sharp drop in transaction value from 2004 to 2005 can be attributed again to the Connecticut Nitrogen Credit Exchange Program. As discussed in the

section on *Market Structure*, this program relies on financing from the Clean Water Fund to support nitrogen removal projects. In 2005, the limited availability of such funds slowed the pace of new treatment facility construction for nitrogen removal. As a result, 2005 was the first year in which the 79 regulated facilities exceeded the discharge limit specified in the program's General Permit.

Total transacted dollars increased most dramatically (121 percent) between 2005 and 2006.A spike in the number of active programs explains this growth. After 2006, growth rates slowed significantly, despite an increase in the number of programs reporting data over this period. Taking into consideration the three programs excluded from our data because they became inactive between 2006 and 2008 (Cherry Creek Reservoir Watershed Phosphorus Program, New York City Watershed Phosphorus Offset Pilot Program, and Carlota Copper), we expect that transaction values have remained fairly steady since 2006.

While most other programs actually experienced growth in 2005, the Neuse River Basin Total Nitrogen Trading Program also saw a decrease in transacted value from $1.7 million (2004) to $39,000 (2005).This drop can be explained by a shift in the duration of nitrogen removal projects. In 2004, the Neuse River program authorized one nitrogen "sale", meaning that one facility made a payment to permanently transfer its nitrogen allocation to another. In 2005, however, the program transacted "leases", which represent a payment for just one year's worth of nitrogen reduction. For this reason, the transaction value in 2004 far exceeded that of 2005.

In conclusion, the two nitrogen programs have experienced more volatility in transacted value than the phosphorus programs. While phosphorus transactions have shown consistent growth over the past ten years, trading under the Connecticut Nitrogen Exchange Program as well as the Neuse River Program account for the 2005 slump in transaction value.

Price per Pound

This section uses transaction value and volume to calculate the price per pound of nitrogen and phosphorus reductions. While the majority of programs use "credit" rather than pound as their unit of transaction, as there is no set standard for calculating credit prices, it was difficult to determine credible comparisons across programs. For this reason, we decided to ask for information on reductions in pounds, a universal measure. However, it is critical to note that the product behind "pounds" traded varies widely between programs. Key differences between units include variation in trading ratios, crediting periods, and co-benefits.

Trading ratios, used to determine the amount of reduction credit to be sold, account for factors such as location, delivery, uncertainty, and retirement when valuing pollutant reductions. For example, trading ratios based on delivery recognize that a pound of nitrogen or phosphorus reduced further upstream from the point of concern (the area where water quality reductions are deemed most critical) has a smaller water quality benefit than does a pound of nitrogen or phosphorus reduced closer to the point of concern.[55]

Crediting period is another variable affecting the price per pound of reduction. Projects can vary in length from one to thirty years. In some cases, buyers make a one-time payment for reductions over multiple years, while other programs transact payments on an annual basis. The Neuse River program

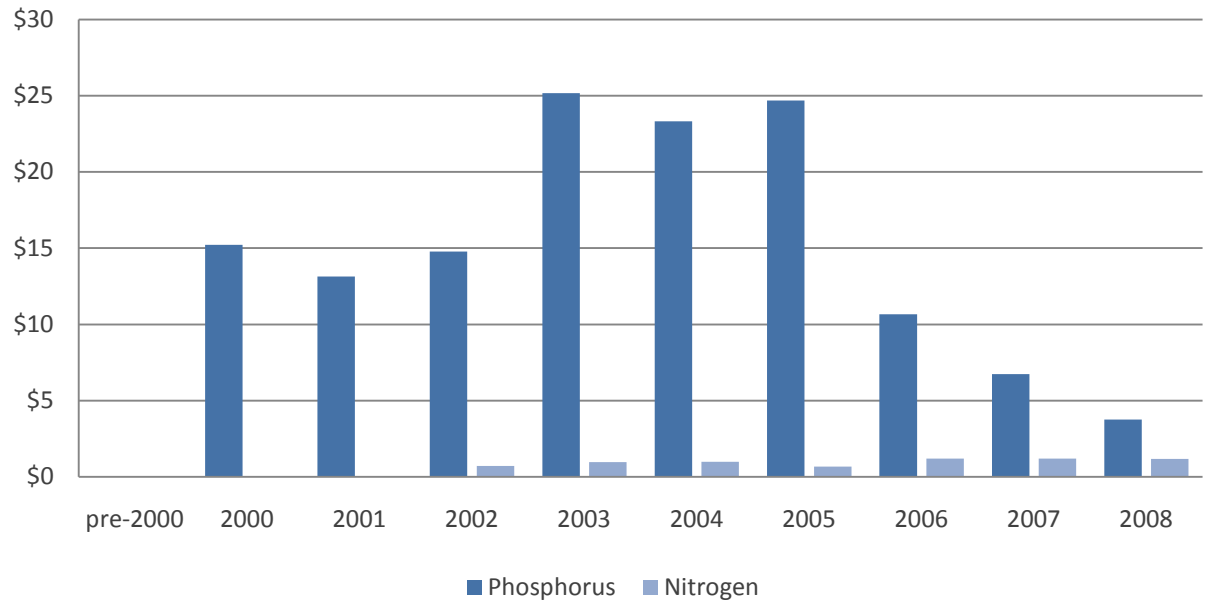
combines both strategies. Point source polluters choose to either "lease" reductions from other facilities on an annual basis or purchase permanent allocations.[xiv] Because we define "transaction" based on the moment money changes hands, price per pound in the Neuse River program had an enormous range.

Many projects may also generate co-benefits such as biodiversity conservation, air quality improvements, job creation, and even building community. Such benefits are not always captured in the price per pound calculation. For example, stakeholders noted that one of the greatest benefits of the Alpine Cheese Company/Sugar Creek Trading Program in Ohio is that it brought all sides to the table to negotiate a solution to the falling water quality in the sub watershed. Regardless of the long-term viability of the trading scheme, there has been significant improvement in the tenor of the conversation about water quality in the sub-watershed among the parties. A similar "benefit" to developing a trading program was cited by PWS project developers in China and Africa as the "intangibles"—non-quantifiable benefits to pursuing trading as a tool to address water quality.

Price per Pound Calculations

Historically, phosphorus reductions have fetched higher prices than nitrogen reductions. Phosphorus prices have also experienced greater volatility, ranging from $3.76 to $25.16.Across programs, nitrogen prices have not fluctuated more than a dollar since 2002.

Figure 6: Price per Pound of Reduction



Since 2000, prices for phosphorus reductions have experienced three distinct trends. Prices hovered around $14 during the first three years of trading, with both the Red Cedar River program and the South Nation Total Phosphorus Management program dominating sales. In 2003, the price per pound of reduction spiked to $25.16.This jump was due almost entirely to the start of trading under the Southern

[xiv] The price per pound for leases ranges from $1.50 to $8.18, while price per pound of permanent sales ranges from $275 to $491.

Minnesota Beet Cooperative (SMBC), which in 2003 made payments of $40 per pound of phosphorus reduction. From 2003 to 2005, prices remained in the $20-$25 range before dropping to $10.67 in 2006.This drop can be explained by trading activity in the South Nation Phosphorus program, where price per pound dropped from $22.35 in 2005 to $12.72 in 2006.Since then, the average price for phosphorus reductions has been declining at about 35 percent annually.

Unlike phosphorus, nitrogen reductions have seen fairly steady prices since 2003.Prices reached their high in 2006 and 2007 ($1.21/pound) and declined slightly in 2008.This slight decrease in 2008 can be attributed to the Neuse River program, which in 2007 authorized long-term contracts at a higher price than the one-year contracts transacted in 2008.

The overall consistency in nitrogen prices can again be attributed to the dominance of the Connecticut Nitrogen Trading Exchange Program. Connecticut's Credit Advisory Board establishes the cost of a nitrogen credit for each year of trading. Price per credit, which differs from price per pound, has increased steadily from $1.65 in 2002 to $4.50 in 2008. Since this program dominates transaction volume, prices have therefore been fairly steady over the past decade of trading.

Because of the small number of actively trading programs, variations in price often reflect trading activity in just one program and are influenced by local conditions rather than overall market conditions. Unlike in regulated carbon markets, where prices respond to global trends in supply and demand, there is little correlation in the movement of prices among water quality trading programs. It is also worth noting is that in reverse auctions, where the sellers are competing with one another, credit prices start low and increase with time. In a bilateral or exchange trade, prices tend to be high initially and then lower as more credits come into the market.

Program Status: Active, Inactive or Somewhere In Between

Program inactivity occurs for several reasons and does not necessarily signify a failure to meet environmental, policy, or market objectives. Key reasons for inactive programs include: meeting permit requirements, lack of adequate regulatory drivers and insufficient economies of scale.

Some programs are classified as "inactive" given our strict definition of what constitutes and "active" program. Technically speaking, some of these programs are still active even though they have met a permit requirement or other standard and no longer need to make payments to implement offset projects, but do need to sustain the required level of water quality through maintenance of the existing trade project or replacement of projects that are removed or fail.

The Rahr Malting Company in Minnesota provides one example of this type of reduced activity. In 1997, the Rahr Malting Company wanted to build its own wastewater treatment facility to cut the costs of using the municipal facility. The Minnesota Pollution Control Agency issued an NPDES permit that allowed Rahr to build the new facility, with the stipulation that it fully offset its discharge by installing non-point source reductions. According to sources in the Minnesota Pollution Control Agency, Rahr was also required to invest at least $250,000 in non-point source pollutant reductions to fully offset the new discharge. By 2002, Rahr had invested in five cost-effective pollutant reductions projects on four different sites and had met the requirements of its five-year NPDES permit. For the purposes of this

report, we consider this program "inactive," given the lack of transaction activity since about 2002, even though they are engaged in ongoing monitoring to maintain the non-point source reductions.

While the achievement of water quality requirements explains the lack of transaction activity in a few cases, the overwhelming influence on inactive programs comes from insufficient demand because of nonexistent or not sufficient regulation. Several programs were developed in anticipation of regulatory drivers that are not yet in place. For example, trading in the Virginia Nutrient Trading Program was created with the expectation of more stringent guidelines and is entirely contingent on the implementation of a TMDL for nitrogen and phosphorus. While the program has yet to experience any monetary transactions, its trading platform has issued binding agreements to 105 facilities, committing $3.1 million for nitrogen and phosphorus reductions.

In other programs where regulation has been successfully implemented, permit requirements have not been stringent enough to necessitate additional reductions. This trend was particularly common in the earlier years of compliant-driven programs when technological advances allowed facilities to achieve permit requirements without trading. In the early 1990s, for example, several utilities in the Tar-Pamlico River Basin in North Carolina generated pre-compliant water quality credits, only to find that they did not require additional credits to meet permit requirements.

It's worth noting that in most cases and for most permitted facilities, the standards were met easily and relatively cheaply suggesting that compliance in the future will become more costly as water quality standards become more stringent. As this happens, the demand for nutrient credits may increase and the overall attractiveness of nutrient trading tools will also increase. This development will bode well for the regions that have invested in the development of trading policies, tools, and platforms in anticipation of this eventual demand.

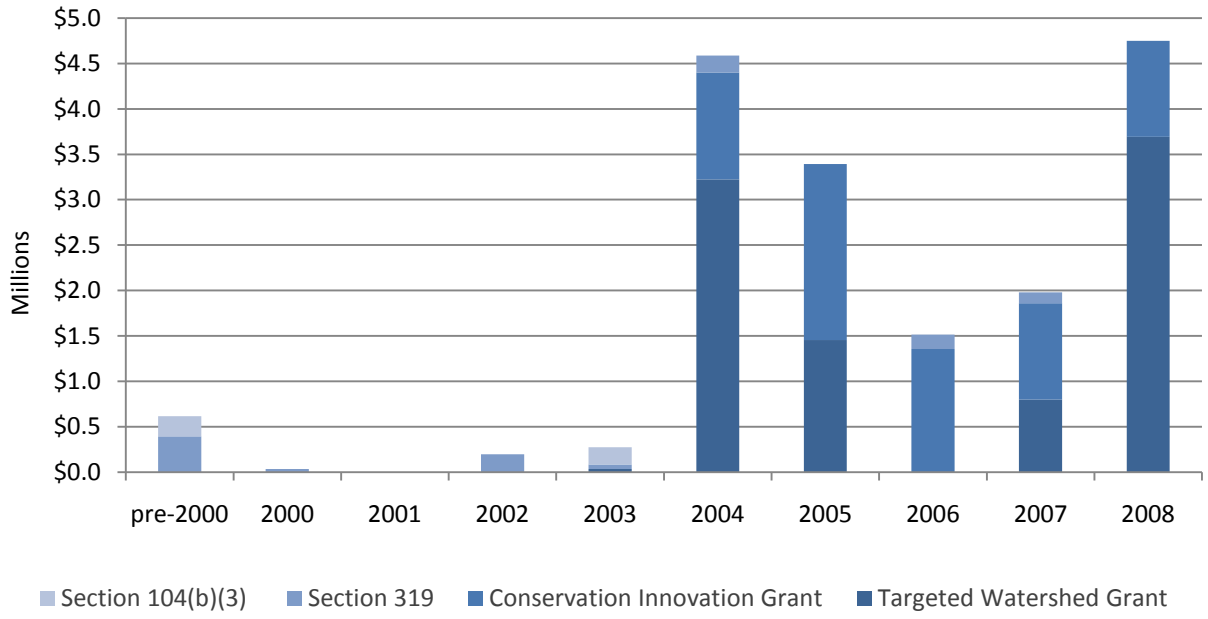
One final story behind transaction inactivity is that markets do not always guarantee a low-cost alternative to pollution reduction. In Minnesota, for example, the Vermillion River Watershed Joint Powers Organization (JPO) received a Targeted Watersheds Grant to study the best way to stabilize temperature and volume in the Vermillion River. The JPO determined that the small market for temperature credits made trading an unattractive option for permit holders; a market approach simply wasn't economically viable. Now nearing the end of the grant period, the JPO will not pursue the establishment of a trading market, although it will allow trading to occur on a case-by-case basis.

Funding for Trading Schemes

Developing a trading scheme requires upfront investment of resources. Government funding has supported the development of a number of programs.[56] Several grants are available for watersheds looking to develop market based water quality projects. In the United States, the two largest funding sources, both competitive grant programs, are EPA's Targeted Watersheds Grant (TWG) and Natural Resource Conservation Service's Conservation Innovation Grant (CIG), a program under the US Department of Agriculture.

It seems the US and Canada are unique in providing targeted competitive grant funding for the development of new trading programs. We did not find similar funding programs in Australia or New Zealand.

Figure 7: Funding by Source and Year for US Trading Programs



EPA Targeted Watersheds Grant

The EPA established the Targeted Watersheds Grant Program in 2003 to "encourage successful community-based approaches and management techniques to protect and restore the nation's watersheds."[57] These objectives can be achieved in a number of ways, including water quality trading, agricultural best management practices, wetland and riparian restoration, nutrient management, fish habitat restoration, and public outreach and education.

From 2003 to 2007, the EPA awarded Implementation Grants to 51 organizations, 16 of which used the money to develop water quality trading programs. These 16 programs received a total of $9.2 million in funding dollars.

USDA Conservation Innovation Grants Program

Authorized under the 2002 Farm Bill, the Conservation Innovation Grants Program "stimulates the development and adoption of innovative conservation approaches."[58] CIG grants use Environmental Quality Incentives Program (EQIP) funds to award single or multi-year grants to non-Federal government and non-government organizations. At least 50 percent of total project cost must come from non-Federal matching funds provided by the grantee. The CIG program is administered by the USDA Natural Resource Conservation Service (NRCS).

The NRCS awarded 265 CIG grants from 2004 to 2008, 12 of which focused on the development of water quality trading programs. These 12 programs have received a total of $6.6 million in funding, with grant amounts ranging from $58,000 to $1 million.

Other Grants

While the Targeted Watersheds Grants and Conservation Innovation Grants have provided the majority of funding for trading programs in the United States, Section 319 grants and Section 104(b)(3) grants, established under the Clean Water Act, also contribute funding.

In 1987, Congress amended the Clean Water Act to establish Section 319, the Non-point Source Management Program. Section 319 provides grant money to support water quality improvements from non-point sources. Most grants, however, were authorized prior to 2000, and few programs seek Section 319 funds today.

Last funded in 2005, Section 104(b)(3) Water Quality Cooperative Agreements funded studies related to pollution prevention. The Environmental Protection Agency awarded grants to state water pollution control agencies, municipalities, interstate agencies, and nonprofit institution to promote the prevention, reduction, and elimination of pollution. At least two programs received 104(b)(3) funding for water quality trading: the Massachusetts Estuaries Project and the Lower Boise River Effluent Trading program.

In Canada, the South Nation Total Phosphorus Management Program (TPM) benefits from funds delivered through the Clean Water Program, a landowner cost-share program for water quality improvement projects. The TPM dollars (money received from the dischargers for their phosphorus offset) are incorporated into the annual Clean Water Program budget and are delivered with other funding. The approach of using a cost-share grant to implement non-point source phosphorus reduction BMPs allows the government to take the TPM dollars further; they can fund several projects at a cost-share rate as opposed to funding 100 percent of a single project, which allows for more phosphorus reduction credits for the same contribution from the discharger.

Outlook for Future Activity

It can be concluded that the activity highlighted in this section points to the fact that ground-level experimentation in trading is yielding valuable lessons such as: the vital role of regulatory based standards to spark demand, price discovery, the importance of monitoring, and valuation methodologies and watershed planning models. Moreover, the transaction activity from trading pollution credits or from offsets does not constitute a cohesive market, and therefore should not be evaluated with the same standards as applied to other, more mature markets.

Those programs that have successfully engaged in transactions have yielded actual reductions in pollutant loadings, sometimes beyond what was required by the regulatory underpinnings and sometimes at a lower cost than with traditional abatement methods. It is important to reiterate that for some project developers, the highest value of the trading program comes not from how much pollution

is reduced or at what cost, but that the whole process yielded a better collaborative approach to the protection of valuable watershed services in the long run—a priceless benefit.[xv]

Outlook on the Regulatory Front

Since trading programs are driven by compliance requirements, adequate regulation is critical to create strong demand for pollution reduction credits and to justify the investment in developing trading as an alternative, potentially cost-effective tool for meeting water quality standards. In the US, as discussed in this section, several programs will most likely not see much trading activity until TMDL limits are put into effect. As the recent Chicago Climate Exchange/PENNVEST report points out, trading could be a moot point in the Chesapeake without the strict enforcement of the TMDL (pending implementation in January 2011).

On a global scale, as suggested earlier, with the least costly pollution abatement activities already undertaken, the cost of abatement going forward is likely to increase, and with that spike, trading is poised to become a more cost-effective option. Those governments—national, regional or local—with trading rules and platforms already developed are well positioned to activate trading whenever new demand drives the market.

Trading in Canada may have a new champion in the Ontario Water Resources Act of 2009 in which specific language promoting trading was incorporated. Once the regulations are implemented, they could become the driver for many new trading programs in Ontario and possibly in other provinces.

As we mentioned earlier in the report in the PWS section on China, there is an exciting potential development of a water pollution emissions trading system that appears ready for launch in a number of cities in China. We'll be keeping an eye on where and when those first trades may occur.

Outlook for Market Structure

Adding to the diversity of market structures already supporting trading activity, watersheds management practitioners have begun to explore multiple credit schemes or programs that create distinct revenue streams for various ecosystem benefits. The concept behind multiple credit schemes is simple: Some water quality projects may provide additional benefits such as improved wetland conditions or clean air, and project developers should be compensated for this added environmental value.

[xv] Dusty Hall and Richard Moore, personal communication, 2009.

Box 3: Interplay between Regulatory and Voluntary-based Efforts To Improve Water Quality: 2 New Programs Typify Different Yet Complementary Approaches to Watershed Restoration

Chesapeake Fund: Developing Innovative Public—Private Partnerships

In spite of decades of efforts to improve water quality in the Chesapeake Bay, pollution continues to increase. In response, new initiatives at the Federal and state level are being implemented to address pollution issues including the potential for WQT to serve as a financing mechanism for reducing pollutants across the watershed. At the Federal level, Chesapeake Bay provisions included in the 2009 Farm Bill will generate additional revenues for conservation in the watershed. The Obama Administration released a Chesapeake Bay Executive Order in May 2009 aiming to step up Bay restoration. The Clean Water Act Total Maximum Daily Load for the Bay is due for implementation in January 2011, and the Chesapeake Clean Water and Ecosystem Act of 2009 promotes, among other things, the creation of a regional trading mechanism to further facilitate restoration.

The Chesapeake Fund, a voluntary-based, new financing structure that facilitates investment in conservation and restoration activities, is poised to utilize all these financing and regulatory tools in implementing restoration projects on-the-ground, where they will have the greatest impact. The Fund's goal is to demonstrate how multiple demand drivers—voluntary- and compliance-based—can be coupled effectively to: 1) Accelerate restoration finance; 2) Disseminate knowledge; and 3) Build lasting and effective public-private financing systems.

Given the current economic climate and projected cost estimates for achieving the Chesapeake Bay watershed's water quality restoration goals, the Bay community must look beyond traditional funding programs and tools toward effective, sustainable, business- and performance-based financing strategies. When brought to scale, the Fund will demonstrate how the public and private sectors can create partnerships to mobilize capital and financial resources to jointly achieve water quality and ecosystem restoration goals.

The Ohio River Basin Trading Project — Innovating within the Regulatory Realm

The Electric Power Research Institute's (EPRI) Ohio River Basin Trading Project (currently in the development stage) is a first-of-its-kind, interstate, multi-pollutant trading program to help improve water quality in the Ohio River Basin. If successful, the program will allow power companies, farmers, and industrial firms to trade water quality credits and thus protect Ohio River Basin watersheds in a cost-effective manner. The current project will establish a market to trade credits for reducing nitrogen and phosphorus discharges and may also include credit "stacking" if the project can generate greenhouse gas emission reductions from avoided nitrous oxide emissions associated with reduced fertilize use on farms.

The trading program will have a rigorous, ecologically based design for long-term water quality management. Using actual modeling data from a number of discrete watersheds within the Basin to evaluate the ecological impact of credit trading, program participants will be able to adapt trading strategies as revised calculations provide additional information.

The benefits of water quality trading may increase sharply as more restrictive wastewater discharge permit limits are adopted. In addition, nitrogen discharges to surface waters from coal-fired power plants could increase as new air emission controls are installed; some of which use nitrogen-based reagents to capture pollutants in flue gas. Purchasing offset credits is likely to be less expensive than investment in on-site treatment facilities, particularly since an ample supply of low-cost credits from agriculture appears achievable. Eventually, the EPRI-led project is expected to serve as a model for developing other interstate water quality trading initiatives. In addition, reduced surface water nitrogen and phosphorous discharges into the Ohio River Basin may help reduce nutrient loading in downstream waterways as far away as the Gulf of Mexico.[59]

While this concept may appear straightforward, the implementation of multiple credit schemes has caused much controversy. The first major pitfall of this market concept occurred with credit "stacking" the process of generating multiple ecosystem credit streams from the same project on the same plot of land. With credit stacking, entities facing regulation can easily achieve compliance by simply taking credit for existing projects. This scenario recently occurred in North Carolina, where a restoration project generated both wetland and water quality credits.

The difference between credit stacking and multiple crediting is that the latter approach does not authorize the generation of multiple credits types from the same plot of land. The Willamette Partnership, for example, recently launched a pilot project that allows landowners to generate up to four distinct credit streams. However, once a plot of land sells one credit type, it can no longer collect additional revenues. The potential benefits of this system abound: lower risk for landowners, high number of buyers and sellers, and of course better environmental restoration. In addition to the Willamette program in Oregon, other programs have also considered and even begun developing multiple credit schemes, including the Ohio River Basin Trading Project (mentioned in the Box above) and the Bay Bank project in the Chesapeake Bay.

Another trend involving multiple credit schemes is the growing number of programs issuing both nitrogen and phosphorus reduction credits. As of 2008, the Great Miami River Watershed Trading Pilot was the only project reporting transactions of both commodities. In the coming years, the Pennsylvania Water Quality Trading Program and Virginia Water Quality Trading Program will transact both phosphorus and nitrogen. The Ohio River Basin Trading Project described above, may push the reality of credit stacking even further with its proposed idea to trade greenhouse gas emissions credits in addition to nitrogen and phosphorus credits.

V. Conclusions and Outlook

Market-based Watershed Protection Widespread and Growing

As many of the examples of PWS and WQT programs illustrate throughout this report, the use of market-based mechanisms to address water resource management is growing and the trends indicate continued growth. Our research found that programs are implemented by governments at all levels, the private sector, non-governmental organizations (NGO), and community groups or some combination of these players. Not surprisingly, each program is unique to the local watershed conditions and shaped by the various political, cultural, and institutional arrangements that affect civil society. Transactions are not strictly limited to cash payments or the exchanges of pollution credits, but also include other types of in-kind compensations supporting a range of activities from adjusting land management practices to improving and protecting water quality, flow and storage, poverty alleviation, institutional capacity-building, technical assistance, overall social concerns and community development.

In all regions of the world, some level of activity was documented although there are clear notable leaders, such as in Latin America, in terms of longest experience and number of PWS programs; China, in terms of the scale of PWS programs underway; and the US, in terms of water quality trading experience.

Even though the totality of these activities documented herein do not constitute a mature or cohesive markets as of yet, the lessons learned from the ongoing implementation of PWS and WQT are valuable and may serve as a key source of information to better inform ongoing market evolution, growth and development. Moreover, these findings are timely given the scale of the current challenges, as suggested in the Preface, which could increase dramatically over the coming years driven by 1) the sheer demand for freshwater resources by an ever-growing population; 2) the escalating cost of watershed restoration if action is not scaled up now given both increases in demand and dwindling or compromised supply of watershed services; and 3) compounded pressures resulting from climate change adaptation, which in many cases, are directly linked to water quality and quantity.

Water Markets Under-performing Because of Lack of "Rules of the Game"

In most cases, the scale of these programs at this time is too small to make a meaningful environmental difference at the landscape level. It is well documented that for markets to grow and mature, there needs to be a strong driver of demand in the form of regulation—starting with implementation of national-level environmental statutes such as the Clean Water Act in the US, along with new regulatory approaches.

Lessons from the carbon market show that regulation is a powerful driver for creating a robust marketplace. The regulated carbon markets are exponentially larger than the voluntary markets and some analysts have predicted they could become one of the largest commodity markets in the world if the US adopts climate legislation with cap-and-trade mechanisms.

Looking Forward: Turning Opportunity into Strategy

With trends clearly pointing to continued expansion of these market based tools, the key question is how to catalyze and guide the rapid scaling-up to ensure that the impact is commensurate with the challenge. What are the policies, who are the actors, and what are the information resources needed to support both policy and players?

On the opportunity side of the equation, there are a number of new initiatives being established to address the challenges ahead as well as the ineffective policies that have been driving watershed restoration over the last few decades. In the US, the Obama Administration's Executive Order targeting the Chesapeake Bay restoration effort represents a bold effort on the part of the federal government in oversight of watershed restoration, which up until now, has been implemented by state and local government environment, natural resources, and planning authorities.

Some of what is driving this renewed interest in watershed restoration is the gap between the resources needed to implement restoration activities and the current level of expenditures on watershed protection and restoration. One study in 2006 estimated the total restoration needs from federal sources to clean up the Chesapeake Bay to be between US$15 to 30 billion annually, and current estimates put annual expenditures in the range of US$200 to 400 million. One need only look at the impact of government investment in China, the US or the national PWS programs in Mexico and Costa Rica, and as of 2009 in Ecuador, to appreciate the importance of national government leadership backed up by significant funding, regulatory tools, and political will.

In the Driver's Seat: The Players Driving the Policies

Governments, while not the only players, are the key players when it comes to establishing policies affecting both regulated and voluntary actions. Governments are in the unique position to implement regulation that achieves the needed environmental outcomes to ensure long-term sustainability of watershed services. This includes: 1) creating appropriate caps to signal price and create adequate demand for full-functioning, robust trading markets; 2) using existing government payment programs to develop and test performance-based metrics for land-use changes aimed at water-quality improvements (such as portions of the US Farm Bill and Chinese subsidy programs); and 3) developing private-public partnerships that stimulate market development, subsidize initial high transaction costs, and mitigate some of the risks associated with early action by the private sector.

Civil society through local environmental NGOs as well as international NGOs has been a key player in the PWS space and will continue to be in the future for ecosystem services markets in general. The capacity of NGOs to promote and fundraise with local and international donors has been vital for the promotion of PWS schemes in all regions, particularly Latin America. Not only have NGOs been effective in bringing together water users, public and private, to pay for hydrological services, but also to involve governments, at the local, regional, and national level, to establish PWS programs that provide conservation and social benefits to local communities. NGOs, with the support and involvement of Overseas Development Agencies, such as USAID, DFID, DANIDA, and other development agencies, have also been important in the dissemination of information regarding the different PWS experiences and promotion of projects on the ground.

The private sector, for its part, has already jumped into the water conservation fray by driving innovation in PWS and WQT, as well as on a number of critical new fronts. The first of these is the Water Disclosure Project promoted by the team at the Carbon Disclosure Project. This global effort drives home the critical importance of transparency and disclosure of the raw data on corporate sector impact on watershed services.

Second, and closely related, is the effort to promote standards for measuring corporate water consumption promoted by the rapidly growing Water Footprint Network (WFN). The WFN, an international, collaborative network of partners has created a water footprint accounting methodology that yields a credible look at water consumption by individuals, communities or businesses coupled with suggestions for lowering ones overall footprint. This methodology has captured the attention of the Coca-Cola Company, Intel, SABMiller, and other large corporate users of water resources.

The World Resource Institute, in partnership with General Electric and Goldman Sachs, launched an initiative early in 2010 to measure water-related risks facing companies and their investors. The initiative's key objective is to develop a Water Index (in collaboration with Bloomberg) as a standardized approach to identify and mitigate water-related corporate risk. As suggested in the press release announcing the initiative, the Index will offer one of the most comprehensive measures of water risks currently available by aggregating nearly 20 weighted factors capturing water availability, regulations, water quality, and reputational issues.

These are but three of the initiatives undertaken by the private sector that, when combined with the efforts of government and the NGO community, begin to bear the kind of resources and collaborative partnerships needed to address the growing global water resource protection challenge.

Connecting Forests, Climate Change and Watershed Protection Markets

At some level, the PWS projects examined in this report represent the first wave of lessons in adaptive management to climate change. Going forward, it is important to make a more deliberate connection between the forest, water, and climate change.

The analysis of the existing schemes for watershed services points toward two types of interventions: on the one hand payments that support changes in farm-based activities, such as the Catskills program in New York or the Silvo-pastoral program in Costa Rica; on the other hand, there are programs that pay for the conservation of forests, avoiding deforestation in key water-recharge areas, such as the PSAH in Mexico at a national scale and local PES schemes in the Andean region. This last objective is precisely what generates an important link with climate change mitigation.

There is a reduction in emissions in the scenario where a higher rate of deforestation would have had occurred if the PWS scheme had not been functioning. Very few programs have that explicit link between ecosystem services, in contrast to the discussions among NGOs and government agencies where the issue of potential bundling is ever present. Costa Rica's PES program has integrated climate change mitigation, watershed protection, biodiversity, and scenic beauty as the ecosystem services it pays for. In the case of the Mexican PSAH, estimates of the avoided emissions were obtained, and even there they were calculated as part of an evaluation report, not as part of the country's mitigation

strategy or the sale of carbon credits. The REDD effect can be significant, as the observed deforestation rate for a 7-year period is 0.6 percent in plots participating in PSAH in two of those years, in contrast to a rate of 1.6 percent in equivalent plots not participating in it at all, an amount in excess of 2 million tons. The evaluation report states that the avoided emissions could have been even higher if the program had had a better targeting system and contracted with forests with a higher risk of deforestation in the first place.

The other important connection between PWS schemes and climate change is that the protection of watersheds and aquifers is actually an *adaptation* strategy. Changes in climate patterns will bring less rainfall in some regions, and more in others. Given an increasing population and pressure on patterns of land use, less rainfall will reduce recharge and water flows. If the forests that protect the catchment areas were conserved, then there would be more time and lower costs to having to adapt to having less water. The same thing would happen in those areas where more rainfall would increase the frequency or strength of natural disasters. Areas with their original natural cover would be less susceptible to damage from this increase in extreme precipitation events, and adaptation costs would be lower. This phenomenon is a strong argument for investing in PES and PWS as a cost-effective way to adapt to climate change.

While the legislation will be different for climate versus water, land use and land-use change will play a critical role in both 1) adapting to negative impacts of climate change on land productivity with the potential negative feedback loop that this could have on water quality; and 2) integrating climate and water quality payments through performance based subsidy payments like the farm bill in the US or through emerging trading markets. Such integration will make it feasible for regulators to more easily apply appropriate caps and spread the cost of compliance between climate and water regulated entities, allowing for lower cost of compliance for each sector.

Voices Articulating the Issues at Hand

Barbara Kingsolver wrote the following statement in the National Geographic special issue of April 2010 on *Water, Our Thirsty World*, "Water is life. It's the briny broth of our origins, the pounding circulatory system of the world. We stake our civilizations on the coasts and mighty rivers. Our deepest dread is the threat of having too little—or too much."[60]

Wendell Berry, author, poet, and farmer, offered this missive on the earth's resources, "To cherish what remains of the Earth and to foster its renewal is our only legitimate hope of survival."[61]

Finally, it was Luna Leopold, son of Aldo Leopold, who said some five decades ago, "Water is the most critical resource issue of our lifetime. The health of our waters is the principal measure of how we live on the land."[62]

How long will it take us to heed these messages and assign the right value to this, our most precious resource? This report catalogues efforts that suggest we are on the right path. Time will tell if these efforts are sufficient to steer the ship on a path of greater sustainability; one that expands the opportunities for market-based tools to work for conservation, communities and people.

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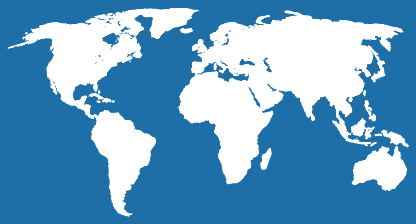

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MARES

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