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Alliances for Green Infrastructure

State of Watershed Investment 2016

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State of Watershed Investment 2016

December 2016

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Acknowledgments

This report is a compilation of the insights of a wide range of individuals across several continents. It would not be possible without the hundreds of individuals who shared critical information about their organizations.

This report is publicly available thanks to the generous financial contributions from our supporters, the Swiss Agency for Development and Cooperation, the MacArthur Foundation, and the Good Energies Foundation.

The production of this report has also required insights, time, and assistance with peer review from dozens of people. We would particularly like to thank Robin Abell, Nigel Asquith, Drew Bennett, Michael Bennett, Maija Bertule, Leah Bremer, Patrick Coady, Bobby Cochran, Kieran Conlan, Jeffrey Cowan, Katharine Cross, Marta Echavarria, Camille Fong, Jessica Fox, Todd Gartner, Pearl Gola, Chris Hartley, George Howard, Jennifer Hoyle, Heidi Huber-Stearns, Claudio Klemz, Cate Lamb, Beria Leimona, Alessandro Leonardi, Rebecca Madsen, Christo Marais, Lynne Matthysen, Dan Nees, Suzanne Ozment, Sarah Polonsky, André Rocha Ferretti, James Salzman, Qianqian Shen, Peter Stangel, Fernando Veiga, and Richael Young.

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Foreword

The World Health Organization and the United Nations estimate that almost 800 million people on our planet do not have access to clean water.[1] By 2025, estimates are that nearly 2 billion people will live in areas plagued by water scarcity.[2]

Despite this scenario, water scarcity is a reversible problem, and there are signs of hope. As this 2016 installment of the *State of Watershed Investment* report series shows, record levels of public and private investment in watershed protection and green water projects are spurring a remarkable amount of innovation that is beginning to respond to the critical need for reliable access to water.

Even more promising is the fact these concepts are making their way into high-level policy and decision-making around the world. In California, a ground-breaking new law recognizes that the state's forests and meadows can act as water infrastructure—opening the door to tapping financing tools for built infrastructure to protect and restore watersheds for water supply. In Peru, under a new national law, utilities now must allocate a portion of water tariffs to green infrastructure and nature-based climate adaptation.

The *State of Watershed Investment* report is offered to a range of audiences including water utility and other government policy makers, engineering and construction firms, public and private investors, and other stakeholders working on access to clean, reliable water supply. The report findings show the potential of green infrastructure for sustainable water management and provide both benchmarks and trends for considering future investments in green infrastructure.

This 2016 report expands upon past studies of water markets and payment mechanisms, and takes into account public subsidy payment programs, user-driven watershed investments, water quality credit trading, and environmental water markets. Findings presented in this report cover the full scale of these payments and investments (e.g., $25 billion in direct water payments in 2015) as well as the complexity of some of the watershed investment models.

For example, the majority of local water user-driven watershed investments involved communities and business leveraging national or state/province public finance for watershed protection—a partnership model where funding is increasingly available from high levels, but where management decisions are made locally and there is local cost-sharing. Evidence indicates that this emerging trend may be a more sustainable, long-term approach to securing clean water at its source.

Another major finding of the report—particularly relevant in light of the recent election in the United States—is that climate change and risk are on the minds of most water planners. Climate change was identified as a "top three" threat in every single region surveyed last year. By contrast, in 2013 fewer than one in five respondents said that climate change was a factor in program design or decision-making.

The trends documented in this report clearly point to a future in which scaled investments in green infrastructure will continue to grow in importance in addressing not just water scarcity, but also climate resilience, food security, sustainable economies, vibrant cities, and basic human health.

Michael Jenkins
Founding President and CEO
Forest Trends

[1] See http://www.unwater.org/water-cooperation-2013/water-cooperation/facts-and-figures/en/.
[2] See http://www.un.org/waterforlifedecade/scarcity.shtml.

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Acronyms

ADERASA	Association of Latin American Water Regulators (Asociación de Entes Reguladores de Agua y Saneamiento de las Américas)
CAP	Common Agricultural Policy
EU	European Union
INDC	Intended Nationally Determined Contribution
ISO	International Organization for Standardization
IWSS	International Water Stewardship Standard
LAWFP	Latin American Water Funds Partnership
MRV	Measuring, Reporting, and Verification
NAP	National Adaptation Plan
NCFF	Natural Capital Financing Facility
NGO	Non-Governmental Organization
NPS	Nonpoint Source
NWRM	Natural Water Retention Measure
PES	Payments for Ecosystem Services
PS	Point Source
PSA	Payments for Environmental Services (Pago por Servicios Ambientales) (Costa Rica)
PSAH	Payments for Environmental Hydrological Services (Pago por Servicios Ambientales Hidrológicos) (Mexico)
REDD+	Reducing Emissions from Deforestation and Forest Degradation (the "+" refers to the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in reducing emissions)
ROI	Return on Investment
SEDAPAL	Lima Drinking Water and Sewerage Service (Servicio de Agua Potable y Alcantarillado de Lima)
SIP	Strategic Integrated Project
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TNC	The Nature Conservancy
TP	Total Phosphorus
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
VNFF	Vietnam Forest Protection and Development Fund
WRC	Water Restoration Certificate

Glossary

Bilateral agreements for watershed protection: This transaction mechanism involves a single user or beneficiary of ecosystem services compensating one or more parties for activities that maintain or enhance ecosystem services delivery to the payer.

Buyers: The actors who pay for watershed services in a transaction. Buyers may act on their own behalf or in the public interest.

Co-benefits: Additional environmental, social, or other benefits arising from a watershed investment project and quantified based on metrics or indicators defined by the project developer, a co-benefits certification program, or third-party project standard accounting for both watershed services and co-benefits.

Collective action: Collective action for watershed management refers to voluntary cooperation among various stakeholders in a watershed, where multiple actors from the public, private, and/or civil society sectors self-organize to address water resources management through information-sharing, joint decision-making, and other coordinated activities. Typically, these partners are united by common challenges or goals and recognize that collective action will deliver better outcomes than unilateral action by any one actor.

Collective action fund/Water fund: Collective action funds are collective action partnerships that include a cooperative funding element in order to maintain, restore, or create green infrastructure in the watershed. Partners contribute financial and/or in-kind support to watershed protection activities, which are typically designed and implemented in consultation with the group. Collective action funds may establish an endowment or trust fund to manage contributions, as in the case of a number of "water funds" in Latin America and the Caribbean; or they may use other systems for administering funds or operate on the principle of matching funds (where partners coordinate investments but resources are never actually pooled).

Commercial credit bank: A site, or suite of sites, where natural systems are restored, established, enhanced and/or preserved for the purpose of providing water quality credits.

Compliance markets: Ecosystem services markets whose buyers participate in them in order to meet regulatory obligations.

Credit: A unit of measure representing the environmental commodity that can be traded, based on the environmental activity. The unit of measure can be a measure of area or it can be a functional measure, such as cubic meters of dry-season flow augmentation resulting from program activities.

Ecosystem market: Any program or platform that facilitates transactions between buyers and sellers who exchange financial compensation for ecosystem assets or practices that restore, enhance, or protect ecosystem services. Markets are organized around specific asset types; ecosystem assets or credits are typically not fungible across markets.

Ecosystem services: The benefits nature provides to human society, such as reliable flows of clean water, timber products, pollination of crops, or cultural values associated with a specific place.

Environmental water markets: Any program or platform that harnesses the trading of water rights for environmental purposes. This report tracks two primary mechanisms: instream buybacks and groundwater mitigation. Also see definitions of "Instream buybacks" and "Groundwater mitigation."

Green infrastructure: Green infrastructure restores, maintains, or mimics natural hydrological processes through natural and semi-natural features and practices. Green infrastructure may be implemented at the site scale or as part of a landscape-scale network. Within urban areas, the term often is used to refer to specific low-impact or green urban design elements/practices, such as the use of bioswales or tree plantings to manage stormwater. However, in this report we use the term more broadly as defined above.

Groundwater mitigation: This transaction mechanism refers to programs that require new users of groundwater in a certain area to mitigate for their impact, typically through purchasing of offsets.

Instream buybacks: This transaction mechanism typically involves governments or non-governmental organizations that act in the public interest buying or leasing surface water rights. Water rights allocations are not

used by the buyer but instead set aside to ensure a minimum level of flows or recharge, often to protect aquatic habitats or maintain groundwater levels.

Interventions: The specific land management, restoration, enhancement, or conservation activities undertaken in expectation of ecosystem services benefits or maintenance.

Offset: See definition of "Credit."

Permanent offset: A credit that confers on its holders long-term or perpetual compliance with a regulatory driver. Credit life typically is linked to the time period during which the environmental benefits from interventions generating the credit are being delivered or primarily delivered. Also see definition of "Credit."

Program: The overarching system that facilitates transactions between buyers and sellers, linked by a common administrator and/or market infrastructure (such as an exchange mechanism, crediting protocol, or regulatory framework). A program can encompass many distinct projects.

Project: A site, or suite of sites, where restoration, enhancement, or other resource conservation actions are implemented for the purposes of marketing the resulting ecosystem service assets or outcomes to buyers.

Public subsidies for watershed protection: Public subsidies for watershed protection reward land managers for enhancing or protecting ecosystem services. They are funded by governments (sometimes with multilateral or donor support), acting on behalf of the public good, and typically operate at a large scale.

Replenishment: Broadly, a guiding principle for activities that aim to generate an annual volumetric benefit equal to a company's consumptive use by watershed restoration, water access and sanitation projects, irrigation efficiency improvements, and/or other interventions. Companies may commit to replenishment activities or targets in order to "balance" their water impacts.

Sellers: The actors who receive compensation or payments from buyers for interventions resulting in maintained, enhanced, or restored watershed services or specific watershed services outcomes.

Term credit: A credit that confers on its holders only annual or seasonal compliance with a regulatory driver. To remain in compliance, the buyer must purchase new credits periodically or find alternative means of meeting regulatory obligations. Credit life typically is linked to the time period during which the environmental benefits from interventions generating the credit are delivered or primarily delivered. Also see definition of "Credit."

Transaction: We consider "transactions" to occur at the point that offsets or agreed deliverables are contracted, regardless of the date of delivery.

User-driven watershed investments: Investments that channel payments from water users, such as companies or water utilities acting on behalf of customers, to landholders or other parties ("suppliers") in exchange for conserving, restoring, or creating green infrastructure. Buyers may contract directly with suppliers in a process known as "bilateral agreements for watershed protection," or pay into a "collective action fund/water fund" that pools contributions for greater impact. User-driven programs can be voluntary or a mechanism to meet regulatory compliance. Also see definitions of "Bilateral agreements for watershed protection" and "Collective action fund/ Water fund."

Voluntary markets: Markets through which firms, individuals, and organizations voluntarily buy offsets or pay for ecosystem services.

Water quality trading and offsets: Water quality trading and offsets allow water users to manage their impacts on watersheds by compensating others for offsite activities that improve water quality or supply. Compensatory activities are packaged as a credit or some other unit traded in an established "market," defined by watershed boundaries. Trading and offsets are often compliance-driven.

Watershed investments: Any transaction between a buyer and a seller where financial value is exchanged for activities or outcomes associated with the maintenance, restoration, or enhancement of watershed services or natural areas considered important for watershed services.

Watershed services: Ecosystem services associated with hydrological functions or systems.

State of Watershed Investment in 2016: An Introduction

Ensuring water supply and sanitation is a job nearly as old as civilization. Archaeological excavations have found ancient sewage systems in Pakistan and India dating to 2500 BC. Aqueducts built by the Romans still crisscross Europe and are even, in a few cases, still in use. In the highlands of Peru, pre-Incan stone canals called *amunas* to this day help store rainy-season downpours for dry months.

In 2016, it is an interesting time to be a water service provider. The Earth's population in the last fifty years has moved *en masse* to cities. Climate change threatens to disrupt existing water supply and sanitation systems, and complicate future planning. Economic crises have followed one after another since this century began, hollowing out public budgets for much-needed improvements and upgrades to water infrastructure systems.

At the same time, the last decade and a half have been marked by a growing realization among water service providers (along with policy makers and many in the business community) that nature is not merely "nice to have." Healthy ecosystems are a critical asset in ensuring that everyone on the planet has access to clean, safe water, and sanitation in this century, and in helping nations to both moderate and successfully adapt to climate change effects.

The goal of this report is to capture the size, scale, and scope of market mechanisms for **green infrastructure**[3] for water. The diversity and often local scale of such **watershed investments** sometimes obscures their true impact: while there is no unified market for **transactions** for watershed protection (in contrast, for example, to a compliance carbon market), the value of these transactions is an order of magnitude larger, reaching nearly $25 billion (B)[4] in 2015. As global leaders struggle to meet the challenge of minimizing and adapting to climate change while lifting 1.2B people out of extreme poverty in this century,[5] the **programs** tracked in this report offer critical lessons for addressing water risk in a sustainable, cost-effective, landscape-scale manner.

In this report, we use the term "watershed investment" in the sense of a long-term investment in an asset, just as a city would "invest" in upgrades to its waste water treatment plant (Box 1). Watershed investments may provide financial returns to the parties funding them, but more often the benefits come in the form of cleaner or more reliable water supplies, cost-savings (for example, for water service providers), or even **co-benefits** like increased incomes for farmers participating in a watershed investment program.

Box 1: What Are Watershed Investments?

This reports defines a watershed investment as any transaction between a **buyer** and a **seller** where financial value is exchanged for activities or outcomes associated with the maintenance, restoration, or enhancement of watershed services or natural areas considered important for watershed services.

We focus on transactions for watershed protection, where financial value is exchanged for activities or outcomes associated with watershed management or restoration. Direct investments in green infrastructure where no transaction between a buyer and a provider of green infrastructure takes place are excluded from this study. For example, a city planting trees along public sidewalks, while certainly a green infrastructure **intervention**, will not be included in this report since no incentive or payment is deployed. If that city paid private property owners to install green roofs or rain gardens, on the other hand, those activities would fall within our tracking.

[3] All terms in blue bold text are defined in the Glossary on page vii.

[4] All monetary values are reported in US dollars ($) unless otherwise noted.

[5] This is the estimated number of people currently living in "extreme poverty," defined as living on less than $1.25 per day. The United Nations Sustainable Development Goal 1.1 aims to "eradicate extreme poverty for all people everywhere" by 2030. See https://sustainabledevelopment.un.org/sdg1 for more information.

This year's report has a broader scope than previous editions: it expands our tracking to include a comprehensive inventory of **public subsidy payments for watershed protection**, wherein governments reward landholders for good stewardship rather than commodity production. Public subsidies of this type are the largest and steadily growing source of funding for green infrastructure ($23.7B in 2015). Our scope also covers a range of innovative mechanisms, including **user-driven watershed investments**, **water quality trading and offsets**, and **environmental water markets**.

We heartily thank the hundreds of individuals who have taken the time to submit data or participate in interviews. Given our broad conceptual and geographic scope, we cannot claim to have a complete global inventory of watershed investment mechanisms, but we believe this report represents the most comprehensive effort to date. We caution readers to understand our reporting methodology and to consider reported numbers as conservative. For more information on our scope and methodology, please see the "Watershed Investments 101" and "Methodology" chapters. For more information on specific programs covered in our survey, please visit our online program inventory at http://www.watershedconnect.org/programs.

Box 2: Key Findings

- **In 2015, governments, water utilities, companies, and communities spent nearly $25B on payments for green infrastructure for water.** Globally, transactions grew an average of 11.8% per year between 2013 and 2015. A total of 419 programs in 62 countries invested in the natural ability of forests, wetlands, grasslands, and other ecosystems to ensure clean, reliable water supplies for cities and communities, and to combat threats from rapid urban expansion and agricultural pollution.
- **Green infrastructure payments protected, rehabilitated, or created new habitat on more than 486 million (M) hectares (ha) of land** around the world, an area nearly 1.5 times the size of India. These programs paid nearly $16B to landholders to reward good stewardship.
- **Most of this spending ($23.7B) came in the form of direct subsidy payments from supranational, national, and state/provincial-level governments to landholders** to protect and restore water-critical landscapes and promote a green economy.
- Meanwhile, **water users themselves — the cities, companies, or water utilities acting on behalf of customers that directly benefit from watershed investments — spent $657M in 2015 to manage water risks in their basins.** State/provincial and local governments took the lead in 2015 in funding user-driven watershed investments, providing eight out of every ten dollars transacted. On the private sector side, consumer-facing businesses, led by the food and beverage industry, made an estimated $15.4M in payments in 2015 to manage physical risk and reputation.
- **Funding mostly stayed local:** unlike conservation finance for biodiversity or globe-spanning carbon markets, watershed investments usually remained within the political or watershed boundaries where they originated. Interestingly, companies, not donors, drove the water space's (small) share of non-locally originating, user-driven watershed investment. Programs reported at least $3.5M in international payments in 2015 following water risk upward along companies' supply chains.
- **Water quality trading and offsets declined in 2015 in many long-standing markets in the United States, Australia, and New Zealand**—but in many areas, this was **a sign of success,** because programs phased out trading as they met their cleanup goals. In other markets, particularly in the US state of Virginia, new growth drove overall global transaction values to nearly $32M in 2015, as private project developers rushed to meet spiking demand for permanent nutrient offsets.

Box 2 (continued): Key Findings

- **Instream buybacks — i.e., the use of traditional water markets in pursuit of environmental flows restoration — slumped globally as the new Australian government dialed back investment in the Murray-Darling Basin** over concerns about conflicts with agricultural water users. In the United States, however, growth of instream buybacks was steady: in 2015, the financial value of buybacks surpassed Australia for the first time, and a shift is underway toward cheaper, more flexible, short-term contracts, resetting the market onto a more sustainable long-term path.

- **One in three programs also reported monitoring and/or evaluating "beyond-water" benefits,** with biodiversity conservation, community benefits, and jobs and training at the top of program administrators' lists. Public subsidy programs also frequently sought to deliver climate adaptation benefits in rural communities, with high numbers of programs harnessing watershed protection subsidies to help address challenges amplified by a changing climate, such as increased flooding, forest fires, and food insecurity.

- **Measuring, reporting, and verification (MRV) practices are on the rise but with little alignment across programs.** Programs that provided detailed data on buyers said that nine in ten buyers asked for some form of assurance that green infrastructure interventions were implemented and performed as intended. But there is little standardization in the watershed investments world for MRV practices, though some programs tested out third-party standards in 2015 at a limited scale. Instead, programs tend to develop their own MRV protocols, if at all. This complicates broad assessments of green infrastructure's effectiveness or return on investment (ROI).

- **Programs reported that a key barrier to scale is a "capacity gap,"** a lack of local technical and financial ability to quickly design and implement effective watershed investments on the ground. Hundreds of millions of dollars appear to be waiting in the wings for green infrastructure investments, but program administrators have little time, resources, or capacity to design suitable **projects** for would-be buyers and investors who require a clear sense of ROI.

Watershed Investment 101: The Case for Green Infrastructure

This report benchmarks global transactions in 2014–2015 that delivered funding for green infrastructure for water (referred to in this report simply as "green infrastructure") from buyers who believe that restoring, enhancing, or protecting natural systems is an effective, sustainable, and (often) cost-effective way to ensure clean, reliable water supplies (Box 3).

Box 3: Benefits of Green Infrastructure for Water Supplies

Healthy landscapes support a complex network of **ecosystem services** and offer numerous benefits—like plant pollination or flood protection—each with their own unique value to ecology and economies.

Some of these services (like pollination) cannot be replaced with existing technology. In other cases, integrating nature-based and built solutions for water treatment, storage, or delivery can reduce operating costs or prolong the lifespan of built infrastructure. For example, reforesting hillsides can limit sedimentation in a hydropower station's reservoir—protecting the turbines from damage and prolonging the life of the reservoir—and also provide immediate, direct benefits for rural communities nearby in terms of soil retention, reduced flood risk, or enhanced groundwater recharge. These benefits are known as **watershed services**.

Other examples of watershed services provided by healthy landscapes:

Water for consumptive and non-consumptive human use	Healthy natural systems help ensure clean, reliable water for drinking, agriculture, hydropower generation, navigation, and other uses.
Aquatic productivity	Healthy aquatic habitats and the species that live in them are an important source of food and medicine. Water quality in coastal fisheries, for example, can be strongly affected by the condition of adjacent upstream watersheds. In other words, what happens on the mountain ridges—for better or worse—impacts the reefs.
Flow regulation and storm/flood buffering	Healthy forests, wetlands, grasslands, and mangroves in some cases act as natural "sponges" that absorb water—recharging groundwater supplies, reducing flood risk, and/or maintaining stream flows during dry periods.
Filtration of nutrients and contaminants	Ecosystems, including forests and wetlands, filter pollutants, improving water quality by trapping sediments and pollutants before they enter surface waters.
Erosion control and soil fertility	Healthy forests and grasslands help stabilize soils, preventing erosion and landslides. Natural areas also host critical nutrient cycling, maintaining soil health and productivity.

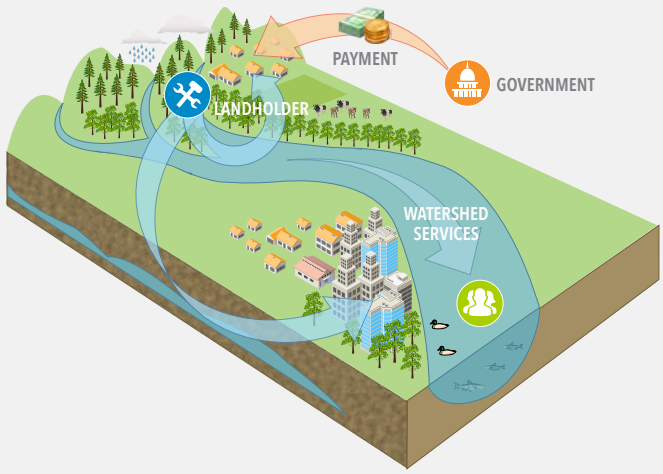
Market Mechanisms for Green Infrastructure

All mechanisms covered in this report originate with a water service provider, government, business, or other party that attaches value to a watershed service, or set of services, and agrees to compensate providers of the service(s) accordingly. For example, a beverage company might be willing to pay local farmers $100,000 per year to reduce pesticide use, if on-site treatment of polluted water would otherwise cost $150,000 per year. In this scenario, an individual farmer might be willing to curtail his pesticide use for $3,000 per year, assuming that this amount would cover his costs to switch to organic methods or otherwise compensate him for foregone income.

This is only one example. In practice, the nature of payments varies according to the buyer's specific goals and the political, social, economic, geographic, and environmental context (Figure 1). Many governments elect to pay subsidies to farmers or other landholders for watershed protection. Meanwhile, one business may decide to partner directly with landholders located near its water source, while another may prefer to contribute to a watershed restoration fund that handles the management decisions. Some program types require fairly sophisticated regulatory frameworks and institutional capacity (such as trading and offsets) or a certain type of property rights regime for water (such as instream buybacks).

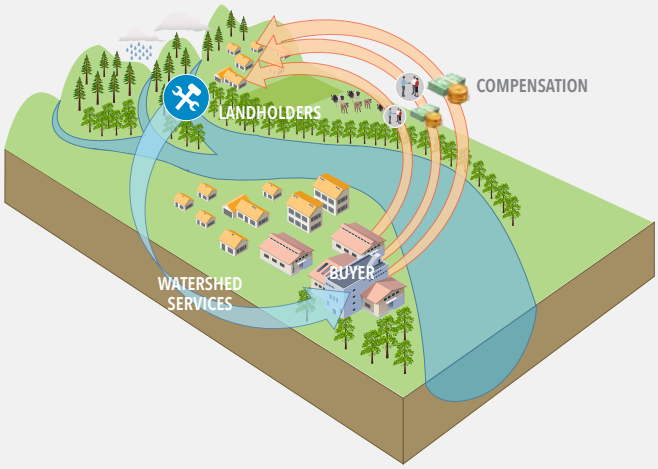
Figure 1: Mechanisms Tracked in This Report

Public subsidies for watershed protection

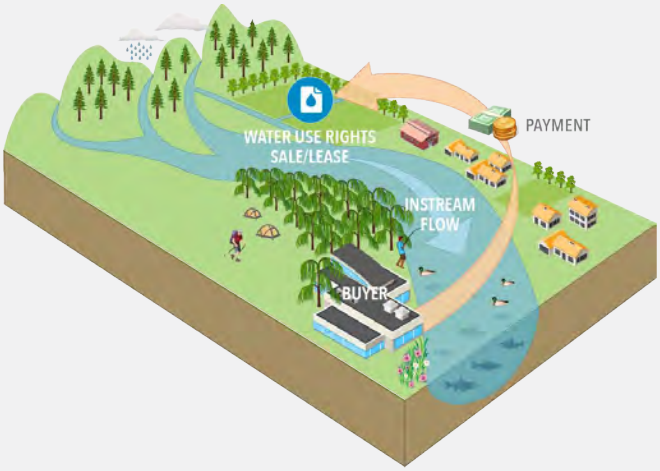


Public subsidies for watershed protection reward land managers for enhancing or protecting ecosystem services. They are funded by governments (sometimes with multilateral or donor support), acting on behalf of the public good, and typically operate at a large scale.

User-driven watershed investments



User-driven watershed investments channel payments from water users, such as companies or water utilities acting on behalf of customers, to landholders or other parties ("sellers") in exchange for conserving, restoring, or creating green infrastructure. Buyers may contract directly with sellers in a process known as **bilateral agreements for watershed protection** or pay into a **collective action fund/water fund** that pools contributions for greater impact. User-driven programs can be **voluntary** or a mechanism to meet regulatory **compliance**.

Water quality trading and offsets	
	**Water quality trading and offsets** allow water users to manage their impacts on watersheds by compensating others for offsite activities that improve water quality or supply. Compensatory activities are packaged as a **credit** or some other unit traded in an established "market," defined by watershed boundaries. Trading and offsets are often compliance-driven.
Environmental water markets	
	Environmental water markets refer to trading of water rights to achieve environmental objectives. This report tracks two primary mechanisms: **instream buybacks** and **groundwater mitigation**. Instream buyback programs involve governments or non-governmental organizations that act in the public interest by buying or leasing water use rights. Water rights are not used for consumptive purposes (like agriculture or drinking water) but instead set aside to ensure a minimum level of flows to protect wildlife and habitats. Groundwater mitigation programs are typically compliance-driven and require new users of groundwater in an area to mitigate for their impact, typically through purchasing of offsets.

In contrast to other **ecosystem market** mechanisms tracked by Ecosystem Marketplace, there is no real "market" for green infrastructure: there is no single established platform where a buyer can go to directly finance interventions that deliver services like aquifer recharge or floodwater storage. There is rarely a market-determined price for watershed services. Even the unit of delivery varies—buyers might pay for hectares of land sustainably managed or pounds of pollution kept out of water bodies.

Hydrological benefits from green infrastructure are also highly localized. Thus, transactions often are local, too. This contrasts with markets for greenhouse gas emissions reductions where transactions and benefits span the globe and are based on the exchange of a clearly defined and universally accepted unit (one tonne of carbon dioxide equivalent). Thus, contracts for green infrastructure services take a multitude of forms.

Green Infrastructure and Water Systems

However, common to most watershed programs tracked in this report is the recognition that natural systems can complement or substitute for "gray" (i.e., built or "hard") infrastructure. Forests or wetlands, for example, can filter out water pollution, regulate stream flows, recharge aquifers, and absorb flooding, thus limiting the need for hard infrastructure to perform these functions. For example, a green-gray hybrid infrastructure approach for a coastal city facing flood risks might include the following defenses: wetland restoration on the periphery of urban areas,

bioswales or permeable pavements within the city itself to naturally absorb floodwaters, upgrades to constructed seawalls to buffer surges, and wastewater infrastructure in order to minimize sewer overflows in the event of a flood event.

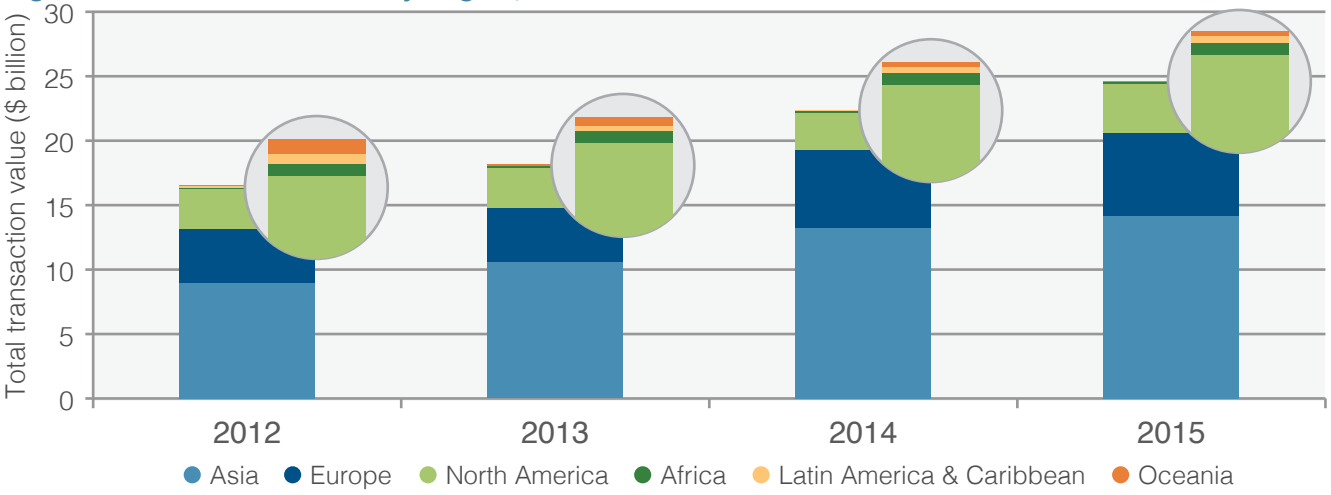
These green-gray infrastructure hybrids incorporate modern technology and practices from watershed management, low-impact development, and even ancient technologies for treating, storing, and moving water across the landscape (Figure 2). Hybrid and green infrastructure solutions can often be implemented at lower cost and in incremental fashion, delaying large upfront capital costs. Green infrastructure can also improve the functioning of built infrastructure, helping society to fully capture or exceed the expected returns on infrastructure investments. Cities and communities often face complex, interlinked water resource challenges with respect to land use in their surrounding areas. For example, new energy development or growing demand for water-intensive crops such as almonds can conflict with drinking water needs. Watershed-scale approaches can help manage such challenges and trade-offs holistically.

Figure 2: The Green-Gray Infrastructure Spectrum

Nearly $25B Flowed to 487M Hectares of Green Infrastructure in 2015; Landholders Directly Benefitted to the Tune of Almost $16B

In 2015, payments to conserve or rehabilitate green infrastructure in our watersheds—the forests, wetlands, grasslands, and other natural systems that filter our water, recharge our aquifers, protect us from floods, and perform a multitude of other hydrological functions—totaled $24.6B (Figure 3). These funds originated with water users themselves and governments concerned about how the loss of healthy natural systems has led to degraded water supplies and growing risks from fire, drought, and storms.

Figure 3: Global Transactions by Region, 2012–2015



These buyers supported 419 programs[6] in 62 countries on at least 487M ha, a land area larger than India (Table 1).[7] One in three programs also reported "beyond-water" benefits, such as biodiversity conservation, support for climate adaptation, and training for local communities in sustainable land management, watershed monitoring, and other skills.

Private landholders were the primary target of payments: in 2015, they earned at least $9.8B in revenues from these programs, while households or individuals on collectively/customarily owned lands received another $6B (Figure 4). Another $7.6B in payments financed protection of public lands.[8] Local tenure patterns and conservation needs drove where payments were ultimately targeted: in Asia, for example, programs mainly engaged communities on collective/customary lands or publicly owned lands, while in Europe and North America most activity focused on payments to private landholders—usually farmers.

[6] This includes 378 fully active and 41 pilot programs. Another 29 programs were determined to be in development but not yet transacting payments. Of the programs tracked in our *State of Watershed Investment 2014* report (Bennett and Carroll 2014), 22 were re-classified as inactive in 2016.

[7] In this report, a *program* refers to the overarching system that facilitates transactions between buyers and sellers, linked by a common administrator and/or market infrastructure (such as an exchange mechanism, crediting protocol, or regulatory framework). A program can encompass many distinct projects. Ecosystem Marketplace primarily collects data for watershed investments at the program level. A *project* is a site, or suite of sites, where restoration, enhancement, or other resource conservation actions are implemented for the purposes of marketing the resulting ecosystem service assets or outcomes to buyers.

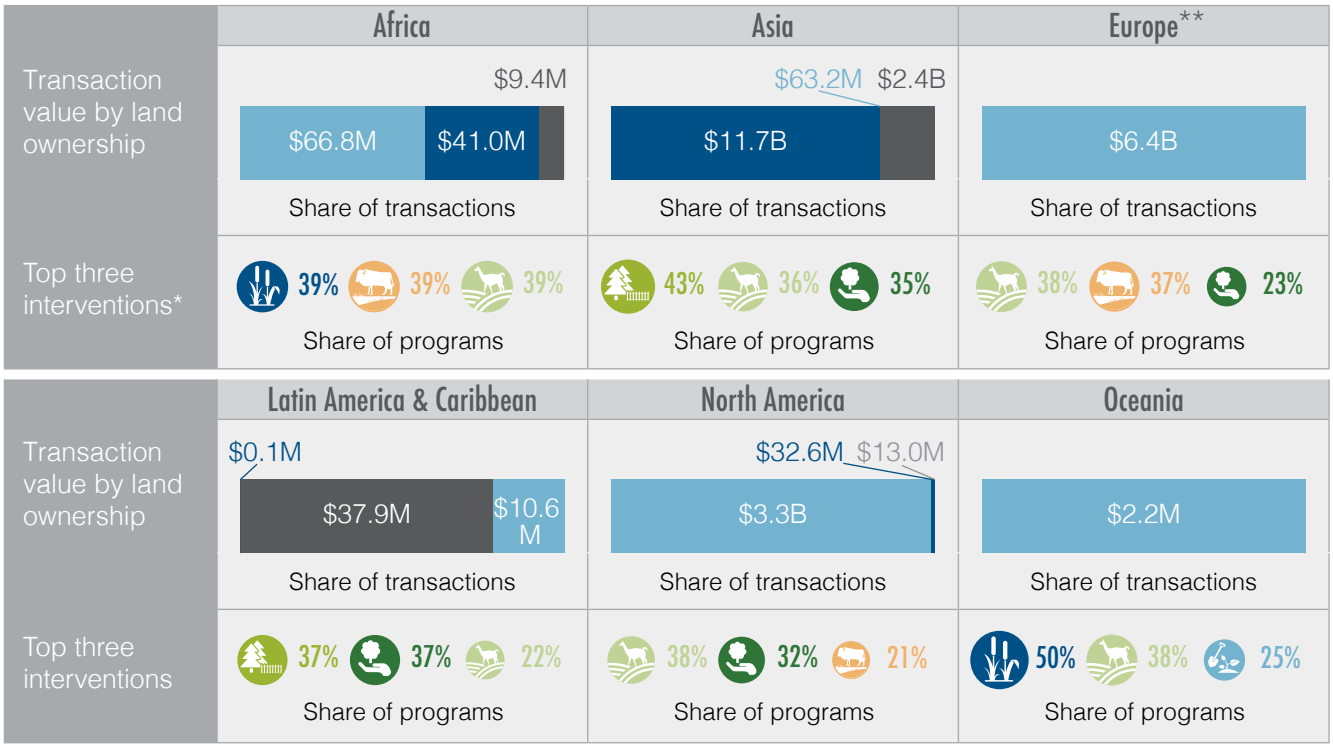
[8] For reported transactions valued at $1.3B, it is not possible to establish the ownership of lands where watershed protection activities took place. Here, land ownership type was either not reported or programs worked across a mix of lands and did not clearly indicate the relative share of transactions or area associated with each type of land involved.

Table 1: Global Program Count, Value, and Hectares under Watershed Management in 2015 by Region

	Africa	Asia	Europe	Latin America & Caribbean	North America	Oceania	Multi-regional programs	Total
Operational programs	16	169	71	47	107	6	3	419
Value in 2015	$117.8M	$14.2B	$6.4B	$65.9M	$3.8B	$52.3M	$2.6M	$24.6B
Area in 2015 (ha)	840K	426.6M	47.4M	2.8M	8.9M	26K	135K	486.7M

Notes: Includes only programs transacting payments in 2014–2015 and classified as either "active" or "pilot/demonstration" stage. In this report, Mexico is included in the Latin America and Caribbean region.

Figure 4: Transaction Value in 2015 by Land Ownership Type and Region; Top Intervention Categories by Share of Programs in 2015 by Region



Land ownership type

- Public ownership
- Private ownership
- Collective/Customary
- Commercial credit bank

Interventions

- Agricultural or pastoral sustainable management
- Forest conservation
- Forest restoration/ enhancement
- Forestry/Agroforestry
- Grassland conservation
- New habitat or green infrastructure creation
- Wetland restoration or enhancement
- Riverine/floodplain conservation
- Riverine/floodplain restoration

Notes: "Hectares under management" is a common way to measure activity, but it is not the only one. In Oceania, for example, some programs transact water rights for the environment instead of investing in land-based interventions. That activity is not captured in Figure 4, but is discussed elsewhere in the report.

*Interventions are reported for total share of programs implementing that intervention by region. Most programs use a mix of interventions—thus percentages for some regions sum to greater than 100%.

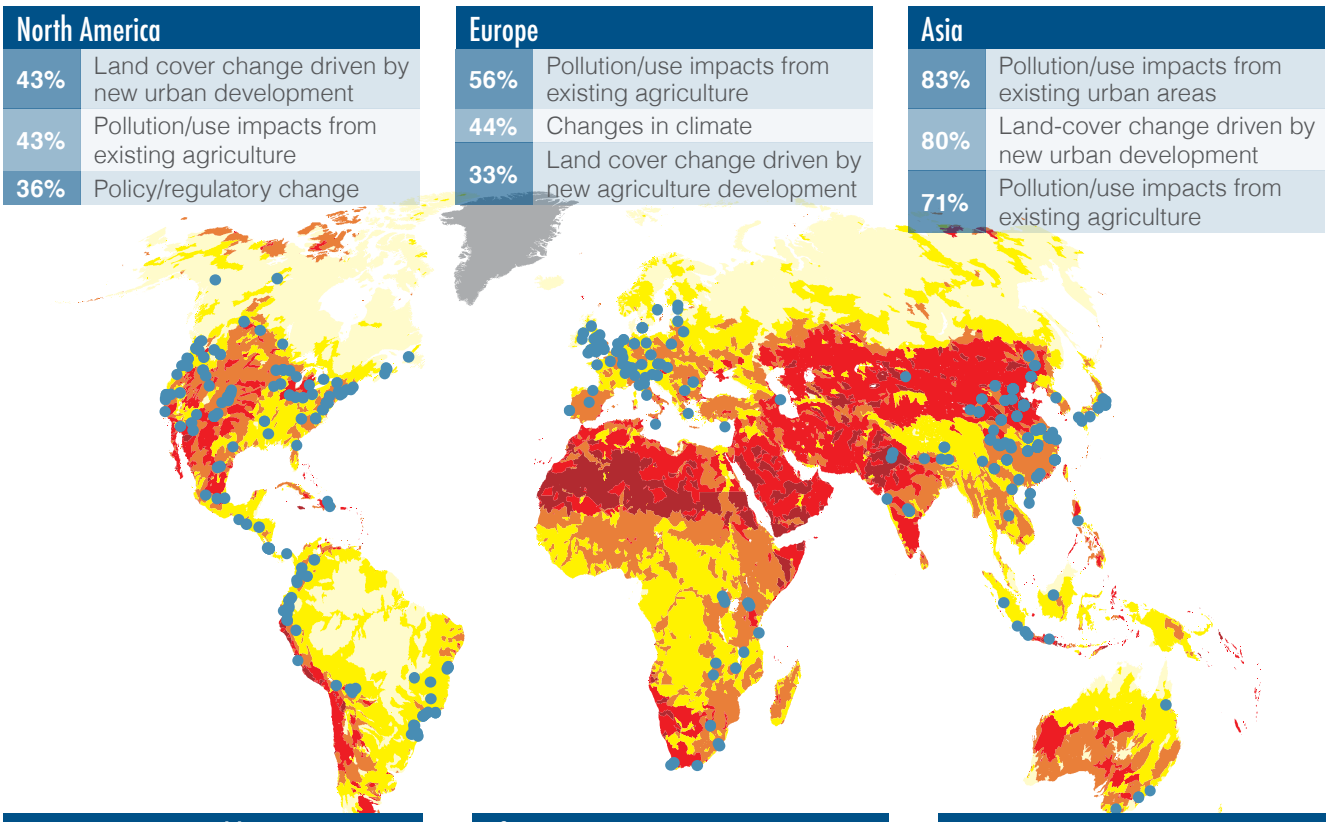
**Transaction data for public lands in Europe is not available.

In terms of the interventions being paid for—i.e., the specific activities carried out, such as replanting native tree species or installing fencing along rivers to keep cattle from trampling sensitive areas—sustainable agricultural management and forest conservation/restoration were common points of focus across all regions (Figure 4). Other activities reflected regionally specific ecosystem concerns: in Africa and Oceania, wetland restoration were also in the top three interventions funded, while in Europe and North America, payments were frequently linked to grassland conservation.

Agricultural Pollution, Urban Expansion Top Programs' List of Key Threats

Programs responded to a range of threats to water resources in 2015, both natural (floods, droughts) and man-made (industrial pollution, aquifer depletion). An estimated 26% of programs are headquartered in areas already facing "high" or "extremely high" water risk (Map 1).[9] Many watershed investment programs are also working to

Map 1: Top Drivers of Watershed Investments and Severity of Water Risk by Region in 2015



Notes: Programs were asked to identify the top three threats facing the watershed(s) where they work. This map displays the three most-frequently reported threats by region. Most programs reported facing more than one threat. Thus percentages sum to greater than 100% for each region.

Source: Gassert et al. 2015.

[9] See Gassert et al. (2015) for an explanation of methodology and water risk indicators.

manage *future* threats to water resources: globally, pressures from urban expansion and the negative impacts of intensive agricultural production are at the top of programs' lists of key water challenges driving their work.

Across the world, programs also reported feeling the effects of climate change: from Australia's ocean acidification; to South Africa's struggles with invasive plants and subsequent increased wildfire risks; to drought in Spain and Portugal; to melting glaciers in Peru's Andean region. The prominence of climate change, which ranked among the top three threats for programs in almost every region, is especially striking given that fewer than one in five survey respondents (18%) for Ecosystem Marketplace's 2014 *State of Watershed Investment* survey said they considered climate change at all in program design or decision-making (Bennett and Carroll 2014).

Mechanisms

Ecosystem Marketplace tracks four core categories of mechanisms in this report: public subsidies for watershed protection, user-driven watershed investments, water quality trading and offsets, and environmental water markets. Public subsidies for watershed protection accounted for the largest share of transactions and activity by land area in 2015, with $23.7B spent by national and subnational governments in 2015 on incentives for watershed management and conservation (Table 2). Meanwhile, user-driven programs, though smaller in scale and impact, were the most numerous. Water quality trading and offsets and environmental water markets programs, the most "market-like" mechanisms in terms of having standardized units of trade and prices subject to the forces of supply and demand, were concentrated in North America and Oceania and operated at lower levels of activity in 2015 than other mechanism types. Key trends in each mechanism's performance and uptake are detailed in the following pages. Descriptions of mechanisms are available page 5.

Table 2: Mechanisms Tracked in This Report: Count of Operational Programs, Value, and Area under Management in 2015

	Public subsidies for watershed protection	User-driven watershed investments	Water quality trading and offsets	Environmental water markets
Count of operational programs	139	197	22	20
Value in 2015	$23.7B	$656.7M	$31.1M	$93.3M
Area in 2015	426.7M ha	11M ha	48K ha	n/a

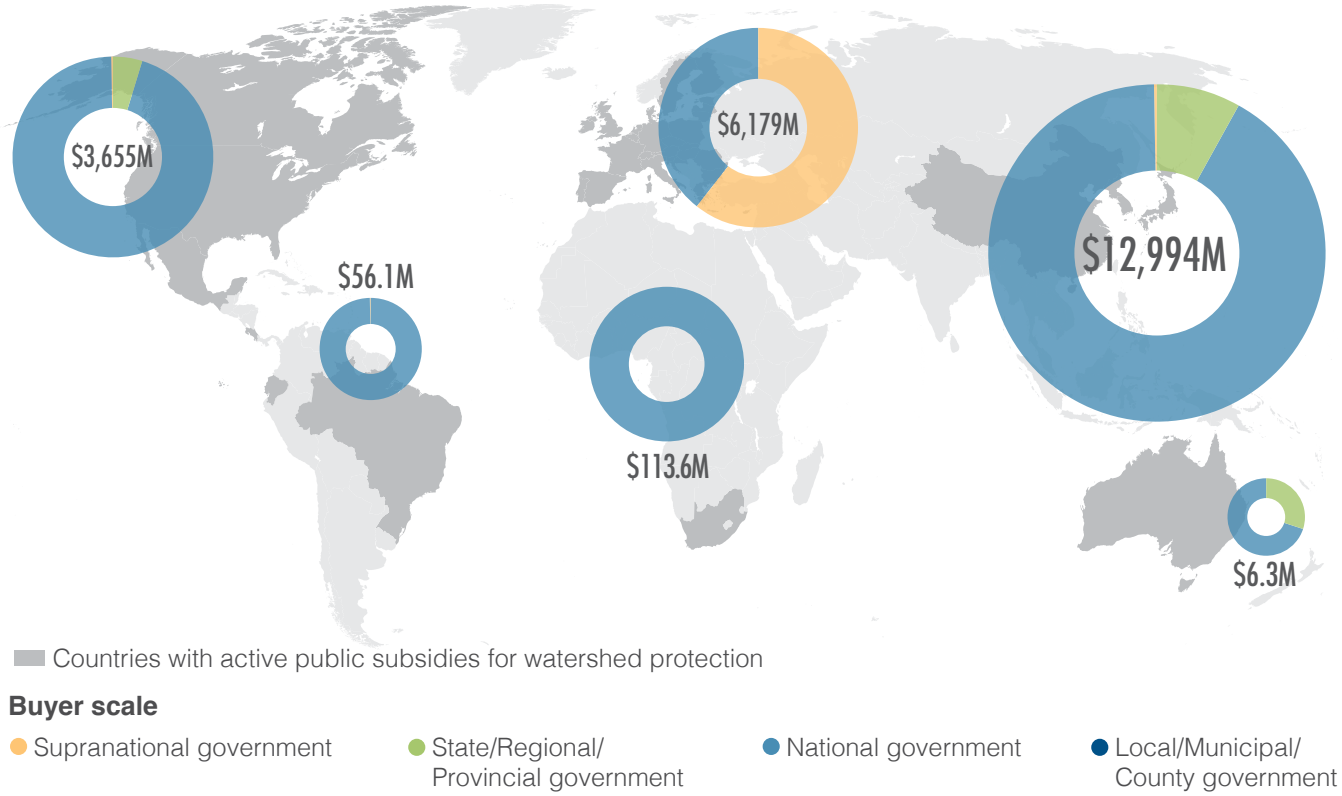
Notes: Based on 378 programs for which information on mechanism type was provided.

Public Subsidies for Watershed Protection: $23.7B in 2015 Paid to Landholders for Stewardship of Water-Critical Landscapes

Most of the spending tracked in this report came in the form of direct subsidy payments to landholders from supranational, national, and state/provincial governments to protect and restore water-critical landscapes. These public subsidies for watershed protection specifically targeted and rewarded sustainable agricultural, pastoral, or forest management practices that supported healthy watershed function; this set them apart from traditional landholder subsidy programs that seek to influence commodity supply or pricing.

Public subsidies for watershed protection included publicly funded payments for ecosystem services programs, such as Costa Rica's national Pagos por Servicios Ambientales ("Payments for Environmental Services") program, where payments were explicitly tied to ecosystem services conservation. The public subsidies category also included subsidies for agri-environmental management or other sustainable land management, where payments were disbursed through traditional subsidy program frameworks, such as the national Conservation Stewardship Program in the United States. These latter payments are designed to encourage landholders to implement conservation or management practices beneficial for watershed services which may otherwise be less profitable than intensive agriculture or other land uses. Within the broader group of public subsidies for watershed protection, some countries have developed their own distinct models, which are also tracked in this report: in China, national and provincial governments spent $13.5B in 2015 on watershed protection, much of it in the form of "eco-compensation" programs that served as the financing component of broader environmental policy reforms to protect important ecological areas and improve cross-jurisdictional coordination. In South Africa, a series of

Map 2: Public Subsidies for Watershed Protection in 2015: Countries with Public Subsidies Programs and Buyer Share of Total Value by Region



Notes: Based on $23.0B in transactions in 2015. For another $727M in public subsidies in 2015 it was not possible to determine the relative contributions of national and subnational governments.

nationally funded public work programs called "Working for" initiatives functioned as both a national public works program and a national ecological restoration program by providing training and jobs in environmental initiatives such as removing invasive plant species, rehabilitating wetlands, and wildfire management.[10]

In total, governments spent $23.7B (or 97% of the total value of global watershed investments) in 2015 in direct subsidy payments (Map 2). Payments flowed to land managers on at least 426.7M ha of private, collective, and publicly owned lands. Subsidies typically were provided at the national level, though in the European Union (EU), under the Common Agricultural Policy (CAP), a large portion of funding was budgeted at the supranational (e.g., multinational) scale and was matched at a national level. Some subnational governments also administered their own public payments for watershed protection in 2015. Typically they benefited from a cost match by the national government (as in China, Mexico, and Canada).

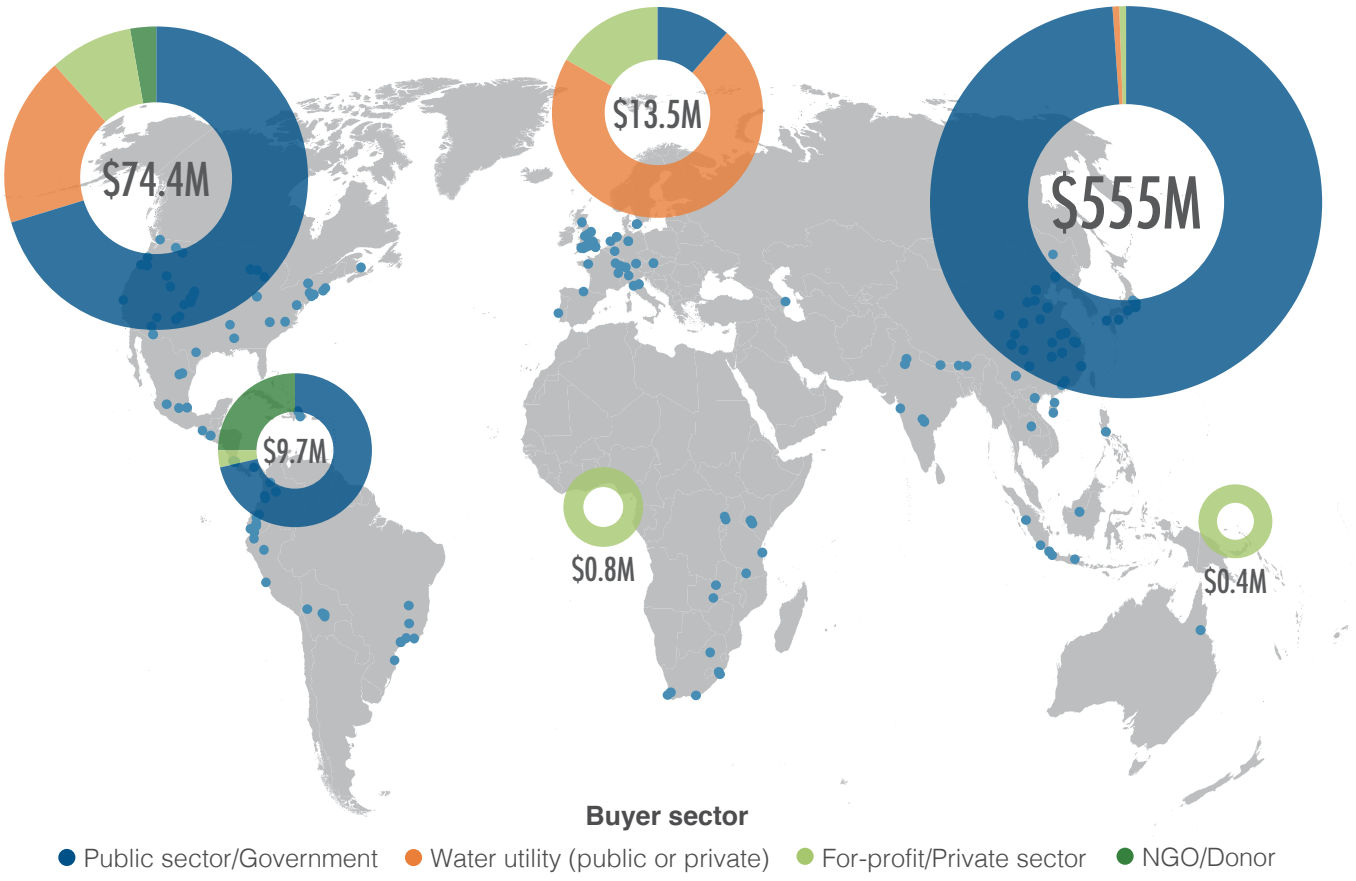
Public subsidies for watershed protection have scaled up rapidly in recent years, growing an average of 14.6% in value per year from 2013 to 2015, driven by continued commitments in China and efforts to "green" agricultural payments in the EU. In a sense, the traditional agricultural subsidy model was retrofitted to help *reverse* some of the effects stemming from governments subsidizing agricultural intensification and land-clearing through traditional agricultural subsidy programs in the twentieth century: now governments are using the same institutions to support a greener economy in the twenty-first century. Still, public subsidies for watershed protection remained a drop in the bucket compared to overall public support to farmers, which was estimated to be at least $585B a year (OECD 2016). As discussed in the previous section, agricultural pollution—often still implicitly subsidized by governments—remains a major challenge for watershed health.

[10] The "Working for" programs aim to provide employment and training while implementing large-scale environmental protection and restoration projects. "Working for" includes subprograms on water, ecosystems, forests, fire, wetlands, energy, and an Eco-Furniture Initiative using timber and biomass harvested from invasive plant species removal.

User-Driven Watershed Investments: Water Users Contributed Nearly $657M to Safeguard Water Supplies Close to Home

Meanwhile, water users themselves—whether cities, companies, or water utilities acting on behalf of their customers[11]—channeled nearly $657M in 2015 through basin-scale programs to manage growing water risks like supply conflicts from rapid urban expansion or agricultural pollution. These programs supported watershed management on an estimated 11M ha of mostly public and smallholder lands, led by large programs in China and Vietnam (Map 3).

Map 3: User-Driven Watershed Investments in 2015: Total Value and Buyer Share of Value by Region and Sector



Notes: Based on $653.8M in transactions in 2015. For $2.9M in transactions, no information on buyer sector was reported.

In China, the largest effort consisted of a shared fund for watershed protection into which fourteen municipalities in Liaoning District contributed payments that were set based on cross-border pollution flows: upper watershed districts paid a fee to lower watershed districts if water quality exiting their district was below a set target.

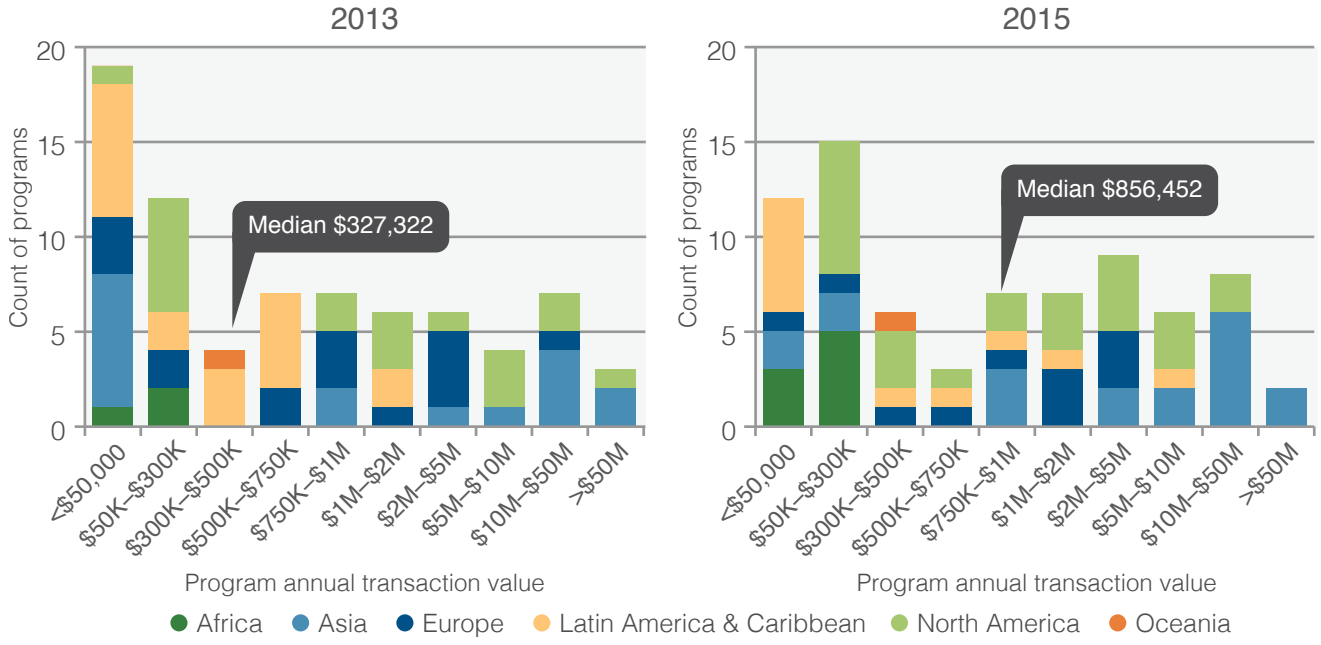
In Vietnam, the nationally mandated Forest Protection and Development Fund requires major water users such as hydropower operators and water utilities to pay annual fees into provincially administered funds, based on a

[11] In this report, utilities are generally treated as a distinct category from either government or private business. Utilities encompass both publicly owned and investor-owned utilities, since both types are typically subject to similar regulations and face similar water resource challenges.

calculation of their reliance on forest ecosystem services. Payments are then disbursed to forest owners (whether individuals or community groups) and have reached an estimated 355,000 households to date.

Outside of Asia, programs tended to be smaller in scale and focused on a single watershed. The global median value transacted by user-driven programs in 2015 was slightly over $856K (Figure 5). While representing far less value than public subsidies, these programs grew at comparable rates over a three-year period (14.1% average growth per year, from total transactions of $504M in 2013 to nearly $657M in 2015). Individual programs themselves have grown during this time as well: median program value transacted in 2013 was just $327K. The overall distribution of programs by value has shifted upward across all regions with the exception of Oceania, where they have remained fairly stable.

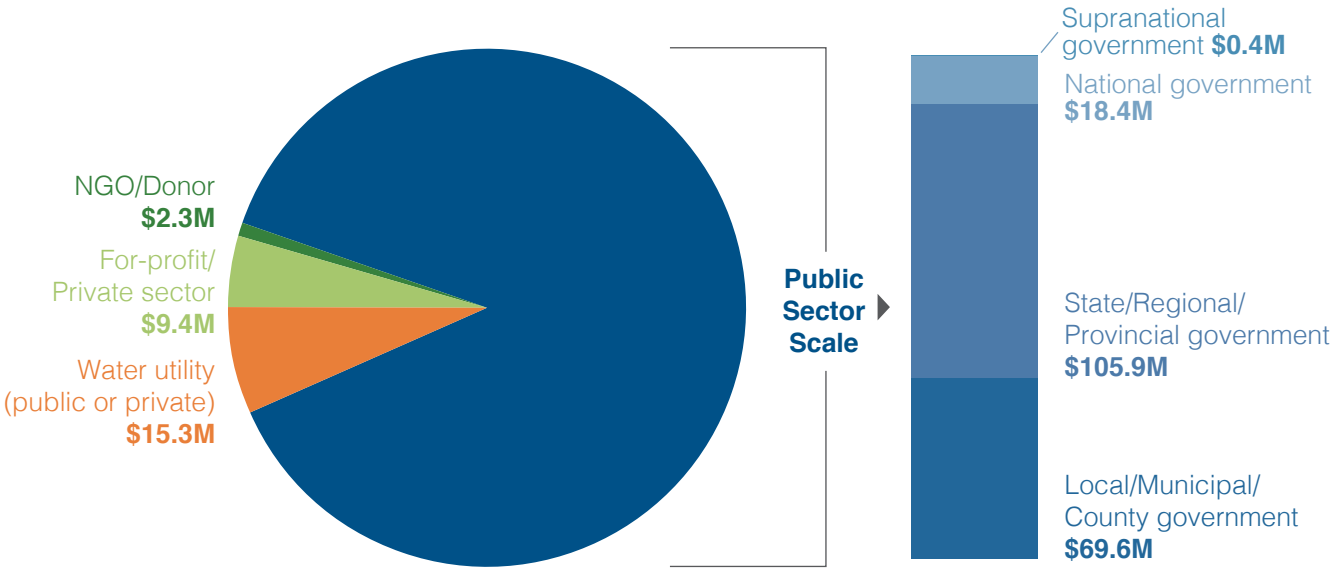
Figure 5: Distribution of User-Driven Programs by Transaction Values and by Region and Global Median Program Transaction Value, 2013 and 2015



User-Driven Watershed Investments: State, Local Governments Lead Spending

According to buyer data provided by 146 user-driven watershed investments programs (out of 204 tracked), state/provincial and local governments took the lead in 2015 in funding green infrastructure. Eight out of every ten dollars were invested by subnational public entities (Figure 6), followed by water utilities (both public and private), and the private sector. NGOs and donors had a low profile in 2015 with only $2.3M in transactions to programs.

Figure 6: User-Driven Watershed Investments in 2015: Share of Total Value by Buyer Sector



Notes: Some programs did not report 2015 transactions broken out by specific buyers' contributions but rather provided only an overall value—thus, this figure reflects $221M out of a total $657M in user-driven watershed investments in 2015.

Water risk, unsurprisingly, was the most common chord struck across all 320 buyers identified by user-driven programs, with 48% of buyers overall picking physical water risk as a "top three" motive (Table 3). However, for some buyers other benefits may be just as or even more important than immediate water risks: programs reported that public sector buyers were motivated not only by the desire to protect valuable water resources but by the Swiss Army knife-like ability of green infrastructure to deliver multiple benefits for the environment and communities. For other water users, co-benefits—while important—took a back seat to compliance and operational and maintenance cost concerns (for utilities) and reputational and supply chain risks (for the private sector).

Table 3: Buyer Motives by Sector for User-Driven Watershed Investment Programs

Rank of motive	Public sector/ Government	For-profit/Private sector	Water utility (public or private)	NGO/Donor
1.				
2.				
3.				
4.				
5.				

 To mitigate risks to water resources or infrastructure from land-use decisions in the basin

 To meet compliance with regulations

 Environmental co-benefits, such as biodiversity or carbon, delivered by project

 Social co-benefits, sustainable livelihoods or drinking water access, delivered by project

 To improve local governance of water resources

 To address physical risks, such as declining water quality or supply disruptions affecting business model

 To avoid or reduce capital costs of drinking water or wastewater services

 To avoid or reduce operational/maintenance costs of drinking water or wastewater services

 To enhance brand value/demonstrate leadership on water resource challenges

 To ensure supply chain resilience

 To mitigate risks to water resources or infrastructure from climate change or natural disasters

Notes: Program administrators were asked to report on up to three key motives each buyer had for supporting watershed investments. This figure summarizes the five most commonly reported motives for each buyer group.

User-Driven Watershed Investments: Collective Action Leverages Private, NGO Dollars for Public Funders

Buyers may contribute to user-driven watershed investment programs either individually or as part of collective action funds (Box 4). The collective action fund model continued to grow in popularity, from 81 active programs in 2013 to 95 in 2015. It's also gradually growing in share of value—from 82% of user-driven transactions in 2013 to 86% in 2015. Programs reported an average of 3.6 buyers per fund in 2015, spanning the public, private, and philanthropic sectors.[12]

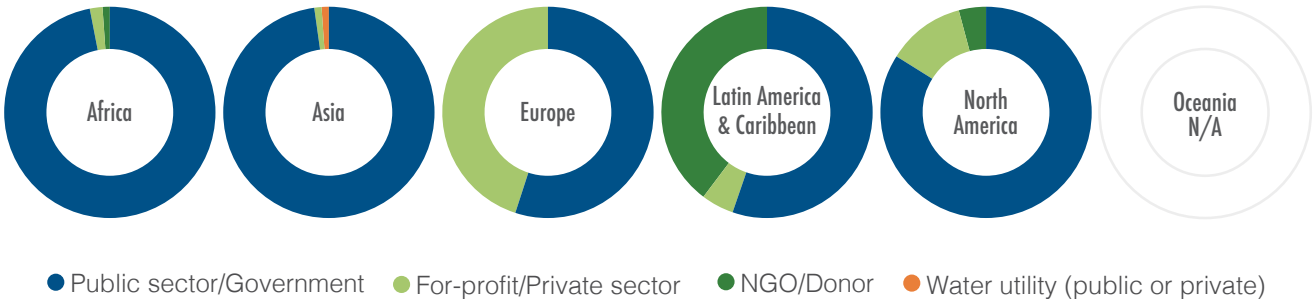
Box 4: Collective Action Funds for Watershed Protection

Collective action for watershed management refers to voluntary cooperation among various stakeholders in a watershed, where multiple actors from the public, private, and/or civil society sectors self-organize to address water resources management through information-sharing, joint decision-making, and other coordinated activities. Typically, these partners are united by common challenges or goals and recognize that collective action will deliver better outcomes than unilateral action by any one actor.

This report tracks activity by collective action funds, which are collective action partnerships that include a cooperative funding element in order to maintain, restore, or create green infrastructure in a watershed. Partners contribute financial and/or in-kind support to watershed protection activities, which are typically designed and implemented in consultation with the group. An endowment or trust fund may be established to manage contributions, as seen among many "water funds" in Latin America and the Caribbean. But collective action funds may use other systems for administering funds or operate on the principle of matching funds (where partners coordinate investments but resources are never actually pooled).

Across the board, most of the money committed for collective action for watersheds came from the public sector, such as a municipal government, but this varied by region (Figure 7). In Europe, for instance, 45 cents out of every collective action dollar came from private contributions; meanwhile in North America, companies contributed an average of 12 cents for every 84 cents from the public sector and 4 cents from NGOs or donors. In Latin America, reported funds from NGOs and the private sector together nearly matched public contributions at a 1:1 rate.[13]

Figure 7: Share of Total Transacted Value for Collective Action Funds by Region and Buyer Sector, 2015



[12] For 2015, 95 collective action funds provided data on 227 buyers.

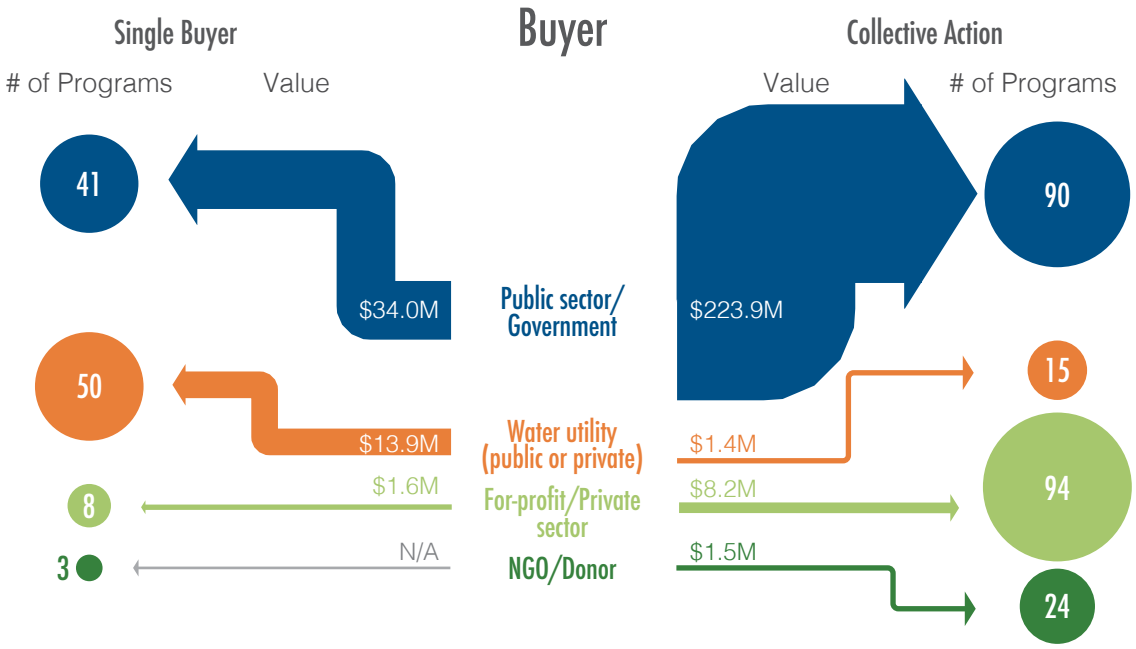
[13] However, many respondents in Latin America and the Caribbean did not provide buyer-specific transaction data. Thus, these figures reflect only a portion of total activity. Detailed data on buyers was provided only for a very small sample, namely ten buyers representing $1,688,170 in transactions in 2015, out of a total of $8,619,090 transacted by collective action funds. It is likely that government and public utilities played a larger role than Figure 7 suggests, since two-thirds of buyers identified came from these sectors.

Moreover, a full 84% percent of private sector contributions to user-driven programs were delivered through collective action mechanisms instead of by a business working alone to protect its watershed (Figure 8). For a business, collective action provides a way to leverage funds from other users, take advantage of the conservation expertise of others in the partnership, and improve basin governance in coordination with important stakeholders. NGOs also heavily favored collective action programs in 2015, participating in 94 of these initiatives compared to just eight programs worldwide where an NGO worked alone as the only buyer.

The public sector also sought out collective action in 2015: 87% of public contributions found a match in private, NGO, or utility dollars, even though the public sector usually contributed the bulk of funds. Nevertheless, more often than not the public sector was successful in bringing other stakeholders to the table to contribute at some level for watershed management.

On the other hand, utilities often seemed inclined to go it alone when it came to watershed investments. Relatively few utilities—15 out of 65 identified by program administrators as buyers in 2015—reported transactions channeled through collective action funds (although not all buyer activities have been reported to Ecosystem Marketplace, as discussed in the notes to Figure 8). Some programs reported that utilities faced challenges in justifying green infrastructure investments to ratepayers. Utilities may be legally constrained from pooling funds with non-public sector actors or spending operational or capital funds on watershed projects. Or perhaps utilities, for institutional or capacity reasons, have simply been slow to form collective action partnerships in the basins where they seek to act.

Figure 8: Comparison of Watershed Investments (by Count of Programs and Transaction Values) for Single Buyer Versus Collective-Action Programs by Buyer Type

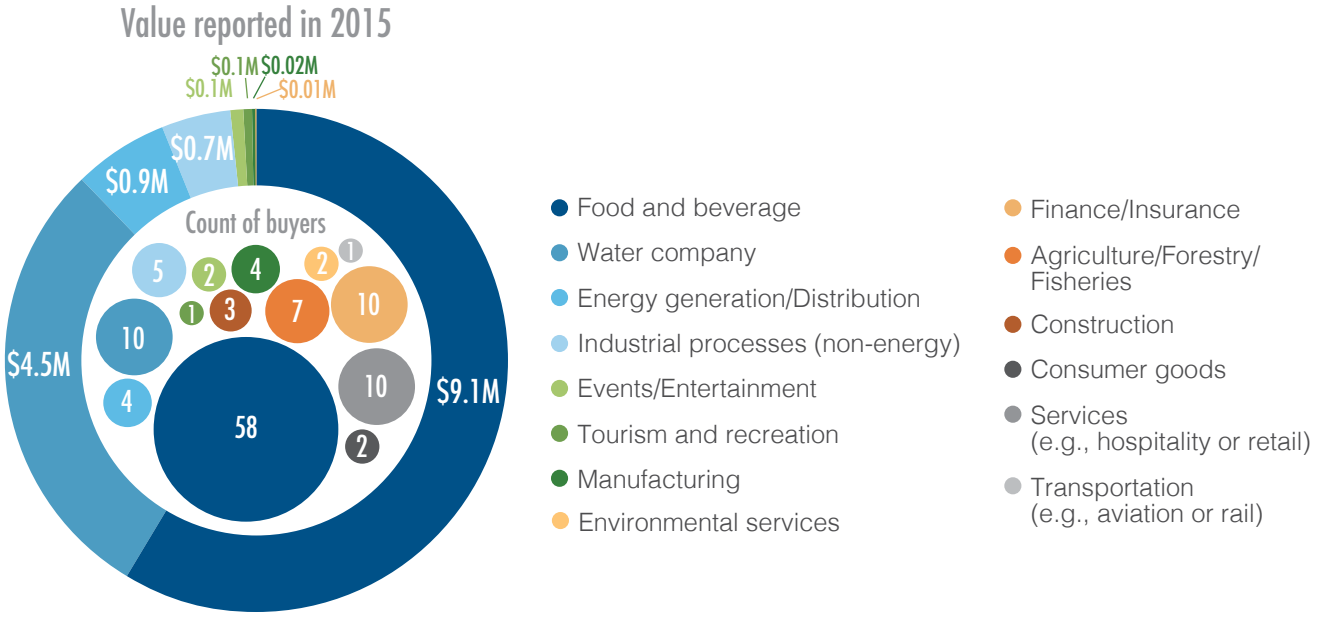


Notes: Data on buyers' specific level of contributions to programs was reported for $284.5M worth of transactions, or 43% of total user-driven watershed investments value, in 2015.

User-Driven Watershed Investments: Consumer-Facing Businesses Made High-Profile Investments in 2015 to Manage Risk, Reputation

The private sector posted an overall total of $15.4M in transactions in 2015 through user-driven watershed investments. The food and beverage sector continued to lead by both value and the number of programs supported (Figure 9), with slightly more than $9M spent and 58 reports of participation (out of a total of 358 buyers identified by user-driven programs). Relatively high values were also reported from the finance/insurance sector, private water utilities, and energy generation firms—all industries that face substantive financial and physical risks associated with water resources.

Figure 9: Private Sector Buyers in 2015 by Industry, Count, and Reported Value Transacted

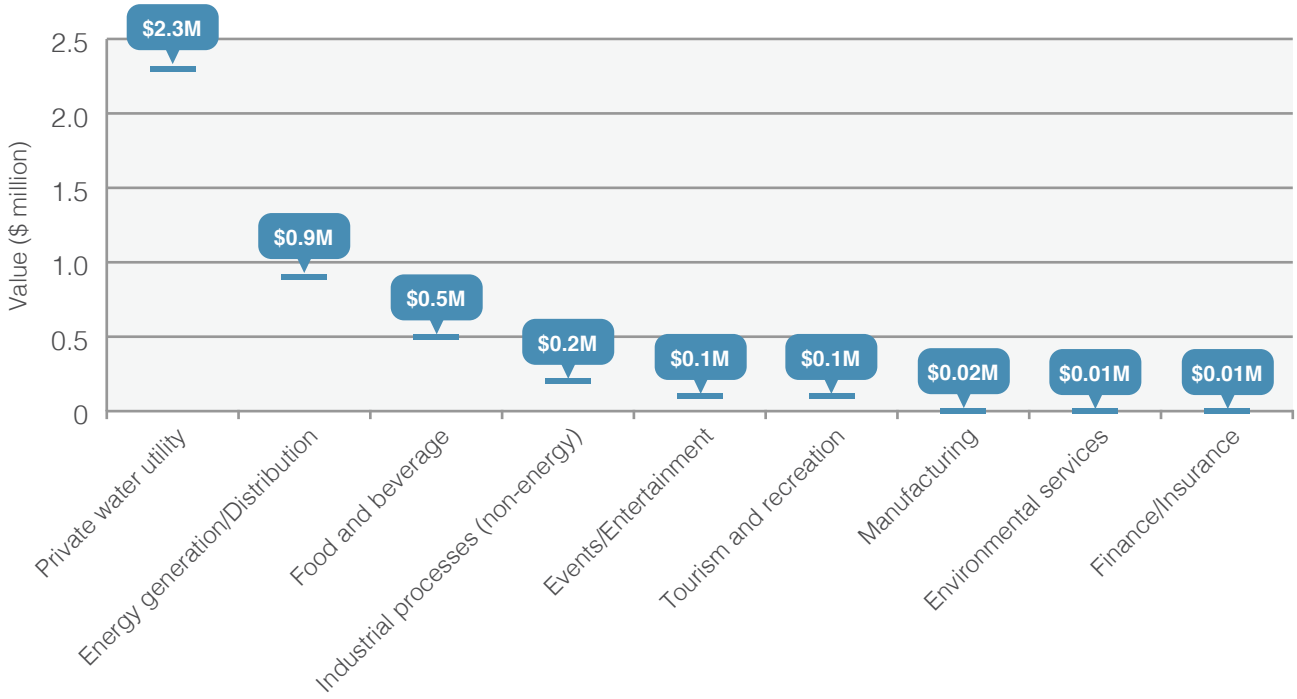


Notes: Companies that supported multiple initiatives are counted multiple times.

Program administrators reported they had buyers in the agriculture/forestry/fisheries, construction, consumer goods, services, and transportation sectors in 2015, but insufficient transaction data was provided for these industries to report here.

Beyond water risk, corporate social responsibility was also a key reason for funding programs: nearly two in three private sector buyers counted "brand value" among their top motives (Table 3 page 19). But among the more active sectors, the size of the average payment made to user-driven watershed investments programs in 2015 suggested that for at least some companies there was more at stake than reputational concerns (Figure 10). Private water utilities, contributed an average of nearly $2.3M. Energy companies paid an average of $943K and food and beverage firms $484K. Considering that the median value transacted by user-driven programs was $856K, these private sector contributions represented a significant share of programs' budgets.

Figure 10: Average Contribution to User-Driven Watershed Investment Programs by Private Sector Buyers in 2015 by Industry



Notes: Program administrators reported they had buyers in the agriculture/forestry/fisheries, construction, consumer goods, services, and transportation sectors in 2015, but insufficient transaction data was provided for these industries to report here.

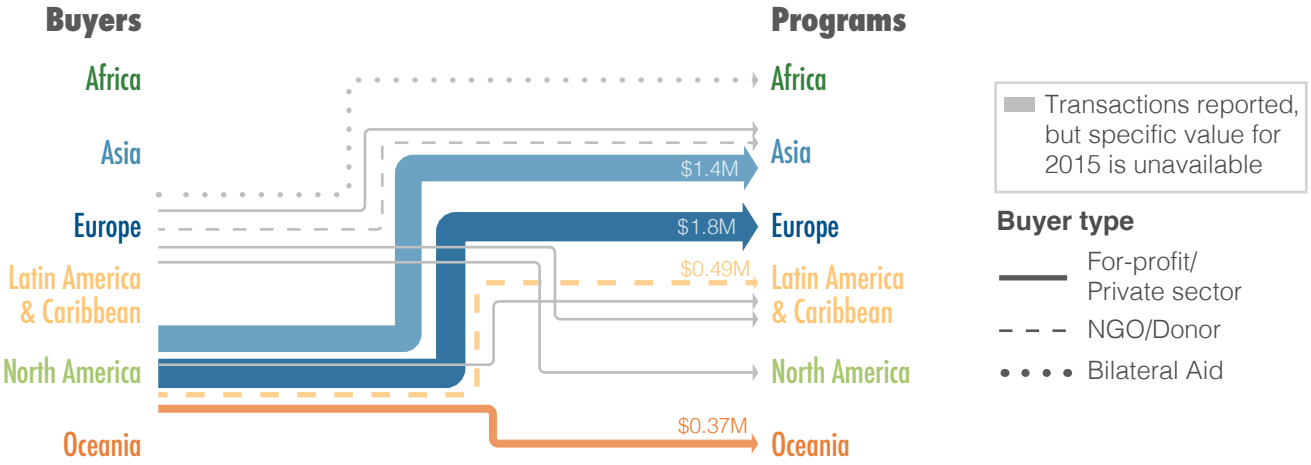
User-Driven Watershed Investments: Buyers Do their Spending Close to Home, with Few International Transactions Reported in 2015

When it comes to "following the money," with watershed investments you don't usually have to go far. The value tracked in this report nearly always remained within the political or watershed boundaries where it originated and matched the buyer's scale: state governments funded green infrastructure at the state level, water utilities at the basin level, and so on, in contrast to carbon or other conservation finance which can span the globe.

The private sector was a key player in the small share of international funding flows reported in 2015, with $3.5M reported as following water risk upward from buyers' headquarters along companies' supply chains (Figure 11). (This figure likely understates the actual value. As Figure 11 suggests, data on the origin of buyer funds was not always reported by programs for 2015.) International watershed investments often flowed from the Global North (and corporate headquarters) to the Global South, where these funds were matched by a local subsidiary or supplier. This was a common model in the food and beverage industry, where multinational firms often shared costs with a local bottling company or agricultural commodity supplier to manage local water resource challenges.

Donor funds were the other primary source of international watershed investments, though relatively little value was reported by programs in 2015. The NGO and philanthropic sector overall appears to have stepped back from a direct funding role in favor of a "connective tissue" role between basin stakeholders, as discussed elsewhere in this report. (See the Regional Trends and Policy Developments chapter of this report page 41).

Figure 11: International Funding Flows for User-Driven Watershed Investments by Value and Source



Note: This analysis should be considered a first and very conservative attempt at tracking international watershed investments from buyers to program sites. Data on cost-sharing for watershed investments—especially when a multinational corporation partners with a domestic subsidiary—is infrequently reported at this level of detail or sometimes "claimed" multiple times by funders involved.

Water Quality Trading & Offsets: $31.8M in Trades in 2015

Water quality trading and offsets are among the more "market-like" mechanisms for watershed protection. Markets typically feature standardized units of trade, market actors or platforms connecting buyers and sellers, and credit pricing shaped by the forces of supply and demand. Water quality trading markets are generally developed as a way to cost-effectively comply with water quality regulations. Facilities that discharge wastewater into rivers or streams can purchase credits representing pollution reductions elsewhere in the watershed. Credits are generated through interventions such as sustainable agricultural management, riparian planting, or on-site discharge reductions at other facilities.

Ecosystem Marketplace identified 19 fully operational and three pilot-stage water quality trading and offsets programs that actively transacted credits in 2014–2015. Together these programs transacted $31.8M in credits in 2015—a significant jump from $20.8M in 2013. Programs were mainly located in the United States (with 16 programs transacting $29.1M) but active trading and offsets markets were also found in Australia, New Zealand, and the United Kingdom.[14] Collectively, water quality trading markets kept more than 30M pounds of nutrient pollution out of waterbodies in these countries in 2015.

US markets for nutrient offsets in North Carolina watersheds and for post-construction phosphorus offset requirements in Virginia, as well as Connecticut's long-running nitrogen trading program for the Long Island Sound were the largest in terms of value and volume traded (Table 4).

Table 4: Major Water Quality Trading and Offsets Programs by Value, Volume, Credit Type, Credit Life, and Average Price in 2015

Program	North Carolina Nutrient Mitigation Program		Virginia post-construction stormwater offsets		Connecticut Nitrogen Exchange		Lake Taupo Water Quality Trading		Chesapeake Bay Watershed Nutrient Credit Exchange Program	
Location	**NC, US**		**VA, US**		**CT, US**		**Lake Taupo, NZ**		**VA, US**	
	2014	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
Value	$9.3M	$11.9M	$6.6M	$12.6M	$3.6M	$3.8M	$2.8M	$1.8M	$0.6M	$1.7M
Volume	120,662	137,027	309	584	n/a	566,845	n/a	n/a	198,622	538,280
Credit type	Lbs N, Lbs P		Lbs TP		Lbs N		Lbs N		Lbs N, Lbs P	
Credit life	Permanent		Permanent		Annual		Permanent		Annual	
Credit source	Nonpoint sources		Nonpoint sources		Point sources		Nonpoint sources		Point sources or nonpoint sources	
Average price, 2015	$86.78 (N), $221.46 (P)		$21,500		$6.73		n/a		$3.05 (N), $4.93 (P)	

[14] To learn more about water quality trading and offsets programs please visit our online program inventory at www.watershedconnect.org/programs.

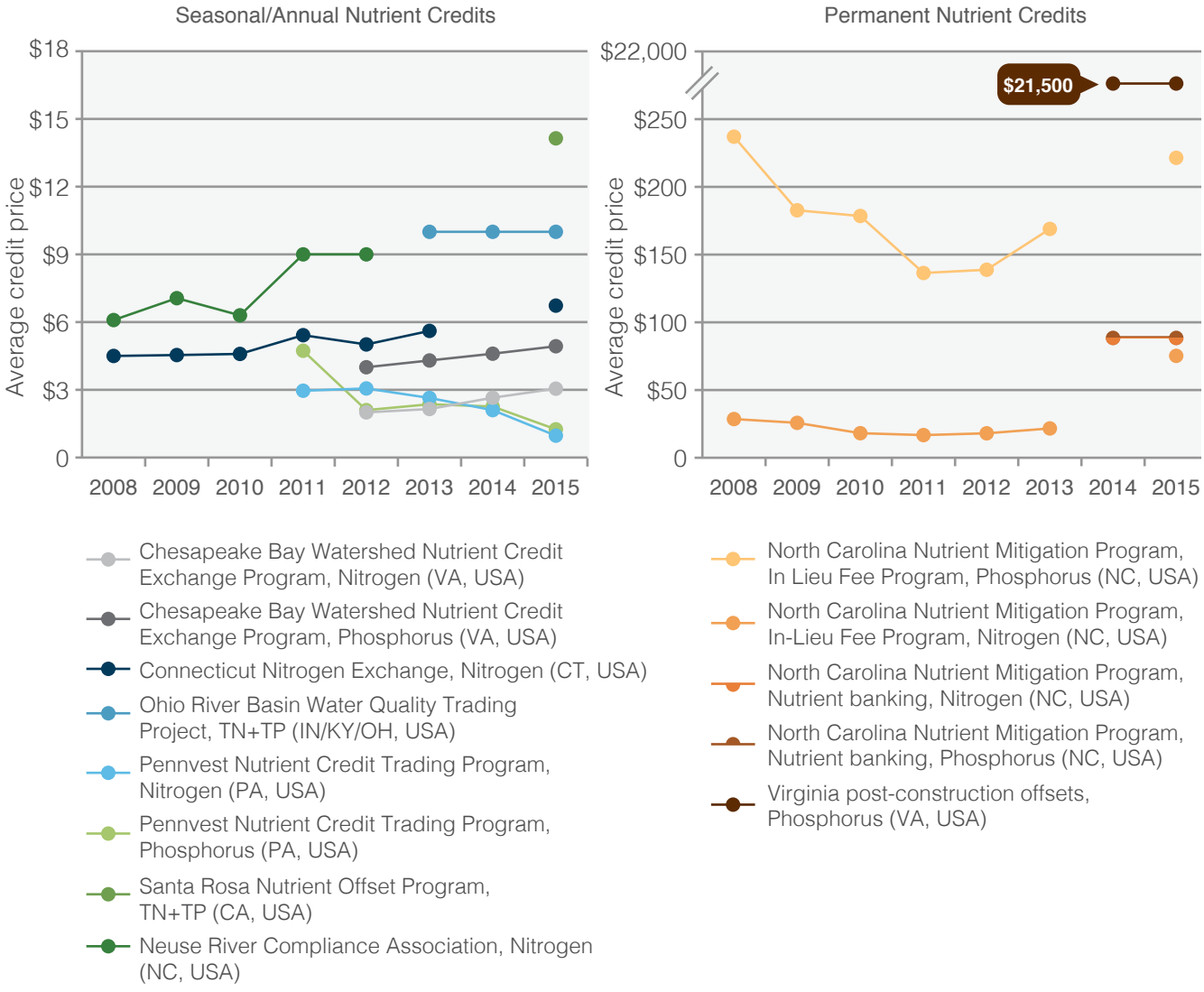
Table 4 (continued): Major Water Quality Trading and Offsets Programs by Value, Volume, Credit Type, Credit Life, and Average Price in 2015

Name	Santa Rosa Nutrient Offset Program		Hunter River Salinity Trading Program		Chesapeake Bay Watershed Nutrient Credit Trading Program		Stormwater Retention Credit Trading Program		Ohio River Basin Trading Project	
Location	**CA, US**		**Hunter River, Australia**		**PA, US**		**DC, US**		**IN/KY/OH, US**	
	2014	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
Value	$0	$330K	$123K	$0	$111K	$30K	$25K	$21K	$90K	$3K
Volume	0	23,345	200	0	67,707	34,598	11,013	11,013	9000	250
Credit type	Lbs Total Nitrogen (TN) and Total Phosphorus (TP)		Right to discharge saline water		Lbs N, Lbs P		Stormwater retention credits		Lbs TN and TP	
Credit life	Annual		10 years		Annual		Annual		Annual	
Credit source	Nonpoint sources		n/a		Point sources or nonpoint sources		Nonpoint sources		Nonpoint sources	
Average price, 2015	$14.14		$614		$0.97 (N), $1.25 (P)		$1.90		$10.00	

Credit-trading markets usually focused on crediting nitrogen (N) or phosphorus (P) load reductions to water bodies, with one credit representing one pound of load reduction. But we also found stormwater retention, thermal loading, and saline discharge outcomes packaged as different types of credits. The duration of credits can vary: compliance credits may cover a period that is either seasonal, annual, some number of years, or in perpetuity (known as "**permanent**" **offsets**). And markets can require all offsets to come from nonpoint sources (NPS, i.e., from land-based restoration projects or agricultural best management practices); point sources (PS, facilities which discharge less than their permitted allocation and may trade the surplus); or both NPS and PS.

This variety of credit offerings, as well as local contextual factors affecting project costs and the frequent role of public administrators influencing or setting prices, means that comparison of price or volume across markets isn't straightforward or particularly informative. But within markets, prices have been fairly stable over time (Figure 12). In the United States, public market administrators play a strong price-setting role in the Connecticut Nitrogen Exchange, North Carolina's Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program), and Washington DC's Stormwater Retention Credit Trading market. Market forces meanwhile are a bit more obvious in Pennsylvania's nutrient trading market, where auction prices for N and P credits have fallen recently, in large part due to a buildup of supply.

Figure 12: Average Annual Nutrient Credit Price by Market, 2008–2015

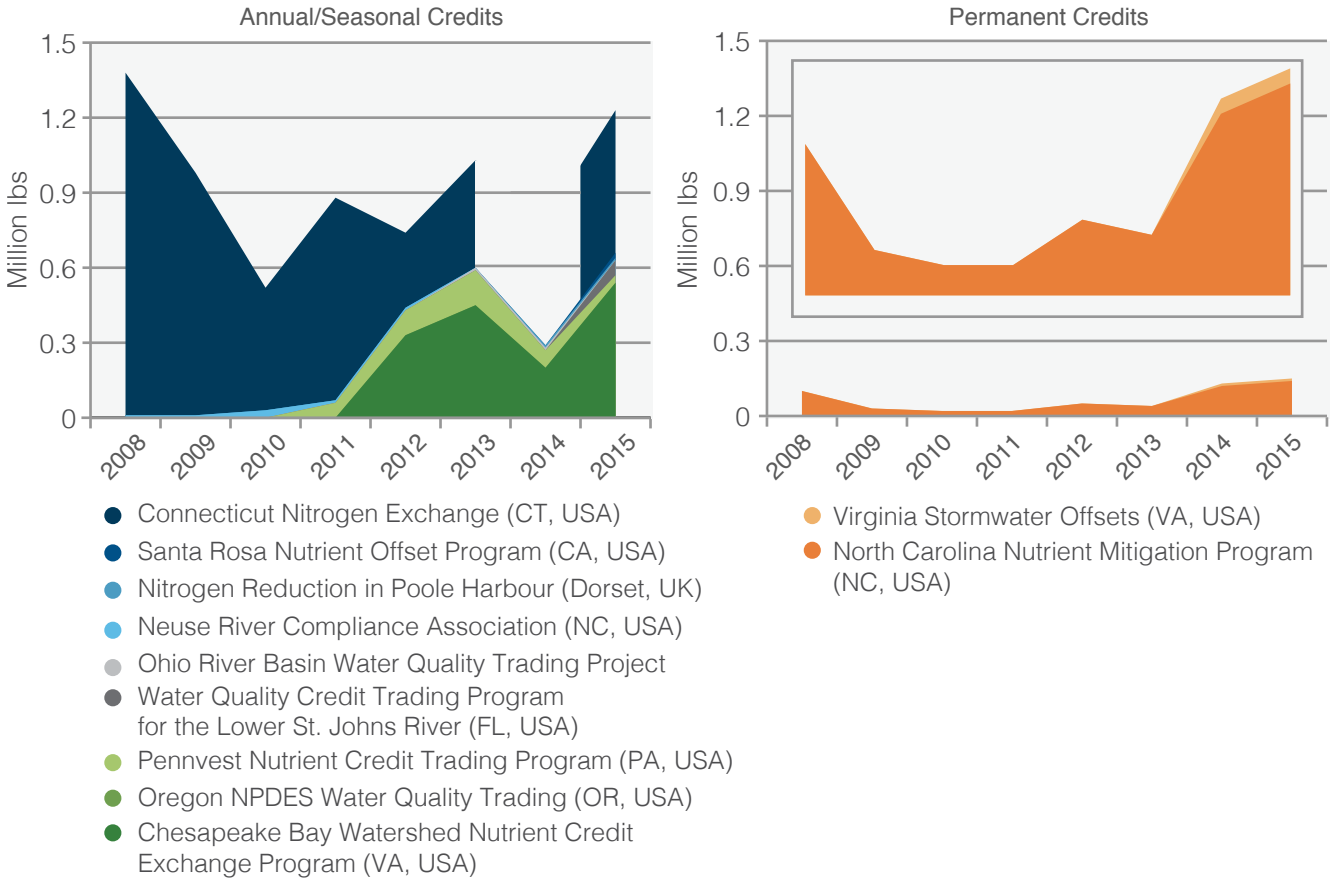


Water Quality Trading and Offsets: Private Project Developers Flock to Permanent Offsets in the United States Where Value Seems a Surer Bet

Although permanent water quality offsets represented only a small share of overall credit-trading volume in 2015 (just over 142,000 lbs of nutrients out of nearly 1.4M transacted overall), they commanded a much higher price than term (i.e., annual or seasonal) credits and thus most of the total value transacted: permanent offsets accounted for an estimated $24.5M in sales in 2015, compared to $7.4M for **term credits**.

The permanent offsets market has posted steady growth since the economic recovery began in 2011, in contrast to the volatility seen in short-term markets (Figure 13). This may be partly a function of demand drivers. In short-term markets, where trading is usually required of existing polluters under a cap or against a baseline and credits may be purchased from either NPS or PS, there may be incentives to try to ultimately phase out trading: facilities often use trading as a short-term strategy to "buy time" while they install upgrades that are seen as a lower-risk path to compliance. But permanent offset requirements are typically triggered by *new* development, and choosing a NPS credit is generally mandatory, making long-term demand more stable and predictable.[15]

Figure 13: Nutrient Market Volumes for Annual/Seasonal and Permanent Nutrient Credits, 2008–2015



Notes: The 2014 volume data for the Connecticut Nitrogen Exchange could not be confirmed and is not displayed in this figure.

[15] Markets for term credits, such as, Virginia's Chesapeake Bay Watershed Nutrient Credit Exchange Program, may also require green infrastructure-based offsets for new development.

Program administrators of short-term markets may also naturally begin shutting markets down as regulator-set water quality goals are achieved. That dynamic was seen this year in Connecticut's Long Island Sound Nutrient Credit Exchange, which met its Total Maximum Daily Load requirements in 2014. Many participating sewage treatment plants in this market have ultimately chosen to install new equipment and cease trading. (Connecticut officials also elected to step back from essentially guaranteeing credit sales, which will likely shrink the market; starting in 2015, sellers have been sharing buyer revenues without an additional state subsidy that in the past has inflated prices received by suppliers.) New Zealand's Lake Taupo trading program also hit its water quality targets ahead of schedule in 2014, though payments and contracts will continue through 2018.

Another major shift in markets—the entry of private sector project developers providing NPS credits—continued in 2015. We documented 28 **commercial credit banks** in North Carolina, 17 certified credit developers in Pennsylvania (though there has been little NPS trading activity in that state of late), and 28 banks in Virginia active in 2015. (As this report was being written in mid-2016, Virginia's number of approved nutrient banks had jumped to 43, with another 15 pending approval.)

Private offset providers dominated supply in Virginia and North Carolina. In North Carolina, a long-running, state-administered fee program scaled back in recent years as private provision of offsets ramped up. In 2013, the Division of Mitigation Services provided 46% of all nutrient offsets tracked by volume, or 22,798 lbs out of a total volume of 46,694 lbs. In 2015, its share of volume relative to private nutrient banks had fallen to 13% (or 17,771 lbs out of 137,027 lbs). In 2015, private nutrient banks sold an estimated $10.6M in offsets, compared to the $1.4M transacted through the Division of Mitigation Services program.

In general, new growth—whether in terms of value or the development of new markets—has been in NPS credits, despite lingering concerns about the difficulties of verifying outcomes from land-based interventions and higher transaction costs associated with trading between NPS and PS parties. On the other hand, since low-hanging fruit for pollution reduction have mostly been picked for PS over the last few decades, NPS credits offer greater potential for cost-effective reductions, despite the challenges associated with engaging agricultural producers and other NPS in pollution reduction. They also provide an avenue for increasing the agricultural community's contribution to meeting water quality goals, since the sector enjoys a number of exemptions from regulation under the Clean Water Act and is often a major contributor to water pollution. Virginia's Chesapeake Bay Watershed Nutrient Exchange Program (which is distinct from post-construction phosphorus offset requirements) mandates that all new or expanding PS facilities use NPS credits to offset pollution loads. Other recently developed trading and offsets programs in the Ohio River Basin, the City of Santa Rosa in California, and the Lower St. Johns River in Florida similarly focus on NPS contributions to improved water quality.

Water Quality Trading and Offsets: Water Quality Market Infrastructure Has a Goldilocks Problem

North Carolina officials' retreat from acting as a major provider of mitigation services may presage a broader shift in markets. Public agencies from Pennsylvania to Connecticut to Australia's New South Wales have created extensive trading platforms over the years and even acted as guarantors of price and volume or as project developers themselves. But the low volumes transacted in the water quality trading world—despite overall growth and value—may make it difficult to justify continuing a high level of public support. In Pennsylvania and Virginia, most trading appears to take place outside of publicly administered trading platforms anyway.

The private sector, at least in some markets, has stepped into the role of credit supplier. But so far, in contrast to the carbon markets, water quality markets have failed to attract private provision of market infrastructure-like standards and credit registries. (The main exception being Markit, which is used by several trading programs to register credits, albeit at a fairly small volume.)

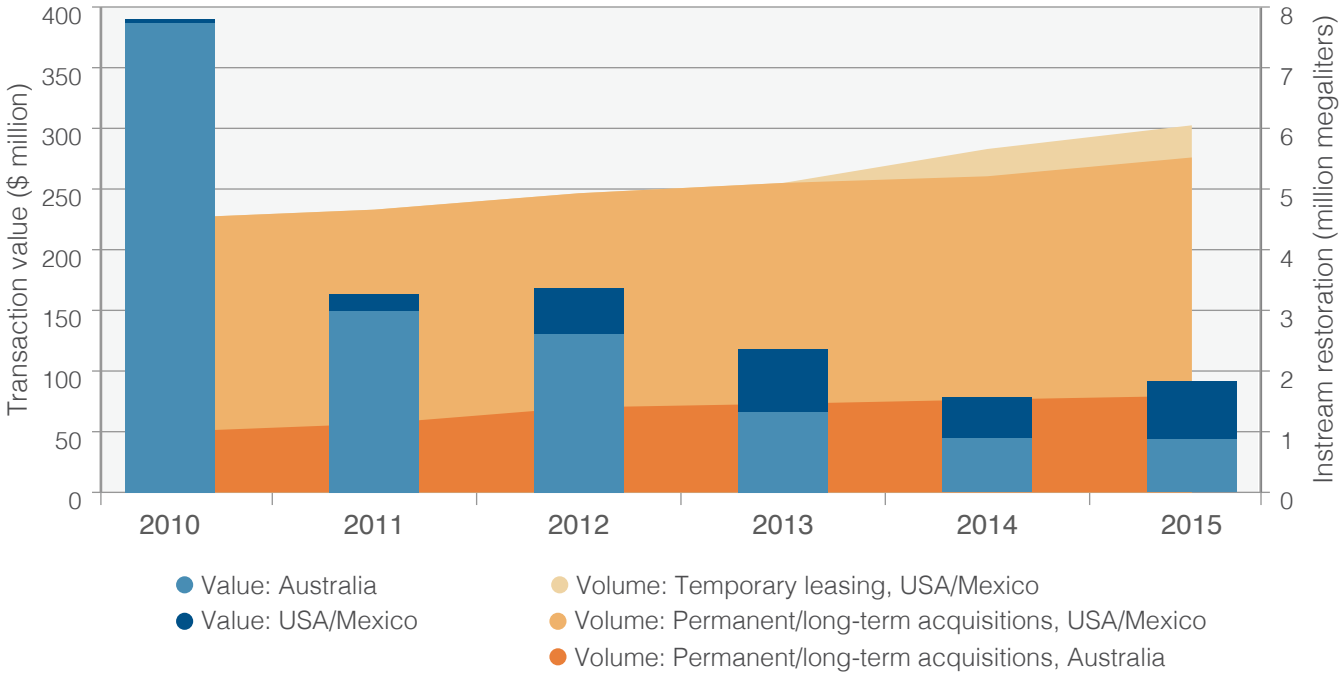
Yet, as markets mature, the need for robust standards to verify performance and platforms to facilitate trading and provide transparency is growing. So as states look to scale *back* engagement on this front, market actors see promise in scaling *up*. Across the United States, practitioners in the NGO and private sector communities are leading efforts to move toward market infrastructure shared across multiple markets, rather than relying on state or regional public agencies to build their own. The US-based National Network on Water Quality Trading released national guidance on developing water quality trading programs in 2015, and cross-market practitioner networks have emerged to wrestle with the implications of shared standards for trading or for harmonizing rules across state lines (Madsen and Fox 2014). The U.S. Environmental Protection Agency (USEPA) and U.S. Department of Agriculture's Office of Environmental Markets (USDA OEM) have also supported greater coordination across markets and solicited practitioner recommendations on how to best support environmental markets, including development of a national credit registry and compiling information on successful programs (Mills and Gilinsky 2016).

Environmental Water Markets: Instream Buybacks Purchasing Hits the Wall, Sparking Interest in Cheaper, More Flexible Leasing

Water markets connect buyers and sellers of water use rights. At least a dozen countries have water rights systems in place to manage allocation and allow trading of those rights (Richter 2016).[16] Most trading takes place between agricultural producers or as agriculture-to-urban transfers. But rights can also be purchased or leased and dedicated to environmental use, known as "instream buybacks." Or water users can use market mechanisms to mitigate for their impacts from groundwater pumping in order to maintain aquifer levels. These two mechanisms—instream buybacks and groundwater mitigation—are collectively referred to in this report as environmental water markets. Environmental water markets are primarily active in Australia and the western United States, where the right to divert water can be legally separated from land ownership and traded. The instream buybacks mechanism also requires legal recognition of instream use as a "beneficial use," which, in the United States, is determined on a state-by-state basis.

Collectively, environmental water markets transacted $93.3M in 2015. The annual volume and value of instream buybacks continued a global decline in 2015 as a new Australian government dialed back investment in the

Figure 14: Annual Transaction Value and Cumulative Volume of Environmental Water Transactions in Australia and USA/Mexico, 2010–2015



Notes: Permanent volume is cumulative. Leasing transaction data is unavailable for 2010–2011. Two programs secure water in the Colorado River Basin spanning the U.S. and Mexico in an effort to rehabilitate the Colorado Delta in Mexico. Volume data is only for programs reporting outcomes in volumetric terms, e.g., megaliters (ML) or acre-feet (AF). Some programs report outcomes in terms of flow, such as cubic feet per second (cfs), which is not directly comparable. Flow augmentation data is available below in Map 4.

[16] A number of valid concerns exist about the potential for water markets to invite speculation or mass purchasing by wealthy parties, resulting in limited or no water for the poor, agricultural communities, and ecosystems. As Richter (2016) notes, it is possible to create regulatory measures to ensure that these users receive non-tradable and affordable entitlements to water for basic use. Water markets should also be designed with the minimum flows and timing of flows necessary to sustain healthy freshwater and estuarine ecosystems.

Murray-Darling Basin over concerns about conflicts with agricultural water users (Figure 14). However, growth in transactions in the United States averaged a respectable 6.7% per year over the 2012–2015 period; as of 2015, the value of buybacks in the United States ($48.4M) has surpassed those in Australia ($43.7M).

Globally, $92.1M was spent in 2015 to secure water for the environment through instream buybacks. Value continued to fall from nearly $150M in 2011, when the Australia Commonwealth government was still extremely active in water rights markets in the Murray-Darling Basin as part of its recovery plan for the embattled river system. A new Coalition government that took power in 2012 prioritized infrastructure investment to improve agricultural water use efficiency over a buybacks strategy and dialed back water rights acquisitions accordingly.

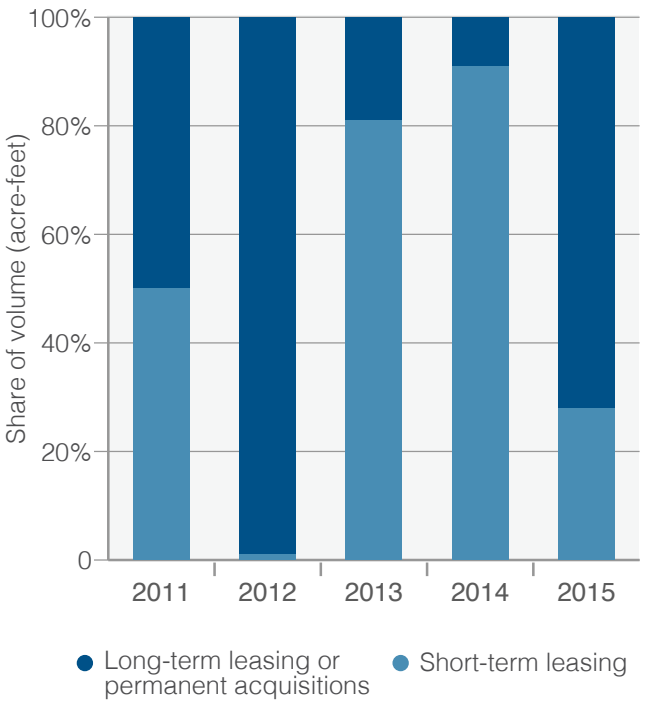
Environmental water rights acquisitions have also been contentious in California where the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service, despite a mandate to acquire water to restore and safeguard wildlife refuge and wetland areas in the state's Central Valley, have consistently fallen short of water acquisition targets due in large part to the unavailability of water during periods of drought and a lack of willing sellers in the agricultural community (Esralew 2013).

Virtually all buyers of water rights for environmental purposes are motivated by concerns (or regulatory mandates) related to aquatic habitats and species, or corporate commitments to **replenishment**.[17] Public sector buyers, as illustrated by Australia's experience in the Murray-Darling, have limited appetite for being perceived as competing with agricultural producers for limited water rights. And NGOs and voluntary private sector buyers may be unable or unwilling to outbid urban and agricultural users.

In response to these constraints on purchasing water for the environment, many programs in the United States make extensive use of short-term lease contracts instead of outright purchasing. Leases, which may be for periods ranging from a few weeks to many years, are typically better-received by agriculture and other water rights holders who are unwilling to permanently part with their water rights but are receptive to flexible deals that provide water for the environment at critical times, such as during spring spawning periods. Leased water is also far less expensive, making it a useful tool for NGOs and conservation groups with limited resources (Map 4).

The balance between acquisitions and leasing varies enormously year-to-year, depending on factors like availability of water rights, drought, and activity by major public purchasing programs (which spiked in the United States in 2012). Nonetheless, since 2011, an average of 50% of the total annual volume secured for instream flows in a given year in the United States has been through leasing (Figure 15).

Figure 15: Relative Share of Instream Flow Volumes Secured through Short-Term Leasing Versus Long-Term Leasing/Acquisitions in the United States, 2011–2015

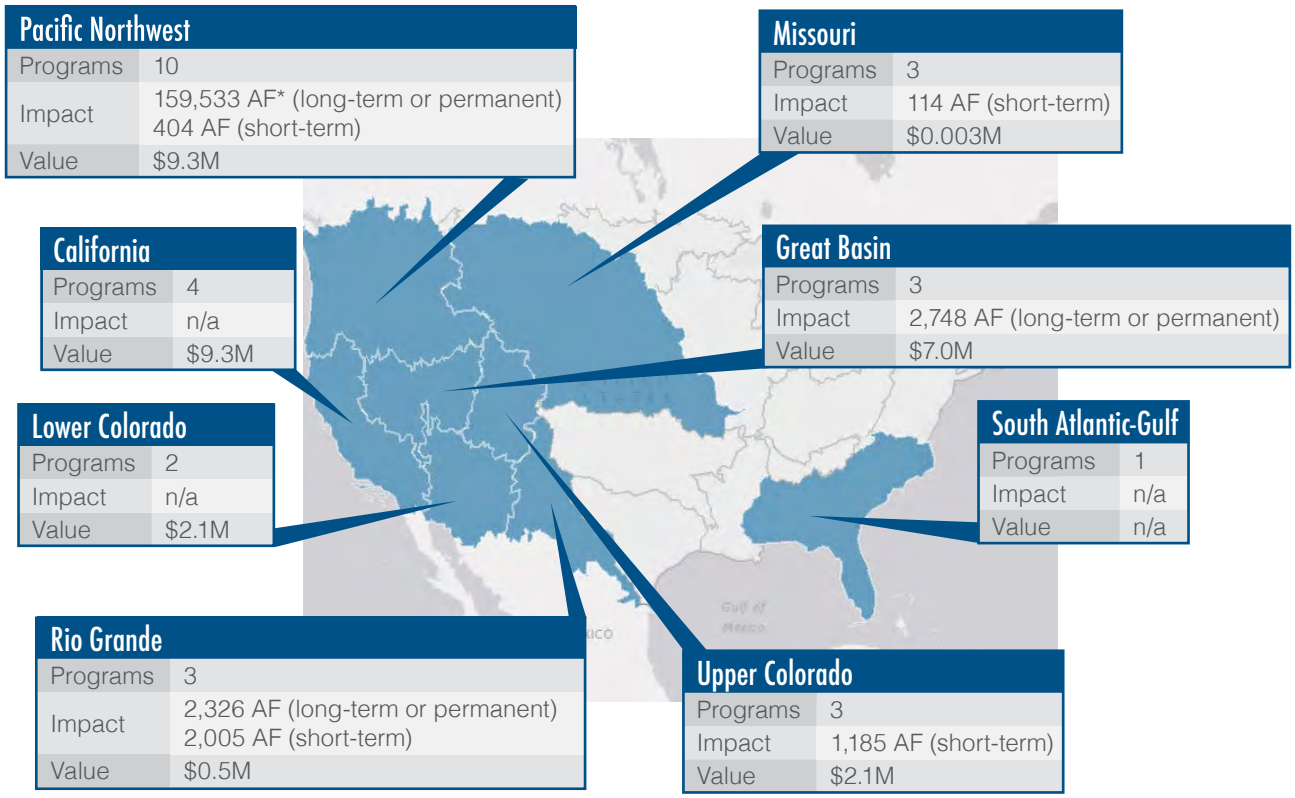


Notes: Volume reflects acre-feet of water leased or acquired. Activities reported in terms of flow (cubic feet per second, or cfs) could not be directly compared with volume in this figure. Only one program reported outcomes solely in terms of flow in 2014–2015.

"Long-term" leasing reflects transactions where a lease contract is for longer than one year. Water rights leasing contracts may be for very long periods (up to 100 years).

[17] "Replenishment" targets set by companies generally aim to generate an annual volumetric benefit equal to a company's consumptive use by watershed restoration, water access and sanitation projects, irrigation efficiency improvements, and other interventions. These companies—Coca-Cola being the most famous among this group—are generally careful to note that they do not consider replenishment activities to function as a true offset for their water impacts, but rather a "balancing" of their consumptive use by returning water to nature and communities. See Rozza et al. (2013) for a further discussion of replenishment rationale and approaches.

Map 4: Instream Buybacks in the United States: Major Water Resource Regions by Count of Active Programs, Impact, and Value in 2015



Notes: Permanent volume is cumulative. Leasing transaction data is unavailable for 2010–2011. Two programs secure water in the Colorado River Basin spanning the USA and Mexico in an effort to rehabilitate the Colorado Delta in Mexico. Volume data is only for programs reporting outcomes in volumetric terms, e.g., megaliters or acre-feet. Some programs report outcomes in terms of flow, such as cubic feet per second, which is not directly comparable.

*AF is acre-feet, a measure of water volume.

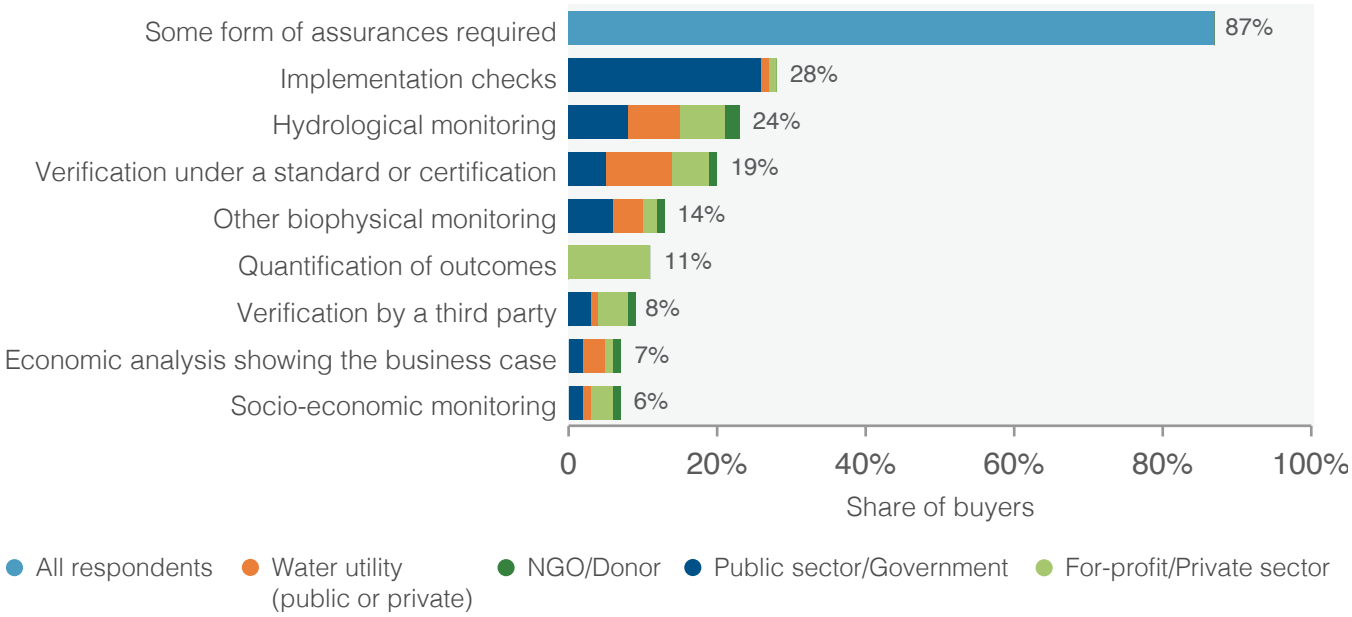
Environmental Water Markets: Groundwater Mitigation Hits a $1.2M High in 2015

Ecosystem Marketplace also identified operational groundwater mitigation programs in seven basins in the western United States (Washington's Dungeness, Kittitas, Walla Walla, and Yakima Basins, Oregon's Deschutes River Basin, Arizona's Verde River Basin, and California's Paso Robles Basin) which together transacted $1.2M in 2015. These programs require property owners seeking new or additional groundwater use to offset their impact through the purchase of mitigation credits or water rights. Compliance is frequently driven by a basin-wide cap on groundwater withdrawals or rules establishing minimum flow requirements for a river system. Groundwater mitigation programs have also been proposed in Washington's Skagit River Basin and Montana's Upper Missouri River Basin.

Demonstrating Performance: Monitoring and Evaluation of Watershed Outcomes Is in High Demand, but with Little Standardization

Programs that provided detailed data on buyers said that nearly nine in ten buyers asked for some form of assurance that green infrastructure interventions were implemented and had performed as intended. This is noteworthy considering that 69% of buyers are acting voluntarily to fund watershed protection. (Voluntary buyers are even more predominant among the private sector: 88% of private sector buyers in 2015 had no regulatory obligations driving them.) But contrary to forest carbon markets, where more than 99% of carbon offsets transacted used a third-party standard to guide project development and verify results in 2015 (Goldstein and Ruef 2016), there is little standardization in the watershed investments world. Instead, buyers' requirements ranged from simple implementation checks (28%), to commitments to ongoing hydrological monitoring (24%), to verification against a standard or certification (19%) (Figure 16).

Figure 16: Assurances Required by Buyer Sector



Public sector buyers, particularly when providing funds through a public subsidy model, favored relatively simple implementation checks to verify that management activities were proceeding as agreed. Utilities tended to require more detailed information about outcomes (as through monitoring of hydrological and other biophysical indicators), third-party verification, or a demonstration of cost-effectiveness. The private sector was also outcome-oriented, although 35 buyers (or 11% of the total) were satisfied by an *ex ante* quantification of outcomes through modeling or calculations carried out prior to implementation, rather than requiring outcomes to be measured in the field.

Standards and Certifications: Voluntary Third-Party Standards Offerings Expand, but Gain Little Traction to Date

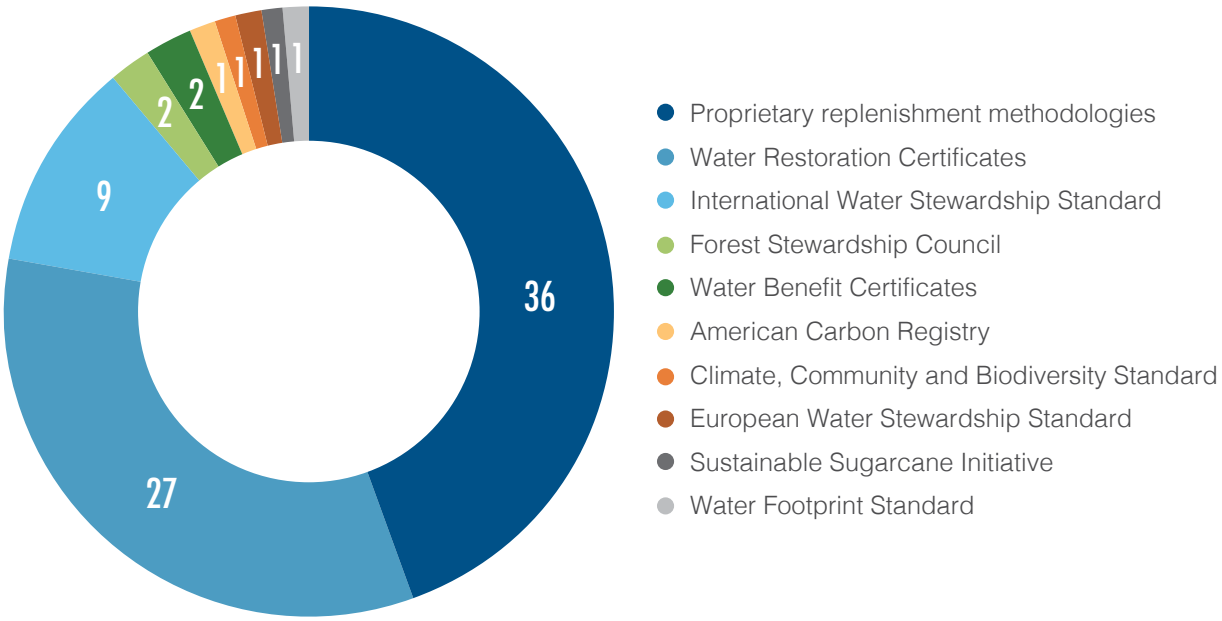
Ecosystem Marketplace asked program administrators to report whether they used third-party standards or certifications in 2015—e.g., whether an independent entity was engaged to certify project design/performance against a standard, audit program reporting, or verify implementation or outcomes.

Outside of performance standards set by regulators for compliance buyers—those driven by water quality standards or other regulations—third-party standards and certifications have yet to gain much of a foothold in the watershed investments world. Just six percent of programs overall said that they voluntarily used an independent standard or certification in 2015 on a total of 81 project sites (Figure 17). (Verification under a standard or certification typically happens at the project level, rather than the programmatic level.)

Some business buyers like Coca-Cola and MillerCoors have worked with consultants and NGOs to develop their own proprietary methodologies for calculating volumetric replenishment benefits from watershed projects. These were the most common systems for verifying implementation or outcomes from watershed investments among voluntary buyers in 2015.

The most successful third-party standard has been the Bonneville Environmental Foundation's Water Restoration Certificates (WRCs), which offer a turnkey solution for replenishment. Twenty-seven projects active in 2014–2015 reported using WRCs. During the same period, nine projects engaged in watershed protection or restoration activities piloted the International Water Stewardship Standard (IWSS), launched in 2014. Two projects reported using a carbon offset standard, either through the American Carbon Registry or the Climate, Community and Biodiversity carbon co-benefits standard. Other projects also variously reported using the Gold Standard Foundation's Water Benefit Certificates, commodity standards like Forest Stewardship Council certification or the Sustainable Sugarcane Initiative, the regional European Water Stewardship Standard, and the International Organization for Standardization (ISO)'s Water Footprint Standard. At a program level, two programs used organic agriculture certification as a basis for payment to farmers, though project-level data was not available.

Figure 17: Voluntary Third-Party Standards and Certifications Reported by Projects, 2015



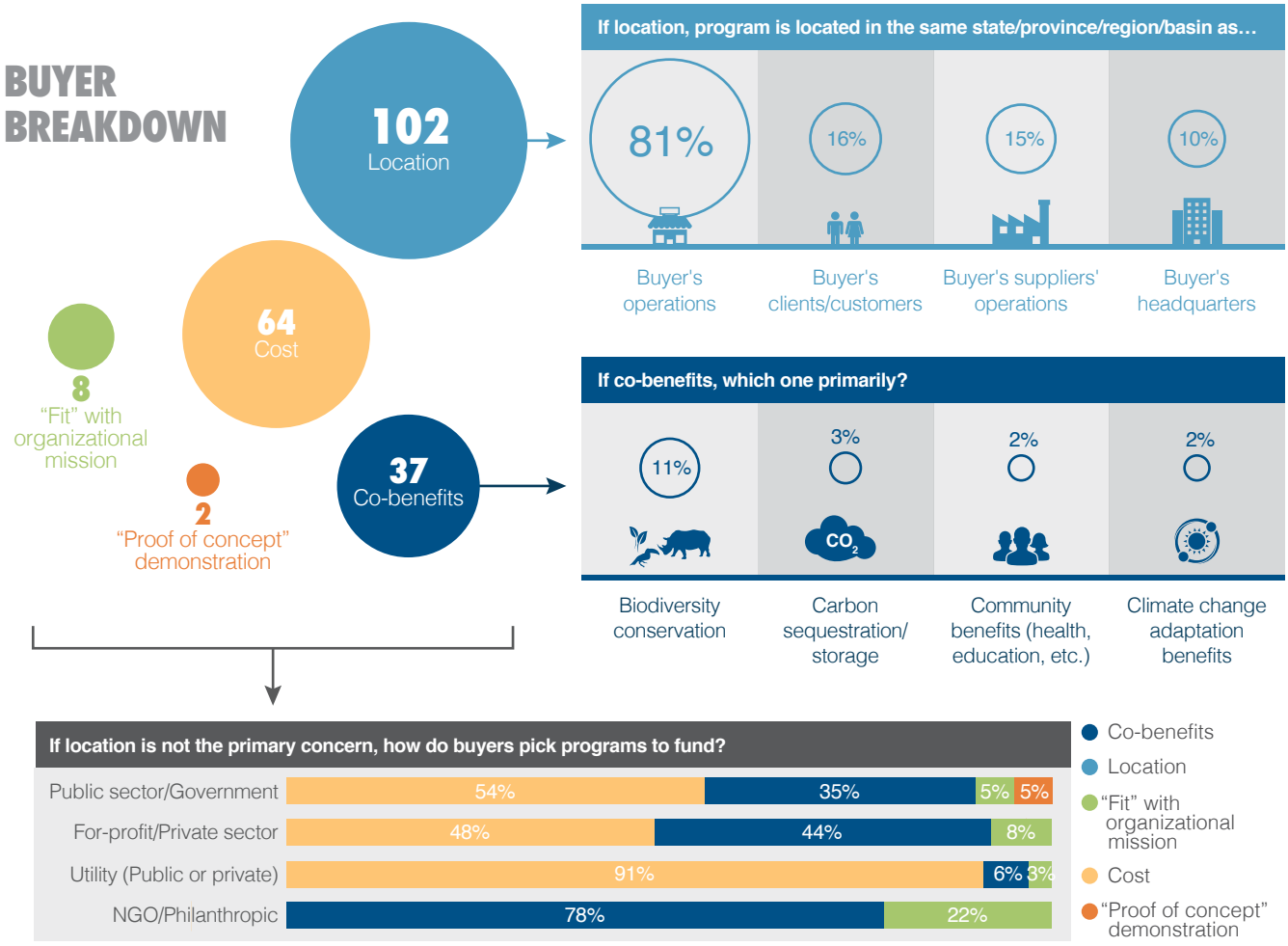
Notes: Use of standards and certifications is reported here at the project level, rather than programmatic, level. Sometimes standards are not fully applied across all project sites participating in a watershed investments program. Certification or verification under a standard also typically happens at the project level rather than at a program-wide scale.

Attracting Buyers: Location, Cost Are Buyers' Top Considerations in Picking Which Programs to Fund

Buyers are usually driven to fund green infrastructure due to water risk, regulation, or reputational concerns. But *which* green infrastructure program do they ultimately choose to support? Program administrators reported in 2015 that—unsurprisingly—the location of an initiative was the main factor in attracting buyers (Figure 18). Since watershed benefits are most likely felt close to the site of intervention, focusing on green infrastructure upstream and nearby to operations or supply chain concerns makes sense in terms of handling specific water quality or supply challenges.

But nearly as many (46%) said other factors were more important to buyers than location. For one in five, program co-benefits were the deciding factor, while other programs reported that costs, "fit" with organizational mission, or the desire to support demonstration of green infrastructure approaches were most important to their buyers. Buyer interests split along sectoral lines as well: program administrators reported that cost was the main issue for utilities in deciding whether to fund watershed protection, while NGOs and philanthropic buyers made their decisions based on expected co-benefits. Government and for-profit buyers were both roughly divided between cost and co-benefits as their most important concern.

Figure 18: Count of Buyers by Primary Concern When Choosing Programs to Fund



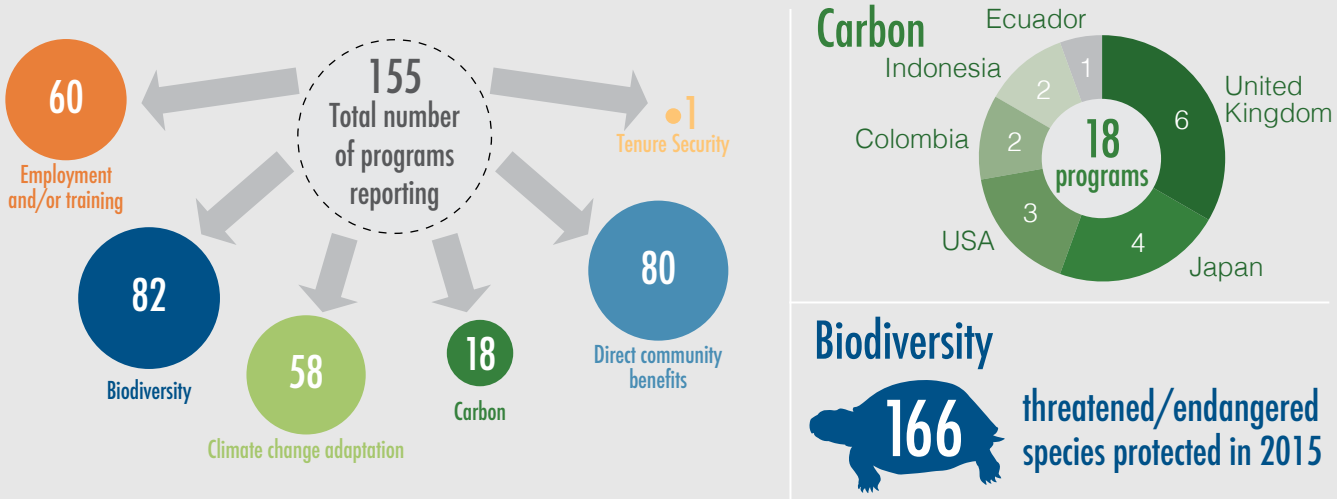
Notes: Respondents could select more than one option regarding location of the program.
For buyers primarily motivated by co-benefits, not all respondents reported the specific co-benefit of interest.

Within the subset of buyers primarily driven by co-benefits, buyers were most often attracted to programs that could deliver strong ecological benefits for biodiversity or climate mitigation. Community and adaptation benefits—while important to buyers, as evidenced by Table 3 page 19 —were less likely to be the *main* factor that drew buyers.

Co-benefits: Impacts and Demand

One in three programs reported monitoring and/or evaluating these "beyond-water" benefits, with biodiversity conservation, community benefits, and jobs and training at the top of program administrators' lists (Figure 19). Public subsidy programs also frequently considered climate adaptation, with high numbers of programs harnessing watershed protection subsidies to help address challenges like increased flooding, forest fire, and food insecurity.

Figure 19: Co-Benefits Reported by Watershed Investment Programs, 2015



Community Benefits Reported by Programs

United States
- Ecotourism: Support for programming/construction of trails or interpretive centers
- Revenue sharing from sustainable forestry

France
- Construction of a methanization unit to convert manure into biogas and fertilizers

Germany
- Procurement/marketing support for agricultural products from participating farmers
- Support for organic agriculture certification

United Kingdom
- Ecotourism: Support for programming/construction of trails or interpretive centers
- Income/productivity improvements from sustainable agriculture

China
- Improved water collection/storage/delivery infrastructure
- Income/productivity improvements from sustainable agriculture

Panama
- Income/productivity improvements from sustainable agriculture

India
- Income/productivity improvements from sustainable agriculture
- Improved water collection/storage/delivery infrastructure

Japan
- Procurement/marketing support for forest products from participating landholders
- Revenue sharing from sustainable forestry

Colombia
- Income/productivity improvements from sustainable agriculture

Italy
- Support for organic agriculture certification

Kenya
- Income/productivity improvements from sustainable agriculture
- Improved water collection/storage/delivery infrastructure

South Africa
- Income/productivity improvements from sustainable agriculture
- Public health education

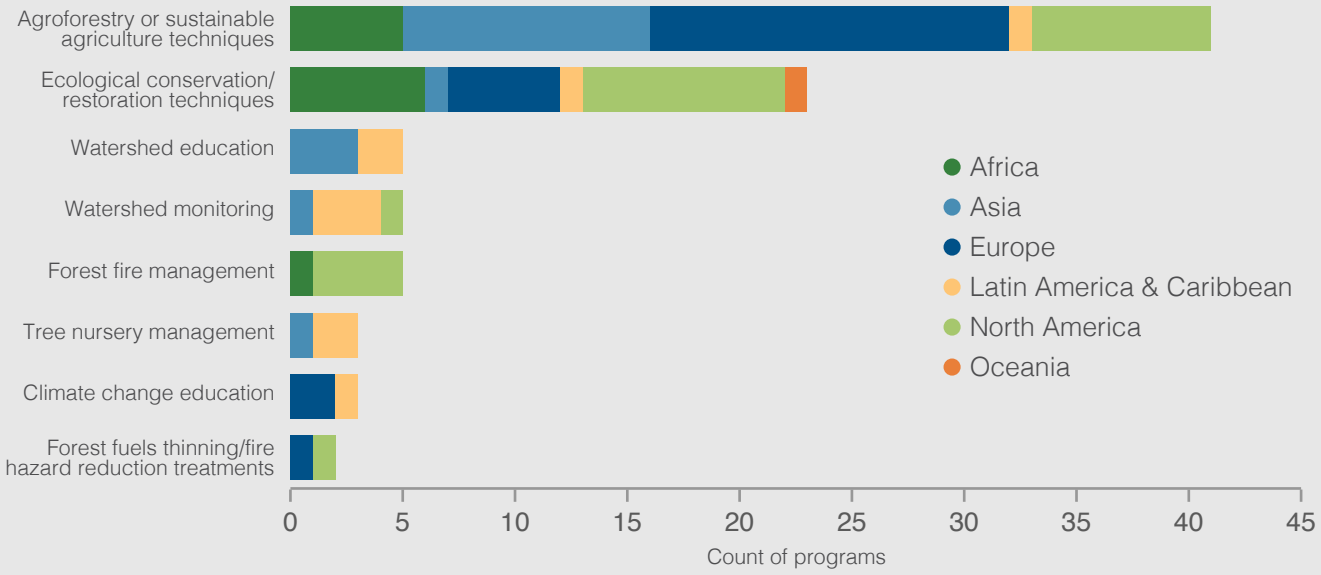
Ecuador
- Income/productivity improvements from sustainable agriculture

Indonesia
- Ecotourism: Support for programming/construction of trails or interpretive centers
- Improved water collection/storage/delivery infrastructure

Uganda
- Access to low-interest loan fund supporting alternative livelihoods
- Income/productivity improvements from sustainable agriculture
- Public health education

Figure 19 (continued): Co-Benefits Reported by Watershed Investment Programs, 2015

Training Delivered by Watershed Investment Program in 2015 by Region



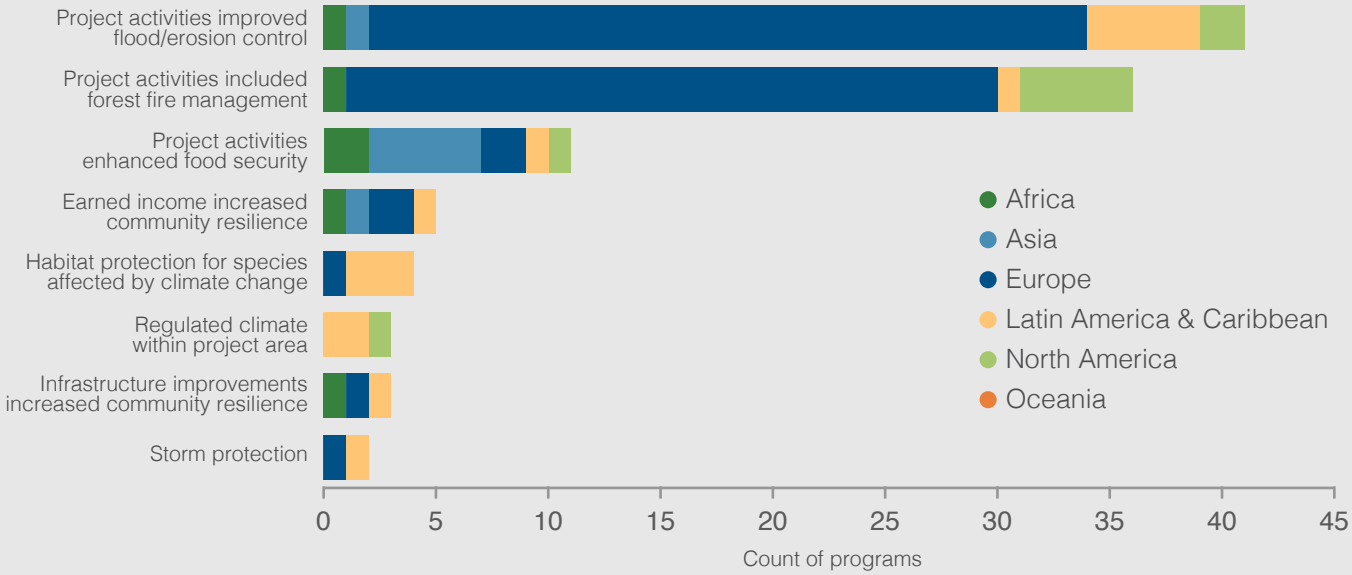
60
programs providing jobs and/or training

1,710
full-time jobs created

402,916
part-time jobs created

16,938
people trained

Climate Adaptation Benefits from Watershed Investments in 2015 by Region



Regional Trends and Policy Developments

Since the last *State of Watershed Investment* report in 2014, enabling policy for green infrastructure has made significant strides in Peru, China, the United States, and other countries, driven by mounting water quality and supply concerns and limited resources to address them. In this section, we review key trends in policy and program design that emerged in 2014–2015 and that were identified by program developers and through Ecosystem Marketplace's ongoing market tracking.

As detailed elsewhere in this report, collective action continues to scale up. The "classic" model of payments for ecosystem services (PES), wherein a single local buyer voluntarily contracts with nearby upstream landholders, is actually fairly uncommon these days when it comes to watershed services. Instead, multiple buyers are connecting with one another, forming broad coalitions to safeguard green infrastructure at a basin-wide scale. Government agencies are often involved, leveraging public funds with new partners to effect change on a larger landscape.

The lines between public subsidies for watershed protection and user-driven watershed investments are increasingly blurred: national funding is finding its way into locally administered initiatives. Or water users and NGOs, rather than taking a direct funding role, are acting as facilitators and technical advisors, helping landholders to access public subsidy money and contributing in-kind support like training and technical advice.

Other new developments in policy and program design in 2014–2015 are summarized below.

Africa

South Africa continues to innovate in its pursuit of a green economy. A recently launched Land Users Incentives program partners with the private sector and NGOs to leverage additional financial support for the publicly funded Natural Resource Management programs (better known as the "Working for" programs). Nearly four percent of the 2015 "Working for" budget came from this match support.

"Ecological infrastructure" is the new buzzword in South Africa. The South African National Biodiversity Institute in 2014 announced an ecological infrastructure program including a proposed national framework for investment and a pilot initiative in the uMngeni catchment together with eThekwini municipality, the Department of Water Affairs, and a host of local stakeholders. Interestingly, the investment framework initially had the goal of a national model for scaling up PES, but has since shifted its focus to ecological infrastructure investment, since the study suggested the latter was more compelling to would-be buyers and more likely to lead to a long-term commitment (SANBI 2014). All of these activities serve as signposts toward the implementation of a proposed Strategic Integrated Project (SIP) 19, which would establish a major ecological infrastructure investment program in South Africa, joining eighteen other SIPs focused on infrastructure initiatives like port development or electrical grid upgrades.

South Africa also hosted some of the world's first International Stewardship Standard pilot projects among stone fruit farmers in the Breede Catchment (Schachtschneider 2016).

In Kenya, the first water fund in Africa was launched in 2015, focused on the Tana River Basin, a major water source for Nairobi. Fund partners include Nairobi City Water & Sewerage Company, the Kenya Electricity Generating Company, and a range of other private and public stakeholders. The Nature Conservancy (TNC) contributed initial financing.

Asia

China continues to scale up public finance for watershed protection and restoration in its pursuit of an "ecological civilization," a vision officially embedded into the country's constitution in 2012. A major initiative in recent years has been the national Key Ecological Function Zones system, announced in 2010, which designates areas critical to water, soil, erosion protection, and biodiversity. These zones provide a more rigorous scientific basis for the enormous financial transfers made from national levels to local communities and help to guide appropriate siting and intensity of ongoing development. These transfer payments under the ecological zoning system continue to grow, from nearly $1.8B in 2012 to over $2.6B in 2015. China is also on track to reach its goal of achieving nearly 25% forest cover nation-wide by 2020—mainly via its Grain-for-Green program, which reforests steeply sloping farmland—and its forest conservation policies that limit logging. It's a remarkable achievement, though a recent study suggests that forest conservation efforts in China may have had the side effect of shifting deforestation to other countries in Asia and around the world (Viña et al. 2016).

Another large-scale forest conservation program in Asia, Vietnam's Forest Protection and Development Fund (VNFF), has managed to scale up rapidly in its first five years of national implementation. Thirty-seven of Vietnam's 63 provinces have a fund in place to disburse payments from forest ecosystem services users to individual and community forest owners. An estimated one-fifth of forests in the country are the target of VNFF payments, which have stabilized since 2012 to around $60M each year. Still, there's work to do: a 2014 review of the first three years of national implementation found that many forest ecosystem services users, particularly in the hydropower sector, have refused to pay mandatory VNFF fees. Debt owed to the program by these users is estimated to be at least $13M (USAID n.d.). The review also found delays in disbursements due to scientific, technical, and coordination gaps, and low overall awareness of the program and the benefits of forest conservation. The Vietnamese government has tracked an overall increase in forest cover and a drop in forest violations, but acknowledges it has still fallen a bit short of forest cover goals as of 2015, thanks to ongoing illegal logging and forest loss from fires (VietnamNet 2015).

At the basin level, we found that Southeast Asia continues to shift away from the classic PES model, a trend first identified in the *State of Watershed Investment 2014* (Bennett and Carroll 2014). PES pilots initiated in the first decade of this century report better success in using the language of "co-investment" in the watershed and promoting good stewardship, rather than focusing on performance-based payments.[18] At least seven basin-scale programs in Indonesia, the Philippines, and Nepal are closing in on a decade of successful activity as of 2015.

In India, private companies and NGOs reported partnering to demonstrate innovative approaches, including new pilots of the Gold Standard Foundation's Water Benefit Certificates and programs harnessing corporate water stewardship support for traditional rainwater harvesting, as well as soil and water conservation techniques. However, the scale of these efforts is quite small, especially considering the country's water challenges. Recent developments in India such as the 12th Five-Year Plan have set goals for strengthening water resources management in watershed development policy and planning, which has been criticized in the past for prioritizing agricultural development in dryland areas over sustainable management (Smyle et al. 2014). But to date there has been little high-level interest in incentive-based approaches.

Europe

Reform of the European Union's Common Agricultural Policy (CAP) for the 2014–2020 period included a commitment to target 30% of direct payments to farmers for "greening" measures (including for crop diversification, grassland conservation, and designation of "ecological focus areas"). The new CAP also increases rural development funds supporting more extensive environmental protection and restoration; funds for watershed-specific activities tracked

[18] For more information on the co-investment paradigm, see, for example, Namirembe et al. (2014).

in this report increased by about $2B per year for the 2007–2013 funding period. However, some environmental groups have noted that mechanisms designed to provide member states with more flexibility have resulted in loopholes and weakening of environmental measures.

In England and Wales, private water companies scaled up their investment in watershed management rapidly in the past decade, driven in large part by concerns about addressing diffuse pollution from agriculture at reasonable cost. In 2004, just two companies included watershed management proposals in their business plans; by 2014, the number of proposals had risen to 300, representing $125M in investment. Approval by the national Water Service Regulation Authority (Ofwat) was contingent on strong expected outcomes and cost-benefit ratios. The share of watershed management in water companies' asset management plans was still very small but growing, from 0.2% in the 2004 price review to 1% in 2014. Ofwat, once "quietly hostile" to watershed approaches on the grounds of consumer protection, is now increasingly supportive of watershed restoration as a first line of defense for many water quality issues (DeVial et al. 2012).

Some utilities and other local water users in England and Wales have opted to connect landholders with CAP funds and national grant programs, offering guidance and assistance in applying for subsidies, rather than providing direct payments themselves. Water users thus supplement public finance with in-kind technical advice, coordination among stakeholders, and help in prioritizing high-potential areas for restoration. Some utilities have explored leveraging public funds with their own payments but have run into barriers related to limits on subsidy payments and the measures that could be supported (Sherrington et al. 2016).

The EU Water Framework Directive, which seeks to establish a framework for community action in the field of water policy, requires that member states develop management plans for river basins. This appears to be driving the creation of new stakeholder networks and bodies of knowledge for coordinated watershed management (both prerequisites for watershed investments), as well as new tools that can catalyze investments, including from the private sector. The European Water Stewardship Standard for example has been piloted for basin planning efforts in Belgium, France, and Germany, and its parent NGO, the European Water Partnership, recently launched a platform for collective action for water stewardship in the agricultural sector.

At the EU level, a 2014 European Commission policy document on "Natural Water Retention Measures" (NWRMs) recognized green infrastructure's broad potential to cost-effectively achieve goals set out in the Water Framework Directive, Floods Directive, and Birds and Habitats Directives. But it identified a need to better integrate green infrastructure concepts into River Basin Management Plans, improve coordinated planning and financing across various policy arenas, and raise awareness among decision makers of NWRMs' multiple benefits (Cools et al. 2014).

A pilot project on NWRM supported by the EC also facilitated regional networks developing an evidence base for green infrastructure and building a community of practice. The project convened stakeholder networks in four regions: the Danube river basin, the Mediterranean sea region, Northern Europe and the Baltic Sea, and Western Europe.

Latin America & Caribbean

In Latin America and the Caribbean, the region's flagship public subsidy programs in Mexico, Costa Rica, and Ecuador remained relatively stable, with little new growth observed since cutbacks in 2009–2010. However, this is not to understate their impact, which continues to grow each year: recent studies find that Mexico's national program of Payments for Hydrological Environmental Services (in Spanish, *Programa de Pagos de Servicios Ambientales Hidrológicos*, or PSAH) has delivered 40–51% reduction in deforestation compared to a counterfactual scenario (Alix-Garcia et al. 2015), while changes to Costa Rica's Payment for Environmental Services program (*Pagos por Servicios Ambientales*, or PSA, in Spanish) helped to significantly expand contracts with small- and medium-sized landholders (e.g., those farming on less than 100 ha) and to more than double the amount of new land enrollment between 2008 and 2014 that is fully funded by ecosystem services beneficiaries providing matching funds.

In Peru, exciting policy innovations were set in motion. In 2014, the National Congress passed its "Mechanisms of Compensation for Ecosystem Services" law after six years of negotiation. The law created a legal framework for conservation activities that harness public and private capital. New regulations passed in 2016 offer further guidance on implementation of watershed investments and clarified water sector reform measures. Twelve cities have approved tariffs that include watershed investments. Lima's water utility SEDAPAL (*Servicio de Agua Potable y Alcantarillado de Lima*) announced it would invest $110M in green infrastructure and climate change adaptation over a five-year period, the largest-ever commitment by any Latin American city or water utility. The city of Lima also made headlines in 2015 when it began tapping its water fees to fund projects like the restoration of pre-Incan water management systems high in the Andes.

Collective action funds continue to drive most of the region's new growth in watershed investments. In Brazil, six "Water Producers" funds mobilized resources in states including Rio de Janeiro, São Paulo, Espirito Santo, Santa Catarina, and the Federal District. We also find a higher degree of coordination across programs and countries here than in other continents, thanks largely to the Latin American Water Funds Partnership (LAWFP), launched in 2012 with support from the Inter-American Development Bank, TNC, the Fomento Económico Mexicano, S.A.B. de C.V. (FEMSA) Foundation, and the Global Environment Facility. LAWFP provides initial capital for funds and extensive technical assistance in getting programs off the ground and ready to attract funding and endorsement from local governments, water service providers, the private sector, and other partners. To date, more than $120M has been raised by water funds for watershed protection (Ortega 2016). As of 2015, 19 active water funds operated under the LAWFP umbrella. In Brazil, the "Oasis" collective action model supported by the the Grupo Boticario Foundation, municipal governments, utilities, and other donors has also replicated rapidly, with four active and six developing watershed investment programs as of 2015.

North America

In the western United States, where forested headwaters areas are under critical threat from wildfire, insect infestations, drought, and climate-driven changes in precipitation, it's all hands on deck. The years 2014–2015 saw partnerships emerge and consolidate around watershed protection. Ironically, the financial juggernaut of fighting ever-bigger wildfires in the western United States means that the U.S. Forest Service (USFS) rarely has much budget left over for restoration projects to reduce the risk of *future* fires on its own. Instead, the USFS, other federal agencies, state land managers, and the communities and businesses downstream of forested public lands are pooling resources and expertise to ensure healthy forests. Private landowners are also beginning to engage in these coordinated efforts. Wildfire risks are widely understood as a growing challenge in the western United States, and gradually programs are piecing together watershed restoration projects encompassing multiple landowners and broad landscapes. Collective action partnerships like these delivered at least $32M to restoration of forested headwaters in western states in 2015. The federal government also scaled up support in 2014–2015 through regional initiatives like the Western Watershed Enhancement Partnership and the Collaborative Forest Landscape Restoration program.

Federal support for market-based solutions coordinating public and private investment in landscape restoration was bolstered by a November 2015 Presidential Memorandum that established a "no net loss" policy for land, water, wildlife, and other ecological resources affected by construction projects on all federal lands. The memorandum also explicitly promoted the use of market mechanisms like mitigation banking, performance-based payments, and public-private partnerships (The White House, Office of the Press Secretary 2015). This directive came on the heels of an October 2015 Presidential Memorandum requiring federal agencies to consider the value of green infrastructure and ecosystem services in their planning, regulatory, and investment decisions (Dickinson et al. 2015). And in December 2015, the Department of Interior launched a new Natural Resource Investment Center to expedite public-private investments in conservation and restoration, which takes water resources as its first main focus.

As discussed elsewhere in this report, some water quality trading markets saw a decline in volume in 2014–2015. But new trading and offsets programs began operations in California and the District of Columbia. In Virginia,

demand for phosphorus credits exceeded supply in the Potomac Basin in 2015 due to large state transportation and airport construction projects seeking to offset their impact. Private nutrient banks were the main suppliers for this new source of demand. Elsewhere in the Chesapeake watershed, Maryland took steps toward developing its trading program with the release of a Nutrient Trading Policy Statement in 2015. Meanwhile, Pennsylvania's trading program drew criticism from the USEPA over how effectively the system—particularly rules for calculating baselines for NPS crediting—would satisfy Total Maximum Daily Load pollution goals for the Chesapeake Bay.

Oceania

In Australia, national investments in water rights for the environment continued to fall off under a new Coalition government concerned about the effects large-scale buybacks have on agricultural communities. Instead, a new Water Recovery Strategy released in 2014 prioritizes infrastructure investment to improve irrigators' efficiency. In 2015, the Coalition government also set a lower limit on surface water buybacks in the Murray-Darling Basin of 1,500 gigaliters (GL), a sharp reduction from the 2,750 GL identified as necessary for recovery in the original Murray-Darling Basin Plan in 2012 and the 3,200 GL asked for by environmental groups.

Elsewhere in Australia, programs in Queensland and the Australian Capital Territory stepped up payments to farmers to manage polluted runoff to the Great Barrier Reef. Municipal water service providers in Queensland and Melbourne also continued pilot offset projects for nutrients and stormwater.

In New Zealand, Lake Taupo's nitrogen trading program hit its 2007 target of a 20% reduction in nitrogen loads three years ahead of schedule, even after the load reduction target was increased (to 180,000 kilograms), following a 2011 review suggesting the initial target of 153,000 kilograms was too low. The Lake Taupo Protection Trust, established to manage public funds for nitrogen reduction, announced that it would continue to administer existing contracts with farmers until 2018 but otherwise shift its attention to "ongoing compliance" and maintenance (Lake Taupo Protection Trust 2015).

Scaling Up Watershed Investments: Demand Drivers to Watch

Global Climate Deal Recognizes Key Role for Ecosystems in Mitigation and Adaptation — Will Funding Follow?

The year 2015 was a year of weather extremes—we saw severe droughts in California and São Paulo, deluges in India and the eastern United States, perpetual water scarcity in the Middle East, and rising seas in Bangladesh. Water-related challenges such as these will become even more frequent, severe, and unpredictable on a warming planet. Green infrastructure investments may help mitigate climate change impacts: for example, natural coastlines can buffer storm surges and slow coastal erosion; wetlands can absorb floodwaters; grasslands, forests, and urban green spaces can recharge groundwater through infiltration. Green infrastructure also requires no energy to operate and reduces urban heat island effects, improving quality of life and enhancing climate resilience in an increasingly urbanized world.

In late 2015, water leaders pushed for water to hold a more prominent role in the Paris Climate Accord. Though water wasn't mentioned in the final agreement, it was included in 75% of countries' National Adaptation Plans (NAPs) (Walton 2015). And the Climate Accord did recognize the role of ecosystems in climate mitigation and adaptation in its preamble which noted the "importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, recognized by some cultures as Mother Earth." Also, its forest clause recommends conservation and enhancement of land-based carbon sinks and reservoirs (The Paris Agreement 2016). That language allows countries to focus on ecosystem-based mitigation and adaptation strategies in their NAPs and Intended Nationally Determined Contributions (INDCs). Since NAPs will determine investment priorities as far as 50 years in the future, this is a significant step. Of course, it remains to be seen whether leaders will connect the dots between green infrastructure and climate change resilience in implementation.

Corporate Water Stewardship Commitments on the Rise

The needle hasn't moved much in terms of voluntary private sector spending on green infrastructure in the last few years. But that may change. The concept of water stewardship has been widely embraced and is (slowly) driving companies towards looking at their surrounding landscapes. Replenishment commitments have been made by Coca-Cola, SAB Miller/MillerCoors, IKEA, Diageo, Keurig, Mars, ITC Ltd., and PepsiCo, as well as multiple domestic firms in India. But concerns exist among project developers about a focus on volumetric recharge at the expense of other ecological functions and worthy projects.

Private Finance Eyes Green Stormwater Solutions and New Debt Instruments

Private capital injections in watershed investments remained scarce in 2015. The majority of private finance committed that year focused on real assets investment and water rights (Forest Trends' Ecosystem Marketplace, forthcoming), but 2016 and beyond may see growing interest in other instruments and partnerships to leverage private capital. Washington DC's Stormwater Retention Credit saw $1.7M committed by Prudential Financial for a TNC-Encourage Capital collaboration that aims to generate credits for sale through green infrastructure projects. Stormwater was also the impetus for a public-private partnership in Prince George's County, Maryland, where the county government has contracted Corvais Solutions to manage and finance $100M in green infrastructure projects. Debt instruments are also becoming more green infrastructure-friendly: a new Water Climate Bonds Standard was floated by the Climate Bonds Initiative for public consultation in late 2015. In May 2016, San Francisco Public Utilities Commission became the first entity to issue a bond under the standard. Phase II of the Water Climate Bonds Standard will develop criteria for natural infrastructure investments.

China Looks to Enforcement, Green Cities

China's latest Five-Year Plan suggests that the country will continue full steam ahead in its ambitious goals to become an "ecological civilization." The Plan includes provisions to step up enforcement of environmental laws through penalties and a clearer process for legal action against polluters. It also introduces a new system of

performance reviews for public officials, which considers environmental records as well as economic indicators (Finamore 2016).

Officials also unveiled a new urban focus for public finance for green infrastructure. In 2015, China's central authorities announced that 16 cities will participate in "Sponge City" pilots demonstrating green infrastructure to manage stormwater and other urban water challenges. The year 2015 also saw the launch of the China Mega-City Water Fund in Beijing, which aims to collect contributions from companies and private individuals for watershed protection around Beijing and to demonstrate a water fund model in China.

Vietnam Fills in Financing, Guidance Gaps

In the coming years, VNFF plans to access REDD+ funding to layer new incentives for forest conservation on top of existing payments, which currently amount to the relatively low average of $90 per household per year. The national government also plans to release guidance on implementation for the national watershed payments system and roll out improvements in monitoring and evaluation, including improved supervision of fund management and better data on forest impacts.

Whither the Brexit?

Business plans for water companies approved for 2014 by water regulators in England and Wales included significant commitments to watershed investments by 2020. But national government support for green infrastructure approaches, which has been slowly warming for nearly a decade, may now be thrown into question by the Brexit. Whether the goals set via the EU Water Framework Directive will be retained, and whether the United Kingdom will maintain its position as a leader in Europe on watershed-based strategies, remains unclear.

Natural Capital Financing Facility Aims to Blaze a Path for Conservation Finance in Europe

In 2014, the European Commission kicked off a three-year pilot of its Natural Capital Financing Facility (NCFF) funded by the European Investment Bank. In its first phase, NCFF has a budget of up to $141M (€125M) for loans and investments that to support projects taking ecosystem-based approaches to natural resources and climate adaptation challenges. It aims to focus on "bankable" initiatives that can either generate revenue or deliver cost-savings, an approach that may prick up the ears of private capital seeking investment-grade conservation projects.

Water Regulators in Latin America Lead the Way to Green Infrastructure Investments

New guidelines on green infrastructure are expected to be formally approved by the Association of Latin American Water Regulators in Spanish, Asociación de Entes Reguladores de Agua y Saneamiento de las Américas or (ADERASA) at its Assembly in November 2016. The guidance, which focuses on how utilities can design and implement watershed investments, was initially presented and reviewed at ADERASA's 2015 Assembly in Lima, which focused heavily on green infrastructure. This represents an important step institutionally; historically, the water sector in Latin America has not focused on the role of water utilities and water regulators in supporting watershed protection.

Collective Action Hits the Gas in Latin America and the Caribbean

In 2016, LAWFP announced a Phase II with the goals of operationalizing 40 funds across Latin America and the Caribbean covering at least 4M ha and enhancing water security for 80M people. Partners say they can leverage at least $500M from local stakeholders through collective action funds.

Recent US Progress on Natural Infrastructure, Collaborative Funding in the Hands of a New Administration

Citizens of the United States elected President Donald Trump and a Republican majority in both Houses of Congress. Under the Obama administration, a series of Presidential Memoranda set out path-breaking new directives on natural infrastructure, no net loss for natural resources, and public-private coordination on financing restoration (see page 44). But memoranda are easily overturned by a new President, in contrast to laws enacted

by Congress. Depending on the inclinations of the new Presidential administration, these initiatives might either advance or be eliminated or revised.

Tapping Water Markets for Conservation

Although overall value of instream buybacks has fallen in recent years thanks to Australia's curtailing of its large-scale public buybacks program in the Murray-Darling Basin, elsewhere the use of water rights acquisitions and leasing has both broadened and deepened. As companies seek to meet replenishment commitments, environmental water markets offer an intriguing "off-the-shelf" solution to meeting volumetric targets for restoring water to nature—a model with which the Bonneville Environmental Foundation has had great success via its Water Restoration Certificates.

Instream buybacks and groundwater mitigation all represent water rights transactions specifically *for* the environment. But most water rights trades are agriculture-to-agriculture or agriculture-to-urban in nature. Our tracking finds a growing interest in using these kinds of trades to generate benefits for nature as well. TNC launched a new vehicle designed to do so in Australia in 2016, the Australian Balanced Water Fund. The fund solicits impact capital for investment in a portfolio of water rights in the Murray-Darling Basin. It generates returns through sales and leasing of water rights, mainly for agricultural use, but a portion of allocations are held in trust to restore water to high-value wetlands in the Murray-Darling Basin. The fund launched with $27M in capital and aims to scale up to $76M in the next four years. TNC aims to replicate the model, which it calls Water Sharing Investment Partnerships (WSIPs), in other areas where it works.

Meanwhile in the United States, a number of local Natural Resource Districts in Nebraska have implemented uni-directional trading rules for groundwater rights transactions that can also generate water for the environment with every trade. Depending on hydrological relationships between groundwater and surface water, sometimes the sale of groundwater rights results in negative impacts on streamflows if the new buyer is located in a higher-"damage" area than the seller. Here, a "damage factor" is applied to the trade to assure that streams are not affected. If the buyer is in a lower-damage area than the seller, then a 1:1 trade is approved. Either way, trading automatically results in enhanced streamflows. And since buyers and sellers will only trade where there is economic opportunity in doing so, the mechanism allows agricultural economies to grow while protecting water resources.

Chesapeake Bay Ponders a Marriage of the Markets

US states sharing the Chesapeake Bay Basin are considering steps to harmonize three different state programs overseeing nutrient trading in Virginia, Pennsylvania, and Maryland. At present, different rules and crediting standards impede cross-border trading. A Maryland Nutrient Trading Policy Statement released in late 2015 notes potential benefits of harmonization, though this would be a complicated endeavor. Mutual recognition of other states' rules, or seeking compatibility without a full overhaul of trading frameworks, may be possible. Meanwhile, Pennsylvania's system has come under criticism from the USEPA over certification of agricultural credits. The state must bring its system into line with what USEPA deems necessary to meet the Chesapeake Bay Total Maximum Daily Load (TMDL) by introducing new trading ratios and performance-based crediting. Some market watchers worry these changes will have a dampening effect on that market.

Scaling Up Watershed Investments: Technical and Financial Capacity Challenges Pose Barriers to Growth

Program developers reported that their major challenges in scaling up transactions and impact in the coming years are regulatory uncertainty, achieving local buy-in, and sufficient financial/technical capacity (Figure 20). "Finding buyers" comes in surprisingly low on the list. Instead, programs worry about long-term outlook for regulatory supports, building effective local relationships, and legal barriers to watershed investments (such as water utilities' ability to spend ratepayer fees on watershed projects, or legal constraints on public funds being placed in an interest-bearing water fund).

In respondents' concerns about managing funds and demonstrating benefits, we also saw evidence of a lingering "capacity gap" in terms of local technical and financial ability to develop effective green infrastructure investments. These "upstream" challenges related to project design and implementation are likely to affect programs' ability to engage buyers "downstream." As this report goes to press in late 2016, money appears to be waiting in the wings for attractive watershed investment projects. In Peru, for example, $135M committed by Lima's water utility SEDAPAL remains mostly on the sidelines given a dearth of local watershed investment projects ready to accept funding. Would-be buyers often seek a detailed "business case" for watershed investments and a clear sense of ROI. Yet, program administrators may have limited bandwidth to respond to these information needs; instead, programs report that they are contending with more fundamental challenges like regulatory uncertainty and developing local technical capacity for watershed management.

Figure 20: Barriers to Scaling up Watershed Investments Reported by Programs

Notes: Respondents were asked to select up to three key challenges for scaling up their programs. The ten most commonly reported barriers to scale are displayed in this figure.

Methodology

What Does This Report Series Track?

The *State of Watershed Investment* series is designed to document annual transactions for watershed services globally, as well as trends in demand and supply, program design, and documented outcomes. Data comes primarily from program administrators through a biannual survey. The report's scope includes any type of financial mechanism linking a buyer and seller in which the exchange is intended to ensure the supplier's provision of watershed services (or some proxy indicator). For public subsidies for watershed protection, we reviewed existing agricultural subsidies and included in our scope only payments explicitly linked to activities or outcomes conserving or improving green infrastructure on agricultural lands important for watershed services. For more information on the types of programs tracked in this report, please see the "Watershed Investment 101" chapter.

Where Does the Data Come from?

Ecosystem Marketplace gathers data through a biannual global survey of program administrators; ongoing tracking through program reports, donor reports and databases, statistical yearbooks, credit ledgers, and credit registries; and interviews with program administrators and market intermediaries. The survey, which gathered data on activity in 2014 and 2015, was available online and disseminated via personal contacts and Ecosystem Marketplace newsletters and announcements from March 28 until June 1, 2016. To avoid double-counting volumes reported by both project developers and brokers, we asked respondents to specify the volume of offsets transacted through a broker or exchange. If we identified an overlap, the transaction was counted only once.

What Was the Response Rate for This Report?

We collected data on 472 active, pilot-stage, developing, or inactive/completed programs, representing 91% of 521 potentially active programs identified in a scoping exercise. Twenty-two programs were determined to be inactive. Survey respondents represented an array of government agencies, NGOs, water utilities, businesses, and regulators. In total, we received survey data from 142 program administrators overseeing watershed investment programs in 2015 and gathered data on another 330 programs through desk research and interviews with market actors. Where data was collected from secondary sources, Ecosystem Marketplace attempted to contact programs to verify this information.

What Estimated Share of Watershed Investments Does Ecosystem Marketplace's Survey Capture?

We attempt to capture 100% of active watershed investments programs globally, but it is impossible to identify every initiative or to discern the level of activity by organizations that choose not to respond to our survey. We believe this report to be the most comprehensive review of market-based mechanisms for watershed services currently available, but we make no guarantees as to its completeness. Additionally, we do not capture most direct investments in green infrastructure, such as a municipality installing bioswales along city streets, since value does not pass from a buyer to a seller in these cases.

How Does Ecosystem Marketplace Ensure the Confidentiality of Survey Responses and Reported Data?

In general, Ecosystem Marketplace reports only aggregated data. Any program-or project-level transaction data mentioned in this report or on our Watershed Connect program inventory (http://www.watershedconnect.org/programs) was already public information or has been approved by the supplier; otherwise it is treated as confidential. Additionally, we do not identify prices or volumes from any country or market for which we have fewer than three data points. We do not share program information with third parties without prior permission.

How Do You Calculate Aggregate Transaction Values?

All transaction figures presented in this text were either reported by programs or obtained via desk research. For programs that reported credit volume data, but not price data, for individual transactions, we use the market-wide

average credit price to estimate overall market value. Where no transaction or price data is available, we do not extrapolate to estimate market size. In other words, this report represents our most comprehensive picture of global watershed investments yet, but it is by no means the complete picture.

How Does This Report Define a Transaction?

We consider transactions to occur at the point of exchange between a buyer and a program administrator or a buyer and seller directly where offsets or agreed deliverables are contracted, regardless of the date of delivery. We count all transactions in the year in which they took place, regardless of "compliance year" or when credits were delivered/activities paid for were implemented; thus, for example a "forward" credit sold in 2014 for the 2015 compliance year would be included in 2014 transaction values.

Do You Screen Programs for Quality?

Ecosystem Marketplace does not apply quality screens to programs or credits, as the aim of this report is to provide the most comprehensive picture possible on watershed investment activity. We do follow up with survey respondents or third parties where necessary to clarify or confirm data that is incomplete or raises a red flag.

How Can I Find Out More about Specific Programs?

A portion of the dataset underlying this report is available publicly in a web-based program inventory that we maintain, at http://www.watershedconnect.org/programs.

My Program Is Not Included in This Report and I Think that It Should Have Been.

We encourage you to contact report authors (at info@ecosystemmarketplace.com). You can also submit a program profile online at http://www.watershedconnect.org/programs.

References

Abildtrup, Jens, Frank Jensen, and Alex Dubgaard. "The Coase Theorem and Real Markets: An Empirical Analysis of Negotiations between Waterworks and Farmers in Denmark." In *Miljøøkonomiske Råds Konference*, pp. 21-p. 2010.

Alix-Garcia, Jennifer M., Katharine RE Sims, and Patricia Yañez-Pagans. "Only One Tree from Each Seed? Environmental Effectiveness and Poverty Alleviation in Mexico's Payments for Ecosystem Services Program."*American Economic Journal: Economic Policy* 7, no. 4 (2015): 1–40.

Alliance for Water Stewardship. "World First Gold alliance for Water Stewardship Certification." Alliance for Water Stewardship. November 26, 2015. Accessed October 18, 2016. http://waterstewardship.org.au/wp-content/uploads/2015/11/WSA_Inghams-Certification_26.11.15.pdf.

Anderson, Pam, Bill Dunn, Tannie Eshenaur, Suzanne Hanson, Andy Holdsworth, David L. Miller, Margaret Wagner, Marcey Westrick, and David Wright. *Clean Water Fund Performance Report*. Minnesota Legacy, 2016. https://www.pca.state.mn.us/sites/default/files/lrp-f-3sy16.pdf.

Australian Government Department of Agriculture and Water Resources. "Average prices of offers pursued from recent tenders." Commonwealth Water purchasing in Murray-Darling Basin. Last modified July 26, 2015. Access October 17, 2016. http://www.agriculture.gov.au/water/markets/commonwealth-water-mdb/average-prices.

Australian Government Department of the Environment. *Water Recovery Strategy for the Murray-Darling Basin.* Commonwealth of Australia, 2014. https://www.environment.gov.au/system/files/resources/4ccb1c76-655b-4380-8e94-419185d5c777/files/water-recovery-strategy-mdb2.pdf.

Aylward, Bruce, Jayanta Bandyopadhyay, Juan-Carlos Belausteguigotia, Peter Borkey, A. Z. Cassar, Laura Meadors, Lilian Saade et al. "Freshwater ecosystem services." *Ecosystems and human well-being: policy responses*3 (2005): 213–256.

Barrett, Kelli. "The Value of Nature To Be Recognized In Every US Federal Agency Under New Guidance." *Forest Trends' Ecosystem Marketplace*, October 9, 2015. Accessed October 18, 2016. http://www.ecosystemmarketplace.com/articles/value-of-nature-in-federal-agencies/.

Barrett, Kelli. "Brazilian Ecosystem Services Matrix Brings Transparency To Environmental Finance." *Forest Trends' Ecosystem Marketplace*, June 5, 2015. Accessed October 17, 2016. http://www.ecosystemmarketplace.com/articles/brazilian-ecosystem-services-matrix-brings-transparency-to-environmental-finance/.

Bennett, Genevieve and Nathaniel Carroll. *Gaining Depth: State of Watershed Investments 2014*. Washington, DC: Forest Trends, 2014.

Bristol Avon Rivers Trust, Environmental Gain Ltd, Bath Spa University, and RM Wetlands & Environment. *Payments for Ecosystem Services (PES)—Pilot PES Research Project.* The Tortworth Brook Project: Final Report, 2014. http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=18550.

Centre for Local Economic Strategies and Wildlife Trust for Lancashire, Manchester and North Merseyside. "Payment for ecosystem services—Irwell Catchment." Centre for Local Economic Strategies and Wildlife Trust for Lancashire, Manchester and North Merseyside, 2015. http://randd.defra.gov.uk/Document.aspx?Document=13742_FinalReportforpublicationApril2016.pdf.

Climate Change News. "India turns back clock to save water, as climate concerns mount." *Climate Change News*. June 4, 2015. Accessed October 18, 2016. http://www.climatechangenews.com/2015/04/06/indiaturnsbackclocktosavewaterasclimateconcernsmount/.

Coca-Cola HBC. *Building a Stronger Coca-Cola Hellenic. 2012 Integrated Report*. Coca-Cola Hellenic, 2012. http://coca-colahellenic.com/media/1203/2012_iar.pdf.

Columbia Basin Water Transactions Program. Water Transactions Data. National Fish and Wildlife Foundation, N.d. Accessed May 11, 2016. http://www.cbwtp.org/jsp/cbwtp/projects/index.jsp.

Connecticut Department of Energy and Environmental Protection and the Connecticut Nitrogen Credit Advisory Board. Betsy Wingfield to Connecticut Nitrogen Trading Program Participants, "Notice of Future Plans of the Nitrogen Trading Program," N.d. http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/future_nitrogen_trading_program.pdf.

Connecticut Nitrogen Credit Advisory Board. *Report of the Nitrogen Credit Advisory Board for Calendar Year 2013 to the Joint Standing Environment Committee of the General Assembly*. Connecticut Department of Energy and Environmental Protection, 2014. http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/nitrogen_report_2013.pdf.

Consolidated Act No. 130 on Water Supply etc. as amended by section 10 of Act No. 355 of 2 June 1999 and Act No. 374 of 2 June 1999. Ministry of Environment and Energy, Danish Environmental Protection Agency (February 26, 1999).

Cools, Jan, Pierre Strosser, Evdokia Achilleos, Thomas Borchers, Steffen Ochs, Axel Borchmann, Emmanuel Steinmann, Martina Bussettini, Maddalena Mattei Gentili, Francesco Gigliani, Liliana Cortellini, Barry van de Glind, Rob van de Veeren, Roy Richardson, Paul Brotherton, Chris Baker, Martina Mlinaric, Lucile DeBoisson, Benoît Fribourg-Blanc, and Natacha Amorsi. EU policy document on Natural Water Retention Measures. Luxembourg: European Union, 2014.

Cronin, Amanda, and Lara Fowler. "Northwest Water Banking: Meeting instream and out of stream water needs in the Pacific Northwest," *The Water Report* 102, (2012):10–16.

Danish Ministry of the Environment. "Afforestation: Increasing the forest area helps protect the drinking water resource." *Danish Environment and Energy Newsletter* 8 (June 2001). http://www.mex.dk/uk/vis_nyhed_uk.asp?id=1957&nyhedsbrev_id=215.

Denny, Rowland. "Connecticut's Nitrogen Trading Program." Presentation to Connecticut Department of Energy and Environmental Protection Headquarters, Hartford, CT, September, 2014. http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/9_17_14_pres_futureplans_ntp.pdf.

DeVial, L., L. Smith, M. Payne, J. Atkinson, A. Darvey, P. Hickey, and A. Murkherjee. "A record of the question and answer sessions." Panel debate at Protecting Water Catchments from Diffuse Pollution—the Emerging Evidence, Birmingham, United Kingdom, February 21, 2012. Accessed October 17, 2016. http://www.rsc.org/images/Panel_Debate_tcm18-216649.pdf.

Dickinson, Tamara, Timothy Male, and Ali Zaidi. "Incorporating Natural Infrastructure and Ecosystem Services in Federal Decision-Making." White House Blog. October 7, 2015. Accessed October 18, 2016. https://www.whitehouse.gov/blog/2015/10/07/incorporating-natural-infrastructure-and-ecosystem-services-federal-decision-making.

Environmental Registry—Public View. Markit Financial Information Services. http://www.markit.com.

Esralew RA. "Overview of the Central Valley Project Improvement Act and the Refuge Water Supply Program in Relevance to the National Wildlife Refuge System." Unpublished, United States Fish and Wildlife Service, 2013. https://ecos.fws.gov/ServCat/Reference/Profile/36692.

European Commission, European Structural and Investment Funds. ESIF 2014–2020 Achievement Details [Data set]. European Commission, 2016. https://cohesiondata.ec.europa.eu/dataset/ESIF-2014-2020-Achievement-Details/aesb-873i.

European Commission, European Structural and Investment Funds. ESIF 2014–2020 Finance Details [Data set]. European Commission, 2016. https://cohesiondata.ec.europa.eu/dataset/ESIF-2014-2020-FINANCE-DETAILS/e4v6-qrrq.

European Commission. *Rural Development in the EU Statistical and Economic Information Report 2012*. European Commission, 2012. http://ec.europa.eu/agriculture/statistics/rural-development/2012/index_en.htm.

European Commission. Supporting the Implementation of Green Infrastructure. European Commission, 2014. http://ec.europa.eu/environment/nature/ecosystems/docs/green_infrastructures/GI%20Final%20Report.pdf

European Community. *Fourth National Report of the European Community to the Convention on Biological Diversity*. European Community, 2009.

Finamore, Barbara. "Tackling Pollution in China's 13th Five Year Plan: Emphasis on Enforcement." *The Huffington Post*, March 11, 2016. Accessed October 17, 2016. http://www.huffingtonpost.com/barbara-a-finamore/tackling-pollution-in-chi_b_9441574.html.

Forest Fund Foundation Fukuoka. "Forest reclamation development projects, business performance of the water source." Forest Fund of Water Sources. N.d. Accessed October 17, 2016. http://www.f-suigen.or.jp/02/04.html.

Forest Trends' Ecosystem Marketplace. *State of Private Investment in Conservation.* Washington, DC: Forest Trends, forthcoming.

Fukuoka City Waterworks Bureau. "Fukuoka City tap water sources recharge business fund." Water Source and Water Quality Information. April 21, 2016. Accessed October 18, 2016. http://www.city.fukuoka.lg.jp/mizu/ryuiki/0037.html.

Fukuoka City Waterworks Bureau. *Waterworks Technologies of Fukuoka City, Overcoming Water Shortages*. Fukuoka City Waterworks Bureau, N.d. http://www.city.fukuoka.lg.jp/data/open/cnt/3/1796/1/English.pdf.

Gassert, Francis, Matt Landis, Matt Luck, Paul Reig, and Tien Shiao. *Aqueduct global maps 2.1: Constructing decision-relevant global water risk indicators*. Washington, DC: World Resources Institute, 2014.

General Mills. "General Mills announces global water stewardship commitment." Minneapolis: General Mills, March 22, 2016.

Goldsmith, Louise. "Building Community Flood Resilience in West Sussex." Presentation at National Flood Forum Conference, London, March 2014.

Goldstein, Allie and Franziska Ruef. *View from the Understory: State of Forest Carbon Finance 2016*. Washington DC: Forest Trends, 2016.

Government of the Netherlands. *Draft National Water Plan 2016–2021*. Government of the Netherlands, 2014. Accessed October 18, 2016. https://www.government.nl/binaries/government/documents/policy-notes/2014/12/23/draft-national-water-plan-2016-2021/draft-national-water-plan-2016-2021.pdf.

Greci, Dennis. "The View from DEEP." Connecticut Department of Energy and Environmental Protection, 2013.

Greiber, Thomas, Chantal van Ham, Gerben Jansse & Marta Gaworska. *Final report study on the Economic value of groundwater and biodiversity in European forests*. The IUCN Regional Office for Europe. Brussels: IUCN, 2009.

Guide2. "World's only nitrogen trading market assessed." Guide2. July 16, 2015. Accessed October 18, 2016. http://www.guide2.co.nz/money/news/business/worldsonlynitrogentradingmarketassessed/11/28498.

Hamrick, Kelley and Kelli Barrett. "New DOI Investment Center Seeks To Water The Thirsty West." *Forest Trends' Ecosystem Marketplace*. December 16, 2015. Accessed October 18, 2016. http://www.ecosystemmarketplace.com/articles/new-doi-investment-center-seeks-to-water-the-thirsty-west/.

Holland, Craig. "Financing solutions for storm water run-off." *Environmental Finance*. June 15, 2016. Accessed October 18, 2016. https://www.environmentalfinance.com/content/analysis/financingsolutionsforstormwaterrunoff.html.

Inoue, Makoto, and Hiroji Isozaki, eds. *People and forest—Policy and local reality in Southeast Asia, the Russian Far East, and Japan*. Vol. 3. Springer Science & Business Media, 2013. Kenny, Alice. "The Inside Story of Peru's Shift to Green Infrastructure." *Forest Trends' Ecosystem Marketplace*. November 17, 2015. Accessed October 18, 2016.http://www.ecosystemmarketplace.com/articles/inside-perus-coming-green-water-revolution-2/.

Lake Taupo Protection Trust. *Chairman's Report on Trust Operations For the Year Ended 30th June 2015*. Lake Taupo Protection Trust, 2015. http://www.laketaupoprotectiontrust.org.nz/file/downloads/pdf/chairs-annual-report-ye-30.6.15.pdf.

Madsen, Becca, and Jessica Fox. *Development of Water Quality Trading Standards 2014 Technical Report*. Palo Alto, CA: Electric Power Research Institute (EPRI), 2014.

Mills, Ann and Ellen Gilinsky. "EPA and USDA Pledge Actions to Support America's Growing Water Quality Trading Markets." *USDA Blog*. August 2, 2016. Accessed October 18, 2016. http://blogs.usda.gov/2016/08/02/epa-and-usda-pledge-actions-to-support-americas-growing-water-quality-trading-markets/.

Milman, Oliver. "More than $1.7bn needed to improve water quality on the Great Barrier Reef." *The Guardian*. January 19, 2015. Accessed October 18, 2016. https://www.theguardian.com/environment/2015/jan/20/more-than-17bn-needed-to-improve-water-quality-on-great-barrier-reef.

Namirembe, Sara, Beria Leimona, Meine van Noordwijk, Florence Bernard, and Kukunda E. Bacwayo. "Co-investment paradigms as alternatives to payments for tree-based ecosystem services in Africa." *Current Opinion in Environmental Sustainability* 6 (2014): 89–97.

New South Wales Environment Protection Authority. *Hunter River Salinity Trading Scheme Credit Auction 2014 auction report*. NSW Environment Protection Authority, 2014. http://www.epa.nsw.gov.au/resources/licensing/hrsts/14804hrstsaucrep2014.pdf.

North Carolina Department of Environmental Quality, Division of Mitigation Services. DMS Project Documents [Data set]. North Carolina Department of Environmental Quality, 2016. Accessed May 5, 2016. https://deq.nc.gov/about/divisions/mitigation-services/dms-projects.

North Carolina Department of Environmental Quality, Division of Mitigation Services. Private Mitigation Banks CreditLedgers. Nutrient Offset & Buffer Mitigation Program. N.d. Accessed May 5, 2016. https://deq.nc.gov/about/divisions/water-resources/water-resources-permits/wastewater-branch/401-wetlands-buffer-permits/401-nutrient-offset-buffer-mitigation-program.

OECD. *Agricultural Policy Monitoring and Evaluation 2016*. OECD, 2016. DOI: 10.1787/agr_pol-2016-en.

OECD. *Water Governance in the Netherlands: Fit for the Future?* OECD Studies on Water, OECD Publishing, 2014. http://dx.doi.org/10.1787/9789264102637-en.

Ortega, Santiago. "Latin American partnership to provide water security for 80 million people." *The Guardian*. N.d. Accessed October 18, 2016. https://www.theguardian.com/femsa-partner-zone/2016/jul/06/latin-american-partnership-to-provide-water-security-for-80-million-people.

Pennsylvania Department of Environmental Protection. 2014 Nitrogen Generators. Pennsylvania Department of Environmental Protection, 2016. Accessed October 18, 2016. http://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/NutrientCreditRegistry/2014_Nitrogen_Generators.pdf.

Pennsylvania Department of Environmental Protection. 2014 Phosphorus Generators. Pennsylvania Department of Environmental Protection, 2016. Accessed October 18, 2016. http://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/NutrientCreditRegistry/2014_Phosphorus_Generators.pdf.

Pennsylvania Department of Environmental Protection. 2015 Nitrogen Generators. Pennsylvania Department of Environmental Protection, 2016. Accessed October 18, 2016. http://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/NutrientCreditRegistry/2015_Nitrogen_Generators.pdf.

Pennsylvania Department of Environmental Protection. 2015 Nutrient Buyers Summary. Pennsylvania Department of Environmental Protection, 2016. Accessed October 18, 2016. http://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/NutrientCreditRegistry/2015_Nutrient_Buyers_Summary.pdf.

Pennsylvania Department of Environmental Protection. 2015 Phosphorus Generators. Pennsylvania Department of Environmental Protection, 2016. Accessed October 18, 2016. http://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/NutrientCreditRegistry/2015_Phosphorus_Generators.pdf.

Pennsylvania Department of Environmental Protection. Certified Nutrient Credit Generator Proposals. Pennsylvania Department of Environmental Protection, 2016. Accessed October 18, 2016.http://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/NutrientCreditRegistry/Certified_Nutrient_Credit_Generator_Proposals.pdf.

Pennsylvania Department of Environmental Protection. Nutrient Credit Registry [Data set]. Pennsylvania Department of Environmental Protection, 2016. Accessed October 18, 2016. http://www.dep.pa.gov/Business/Water/PointNonPointMgmt/NutrientTrading/Pages/NutrientCreditRegistry.aspx.

Poole Harbour Catchment Initiative. *Catchment Plan Update May 2014*. Bath, United Kingdom: Wessex Water, 2014.

Portland General Electric Company and Confederated Tribes of the Warm Springs Reservation of Oregon. *Pelton Round Butte Project (FERC 2030) Pelton Round Butte General Fund and Water Rights Fund 2014 Report*. Portland General Electric Company and Confederated Tribes of the Warm Springs Reservation of Oregon, 2014. https://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13560654.

Public Act No. 15–38. State of Connecticut. June 5, 2015.

RES. "Virginia DOT Selects RES for MultiYear Supply of Nutrients Offsets" Richmond, VA: RES, July 23, 2015. http://www.businesswire.com/news/home/20150722005067/en/CORRECTING-REPLACING-Virginia-DOT-Selects-RES-Multi-Year.

Richter, Brian. *Water Share: Using water markets and impact investment to drive sustainability*. The Nature Conservancy: Washington, D.C., 2016.

Rogers, S., Rose, S., Spence, J. and Hester, N. *Holnicote Payments for Ecosystem Services (PES) Pilot Research Project 2014–2015: Final Report to Defra on Project NR0156*. London: Department for Environment, Food, and Rural Affairs, 2015.

Rozza, Joe Paul, Brian D. Richter, Wendy M. Larson, Todd Redder, Kari Vigerstol, and Paul Bowen. "Corporate Water Stewardship: Achieving a Sustainable Balance." *Journal of Management and Sustainability* 3, no. 4 (2013): 41. RSPB. *The Feasibility of a Nitrogen PES Scheme in the Poole Harbour Catchment*. RSPB, 2013. Retrieved from https://www.cbd.int/financial/pes/unitedkingdom-poole.pdf.

SANBI. *A Framework for investing in ecological infrastructure in South Africa*. Pretoria: South African National Biodiversity Institute, 2014.

Schachtschneider, Klaudia. *Breede Catchment Water Stewardship Programme—Summary report*. WWF, 2016.

Schaefer, K.S. "A-B InBev: How a Global Brewer Is Setting the Bar for Innovation in Local Water Conservation." *Sustainable Brands*. November 9, 2015. Accessed October 18, 2016. http://www.sustainablebrands.com/news_and_views/leadership/kim_soko_schaefer/-b_inbev_how_global_brewer_setting_bar_innovation_local.

Schwagerl, Christian. "With Too Much of a Good Thing, Europe Tackles Excess Nitrogen." *Yale Environment 360*. April 14, 2015. Accessed October 18, 2016. http://e360.yale.edu/feature/with_too_much_of_a_good_thing_europe_tackles_excess_nitrogen/2865/.

Sherrington, Chris, Dominic Hogg, and Ayesha Bapasola. *Winford Brook PES Pilot Research Project*. Bristol, UK: Eunomia, 2016. http://www.eunomia.co.uk/reports-tools/payments-for-ecosystem-services/.

Sherrington, Chris. "Payments for Ecosystem Services Round 3: Winford Brook PES Pilot Research Project." Presentation to Chew Valley Area Forum, Bath, UK, April 2016. Accessed October 18, 2016. http://www.bathnes.gov.uk/sites/default/files/winford_brooks_project.pdf. Short, C., J. Phelps, D. Henehan, C. Staddon, S. Wells, and J. Turvill. *Cotswold Catchment Payments for Ecosystems Services Pilot: Catchment Based Approach Collaborative Project Demonstrating the Integrated Local Delivery Framework, Defra Project Report NE0144, Defra funded Round 2 PES pilot*. CCRI: Gloucester, 2014.

Smith, Laurence, Keith Porter, Kevin Hiscock, Mary Jane Porter, and David Benson, eds. *Catchment and river basin management: integrating science and governance*. Routledge, 2015. Smyle, Jim, Crispino Lobo, Grant Milne, and Melissa Williams. *Watershed Development in India: An Approach Evolving through Experience. Agriculture and Environmental Services Discussion Paper 04*. Washington DC: World Bank, 2014.

The Nature Conservancy. "New Investment Model for Green Infrastructure to Help Protect Chesapeake Bay." Washington, DC: The Nature Conservancy, March 7, 2016. http://www.nature.org/newsfeatures/pressreleases/new-investment-model-for-green-infrastructure-to-help-protect-chesapeake-bay.xml.

The White House, Office of the Press Secretary. "Presidential Memorandum: Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment." The White House. November 3, 2015. Accessed October 18, 2016. https://www.whitehouse.gov/the-press-office/2015/11/03/mitigating-impacts-natural-resources-development-and-encouraging-related.

Trung, Pham Van "Lessons and experiences from implementation of PFES in Vietnam." Presentation at ASFN Workshop, Inle Lake Myanmar, June 2015.

UNFCCC. "Paris Pact on Water and Climate Change Adaptation Announced." UNFCC, December 2, 2015. http://newsroom.unfccc.int/lpaa/resilience/press-release-lpaa-resilience-1-paris-pact-on-water-and-climate-change-adaptation-announced/.

United Nations. *Paris Agreement*. Bonn: United Nations Framework Convention on Climate Change, 2015. http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

United States Bureau of Reclamation. *Executive Summary, 2015 CVPIA Planned Activities*. United States Bureau of Reclamation, n.d. Accessed October 18, 2016. https://www.usbr.gov/mp/cvpia/docs_reports/awp/2015/docs/Exec_Summary.pdf.

United States Department of Agriculture Office of Communications. "Forest Service partnership effort improves health of America's Forest." United States Department of Agriculture News Releases, April 7, 2015. Accessed October 18, 2016. http://www.fs.fed.us/news/releases/forest-service-partnership-effort-improves-health-americas-forest.

United States Department of Agriculture Office of Communications. (2016, July 18). "USDA Announces $260 Million Available for RCPP." United States Department of Agriculture News Releases, July 18, 2016. Accessed October 18, 2016. http://southeastagnet.com/2016/03/16/136425/.

United States Environmental Protection Agency. "319 Grant Program for States and Territories." Polluted Runoff: Nonpoint Source Pollution. Last modified February 2, 2016. Accessed October 17, 2016. https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/319-grant-program-states-and-territories.

United States Environmental Protection Agency. "EPA, MDE, Prince George's County Announce Public, Private Partnership Model to Accelerate Green Stormwater Controls and Support Local Job Creation." EPA Newsroom, January 10, 2014. Accessed October 18, 2016. https://yosemite.epa.gov/opa/admpress.nsf/596e17d7cac720848525781f0043629e/c73e9dd8611d83ad85257c5c005cbd1b!OpenDocument.

USAID EC-LEDS. *Vietnam: Preserving Forests, Engaging Communities*. USAID, 2016. https://www.ec-leds.org/sites/default/files/Vietnam%20PFES%20Success%20Story.pdf.

USAID. *Improving PFES implementation through Communities of Practice*. USAID, n.d. Accessed October 18, 2016. http://www.snv.org/public/cms/sites/default/files/explore/download/vfd_story_pfes_cop.pdf.

van den Brink, C., A. Dries, C. Steinweg, and W.J. Zaadnoordijk. "Drenthe takes action to reduce risks of pesticides; Number of harmful substances and crops still requiring attention." Presentation to AquaConsoil Barcelona 2013, 12th International UFZ-Deltares Conference on Groundwater-Soil-Systems and Water Resource Management, Barcelona, Spain, April 2013.

Van Wye, Brian. "Making stormwater retrofits pay." *Water Environment & Technology Magazine*, 24 (2012), 64–67.

Vietnam Forest Protection and Development Fund. *Payments for forest environmental services (PFES) in Vietnam: Findings from three years of implementation*. Vietnam Forest Protection and Development Fund, 2014. http://www.cifor.org/publications/pdf_files/factsheet/5066-factsheets.pdf.

VietnamNet. "Vietnam falls short on forestry protection plan." *VietnamNet*. December 17, 2015. Accessed October 18, 2016. http://english.vietnamnet.vn/fms/environment/148807/vietnam-falls-short-on-forestry-protection-plan.html.

Viña, Andrés, William J. McConnell, Hongbo Yang, Zhenci Xu, and Jianguo Liu. "Effects of conservation policy on China's forest recovery." *Science advances* 2, no. 3 (2016): e1500965. Virginia Department of Environmental Quality. *Trading Nutrient Reductions from Nonpoint Source Best Management Practices in the Chesapeake Bay Watershed: Guidance for Agricultural Landowners and Your Potential Trading Partners*. Virginia Department of Environmental Quality, 2008. http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/VANPSTradingManual_2-5-08.pdf.

Virginia Department of Environmental Quality. *2014 Nutrient Trades Report*. Virginia Department of Environmental Quality, 2015. http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/NutrientTradesReport2014.pdf.

Virginia Nutrient Credit Exchange Association. *Exchange Compliance Plan 2015 Annual Update*. Virginia Department of Environmental Quality, 2015.http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/ExchangeCompliancePlan-2015AnnualUpdate.pdf.

Walker Basin Restoration Program. Willing Seller Water and Land Acquisitions. National Fish and Wildlife Foundation, 2013. http://www.walkerprogram.org/wp-content/uploads/2013/10/WBRP-Acquisitions-Table-16_0627.pdf.

Walton, Brett. "Water Gained Stature at Paris Climate Talks." *Circle of Blue*. December 15, 2015. Accessed October 18, 2016. http://www.circleofblue.org/2015/world/water-gained-stature-at-paris-climate-talks/.

Walton, Brett. "Water Buyback Limit Proposed for Australia's Murray-Darling Basin." *Circle of Blue.* June 3, 2015. Accessed October 18, 2016. http://www.circleofblue.org/2015/australia/waterbuybacklimitproposed foraustraliasmurraydarlingbasin/.

Washington Department of Ecology. "Ecology committed $6.7 million in drought relief funding for 2015." Washington Department of Ecology. February 5, 2016. Accessed October 18, 2016. Retrieved from http://www.ecy.wa.gov/programs/wr/funding/fo-2015-expend.html.

Water Environment Federation. "China Announces Sponge City Pilots." *The Stormwater Report*, April 27, 2015. http://stormwater.wef.org/2015/04/chinaannouncesspongecitypilots/.

World Resources Institute. *Comparison and effectiveness of Chesapeake Bay nutrient trading program policies*. Washington DC: United States Department of Agriculture Office of Environmental Markets, n.d. http://www.usda.gov/oce/environmental_markets/files/ComparisonEffectivenessChesBayNutrient TradingPolicies.pdf.

Zwick, Steve. "Lima to Invest $110 Million in Green Infrastructure and Climate Adaptation." Forest Trends' Ecosystem Marketplace. April 30, 2015. Accessed October 18, 2016. http://www.ecosystemmarketplace.com/articles/lima-invest-110-million-green-infrastructure-climate-adaptation/.

Appendix: Directory of Program Developers

Organization	Country	Website
Department of Environment, Water and Natural Resources	Australia	www.environment.sa.gov.au
Fundação Grupo Boticário de Proteção à Natureza	Brazil	www.fundacaogrupoboticario.org.br
Município de Montes Claros	Brazil	www.montesclaros.mg.gov.br
Prefeitura de São José dos Campos	Brazil	www.sjc.sp.gov.br
Prefeitura Municipal de Guaratinguetá	Brazil	n/a
Project Management Unit "Programa Produtor de Água do ribeirão João Leite"	Brazil	n/a
Serviço Autônomo Municipal de Água e Esgoto	Brazil	www.samaesbs.sc.gov.br
The Nature Conservancy	Brazil	http://www.tnc.org.br/
ALUS Canada	Canada	www.alus.ca
Government of Prince Edward Island	Canada	n/a
Asociacion de productores de caña de azúcar de Colombia	Colombia	www.asocana.org
Bogotá Water Fund ("Agua Somos")	Colombia	Under construction
Medellín Water Fund ("Cuenca Verde")	Colombia	http://www.cuencaverde.org/
The Nature Conservancy	Colombia	http://fundosdeagua.org/es
Valle del Cauca Water Fund ("Agua por la Vida y la Sostenibilidad")	Colombia	Under construction
ESPH (Empresa de Servicios Publicos de Heredia)	Costa Rica	www.esph-sa.com
Fundación para el Desarrollo de la Cordileera Volcánica Central (FUNDECOR)	Costa Rica	www.fundecor.org
Nectandra Institute	Costa Rica	www.nectandra.org
Aalborg Municipality	Denmark	n/a
FONAPA	Ecuador	www.fonapa.org.ec
FORAGUA	Ecuador	www.foragua.org
Municipality of San Pedro de Pimampiro	Ecuador	www.pimampiro.gob.ec
Gemeindewerke Kaufering	Germany	http://www.kaufering.de

Organization	Country	Website
Pronatura Noroeste	Mexico	www.pronatura-noroeste.org
Protección de la Fauna Mexicana, A.C.	Mexico	n/a
Sendas AC	Mexico	www.sendas99.wordpress.com www.pixquiac.org
Amazónicos por la Amazonía	Peru	www.ampaperu.info
Comité Gesor del Mecanismo de Retribución por Servicios Ecositémicos	Peru	n/a
University of Lisbon and WWFMedPo	Portugal	www.wwf.pt
South Africa Department of Environmental Affairs Natural Resource Management Programmes	South Africa	https://www.environment.gov.za/projectsprogrammes/wfw
Four Returns	South Africa	www.fourreturns.co.za
Ruvuma Basin Water Board	Tanzania	http://ruvumabasin.or.tz/
Wami Ruvu Basin Water Board	Tanzania	http://www.wamiruvu.co.tz/
Pangani Basin Water Board	Tanzania	http://www.panganibasin.com/
Bear Creek Watershed Association	United States	www.bearcreekwatershed.org
Conservation Marketplace Midwest	United States	http://www.conservationmarketplacemidwest.org/
Massachusetts Department of Conservation & Recreation	United States	www.mass.gov/dcr
Minnesota Department of Agriculture	United States	http://www.mda.state.mn.us/protecting/waterprotection/awqcprogram.aspx
National Forest Foundation	United States	www.nationalforests.org
The Freshwater Trust	United States	www.thefreshwatertrust.org
Tierra Resources	United States	www.tierraresourcesllc.com
Water Resources Research Center	United States	www.conserve2enhance.org
International Water Stewardship Programme	Zambia	http://www.iwasp.org/what-we-do/partnership/zambia-itawa-springs-protection-project-0 http://www.iwasp.org/what-we-do/partnership/zambia-lusaka-water-security-initiative-luwsi

Note: These program developers responded to Ecosystem Marketplace's survey in 2016 and indicated that they would like to be listed in the report directory. This is not a comprehensive list of all watershed investment program developers.

Our Supporters

Schweizerische Eidgenossenschaft
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Swiss Agency for Development and Cooperation SDC

The Swiss Agency for Development and Cooperation (SDC) is Switzerland's international cooperation agency within the Federal Department of Foreign Affairs (FDFA). In operating with other federal offices concerned, SDC is responsible for the overall coordination of development activities and cooperation with Eastern Europe, as well as for the humanitarian aid delivered by the Swiss Confederation. The goal of development cooperation is that of reducing poverty. It is meant to foster economic self-reliance and state autonomy, to contribute to the improvement of production conditions, to help in finding solutions to environmental problems, and to provide better access to education and basic healthcare services.

MacArthur Foundation

The John D. and Catherine T. MacArthur Foundation (www.macfound.org) supports creative people and effective institutions committed to building a more just, verdant, and peaceful world. In addition to selecting the MacArthur Fellows, the Foundation works to defend human rights, advance global conservation and security, make cities better places, and understand how technology is affecting children and society. MacArthur is one of the nation's largest independent foundations. Through the support it provides, the Foundation fosters the development of knowledge, nurtures individual creativity, strengthens institutions, helps improve public policy, and provides information to the public, primarily through support for public interest media.

Good Energies
POWER FOR A BETTER WORLD

Good Energies Foundation (http://www.goodenergies.org) supports sustainable systems that can prevent poverty and disruption caused by climate change in the Global South. Good Energies Foundation was established in 2007 and founded as an integral part of Good Energies Inc., a private equity company specialised in investing in the renewable energy and energy-efficiency industries. Good Energies Foundation's historical mission is the alleviation of future poverty in the Global South by mitigating climate change. Good Energies Foundation initially leveraged its know-how in solar photo-voltaic to provide access to clean energy, especially in the area of rural electrification. At a later stage, climate-change related solutions were added to the portfolio, including sustainable reforestation models. As temperatures rise, we believe that innovative solutions are urgently needed to prevent the future displacement and impoverishment of the world's most vulnerable populations.

FOREST TRENDS

The Family of Forest Trends Initiatives

Biodiversity Initiative

Promoting development of sound, science-based, and economically sustainable mitigation and no net loss of biodiversity impacts

Coastal and Marine Initiative

Demonstrating the value of coastal and marine ecosystem services

Communities Initiative

Strengthening local communities' capacity to secure their rights, manage and conserve their forests, and improve their livelihoods

Ecosystem Marketplace

A global platform for transparent information on environmental finance and markets, and payments for ecosystem services

Forest Policy, Trade, and Finance Initiative

Supporting the transformation toward legal and sustainable markets for timber and agricultural commodities

Public-Private Finance Initiative

Creating mechanisms that increase the amount of public and private capital for practices that reduce emissions from forests, agriculture, and other land uses

Water Initiative

Promoting the use of incentives and market-based instruments to protect and sustainably manage watershed services

Learn more about our programs at www.forest-trends.org