Economic Valuation of Watershed Systems:
A Tool for Improved Water Resource Management

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ECONOMIC VALUATION OF WATERSHED SYSTEMS:
A TOOL FOR IMPROVED WATER RESOURCE MANAGEMENT
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Background: Intro to Environmental Valuation & Watershed Management

In recent years, international discussions on poverty reduction and sustainable development have led to a high level of political support for water management as a global issue. At the OAS General Assembly meeting in June 2007, for example, two major resolutions were adopted that underscore the importance of water resource management in terms of health, human rights and sustainable development. Of particular note, the GA passed Resolution 2347, which calls for an Inter-American Meeting on the Economic, Social, and Environmental Aspects related to the Availability of and Access to Drinking Water, to be held in the first quarter of 2008. Although such concern for the sub par management practices which magnify pressure on water resources is noteworthy and indicative of positive progress toward the development of an improved approach to water management, it is crucial to note that high levels of political support have rarely translated into sufficient levels of investment to effectively advance water resource management. The 2005 Millennium Ecosystem Assessment concludes that globally, 60 percent of all ecosystem services are currently being degraded and used unsustainably, while two ecosystem services in particular – capture fisheries and fresh water – have already depleted far beyond levels required to sustain current demands. Moreover, the MEA stresses that in spite of increased political support, between five and twenty-five percent of all global freshwater uses currently exceed long-term accessible supplies, and now require use of engineered water transfers and/or the overdraft of groundwater supplies to provide drinking water to populations living in these "hotspots."

From an economic standpoint, watersheds provide a diverse array of goods and services to society. These include both market goods and services, such as drinking water for example, as well as non-market goods and services such as the storm protection functions provided by mangroves or the water filtration functions provided by wetlands.[2] Although various studies including one by the United Nations Economic Commission for the European Union note that degradation of watershed services represents a loss of capital assets, significant gaps remain at the policy and methodological levels in terms of economically quantifying both the costs of water related investments as well as the direct and indirect costs of watershed degradation, and the multiple benefits of supporting integrated water resource management. Put simply, there is currently no unified framework though which policy-makers can effectively access information and best practices that academics in the field of environmental economics have developed with regard to valuation of water resources.

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[1] This Note has been prepared by Jeffrey Goldberg of the OAS Department of Sustainable Development. Views expressed in this information note do not necessarily reflect the position of the OAS member countries or the OAS General Secretariat

[2] Gleick 1993, Naiman et al. 1995, Postel and Carpenter 1997

Thus, this background paper provides an analysis of some of the opportunities and challenges associated with performing economic cost-benefit analysis of water management practices as part of the process of developing policy options. It is hoped that this will spark discussion with regard to the topic as the agenda for the upcoming Inter-American meeting on water is addressed, and that economic valuation and cost-benefit analysis will be utilized increasingly as policy-makers seek to improve upon current approaches to water resource management**.**

According to a recent study by the Nature Conservancy and USAID, the vast majority of current management practices currently employed across the Western Hemisphere do not fully capture the total economic value of watershed systems. As in other areas of environmental valuation and related environmental accounting procedures, the key challenge remains measuring 'non-market' services.[3] For example, natural hydrological functions, sustainable upstream agricultural practices such as soil conservation and associated protection of downstream areas against flooding and sedimentation all contribute to the economic value people derive from the watersheds in which they live. However, since these ecosystem functions are not measured and exchanged within economic markets, they typically elude market prices.[4] Because of the perceived complexity of measuring the economic value of these ecosystem functions, the non-pricing or under-pricing of watershed ecosystem services perpetuates a vicious cycle in which environmental degradation is never fully considered as a component of market prices. In effect, existing investment flows are prioritized for other initiatives, and many of the most valuable goods and services generated by water systems are not given due consideration as watershed management projects are formulated and implemented at the policy level.[5]

As such, it is proposed that a Stern-like report on the economic costs and benefits of watershed management be prepared for the Americas in the coming months to help advance policy matters. It is in this light that this paper highlights the benefits of using economic valuation techniques as tools that can effectively intersect with and facilitate the formulation of stronger water management policies that account more fully for the total economic value of the goods and services generated by watersheds. Beginning with a brief overview of economic valuation as a foundation for analysis, this paper ultimately stresses that watershed valuation techniques represent a crucial first step through which policymakers can monetarily convey the need for increased investment in the protection of natural water resources, and can justify the enactment of policies such as Payment for Ecological Services to more optimally manage watersheds' goods and services to the benefit of both civil society and national economies.

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[3] Karin M. Krchnak, *Watershed Valuation as a Tool for Biodiversity Conservation,* TNC & USAID, 2007*:* 4

[4] Michael Richards, *The Potential for Economic Valuation of Watershed Protection in Mountainous Areas: A Case Study from Bolivia*, Mountain Research and Development, Vol. 17 No. 1 (Feb. 1997): 19.

[5] Lingappan Venkatachalam, *Economic Valuation of Watershed Services of Commons: Marginal Opportunity Cost Approach within the Environmental Accounting Framework*: 1

Economic Valuation: Overview

To begin, the objective of watershed valuation projects is two-fold. First, valuation techniques help policymakers quantify in economic terms the relative importance of natural water systems. And second, such techniques provide a basis for enabling policymakers to balance preservation of such systems while simultaneously enhancing economic returns on the environmental goods and services they provide. As noted, neglecting to account for the total economic value of watersheds creates a serious policy dilemma, as it becomes impossible for management projects to sustain the integrity of entire water systems when investment rates do not reflect all of the intrinsic values tied to such systems. Traditionally, water management has focused on meeting the human demand for potable water through investment in downstream purification technologies. This approach, however, has failed to stimulate due consideration toward the inextricable link between clean drinking water and natural ecological and hydrological functions of watersheds. The quantity and quality of marketed drinking water is wholly dependent upon upstream variables such as existing agricultural practices, soil conservation and levels of forestation, all of which heavily impact the overarching functionality of natural ecological and hydrological watershed processes and in turn affect the drinking water consumed by downstream communities. If upstream management practices such as organic agriculture, sustainable livestock management, soil conservation and reforestation are neglected, traditionally utilized downstream purification technologies may prove more costly than beneficial, as it may become necessary to retrofit capital to correct for increased degradation of upstream water sources, which directly impact the quality and quantity of downstream water.[6]

Accounting for the total economic value of watersheds and integrating upstream variables into current management practices, however, provides leverage for an alternative management option in which policymakers can manage water resources more holistically and in which the livelihoods of upstream communities may be simultaneously improved (e.g., farmer's enhanced long-term return via soil conservation). Thus, internalizing the non-market values (externalities) tied to watersheds will result in more socially and economically optimal use of water systems.

In order to attain an optimal level of management that will both preserve environmental integrity and enhance returns on watersheds, policies must reflect the value of ***all*** possible marginal benefits and costs tied to water management projects. From a neoclassical economic standpoint, communities tend to balance marginal benefits and marginal costs in order to formulate and enforce policies. If marginal costs exceed marginal benefits, then communities will not have any incentive to invest more in the existing framework of watershed management. Thus, through analysis of aggregate benefits and costs associated with a given watershed, project managers can calculate the **total economic value** of the benefits and costs generated by such systems, and thus can formulate and enforce more effectively managerial polices within the watershed at hand.[7]

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[6] Karin M. Krchnak, *Watershed Valuation as a Tool for Biodiversity Conservation,* TNC & USAID, 2007*:* 4

[7] Matthew Wilson and Stephen Carpenter, *Economic Valuation of Freshwater Ecosystem Services in the United States: 1971 – 1997.* Ecological Applications 9(3), 1999: 77

However, at present, the total economic value assigned to watersheds tends to be grossly inaccurate. Watershed management projects typically only account for those values that are directly measured by economic markets. Given that the most up to date watershed assessments do not account for non-market values, current policy tends to underestimate total economic values of such systems. Without efforts to quantify the non-market benefits associated with goods and services generated by watersheds, policy and managerial decisions hold the potential to be skewed in favor of environmentally degrading practices by neglecting the diffuse interests that benefit from many of the non-market oriented characteristics of such systems.[8] To curtail the impact of such negative externalities and correct the total economic value of environmental assets, economists and other policy-oriented social scientists have developed a diverse array of techniques for measuring the value of non-market environmental goods and services.

Before delving into analysis of such techniques, it is useful to consider the different types of values embedded within watershed systems, and how such values impact the measurement of economic benefits and costs. The total economic value of watershed systems is comprised of both 'direct-use' and 'non-use' values. Direct use values of watersheds are comprised of the values that people derive from directly utilizing an associated good or service, such as a watershed's drinking water or its irrigation capacity. Though most directly linked to human well being, such values comprise only a portion of the total economic value of watersheds. Resource managers and policymakers should be aware that 'nonuse' values, which refer to the present or future value that people may derive from goods and services independent of any direct use, also comprise a significant portion of a watershed system's economic value.

Non-use values include 'existence values' and 'pure non-use values,' as well as 'bequest values' and 'option values.'[9] Bequest values and option values constitute the non-use values that have the greatest effect on the economic value of natural watersheds. Bequest values arise from the desire of individuals to preserve watersheds for the use of future generations. Option values, on the other hand, arise from uncertainty about the future demand or supply for watershed goods and services. Neglecting the importance of such non-use values holds the potential to result in the depletion, degradation and over-exploitation of watershed resources in the long term, which would cause an overall loss of social welfare[10]. Accordingly, such values constitute the logic behind movement toward improved upstream management practices such as organic agriculture, sustainable livestock management, soil conservation and reforestation.[11] However, given that the temporal scope of these non-use values is grounded in the preservation of future goods and services of watersheds, markets for such

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[8] Matthew Wilson and Stephen Carpenter, "Economic Valuation of Freshwater Ecosystem Services in the United States: 1971 – 1997." *Ecological Applications* 9(3), 1999: 77

[9] G.D. Anderson and R.C. Bishop, "The Valuation Problem," *Natural resource economics: policy problems and contemporary analysis,* Boston, 1986: 102.

[10] E. Barbier, "The Economic Value of Ecosystems: 2-Tropical Forests." LEEC Gatekeeper GK 91-01. London Environmental Economics Centre, International Institute for the Environment and Development, London, 1991.

[11] Matthew Wilson and Stephen Carpenter, *Economic Valuation of Freshwater Ecosystem Services in the United States: 1971 – 1997.* Ecological Applications 9(3), 1999: 77

amenities simply do not exist, and as such the present need for the aforementioned practices of sustainable watershed management cannot be quantified or accurately understood. Hence, economists and policy-oriented social scientists utilize a wide range of valuation techniques to measure the value of non-market environmental goods and services, with the objective of demonstrating the total economic value of assets being assessed and to ensure that available resources are being optimally allocated and that calls for additional investments can be justified if they are needed. To date, valuation techniques have been applied periodically at the policy level, but have by and large, remained relatively confined to the academic sphere. Such techniques, however, are of little practical value unless applied at the policy level. Accordingly, the following section describes several environmental valuation techniques as they relate to the goods and services generated by watersheds, and highlights how these techniques can be of benefit to policy-makers responsible for addressing key environmental issues.[12]

Valuation for Watershed Systems

Throughout the past three decades, environmental economists have developed various kinds of economic valuation techniques that have proven successful in identifying the value of non-market benefits associated with the environment and natural resources. As noted, for such techniques to tangibly contribute toward the preservation of environmental resources and the enhancement of social welfare, it is imperative that policymakers be aware of their utility and practical application. In the case of economic valuation of watershed benefits a plethora of different approaches currently exist. These can be classified into two categories – revealed preference methods, and stated preference methods.

- *Revealed Preference Methods:*

To place a monetary value on an environmental asset, revealed preference methods draw upon information pertaining to individual preferences for environmental and natural resources through direct or surrogate market comparisons. Put simply, revealed preference approaches place value on non-market goods and services by extrapolating and drawing correlations from related market data. In terms of watershed valuation, two revealed preference approaches are particularly useful – the hedonic pricing method and the production function or averting behavior method.

- HEDONIC PRICING – To place values on watershed goods and services, the hedonic pricing approach estimates a statistical relationship between the attributes of specific surface freshwater systems and the price of a good for which a market already exists in that same system.[13] In other words, the hedonic model assumes that market goods, such as houses, have values influenced, in part, by the characteristics

[12] It is important to note that a detailed technical analysis of these techniques does not fall within the scope of this paper and as such, the following descriptions are simply meant to serve as an overview of current valuation techniques, so as to present these methods as politically viable topics.

[13] Matthew Wilson and Stephen Carpenter, *Economic Valuation of Freshwater Ecosystem Services in the United States: 1971 – 1997.* Ecological Applications 9(3), 1999: 776

of neighboring ecosystems.[14] Based on this assumption, the benefits observed in such market goods due to improvement in watersheds can be captured through changes in the market prices of the related goods. For instance, with all other variables held constant, the benefits of improved watershed management could be identified by tracking increases in land prices within the region at hand.

- PRODUCTION FUNCTION METHOD – To monetize values of watershed goods and services, the production function approach establishes a relationship between an environmental input and a resulting output, and then utilizes current market prices of the output to value the environmental input. In cases where change in the environmental input alters the production of goods related to the resulting output, the production function method measures the difference between the profit before the change and after the change by taking all productive adjustments into account. For instance, if deterioration in irrigation water quality alters the entire production function (i.e. – altering the amount of fertilizers used, pesticides used, etc.) then the economic value of the loss is measured in terms of the change in agricultural profit taking all productive adjustments into account. Thus, the production function method internalizes non-market watershed values by considering all changes incurred at the productive level on account of environmental inputs, such as chemical regulation and changed agricultural practices.

- *Stated Preference Method*

In the case of the stated preference method, the contingent valuation (CV) method is the most appropriate approach in terms of identifying the total economic value of watershed benefits.[15] To place monetary values on the non-market goods and services generated by watersheds the CV method directly solicits willingness to pay (WTP) estimates from a random sample of the population living within the region of interest. To attain these estimates, the CV valuation approach utilizes sample surveys, which pose a series of questions related to hypothetical projects and policy initiatives. Such CV surveys typically consist of three major parts, which include (1) the scenario or description of the policy or program by which the good or service is going to be provided; (2) a value elicitation mechanism; and (3) questions pertaining to the socio-economic, demographic and environmental factors that could potentially influence the value individuals attribute to the environmental good or service at hand.[16] Put simply, a typical CV survey presents a scenario of a watershed and a series of questions related to a hypothetical market in which benefits associated with a potential change in the given watershed might be purchased. Thus, the values revealed by respondents are said to be contingent upon hypothetical markets presented in the survey instrument.[17] In this light, it is important to note that the theoretical

[14] Ibid.
[15] Lingappan Venkatachalam, *Economic Valuation of Watershed Services of Commons: Marginal Opportunity Cost Approach within the Environmental Accounting Framewor*: 1.
[16] Matthew Wilson and Stephen Carpenter, *Economic Valuation of Freshwater Ecosystem Services in the United States: 1971 – 1997*. Ecological Applications 9(3), 1999: 778.
[17] Ibid.

construct of the CV method is the root of much criticism, as many economists are wary of relying on hypothetical transactions to reflect how people would behave in a functioning market.[18]

Of all the outlined valuation techniques no single approach has been deemed most useful in terms of illuminating the total economic value of watershed environments. Though no particular technique is more valid than another, the estimation of meaningful economic values for all individuals that might potentially benefit from water quality improvements remains a considerable methodological challenge. As noted, to capture the "total economic value" of a given improvement in a watershed system, both use and nonuse values must be estimated. The methods outlined above differ greatly in terms of both data requirements and underlying assumptions about economic and environmental linkages. Because each valuation method targets a different aspect of total economic value, their respective estimation potentials tend to be limited to different aspects of the total environmental service packages tied to watershed systems. Thus, to accurately determine the total economic value of any given watershed, policymakers would be best advised to utilize several of the described valuation methods within the specific region or watershed of interest. Of course, federal agencies that have heretofore never used such valuation studies should not be expected to blindly implement such techniques. As such, the following section provides an overview of a case study in which several valuation techniques were successfully utilized to establish an estimate for a water-user fee to be used to support the preservation of non-market watershed benefits.

Application of Watershed Valuation: Successful Case Studies and Ensuing Results

To date, many federal and local agencies have successfully utilized the aforementioned valuation techniques to catalyze shifts in current water management practices in various settings across the globe. Within Latin America and the Caribbean, the Nature Conservancy has spearheaded several valuation initiatives in recent years to amass support for increased investment in the preservation of watersheds and the goods and services they provide. Although a wide range of successful case studies exist, for brevity's sake, this section provides an overview of a single watershed valuation project initiated by partnerships between the Nature Conservancy, USAID and local agencies to assess the total economic value of the Sierra de las Minas Biosphere Reserve in Guatemala. Beginning with a brief overview of the Biosphere Reserve, this section ultimately illustrates how the valuation studies conducted by these agencies acted as a driving force behind the formulation and implementation a water user-fee, and for new policies that reflected a more integrated approach to watershed management within the Reserve.

- SIERRA DE LAS MINAS BIOSPHERE RESERVE, GUATEMALA

The Sierra de las Minas Biosphere Reserve contains sixty-three rivers and provides drinking water to over

[18] Matthew Wilson and Stephen Carpenter, *Economic Valuation of Freshwater Ecosystem Services in the United States: 1971 – 1997.* Ecological Applications 9(3), 1999: 778.

500 rural communities (approximately 400,000 people). As such, the continual flow of these rivers is vital to the livelihoods of these rural communities and serves a number of functions such as irrigation of subsistence crops and small scale cattle pastures, processing of coffee and fruit for exports, and the production of hydroelectric energy. Despite the socioeconomic and financial values of these water resources, a recent study by the Nature Conservancy notes that current land use practices are degrading the watersheds of the Biosphere. Specifically, inappropriate agricultural and cattle ranching practices have caused deforestation rates to skyrocket within the Biosphere, which has lead sharp decreases in water supply, particularly during the dry season.[19]

In an effort to improve upon existing watershed management practices within the Sierra de las Minas Biosphere Reserve in Guatemala, a small NGO by the name of *Fundacion Defensores de la Naturaleza (Defensores)* partnered with The Nature Conservancy and USAID and conducted several watershed valuation studies to convey the value of integrating upstream forest conservation into existing practices of watershed management. By using the valuation techniques noted above, *Defensores* successfully generated baseline estimates for the total economic value embedded within the watersheds of the hemisphere. Specifically, *Defensores* utilized contingent valuation studies, production expenditures evaluations and analysis of subsidiary markets to measure the total economic value of the Biosphere's watersheds, and assumed that existing water management practices would lead to a 20 – 30% reduction in current levels of forestation and stream flow. The study ultimately calculated that deforestation and reduced stream flow would lead to an annual loss of US$15,000 - US$52,000 in terms of net agricultural profits, and that a water user fee of US$ 0.38 to US$ 1.99 per cubic meter would generate sufficient funds to initiate reforestation projects in upstream watershed regions, and enforce sustainable practices to prevent future forest degradation.[20][21]

The findings of the valuation study prompted immediate action at community and policy levels, raising awareness with regard to the value of water within rural communities throughout the Biosphere and augmenting the political leverage of *Defensores* as an organization. Since the publication of the valuation study's findings, *Defensores* has formed three pilot watershed committees in the three largest watersheds within the reserve – San Jeronimo, Teculutan and Lato. Such initiatives have been met with great success, as governmental investment in watershed related services has markedly increased since the formation of these organizations. In the dry season of 2004, for example, 14 municipalities in and around the Reserve fronted the funds to provide for a total of 15 municipal park guards to work with *Defensores* staff and Guatemala Protected Areas Council (CONAP) park guards to address upstream threats, such as forest fires, to downstream water quality. Investment rates in watershed management initiatives have continued to increase over time. In 2005, the total of municipal park

[19] Karin M. Krchnak, *Watershed Valuation as a Tool for Biodiversity Conservation,* TNC & USAID, 2007*:* 14
[20] Ibid.
[21] Brown, M., de la Roca, I., Vallejo, A., Ford, G., Casey, J., Aguilar, B. and R. Haacker. *A Valuation Analysis of the Role of Cloud Forests in Watershed Protection: Sierra de las Minas Biosphere Reserve, Guatemala and Cusuco National Park, Honduras,* RARE Center for Tropical Conservation, Fundacíon Defensores de la Naturaleza and Fundacíon Ecologica. 1996.

guards employed within the reserve had raised to 30 while 6 municipal fire brigades were created and began working in upstream areas of the Reserve.

Moreover, within the Teclutan watershed, *Defensores* has facilitated the formation of the Pro-Teculutan River Sierra de las Minas Biosphere Reserve Association, through which a comprehensive watershed management plan has been developed to guide land use planning and define priorities related to water use, reforestation, environmental education and productive agricultural activities. Additionally, *Defensores* has been working with city officials to develop a public outreach campaign that seeks to incorporate the voice of local peasants into the discussions and plans initiated by the Pro-Tecultutan River Sierra de las Minas Association.[22]

Clearly, the field of environmental economics is making strides toward providing techniques through which the true value of environmental and natural services can be conveyed to project managers, policy-makers and potential investors to catalyze unified movement toward a more integrated approach to watershed management. Indeed the case study of Sierra de las Minas illustrates that valuation of watersheds holds the capacity to achieve this end. It is important to note, however, that the successful application of such valuation techniques requires a level of technical expertise that is often not available in many localized settings. In the aforementioned case studies, the Nature Conservancy and the USAID brokered watershed valuation studies, and transmitted the findings of these evaluations to the appropriate local agencies. However, this kind of direct multi-lateral assistance cannot be applied in all countries and in all necessary settings on a long-term basis. As such, the Rio Summit on Sustainable Development in 1992 issued a key document suggesting that governments of participating countries utilize environmental accounting to harmonize existing economic policies with policies pertaining to the management of natural resources and the environment.[23]

Environmental accounting can be applied in various settings, ranging from small and large business enterprises to federal agencies charged with the formulation of national policies. Given that this paper's aim is to highlight the merits of employing valuation techniques as a key component of federal policymaking, this paper focuses on environmental accounting from the national level. In this context, environmental accounting systems measure both the contribution of the environment to the national economy and the impact of the economy on the environment by synthesizing data from these disciplines within a common framework. In other words, by monitoring and monetizing national consumption of natural resources environmental accounting provides policy-makers with indicators and descriptive statistics to monitor interactions between economic activity and environmental assets, and measures the costs and benefits of actual and potential policies upon the economy and the environment.[24] In 2003, the United Nations Statistics Division (UNSD) thrust environmental accounting into the international limelight by spearheading efforts to make the practice of environmental accounting more coherent and accessible to all its member countries. Specifically, the UNSD developed 'The Handbook of

[22] Karin M. Krchnak, *Watershed Valuation as a Tool for Biodiversity Conservation,* TNC & USAID, 2007*:* 16
[23] Kirk Hamilton and Ernst Lutz, *Green National Accounts: Policy Uses and Empirical Experience,* World Bank, July 1996.
[24] Ibid.

National Accounting: Integrated Environmental and Economic Accounting,' referred to as SEEA 2003, which highlights mechanisms through which any nation can compile information regarding the environment and measure the actual or potential economic and environmental impact of federal policies upon such natural resources.[25] In addition to unifying statistical frameworks, SEEA 2003 developed a database for strategic planning and policy analysis to identify more sustainable paths of development. With these unified frameworks, the information needed to conduct valuation of environmental goods and services is now more readily accessible to policymakers and relevant stakeholders, and in effect the total economic value of environmental assets such as watersheds can be compared to present investment rates directed toward such resources.

Indeed, since SEEA 2003's publication, environmental accounting systems have mushroomed in countries across the globe, and information from such systems has been utilized successfully to justify the implementation of policies that account for the total value of environmental assets (the internalization of the environmental externality). A global assessment of environmental statistics and environmental-economic accounting conducted by the United Nations Statistics Division in 2006, for example, indicated that environment statistics and environmental-economic accounting systems are now well-established and expanding components of national accounting programs across the globe. Specifically, the survey indicated that 50 per cent of responding countries possessed an environmental accounting programs and 70 per cent of respondents expressed plans to expand existing programs both in terms of broadening informational scope of existing systems and expanding regional assessments.[26] In a geographical breakdown, the study indicated that 22% of LAC countries possessed an environmental accounting system at the time the survey was conducted.

Within the context of water management in particular, environmental accounting systems hold the capacity to relay the results generated by valuation studies to policymakers, such as the cost-effectiveness of integrating upstream and downstream management practices. In effect, environmental accounting systems play an invaluable role in terms of evaluating the economic and environmental efficiency of current water management practices, as they provide a common informational baseline through which stakeholders and decision-makers may assess the cost-effectiveness of existing policies and investment rates, and enact changes accordingly. Interestingly, the global assessment of environmental accounting systems conducted by the UNSD notes that water accounts are among the modules most consistently compiled within existing environmental accounting programs. The study highlights that the LAC region in particular has been noted as a forerunner in terms of water accounting.[27] Just last month, the UNSD and the Central Bank and Ministry of Environment of the Dominican Republic jointly convened a Regional Workshop on Water Accounting for LAC countries in Santo Domingo of the Dominican Republic. The workshop intended to: (a) to provide an overview of environmental accounting; (b) to present the framework and uses of the System of Environmental-Economic

[25] UN Statistical Division - http://unstats.un.org/unsd/statcom/doc07/Analysis_SC.pdf
[26] UN Statistical Division - http://unstats.un.org/unsd/statcom/doc07/Analysis_SC.pdf
[27] Ibid.

Accounts for Water (SEEAW); and (c) to discuss the requirements for the advancement of the implementation of the SEEAW in the LAC region.[28] Thus, a regional framework is emerging through which environmental accounting systems are being formally recognized and promoted as tools that can be used to bridge the gap between the information provided by valuation studies and the development and enforcement of policies that reflect the total value identified by such evaluations. It is in this light that the following section explores the link between valuation studies/environmental accounting systems and Payment for Ecological Service schemes.

Payment for Environmental Services

In cases where current management practices are deemed sub par by valuation studies and/or environmental accounting systems, direct payments for ecological services (PES) can be justified by policymakers and stakeholders as part of the costs needed to manage watershed systems more cost-effectively. PES systems can broadly be defined as initiatives that aim to alter the incentives of service managers and/or to generate resources to finance conservation efforts by incorporating and selling environmental services in formal economic markets.[29]According to the Nature Conservancy & USAID, PES schemes in the water sector promote the conservation of upstream areas and, ultimately, entire watersheds through compensation for environmentally sound land uses practices.[30] Such compensations can be made through taxation incentives, trust-fund disbursement or direct remuneration between bilateral or multilateral parties.[31] In the Sierra de las Minas case study, for example, valuation techniques were utilized to establish and enforce a water user fee. As noted, the funds collected from this water fee were allotted to compensate Park Rangers to monitor and protect the environmental integrity of upstream land use and to improve the quality and quantity of downstream drinking water accordingly. Thus, by taxing all public water consumers, involved governmental agencies were able to accrue the financial resources needed to compensate the park rangers to regulate the non-market benefits identified by the valuation projects in a more socially and environmentally optimal manner.

Clearly, the idea of internalizing positive environmental externalities by way of a remuneration mechanism is of sound logic and has been met with great success in a wide range of different settings. However, the question remains as to what type of payment mechanism would most efficiently generate sustainable financial resources to enforce policies that account for the total value of the goods and services generated by watersheds on a long term basis. According to a study conducted by Scherr, existing PES schemes can be classified into the following four categories:

- *PUBLIC PAYMENT* – In this system, various levels of the governmental system possess the power to determine which environmental services are top priority for conservation, and

[28] UN Statistical Division - http://unstats.un.org/unsd/envaccounting/workshops/provisionalAgenda2007.pdf
[29] Sheila Wertz Kanounnikoff (Iddri), *Payments for environmental services – A solution for biodiversity conservation?* Iddri – Idees pour le debats 07/2006: 7
[30] Karin M. Krchnak, *Watershed Valuation as a Tool for Biodiversity Conservation,* TNC & USAID, 2007*:* 1.
[31] S. Pagiola, *Payment for Envrionmental Services*, Environment Matters, World Bank, 2000

implements payment schemes accordingly. For example, the current PES System used to fund the preservation of environmental services generated by forests in Costa Rica was designed and is still implemented by a governmental agency, known as FONAFINO.[32]

- *OPEN-TRADING* – In this PES scheme, the government determines the mandatory level of specific ecosystem service to be provided as well. However, under this model involved parties can decide to either comply with regulations or compensate by paying others who are in the position to supply the service more cheaply. A common example of a successful Open-Trading PES Scheme is the Clean Water Act, which was enforced by the US government in 1972 and ultimately led to the development of wetland mitigation banks.[33]
- *SELF-ORGANIZED PRIVATE PAYMENT DEALS* – This approach involves closed transactions between offsite beneficiaries and service providers. This PES scheme ensures the conservation and continued provision of environmental goods and services through "conservation-concession" type agreements between NGO's, governments and local land users to. In the Cauca Valley of Colombia, for instance, a collection of private water user associations successfully developed a private interest group, known as the Association of Water Users, through which involved parties voluntarily pay fees to the regional environment authority, the Cauca Valley Corporation (CVC), to enhance upstream-downstream preservation efforts.[34]

To date, no studies provide definitive conclusions with regard to which PES mechanism most efficiently contributes to the preservation of watershed goods and services. This, of course, is largely due to the wide range of political, social, economic and environmental settings in which watersheds are situated. Indeed, the majority of currently existing PES schemes across the globe have been developed along regionally-specific lines. As of September 2004 over 300 different PES schemes had been inventoried throughout the world, each with unique objectives and technical payment mechanisms set up with deference to local specificities.[35] Nevertheless, within the context of watershed management the growing application of PES schemes to water related initiatives is indicative of a growing awareness among governmental actors, project managers and local stakeholders with regard to the total economic value of water. For example, while past water values were solely monetized by virtue of direct use values, such as demand for drinking and agricultural purposes, current water user fees across the hemisphere are increasingly incorporating the value of benefits not traditionally measured by market

[32] K. Chomitz, E. Brenes, L. Constantino, *Financing Environmental Services: The Costa Rican Experience,* World Bank: Central America Country Management Unit, Latin America and The Caribbean Region, June 1998. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2000/08/26/000094946_00081505312640/Rendered/PDF/multi_page.pdf

[33] Sheila Wertz Kanounnikoff (Iddri), *Payments for environmental services – A solution for biodiversity conservation?* Iddri – Idees pour le debats 07/2006: 10

[34] Marta Echevarria, *Water User Associations in the Cauca Valley, Colombia: A volunteer mechanism to promote upstream-downstream cooperation in the protection of rural watersheds*, Food and Agriculture Organization of the United Nations, April 2002.

[35] Keryl Meynard and Marc Paquin, *Payment for Environmental Services: A Survey and Assessment of Current Schemes,* Unisfera International Centre, September 2004. http://www.cec.org/files/PDF/ECONOMY/PES-Unisfera_en.pdf.

forces into the consumer water fees, as seen in the case of Sierra de las Minas Biosphere Reserve in Guatemala. To more effectively manage watersheds across the hemisphere and globe, however, it is imperative that site-specific PES schemes continue to be implemented within localities to provide the funds needed to internalize non-market benefits such as natural hydrological functions, upstream forest conservation and sustainable agriculture. To meet this end, the total economic value of goods and services generated by watersheds must first be conveyed to project managers, governmental actors and downstream water users. As such, it is crucial that current policies and projects related to watershed management place due emphasis upon valuation studies and/or environmental accounting, so as to further the process of conveying the value tied to upstream water conservation to all relevant stakeholders, and provide leverage to utilize PES mechanisms as a means to accrue funds to be used toward the internalization of positive upstream externalities.

Conclusions

Above all else, this paper has stressed the utility of valuation studies as a tool through which positive economic externalities embedded within watershed systems can be more accurately understood and internalized. At present, the principle challenge facing watershed management programs is that the most important benefits, such as hydrological functions, soil conservation, and the associated protection of downstream areas against flooding and sedimentation are not assigned direct market values. As noted, the objective of watershed valuation projects is to help policymakers quantify in economic terms the relative importance of natural water systems and to take the actions necessary to preserve of such systems while simultaneously enhancing economic returns on the environmental goods and services that they provide. Though valuation studies are often conducted vis-à-vis partnerships with multi-lateral aid agencies and iNGO's, environmental accounting systems provide an alternative outlet through which national actors may assess the total economic value of watersheds and consider potential policy reforms accordingly. Whether brokered internationally or nationally, studies that account for the total economic value of watersheds and integrate upstream variables into current management practices provide crucial information for alternative management options in which water resources can be managed more holistically and in which the livelihoods of upstream communities may be simultaneously improved (e.g., farmer's enhanced long-term return via soil conservation). Thus, in order to internalize the non-market values tied to watersheds and achieve a more socially, economically and environmentally optimal use of water systems, water valuation studies should be considered a crucial first step in conveying the need for increased investment to all relevant stakeholders. Without these studies, federal water agencies will lack the leverage needed to justify additional calls for investment in water resources, and management projects will remain wholly unable to integrate non-market benefits, such as protection of upstream areas, into current project plans.

The upcoming watershed meetings of the OAS National Focal Points and the VI Inter-American Dialogue on Water Resource Management each present a unique opportunity for all participating countries to follow up on recent political mandates pertaining to sustainable development and integrate economic

methodologies into new policy pertaining to water systems. At present, the rapidly growing interest in economic valuation, PES, and the Stern report has shown that economic analysis can be a potent catalyst to political action. At present, the rapidly growing interest in economic valuation, PES, and the Stern report has shown that economic analysis can be a potent catalyst to political action. In the carbon markets, for example, PES schemes are playing a key role in controlling adverse emissions as evidenced by the fact that the transaction value of global carbon markets has grown to over $30 billion.

This suggests that a compelling opportunity lies ahead to utilize valuation techniques on a more holistic basis. These techniques have proven their worth in valuing environmental services within the context of individual disciplines such as water management. Similarly, they are equally effective when applied in areas such as air quality management or sustainable soil management. Perhaps their highest utility will be realized when they are applied in a "bundled" scenario where interrelated environmental services are valued as a comprehensive whole to reflect a region's cumulative environmental value. There is much ongoing discussion around the concept of valuing "bundled" services and it is the intent of Inter-American Dialogue and the OAS in particular to examine the practical issues of bundling services, and set clear goals for doing so prior to the next Inter-American meeting on water management issues in March 2008.[36]

[36] Resolution 2347 of the 37th OAS General Assembly, held in Panama in June 2007, calls for an Inter-American Meeting on the Economic, Social, and Environmental Aspects related to the Availability of and Access to Drinking Water, to be held in the first quarter of 2008. Item 6 of the Resolution instructs the General Secretariat of the OAS to include on the agenda for the upcoming meeting of focal points on integrated water resource management, to be held in August 2007, the preparation of the proposed agenda for the Inter-American meeting mentioned above, for consideration by CEPCIDI.