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Payments for Watershed Services

The Bellagio Conversations

IBSN: 978-99905-971-0-3
Legal deposit: 8-1-931-08

Citation: Asquith, N. and S. Wunder (eds). 2008. Payments for Watershed Services: The Bellagio Conversations. Fundación Natura Bolivia: Santa Cruz de la Sierra

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Copy edited (Stephanie Secomb), designed (Raul Castillo) and printed (Imprenta España) in Bolivia

The Bellagio Conversations were hosted by the Rockefeller Foundation in its Bellagio Study and Conference Center in Italy. They received financial support from the Rockefeller Foundation and from the UK Department for International Development (DFID) as part of a multi-country project coordinated by the International Institute for Environment and Development (IIED) on developing markets for watershed services and improved livellihoods. The views expressed in this report do not necessarily represent those of the institutions involved, nor do they necessarily represent official UK government and/or DFID policies.

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The Bellagio Conversations

From March 12th to 17th 2007, 24 individuals from 13 countries met at the Rockefeller Foundation's Bellagio Center at Lake Como (Italy) to discuss lessons learned from recent global experiences with payments for watershed services (PWS). The selection of participants reflected a desire to bring together a mix of:

- Practitioners—managers who are actually implementing PWS schemes;
- Investigators—researchers who have been directly involved in studying the design and implementation of PWS schemes; and
- Investors—intermediaries who have the potential to invest in PWS initiatives.

Between them, these practitioners, investigators and investors had experience of nine payments for watershed services schemes and detailed knowledge of 15 more.

The goal of the Bellagio meeting was to consider how these experiences and knowledge could be used to improve the efficiency of watershed management. We believe that the resulting "Bellagio Conversations" can help shed light on some of the most important, pressing, complex and under-discussed PWS issues. Our hope is that these conversations will encourage others to tackle the opportunities and challenges of payments for watershed services.

What are payments for watershed services?

Most water users would prefer their water to be free of charge, and most upstream land managers would prefer their activities to be unrestricted. However, the upper watersheds that should provide clean water to downstream users often have to support additional and sometimes conflicting functions, such as agriculture and forestry activities. Existing regulatory frameworks have often proved unable to reconcile these conflicting needs. Watershed management may be improved by providing incentives to upstream land users to adopt production systems and land use practices that are better aligned with the importance and value attached by downstream recipients to the environmental services yielded by those systems.

Payments for watershed services (PWS), a subset of "payments for environmental services" (PES), appear to have the potential to improve resource management. The rationale behind PWS is that downstream service users benefit from the upstream land use practices that ensure the supply of services such as protection from erosion and sedimentation, and stream flow stabilization. However, if upstream service providers are to take appropriate land use decisions, and provide downstream users with such services, they likely need to be compensated for their opportunity costs, i.e. the economic gains they would have made if they had continued with their first land use plan.

In order to illustrate the PES concept, the following is a useful starting point. In one—albeit not universally accepted—definition, PES transactions are: (1) voluntary (2) between at least one service buyer (3) and at least one seller (4), focused on a well-defined service (or a land use likely to provide that service), and (5) conditional upon contract compliance.[1]

[1] See Wunder (2005) or Engel *et al.* (2008). For a general introduction to PES see Landell-Mills and Porras (2002).

The last of these archetypal PES criteria, pronounced conditionality (5), is perhaps its most revolutionary feature. The concept of conditionality is an important theoretical difference between PWS and other watershed management tools—downstream water users pay for watersheds services if, *and only if*, lands are managed in such a way to provide the desired service. In contrast, traditional tools such as integrated watershed management (IWM) have not had the same degree of conditionality. IWM interventions have sometimes involved rewards and investments, e.g. building a local school, but these have not been contingent, i.e. the school would not be closed if providers failed to comply with agreed-upon land use measures.

The criterion of a well-defined service (4) is particularly critical for watershed services, because the biophysical linkages between land use changes and service outcomes can be complex. The criteria of at least one buyer (2) and one seller (3) ensure that PES is a real transaction between economic agents, though in practice intermediaries such as non-government organizations (NGOs) often play a prominent role in negotiations. Finally, the voluntary nature of PES deals (1) may or may not in practice be fully attained. For instance, collective deals can be struck between a service-providing upstream community and a downstream water authority, in which case both individual buyers and sellers may have been "signed up for PES" without their individual consent.

Few experiences to date have simultaneously complied with all these theoretical principles. In cases where the PES principles apply with little deviation, it may be useful for the clarity of analysis and discussion to refer to such schemes as "PES-like" (or "PWS-like").

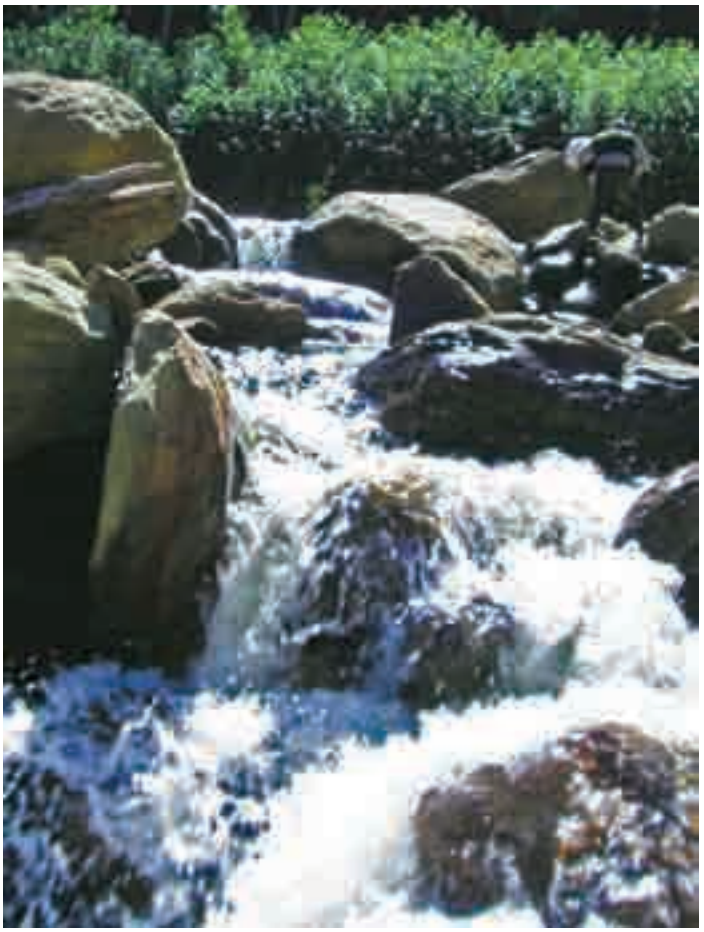
In practice, two generic PWS types are being implemented around the world. The first one is user-financed PWS schemes, the conditions of which have usually emerged from the negotiation process between buyers and sellers (often through intermediaries). Such schemes are typically carried out at the scale of one or more targeted watersheds, and are thus small-to-medium sized in terms of contracted areas. Most are designed in ways that bring them close to the five theoretical PES principles. Examples include the Vittel watershed scheme in France and municipal water programs in Heredia (Costa Rica), Pimampiro (Ecuador) and Los Negros (Bolivia).[2]

User-financed PWS: *The Vittel (Nestlé Waters) watershed protection program in Eastern France*

Since 1993, mineral water bottler Vittel has conducted a PWS program in a 5,100 ha catchment in the Vosges Mountains. The program pays all 27 farmers in the watershed to adopt best practices in dairy farming. The program is implemented through Agrivair, a buyer-created agricultural extension agency, which is trusted by farmers. It has persuaded farmers to convert to extensive low-impact dairy farming, including abandoning agrochemicals, composting animal waste, and reducing animal stocks. The program combines cash payments with technical assistance, reimbursement of incremental labor costs, and arrangements to take over lands and provide use rights to the farmers. Contracts are from 18 to 30 years, payments are differentiated according to opportunity costs, and both land use and water quality is closely monitored. Total costs (excluding the intermediary's transaction costs) were almost US$25 million between 1993 and 2000. Monitoring has shown an improvement of the water service compared with the declining ecosystem service baseline, and the high service value has made the investments profitable.

[2] For a discussion of user- versus government-financed schemes, see Aylward (2007), Engel *et al.* (2008), and Wunder *et al.* (2008). For the respective user-financed PWS schemes, see case studies by Perrot-Maître (2006), Pagiola (2008), Wunder and Albán (2008) and Asquith *et al.* (2008).

The second generic type is government-financed PWS schemes, where the state acts on behalf of service users across a number of targeted watersheds or regions, using tax revenues or obligatory user fees for payments. Here, service users cannot directly decide to stop the payments if they do not get what they paid for. Correspondingly, service providers normally cannot influence scheme design or payment rates, which tend to be offered by the state as a fixed menu. Payment rates and other modalities are typically more uniform and less customized to local conditions, and side objectives such as poverty alleviation and regional development typically play a large role. Such schemes thus tend to be "PWS-like", less-than-fully conforming to the five PES principles. On the other hand, these schemes are normally much larger in size, thus exploiting economies of scale in setup and ongoing administrative costs. Some state-run schemes are at least nominally focused on watershed protection, such as the Chinese Sloping Land Conversion Program (7.2 million ha land retired; 4.9 million ha planted with trees), or Mexico's national watershed protection program (126,000 ha). Other schemes buy not only watershed protection, but also other environmental services that are provided from contracted areas. Examples here are Costa Rica's PES scheme (600,000 ha), and the United States Conservation Reserve Program (about 14.5 million ha).[3]



Experiences to date demonstrate the many possible variations of payments for watershed services initiatives. Schemes have varied in their level of conditionality, their form of payment, and their degree of government involvement. One thing is clear though: the PWS concept is becoming increasingly popular, even while there have been few experience-based assessments of what works in PWS schemes, what doesn't and why.

The Bellagio Conversations were designed to fill this gap. Prior to our meeting in March 2007, a series of 10-page "primer" papers were commissioned among participants to assess the global state-of-knowledge on each of what we considered to be the "hot" PWS issues. Our conversations in Bellagio were then structured as follows: the first day and a half comprised a series of short (20-minute) presentations based on the primers followed by an hour of discussions. The purpose was to approach a consensus on each topic within the group. On the third day, participants split into self-selected small groups to further discuss and begin writing

[3] For a comparison of different government-financed schemes, see Wunder *et al.* (2008). For case studies of the respective government-financed schemes, see Bennett (2008), Muñoz-Piña *et al.* (2008), Pagiola *et al.* (2008), and Claassen *et al.* (2008).

on each of the key issues. The primers provided starting points for writing, but the groups were not bound to them. Drafts were presented to the entire group for comments and editing, until by the end of the fourth day each draft had been co-written by at least three authors, and had received comments from multiple participants.

We decided to focus our conversations on currently unresolved PWS issues that are already much discussed globally, and questions we considered important but are not currently on the global agenda, namely:

- How do laws and policies affect PWS schemes, and how can they best be influenced?
- How much research is needed prior to and during PWS implementation? When and how does it make sense to minimize transaction costs?
- When should services be "bundled" to increase payments?
- How can service users be stimulated to pay?
- How important are PWS initiatives for poverty reduction?
- How can PWS schemes be designed so as to balance efficiency with fairness?
- At what scale are PWS schemes best applied?

In presenting the edited results of the Bellagio Conversations, we hope to help other practitioners as they, along with us, continue to wrestle with the opportunities and challenges of PWS design and implementation.

Government-financed PWS: *Costa Rica*

The 1996 Forest Law established four primary purposes for Costa Rica's PES Program:

1) Mitigation of greenhouse gas emissions;
2) Hydrologic services;
3) Biodiversity conservation; and
4) Protection of scenic beauty.

The same law established a regulatory framework for contracting with landowners and established the semi-autonomous National Fund for Forest Financing (FONAFIFO). To participate in the program, landowners submit their land title, a plan, and a sustainable forest management plan prepared by a licensed forester. Once this plan is approved, specified practices (i.e. timber plantation, forest conservation or forest management) must be adopted, which triggers payments. In 2006, for example, annual payments for conservation averaged US$64/hectare, while for forest plantations ~US$816/hectare is disbursed over 10 years. An initial disbursement can be requested upon contract signing, but all subsequent annual payments require verification of compliance. The program is funded primarily with revenues from a national tax on fossil fuels, and the area enrolled represents about 10% of the country's forests. Lack of customized monitoring data makes precise impact quantifications difficult, but the PES program is likely to have caused at least some modest increase in national forest cover and quality. The program is popular with landowners, with requests to participate far outstripping available financing. The World Bank supported the scheme's strengthening and development through the Ecomarkets project.

How do laws and policies affect PWS schemes, and how can they best be influenced?

Government roles in PWS schemes range at best from enabling and implementing and at worst they can be obstructive, but they are rarely avoidable. PWS protagonists should anticipate actively engaging with law and policy institutions in the process of exploring PWS. Some specific legal and institutional changes are likely to be desirable but may not be easily addressed at the outset. Thus, PWS implementers should not wait for the perfect legal conditions to be pre-established, but rather try to influence conditions as they go along.

PWS schemes do not operate in a legal, social or political vacuum; a range of laws, policies and institutions will affect them and thus need to be understood by PWS implementers. They must scrutinize what framework conditions may constitute preconditions for the success of their PWS scheme. Similarly, they must understand what legal and political factors are to be taken as a given, and will likely define the scope of PWS. Developing this understanding and the room for manoeuvre in the policy environment is critical to gaining social acceptance.

Q1 Are there certain policy, legal and regulatory changes that are always necessary to establish a PWS scheme?

Probably not. PWS schemes need to be developed to fit their particular contexts. For example, in Heredia, Costa Rica, the PWS scheme was developed based on existing public utilities regulation. The Catskill program of New York City was made possible by new uses and interpretations of existing law. Development of PWS schemes may require legislation, or may best be done through institutional means. In general, there are political costs to enacting legislation and bureaucratic costs to working within the existing system. Based on local knowledge and an assessment of local support and the institutional position of the PWS scheme, promoters should assess which strategy is preferable. Often, the right answer will be a combination of both legislative and institutional changes. In circumstances where it is difficult to foresee any progress on PWS without policy and legal change, an objective assessment of the prospects of obtaining such change may lead to the realistic conclusion that it is better to search for alternative policies.

Q2 Are laws establishing private property rights required for user-financed PWS schemes?

Reasonably clear rights to land access, management or use are certainly needed, but this does not necessarily imply western-style ownership rights. Access, management and use rights may be customary rather than statuary, and can exist in many forms—both individual and communal. In some PWS schemes, notably the RUPES (Rewarding the Upland Poor for Environmental Services) program in South East Asia, changes in land rights have been used as a compensation tool, i.e. awarding consolidated tenure security to local land users as a reward for (promised) future environmental services. One of the compensation modes in Bolivia's Los Negros PWS scheme has been barbed wire, which service providers have used to strengthen their *de facto* property rights. However, changes in land use rights are value-laden and complex issues, and are perhaps best used only when the need is essential and the solution commands widespread public support.

Q3 Where should one look to find legal and regulatory guidance for PWS schemes?

In practice, working with existing law is usually the best course, at least initially. Existing laws and regulations may already contain part of the legal basis for PWS. The key is to revitalize these laws with public support and clarity for utilizing their PWS potential, which may boost legitimacy and support. Alternatively, the path to take will depend on whether existing laws are internally inconsistent, are unenforceable, or conflict with bureaucratic vested interests.

Q4 When is legal change necessary or desirable?

Strategic use of legal or regulatory reform can play a key role to:

- *Establish a new right to a resource*
  Zimbabwean legislation that gave communities the right to manage their wild game became the basis for an interlocking system of communal programs to protect biodiversity.[4] In Tanzania, legislation on community forests has helped provide incentives for communities to manage watershed regeneration.
- *Establish a source of funds*
  New legislation in Mexico allocated about 2.5% of existing water fee revenues to support PWS schemes. In Costa Rica, a surcharge on all fossil fuels paid for forest environmental services and, more recently, 25% of revenue from a new water fee, were earmarked for PES. However, in practice only a smaller proportion was actually allocated by the Treasury.
- *Authorize new institutions*
  In China, the government authorized local water users to join together in irrigator associations. Many states in the USA now authorize government to partner with citizen-based, stream-corridor associations to promote watershed restoration. Costa Rica has created a specialized PES institution, FONAFIFO.
- *Create bureaucratic space*
  South Africa´s new water act allowed managers to develop a water pricing strategy that recognized the negative impact of terrestrial invasive alien plants and that their removal enhances the provision of watershed services. In Europe, to overcome the focus of agricultural departments on commodity production regardless of environmental consequence, the European Union (EU) passed legislation creating explicit programs of payments for sustainable agriculture.
- *Remove obstacles to PWS schemes*
  To eliminate perverse subsidies that make PWS economically ineffective, a number of states in the USA have repealed laws that tax lands with high biodiversity value in ways that are intended to encourage their development. In the Netherlands, the structure of agricultural payments has been altered to encourage local farmer efforts to control nutrient applications, instead of expanding their use.
- *Ensure monitoring, compliance and transparency*
  Many countries have passed freedom of information laws to ensure that payment streams are public information. In Ghana, regulations require amounts of revenue paid to land owners to be made public.

[4] For a case study of the Zimbabwean CAMPFIRE program seen through a PES lens, see Frost and Bond (2008).

Q5 Can or should payments be made for activities that are obligatory under law?

Several payment schemes around the world are paying land users to conserve forest, even though clearing this forest would be illegal. PWS can enhance compliance with laws banning forest clearing, by co-financing private landowners' costs of complying with the law. Costa Rica's 1996 Forest Law simultaneously banned clearing and established a PES scheme compensating landowners for forest conservation. Conversely, laws that ban forest clearing can also provide incentives for participation in PWS and help justify sanctions for breaking contracts. Although PWS is often seen as an alternative to command-and-control policies, the two types of tools can often complement each other in practice.

Q6 How can the policy and institutional environment strengthen local institutions and improve PWS implementation?

Policy and institutional entry points emphasizing information transparency, decentralization, local financing and planning can all be seized to explore PWS ideas. This, in turn, may build local institutional capacity. In some contexts, governments can be encouraged to directly facilitate user-financed schemes, or support intermediaries in facilitating and brokering negotiations. Where there is bureaucratic space, or where such space can be created, these local ideas and demands can be fed back into improved government policy.

Q7 How can social and political circumstances best be influenced?

- PWS promoters need to be aware of trends that support PWS, such as decentralization, regulatory flexibility, and new service roles. They can then design PWS schemes explicitly to exemplify and support such trends. Similarly, they must understand the existing bureaucratic culture and avoid any unnecessary challenges to it. They should seek champions in the existing bureaucracy who share the same goals.
- Where key institutions and government functions are poorly integrated, national or state legislation endorsing or authorizing PWS is fundamental. PWS promoters can help develop such legislation by using the results of PWS pilot projects as the basis for its design. Moreover, governments are often spurred by PWS concepts and experiments to address underlying issues which PWS promoters themselves would be ill advised to focus on. Once government proposes such a course, however, PWS advocates should participate in the debate over these issues, lest they wind up becoming obstacles. The EU incorporates many PWS concepts into its agri-environmental funding programs.
- PWS proponents must seek to convert key critical voices or social interests, such as an urban business community, through arguments that demonstrate the cost-effectiveness of PWS. Where PWS schemes are yet to be started, this may best be done by reference to comparable approaches elsewhere, such as documented benefits of PWS in terms of income, development and jobs created.
- Implementers must be aware of the arguments being wielded against PWS in their particular context, e.g. "PWS is merely paying people to obey the law", "PWS privatises public resources and commoditizes them", or "PWS favours the rights of some against those of others". Such potentially legitimate concerns need to be addressed within the local context. One, often prominent, issue is how to deal with squatters, and with ambiguous access and ownership rights to land.
- PWS proponents should recognize and use the lessons from similar schemes elsewhere. Although innovative, PWS initiatives do have a track record. Both large-scale and small-scale successes exist, providing hope that PWS can be a cutting-edge tool for sustainability. Both large scale and small-scale failures exist also, and these can be learnt from. It may be useful to present PWS as a broad strategic environmental and economic approach–demonstrating how the innovative nature of PWS not only provides new resources for economic development, but also provides a new way to address long-term intractable problems.

PWS schemes are inherently political; they alter who gets what, when, why and how. The first rule of advocacy politics is to have a clear and compelling good idea. The second rule is to build as large a network of supporters as possible. The third rule is to find champions within leadership echelons of local political and institutional structures.

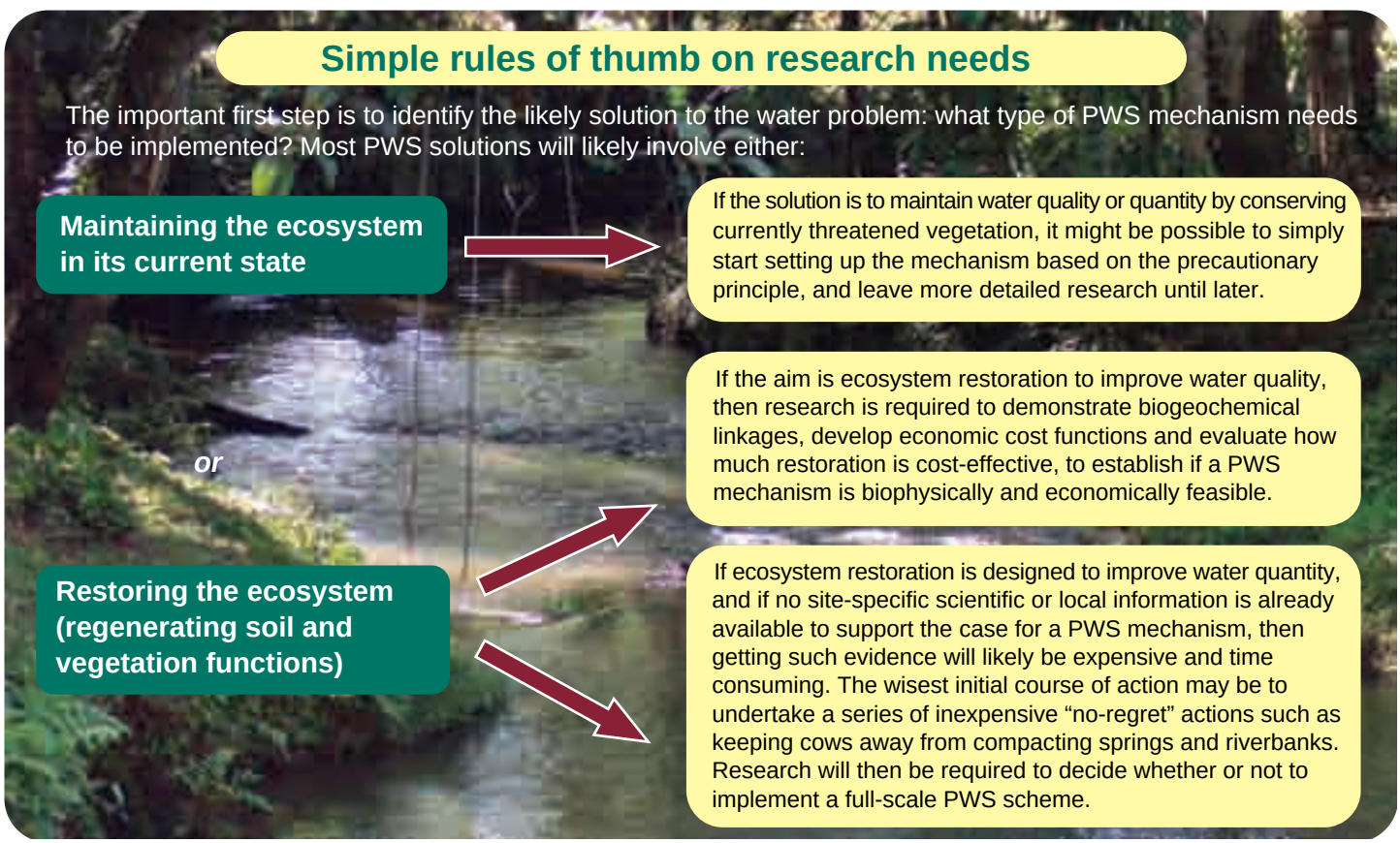
How much research is needed prior to and during PWS implementation? When and how does it make sense to minimize transaction costs?

Experience suggests a steep learning curve while implementing PWS schemes, especially user-financed pilots at a watershed scale. For those, it is advisable to not "let the perfect be the enemy of the good": rather than trying to architect all the details in advance, one can fine-tune the design and incorporate knowledge as they go along. For government-financed schemes, significant design adjustments over time may meet much more political opposition. Most existing PWS schemes are based on incomplete knowledge regarding the links between basic land use and hydrology.

Public perception about the links between forest conservation or reforestation and water flows are sometimes at odds with scientific findings. In addition to "getting the science right", PWS initiatives need to be based on what local stakeholders perceive to be logical, fair and feasible. Scientific knowledge should thus be integrated with indigenous knowledge systems. PWS implementation should always be accompanied by some measurement of the water services delivered, but it is vital to point out in advance that PWS schemes cannot *assure* a certain outcome at any point in time—be it improved water quality or higher water yields—because of the influence of third factors. Usually PWS schemes augment the *probability* of a desired service-delivery outcome.

Q1 Given that high quality research is costly, is it possible to initiate a PWS scheme with little or no scientific research, leaving critical studies for later?

As a PWS program matures, it may steadily require more sophisticated information and an engagement with complex issues, which will increasingly require more formal research tools. However, the initial need for most PWS schemes is simply sufficient knowledge to begin in a responsible way: this may not require complex, time-consuming studies. Indeed, it may well be feasible to get started on a watershed scale PWS scheme without spending large amounts of money or time. The type of PWS initiative to be implemented will largely determine research needs. See the following text box for a guide to how much research is needed *a priori* for some common types of PWS schemes.



Q2 What is the minimum information needed to initiate a user-financed PWS scheme?

It is always important to have at least an initial understanding of the context of the watershed, even if this is based on little or no scientifically collected data. Implementers should be able to answer a series of key questions using either the results of new research or with their best available knowledge. The extent to which new research is required to answer these questions will depend on the local context, resources available, and pre-existing knowledge. Preparatory efforts will thus differ in each case but experiences demonstrate that some information—particularly in relation to the hydrological basics—is required to at least guide the direction of proposed action:

- *Clarify the hydrological uses that potential buyers are interested in receiving*
  These may include: drinking water, hydropower, irrigation agriculture, industrial water use, recreational use, and aquatic biodiversity protection.
- *Identify the specific hydrological service(s) upon which each service user depends*
  These services include the enhancement of stream flow quantity, control of its variability and quality (including sediments, pathogens, nutrients, and pollutants) and risk management (including flood, landslide and erosion prevention).
- *Develop a baseline against which to broadly assess hydrological service delivery*
  This baseline may be based on empirical data, modelling such as the RUPES Rapid Hydrological Appraisal developed in Asia or SWAT (Soil and Water Assessment Tool) models. If no data are available, locally gathered qualitative information can be helpful.
- *Scrutinize probable livelihood scenarios with and without PWS implementation*
  Attention must be given to the limitations and opportunities relating to different socio-economic groups, given their production and management practices. This can either come from a detailed investigation or from in-depth local knowledge.
- *Establish a basis for setting a price for the provision of the service*
  Relevant parameters can be the opportunity costs of land and labour; water tariffs and stated willingness to pay for water improvement; and outcomes from direct negotiations between service buyers and sellers. It is important to ensure that the value of the service in demand is likely to exceed the opportunity costs; otherwise there is no economic basis for a PWS scheme.
- *Identify governance constraints and opportunities in the political environment*
  This refers to the factors explained in detail in the previous section.

Q3 Are some hydrological rules scientifically proven?

The relationship between land use and hydrology is complex, and established wisdom about their nature can also change over time. However, some patterns are reasonably robust:[5]

- Intact natural vegetation cover guarantees optimum stream flow under given geo-climatic conditions. It also affords maximum soil protection and therefore provides optimum regulation of seasonal flows while moderating erosion and stream sediment loads.
- In addition, *montane cloud forests* and related cloud affected ecosystems such as *páramos* provide maximum amounts of stream flow due to a combination of high rainfall, extra inputs from cloud water capture by the vegetation, and low water use due to frequent occurrence of fog.
- Intact natural vegetation cover *per se* is no guarantee that floods or landslides will not occur, especially in large scale watersheds and under extreme weather events. Nevertheless, their frequency will be less with intact vegetation than is usually observed after conversion. For flooding, this is especially true in smaller-scale watersheds and for small and medium sized storm flow.
- Removal of old-growth forest at large scales (> 10,000 km^2) in humid parts of the world reduces rainfall during the transition between the rainy and dry seasons. Annual average effects are modest (5-10%) but are higher during the transition.
- Removal of forest has an initial short-term effect of increasing annual water yield (100-800 mm for a 100% change in cover), with the size of change depending on rainfall and degree of surface disturbance. Subsequent water yield depends on the new land cover.
- Converting forest to non-forest cover *increases* low flows (as long as soil degradation is kept moderate and mean annual precipitation totals in excess of potential evaporation, i.e. ~ 1,500 mm or more).
- Converting forest to other uses is likely to lead to *reduced* low flows, if soil degradation has caused overland flow to exceed 15-20% of rainfall. This degraded stage is typically reached after prolonged exposure of bare soil to the elements, by intensive grazing or the use of heavy machinery, too frequent or poorly timed use or occurrence of fire hampering vegetation recovery, improper tillage regimes, and by the introduction of compacted surfaces such as roads.
- Reforestation does not re-create the ecological conditions of old-growth forest within the lifespan of most PWS programs, due to the higher water use of the rapidly growing trees compared with that of the vegetation the trees are replacing. From the perspective of downstream water users, the initial hydrological response to reforestation can in fact be negative i.e. reforestation results in less stream flow—due to the high use of water by growing trees.
- Reforestation is unlikely to reduce the risk of flooding to the same degree as the former old-growth forest because the recovery of degraded soils often takes decades. In addition, the impacts of development on drainage infrastructure (such as associated with roads or housing) are not undone by tree planting.
- Establishing forest on grasslands or degraded savannas leads to reductions in low flows when the trees´ increased water use is not offset by improved infiltration. In naturally non-forested landscapes such as southern African grasslands, tree planting will result in streamflow reduction of around 300 mm per year. In such areas, restoring the natural grassland vegetation is more likely to increase streamflow. Increases in low flows will require a sufficiently large improvement in infiltration after revegetation. To compensate for the use of 300 mm of extra soil water by trees, a 30% switch from overland flow to infiltration is needed at an annual rainfall of 1,000 mm/year to break even. This can only be expected where surface soils are partly degraded yet are deep enough to store the extra infiltrated water.

[5] These results draw heavily on the summary description in Bruijnzeel (2004).

Q4 Who should bear the costs of gathering essential hydrological knowledge?

Generating the basic hydrological knowledge (including analyzing pre-existing data) can be very costly. In developing countries, these costs may often be too high to be internalized in user-financed PES schemes. In such cases, implementers might be able to bring in researchers from government-funded national and international scientific institutions. In the case of the user-financed PES initiative in Heredia, Costa Rica, 100% of PES revenues are used for forest protection and reforestation, while research costs are covered from a separate budget of the public utilities company. In other cases, external donors have been willing to support these costs especially during the start-up phase.

Q5 How can research costs be minimized?

Implementers should not necessarily be worried about high research costs, as long as buyers and sellers are happy with the result and cover the total bill. Obvious business practice is to seek the cheapest way of operation, but the balancing decision will hinge on the complexity of service delivery and stakeholder interests. Research costs may be reduced through diverse institutional arrangements that make information acquisition easier. These arrangements include centralizing operations, forming partnerships and networks, using intermediaries and brokers, learning-by-doing, and the formation and use of social capital (e.g. social norms and trust).

Q6 What have been the most important set-up costs in PWS experiences to date?

The cost of information acquisition by potential service suppliers has probably been central to most implemented PWS schemes. Because environmental services are a relative new type of service traded in the economy, part of the costs of building a transaction implies informing these potential suppliers of the things they need to do to provide and sell the service. This takes the form of proposals, training, technical assistance, etc. Most information required for the development of a PWS mechanism is part of what economists term *transaction costs*, defined as the:

- Search and information gathering costs, related to knowing what goods or services are being demanded, and at what price they can potentially be delivered.
- Negotiation and decision costs, related to crafting an acceptable agreement between parties, and converting this consensus into a contract agreeable to the parties.
- Monitoring and enforcement costs: actions that ensure the parties either comply with contracts, or face the penalties explicit in the contract, thus securing the conditionality and effectiveness of service provision under a PES scheme.

Q7 Why can we not depend on the market to minimize transaction costs?

In a normal market competition puts pressure on suppliers and consumers to find ways to minimize transaction costs. The PWS case is different: only exceptionally do PWS schemes work as competitive markets. There may be only one buyer or a few buyers downstream—and certainly for government-financed PWS the buyer function is concentrated. For upstream service providers, similar structural restrictions apply: one often has to work with a minimum share of all service providers for actions to have significant effects. Hence, normally we cannot rely on market forces to find the PWS arrangement with lowest transaction costs. Governments and other social actors need to act cooperatively to create cost-effective arrangements that eliminate excessive transaction costs. The needed institutional innovation may take the form of social capital, yet there is also place for new legal arrangements.

Q8 Do transaction costs decline over time or as PWS schemes get bigger?

Two things have the potential to lower transaction costs: time and size. A project manager can be confident that certain costs will decrease over time, just because of the learning-by-doing process reducing informational costs. As for size, a larger scale project can reasonably pay for more elaborate fixed transaction cost elements, such as more precise monitoring and less trust-intensive client verification. In principle, a smaller scale project could be more flexible, leaving all parties of the transaction sufficiently satisfied to continue with the deals.

Q9 How can transactions costs be lowered?

Some transaction costs will decrease simply as experience is gained and processes are improved. Collaborating in networks or using intermediaries or brokers can also reduce transaction costs. Local NGOs and government agencies can share knowledge and provide access to the technological or social capital that will reduce a particular project's costs. Sharing the knowledge generated by a particular experience or pilot project among peers can present options for how other projects can reduce their transaction costs. For example, after a meeting that described the PWS experiences in Bolivia's Los Negros valley, two other municipalities started their own, improved schemes. Project managers who have received donor money have a moral responsibility to voluntarily share acquired knowledge that helps others to reduce transaction costs.

Q10 Can monitoring and adaptive management improve the efficiency of PWS schemes?

As a PWS scheme becomes more mature, probably the knowledge base can be refined, and PWS design can be improved. Adaptive management is thus critical to PWS success. However, in order to manage adaptively, effective and efficient monitoring systems are required. While not all monitoring is research (and *vice versa*), data must be collected and studies undertaken while the scheme is operating in order to measure the impacts. Monitoring efforts should include a range of variables: monitoring of service provision is key, but livelihood impacts, scheme costs, or broader stakeholder satisfaction may also be processes to assess continuously. Managers should act based on monitoring results.

When should services be "bundled" to increase payments?

Some PWS schemes have tried to either "'bundle" various services together for sale to one buyer, or to "layer" payments from multiple buyers into payments to providers. "Bundling" refers to selling several commodities to the same buyer, e.g. water users buying water quality protection pay a premium for also protecting biodiversity in the same area. This occurs in the Mexican and Costa Rican national-level schemes. More usual at the local level is "layering" sales—selling multiple services to *different* buyers: this requires interaction with several service users (raising transaction costs), facing trade-offs in the provision of various services (raising management and monitoring costs), and facing possible free-riding/additionality dilemmas between several buyers.

A land use action in a given watershed normally produces more than one environmental service. For example, forest conservation may protect carbon stocks, safeguard biodiversity, and ensure water supplies. The question is often asked, therefore, whether it is possible to sell more than one service from the same area. In fact, in some cases increasing the provision of one service may reduce the level of other services. For example, some fast-growing plantations intended to sequester carbon may have low biodiversity levels.

Q1 When may one try to sell more than one service?

To induce landowners to adopt the desired land use requires a minimum payment based on the opportunity cost of the most profitable land use. If selling a single service is insufficient to compensate landowners for this opportunity cost, then selling more than one service might solve the dilemma. In general, promoters should start with the service that is most valuable and easiest to sell, and then continue working through the other services until a sufficient payment level is reached. Alternatively, promoters might try to negotiate with various buyers at the same time to form a consortium.

Q2 When is it *possible* to sell more than one service?

At a minimum, several services need to be being generated jointly, *and* there need to be potential buyers for each service. However, that may not be enough. Many potential buyers have rules that explicitly prevent them from buying services when other payments are already made. The Clean Development Mechanism (CDM), for example, will only pay for carbon sequestration that is truly additional: i.e. that would clearly not have happened without carbon payments. Similarly, The Global Environment Fund (GEF) will only pay for the incremental costs of activities that would clearly not take place without GEF support. If other payments (e.g. from water users) are already sufficient to compensate land users for the opportunity costs, GEF or CDM additionality rules cannot be met. In addition to formal restrictions, some potential buyers will strategically find it rational to try to free-ride as much as possible on other user payments. When other services are also provided, there may be some buyers who are willing to pay a premium, over and above the price of the service in which they are principally interested. For example, in order to control the invasive alien plant species that consume large amounts of water in South Africa, water security is highly subsidized through the Working for Water public works program. Note also that some buyers will *only* consider projects that provide multiple benefits, but without being willing to pay a premium for them. For example, some buyers of carbon only consider projects that also conserve biodiversity. In that case, generating multiple services may provide access to one market, but will not necessarily result in a higher payment.

Water consumers in the city of Saltillo (Mexico) make voluntary payments for upstream watershed management, and have expressed explicit additional willingness to pay also for protecting upstream bird habitat.

Q3 To whom can multiple services be sold?

Bundling is a well-defined concept for marketers, referring to selling several commodities to the same buyer. Transferring this to the environmental service and PWS sphere, bundling occurs if for example water users paying for water quality protection are willing also to pay a premium for biodiversity being protected in the same area. A good example is where buyers of climate-change mitigation measures pay a premium for biodiversity and other (e.g. social) on-site benefits. Government-financed schemes often have the explicit mandate to protect various services (e.g. the Costa Rican government-financed PES scheme), and are thus classical examples of naturally bundled PES programs. Yet, some small-scale, user-financed bundling schemes also exist. Water consumers in the city of Saltillo (Mexico) make voluntary payments for upstream watershed management, and have expressed explicit additional willingness to pay also for protecting upstream bird habitat. However, this seems to be more the exception than the rule: most service buyers are only interested in buying one particular service. Usually, the more realistic challenge is to "layer" —to sell multiple services to *different* buyers—such as in Los Negros, Bolivia. Unlike bundling, layering requires interaction with several service users (raising transaction costs), facing trade-offs in the provision of various services (raising management and monitoring costs), and facing possible free-riding/additionality dilemmas between several buyers.

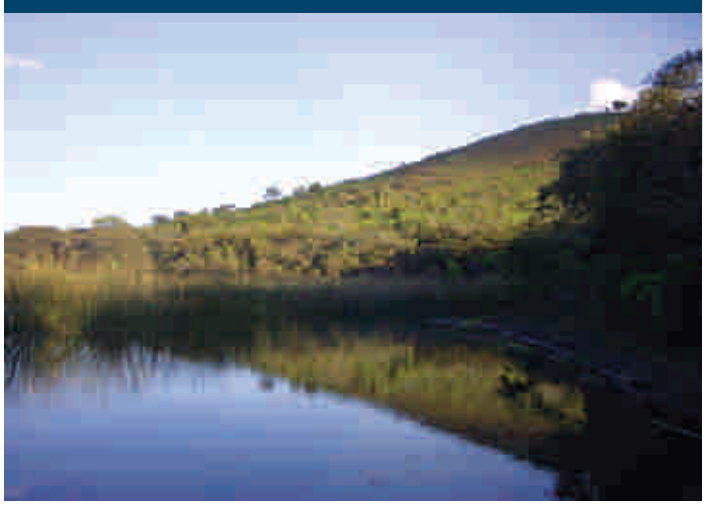
User-financed PWS: *Los Negros, Bolivia*

Forty-six upstream farmers are currently protecting 2774 ha of Bolivian cloud forest through a locally managed PWS scheme. Annual contracts prohibit tree cutting, hunting and forest clearing on enrolled lands. The negotiated payment mode is annual in-kind compensations—beehives supplemented by apicultural training—in return for forest protection. One service buyer is an international conservation donor, and other service users include downstream irrigators who benefit from stabilized dry-season water flows. Individual irrigators are paying through the local water cooperative, and the municipal government also contributes. External donors have funded studies providing basic economic, hydrological and biodiversity data, and covered PES start-up (~US$40,000) and running transaction costs (~US$3000 per year over the last three years). Landowners submit to independent yearly monitoring and are sanctioned for non-compliance. The greatest challenges in the development of the scheme have been the slow process of building trust between service buyers and providers, and in achieving clear service-provision additionality.

How can service users be stimulated to pay?

In many countries, there is a deep-rooted perception that we shouldn't have to pay for nature—one of God's gifts—and that only man-made products or services should carry a cost. This conviction, together with a traditional perception of widely abundant natural services, severely limits PWS acceptance. The often rather unpredictable outcomes of the PWS process may also limit public support. On the other hand, the PWS concept is intuitively appealing to many, who see it as a way to continue to enjoy healthy and productive watersheds. A gradual shift towards a costs-savings or business-like approach to PWS may thus help further convince potential buyers and other society stakeholders.

Using the ecosystem services of natural watersheds can often meet human needs for water at a lower cost than conventional, technological alternatives. For example, the New York City Commission for the Environment arguably saved the city US$8 billion by investing US$1 billion in watershed protection and restoration in the Catskill Mountains. Generally, avoidance of cost intensive technical solutions like building water treatment facilities provides both short and long term benefits to local governments. Preventative approaches such as payments for watershed services can often be a financially and socially attractive option. Terminology such as "PWS" may sometimes confuse the public, since the acceptance of the phrase varies widely across societies and cultural settings. Moreover, the term describes a process rather than a result. If "PWS" is used to describe an intervention, the public may not have a clear idea of what the result of the scheme will be, and so it may be difficult to attract popular support. An alternative terminology—such as environmental resource investment or natural capital financing—may be more useful. The selected terminology should change perceptions so that the public recognizes watersheds as assets that include both economic and other intangible values, each of which can be capitalized.



Users have no problem paying high prices for bottled water, and are often unaware that watershed restoration could secure similar water quality, at a fraction of the price.

Q1 How important are end-user attitudes towards payments?

Watersheds have been providing services free of charge for thousands of years. Thus, there is often a deeply rooted perception that we don't pay for nature, and that only man-made products or services should carry a cost. This is especially true in some Andean countries. On the other hand, an educated public often understands the PWS idea, feels a connection to it, and can be brought to recognize that investments must be made in order to continue to enjoy healthy and productive watersheds. A shift towards a costs-savings or business deal approach to PWS may thus help convince potential buyers and other stakeholders. Educating the end user is clearly an important issue. Water that has been packaged in a modern container, shipped, and heavily marketed is perceived as superior, safer, more convenient, and ready for consumption. Users have no problem paying high prices for bottled water, and are often unaware that watershed restoration could secure similar water quality, at a fraction of the price.

Q2 Is the "asset management" concept an effective incentive for users?

One emerging idea is that maintaining the health of a watershed ecosystem is the equivalent of asset management. Asset management comprises business practices designed to increase the value of the asset and reduce the risks of failure and increased long-term cost to its owner or user. It is a well-understood strategy for obtaining maximum value from physical assets and may be usefully applied to natural resource assets. To do so, the asset's economic value must be established. For PWS schemes, the defined asset is the watershed area: the forest, rivers, or glaciers or other source of freshwater, and the area it encompasses. By maintaining the ecosystem, through user fees or "insurance" policies, users would be recognizing an economic value that was not previously recognized, and increasing the asset's value. This approach—asset management—can help create new understandings of the value of natural assets and ecosystem services. But it is probably not the best approach to obtaining short term funding or identifying the most immediate financial benefits. Risk management, insurance to maintain human health, and opportunities to avoid capital costs may be more pragmatic in mobilizing ecosystem service investments in the short term.

Q3 Is the use of risk management an effective strategy for increasing support of PWS programs?

Risk management may be a useful tool to incorporate into PWS decision-making, as it is a process that many people implicitly undertake in their daily lives. Risk management involves working through the implications of various risks using "what-if" scenarios. A key element of risk management is to understand the consequences, and to quantify their cost and operational implications. To be effective, risk assessment should be user and site specific, and should address both existing and potential problems, such as described in the following table:

Type of risk	Example
Delivery shortfall	What could reduce streamflow? E.g. diversion by natural or human impact, financial viability of the delivery system
Health hazards from reduced quality	Contamination after leaving the source, exposure to contaminants in surtace waters, inability to adhere to health standards
Environmental	Erosion, landslides, flood control, weather/climate change factors
Operational	Price increases due to disruptions, quality control, silting, clean up
Legal and regulatory	Overlapping land claims, government policy affecting land use
Reputational	Large users´reputations may be at risk if they are perceived not to have ecosystem concerns

Q4 How can the biggest water users (farmers, utilities etc.) be persuaded to pay?

The largest users of fresh water are usually farmers. Until now, they have not been required to pay, or have paid only negligible amounts for irrigation water because governments have been reluctant to impose higher costs on them. Large power and water utilities companies have also often not paid for the full direct and environmental costs of their water projects, thus causing significant long-term economic harm to society. Where local resistance to changing policies cannot be overcome, new strategies must be considered, such as soliciting the participation of local and international capital markets, which have a vested interest in more rational economic policy. One way might be to convince the largest lenders in emerging markets not to fund irrigation or utility projects in which social and environmental impacts have not been incorporated. Lenders could also provide incentives for the use of ecosystem services where this is the most cost-effective way of meeting water resource goals.

How important are PWS initiatives for poverty reduction?

Whether for practical implementation reasons or for social justice, PWS programs cannot ignore the poor. Ensuring and improving the provision of watershed services will often by itself reduce poverty. However, PWS cannot be viewed as an all-encompassing poverty alleviation tool. In government-financed PWS programs especially, there will often be hard trade-offs between maximizing watershed services and maximizing poverty reduction. Experience to date shows good PWS progress in addressing both objectives, but that there is often considerable potential to better manage the trade-offs.

A large number of the world's poorest people live in rural upland catchments. Sometimes they are potential suppliers and sometimes they are beneficiaries of watershed services. However, often the structural reasons for poverty are deep-rooted, and PWS programs alone are unlikely to solve them. Although PWS may have important localized effects on poverty alleviation, it can only serve as a targeted poverty alleviation tool if implementers are willing and able to make trade-offs between maximizing watershed services and alleviating poverty.

PWS usually produces opportunities for the poor, but these are sometimes accompanied by risk. The opportunities include improved and more diversified incomes, improved governance and local organization, and enhanced capacity to prevent environmental degradation. Conversely, potential risks include uncompensated exclusion of non-participants from resources, and under-compensated opportunity costs on behalf of service providers. Each individual PWS scheme must come to its own equilibrium on how to balance maximizing the provision of watershed services and impacting the poor. However, PWS schemes to date have had positive welfare effects on most participants, even when there was no explicit poverty targeting. There is only anecdotal evidence about PES schemes having made poor people worse off on a significant scale.[6]

Q1 How are poor people affected by PWS schemes?

The poor are often sellers and sometimes buyers of watershed services. As water users, the poor often depend disproportionately on watershed services and are more vulnerable to declines in service provision (the rich are better able to find substitutes). The poor are more affected by deteriorating water quality and reduced supplies, and have less capacity to cope with economic stresses. They often live in risky environments that are prone to floods or landslides. On the service seller side, heavily forested upper watersheds and other environmentally fragile production areas capable of producing environmental services tend to be disproportionately inhabited by poor people. Since their land use practices often impact on the watershed, in principle they also qualify as service providers.

Government-financed PWS: *Mexico*

Mexico's Program for Hydrologic Environmental Services focuses on the conservation of threatened natural forests for the sake of maintaining the flow and quality of water. Funding for the program, which grew from US$18 million in 2003 to US$30 million in 2004, derives from charges paid by federal water users. Monies are disbursed to individual and collective landowners possessing natural forests that serve watershed functions. Payments for cloud forests (US$40/hectare/ year) exceed those for other tree-covered land (US$30/hectare/year). Contracts with suppliers of environmental services are for five years, with conditional renewal. Cash payments are made at year's end, provided that compliance with contractual obligations has been satisfactory during the preceding twelve months. Monitors analyze satellite imagery and carry out random field visits to detect changes from forest-cover baselines. The 2003 budget allowed for the enrollment of 126,000 hectares. Areas given highest priority are those where the threat of deforestation is greatest, zones with an elevated incidence of poverty or biodiversity, and watersheds important for downstream communities or aquifer recharge.

[6] See Grieg-Gran *et al.* (2005) and Pagiola *et al.* (2005) for comparative assessments about the welfare impacts of PES schemes on the poor.

Q2 To what extent can poor people become sellers of watershed services?

A high overlap in PWS schemes between areas supplying watershed services and poor inhabitants will likely lead to poverty alleviation. For example, the Mexican national PWS initiative enrols areas based on the risk of deforestation (as calculated from a statistical model), but also prioritizes areas of extreme poverty. Over time, shifts in the weight attached to these priorities have also affected the environmental efficiency of the scheme. However, even without any poverty targeting, the criterion of heavily forested areas naturally directs area selection to some of the poorest regions in Mexico. In Costa Rica, places with high environmental value have priority (such as land in biodiversity corridors, protected areas, critical watersheds), but regional poverty reflected via a national social development index is also explicitly weighted. Some cases of environmental restoration, e.g. tree planting or eradication of invasive alien species, are highly intensive in the use of unskilled labour, so that they also naturally go hand in hand with poverty alleviation.

Q3 Are there trade-offs between maximizing watershed services and poverty alleviation?

Yes. Service buyers will want payments for watershed services to be as close as possible to the land user's opportunity cost of providing the service. Poor service providers will want to be paid as close as possible to the value of the service. Since buyer financial resources are finite and they usually are in a better position to determine the rules of the game, in practice this tends to translate into making a larger number of people a little better off by paying a high number of providers slightly above the opportunity cost of service provision. Alternatively, paying significantly more than the opportunity cost of service provision and thereby making a smaller number of people much better off will produce a lower volume of watershed services. The trade-off between the two scenarios is clear, but the latter scenario is not necessarily superior on the grounds of social justice.

Q4 What is the risk of PWS schemes having adverse impacts on the poor?

PWS-triggered changes in land use and management may affect the poor adversely when they are not compensated or under-compensated. Poor people often engage in land use practices—such as overgrazing, cropping on steep slopes, slash and burn, etc.—that due to their negative hydrological impacts would make them the first choice for change. As long as they are compensated appropriately, trying to change poor people's land use practices is not intrinsically a problem. However, the landless poor are often dependent on common pool resources. Other groups of poor may have ill-defined land access rights, making them ineligible for PWS. It is thus within the realm of possibility that PWS schemes may negatively affect some groups of poor people—typically, those not directly participating in the scheme. Nevertheless, many of these potential negative effects of PWS interventions are universal to all watershed conservation initiatives, and are not unique to PWS. Indeed, to the extent that service provision agreements are usually voluntary, and often negotiated, PWS schemes are in fact less likely to adversely affect the poor than many other types of conservation initiative: providers will only join the schemes if they calculate that they will be made better off from participation.

Q5 To what extent can contract design favour poor people's participation?

Transaction costs on both sides of the agreement can become barriers to access for the poor. Buyer transaction costs are high if there is a need to contract numerous land users. One partial solution can be to use intermediaries who can lump poor providers, such as in the case of Costa Rica's PES system. High transaction costs can discourage poor land users. Keeping contract design and associated monitoring requirements simple can help to counteract this, as can efficient intermediaries. However, the poor are more risk-averse and more vulnerable, and may fail to fully understand the contracts they are signing (i.e. there is not free and informed consent).

The form of payments will be determined by context. In Sukhomajri, India, water rights were de-linked from land rights, and the landless were able to sell their water rights locally. In Bungo, Sumberjaya, Indonesia, service providers identified secure land tenure as the preferred form of compensation. In Pimampiro, Ecuador, service providers received cash and spent the extra income on both basic needs (e.g. cooking gas costs), and children's education.

Q6 Can the type of payments help enhance social equity?

The form of payments will be determined by the context in which the PWS is being proposed and negotiated. Payments may be in cash or kind, involve the provision of technical assistance, or, more controversially, involve even entitlements and property rights. Having a number of negotiable options for selection by the poor may improve welfare outcomes. In Sukhomajri, India, water rights were de-linked from land rights, and the landless were able to sell their water rights locally. This partially compensated them for reduced access to biomass for grazing in the upper slopes. In Bungo, Sumberjaya, Indonesia, service providers preferred secure land tenure as form of compensation. In Pimampiro, Ecuador, service providers received cash and spent the extra income on both basic needs (e.g. cooking gas costs) and children's education.

Another potential positive impact of PWS schemes is to empower both buyers and sellers. Some PWS mechanisms have been able to recast relations from the typical government patron-project beneficiary to more equal contractual terms. Rural communities may be viewed as service providers, rather than "beneficiaries", while the urban poor may be seen as valued stakeholders who are paying for a watershed service. Participating in PWS schemes may strengthen poor people's land-tenure security. The sense of entitlement and ensuing empowerment can have far-reaching impacts on wellbeing, and may be even more important than income gains.[7] In Bolivia's Los Negros watershed, for example, upstream community members note with pride that for the first time, outsiders are valuing the forests *in situ*.

[7] See for example, Rosa *et al.* (2003).

How can PWS schemes be designed to balance efficiency with fairness?

Designing clear and effective contracts that avoid the exploitation of the seller by the buyer (and *vice versa*) is crucial if PWS programs are to be sustainable in the long-term. Buyers of hydrological services may desire PWS contracts in perpetuity, when land purchase is not a practical alternative. As such, the perceived fairness of schemes will be an important determinant of whether the agreement is maintained, and buyers may thus want to make an effort ensuring that contracts are both fair and efficient.

Q1 Why is it important to have a written contract?

A contract is an agreement between the buyer and seller (the parties to the agreement) on the terms of a transaction. Contracts clarify roles and responsibilities of the parties. The advantages of having a written contract are that:

- Buyers and sellers have a clear and physical record of the terms of the deal, and can revisit the agreement to refresh their memory or renegotiate it as necessary.
- Intermediaries have physical evidence of the transaction to offer to buyers.
- Third parties and evaluators are informed of the key elements of the deal.
- The agreement could potentially be officially recorded in the relevant property registry.

Q2 Under what conditions should a buyer enter into a contract with a prospective seller?

The seller should at a minimum be the proprietor or recognized user of the land, that is have the *de facto* right to manage and control activities on the contracted lands—notably including the ability to exclude third party access. Note that the right of alienation (right to sell) is not required for environmental service provision.

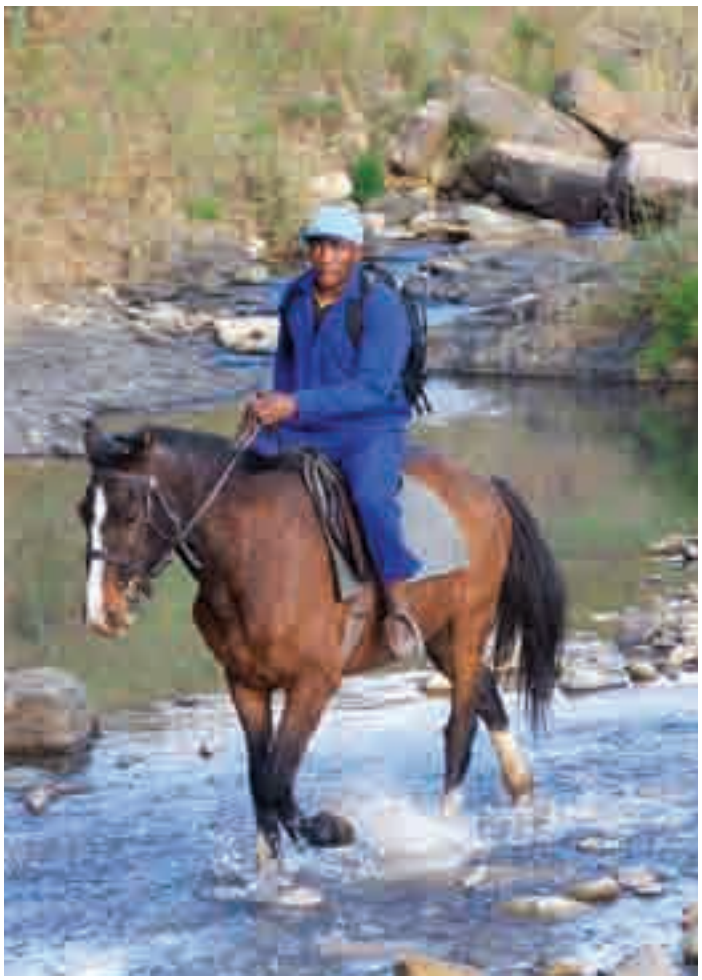
Q3 What are the critical aspects of a contract that the buyer must convey to the seller?

It is incumbent on the buyer or the intermediary—particularly where power imbalances exist (as discussed below under "fairness")—to ensure that the seller understands:

- The contract's consensual character—it is not a mandatory government program.
- The nature of a contract—the risk that the landowner may fail to understand that payments are contingent.
- The timeline—the duration of multi-year commitments and termination/renewal options may not fully be appreciated, leading to the risk of breach of contract.

Q4 What is the deliverable under a PWS contract?

Property rights for specific hydrological services produced by land management do not exist. Therefore, contracts typically call for the seller to undertake a specific land use or management activity. As verification of land/water interactions is difficult, costly, and not under the provider's full control, contracts instead tend to specify certain desirable land management practices (e.g. maintenance of forest cover) as the conditional deliverable. Participants in Mexico's PWS scheme, for example, are paid to not deforest their land—whether that results in improved water services or not. In Costa Rica participants are also paid for forest conservation, but also to undertake a number of land protection activities such as patrolling and managing firebreaks.



Q5 What studies are needed to determine payments?

Most schemes to date have focused on identifying the opportunity cost of net benefits foregone by the landowner from their prior or intended use of the land, which represents a floor for payments. Most programs have relied on approximate opportunity cost estimates for setting payments—because these are easier to calculate, and because the buyers tend to be more powerful, pressing payments towards the lower boundaries. An upper ceiling would be the full value of the hydrological services provided. However, mainly due to the biophysical uncertainties involved, it is often difficult or impossible to assign a reliable monetary value to the watershed services in question. Hence, the sometimes encountered idea that one can only do PWS after having done an exhaustive economic valuation study is also deceptive: PWS payments are a negotiated outcome, and service values—whether well-defined or fuzzy—are but one of the parameters to inform these negotiations.

PWS schemes have used cash, goods and services as compensation. The form of payment—be it saplings, beehives or cash—should be customized to local needs.

Q6 How should contracts be priced?

For user-financed schemes, negotiations between buyers and sellers have often taken place in advance of the onset of a program. For government-financed PWS, prices are often set through political processes instead. In such PWS schemes, political or legal-administrative concerns over price discrimination across different regions or recipient groups have typically led to the selection of standard, relatively fixed prices, or at most a limited tiered pricing system. For user-financed schemes, negotiations between buyers and sellers usually take place in advance. Efficiency is usually more critical here, and buyers have been more eager to differentiate prices and target payments in space, based on the variable service potential of lands. In Los Negros, Bolivia, a fixed price system was negotiated in the first year, but later substituted by a differentiated system based on forest types and expected service benefits. In terms of the actual payments, PWS schemes have used cash, goods and services as compensation, in most cases, with an emphasis on cash. The form of payment—be it saplings, beehives or cash—should be customized to local needs.

Q7 Can auctions be used for pricing PWS?

The only examples of highly price-differentiated government-financed PWS initiatives are reverse-auction based systems, designed to reveal landowners' true opportunity costs. These have only been applied to a limited extent in developed countries, such as Australia and the USA, but there they have been quite successful.[8] They have been used for contracts involving biodiversity and the provision of watershed protection. In developing countries, this type of scheme remains largely untested. When low-income groups living in upper watersheds are the service providers, there have been moral concerns to squeeze them down to a price close to their opportunity cost. However, empirical experimentation with reverse auction in developing countries is warranted.

Q8 How long should contracts last?

There is little or no experience on what is the optimum duration for a PWS contract, but some considerations include:

- There may be a significant time lag between changing land use and the *emergence* of an observable watershed service. This suggests that, where possible, contracts need to be long enough for the maturity of the contract to match service provision.
- Prices for agricultural commodities and inputs change over time, so long-term fixed-price contracts run the risk of becoming obsolete.
- Negotiating contracts is costly, suggesting that short term contracts are less desirable.

In practice, the average duration of PWS contracts has probably been around five years, thus striking a compromise between these opposed concerns. However, for the first generation of user-financed contracts, where trust issues are a main concern, contract duration may often be just one year.



Q9 How should performance be monitored?

Due to issues of scale and the difficulties in measuring and interpreting perceived changes in watershed services, most PWS examples to date have based the contract on changes in (actual or planned) land use. Issues that arise include:

- Assessing the character of the changes required.
- Ensuring that changes are taking place within the defined location. The means of verification (tools), the frequency (how often) and the sampling framework (how many of the contractors) should all be agreed upon by the stakeholders, and be clearly stated.

[8] For a description of auctions under the US Conservation Reserve Program (CRP), see Claassen *et al.* (2008). For a discussion of auction-based methodologies, see Ferraro (2008).

Q10 How should risks be allocated between parties?

Contracts should always explicitly determine the allocation of risk, whether from a natural catastrophe or from third party action, which may lead the land under PWS not to deliver the targeted service, due to fire, flooding, disease, etc. In the Costa Rican program, for example, some risks are borne by the landowner, so that the contract may be terminated or certain areas be excluded. This can pose hardships for landowners, but may be necessary to maintain PWS incentives. One solution can be insurance that either the landowner or the service buyer can buy into, pooling their risk with others in the program.

In contracts that call for provision of a specific type of land management, the buyer bears full risk of uncontrolled third factors (e.g. weather) compromising the service provision. A less common alternative is to specify direct indicators of performance in terms of downstream services. This shares risk in a different way, by linking payments to outcomes (which may not perfectly correlate with effort), e.g. payments might be made when a river has a flow of more than 30 litres per second, rather than for each hectare of forest conserved. With outcome linked payments service buyers pay for exactly what they receive, suppliers can innovate, perhaps supplying the service at lower cost. But such outcome-based payments are more risky for suppliers, since outcomes are dependent on other factors than simply their efforts.

Q11 How can parties terminate or renew the agreement?

All contracts should include provisions for termination and renewal.

- Termination clauses in contracts should clearly state under what circumstances each party could opt out.
- Equally important is defining under what conditions the contract can and will be renewed. The renewal clause should clearly state under what circumstances a contract could be renewed, both with and without modification.

Q12 When is a contract for PWS unfair?

Fairness is defined in the eyes of the beholder, so it is important to employ explicit criteria specifying which processes and outcomes are to be considered inequitable, rather than those that merely represent strategic positioning in the negotiation. If one landowner is paid more than another for services, the outcome may be perceived as unfair by the latter, even though such an arrangement may be efficient in that the former landowner actually provides more of the service. If asymmetries of information or power lead to the acceptance of contracts by sellers that make them worse off (i.e. payments that are less than the sellers' opportunity costs), then the contract would be unfair. If such asymmetries lead to the buyer paying above the value of the expected hydrological services, the contract would also be unfair. In both cases, contracts will also be inefficient from a societal viewpoint, and are unlikely to last. Perceived fairness is an important determinant of sustainability.

At what scale are PWS schemes best applied?

PWS implementers may be faced with considerations on how to choose between different spatial and temporal scales of operation. Both the supply of and demand for most watershed services is continuous over time, so in principle it makes sense to design PWS contracts for the long term—or for however long it takes to secure the service. In terms of spatial scale, implementers need to be clear about what specific hydrological services the PWS will sell, the corresponding spatial scales over which each of these are observable, and then design their schemes accordingly. Large PWS schemes can benefit from economies of scale, but it tends to become harder to target high-value, high-threat zones, and to differentiate payment rates. This is a handicap in terms of achieving additionality and economic efficiency. It is unwise to start operating at the large scale in pilot phases: risks of mistakes are higher initially, and starting with small trials allows for better adaptive management.

PWS implementers may be faced with considerations of how to choose between different scales of operation—including temptations to scale up a successful pilot scheme. A particular PWS scheme may function better at one scale than another, in terms of cost-efficiency, sustainability, equity, or other output performance indicators. We don't yet know what the optimal scale for achieving these objectives is. For user-financed schemes, experience suggests that the PWS level of organization should probably fit closely to the scale of the biophysical service that users are demanding—e.g. the appropriate order of catchment corresponding to the range within which a certain service is being provided and used. Nevertheless, decisions are ultimately also influenced by the economic, social, and political-administrative management context, especially as we move to government-financed schemes with significant political dimensions.

Q1 What dimensions need to be considered?

Various factors that measure scale and set its dimensions are relevant to PWS design: temporal, functional, spatial and administrative. The following table provides an overview.

Examples of variables measuring and influencing PWS scales		
1	**Units**	Number of persons, hectares, cubic meters of water, costs
2	**Financing**	Government versus user-financed schemes
3	**Services**	Sub-services (sedimentation versus dry-season flow)—spatial range of supply and demand
4	**End use**	Hydroelectric power versus drinking water, added ecosystem services (such as water plus carbon services)
5	**Watershed dimensions**	Micro watershed (drinking water quality) versus higher order catchment (flood risks in greater river basin) or cross-watershed functions (aquifer recharge)
6	**Administrative units**	Municipal, departmental, national scale, transboundary water courses
7	**Direction**	Is both "scaling up" and "scaling down" potentially relevant?
8	**Temporal aspects**	Choice of contract length; identifying long-term payment vehicle

Q2 For what time scale should a PWS scheme be designed?

Both the supply of and demand for most watershed services are continuous over time. It thus makes most sense to design PWS payments and contracts for the long term. This then raises the issue of how to make payments in situations where services take a long time to be delivered/or to mature. Conversely, factors that likely reduce the optimal time-scale length are insecurities about PWS modalities, lacking trust between buyers and sellers (both most likely in early phases), expected future variability in service values and in providers' opportunity costs, or short administrative funding horizons.

Q3 How large should PWS schemes be within a watershed?

Implementers first need to have clarity over what specific hydrological services the PWS will sell, and the corresponding spatial ranges within which each of these are observable. For instance, a PWS scheme can prove too small in scale if it does not integrate sufficient service providers, so that non-paid upstream actors could jeopardize service provision. Conversely, it can be too extensive if the catchment is so large that links between upstream land use practices and downstream water yield and quality become obscured by intermediate processes (e.g. sediment deposition) or background noise (e.g. variations in rainfall across sub-watersheds cancelling out peak flows in larger basins). The biophysical aspects thus fundamentally set the stage for PWS scale choices.

Q4 Should schemes extend beyond a single watershed?

Under certain environmental conditions, functions such as aquifer recharge may depend on processes functioning in neighbouring watersheds—an argument for larger PWS size. In addition, larger PWS can make economic and administrative sense. The strongest argument is that the transaction costs of both starting and running a PWS scheme tend to be lower at larger scales. If the state is generally recognized as a good custodian of resources, a national-level initiative may secure legitimacy for PWS more quickly.

Marketing of PWS systems to investors may also be easier at larger scales. Donors financing the start-up costs often like larger-scale impacts that benefit more people and which provide more powerful examples in advocacy work. If the PWS scheme is to jointly produce other benefits within an integrated social-ecological system, larger size can be positive (e.g. for creating biodiversity corridors).

Sub-national government-financed PWS schemes can also make sense, in cases where decentralization has made regional government the most powerful actor in service-buyer coordination. In Colombia, for instance, current efforts to create a nationwide PWS system may have the best chances of success at the level of the *corporaciones*—regional environmental agencies collecting legally mandated payments from both hydroelectric power producers and industrial water consumers.

The biophysical aspects of a watershed fundamentally set the stage for PWS scale choices.

Q5 Are there disadvantages to large-scale schemes?

In large PWS schemes, it generally tends to become harder to target high-value, high-threat zones, and to differentiate payment rates in space. This is a handicap in terms of achieving additionality and economic efficiency for national-level PWS schemes, such as in China, Costa Rica, or Mexico. In such circumstances, PES payments become more like general subsidies. When rates become too inflexible and fail to reflect variations in quality or amount of the service provided, key economic signals between buyers and sellers are weakened, making resource allocation less efficient. In particular, there is a high risk of paying for actions that would have happened anyway (zero additionality). In pilot phases, it may be particularly unfortunate to start operating at the large scale. Because uncertainty and the risks of making mistakes are higher initially, starting out on a small-scale trial basis may allow more effective adaptive management. For evaluations of "what works, what doesn't?" limiting experiences to single-design large-scale schemes from the outset would preclude important learning-by-doing experimentation.

Q6 Can one move across scales or have multi-scale schemes?

Scaling up of PWS initiatives is often seen as a way of broadening impacts and increased cost efficiency, while downscaling to less spatial coverage and more focused impacts may sometimes seem desirable to better target effects. In addition, changing circumstances (e.g. new environmental problems, political-institutional changes) could alter the pros and cons of operating at a certain scale. However, among PES experiences so far, neither much up- nor downscaling has occurred: big schemes tend to remain big and small schemes tend to remain small—although the latter may be *replicated* at similar scales elsewhere. In exception are some of the largest government-financed PWS schemes, such as the Chinese Sloping Land Conversion Program or some of the EU agri-environmental schemes, which have started operation at a pilot scale before scaling up to mega-levels. These exceptions apart, the transaction-cost and political economy obstacles to moving across scales may simply be prohibitive: renegotiating incentives and redesigning contracts is cumbersome, ongoing payments are often expected to continue, etc. This reinforces the need to select the appropriate scale at the outset, before the initiative becomes locked in to certain modalities.

Q7 Can PWS implementation be multi-scaled?

Both in Mexico and Costa Rica, there are plans to supplement the national schemes with additional smaller-scale, spatially more focused schemes. In Costa Rica, FONAFIFO functions already to some extent as an "umbrella" under which local water consumers (e.g. a brewery or a water-utility company) can earmark payments for recipients in their particular target watershed. What makes multi-scaling interesting is that one can aim for the best of both worlds: get the legitimacy and managerial economies of the national scale PWS, while retaining the flexibility and focus of small-scale schemes. In some contexts, parallel implementation of national and small-scale schemes could provide for complementary cross-fertilization of knowledge. In other cases, the two could come to compete for the same buyers' willingness to pay: people who already pay into one PWS scheme are likely unwilling or unable to pay into another. While the "umbrella" and multi-scaling concepts are thus certainly promising, we need to experiment more with them before we can recommend any particular models for replication.

Concluding remarks

Payments for environmental services, and in particular payments for watershed services, currently attract considerable interest among academics, donors and practitioners. Few efforts so far have been made to compare and analyze existing initiatives. The Bellagio workshop was an attempt to do this in an informal setting. Our conversations are no substitute for a formal comparative analysis and systematic extraction of lessons, but we believe that what we lacked in methodical analysis, we made up for in on-the-ground, practical experience.

The Bellagio Conversations are the result of a meeting of opinions, ideas and knowledge from around the world, from a diverse range of practitioners, investigators and investors, all of whom have concrete experience with the particular watershed management tool that is PWS. Throughout the meeting in Bellagio we found ourselves continually repeating phrases such as “preliminary findings show”, “this needs empirical testing”, or “we’re not yet sure of the best way to go”. Recognizing our cognitive limitations in the innovative field of payments for watershed services is perhaps the first necessary condition for eventually making progress.

The conversations described here do not pretend to be a “how-to” guide, though they could provide inputs for such a document in the future. There is currently no general PWS recipe, and each PWS initiative will need to develop in its own social, economic, and cultural contexts. However, there are some emerging common threads. In particular, the two subgroups of user-financed and government-financed PWS initiatives obey quite different rules, but internally exhibit characteristics that allow for sharing and learning. In this way, a structured brainstorming meeting, as we had in Bellagio, can help guide thoughts, hypotheses and experiences in a variety of fields such as research, design implementation and policy advocacy.

It is the hope of all who participated in the Bellagio Conversations that our experiences will help encourage potential new PWS innovators to get involved, to develop better schemes, and to not repeat our mistakes. In our view, payments for watershed services initiatives can be a powerful conservation tool in the right circumstances. Understanding the opportunities and challenges involved will help us to know when to take the plunge and how to make the most of it.

References

Asquith, N., M.T. Vargas, and S. Wunder. 2008. “Selling two environmental services: in-kind payments for bird habitat and watershed protection in Los Negros, Bolivia.” *Ecological Economics*, 65:4, pp. 675-84

Aylward, B. 2007. “Agricultural landscapes and domestic water supply: the scope for payments for watershed services with special reference to sub-Saharan Africa. Report to the Food and Agriculture Organization” (unpublished), Ecosystem Economics LLC, pp.89

Bennett, M.T. 2008. “China's Sloping Land Conversion Program: institutional innovation or business as usual?” *Ecological Economics*, 65:4, pp. 699-711

Bruijnzeel, L.A. 2004. “Hydrological functions of tropical forests: Not seeing the soil for the trees?” *Agriculture, Ecosystems & Environment*, 104, pp.185-228 (doi:10.1016/j.agee.2004.01.015)

Claassen, R., A. Cattaneo, and R. Johansson. 2008. “Cost-effective design of agri-environmental payment programs: U.S. experience in theory and practice.” *Ecological Economics*, 65:4, pp. 737-52

Engel, S., S. Pagiola, and S. Wunder. 2008. “Designing payments for environmental services in theory and practice: an overview of the issues.” *Ecological Economics*, 65:4, pp. 663-74

Ferraro, P. 2008. “Asymmetric information and contract design for payments for environmental services.” *Ecological Economics*, 65:4, pp. 810-21

Frost, P.G.H. and I. Bond. 2008. “The CAMPFIRE programme in Zimbabwe: payments for wildlife services.” *Ecological Economics*, 65:4, pp. 776-87

Grieg-Gran, M., I.T. Porras, and S. Wunder. 2005. “How can market mechanisms for forest environmental services help the poor? Preliminary lessons from Latin America.” *World Development*, 33:9, pp. 1511-27

Landell-Mills, N. and I. Porras. 2002. *Silver bullet or fool’s gold? A global review of markets for forest environmental services and their impact on the poor.* IIED: London

Muñoz-Piña, C., A. Guevara, J.M. Torres, and J. Braña. 2008. “Paying for the hydrological services of Mexico's forests: analysis, negotiation and results.” *Ecological Economics*, 65:4, pp. 725-36

Pagiola, S., A. Arcenas, and G. Platais. 2005. “Can payments for environmental services help reduce poverty? An exploration of the issues and the evidence to date.” *World Development*, 33:2, pp. 237-53

Pagiola, S. 2008. “Payments for environmental services in Costa Rica.” *Ecological Economics*, 65:4, pp. 712-24

Perrot-Maître, D. 2006. “The Vittel payments for ecosystem services: a “perfect” PES case?” *Project Paper #3*: 24. IIED: London

Rosa, H., S. Kandel, and L. Dimas. 2003. “Compensation for environmental services and rural communities.” 78. PRISMA: San Salvador

Turpie, J.K., C. Marais, and J.N. Blignaut. 2008. “The Working for Water programme: evolution of a payments for environmental services mechanism that addresses both poverty and ecosystem service delivery in South Africa.” *Ecological Economics*, 65:4, pp. 788-98

Wunder, S. 2005. “Payments for environmental services: some nuts and bolts.” *CIFOR Occasional Paper*, #42, pp. 24

Wunder, S. and M. Albán. 2008. “Decentralized payments for environmental services: comparing the cases of Pimampiro and PROFAFOR in Ecuador.” *Ecological Economics*, 65:4, pp. 685-98

Wunder, S., S. Engel, and S. Pagiola. 2008. “Taking stock: a comparative analysis of payments for environmental services programs in developed and developing countries.” *Ecological Economics*, 65:4, pp. 834-52

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