Investments and fiscal measures for the protection and improvement of biodiversity and ecosystem services

Thomas Chiramba, Silas Mogoi and Isabel Martinez (UNEP), Tim Jones (DJEnvironmental)

Challenges

UNEP's Water Investing in Natural Capital (2011) highlights the importance of investing and conserving biodiversity and ecosystem services. The report points that in terms of ecosystem health and function, global assessments of the health of the world's water river systems and aquifers suggests that the aggregate trend is one of decline (Millennium Ecosystem Assessment Report 2005; WWF's Living Planet Report 2010; the UN World Water Development Report 2010).

Examples of the decline included in the report are:

- Barriers have been laid across China's Taihu Lake to stop regular algal blooms reaching the water treatment plant that supplies water to over 2 million people (Guo 2007);
- From October 2002 until October 2010, the absence of flow has meant that dredges have been used to keep the mouth of the Australia's River Murray open to the sea;
- In Manila, the Philippines, groundwater extraction, primarily for industrial purposes, is lowering the water table at a rate of between 6 metres and12 metres per year (Tropp 2010);
- In 1997, China's Yellow River flowed all the way to the sea only for 35 days and for much of the year this river's last 400-plus miles were dry (Fu 2004).

Ecosystem services – for example the regulation of water quality and quantity – have enormous economic value, yet the linkage between degradation of ecosystem services, growing resource scarcity and the rising costs of providing those services artificially (e.g. through costly water treatment plants) have been widely neglected until relatively recently. Indeed it is only in the last decade or so, particularly since publication of a seminal journal article by Daily et. al (1997) that 'ecosystem services' is a phrase in regular usage.

Ecosystem services provided by watersheds

Smith *et al*. (2006) provide the following categorisation of the ecosystem services provided by a typical watershed:

1. *Provisioning services* – i.e. services focused on directly supplying food and non-food products from water flows: freshwater supply, crop and fruit production, livestock production, fish

production, timber and building materials supply, medicines, hydroelectric power.

2. *Supporting services* – i.e. services provided to support habitats and ecosystem functioning: wildlife habitat (i.e. biodiversity conservation), flow regime required to maintain downstream habitat and uses.

3. *Cultural and amenity services* – i.e. services related to recreation and human inspiration: aquatic recreation, landscape aesthetics, cultural heritage and identity, artistic and spiritual inspiration.

4. *Regulating services* – i.e. services related to regulating flows or reducing hazards related to water flows: regulation of hydrological flows (buffer runoff, soil water infiltration, groundwater recharge, maintenance of base flows), natural hazard mitigation (e.g. flood prevention, peak flow reduction, landslide reduction), soil protection and control of erosion and sedimentation, control of surface and groundwater quality.

The way in which management of the upstream part of a river basin or watershed influences the quantity, timing and quality of water available for downstream economic uses is among the easier ecosystem service linkages to convey (in principle at least) to non-specialist stakeholders.

The importance of maintaining intact vegetation cover – especially forest cover – in the upstream parts of river basins as a means of regulating infiltration, runoff, erosion and sedimentation, and the significance of healthy forest and freshwater ecosystems for maintaining biodiversity means that water managers and conservationists often have a common interest in the protection and/or enhancement, rehabilitation, or restoration of these ecosystems. This linkage is even more significant if the potential for additional 'wins' through the role of forests in limiting carbon emissions is taken into account (though the latter is largely beyond the scope of this session).

UNEP (2011) report considers that "*there is a new recognition of the positive synergy that emerges between healthy environments and healthy communities*". When astute investments in the restoration of ecosystems are made, internal rates of return in excess of 10 per cent are attainable.

Biome/ecosystem	Typical cost of restoration (high-cost scenario)	Estimated annual benefits from restoration (avg. cost scenario)	Net present value of benefits over 40 years	Internal rate of return	Benefit/cost ratio
		US$/ha	US$/ha	%	Ratio
Coastal	232,700	73,900	935,400	11%	4.4
Mangroves	2,880	4,290	86,900	40%	26.4
Inland wetlands	33,000	14,200	171,300	12%	5.4
Lake/rivers	4,000	3,800	69,700	27%	15.5

Table 1: Examples of the estimated costs and benefits of restoration projects in different biomes
Source: Adapted from TEEB (2009a)

Approaches

Restoration of degraded river systems

As documented by Le Quesne et al. (2010), some countries are now investing large amounts of money in the restoration of degraded river systems and the development of policies and administrative arrangements designed to prevent degradation of these systems.

Two examples of governments investing in river restoration

Korea

In July 2009, the Republic of Korea announced a Five-Year Plan for Green Growth in order to implement the National Strategy for Green Growth over the period 2009-2013. This includes a 22.2 trillion Korean won (US$ 17.3 billion) investment in a Four Major Rivers Restoration Project. The five key objectives of the project are as follows: (1) securing sufficient water resources against water scarcity, (2) implementing comprehensive flood control measures, (3) improving water quality whilst restoring the river-basin ecosystems, (4) developing the local regions around major rivers, and (5) developing the cultural and leisure space at rivers. Overall, it is expected that the project will create 340,000 jobs and generate an estimated 40 trillion won (US$ 31.1 billion) of positive economic effects as rivers are restored to health.

Australia

In January 2007, the Australian government announced a A$10 billion (US$10 billion) commitment to restore health to the seriously over-allocated Australia's Murray Darling basin and appoint an independent authority to prepare a new plan for the basin using the best available science. Some A$3.1 billion is being spent on the purchase of irrigation entitlements from irrigators and the transfer of these entitlements to a Commonwealth Environmental Water

Holder, A$5.9 billion on the upgrade of infrastructure with half the water savings going to the environment and A$1 billion on the collection of the information necessary to plan properly.

Sources: Office of National River Restoration (under the Ministry of Land, Transport and Maritime Affairs) (2009); Korean Ministry of Environment and Korea Environment Institute (2009) and Murray Darling Basin Authority (2010).

Recognising and valuing the services provided by ecosystems

A central requirement for greening of economic growth is the proper recognition and valuing of the services provided by ecosystems, as highlighted in the Synthesis Reports of the Millennium Ecosystem Assessment. By finding means of incorporating these values into market-based mechanisms, not only can they be properly taken into account in conventional economic decision-making processes, but also market-based financial incentives can be established to support and maintain ecosystem services.

Payment for Ecosystem Services

One of the key ways that water managers and those interested in conserving biodiversity have come together is through the setting up of fiscal measures that provide incentives for the sustainable management of ecosystems. Such measures may take a range of different forms – they may, for example:

- be public or private
- involve cap-and-trade schemes
- involve direct or indirect payments
- involve downstream users explicitly paying for services supplied by upstream land/water managers
- be aimed at generating multiple economic, social and environmental benefits (rather than purely environmental benefits)

One of the most widely implemented approaches during the last five to ten years (although its use is still in relative infancy in many countries) is commonly referred to under the umbrella of ‘Payment for Ecosystem Services’ (PES), although some confusion surrounds the use of this term.

Indeed, Greiber (2009) states that:

"*PES sometimes appears to have become a 'catch phrase' which needs further clarification on what it actually embodies – virtually all financial and legal incentive mechanisms for promoting conservation and good environmental citizenship, or only specific ones. Depending on the concrete definition of a PES mechanism, its legislative and practical requirements will differ considerably*."

Greiber further concludes that:

"*What makes a PES a PES is that in any payment arrangement those who pay are aware that they are paying for an ecosystem service that is valuable to them or to their constituencies – and those who receive the payments engage in meaningful and measurable activities to secure the sustainable supply of the ecosystem services in question.*"

Some environmentalists have expressed fears that direct payments for ecosystem services may do more harm than good for the conservation of biodiversity (see Wunder, 2006 for a discussion of some of the key issues in this debate). A key constraint (see Wertz-Kanounnikoff, 2006) is that *payment* for ecosystem services presupposes that the services supplied by a particular ecosystem are understood in a real 'on the ground' (rather than purely theoretical context) and that means of valuing these economically are available. This is by no means always the case and while experience and know-how are expanding rapidly in all regions of the world, the necessary scientific/technical and socio-economic background studies required to prepare a successful PES scheme are inevitably costly and time-consuming.

In spite of such constraints, leading global conservation NGOs such as Conservation International, The Nature Conservancy, and WWF, are all actively implementing PES projects and PES is recognised as an important tool by the Conservation on Biological Diversity (CBD). Goal 4 of the CBD's Strategy for Resource Mobilization seeks to: *"Explore new and innovative financial mechanisms at all levels..."*. The first of six strategic objectives under this goal is *"To promote, where applicable, schemes for payment for ecosystem services, consistent and in harmony with the Convention and other relevant international obligations."*

The TEEB/Bank of Natural Capital considers that PES "*offers a real opportunity to bring nature into our markets with a visible value*" and highlights PES as "*a key strategy for governments at international, national and local levels because [PES] rewards those who have the most immediate relationship with natural capital, but who usually lose out most in the trade and conversion of natural resources – namely the poor."* Alleviation of poverty as a driver of natural

resource degradation is recognised by biodiversity conservationists and water managers alike as one of the most valuable potential contributions of effective PES schemes.

Lessons learnt from PES in practice

Different PES approaches have been reviewed including three from Africa, three from Asia and three from Latin America and the Caribbean (LAC). They cover a broad range of scenarios, from initial valuation of ecosystem services in the Sourou River Valley (Burkina Faso), to implementation of pilot PES schemes in Lam Dong Province (Vietnam), Lake Naivasha basin (Kenya) and the Maloti-Drakensberg region (South Africa), through efforts to solve specific water management challenges in Fukuoka City (Japan) and Pingwu County (China), to relatively mature PES programmes in Costa Rica, Ecuador and Mexico, which have already served as models for replication and scaling up elsewhere in the LAC region (see compendium table). .

Below is summary of some of the common themes and key points emerging from the case studies of PES as a whole.

1. *On the design*

Payment for Ecosystem Services (PES) schemes need to be carefully designed and targeted to:

- be appropriate for the relevant legislative and institutional/governance framework (this is clearly most important for public PES schemes – see Greiber 2009).
- have clear predefined objectives, targets and indicators of success (and failure);
- apply to specified geographical (or hydrographical) limits.

As such mechanisms are being newly applied in many countries or individual river basins/watersheds, pilot projects provide a valuable means of testing and adapting internationally or nationally proven approaches to local conditions.

2. *Set up baseline scenario and monitoring*

- It is vital to have a baseline scenario against which to measure changes in economic, social and environmental factors during implementation. This can easily be forgotten in the midst of complex negotiations to establish workable financial mechanisms.
- A programme of monitoring of economic, social and environmental factors needs to be designed in advance as an integral component of implementation.

3. Public awareness campaign

A programme of public awareness can be important in sensitising stakeholders to upstream–downstream environmental linkages and the economic significance of the ecosystem services management carried out by watershed owners/managers. This can enhance willingness to pay on the part of users, and willingness to adapt land/water management practices by service 'suppliers' – or at least willingness by both groups of stakeholders to engage in dialogue.

4. Start small and scale up

Experience shows that it may be better to 'start small' and to 'scale up' rather than to try to implement a fully fledged financial mechanism from the beginning. This can be done, for example, by targeting a specific land/water management practice – and the driver(s) underlying it – that influences a specific ecosystem service (e.g. deforestation driven by the need for fuel wood, causing increased runoff, erosion and sedimentation of water courses). Trying to address multiple management practices, drivers and ecosystem services simultaneously from the start is liable to overwhelm the programme managers as well as stakeholders.

5. Identify beneficiaries and suppliers of ecosystem services

It s important to identify 'beneficiaries' and 'suppliers' of ecosystem services and representatives of each group who are able and willing to participate in discussions/negotiations on behalf of others.

Stakeholders may include all or some of the following categories of 'actor', only some of whom are direct suppliers/sellers or users/buyers:

- government ministries/departments
- government agencies
- local authorities
- river basin management authorities
- public corporations
- private corporations
- individual consumers
- individual landowner/managers
- community groups
- water users' associations
- national or international NGOs
- development assistance agencies

- other external donors

6. The elements

Sustainable provision of ecosystem services can be achieved through changes in land-use practices and incentives to farmers that are both equitable and targeted at maintaining or enhancing livelihoods.

7. Continuous adaptation to deal with key challenges

PES is not a panacea. All of the case studies included in the documentation for this session confronted a range of challenges, requiring continual adaptation.

8. Tips for successful PES

Building trust:

- Building trust and a spirit of partnership or mutual 'buy-in' among stakeholders.

Financial mechanisms:

- Ensuring that any financial mechanism proposed is in line with the provisions of applicable policy and legislation (recognising that if not, further lengthy preparatory work may be needed to lobby for and secure the necessary changes).

- Counterpart/additional contributions may be leveraged by the successful operation of an investment scheme. This can dramatically increase the overall funding mobilised and – more importantly – the beneficial environmental impacts of that funding.

Financing/payment:

- Convincing downstream water users that they should contribute financially to protection, maintenance or restoration/rehabilitation of ecosystem services by upstream landowners/managers.

- Addressing the contention that downstream water users, who already pay fees or taxes for their water consumption, may be 'forced to pay twice' by any additional levy or charge for ecosystem services.

PES Charges and sustainability

- Setting the charges paid by water users at a level that is acceptable to the water users but which still generates sufficient income to finance planned investments in upstream environmental protection measures.

Equity and fairness

- Setting levels of payments to upstream land/water managers that are equitable and which are sufficient to act as an incentive in themselves to conserve natural resources (regardless of the stipulations of any contract or sanctions for non-compliance) rather than to continue exploiting them unsustainably.

Lessons learnt from selected PES cases

Case	**Lessons learnt**
Fund for the Protection of Water (Fondo para la Protección del Agua – FONAG)	Governments, NGOs (including international NGOs), development assistance agencies, the corporate sector and local communities can work effectively together on PES schemes if the benefits for all stakeholders are clear. Relatively modest expenditure can leverage much bigger overall investment through counterpart contributions. Restricting use of the fund to yields from interest and investments – NOT capital – means that the fund grew slowly but sustainably. Strong capacity building and communications/ awareness-raising components have been vital to FONAG's success.
PROCUENCAS Payment for Ecosystem Services scheme, Costa Rica	Upstream environmental services are linked to downstream beneficiaries through a direct and earmarked monthly financial charge to all city water end-users. The case is a good example of a small, independent PES scheme that has successfully addressed 'willingness-to-pay' (WTP) issues through clear articulation of the linkages between watershed conservation, quality (and cost) of water supply management and public health objectives.
Programme for Payment of	Scheme identified those benefiting from ecosystem services

Hydrological Environmental Services (Programa de Pago por Servicios. Ambientales-Hidrológicos – PSAH), Mexico	and found a mechanism through federal law for charging for 'natural capital'. Contracts with landowners were based on meeting conditions/ indicators that could actually be monitored (e.g. rates of deforestation via satellite photos) against a baseline scenario. Criteria used to set geographical priorities so that over-subscription of the scheme could be dealt with. In this case a points system was used to prioritise areas according to the value of environmental service, as well as the level of poverty and risk of deforestation.
Economic value of the Sourou valley, Burkina Faso – a preliminary evaluation	Apparent economic benefits accruing from a particular use (in this case agriculture) of a region's land and water resources may in fact be relatively insignificant if a comprehensive ecocomic valuation of ecosystem services is conducted.
Payment for Environmental Services pilot project in Lake Naivasha basin, Kenya	Sustainable provision of ecosystem services can be achieved through changes in land-use practices and incentives to farmers that are both equitable and targeted at maintaining or enhancing livelihoods. Strong stakeholder partnership leads to more successful implementation. Necessary preconditions include: availability of baseline hydrological data; establishment of a strong business case; building of trust and commitment among stakeholders establishing a market mechanism – that stakeholders are easily able to engage with – for the selling and buying of ecosystem services. Appropriate and adequate capacity building of ecosystem service providers and beneficiaries strengthens implementation of PES projects.
Payment for Ecosystem Services (PES): Feasibility	Improved management can shift destructive summer flows in periods of water abundance or excess, to the winter months

and Implementation in the Maloti-Drakensberg Transfrontier Project Area, South Africa	when water is scarce and when value can be added. Management results in significant reductions in soil erosion, reducing the sedimentation of water infrastructure, improving productivity and increasing carbon sequestration. Watershed management may be one of the cheapest and socially equitable water augmentation options available to South Africa. Management costs vary – some catchments show that restoration and management is financially feasible with only baseflow enhancement being marketed, while other catchments require three services to be traded before management is financially feasible. Catchment management becomes increasingly feasible when more than one of the services is traded. Rural people can farm water, carbon sequestration and sediment yield reduction as complementary services to sound cattle farming.
Payment for Forest Environmental services (PFES): pilot implementation in Lam Dong Province, Vietnam	The identification and emergence of champions at all levels of the implementation process (national, provincial, district, and commune) was a key factor for success. The limited number of environmental services implemented under the pilot policy (water regulation, soil conservation, and landscape visual quality) reduced the risk of implementation failure. Despite the fact that extensive scientific/technical studies were carried out to value ecosystem services, the final payment structure also took into consideration the socioeconomic and socio-political context of the communities in question. Strictly adhering to the valuation studies, while scientifically robust, would not have guaranteed the uptake of the project and the backing of the community and payers. The development of the management mechanism was greatly assisted by local household participation in its design,

	implementation, and evaluation. The proper and equitable distribution of payments is contingent on the equitable and precise allocation of forest parcels to households. However, lacking a private land tenure system and integrated land-use planning system, the process of forest demarcation, allocation, filing, and approval in Lam Dong Province required significant time and money, at times impeding the proper and timely disbursement of payments to households. There was an issue of whether payments under PFES should be considered as being made from the state budget or whether they replaced the water-resource tax that hydropower plants had to pay. These and many other issues, connected to the innovative concept of PES, took time to resolve among various stakeholders. Establishing automated gauging stations in a relatively remote provincial river basin was a great challenge.
Conserving and managing forests as source of water for Fukuoka City, Japan	Good use of education and exchange programmes to foster interaction between beneficiaries and service providers.
Payment for Ecosystem Services and alternative livelihoods in rural China	The effectiveness of the scheme was increased by providing training and capital for villagers to pursue new (environmentally-friendly) sources of income

References

Daily, G.C., Alexander S.E., Ehrlich P.R., Goulder L.H., Lubchenco J., Matson, P.A., Mooney H.A., Postel S., Schneider S.H., Tilman D., and Woodwell G.M. 1997. Ecosystem services: Benefits supplied to human societies by natural ecosystems. *Issues in Ecology* **2**:1-18.

Greiber, T. (ed). 2009. *Payments for Ecosystem Services – Legal and Institutional Frameworks*. IUCN Environmental Policy and Law Paper No. 78. IUCN, Gland, Switzerland.

Korean Ministry of Environment and Korea Environment Institute. 2009. "Four major river restoration project of Republic of KOREA." Korea Environmental Policy Bulletin (KEPB), Issue 3, Volume VII.

Le Quesne, T., Kendy, E., and Weston, D. 2010. The implementation challenge: Taking stock of government policies to protect and restore environmental flows. WWF Report. Available at http://www.hydrology.nl/images/docs/alg/2010_The_Implementation_Challenge.pdf

Murray Darling Basin Authority. 2010. Guide to the proposed Basin Plan. Murray Darling Basin Authority, Canberra.

Office of National River Restoration (under Ministry of Land, Transport and Maritime Affairs). 2009. Restoration of four major rivers – Revival of rivers: A new Korea.

Smith, M., de Groot, D., Perrot-Maître, D. and Bergkamp, G. (2006). *Pay – Establishing payments for watershed services*. Gland, Switzerland.

TEEB/Bank of Natural Capital. *Payments for Ecosystem Services at the National Level*. http://bankofnaturalcapital.com/2010/10/05/payments-for-ecosystem-services-at-the-national-level/ downloaded 6 September 2011.

Wertz-Kanounnikoff, S. 2006. Payments for environmental services – A solution for biodiversity conservation? *Idées pour le débat* **12/2006.** Institut du développement durable et des relations internationales (IDDRI), Paris, France.

Wunder, S. 2006. Are direct payments for environmental services spelling doom for sustainable forest management in the tropics? *Ecology and Society* **11**(2): 23.