



Green Water Credits

**Lessons Learned from
Payments for Environmental
Services**

Green Water Credits: Lessons Learned from Payments for Environmental Services

Green Water Credits Report 2

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Green Water Credits is a mechanism to pay rural people for specified land and soil management activities that determine all fresh water resources at source. These activities are presently unrecognized and unrewarded. Direct payment will enable better management of the resource. This proof-of-concept program is supported by the International Fund for Agricultural Development (IFAD) and the Swiss Agency for Development and Cooperation (SDC)

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Summary

Green Water Credits is a mechanism for payments to land users for specified land and soil management activities that determine the supply of fresh water at source. These activities are presently unrecognised and unrewarded. Direct payment will enable better management and therefore *less* runoff, flooding, and siltation of reservoirs, and *more* groundwater recharge and stream base flow, particularly during the dry season. At the same time, *Green Water Credits* will diversify rural incomes and help communities to adapt to economic and environmental change. The proof-of-concept project aims to demonstrate the viability and feasibility of the concept. World-wide experience with payments for environmental services (PES) initiatives¹ offers several useful lessons:

Security of expectations

- a) The purpose must be clearly understood by all parties. *Green Water Credits* are payments for specified land and soil management practices which affect the provision of watershed services. They are *not* payments for water, payments for past activity or restraint, or a subsidy for conservation although this may be a collateral benefit;
- b) Buyers and sellers must be clearly identified. The buyers are downstream water users that benefit from security of supply and protection against damaging floods. The sellers are land users in the catchment who are in a position to determine water resources at source; they must have control over the use of land and water in the catchment;
- c) The specified management must be clearly linked to the benefits required; cause-and-effect must be established between the management activities and *improved* groundwater recharge, stream flow and water quality; and *control* of erosion, siltation and flooding. Buyers must know that upstream land managers can effect these improvements;
- d) Buyers need confidence that the specified management activities will be carried out to the required standard. Sellers need confidence that payments will be fair and will be made for long enough for them to benefit from their investment.

¹ PES initiatives have been developed for a number of environmental services: watershed services, carbon sequestration, biodiversity conservation and landscape beauty. This report focuses primarily on the experience with payments for watershed services as this is most relevant to *Green Water Credits*.

Policy, legal, and institutional framework

- e) PES schemes benefit from a supportive policy, legal, and regulatory setting. But they can operate successfully in the absence of land titles or formal PES laws;
- f) NGOs and civil-society organisations have an important part to play in ensuring that the poorest can participate in PES programs.

Design of payment mechanisms

- g) In developing countries, simple mechanisms such as contracts have mostly been used. Cash payments are the most common; in-kind payment is another option;
- h) The rate of payment should be negotiated on the basis of the cost of the specified management practices, specifically the opportunity cost of changing management practice, and the buyers' willingness to pay;
- i) Simple monitoring approaches and sanctions such as temporary exclusion can be effective. However, this requires an intermediary with local knowledge.

Costs and benefits for upstream land managers

- j) Specific consideration needs to be given to the trade offs between different goals - such as efficiency, effectiveness in improving water resources, and poverty alleviation;
- k) To enable the poorer farmers to take part, rules will be needed that allow for informal tenure and small land holdings, and which hold-down transaction costs;
- l) Efforts should be made to enhance non-financial benefits such as capacity-building and improvement in social organization;
- m) Payment in advance, or credit, is needed to match the benefits to the upstream land managers with their costs.

Costs and benefits for downstream water users

- n) In the absence of direct private-sector beneficiaries, governments can fund payments to upstream land managers;
- o) Many PES programs have focused on using upland forests to deliver watershed services. However, farm practices in the catchment can also provide these services while, simultaneously, retaining or enhancing farm production.

Applying *Green Water Credits* in Africa

- p) The inclusion of many farmers, each controlling only a small patch of land, imposes high transaction costs which will erode the amounts that can be paid out to the service providers;
- q) The payments mechanism will have to take account of multiple and overlapping sources of formal and informal authority;
- r) Many of the major river basins of Africa are shared between one or more countries; this is a challenge for basin-wide implementation of *Green Water Credits*;
- s) There are gaps in the capacity of existing water management institutions; NGOs and community-based organisations can help bridge these gaps.

1 Introduction

Green Water Credits is a mechanism for payments to land users for specified water management activities that determine the supply of fresh water at source. These activities are presently unrecognised and unrewarded. Direct payment will enable better management. At the same time, *Green Water Credits* will provide reliable diversification of rural incomes, helping communities to adapt to economic and environmental change.

Green Water Credits addresses two Millennium Development Goals: Goal 1, to eradicate extreme poverty and hunger, and Goal 7, to ensure environmental stability. It combats poverty and hunger by enhancing people's resilience to external shocks by enabling them to build assets: water resources, stable soils, better and more reliable crops, and diversified rural incomes. It addresses environmental stability by improved land and water management that will benefit water supplies downstream, enhance aquatic and wetland habitats, reduce siltation of reservoirs and waterways, and protect land and infrastructure from floods.

The source of fresh water is rain and snowmelt. Depending on soil use and management, it is either shed as damaging runoff or infiltrates into the soil. The infiltrated water may be used by plants (*green* water), returning to the atmosphere and coming back again as rainfall, or it recharges groundwater and stream base flow that can be tapped for use downstream (*blue* water), Figure 1.

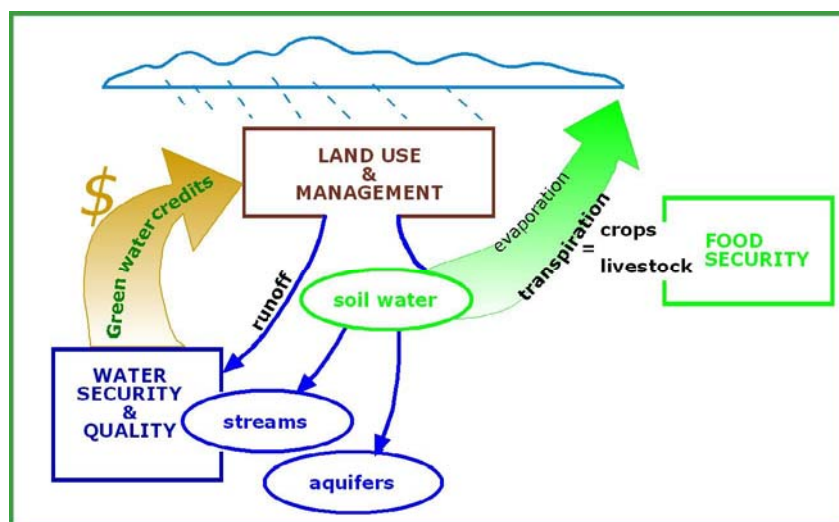


Figure 1: *Green and blue water in the water cycle*

Depending on soil management, the amount of water that infiltrates into the soil may be increased two- or three-fold – with an equivalent decrease in soil erosion, drought, and floods. The key water managers are rural people – farmers, pastoralists, woodmen - but the delivery of water is accidental to their daily management of the land; it goes unrecognised and unrewarded.

At source, fresh water has been treated as common property, so there is no incentive for sustainable management. *Green Water Credits* remedies this market failure through payments *from* the downstream beneficiaries *to* upstream land managers for the water management services that they provide. The payments provide a financial incentive for the upstream water producers; they introduce market forces in support of water resource management and allocation.

This report is a synthesis of the literature on schemes that have provided payments for environmental services (PES); it reviews a wide range of PES experiences, including schemes in both the developing and the developed world. These experiences are analysed by topic: the policy, legal and institutional framework, the design of payment mechanisms, costs and benefits for upstream land managers, and costs and benefits for downstream water users. In each section, lessons are drawn for the development of the new mechanism. Given that the proof-of-concept project is in Africa, the final section addresses implications for the application of *Green Water Credits* in that continent.

2 Policy, legal and institutional framework

2.1 Property rights, title and established access

Environmental services depend on access to land and water resources. Therefore, the laws and institutions must confer some minimum security of property rights, land tenure or recognised rights of access to the resource for the custodians or managers of land and water in the catchment. This does not mean PES schemes can work *only* in the presence of clear land title; for instance, in extractive reserves in Acre, Brazil, communities have secure access, withdrawal and exclusion rights that are sufficient for them to be compensated for their role in maintaining environmental services (Rosa and others 2004). Several other cases from Latin America demonstrate that the clear definition of land title is not a prerequisite for PES to succeed (FAO 2004); however, participants must be able to demonstrate land stewardship in order to guarantee provision of the service.

Legal setting

Specific legislation has sometimes been enacted: Costa Rica and Mexico, for example, have established national legal frameworks for PES. But most PES schemes operate without such a legal framework and this does not present an obstacle to success (FAO 2004). Other types of legal framework, not specifically designed for PES, also support PES projects; in the Philippines, a national law providing the legal basis for local government units to collect a share of the proceeds from natural resources was successfully used in court by one local government to compel a water district to pay 1 per cent of gross revenue for its use of natural resources within a watershed, part of which was to be used for protection of the watershed (Arocena-Francisco 2003).

Policy and regulatory framework

Supportive national policy and regulatory environments may also have a major impact on PES schemes; for instance, they can address and eliminate perverse incentives like subsidies for irrigation and industrial water use - a necessary preliminary step for successful PES implementation (Mayrand and Paquin 2004, Gouyon 2003).

Lesson for Green Water Credits: PES schemes benefit from a supportive policy, legal, and regulatory setting. But they can also operate successfully in the absence of land title or formal PES laws.

2.2 Civil society and the market

Government institutions have a significant role but civil society and the market often drive PES. Evidence from developed countries suggests that market-based mechanisms, combined with civil society institutions, are best able to deliver the highest combined levels of efficiency and equity (Gouyon 2003). NGOs and community-based organisations can play an important role in this process through mediation with markets (Rosa and others 2004). Civil society organisations have also performed channelling and implementing functions to overcome transaction cost barriers to participation; government entities may also fill this gap.

Lesson for Green Water Credits: NGOs and civil society organisations have an important part to play in ensuring the poorest can participate in PES programs.

3 Design of payment initiatives

3.1 Terminology – What are the payments for?

The terminology used in PES initiatives has proved to be contentious - in some cases because of associations with neo-liberal policies and moves to privatise water, in others because of differences in opinion about what the payments are for. Are they a reward for services rendered; or an incentive to refrain from environmentally damaging activities; or compensation for losses already incurred, activities already undertaken, or land use restrictions in the past? The Payments for Hydrological Environmental Services scheme in Mexico provides an example of these different views: case studies conclude that there was poor understanding by the recipients of the payments of the objectives of the program - payments were seen as a subsidy to conservation rather than as a payment for specific services; also, the program was having little effect on behaviour – the payments were going to *ejidos* (communities managing commons) that already practised conservation or where there was little risk of deforestation (Martinez 2005).

Lesson for Green Water Credits: The term Green Water Credits may be difficult for buyers and sellers of the management services to understand. Certainly it needs to be explained carefully if the objectives of the scheme are not to be misinterpreted.

3.2 Selling the service

Existing PES initiatives have focused on three kinds of activity:

- *Asset-building*: restoring natural habitat or tree planting, e.g. in Piracicaba, Brazil, funds from municipal water revenues are being used to assist farmers to plant trees in riparian areas (Viana and others 2002).
- *Restrictions on land use*: maintaining existing natural habitats and protecting them from incursion, e.g. in Pimampiro, Ecuador, farmers are paid to conserve primary forest, natural grassland, and (at a lower rate) already-disturbed forest and grassland (Echavarría and others 2003).
- *Improving existing land use*: e.g. by reducing pesticide use, reducing harvest rates to sustainable levels, or soil conservation. The Costa Rica PES scheme, until recently, paid landowners for sustainable forest management (Landell-Mills and Porras 2002).

Lesson for GWC: In PES, land managers are not selling a commodity but a service that is believed to affect the supply and quality of a commodity or resource. They have been able to demonstrate that they are carrying out certain activities that maintain resources or environmental services. The scientific basis for making these links has often been weak but schemes have gone ahead where local perceptions of the links have been strong, e.g. Pimampiro, where improvement in water-supply infrastructure also helped, and Los Negros in Bolivia (Robertson and Wunder 2005). In other cases, such as Lombok Island in Indonesia (Munawir personal

communication 2006) and Mairana in Ecuador (Robertson and Wunder 2005), schemes have stalled because of buyer scepticism about the land-water links.

3.3 Payment mechanisms

Payment mechanisms are many and various. They include:

- *Direct contracts between buyers and sellers:* e.g. The La Esperanza Hydropower project in Costa Rica signed a 99-year contract with the Monteverde Conservation League to maintain the watershed protection services provided by 3000 ha of cloud forest (Rojas and Aylward 2003);
- *Intermediary-based transactions:* where negotiation of the contract is between the intermediary and the buyers and the intermediary and the sellers. The intermediary may be government or an NGO. This category also includes trust funds which pool contributions made by water users to fund improved watershed protection, for example the Water Conservation Fund in Quito, Ecuador (Echavarría 2002);
- *Area-based schemes:* where the rules and rates of payment are set out in national or local regulations (usually after negotiation). An intermediary organization may be involved in administering the contracts. Examples of national schemes include PES in Costa Rica and Mexico;
- *Product-based mechanisms:* whereby land managers who meet the requirements of certification schemes, e.g. *salmon-safe* certificates in the USA, receive a price premium or other benefits such as improved market access;
- *Sophisticated trading mechanisms:* such as credits, licences and use rights. These have been used only in developed countries, e.g. salinity credits in Australia.

Lesson for GWC: In developing countries, simple mechanisms such as contracts have mostly been used. Intermediaries have played an important role in bringing buyers and sellers together; it is vital that the intermediary organization is well-established and adequately resourced.

Product-based mechanisms have not been used specifically for watershed protection but certification schemes could be an additional incentive to farmers; e.g. the Rainforest Alliance scheme for coffee requires restoration of natural forest and wildlife corridors, integrated pesticide management, and treatment of processing waste (CI/IIED 2006).

3.4 Types of payment

Payments are mostly in cash but there are examples where sellers have opted for in-kind payments: e.g. in Los Negros, Bolivia, the payment is one beehive per 10 ha of forest conserved per year. Reasons for preferring in-kind payments in this case include the opportunity for lasting benefits through a new activity (as cash may be quickly spent) and associations of cash payments with the buying up of the forest by outsiders (Robertson and Wunder 2005).

Lesson for GWC: While cash payments are the most common, the option of in-kind transfers should not be discarded.

3.5 Determination of the rate of payment

Ideally, rates of payment should be determined by both the value of the environmental service to beneficiaries and the costs to land managers. They should lie between the beneficiaries' maximum willingness-to-pay and the sellers' minimum willingness-to-accept. In practice, rates have tended to be set close to the minimum willingness-to-accept: upstream land managers are in a weak bargaining position because they are many, dispersed and, individually, control only small areas; also, it is harder for them to estimate the value of the service to downstream users than it is for proponents to estimate the opportunity costs of changing land management practices. For instance, payments in Costa Rica's PES scheme were determined by the available funds and the opportunity cost of land in areas suitable for ranching (Pagiola and others 2005).

Lesson for Green Water Credits: Rates of payment are most likely to be determined according to the opportunity cost of changing management practices. This is a practical option but not necessarily the most equitable one. Analysis of willingness-to-pay is also necessary to ascertain whether there will be enough demand.

3.6 Monitoring and sanctions for non-compliance

It has to be verified that the management practices paid for are actually being carried out. This may be done by remote sensing or by field inspection. Small intermediaries argue that their personal knowledge of participants facilitates monitoring.

Where participants are found to be violating the terms of the contract or the rules of the scheme, one possible sanction is to exclude them from the scheme thereafter (e.g. Los Negros in Bolivia), or for a pre-determined period (Pimampiro, Ecuador where the number of participants declined for a while as six-month exclusions were enforced but subsequently increased as participants decided to re-enter).

Lesson for Green Water Credits: Simple monitoring approaches and sanctions can be effective but require intermediaries with local knowledge.

4 Costs and benefits for upstream land managers

4.1 Impacts on the poorest

In most cases, PES have been designed as a means of reducing the costs of meeting environmental goals, rather than for poverty reduction, so they rarely aim at the poorest of the poor. To benefit directly from the sale of ecosystem services, people have to hold land; at least, they must have some formal rights over the resource – so the distribution and ownership patterns of land are critical to any impact of PES on poverty (Pagiola and others 2005).

Landless labourers, usually the poorest group in the rural economy, are unlikely to benefit as sellers of environmental services (Grieg-Gran and Bishop 2004). The case of Sukhomajri, in India, where the landless were assigned water rights, is an instance of how a scheme can be designed to benefit the very poor but this is considered a special case and has proved hard to replicate (Kerr 2002). In South Africa's *Working for Water* program, otherwise-unemployed labourers are paid for removing alien vegetation, so contributing to improved water flow.

Even where the poor hold land, they may not be well-placed to participate in PES because they may be unable to make or sustain the required changes in land management – which may conflict with their immediate needs.

Lesson for Green Water Credits: Specific consideration needs to be given to the trade offs between different goals, such as efficiency, effectiveness in improving water resources, and poverty reduction. If Green Water Credits is to have the maximum benefit for water resources, it should focus on those land managers holding land in critical parts of the catchment and those most capable of making the required changes in management. If Green Water Credits is also to be pro-poor, special components will be needed; these may have to be funded separately because they are likely to affect the efficiency of the scheme.

4.2 Barriers to participation of smallholders

There is little evidence that a minimum size for participating landholdings is a barrier to the participation of smallholders in PES. But there are other barriers. In Costa Rica, the minimum size of landholdings that qualify for PES is as small as one hectare for reforestation and two for forest protection (Rojas and Aylward 2003). Even so, smallholders in some areas are reluctant to join the scheme; a study of the Virilla catchment found that the main concerns of non-participants were about the rules, in particular the restrictions on using forest as a temporary shelter for cattle, and uncertainty over future changes in the law (Miranda and others 2003).

The requirement of formal title to the land has also been an obstacle. Los Negros in Bolivia is an example of an initiative which has proceeded even though few farmers have formal title. Local recognition of land boundaries, between neighbours, has provided a basis for the drawing up maps of land holdings and land conservation contracts - which are felt to be a benefit by the landholders because they strengthen their claims to title (Asquith personal communication 2005, Robertson and Wunder 2005).

Lessons for Green Water Credits: To enable smallholders to participate, entry rules must allow for small land holdings and informal tenure. At all events, procedures and requirements should be straightforward. Transaction costs for small landholders may be held down by establishing a group application and monitoring procedure (although contracts should be individual).

4.3 Financial and non-financial benefits

The immediate and visible impact of market initiatives is on cash incomes. In Pimampiro, Ecuador, the local government is paying a small group of farmers in the headwaters of the town's water supply to protect their forests. In absolute terms, these payments are small (\$US12 per hectare per year) but they constitute, on average, a third of household income, enabling the farmers to pay school fees, for health care, and other necessities (Echavarría and others 2004).

Payments may also reduce people's vulnerability to economic, social and environmental change by diversifying livelihood options into additional, resource-based enterprises such as forestry.

One of the most important spin-offs of the introduction of a system of payment for area-based services is formalisation of land tenure. PES and tenure reform may form part of an integrated project; alternatively, PES schemes may be restricted to places where land rights are already clear. Strengthening of social organisation may be another component of a payment scheme - for the practical reason that buyers need to deal with a small group of suppliers' representatives, rather than innumerable individuals. Other benefits may follow: title is collateral against which to raise credit, and cooperatives are in a stronger position than individuals to trade in many things apart from environmental services.

Capacity building is both an output of PES initiatives and, also, a prerequisite of their success. For instance in Pimampiro, farmers have received help with soil conservation, organic farming and forest management, which has enabled them to increase productivity and quality (Echavarría and others 2004). Capacity building within supporting institutions is no less significant.

Lesson for Green Water Credits: Financial benefits are important and immediate benefits of PES schemes but non-financial benefits such building capacity and social organization should not be ignored – rather they should be built into the design of the scheme.

4.4 Costs

There are two main types of costs for upstream landholders: the costs of entering and remaining in the scheme (transaction costs) and the costs of making the required changes in management practices.

Transaction costs can be very large, e.g. the running costs of the Chinese Sloping Land Conversion Program is about 60 per cent of its total budget (Wang Dehui and Jin Leshan, personal communication, 2006). And these costs are likely to be proportionately more for smallholders. In Costa Rica, participants have the option of using an intermediary organisation but, in return have to pay 12-18% of their receipts; in the Virilla catchment 80 per cent of participants took advantage of intermediaries (Miranda and others 2003). More significant in the case of the Costa Rica scheme is that the land must remain idle while the application is processed; this can take 12 months - too risky for many smallholders.

Lesson for Green Water Credits: Transaction costs erode the net benefits of PES, especially for smallholders, so application procedures need to be as simple as possible. Group application may also help to hold-down costs.

The costs of changing land management practices can also be significant and many activities involve big outlays. For example in Nicaragua, a farmer with 20ha wanting payments under the RISEMP silvi-pastoral program would have to invest \$US500 in the first year (equivalent to three quarters of income) to accomplish the specified practices (Pagiola and others 2005).

Lesson for GWC: The timing of payments should match the timing of the costs to the service providers. Alternatively, credit may be provided.

5 Costs and benefits for downstream water users

5.1 Benefits

Land and soil management practices in the catchment are commonly associated with the following services:

- Increased water transmission (absolute yield of *blue* water per unit rainfall)
- Improved water quality
- Buffering of above-average rainfall events
- Reduction in extent and severity of soil erosion
- Reduced sedimentation of reservoirs and waterways
- Stability of slopes.

Many PES schemes have focused on upstream forests to provide these services even though forests may not deliver the services expected of them. For instance, trees actually use a lot of water, more than most other kinds of vegetation, so they may reduce the transmission of water. And some kinds of forest – those without a thick surface litter layer, offer little protection against soil erosion. Equally, it is possible to deliver many of the desired environmental services in agricultural and pastoral landscapes. See, amongst others, van Noordwijk (2005), Falkenmark and Rockström (2004).

Lesson for Green Water Credits: PES program have focused on forests to deliver watershed services. Farm practices in the catchment can also provide these services while, simultaneously, retaining productive capacity.

5.2 Willingness and ability to pay

Willingness to pay for environmental services depends on the beneficiaries which include, in particular, water users. In the large commercial sector, these include hydro-power companies which require high-volume transmission, security of supply, and control of siltation in reservoirs (e.g. Pagiola and Platais 2002) and I such as the textile industry, steelworks and brewing. In Colombia, the electricity sector has contributed a percentage of its sales to finance watershed management (FAO 2004). The private sector may also be willing to pay for maintenance or improvement of water quality: for instance in the Philippines, a company bottling spring water is working with farmers in its catchment (Arocena-Francisco 2003).

Other big water users are in the public sector and governments may assume responsibility for environmental services in their own right (Gouyon 2003). Municipal utilities pay for maintenance of water supply and quality in, e.g. New York (Swallow, Meinzen-Dick and van Noordwijk 2005) the Maasin watershed in the Philippines (Arocena-Francisco 2003) and Honduras (Mayrand and Paquin 2004).

The Costa Rica PES scheme is funded by a basket of government fuel tax and monies from water and energy utilities (Landell-Mills and Porras 2002). Water utilities also finance PES systems in Honduras. Potentially, governments could fund services that reduce public risk from floods and landslides.

Lesson for Green Water Credits: In the absence of big downstream private-sector beneficiaries, governments can fund payments to upstream land managers.

6 Applying PES in Africa

6.1 Existing initiatives

There are no operational PES schemes in Africa but there are several initiatives to improve ecosystem management which may introduce payment systems as part of an integrated strategy.

In Western Kenya, the World Bank and the Global Environment Facility are supporting an ICRAF- Kenya Agriculture Research Institute project to reduce soil erosion and pollution of Lake Victoria by supporting farm conservation strategies and local capacity building for integrated ecosystem management. The aim is to encourage a move away from short-term planting of crops such as maize to more sustainable forms of agriculture. The project focuses on nine 100km² blocks of land in the Nzoia, Yala and Nyando river basins. Within each block, 20 sites of 64 ha each have been randomly selected and the project will work with 8000-12000 households. The role of payments for watershed services in encouraging the transition to best management practices is not clear; farmers are expected to benefit through the diversification of farm production and the sale of carbon credits.

Uganda Breweries Ltd and the Uganda Directorate of Water Development are also working together to reduce pollution in Lake Victoria and surrounding wetlands. The company is paying the National Wetlands Program to support the management of wetlands and to fund environmental education activities; Makerere University is monitoring water quality. This is a one-off case of corporate responsibility rather than an on-going contribution for environmental services (Alice Ruhweza, NEMA, personal communication, 2006).

In South Africa, IIED and CSIR are examining the feasibility of payment schemes in the Sabie-Sand catchment, Mpumalanga, and the Ge-Selati River, Limpopo Province. The latter initiative faces complex water rights - governed by current legislation and historical abstraction rights; those paying for watershed management services would have no guarantee under current legislation that they would be able to access any additional water flow generated because of abstraction restrictions already in place (IIED 2005).

6.2 Challenges in the African context

A recent workshop on watershed management (Swallow and others 2005) highlighted various characteristics of catchments in Africa that are relevant to the introduction of *Green Water Credits*:

- Levels of poverty are higher in Africa than in other regions of the world and many countries are experiencing increasing poverty;

- Most countries in Africa share river basins with other countries and most important water resources are shared among two or more countries;
- National and regional institutions involved in watershed management have variable capacity, often weak – especially in respect of integration across disciplines;
- There is a legacy of close dependence between land and water rights; water rights largely follow land rights. Rights to land and water are held under multiple property systems and are sanctioned by multiple sources of authority.

Across the continent, there is a great range of land and water management situations - in terms of hydrology, policy, culture, governance, investment, and poverty. All this has to be taken into account in the design of Green Water Credits. There can be no guarantee that what works in one place will work in another.

Poverty means that land users and governments have short-term perspectives and public investment is very dependent on the priorities of donors - who emphasise short-term poverty alleviation rather than long-term investment in infrastructure, resource conservation and technical and management capacity (Swallow and others 2005).

Lesson for Green Water Credits: The short-term imperative of poverty reduction is an opportunity for Green Water Credits which offers immediate payments for better management practices. At the same time, there is greater pressure to demonstrate that the poor will benefit than in the case of schemes already operating in Latin America; and erosion of payments to the many smallholders by the high transaction costs (Section 4.4) is an important issue.

Shared river basins: Most PES schemes have been introduced at the local or national level. Payments across international boundaries pose a challenge; the difficulties involved in negotiations between upstream and downstream interests, or achieving cooperation between municipalities, are formidable enough.

Lesson for Green Water Credits: A shared river basin does not rule out the introduction of Green Water Credits but some of the most significant river basins will be the more challenging.

There is also the issue of demonstrating the impact on of changes in land use and management on water flow as the size of the basin increases. At the local scale, the impact of management is visible; at the basin scale, only a basin-scale change of management will have a visible impact - so decisions about future management have to be based on models. Faurès (2005) argues that, as the size of the basin increases, the impact of land use impact on the hydrological regime becomes insignificant compared with that of natural factors and extreme climatic events, but this does not apply so much to water quality.

Institutional capacity: Several African countries, notably South Africa and Ghana, have introduced new policies and legislation for water and environmental management; some cases involve the creation of catchment and basin authorities. But the capacity of water management institutions to implement these policies is lagging behind (Swallow and others 2005).

Lesson for Green Water Credits: Green Water Credits might be introduced most easily at the small, local level where there are NGOs or community-based institutions to facilitate and provide support. Prerequisites of introduction at a larger scale include:

- *Information for decision makers about the links between, on the one hand, land use and management and, on the other hand, green and blue water resources; also about the economic and social impact of water resource management;*
- *Coordination across disciplines and between various institutions already in place - perhaps initiated by multi-stakeholder steering group;*
- *Investment in capacity building for water management institutions at local and national or basin level;*
- *Development of a platform for negotiation between upstream and downstream interests. This may be a new institution or some existing, mutually-respected and effective institution may assume this role.*

Overlapping rights and systems of authority: Crop production in Africa is carried out mostly by smallholders who operate under unsecured customary land ownership; grazing land is mostly communal (Kujawila 2005). Superimposed on these informal systems are recent, formal systems of land registration which vary in their coverage and effectiveness but are widely considered to have proven inappropriate in the African context (Quan, Tan and Toulmin 2005).

The complexity is illustrated by the Nyando Basin in Kenya where land and water are held under at least six kinds of private tenure, and at least five types of public land administered under different statutes and involving different government departments. Also, ethnic groups such as the Luo have strong customary authorities with many and various prohibitions and restrictions on individual land use. Clans and sub-clans are important sources of social authority but, in some parts of the watershed, land allocation policies have placed clusters of different ethnic groups next to each other - with the result that traditional systems of authority have been weakened (Swallow, Onyango and Meinzen-Dick 2005). At the village and farm level, several projects and programs such as the National Soil and Water Conservation Program have established focal area development committees to coordinate local contributions to extension and development plans!

Lesson for Green Water Credits: Multiple and overlapping sources of formal and traditional authority for land and water management have to be recognised in the design of the scheme. Where there are strong customary institutions or well-functioning community development committees, these may provide a means for grouping farmers together for negotiation, monitoring, and channelling payments.

6.3 How can Green Water Credits increase the resilience of communities in the face of drought, floods and climate change?

Water scarcity in drylands is not a function only of annual rainfall. In the first place, it depends on the seasonal and year-to-year variability of rainfall, especially the frequency and intensity of droughts and dry spells. Figure 2 expresses this variability as the coefficient of variation (CV) of the climate moisture index - the ratio of rainfall to potential evapotranspiration. Class 3 is a CV of >0.75 , class 2 a CV of $0.25-0.75$, class 1 a CV of <0.25 ; the greatest variability is across the sub-humid-semiarid transition zone which supports 20% of the African population.

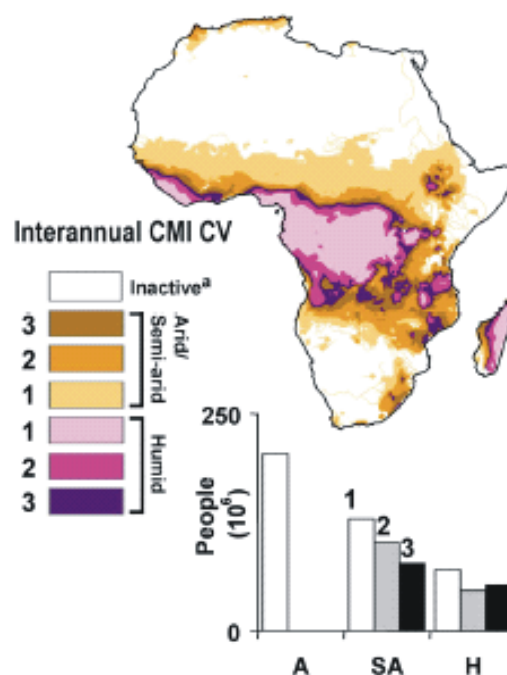


Figure 2: Africa, Inter annual CMI CV and populations subject
(Vörösmarty 2005)

Secondly, agricultural drought – drought in the root zone – is much more common than meteorological drought which is a period of much below average rainfall that is insufficient to maintain crops and pastures. Political drought - where various failings are attributed to drought - is commonplace. For instance in East Africa, meteorological drought occurs about once a decade, dry spells of 2-5 weeks in the growing season occur once in every 2 or 3 years (Barron and others 2002). The natural buffers against dry spells and drought are *green* water, stored in the soil, and perennial streams and groundwater (*blue* water) that are recharged by water infiltrated through the soil. Agricultural drought and water scarcity are frequent because most rain runs off the soil surface; farmers' field water balances show that only 15-20 percent of rainfall actually contributes to crop growth or recharges groundwater, the proportion is as little as 5 per cent on degraded land (Rockström 2003).

The purpose of *Green Water Credits* is to enable land users to make the most of *green* and *blue* water resources and, even, adopt practices that increase *blue* water delivery at the expense of farm production where this is demanded by the *Green Water Credits* market. Thus Green Water Credits is a mechanism for asset-building – stable soils, green and blue water resources, diversified rural livelihoods, and investment of cash – that builds the resilience of ecosystems and rural communities in the face of economic, social and environmental change. At the same time, it secures water supplies and ecosystem services downstream.

7 Conclusions

It is obvious from the range of experiences examined in this paper that PES can be applied across a wide range of settings in the developing world, including in areas lacking formal land tenure and enabling legislation. Many of the initiatives reviewed demonstrate how intermediary organizations, such as community-based organizations, NGOs, and other civil society groups, could serve a key role in overcoming gaps in the formal legal and policy framework and, even, gaps in the capacity of governments. The importance of these organizations to the success of PES schemes is a common theme in this review, in particular in reducing transaction costs and facilitating participation of farmers with small land holdings and insecure tenure. Thus, while Green Water Credits is not limited to specific locations with a pre-defined set of characteristics, it will always need to identify appropriate partner organizations.

Given that there is almost no previous experience with PES in Africa, early consideration of specific elements necessary in the African context will be crucial in the design of pilot operations. However, the clear message that emerges from the diversity of the schemes reviewed is that the PES concept is flexible and adaptable.

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GWC 2	<i>Lessons learned from payments for environmental services</i>	Grieg-Gran M and others 2006
GWC 3	<i>Green and blue water resources and assessment of improved soil and water management scenarios using an integrated modelling framework.</i>	Kauffman JH and others 2007
GWC 4	<i>Quantifying water usage and demand in the Tana River basin: an analysis using the Water and Evaluation and Planning Tool (WEAP)</i>	Hoff H and others 2007
GWC 5	<i>Farmers' adoption of soil and water conservation: the potential role of payments for watershed services</i>	Porras I and others 2007
GWC 6	<i>Political, institutional and financial framework for Green Water Credits in Kenya</i>	Meijerink G and others 2007
GWC 7	<i>The spark has jumped the gap. Green Water Credits proof of concept</i>	Dent DL and JH Kauffman 2007