Use of Market-based Incentives in Watershed Management: Driving the Green Economy through involving Communities & the Private Sector

UNEP

United Nations Environment Programme
Freshwater Ecosystems Unit, Division of Environmental Policy Implementation

Foreword

Access to reliable, clean water is integral to sustainable development and the transition to a green economy. But the world is consuming freshwater at rates that simply cannot be sustained, and freshwater ecosystems are under threat.

Aquatic ecosystems are degrading faster than any other, and 60 per cent of the services they provide are being lost (MEA 2005). Globally, 24 per cent of mammals and 12 per cent of birds connected to inland waters have been classified as threatened (UN WWAP 2003). The situation is particularly daunting in developing countries, where 90 per cent of sewage and 70 per cent of industrial waste is dumped untreated into surface waters (UN-Water, 2010). The international community has awoken to many of the threats facing our freshwater supply, but the importance of sound watershed management has been too often overlooked.

As this report shows, the transition to sound watershed management will require a shift in thinking. Managing watersheds shouldn't just be about regulations. It should be about developing complementary models for the protection and rehabilitation of watersheds through community participation schemes, public-private partnerships and private investment structures. And it should employ proven market-based incentives to promote the adoption of sustainable land-use and watershed management practices. By applying such methods, policy makers can strengthen the participation of local communities and the private sector, reverse ecosystem degradation and safeguard critical ecosystem services.

This report is meant to serve as a resource for governments and stakeholders who are interested in learning about market-based incentives for watershed management. It presents 26 watershed-level case studies that demonstrate how market-based incentives have been used in different contexts across the globe, and it outlines key countrywide policy recommendations that governments can use to facilitate the uptake of market-based incentives. More importantly, the report can help policy makers understand the prerequisites for the successful implementation of market-based incentives for watershed management.

Managing and investing in watersheds is essential to addressing water security for both people and ecosystems. It is UNEP's hope that this report will encourage new investments in watershed management and promote reforms to existing regulation schemes. By managing their watersheds smartly and sustainably, governments can support local communities, strengthen the private sector and promote important synergies between ecosystem health and human well-being.

Mette L. Wilkie
Director, Division of Environmental Policy Implementation, United Nations Environment Programme

Contents

Acknowledgements

This study was implemented by the Freshwater Ecosystems Unit, Division of Environmental Policy Implementation (DEPI), United Nations Environment Programme (UNEP) under the oversight of Thomas Chiramba and Youngsoek Lee.

Authors:

Edwin Muchapondwa (University of Cape Town, South Africa)
Jesper Stage (Luleå University of Technology & Mid Sweden University, Sweden)
Youngsoek Lee (UNEP DEPI)
Thomas Chiramba (UNEP DEPI)
Eric Mungatana (University of Pretoria, South Africa)
Pushpam Kumar (UNEP DEPI)

Reviewers:

Jordi Gallego-Ayala (Water Regulatory Council of Mozambique, Mozambique)
Rashid Hassan (University of Pretoria, South Africa)
Christo Marais (Department of Environmental Affairs, South Africa)
Barbara Schreiner (Pegasys and Water Research Commission, South Africa)
Michael Young (University of Adelaide, Australia)
Elizabeth Migongo Bake (UNEP DEPI)

The authors would like to thank Harry Biggs (South African National Parks, South Africa), Jordi Gallego-Ayala (Water Regulatory Council of Mozambique, Mozambique) Katy Hansen (University of Oxford, United Kingdom), Sharon Pollard (Award, South Africa), Barbara Schreiner (Pegasys and Water Research Commission, South Africa) and Michael Young (University of Adelaide, Australia) for discussions during early stages project which helped generate a better framework for research implementation.

The authors would also like to thank Peter Chacha (University of Cape Town, South Africa), Johane Dikgang (University of Johannesburg, South Africa), Nyasha Mahonye (University of the Witwatersrand, South Africa), Boscow Okumu (University of Cape Town, South Africa) and Byela Tibesigwa (University of Cape Town, South Africa) for research assistance in identifying and reviewing the relevant case studies.

The contribution of the following participants at the International Workshop on Use of Market-based Incentives in Watershed Management in identifying more case studies and sharing practical experiences around them is gratefully acknowledged: Aldulla abdulkader Noaman (Sana University, Yemen), Leonard Akwany (Wetlands International, Kenya), Dongjin Choi (Research Institute for Environment and Development, South Korea), Kristina Donnely (Pacific Institute, USA), Jordi Gallego-Ayala (Water Regulatory Council of Mozambique, Mozambique), Luis Gamez, (Public Utilities Company of Heredia, Costa Rica), Zenebe Gebreegziabher (Mekelle University, Ethiopia), Katy Hansen (University of Oxford, United Kingdom), Aloyce Hepelwa (University of Dar es Salaam, Tanzania), Sadarshan Khanal (ANSAB, Nepal), Mark Kieser (Kieser-Associates, USA), Fred Kihara (The Nature Conservancy, Kenya), Claudio Klemz (The Nature Conservancy, Brazil), Andrew Knipe (Gamtoos Irrigation Board, South Africa), Sarshen Marais (Conservation South Africa, South Africa), Christo Marais (Department of Environmental Affairs, South Africa), Hyunjoo Moon (Korea Environment Institute, South Korea), Nancy Njenga (WWF, Kenya), Wilfred Nyangena (University of Nairobi, Kenya), Pim Pelders (Natura Bolivia, Bolivia), Rolien Sasse (WWF, Kenya), Barbara Schreiner (Pegasys and Water Research Commission, South Africa), Michael Spencer (Alliance for Water Stewardship, Australia), Adrian Sym (Alliance for Water Stewardship, Germany), Martine Visser (University of Cape Town, South Africa), Marijn Zwinkels (Living Lands, South Africa).

The administrative support around the International Workshop provided by Carmen Ross (University of Cape Town, South Africa) is gratefully acknowledged.

Printing: UNON Publishing Service Section, Nairobi, ISO 14001:2004-certified

For any comments or feedback, please send them here:
Mr. Joakim Harlin
Chief, Freshwater Ecosystems Unit
United Nations Environment Programme
Email: joakim.harlin@unep.org

Acronyms & abbreviations

CAC	command and control
DAWASCO	Dar es Salaam Water and Sewerage Corporation
ESPH	Public Utilities Company of Heredia
FAO	United Nations Food and Agriculture Organisation
FONAG	Fondo del Agua (Water Conservation Fund)
Fundágua	Water Resources Fund
GIZ	German development agency
IIED	International Institute for Environment and Development
MA	Millenium Ecosystem Assessment
MRFF	Macquarie River Food and Fibre
NGO	non-governmental organization
OECD	Organization for Economic Cooperation and Development
PES	payments for ecosystem services
PLC	Public Limited Company
PRESA	Pro poor Rewards for Environmental Services in Africa
PROCUENCAS	protección y recuperación de microcuencas para el abastecimiento de agua potable
RACs	regional autonomous corporations
RMB	Chinese Renminbi Currency
SAB	South African Breweries
TNC	The Nature Conservancy
UNEP	United Nations Environment Programme
WfW	Working for Water (WfW)
WWF	World Wide Fund for Nature

Disclaimer

The views expressed in this publication do not necessarily reflect the views or policies of UNEP or contributory organization(s). The designations employed and the presentations do not imply the expressions of any opinion whatsoever on the part of UNEP or contributory organization(s) concerning the legal status of any country, territory, city or area or its authority, or concerning the delimitation of its frontiers or boundaries.

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source.

No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

This publication should be cited as:

Use of market-based incentives in watershed management: driving the green economy through involving communities and the private sector, UNEP, Freshwater Ecosystems Unit, Division of Environmental Policy Implementation (2015)

Glossary of terms

Adaptive management is a systematic approach for improving resource management by learning from management outcomes. An adaptive approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of those alternatives, learning about the impact of management actions through monitoring and using the results to update knowledge and adjust management actions.

Command and control policy instruments operate by imposing mandatory obligations or restrictions on the behaviour of firms or individuals.

Ecosystem degradation refers to the persistent reduction in the capacity of the ecosystem to provide services. For provisioning services, the degradation of an ecosystem is a decreased production of the service through changes in the area over which the service is provided, or decreased production per unit area; for regulating and supporting services, it is a reduction in the benefits obtained from the service, either through a change in the service or through human pressures on the service exceeding its limits; for cultural services, it is a change in the ecosystem features that decreases the cultural benefits provided by the ecosystem. The reversal of ecosystem degradation improves human welfare by providing greater qualities and/or quantities of ecosystem services e.g., supply of fresh water (Millennium Ecosystem Assessment (MA), 2005).

Gender refers to the different roles, rights and responsibilities of men and women and the relations between them. Gender does not simply refer to women or men, but to the way their qualities, behaviours and identities are determined through the process of socialization. Gender is generally associated with unequal power and access to choices and resources. The different positions of women and men are influenced by historical, religious, economic and cultural realities. Those relations and responsibilities can and do change over time.

Gender mainstreaming is the process of assessing the implications for women and men of any planned action, including legislation, policies and programmes in all areas and at all levels. It is a strategy for making the concerns and experiences of women and men an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres, so that women and men can benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality (United Nations, 1997).

Market-based incentives refer to inducements that change the behaviour of actors with respect to economic choices by altering their economic conditions when they participate in the market.

Market-based policy instruments operate by altering the structure of pay-offs (e.g., costs, prices, profits, etc.) that agents (profit-maximizing firms and utility-maximizing individuals) face and thereby creating incentives for them to voluntarily change their behavior.

Polluter pays principle is the principle whereby the polluter should bear the cost of measures to reduce pollution, according to the extent of either the damage done to society or the exceeding of an acceptable level (standard) of pollution.

User pays principle is the variation of the polluter pays principle that calls upon the user of a natural resource to bear the cost of running down natural capital.

Watershed is an area of land where all the water that is under it or drains off it goes into the same place. Land elevation, not political borders and/or administrative borders, defines watershed boundaries. The terms catchment and river basin are often used as synonyms for watershed.

Watershed degradation is the loss of the (socioeconomic and environmental) value of a watershed over time, resulting from inferior quality, quantity and environmental flows, including the productive potential of land and water, accompanied by marked changes in its hydrological behaviour.

Watershed management is the process of formulating and carrying out a course of action that seeks outcomes balanced between the three dimensions of sustainable development (economic efficiency, social equity and environmental sustainability) in a watershed. Watershed management is an ongoing undertaking. A distinction is made between measures, such as land-use and pollution control, to improve water quality and moderate run-off processes and measures to allocate scarce water resources among different users. The report focuses on actions for improving water quality and quantity in specific watersheds rather than simple demand management.

Watershed services are the outputs from watersheds and include water purification, flow regulation, erosion control, stream bank stabilization and water supply.

Water user associations are cooperative associations of individual water users operating at restricted localized levels who wish to undertake water-related activities for their mutual benefit.

Summary

The overall motivation of the present report is to provide impetus to the use of the most successful market-based incentives to promote the adoption of sustainable land-use and watershed management practices to facilitate the reversal of ecosystem degradation and the protection of ecosystem services through strengthening and increasing direct participation and contribution by local communities, and the private sector.

Access to reliable, clean water is one foundation of a green economy and yet the global use of fresh water is now well beyond levels that can be sustained even at current levels of demand. Water demand is projected to overshoot water supply by 40 per cent in 20 years' time. There is an urgent need to stop and/or mitigate the deterioration in freshwater ecosystems and the services they provide. Much money has been pumped into the water supply sector (e.g., access to safe water and sanitation) for evident reasons: Millennium Development Goal targets for instance. Even though United Nations agencies and international banks have pumped a lot of money into river basin management, there has been little funding to support watershed management, yet water for human consumption, wildlife, industry and recreation are all impacted by activities that occur within the watershed. The management of, and investment in, watersheds is therefore essential to address water security for both people and ecosystems in terms of water scarcity and quality.

Watershed management is a complex activity in many parts of the world, with limited funding available and constraints on human resources (at least in developing countries), and there is a need for a global effort to identify strategies that can work. Watershed management has traditionally relied on investment from public funds and on regulatory instruments. While those measures may work well in some contexts, such interventions have clearly not been enough as they have largely relied on scarce public funds and, as a consequence, some watersheds have continued to be bedevilled by problems such as water pollution, land degradation, sedimentation of dams, changing flow regimes and changes in environmental flows.

At the same time, the full potential of the key players and beneficiaries, e.g., local communities and the private sector, particularly those with vested interests, has not been harnessed in watershed management. Watershed management may therefore benefit from a change in thinking from the regulatory perspective alone, to support the development of complementary approaches for the protection, improvement and rehabilitation of watersheds through community participation schemes, public-private partnerships and private investment structures.

To complement the regulatory approach to watershed management, attention is now also being given to market-based incentives because of the cost efficiency they produce in some watershed contexts. Market-based incentives can broadly be classified into a number of categories: price-based, allocation-based, those enhancing existing markets and those creating new markets, and can be tailored to specific situations to generate rewards or impose penalties to encourage proactive watershed management activities. Alongside traditional regulation, market-based incentives hold the promise of increasing the stakeholder base for watershed management and the financial flows to watershed management, and improving the effective provision of watershed services.

To help identify proven market-based incentives for use to catalyse local community and private sector participation in the protection and management of watersheds, lessons have been drawn from a review of 26 case studies from Africa, Asia, Europe and North and South America, demonstrating how market-based incentives have been used in different contexts. In reviewing those case studies, emphasis was placed on understanding the threats to specific watersheds, the market-based incentives used, the countrywide policy environment, the outcomes from the interventions, the factors for success and failure, and the pertinent policy issues in support of upscaling and the uptake of appropriate market-based approaches.

The key policy recommendations that Governments should consider in order to upscale and facilitate the uptake of market-based incentives to promote participation by local communities and the private sector in watershed management are as follows:

1. Institute appropriate legal and institutional reforms for market incentives to work properly.
2. Promote research on watershed hydrology and the associated economic consequences to identify the opportunities for the private sector to reduce business risks and increase profits from its proactive participation in watershed management.
3. Package watershed management to incorporate forward and backward linkages to attract private sector participation.
4. Use market-based incentives which are consistent with local institutional capacity.
5. Provide more institutional support for both market-based incentives and traditional regulation.
6. Mainstream watershed management in poverty reduction and other development strategies to leverage funding.
7. Integrate gender mainstreaming in watershed management.

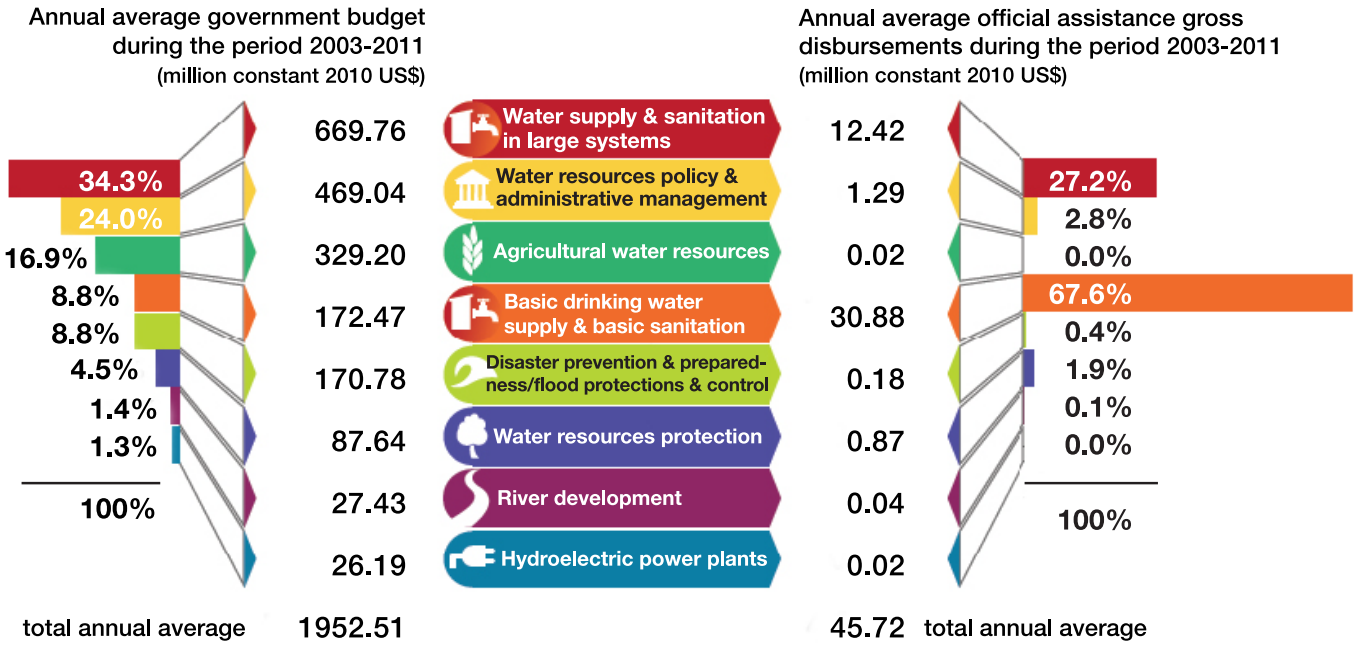
1. Introduction

1.1 Background

The green economy is one that results in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP 2010). Thus, on the environmental side, the green economy attempts to reduce carbon emissions and pollution, enhance energy and resource efficiency and prevent the loss of biodiversity and ecosystem services. Notably, access to reliable, clean water is one foundation of a green economy (UNEP, 2011) and yet the global use of fresh water is now well beyond levels that can be sustained even at current demands (MA, 2005). Up to 25 per cent of global freshwater use exceeds long-term accessible supplies and is maintained only through engineered water transfers or the overdraft of ground water supplies (MA, 2005). Forest and mountain ecosystems are associated with the largest amount of fresh water at 57 per cent and 28 per cent respectively (MA, 2005). They are also under threat. Water demand is projected to overshoot water supply by 40 per cent in 20 years' time (UNEP, 2011). There is an urgent need to stop and/or mitigate the deterioration in freshwater systems. Greater attention has been paid to other aspects of freshwater supply (e.g., access to safe water and sanitation) but not watershed management.[1] There has been little funding to support watershed management and yet water for human consumption, wildlife, industry and recreation are all impacted by activities that occur within the watershed. For example, the share of water resources protection in the annual average government budget on national water investments during the period 2003–2011 for 13 pilot countries under the United Nations water country briefs initiative was just 4.5 per cent.[2] The annual average official development assistance gross disbursements were equally low (see figure 1). The management of, and investment in, watersheds is therefore essential to address water security for both people and ecosystems in terms of water scarcity and quality (UNEP, 2011).

Watershed management is a complex activity in many parts of the world and with limited funding; there is a need for a global effort to identify strategies that can work. At the international level, the main approach followed for water resources management is integrated water resources management and most countries around the world have adopted that approach, but face implementation challenges in terms of policy tools and

Figure 1. **National water investments in pilot countries under the United Nations water country briefs initiative.**



Source: UN Water (2013)

[1] *For example, foreign aid agencies financed 7,660 water and sanitation projects amounting to $78 billion between 1980 and 2000 (Hicks et al., 2008).*

[2] *Includes Bangladesh, Chile, Gambia, Ghana, Guyana, Kyrgyzsta*

funding. At the national level, watershed management has relied on support from scarce public funds and "command-and-control" (CAC) policy instruments. Thus, over the years, the adverse impacts of poor land-use practices and management on watershed health, agricultural productivity, food security and other related development and environmental issues have led Governments and (regional and international) development agencies to encourage and support land users to adopt sustainable land-use practices. On their part, Governments have "modified" their political and legal frameworks to include measures that prevent land users from undertaking activities that degrade watersheds, or compel land users to restore land they have degraded.[3]

Even though such measures work well in some watershed contexts, clearly such interventions have not been enough, as some watersheds have continued to be bedevilled by problems such as water pollution, land degradation, sedimentation of dams, changing flow regimes and changes in environmental flows. One important reason why those problems have been so difficult to address using only traditional regulatory instruments is that they are frequently quite diffuse in character except where infrastructure is the main driver (i.e., dams). If most of the problem in a location is caused by one or two agents, then those agents can be regulated with relative ease. However, the actual situation is frequently one where the problem is a side effect of the behaviour of a large number of different agents, each of whom may be largely beneficial for the local economy and each of whom may cause a relatively small part of the overall problem (and is therefore difficult to ban, regulate or even monitor), but who combine to cause considerable problems. Another important reason why such problems have been so difficult to address using traditional regulatory instruments alone is that monitoring has relied on scarce public funds and therefore achieved little coverage. It is thus clear that while regulatory instruments inevitably have a place in watershed management, there are gaps which require reinforcement from alternative instruments.

In search of alternative instruments, it is instructive to note that the full potential of key players and beneficiaries, such as local communities and the private sector, particularly those with vested interests, has not been fully harnessed in watershed management. As appreciation of the local and global value of ecosystems increases, opportunities open up to develop innovative solutions that allow stakeholders to share not only in the costs of improved watershed management through sustainable land use and pollution abatement, but also in the subsequent benefits. Accordingly, watershed management will require a change in thinking from the regulatory perspective alone to support the development of complementary models for the protection, improvement and rehabilitation of watersheds through community participation schemes, public-private partnerships and private investment structures (Naidoo *et al.*, 2012).

In pursuit of new models for the protection, improvement and rehabilitation of watersheds, it is important to recognize that women and men around the world play distinct roles in natural resource management. Moreover, gender roles are differentiated in collecting water, fuel and fodder for domestic use and in generating income. Women are the cornerstone of small-scale agriculture and related water use, soil and water conservation initiatives and conservation in rural areas in many developing countries. Due to their distinctive engagement with the natural environment, women's experience and knowledge are critical for environmental management (UNEP, 2005). Using a gender mainstreaming perspective (i.e., enabling the integration of women's knowledge into watershed management, and enabling them to be part of decision-making processes and benefit from interventions) will increase the chances of the effectiveness and sustainability of public-private partnerships and private investment structures.

To complement the regulatory approach to watershed management, attention is now also being given to market-based incentives, because of the cost efficiency they produce in some watershed contexts (FAO, 2011; UNEP, 2011). Market-based incentives refer to inducements that change the behaviour of actors by introducing prices, market transactions, or other mechanisms typically associated with markets, into the watershed management context. While some activities that degrade watersheds can be thought of as "market" behaviour, in that these activities take advantage of externalities for short-term economic gain, the provision of market-based incentives (either by the private sector through their response to policy-altered market conditions, or by local and central governments through market-based policy instruments) can also align economic behaviour with longer-term sustainability goals. Thus, markets can be used to signal the desired types of land-use and watershed management practices through the use of incentives. Incentives can be positive or negative and thereby either provide rewards for "desired practice" or impose costs for "undesirable practice" (Muchapondwa *et al.*, 2012).

Market-based incentives can provide land users and other actors in and around watersheds with the motivation to implement sustainable land- and water-

[3] *The latter measure is not widespread in developing countries and is rarely enforced where it does exist.*

use practices, as those practices are often associated with market commodities and/or outcomes which allow them to benefit directly from their actions. The rewards which could be received by land users for desired practices may include goodwill, cost reductions, revenue enhancements and access to niche markets. Various market-based policy instruments can be tailored to specific situations to generate those rewards or withdraw them or impose penalties, so as to incentivize economic agents to change their behaviour in their interaction with watersheds. It is through their ability to change the behaviour of local communities and the private sector to partake in sound watershed management that market-based incentives can help drive the green economy agenda.

1.2 Purpose & scope

The overall motivation of the present report is to provide impetus to the use of the most successful market-based incentives to promote the adoption of sustainable land-use and watershed management practices to reverse ecosystem degradation and maintain ecosystem services through strengthening and increasing direct participation and contribution by local communities and the private sector. To help identify proven market-based incentives that could be used to catalyse local community and private sector participation in the protection and management of watersheds, lessons were drawn from a review of 26 watershed-level case studies from Africa, Asia, Europe and North and South America, demonstrating how market-based incentives have been used in different contexts. In reviewing those case studies, emphasis was placed on understanding the threats to the specific watersheds, the market-based incentives used, the countrywide policy environment, the outcomes from the interventions, the factors for success and failure and the pertinent policy issues in support of upscaling and the uptake of appropriate market-based approaches. The report thus provides a practical reference for identifying a set of market-based incentives that could be implemented in both developed and developing jurisdictions to address the challenges of watershed management and outlines key countrywide policy recommendations that Governments should consider in order to upscale and facilitate the uptake of market-based incentives in watershed management to promote participation by local communities and the private sector. Alongside traditional regulation, market-based incentives hold the promise of increasing the stakeholder base for watershed management, increasing the financial flows to watershed management and improving the effectiveness of the provision of watershed services.

The rest of the report is arranged as follows: section II sets out the details of the methodology used to obtain information about existing market-based approaches to watershed management. Section III provides a brief review of the literature on the problems confronting watersheds, how Governments have responded to them, mostly using the regulatory approach, and how the socio-ecological characteristics of watersheds call for complementary tools such as market-based instruments. Section IV outlines the classification and types of market-based incentives and briefly illustrates how they can be applied to watershed management. Section V draws lessons for catalysing local community and private sector participation in the protection and management of watersheds from case studies in which market-based incentives have been used in different contexts. Section VI concludes by outlining the key countrywide policy recommendations that Governments and stakeholders could consider in order to upscale and facilitate the uptake of market-based incentives to promote participation by local communities and the private sector in watershed management.

2. Methodology for gathering evidence on market-based incentives

2.1 Overview

This section gives details about the methodology used. In order to generate recommendations to assist with providing impetus to improved watershed management through use of market-based incentives, two methodologies were used to guide the content of the present report: a desktop literature review and a workshop of global experts.

2.2 Desktop literature review

A desktop literature review was conducted with a view to analysing and clarifying the background of market-based incentives and identifying, and analysing case studies where market-based incentives had been applied. While literature is awash with case studies focusing on water management, the selected case studies either involve actions for improving water quality and quantity in specific watersheds, or involve policy tools which are motivated by the desire to improve water quality and quantity in specific watersheds. A distinction is thus made between measures, such as land-use and pollution control, to improve water quality and moderate run-off processes, and measures to allocate scarce water resources among different users. The present report largely focuses on the former, which is generally thought of as true "watershed management" rather than "demand management". However, a few cases on demand management will be considered if they are mostly motivated by the desire to improve water quality and quantity in specific watersheds. In reviewing case studies, emphasis was placed on understanding the threats to the specific watersheds, the market-based incentives used, the countrywide policy environment, the outcomes of the interventions, the factors for success and failure and the pertinent policy issues in support of upscaling and promoting uptake of the appropriate market-based approaches.

2.3 Workshop of global experts

Based on the initial findings from the desktop literature review, a global review workshop was organized by the University of Cape Town and the United Nations Environment Programme (UNEP). The purpose of the workshop was to involve global experts and other stakeholders (including communities, the private sector and policymakers) in the review of case studies on market-based incentives and mechanisms to reverse water and land degradation in watersheds, and obtain additional information on the operation of those incentives. UNEP played a key role in identifying, inviting and funding the appropriate participants. The workshop was attended by 33 participants from 18 countries[4] and 25 per cent of the participants were female. Each participant was asked to contribute and present a case study of a scheme where local communities and/or the private sector had participated in watershed conservation involving market-based incentives. Participants also contributed to discussions about whether or not watershed management interventions presented at the workshop would work in their contexts. That discussion culminated in the identification of pertinent policy issues in support of upscaling and promoting wider uptake of the appropriate market-based approaches. A more detailed report on the workshop of global experts is presented in annex B.

[4] *Australia, Bolivia (Plurinational State of), Botswana, Brazil, Costa Rica, Ethiopia, Germany, Kenya, Mozambique, Nepal, Netherlands, Republic of Korea, South Africa, Sweden, United Republic of Tanzania, United States of America, Yemen and Zimbabwe.*

3. Watershed problems & traditional government responses

3.1 Overview

This section provides a brief review of the literature on watershed problems and management, which was presented and refined at the workshop of global experts. The emphasis is on highlighting important issues in watersheds and how Governments have responded to them. It will quickly become clear that complementary ways of addressing the issues are needed in order to deal with residual problems, which traditional interventions are not appropriately geared to resolve. The rest of the section is organized into four subsections, namely: (a) a typology of watershed problems; (b) regulatory watershed management; (c) potential challenges with regulatory watershed management; and (d) conclusion.

3.2 A typology of watershed problems

Watershed problems are multifaceted. However, Sheng (1990) identifies the common watershed problems and broadly classifies them into four categories as follows:

- The physical problems of watersheds include steep slopes, badlands, slide-prone soils and weak geologic formations. Those problems are usually accompanied by features such as heavy and intense rainfall, excessive run-off, torrential flows and strong winds.
- Resource use problems of watersheds include activities such as shifting cultivation, forest destruction, fire, overgrazing, poor road construction and maintenance and uncontrolled mining.
- The end problems of watersheds include the final effects of watershed degradation, such as soil erosion, landslides, heavy sedimentation, water pollution, floods and droughts.
- The socioeconomic and other problems of watersheds include severe poverty, unemployment, seasonal shortages of labour, low education attainment, low acceptance of innovations and bad land tenure systems. Those problems impact men and women differently, given their distinct roles in watershed management, especially in the rural context in developing countries.

The problems set out above frequently interact. Thus, for instance, a poorly functioning land tenure system where farmers expect to be farming some other plot of land in a few years will make them less likely to take care of their land, since any loss in productivity will primarily affect future land managers rather than themselves; they may therefore (especially if they are poor and have no other sources of income) focus on short-term profits at the expense of long-run productivity, e.g., overgrazing or otherwise farming in ways that lead to erosion. Similarly, if forest tenure is not functioning, the individual user can harvest trees on common land, including land with steep slopes where trees are needed as protection against landslides. In addition, land reforms in several developing countries, while important for the poor and landless, have generally targeted male household heads, excluding women from legal tenure, which in turn affects their claims to water for irrigation and their participation in community institutions (Sheng, 1990; Deere and Leon, 1998; van Koppen, 1998).

The work of managing watersheds can generally be divided into three categories: protection, improvement and rehabilitation. Protection measures are employed to maintain the status quo. Improvement techniques are used to obtain benefits such as water yield and flood control. Rehabilitation is applied to seriously deteriorated watersheds to restore lost benefits. Unfortunately, many watersheds in both developing and developed countries often need rehabilitation (Sheng, 1990).[5]

Watersheds are a common pool resource, of which the management usually involves a multiplicity of stakeholders, often with diverse views, opinions and interests. For example, upstream farmers may aim to maximize returns from their land in the shortest possible time without worrying about the adverse effects of their land-use practices on downstream watershed users. In fact, in such a situation, conservation agencies and Governments may prefer to have the upstream farmers slow down their activities for better watershed protection (Sheng, 1990).[5]

In that context of a multiplicity of users, watershed management has tended to be unsuccessful because (a) watershed services usually have "public good" characteristics of non-excludability and indivisibility,

[5] *However, there are also watersheds that are underutilized in developing countries.*

which make their provision prone to free-riding behaviour; (b) economic agents interact with watersheds through various systems of tenure such as "open access", which usually create incentives for accelerated rates of use due to the lack of assurance that watersheds preserved in the present will be available in the future; and (c) watersheds might not, in a financial sense, compete successfully against other land uses which offer better livelihood options. It is also believed that poor watershed management has come about because conventional economic approaches have been unable to capture the "true" value of watersheds. The threat of the possibility of (a) free-riding behaviour, (b) open access tenure, (c) the failure of watersheds to provide livelihoods and (d) the use of non-comprehensive economic approaches, together create the need to constrain the actions of firms, households, agencies and other agents in the economy with regards to their interaction with watersheds (Muchapondwa *et al.*, 2012).

3.3 Regulatory watershed management

According to Sterner and Coria (2012), one way of regulating the behaviour of firms, households, agencies and other agents in the economy is by prescribing the technology to be used, or the conditions of use, or the extent of use of a resource. Those are usually backed by environmental regulations that prescribe the dos and don'ts and the requisite economic sanctions associated with the violation of the rules. That regulatory approach, called "command-and-control" (CAC), has been applied by many Governments across the globe in watersheds to ensure the durability of watershed services and to deter their further degradation.[6] Most environmental laws fall into that category, which typically involves three elements:

a. Identification of a type of environmentally harmful activity;
b. Imposition of specific conditions or standards on that activity;
c. Prohibition of forms of the activity that fail to comply with the imposed conditions or standards, coupled with sanctions to deter such activity in the future.

Table 1 provides a summary description of some of the commonly used CAC approaches.

In table 1 below, one type of CAC measure is a technology standard that prescribes the most preferred technology to be used in a watershed. For example, it could define the best available technology in the effluent and wastewater treatment system, the most efficient irrigation technology in agriculture and others. Another type of standard is a performance standard, which may prescribe the extent of use of water resources in a watershed, for example, the abstracted volume for industrial use. Bans prohibit certain activities in the watershed, for example, pesticide use, cutting trees, charcoal burning and cultivating land above certain slopes.

One of the reasons why regulations are still a favourite tool for policymakers is that they are intuitively simple and easy to implement. Regulations, for example technology standards, "work" in the sense that if implemented across the board, all firms in a watershed will in fact use the specified technology

Table 1: **Types of environmental regulations and description**

Environmental regulations	Description	Example of use in watershed management
Standards	Prescribing technology to be used	Use of septic tanks in processing organic waste
	Prescribing the extent of use	Controls on volume of water abstracted for industrial use
Bans	Prohibiting certain activities	Prohibiting cutting of trees or cultivating land above a certain slope
Permits and quotas	Granting right and extent of use	Volume controls on soil, air and water pollution
Zoning	Restricting location or timing of use	Restrictions on spatial transfer of water usage

Source: *Sterner and Coria (2012) (adapted).*

[6] *One can regulate behaviour by use of (a) "command-and-control" and/or (b) market-based instruments. Each of those options or a combination thereof is likely to be better in particular circumstances – it mainly depends on the nature of the threat to watersheds and the technical capacity to implement the measure.*

and the intended environmental target will be reached if the standard has been set appropriately. Outright bans on a specific activity will work if policymakers are genuinely willing to abstain entirely from allowing that activity and are willing to provide the necessary resources to ensure that the activity does not in fact take place. However, those measures have sometimes run into enforcement problems in both developed and developing countries. There are several reasons for this.

3.4 Challenges in regulatory watershed management

The fact that firms can produce more cheaply by using substandard technology will encourage them to try to evade regulations prescribing the use of better but expensive technology. Moreover, with rising incomes and/or increased population pressure, both of which will lead to increased overall economic activity and hence increased pressure on the watershed, the technology standards will need to be tightened on a regular basis in order to ensure that the overall environmental quality targets for the watershed are still met. Since each tightening of the standards will increase the costs for firms further, they will fight those tighter standards (frequently leading to weaker standards than would be needed to maintain environmental quality) and become even more prone to evading them.[7]

Performance standards where firms may, for example, only use a specified amount of a resource per month, will run into similar problems in the longer term. Firms will have no incentive to look for additional ways to economize on the regulated resource once the performance goal is met, so all firms in the sector will tend to use the maximum permitted amount of the resource.[8] Thus, regulations discourage innovation. A good example is a performance standard on nutrient loading which will naturally not incentivize reduced use of fertilizer and pesticides. In short, while some CAC approaches aim to discourage certain behaviours harmful to the watershed, they do not encourage positive attitudes which lead to proactive behaviour (FAO, 2011).[9]

When there are several different economic activities affecting the same watershed (e.g., agriculture, mining, industry), or when different firms within a similar economic activity are very different in setup (e.g., large vs. small-scale farms), the regulatory problem becomes even more complicated. Leaving aside that those different firms may cause problems for each other through their economic activities (which is, of course, at the heart of the watershed management problem in the first place), they will have very different cost structures. That means that any attempt to regulate through technology or performance standards will impose not only arbitrary costs, but arbitrary cost differences, on the different firms. Different firms may well have completely different costs for achieving the same technology or performance standard and even if policymakers try to take this into account by implementing different standards for different activities, there is no guarantee that this distribution of the cost burden is in any sense efficient or fair. Firms in all sectors will have an obvious incentive to exaggerate the cost of meeting any standard, so policymakers and government officials will have little reliable information on the actual costs of implementing those standards in different sectors.

Where a ban is used, frequently a certain level of the activity may in fact be desirable (e.g., charcoal production as a source of cheap energy for the poor); that will frequently lead to waivers being given at least to some operators, which will encourage additional operators to try to get waivers and undermine the theoretical ban. When there is an effective ban in place, on the other hand, the activity will be forced underground and will not necessarily follow any other regulations either. Frequently, it will also be the case that the activity is sufficiently profitable that operators can bribe the government officials tasked with ensuring that the activity does not take place.

All watershed management approaches depend on proper monitoring and enforcement, which is often costly. This is a big challenge, especially for developing countries, where weak monitoring and enforcement of CAC approaches can substantially undermine their effectiveness. Pretty and Shah (1997) document widespread but ineffective use in sub-Saharan Africa and South Asia of requirements for farmers to adopt terraces and other practices, or face various penalties. Furthermore, corruption and other wasteful activities are associated with the implementation of CAC methods. That is linked to a problem mentioned in the introduction to the present report: the fact that frequently an individual agent's contribution to the overall problem may be quite small. For example, the soil run-off from an individual smallholder farm in an individual year will often be quite limited. It is the overall

[7] *In some cases, already established firms will also lobby for "temporary" exemptions from the new standards, exemptions which tend to remain in place indefinitely.*

[8] *With increasing overall economic activity, there will, again, be increased pressure on the regulated resource and the performance standards will need to be tightened further, leading to opposition which will often serve to dilute the standards.*

[9] *Of course, in rare cases, it is possible that some watershed agents may be highly motivated to comply with regulations out of a desire to improve the environment, or contribute to the overall health of the watershed, even if their actions do not contribute to the bottom line.*

run-off from all farms jointly that poses a problem for downstream watershed users, but it is each individual upstream farm that must be monitored and it is each individual farmer who must (in theory) be penalized for breaking the regulations, even if the contribution to the overall problem is minimal. Monitoring costs will thus tend to be quite high and while this will also be the case for other forms of environmental management, CAC faces the additional problem that the political support for enforcing strict regulation on a smallholder farmer will tend to be limited in practice. That can lead to an outcome where regulations are in place in theory but where enforcement is weak and farmers either bribe officials to ignore the regulations, or where officials do not bother to monitor many firms because they know that, in any case, courts will never enforce the regulations. Developed countries also struggle with the problem of maintaining water quality and other watershed services in a context where technology standards, performance standards and other regulations tend to break down or become increasingly complex with time. For example, the European Union Water Framework Directive of 2000 can be seen as an attempt to bypass implementation problems, setting overall environmental goals for entire watersheds and catchment areas rather than regulations for individual economic activities. However, how those environmental goals will actually be achieved for a specific watershed is left as a problem to the individual member State, which then has to decide which instruments to use.[10]

3.5 Conclusion

To summarize this section, it is noted that, in the context of a multiplicity of stakeholders, the threat of the possibility of (a) free-riding behaviour, (b) open access tenure, (c) the failure of watersheds to provide livelihoods and (d) the use of non-comprehensive economic approaches, together create the need to constrain the actions of firms, households, agencies and other agents in the economy with regard to their interaction with watersheds. Accordingly, many regulations have been issued to promote watershed management in both developed and developing countries. Even though all watershed management approaches depend on proper monitoring and enforcement, which is often costly, that is a big challenge for developing countries where weak monitoring and enforcement of CAC approaches undermines their effectiveness substantially. As such, CAC approaches have not been able to solve all the watershed problems, as they have largely relied on scarce public funds and technical capacity. Leveraging more funds would be one way of enhancing the effectiveness of CAC approaches. In addition, there needs to be a realization that there are other watershed contexts for which regulatory approaches will not necessarily be the most efficient. Indeed, the growth in awareness of market-based incentives and the associated tools provides a convenient complementary policy mix to achieve greater conservation and environmental protection in watersheds.

[10] *It is quite promising that the Water Framework Directive also promotes the use of economic incentives in water management. Market-based incentives also suffer from fewer monitoring and enforcement problems.*

4. Complementary use of market-based incentives in watershed management

4.1 Overview

This section defines the complementarity of market-based incentives, outlines the classification and types of market-based incentives and briefly illustrates how they can be applied to watershed management. Market-based approaches use market instruments to encourage behaviour change by economic agents such as firms, households and agencies. The approach works through market signals rather than through explicit directives and prescriptive regulations as in CAC systems. While CAC systems impose restrictions in a top-down approach, market-based incentives influence choices in a more subtle manner by taking a bottom-up approach (Muchapondwa *et al.*, 2012).

Market-based incentives, which increase the perceived magnitude of benefits from well-managed watersheds accruing to landholders and users and increase the costs of alternative land uses (e.g., crop farming, livestock farming, industry, mining, settlements) are required in order to promote watershed management. The important aspect in the design of those economic incentives is that they should raise the rewards coming from watershed management relative to rewards coming from alternative land uses. Otherwise giving watershed management a reward which is isolated from rewards coming from alternative land uses might result in inadequate incentives to shift into more watershed management. Thus, in a watershed, there is a risk that poorly designed incentives (i.e., those designed as if they are to be implemented in a sub-watershed setting) might not encourage any watershed management at all, owing to other land uses still providing better opportunities. Thus, incentives need to overcome the sources of watershed market failures (Muchapondwa *et al.*, 2012).

Any watershed management policy requires monitoring and enforcement and, as we saw in the earlier discussion, this has sometimes posed problems with traditional CAC approaches. Market-based incentives often require monitoring at least as detailed as CAC approaches; it is frequently harder to monitor the exact pollution levels of a firm, for instance, than to monitor whether the firm uses the specified technology or not. On the other hand, enforcement is often simpler. Moreover, some of the market-based incentives help to fund the monitoring and enforcement activity and/or create incentives for individual agents to contribute to the monitoring and enforcement activity themselves. The more watersheds are conserved through market-based incentives, the more resources remain to conserve other ecologically important watersheds.

Market-based approaches are gaining much attention as complementary strategies to traditional regulation in conservation (Bräuer *et al.*, 2006; FAO, 2011; UNEP, 2011). In some contexts, market-based incentives have the following advantages over CAC approaches:

a. They allow a flexible response to price signals;
b. They are cost effective and encourage improvements to be achieved in the cheapest manner;
c. They encourage firms to look for ways to achieve further environmental improvements, even after the initial goal has been reached;
d. They encourage firms to innovate and develop methods and technologies that are less harmful for the environment and to switch to cleaner technologies once these have been developed;
e. They frequently increase government net revenue and thus help pay for monitoring and enforcement of the policies that they form part of;
f. They avoid some of the negative incentives which may be occasioned by some regulatory approaches;
g. They attempt to follow the "user pays" principle so that the full social costs are reflected.

4.2 Types of market-based incentives

Market-based incentives can broadly be classified into four categories (price-based; allocation-based; those enhancing existing markets; and those creating new markets) as illustrated in figure 2.

4.2.1 Price-based incentives

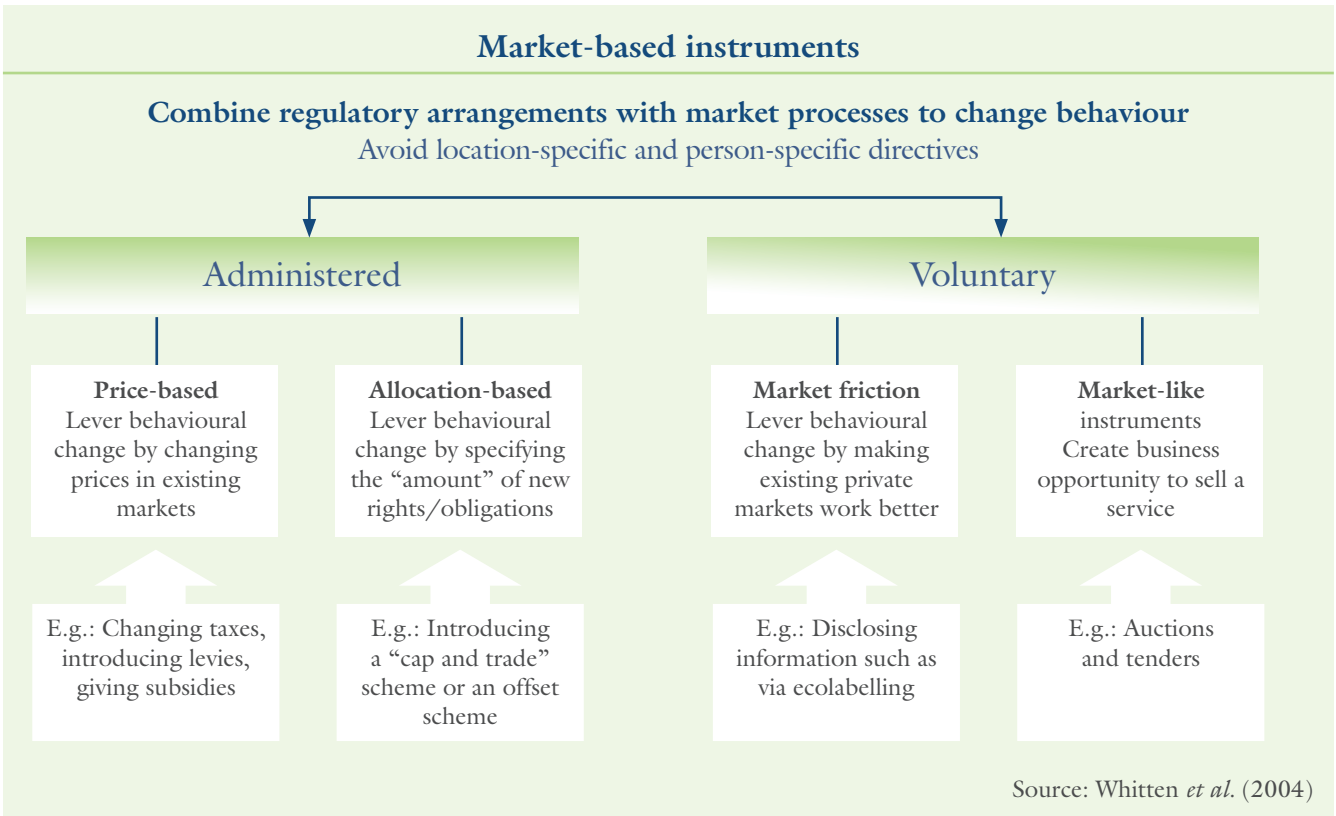
Price-based instruments are either direct positive incentives in the form of subsidies or tax breaks, or negative incentives in the form of taxes, charges and fees that can be attached to environmentally beneficial or damaging activities respectively. That gives those activities a price which they formerly lacked, i.e., it is an attempt to incorporate the external costs or benefits of an action. Individuals will normally respond by adopting the behaviour which costs them least. If the signals are set at the right level, it leads to better resource use. There are five common types of market-based incentives in that category, namely: (a) taxes, (b) fees and charges, (c) subsidies and subsidy reduction, (d) deposit refund schemes and (e) refunded charge systems.

Environmental taxes are unrequited (i.e., not in proportion to services provided) compulsory payments to the Government, levied on bases deemed to be of particular environmental relevance. Fees and charges are requited compulsory payments to the Government. Environmental subsidies consist of financial assistance (often from governmental bodies) to businesses, citizens, or institutions to encourage a desired activity deemed beneficial, by increasing or reducing the operating costs for harmful or beneficial activities, or by increasing the revenues of such entities for the purpose of achieving an objective.

Deposit refund schemes are a special case of "taxes" in which front-end charges (such as those on some beverage containers) are combined with refunds payable when a particular behaviour, such as returning an empty container to an approved outlet, is carried out. Refunded charge schemes are less widely used, but entail collecting a charge based on the level of some undesirable output, such as effluents, but then refunding the revenue to firms in the same sector based on some other criterion, typically the desired output from the sector. Since the overall costs of the firms in the sector do not change, only the distribution of the costs among environmentally "good" vs. "bad" firms, that type of instrument can be useful when there is a danger that a high environmental tax would cause problems with outside competitors who do not pay the tax.

The main policy concern when applying price-based incentives is how to correctly price watershed services, especially water. Water boards and other service providers incur costs to protect, procure, treat and pump water to consumers. There is a need, therefore, at least to charge a cost-recovery price for the immediate supply of water, as opposed to guaranteeing future supplies. In addition, there is a need to move

Figure 2: **Types of market-based instruments**



Source: Whitten *et al.* (2004)

the pricing beyond merely direct operational costs to signal the scarcity value of water and for reasons of watershed protection, improvement and rehabilitation (i.e., the environmental cost of water).

In general, if prices are too low, they fail to affect behaviour to reduce water consumption and/or cover the costs of its supply. For example, in most industries, the cost share of water is normally small relative to other inputs. Even for households, in cases where there is a graduated water charge system (i.e., a minimum flat rate combined with a consumption-based charge), the flat rate may cover most of the consumption and thus limit the effect on consumption of the charge.

Price-based incentives useable in watershed management include water tariffs, irrigation water fees, water abstraction fees, pollution charges, effluent charges, subsidies, subsidy removal and sewerage treatment charges, among others. The following are the most common types of price-based instruments used in watersheds:

Water abstraction fees

These are mostly used in Europe at the national or watershed level (Renzetti, 2005). They are usually imposed on direct users of water resources from the watershed by municipalities. In Finland, for example, some industries abstract water directly from the source in the watershed and therefore pay water abstraction fees. In other cases, water supply companies pay those fees which are in turn passed on to the consumers of drinking water and in wastewater treatments. Water abstraction fees can contribute to watershed management where their motivation is to raise revenue for watershed protection, improvement and rehabilitation.

Water tariffs

Water tariffs are used in both developed and developing countries. They are very common at the municipal level where municipalities take the responsibility of supplying water to end users. The primary purpose of water pricing is (partial or full) recovery of system costs, but frequently the pricing does not take the full environmental cost of water provision into account. In fact, water pricing currently never takes the full environmental cost of the water provision into account. The current pricing schemes are typically structured to include a fixed charge, consumption-based (sometimes graduated) charges and administrative fees (Sterner and Coria, 2012). The full environmental cost recovery has been a goal of the European Union Water Framework Directive for more than a decade, without much success. That poses a baseline challenge in the event that new charges to compensate for the environmental cost of water provision are contemplated. Water tariffs can contribute to watershed management where their motivation is to raise revenue for watershed protection, improvement and rehabilitation. Countries such as Costa Rica have been able to charge a "green" water tariff, which takes into account the costs of protecting the watershed.

Pollution/effluent charges

Most European countries use pollution charges targeted at regional and municipal levels. Pollution charges tend to be presumptive in that the link between the pollutant and damage to the water resource is roughly estimated. The main aim is to cover administrative costs, while also controlling pollution and preserving the quality of the unmined water resource. Greater charges are often imposed on industries compared to households, reflecting varying levels of pollution by different agents. Effluent charges are usually levied on direct discharges to natural waters in the watershed. Here, the pricing schemes are also structured to include a fixed charge, discharge-based charges (graduated) and administrative fees. Pollution/effluent charges can contribute to watershed management by displacing the need for higher levels of watershed protection, improvement and rehabilitation.

The weakness of pollution charges is that it is normally difficult to know the precise level of pollution reduction to be obtained in response to charges being applied. That is complicated by the fact that, in some cases, it is difficult to establish the fees-demand relationship. Thus, charge setting must be flexible and there must be scope to adjust the level until the target is reached. Another potential problem is that non-point pollution is often hard to monitor directly; one way out of this problem is to estimate the pollution from a proxy input, such as water-use data, which is expected to be correlated with pollutant loading per industry. However, that proxy must be relatively closely related to the pollutant; if that is not the case, firms will have a strong incentive to reduce the use of the proxy rather than the emissions of the pollutant itself.

Another potential weakness of pollution charges is that they rely heavily on well-functioning enforcement and thus are subject to problems analogous to those for regulatory instruments. If the public sector is unable in practice to collect fines from agents who do not meet the regulatory pollution standards, it is likely that it will also be unable to collect pollution taxes from the same agents.

Subsidies and subsidy reduction

On the supply side, subsidies and subsidy reduction are useful in engaging the private sector in watershed management. Subsidies can be used to promote the acquisition of the best available technology for water

efficiency, to subsidize capital investment in the supply of water, or to encourage landowners to switch to land uses that are less intensive and prone to erosion. Enforcement is likely to be easier in practice, with subsidies linked to desirable behaviour rather than with taxes based on undesirable behaviour, as there is no punitive element involved; agents can opt out if they are not interested, but have an opportunity to gain extra revenue from the scheme (Sterner and Coria, 2012). Other forms of subsidies, such as agricultural subsidies of various kinds, frequently have indirect negative impacts on watersheds by increasing overall pressure on water use and by encouraging the use of inputs that pollute the water. Reducing such subsidies can thus also have beneficial effects for watersheds by boosting the relative values of watershed services and encouraging more investment in watershed protection, improvement and rehabilitation, but might be politically difficult.

Trading programmes have become increasingly popular over the last few years. It is mainly their assumed cost-efficiency that has brought them into focus. The most commonly used types are credit programmes and cap-and-trade systems.

On the demand side, the reduction or removal of previously existing water subsidies ensures that pricing of water reflects the actual costs and that the prices are not artificially depressed. Depressed prices are a big lacuna because pricing becomes inefficient as a tool for affecting water usage and for conservation purposes. Renzetti (2005) argues that, in Australia, government subsidies are designed to keep the sewerage charges per household below a politically significant amount, thus affecting the ability of the charge to influence both water consumption and sewerage discharge into the watershed.

An advantage of price and compensation-based instruments is that they can easily be set up so that part of the revenue is earmarked for monitoring and enforcement activities, simplifying the maintenance of the scheme. A disadvantage of those instruments, on the other hand, is that they cannot guarantee the extent of changes in behaviour. Since they rely on price signals rather than inducing scarcity, there is still the danger of overexploitation if price incentives are set too low for political reasons or because of uncertainty about how agents will respond to changes in their cost structure. Price-based schemes need to be monitored to ensure that the target outcome is actually achieved, so they need to be monitored both at the level of individual agents and at the aggregate level, and there needs to be flexibility in the price setting so that prices can be adjusted if the target is not reached. When scarcity prices are set by Governments, they find it very hard to change the price as circumstances change. It should be possible to double the scarcity price signal in a month if the scarcity intensifies rapidly in response to, for example, the rapid onset of a drought.

4.2.2 Allocation-based incentives

Allocation-based instruments are also known as quantity-based or indirect incentives. They create a market by distributing permits to carry out an activity associated with specified resource uses or environmental damage. A limit is set on the number of permits, allowing, in theory, the total amount of damage to be controlled. This allows more flexibility than a tax system, as those who find it cheapest and easiest to change their behaviour may make the biggest changes and then sell their permits to those who find change very expensive. However, as seen in the European Union emissions trading system, there is no set price for the permits and no built-in guarantee that a specific number of permits will lead to a reasonably low (or high) permit price.

Trading programmes have become increasingly popular over the last few years. It is mainly their assumed cost-efficiency that has brought them into focus. The most commonly used types are credit programmes and cap-and-trade systems.

Under credit programmes, credits are assigned (created) when a source reduces pollution/emissions below the level required by existing, source-specific limits; those credits can enable the same or another firm to meet its control target. Under a cap-and-trade system, an allowable overall level of pollution is established and allocated among firms in the form of permits, which can be freely exchanged among sources. In theory, the allocation can be carried out through free distribution or through sale (for example, auction) by the Government.

In the cap-and-trade approach, allowances for future emissions or development of land are sold or granted free ("grandfathering") to existing polluters/developers. In addition, cap-and-trade programmes offer the opportunity to choose the magnitude of environmental improvement that should be achieved. The cap-and-trade programme emphasizes tradability, security of property rights and total emissions levels. The

name of the programme is indicative of the procedure followed. First, regulators determine the total quantity of allowable emissions or resource harvest (the cap). Next, the rights to those emissions are allocated among polluters (by auction, grandfathering, or some other mechanism but not relative to current output, because the total amount of emissions is capped). The allocated rights then become subject to free trading among the polluters that own the rights (Sterner and Coria, 2012).

Dales (1968) was the first to suggest such a scheme to an authority in Ontario, Canada, that would sell the "rights to pollute" water bodies. A local authority would thus decide total pollution levels and the market would allocate the pollution rights among firms to reflect their demand for pollution or their abatement costs (Sterner and Coria, 2012).

In the context of watershed management, tradable permit schemes generally manifest themselves as tradable pollution permits/credits and water trading or water markets. The tradable pollution permits/credits relate to the "rights to pollute" water bodies, as in the Canadian example highlighted earlier. Australia has aggressively implemented water market policies since 1994 (Bjornlund, 2006). These have been of two major types: markets in water allocations (the right to short-term use of water) and markets for water entitlements (the long-term right to access water) (Al-Marshudi, 2007). Water trading or water markets can be used to promote the efficient allocation and use of water within a given river basin level, while preserving or maintaining overall water use at sustainable levels (Renzetti, 2005).

Modern water markets are largely used in Australia, Chile, China and the United States (California). Water markets are also in place in Brazil, India, Indonesia, Mexico, Pakistan, Spain and South Africa (Takaya and Fleskens, undated). Water markets have not just been used as pure demand management systems but rather have been complemented with restrictions, usually to address environmental concerns. Restrictions such as the preservation of river flows, control of salinity, and the protection of wetlands and river ecosystems have also been instituted (Renzetti, 2005).[11] Therein lies the contribution of water markets to watershed management.

In general, for the market to function well there is a need for a clear overall programme framework for water trading. That must be open and extremely transparent, with a clear administrative framework and user-based management. The bottom line is that, while water does not necessarily have to be privately owned, the owner of the rights must believe the system provides a level of security of entitlement to facilitate trade and trust (Renzetti, 2005). Allocation schemes are also dependent on functioning monitoring and enforcement mechanisms; there must be fines or other punitive systems in place that discourage agents from using more than their permits allow and those systems will only function if the punishment for non-compliance is seen as credible.

There is a need for long lead times in the evolution of allocation-based systems so that, for example, water quantity and pollution trading arrangements can emerge in the years to come. To this end, more could be achieved from a baseline with strong local or regional governance arrangements.

There are lessons to be learned from the falaj water trading systems found throughout much of the Middle East and in some parts of Asia. Those systems were developed to move water from the mountains to fertile farming areas in the interior. For example, there are over 3,000 operational falaj systems in Oman, involving a volume of 459 million m^3 per year and providing 38 per cent of all water used in agriculture. Water rights are held in perpetuity and are linked with local market auctions and can be transferred from generation to generation (Al-Marshudi, 2007). Irrigators hold shares in the flow and trade them on a temporary and permanent basis. In the best instance, a village will collectively own a proportion of the shares and sell the resultant water on a fortnightly basis to finance investments into the system. In short, falaj systems in Oman have many characteristics that are market-driven, involve less government intervention, provide partial cost recovery, invite community involvement and recognize the need to maintain a sustainable environment.

4.2.3 Incentives enhancing existing markets

These instruments are also known as market friction instruments. They engage the public and leverage behavioural change by making existing private markets work better. The mechanisms in this category include information disclosure, certification/labelling, traceability, public-private partnerships and consumer awareness campaigns. They aim to improve the manner in which the current market works by providing more information and reducing transaction costs.

A good example is eco-labelling, which identifies goods which have met specific environmental standards. Producers of sustainable products may differentiate their goods from similar goods produced

[11] *Those restrictions have been in addition to demand management restrictions. There have been restrictions on the spatial transfer of water use and volume of abstraction in Australia, for example. In Colorado, United States, buyers of allotments of water are required to demonstrate a beneficial need and ability to use the water and water can only be used within the district boundaries to prevent speculation in water or the development of a monopoly position in the ownership of rights.*

by competitors in an unsustainable manner. That should allow them to gain higher revenues (if consumers value conservation).

In general, disclosure of information and advising consumers, allows them more of a choice about what type of products they buy. The idea behind those approaches is that, since well-functioning markets depend in part, on the existence of well-informed producers and consumers, information programmes can in theory help foster market-oriented solutions to environmental problems. For example, in the United States, the Energy Policy and Conservation Act of 1975 specifies that certain appliances and equipment (including air conditioners, washing machines and water heaters) carry labels with information on the energy efficiency and estimated annual energy costs of those products. Private, voluntary labelling schemes can also provide information that may affect consumer choices.

A second type of government information programme is a reporting requirement. The first such programme was the Community Right-to-Know Act in New Jersey, United States, established in 1984. Two years later, a similar programme was established at the national level. The Toxics Release Inventory, initiated under the Emergency Planning and Community Right-to-Know Act, requires firms to report to local emergency planning agencies information on the use, storage, and release of hazardous chemicals. Such information reporting serves compliance and enforcement purposes, but may also increase public awareness of the actions of firms, which may be linked with environmental risks. Thus, although mainly a regulatory instrument, those policies can also (through the effect on their consumers) create a financial incentive for firms to reduce the hazards that they create for the environment.

There is room for enhancing the existing supply and demand of watershed services. There are two main approaches, namely consumer education and information campaign programmes, and certification and labelling. Consumer education and information programmes are extremely important to promote changes in behaviour. They can also help users understand the various aspects of the water resources in a watershed, including the state of water resources, the cost of water services provision, the value of water for both human survival and the functioning of the natural environment, among others. From the regulatory perspective, education and information campaigns could boost compliance and trim administration and enforcement expenses.

Certification and labelling can entail setting standards for watershed management directly, or for practices that are indirectly linked to good watershed management, and certifying/labelling producers who follow those management practices. Good soil and water conservation practices in farming could be a prerequisite for eco-labelling of the produce, for instance. Similarly, certification of forest products could be linked to a requirement that forests be replanted and/or that the forest company does not harvest timber on steep slopes where the risk of erosion is high. Certification and labelling can create incentives to adhere to specified management practices by providing consumers with the information necessary to make their choices of products more consistent with the values they place on ecosystem services. If that increases the market share of a product and/or results in a price premium, producers will have an incentive to manage their production in such a way as to achieve certification. That arrangement requires intermediary organizations to establish standards for labelling and to certify practices. The potential of labelling to affect the choices of consumers towards environmentally friendly behaviour is high, especially where environmental awareness is high. It also influences demand for a particular product and forces suppliers to comply with environmental regulations. The downside is that it results in a proliferation of labels, which may erode consumer trust in products.

Consumer education and information programmes are extremely important to promote changes in behaviour.

Certification schemes have similarities to regulatory standards in that they prescribe specific technical and/or performance targets that must be met in order for a firm to achieve a desired label, regardless of the cost of doing so for an individual agent. They are thus subject to some of the same criticisms as regulatory standards. However, an important difference is that firms have the option of opting out if compliance with the certification standard is more costly than the expected benefit, so although certification can impose high costs on an individual agent, there is a cost limit built into the system. Another important difference is that certification schemes may have several different labelling levels, such that specific agents have more leeway to choose the level consistent with their cost structure.

Developed countries have started to purchase higher and higher quality foods from developing countries using market friction tools. The buyer sets

the certification standard and regions are then given the choice of deciding whether or not to participate. In many cases, the result is not a higher price but rather a greater chance of holding market share. Tesco PLC, a British multinational grocery and general merchandise retailer and the second-largest retailer in the world, has an exclusive independently accredited scheme called "Nurture". It is meant to limit the procurement of fruit and vegetables to those regions growing to environmental and responsible standards. The standards cover all aspects of farming practice, promoting the best agricultural practice in the industry. Each grower is audited on an annual basis to ensure they meet the universal standard required. Similarly, the Alliance for Water Stewardship certifies farmers exporting cut flowers and vegetables who improve site level water management.

The forest stewardship schemes are also a good example of the use of public purchasing power to create shifts in industry and regulate the negative environmental impacts of deforestation. The label works by providing an incentive for responsible forestry in the market place, which potentially benefits watersheds. However, a conscious extension of forest stewardship schemes to take greater account of watershed impacts has been carried out poorly so far and might be worth exploring further. The schemes offer manufacturers a competitive advantage and thereby increase access to new markets and maintain access to existing ones.

4.2.4 Incentives creating new markets

These are market-like instruments that create business opportunities to sell a service. A good example is the payments for ecosystem services (PES). Southgate (2007) defines PES as a voluntary transaction between at least one buyer and at least one seller in which payments are conditional on maintaining an ecosystem function that provides a well-defined service. The common denominator across such schemes is that payment arrangements are made whereby those who pay are aware that they are paying for an ecosystem service that is valuable to them or their constituencies and those who receive the payments engage in meaningful and measurable activities to ensure the sustainability of the ecosystem in question (Gutman, 2007). The payments thus provide a direct, tangible incentive to conserve the ecosystem and prevent encroachment by others. Current PES schemes require three steps: (a) an assessment of the range of ecosystem services generated in a particular area; (b) an estimate of the economic value of those benefits to different groups of people; and (c) the establishment of a regime or institution that is able to capture that value and reward landowners for preserving the delivery of the ecosystem services.

PES schemes have been recognized by various sources as having the potential to reflect the value of ecosystem services to planners and policymakers, as well as to compensate land users for environmentally sustainable practices and internalize costs that are currently deemed as externalities (Shackleton *et al.*, 2008). Porras (2013) argues that PES schemes are becoming an important tool for watershed management. Landell-Mills and Porras (2002) and Porras *et al.* (2008) identified 50 ongoing and 45 proposed PES schemes.[12] The schemes pay upstream landowners to manage their land (usually by undertaking soil and water conservation practices, including tree planting) in ways that promote the regular flow of clean water downstream, reduce soil erosion and lower sediment load and other pollution.

The schemes aim to encourage landowners to account for the off-site effects of their decisions (internalize externalities) through payments. The payments are obtained from direct beneficiaries, including Governments, drinking water companies, bottling companies and hydroelectric companies. Without payments, landowners have no incentives to conserve watershed services, because the benefits of clean, regular water supplies go to others downstream.

Payments are conditional upon the delivery of a quantifiable service and the specific terms and conditions are usually set out in a contract. That in turn requires the presence of a secure land tenure system for landowners to fully engage in negotiations. That is a downside, especially for small-scale farmers and rural communities, who may not have titles to their land. The other challenge with PES is that it may involve high transaction costs, at least in the beginning, starting with identifying demand and supply parameters, setting up the market, defining the roles and responsibilities of the two sides and facilitating contractual obligations and contract enforcement, etc. There could also be costs associated with mapping land boundaries, assembling and providing documentation to prove eligibility, and implementing a forest management plan. Indeed, PES depends on sustainable sources of funding which are quite rare. For this reason, PES schemes are likely to face challenges as an instrument in many, if not most, regions, so more could be made of other market-based instruments. There is also a problem in assessing the effectiveness of PES schemes.[13] Nevertheless, a number

[12] *Available online at www.watershedmarkets.org.*

[13] *Five criteria are generally used to evaluate the economic performance of PES programmes: additionality, economic efficiency, conditionality, leakage and the permanence of benefits. Assessments must show whether indeed payments led landowners to change land-use practices, abstracting from other factors. That may necessitate the use of randomized, controlled experiments to be able to link downstream improvements in water quality, quantity and regularity flow with the programme.*

of schemes have been tried and can be categorized into three groups: voluntary contractual arrangements, trust funds and transfer payments.

Voluntary contractual arrangement schemes involve the negotiation and agreement of a contract in which resource users who benefit from watershed services compensate upstream landowners for the cost of adopting management actions needed to ensure provision. A good example of voluntary contractual arrangements is the agreement between La Esperanza Hydropower Company and the Monteverde Conservation League in Costa Rica, which is the sole owner of the forested area upstream from the La Esperanza plant (Rojas and Aylward, 2002).

Trust funds are established as a decision-making entity for the purpose of allocating funds to priority conservation measures in cases where an agreement involves many stakeholders. One example is the FONAG (Fondo del Agua) Trust Fund in Quito, which was set up to protect upstream ecological reserves. The fund is overseen by a stakeholder board and allocates pooled funds and in-kind support received from municipal entities that provide water and electricity, from non-governmental organizations (NGOs) and from private sources (Echavarria, 2002 and 2003).

Transfer payment schemes involve direct payments made to landowners as compensation for the cost of adhering to specified management practices. This is a hybrid approach, in that payments are usually made on the basis of voluntary contractual arrangements with landowners but differ in that the contract is normally made between landowners and the Government for purposes of achieving broader policy objectives, rather than directly with downstream users in response to their specific concerns. When such schemes are voluntary, landowner participation will depend on whether payments are sufficient to offset their opportunity costs, which may be revealed by allocating them on the basis of bidding systems.[14]

4.3 Market-based incentives are complementary & not a panacea

Market-based instruments can change prices in such a way that they provide clearer signals to firms and households of the benefits and costs of their behaviour for the watershed as a whole. That can make watershed management more cost effective: by reducing the cost of achieving a specific level of environmental quality, or by raising the level of environmental quality that can be achieved at a specific cost, such schemes can potentially make the entire set of communities depending on a watershed better off.

It is evident that market-based incentives work well in cases where there are well-defined problems, well-defined rights and responsibilities associated with property arrangements, single and controlled environmental degradation, well-established links between cause and effect, such as management actions and their consequences, and mutual expectations regarding the value of ecosystem services. Watershed management problems are however complex and, in certain instances, could render market-based incentives ineffective. As such, a number of caveats are in order.

Market solutions to watershed management problems potentially face two related problems. First, many of the benefits of watershed management, such as flood control and water quality, are public goods, which means that many agents in the economy are able to benefit from those goods without paying for them (unless compelled to by a State authority). Stakeholders would have little incentive to protect, improve or rehabilitate the watershed if they could not exclude non-payers from enjoying those benefits (Pagiola *et al.*, 2002). Second, some ecosystem service benefits of watersheds, such as the transport of pollutants away from non-point sources, are externalities that are not readily priced by a market (again, without government intervention). Accordingly, landholders upstream can affect water quantity and water quality downstream through their decisions on land management practices, but they have little incentive to consider those impacts because they are not directly affected. Thus, market-based incentives might not work because of the public good and externality characteristics of watershed services, unless they are designed so as to compel free-riders to pay for the positive externalities, which could be funded by the State through a system of taxation.

Another important caveat is that, besides efficiency objectives, distributional impacts need to be considered. Market-based incentives change the price structure of, and assign monetary values to, goods and services that had lower, or no, monetary values previously. That is an important part of the rationale for market-based incentives; by encouraging agents to take the costs and benefits of environmental goods and services into account, they also encourage greater consideration of those environmental goods and services. However, the introduction of a new market-based incentive will also create distributional impacts. Thus, for instance, a subsidy scheme or a PES scheme will raise the value of

[14] *PES schemes could suffer from hidden action (or moral hazard) problems which may arise after a contract has been negotiated. For example, the conservation agent may find monitoring contract compliance expensive and sanctioning non-compliance politically costly, and thus fail to enforce the contract. Under such conditions, the landowner has an incentive to breach contractual responsibilities (Ferraro, 2008).*

land that has the capacity to provide the services being paid for, while an environmental tax will reduce the value of land on which the activities are taking place that cause the problem which is being taxed. That means that land values can increase or decrease, depending on the incentive chosen; that will in turn have an effect on the overall distribution of wealth in the community. Depending on the structure of land ownership, the redistribution of wealth may be problematic. Market-based incentives should make overall economic activity more productive by encouraging a fuller consideration of social costs and benefits and will thus make the community as a whole better off, but may need to be combined with other policies to ameliorate the distributional impacts if those are deemed to be important enough.

It also needs to be taken into consideration that in most developing countries women have no access to land rights, either as private property (inheritance), usufruct rights on common property resources, or direct purchase/lease from the market. That has an impact on their livelihood strategies, including food security and social status (Agarwal 1994). Independent or joint land tenure for women can provide them with access to collateral for bank loans (agricultural credit) in their own names or access to agricultural extension services and information systems on market-based incentives, which are typically targeted at men. However, land reforms in several countries, while important for the poor and landless, have generally targeted male household heads, excluding women from legal tenure, which in turn, affects their claims to water for irrigation and their participation in the community institutions that are targeted by market-based incentives (Deere and Leon 1998, van Koppen 1998).

It is also important to note that most types of market-based incentives require solid support from the public sector in order to work well. Certification and labelling have the potential to work, even when the public sector is weak, but all the other instruments require clear government regulations for collecting taxes, monitoring use and ownership, etc. Indeed, some of the problems with monitoring and enforcement alluded to in the case of CAC approaches equally apply to market-based incentives. Weak monitoring and enforcement can also undermine the effectiveness of market-based incentives. In particular, corruption is also a potentially huge problem, especially in relation to those market-based incentives involving cash flows. Here again, agents could bribe officials and thereby avoid the true cost of their actions, for instance, effluent charges would be ignored in return for bribes.

Market-based incentives are sometimes perceived as an alternative to government regulation, but this is incorrect. They are a different and potentially more efficient means of environmental management than the CAC approach and have the potential to collect revenue that can help pay for the government intervention that they require, but both approaches require government intervention in order to work. Accordingly, market-based incentives should be thought of as complementary to the CAC approach rather than a panacea. The review of case studies to be carried out in the next section is instructive, as it helps to identify ways of increasing the contribution of market-based incentives in watershed management.

5. Lessons learned from applying market-based incentives in watershed management

5.1 Overview

As seen in section IV, there are in principle quite a number of market-based incentives that policymakers can choose from, in order to promote sound watershed management. This section reports on the lessons drawn from a review of 26 watershed-specific case studies where market-based incentives have been used in different contexts.[15] The selection of case studies for review was guided by whether they had involved market-based incentives intended to improve water quality and quantity in specific watersheds. In reviewing those case studies, emphasis was placed on understanding the threats to the specific watersheds, the market-based incentives used, the countrywide policy environment, the outcomes from the interventions, the factors for success and failure and the pertinent policy issues in support of upscaling and the promotion of uptake of the appropriate market-based approaches.

The case studies are summarized in table 1 in annex A. The cases studied show the use of a wide diversity of market-based incentives: 11 case studies involve price-based incentives (case studies 1–11), 2 case studies involve allocation-based incentives (case studies 25–26), 3 case studies involve market friction (case studies 12–14), and 10 case studies involve creating new markets (case studies 15–24).

Despite our classification above, many of the case studies describe themselves as PES schemes. However, a detailed analysis reveals that many of the cases described as PES schemes studied here are in fact subsidy schemes where landowners are paid (disproportionately to the effort applied) to abstain from land uses (primarily forestry, but also agriculture) that would have negative impacts on the capacity of the watershed to provide quality water downstream. Some of the schemes are described as PES schemes, but payment is normally based on input provision (land use) rather than on service provision (water quality and quantity outcome). The clearest case of payment based on service provision is, ironically, the one in Australia where private landowners pay a government agency for afforestation based on the resulting water quality outcomes (case study 23). At the same time, the French Vittel case is often quoted as a model of private sector participation in PES (see box 1 and case study 2).

This section pays attention to the lessons learned from both watershed-specific case studies and country strategies, in order to draw conclusions about the models and actions necessary for the effective upscaling and promotion of uptake of market-based incentives in watershed management across the globe. In particular, the conclusions drawn inform a global strategy to catalyse local community and private sector participation in the protection and management of watersheds by creating an enabling environment.

The "polluter pays" principle is largely absent from the actual market-based incentives practices studied here. That principle is fundamental because of the strong support it has received in most countries which are members of the Organization for Economic Cooperation and Development (OECD) and the European Union and in international environmental law (De Lucia, 2013). In almost all the case studies reviewed, the "victim pays" principle applies i.e., it is the beneficiaries who pay potential polluters, either to abstain from degrading the quality of the watershed or to carry out activities that will improve its quality (the latter set of actions sometimes involves agents other than the original polluters). The main reason for that is likely to be that "victim pays" schemes are easier to enforce; it is easier for a public (or private) institution with an interest in improved environmental quality to pay other agents to abstain from carrying out activities that harm the environment than to force those agents to pay for the environmental damage that their activities cause. In cases where the actions undertaken improve or rehabilitate watersheds, the "user pays" principle is appropriate.[16] The only clear case of a polluter being involved in improvement measures is that from eMalahleni in South Africa (case study 11), where

[15] *Twenty-six case studies from Australia (Goulburn Broken Catchment and Macquarie river Catchment), Bolivia (Plurinational State of) (Los Negros river watershed), Brazil (Camboriu river watershed), China (Miyun reservoir), Colombia (Cauca river watershed), Costa Rica (Virilla river watershed), Germany (Stevertal reserve), Ecuador (Cayambe-Coca and Antisana watersheds), France (Vittel catchment), Honduras (Jesus de Otoro watershed), India (Lake Sukhna watershed), Kenya (Kapingazi river watershed, Lake Naivasha catchment, Upper Tana watershed), Peru (Rimac river watershed), Philippines (Laguna de Bay), Republic of Korea (Lake Paldang), South Africa (eMalahleni, Emfuleni, George, Orange-Riet), United Republic of Tanzania (Ruvu Uluguru mountains watershed) and United States of America (Catskill and Delaware watersheds and Great Miami river basin) were reviewed.*

[16] *The "user pays" principle is the variation of the "polluter pays" principle which calls upon the user of a natural resource to bear the cost of running down natural capital.*

Box 1

Private company making payments to farmers and forest landholders (Vittel, France)

Brief description: private company making payments to dairy farmers and forest landholders for switching to more extensive farming practices and watershed reforestation to improve water quality by reducing nitrates and pesticides and restoring natural water purification.

Type of market-based incentive: price-based – subsidies to dairy farmers; free labour inputs; conservation easement purchases; debt cancellation for landowners.

Financing of watershed management: private profits.

Background: the French laws on the limits of nitrate levels in natural mineral water are very strict and water quality has to be achieved naturally. In the 1980s, Vittel, a subsidiary of Nestlé Waters and a world leader in natural mineral water, was faced with a problem of increased nitrates in the artesian springs in the Vittel catchment, mainly due to heavy farming.

Action: For an estimated $9 million, Vittel purchased 1,500 ha of agricultural land around the Vittel springs. It enticed landowners to sell their lands by offering prices higher than the market price and by offering to give back to those farmers willing to improve their management practices a free usufruct of the land. Since the company could not purchase the entire 10,000 hectares or force out the 40 farmers, the only alternative the firm had was to establish incentives for farmers to voluntarily change their practices. The technological farm package includes extensive pasture-based dairy farming, improved animal waste management and elimination of corn cultivation and agrochemicals. In return, farmers were provided with several incentive packages, namely: 18–30 year contracts; abolition of debt linked to land acquisition; the acquisition of 1,450 ha of land which was left in usufruct to the farmers for up to 30 years; an annual subsidy of about €200 per ha over 7 years to ensure guaranteed income during the transition period (which corresponded to about 75 per cent of disposable income); the reimbursement of farmers' debts up to €150,000 per farm to invest in new equipment and buildings; free labour to apply compost in farmers' fields and free technical assistance.

Outcomes: By 2004, several of the 26 remaining farmers had chosen early retirement and adopted the new practices and over 92 per cent of the basin was protected. Agrivair introduced a forest management programme with the aim of maintaining a balance of trees to maximize nitrate uptake. Vittel does not make payments based on the relationship between pollutant contents and water quality, but rather compensates farmers for the risk and the reduced profitability associated with the transition to the new technology. Vittel pays each farm about $230 per ha per year for seven years. The company spent an average of $155,000 for agricultural investment per farm or a total of $3.8 million. On average, subsidies account for 75 per cent of the disposable income of the farms (Perrot-Maître and Davis, 2001).

Source: *Perrot-Maître (2010) and Perrot-Maître and Davis (2001)*

mining companies are involved in cleaning up water at old mining sites – presumably to avoid the risk of far higher clean-up costs in future – but have also involved the local municipality in paying and managing part of the clean-up.

The choice of market-based incentives, and indeed the decision on whether to use market-based incentives at all, needs to take the local context into account. There is no single set of instruments that will fit all conditions. Some market-based incentives depend on well-functioning public institutions and policies, while others are less sensitive to the institutional context. Certification schemes, where external NGOs take responsibility for the monitoring and enforcement of market-based incentives, may be the best option in settings where the local institutional capacity is very weak. Price-based schemes, where prices in existing markets are changed through taxes or subsidies, may be less sensitive to weak institutions than policies that create new markets through allocation or PES schemes. There is a case for Governments to take the local institutional capacity into account in the choice of market-based incentives in order to promote sustainable watershed management. Where the local institutional capacity is the key constraint, the lessons drawn from the case studies show that the choice of market-based incentives should follow a certain order in ascending institutional capacity, i.e., (a) those enhancing existing markets (e.g., certification); (b) price-based (e.g., taxes, subsidies and water funds); (c) allocation-based (e.g., water trading); and (d) those creating new markets (e.g., PES). In developing countries, where markets are generally still underdeveloped, Governments should prioritize market-based incentives which work through existing markets rather than new markets. Developing countries would do well to embrace market-based incentives such as certification for their export products.

5.2 Payments for ecosystem services dominate market-based incentives in watershed management but viable designs are required for sustainability

It is clear that the PES concept has been popular with the development community (case studies 15–23). In several of the cases from developing countries, nominal PES schemes (in practice largely subsidy schemes, as noted earlier) have been put in place with donor support, but apparently with limited consideration of the long-term viability of the scheme once outside funding ends. Where the local buy-in from the intended beneficiaries was weak, those schemes had limited success after the initial phase had ended. That is likely to be linked to the observation above that most of the successful schemes began in situations where the beneficiary saw a clear and present need for improved management practices upstream, was willing to pay for those practices and could identify who to pay. When the problems were caused by a wide range of different agents, as in the cases from Peru or the Philippines (case studies 10 and 18), or when not all intended beneficiaries were on board with the new scheme, as in the cases from Naivasha in Kenya or Morogoro in the United Republic of Tanzania (case studies 17 and 19), or when it was unclear who would pay and for what, as in the case from Peru (case study 18), voluntary and semi-voluntary schemes were unlikely to work in practice.

When the incentives of the supplier and demander of service are well aligned, it is possible to strike a mutually beneficial deal. It is likely to be easier to get a quick agreement by the upstream party to undertake desired practices if the number in that party is small and the party either has a natural motive to undertake such practices especially because of their current mandate, or can be adequately incentivized by the downstream buyer. The State Forests in the Australian Murray-Darling case would probably have undertaken similar watershed conservation actions, albeit fewer and less extensive, even if they had not been offered budget support by the association of downstream farmers (case study 23). Thus, in cases where State agencies are upstream, the incentives required for them to buy into watershed conservation are lower than for upstream private agents. In the Vittel case, the bottler enticed landowners to sell their lands by offering prices higher than the market price and by offering to give back to those farmers willing to improve their management practices a free usufruct of the land (see box 1 and case study 2).

5.3 Appropriate legal & institutional arrangements are needed for market incentives to function properly

In spite of diversity in the case studies reviewed, they chime in a remarkable way on the need for appropriate legal and institutional frameworks to allow market incentives to function properly. In some cases, legal and institutional reforms are required. For example, in the United States, the success of the Catskill and Delaware watersheds case was a result of federal, state and local

regulatory changes that were necessary to implement the watershed management programme (case study 1). In South Africa, the legal and institutional reforms drove the establishment of water user associations, which have been key to self-sufficiency and on-farm sustainability in a number of catchment areas (2030 Water Resources Group, 2013). In the Orange Senqu basin case, for example, it was noted that, as a result of the 1998 National Water Act, the once State-owned and managed irrigation schemes were gradually privatized and run by water user associations, bringing good outcomes for the watershed (case study 26).

It is evident from all the case studies that all market-based incentives require appropriate legal and institutional arrangements. In particular, PES needs a special legal framework, as it involves the creation of entirely new markets (for example, see case studies 15–23). Private PES schemes (i.e., involving private agents) require: (a) basic contract law, which provides contracting parties with sufficient legal remedies to enforce contract rights in cases of non-compliance with contract obligations; (b) a legal system based on the legal principle that agreements must be kept, as well as general respect for the rule of law; and (c) the absence of any legal provision which could be interpreted as prohibiting PES contracts and their subject matter (FAO, 2011). Private PES schemes are usually limited to the local scale and therefore do not have a socio-ecological impact at a greater, national, regional or global level. They have the potential to contribute at a larger scale if a nested approach is applied. A nested approach requires an enabling framework comparable with public PES schemes (i.e., those involving the public sector) (FAO, 2011).

Public PES schemes require at least a clear legal basis for the respective public entity to enter into a PES contract. Public entities must be legally empowered to become active and a contracting party in PES schemes. For example, the German Federal Nature Conservation Act (Bundesnaturschutzgesetz), as amended on 29 July 2009, aims to improve cooperation between nature users and conservationists by strengthening the role of contract-based nature conservation. That provides a clear mandate for the public authorities and encourages them to enter into PES contracts (FAO, 2011) (case study 3). In addition, those drafting laws and regulations have to decide how to generate financial resources for public PES investment. Collecting such resources (e.g., through taxes, fees, levies, trust funds, government bonds, etc.) requires a legal basis. At the same time, public PES schemes require at least a clear legal basis for the respective public entity to enter into a PES contract. It has to be decided whether to create a special PES fund to manage the resources and, if so, rules have to be established on how to govern that fund. Furthermore, clear regulations have to be developed on how to invest the resources. Finally, it must be determined how to use public goods in general (e.g., publicly-owned land) as part of PES schemes (FAO, 2011).

Different legal instruments have the potential to create a legal environment which enables or hampers PES development. In Ecuador, for example, the 2008 political constitution (constitución política) recognizes the inalienable rights of nature, called ecosystem rights (case study 6). At the same time, it recognizes the right of people to benefit from the environment and from natural resources. Finally, the production, provision, use and exploitation of ecosystem services shall be regulated by the State. PES-specific laws exist, for instance in Argentina and Costa Rica. In Argentina, Law No. 26.33185 defines ecosystem services as the tangible and intangible benefits generated by ecosystems that are necessary for the survival of natural and biological systems, as well as for the well-being of Argentinians (Lugo, 2008). In Costa Rica, Forest Law No. 7575, enacted in 1996, explicitly acknowledges four categories of ecosystem services that are delivered by forest ecosystems: mitigation of greenhouse gas emissions; hydrological services (which includes water for human consumption, irrigation and energy production); biodiversity conservation; and scenic beauty for recreation and ecotourism. That law provides the regulatory basis for compensating landowners for the services provided by their lands and, for that purpose, established the National Fund for Forest Financing (Fondo Nacional de Financiamento Forestal) (Pagiola, 2006; Greiber, 2009; FAO, 2011) (see box 2 and case study 21). The Tanzanian Water Act also recognizes payments for ecosystem services as a conservation instrument (case study 17). On the other hand, in Kenya there is no policy at a national level which supports payments for ecosystem services, thereby making implementation of such market-based incentives difficult (case study 19).

In Brazil, for example, promising legal and financial frameworks to support PES development have been created at the state level (Valladares, 2009; FAO, 2011) (case study 15). The State of Espirito Santo adopted Law No. 8960 in July 2008 which establishes a State Water Resources Fund (Fundágua). That fund collects money from different sources, including petroleum royalties, water fees or fines. They can then be invested, into PES schemes, amongst others, rewarding rural property owners for the expansion, conservation and/or preservation of forest cover and adequate soil management in areas of relevance for water resources. An alternative to the development of a specific PES law is the amendment of pre-existing sectoral environmental legislation. An enabling legal

Box 2

Payment for environmental services needs to be legalized in the country (Costa Rica)

Brief description: water users pay upstream landowners to provide watershed services.

Type of market-based incentive: creating markets – payment for ecosystem services to upstream forest landowners for changing land-use practices.

Financing of watershed management: water user fees; municipality grant; external donation.

Background: strong legal frameworks covering public utilities (reg. number 7593), services and quality/health regulation/water company regulations/safe water drinking regulations (number 7789), and environmental service laws (biodiversity and environmental laws) have been important in the management of Costa Rican ecosystems. Action was taken to introduce water pricing to pay for services provided by forests in watershed areas. That "green fee" constitutes an additional line item in the water bills generated for water users and was arrived at after consideration of the economic valuation of watershed land and recovery or protection replacement cost. The first catchment programmes financed through cost recovery were started in 2002.
Heredia is part of the large urban conglomeration of the central valley of Costa Rica. Water for the city comes from the Virilla river watershed. About 6 per cent of the Virilla watershed is covered by forest, 32 per cent by grassland and 38 per cent of the area is agricultural land. The area of the watershed providing water to Heredia is approximately 11,340 ha (IIED, 2012). Threats to the watershed include nitrogen loading in the upper catchment owing to forest and marginal dairy farming, an expansive and sprawling human population in the mid–catchment, who often engage in poor agricultural practices, and increased water demand and wastewater treatment needs.

Action: a "green fee" of $0.31/month was first introduced in 2002 for the 48,667 user households as an initial step to make water users pay for watershed services. The "green fee" is channelled into a fund (ESPH-PROCUENCAS) into which, together with additional financing from other sources, is used to fund watershed conservation projects.
The following land uses are promoted: conservation and management of the forested area, prevention and control of forest fires, restricted timber extraction, implementation of a management plan, prohibition of livestock rearing and limiting of subsistence farming only to one ha per provider, without the use of pesticides and agrochemicals. Each provider of ecosystem services in the watershed receives approximately $120/ha/year for a period of 10 years for forest conservation and succession. For reforestation, the payment is approximately $1200/ha/5 years, with evidence showing that this is not popular with landowners (Gamez, 2010). The amounts were set through negotiations between the Water Committee and each of the providers. The cost of the initial set-up was approximately $10,000, some of which has gone to current payments.

Outcomes: to date the scheme has involved 30 landholders as providers of ecosystem services in the watershed and 1,195 ha of land have been conserved. The scheme has been in operation for 12 years now and through learning by doing, has created synergies between stakeholders for the sustainability of the programme. In addition, the programme has activated citizen interest and encouraged environmental responsibility among water users.

Source: *Agarwal and Narain (1999a,b); Agarwal and Narain (2000); Porras et al. (2008); Gamez (2010).*

framework for PES schemes requires compatibility with indirectly relevant laws. Such laws need to be carefully assessed, as they may introduce perverse incentives which clash with the objectives of PES. At the same time, those laws might also include certain provisions with great potential to support PES initiatives. In Colombia, Law No. 99 of 1993 requires the investment of a certain amount of money coming from water-use projects, the energy sector or irrigation districts into watershed conservation activities (case study 22). Such mandatory investments thus provide a potential source of funding for PES projects (Navarrete Le Bas, 2009; FAO, 2011). For the upscaling of payment for environmental services to be effective, it needs to be legalized in the country concerned, so that it is easily implemented.

There are often challenges with institutional capacity. Institutional limitations and the context in which market-based incentives are implemented can be a drag on the effectiveness of the programme. Market-based incentives are not an alternative to planning and governance (Lockie, 2011). They depend on the capacity of the State or other agencies to define and enforce appropriate property rights, identify and mobilize sellers, solicit trust, act on behalf of absent buyers, monitor implementation and outcomes and reduce information asymmetries and minimize transaction costs. For example, the Colombian private sector is not legally empowered to implement private watershed management plans (see box 3 and case study 22). In such a case, the administration of watershed management becomes highly dependent on effective government actions.

In cases where the public water utility does not have the capacity to deliver sound watershed management, other institutions should be considered. For example, in the Jesus de Otoro case in Honduras, watershed management is coordinated by a local NGO, the Council for the Administration of Water and Sewage Disposal (case study 20), which got authority from the municipality to manage water provision and sanitation in Jesus de Otoro. Even though bringing an NGO on board helped kick off the PES scheme in Jesus de Otoro, the size of the area covered is too small to make a sufficiently significant impact on the watershed services to convince a downstream user to keep making payments. The level of payment upstream needs to be high enough to cover the opportunity cost of land if more upstream landowners are to be enrolled into the scheme.

5.4 Involvement of public institutions & other stakeholders in a participatory process drives successful outcomes

A proactive attitude of the Government is very valuable in promoting the use of market-based incentives. That is particularly critical with new instruments, such as the concept of payment for environmental services and giving it credibility with a wide group of stakeholders. That is usually necessary because of the public good characteristics of watershed services. In most of the successful case studies, a public agency played an important role either as a counterpart or as an intermediary. Thus, moving forward there will still be roles for the public sector and ideally such roles should be built into legislation for better accountability by public agencies.

The involvement of public institutions and other stakeholders in a participatory process often results in successful outcomes. If there is "early buy-in" from other stakeholders, problems associated with a lack of trust from regulators can be avoided.[17,18] The partnership between local communities, Vittel, a private company which is a subsidiary of Nestle Water, public institutions, such as the Rhine-Meuse River Basin Agency, and the French National Institute of Agronomic Research was critical to the success of the Vittel case (case study 2). In the Colombian Cali case, the partnership involved the downstream association of irrigators which paid the government conservation agency, which in turn subcontracted upstream forest landowners to provide watershed services (see box 3 and case study 22). In the Chandigarh case in India, there was initially a successful partnership between the local people and the forest department in implementing the project (case study 8).[19] Various types of expertise are required to make a programme successful and the involvement of all stakeholders with the required expertise is essential. In the Tanzanian Morogoro case, the Wami Ruvu basin water office provided support on hydrology monitoring; the Uluguru Nature Reserve office conducted training sessions on tree planting, agroforestry and reforestation techniques; and Sokoine University provided technical support in terrace building, land-use planning and management (case study 17). In the Chandigarh case, the Center for Soil and Water Conservation Research Training Institute designed soil conservation structures that were meant to store rain water for irrigation for the upstream villages.

The intermediation role played by NGOs in a number of cases secured the cooperation and commitment of local communities, the Government, the private sector and civil society organizations. In fact, the external support from such organizations (e.g., CARE, TNC, WWF) to fund the initial costs, which are high, helps to jump start PES schemes (see case studies 6, 9, 15, 16, 17, 18, 19 and 20). For example, in the Tanzanian Morogoro case, investment costs in implementing soil and water conservation practices (e.g., farm inputs), working tools and high labour demands were high and the intervention of CARE-WWF proved helpful (case study 17). At the same time, local contexts differ widely and there is a risk that schemes driven by external NGOs may be less able to tailor policies to local constraints. Strong interest from, and engagement by, a public institution can provide a much needed backstop when the NGO has to move on. Thus, the intermediary role of a public institution beats that of an NGO in the long run.

[17] *Transparency and constant dialogue and communication with stakeholders at all level of decision-making is critical. Failure to engage the public in all aspects of decision-making regarding adoption of market-based incentives is a sure recipe for failure (Renzetti, 2005). On the other hand, engaging the public has many benefits, such as tapping into local knowledge and experience and adding legitimacy because they become owners of the programme. Continuous consultation and communication is absolutely necessary for the success of market-based incentives. Engaging the public through a gender lens also allows gender differentiation in the use of watershed natural resources and, therefore, a sustainable entry point in strengthening gender sensitive mechanisms, such as land tenure, access to credit and eligibility for market-based incentives. There is a need to identify people's gender-based needs and problems from the outset. A project can only succeed if it is aimed at meeting their needs, solving their problems and mitigating their hardship. The gestation period for watershed management projects should be short and the benefits should accrue in the shortest possible period.*

[18] *In addition, there is a case for developing business cases for each ecological service, based on the services they provide to aid human well-being.*

[19] *However, despite the success of the village in regenerating the forest, the forest department has refused to give more than 25 per cent of the timber to the community. As a result, the Sukhomajri community has been in a prolonged struggle with the forest department and the neighbouring town of Dhamala. It is therefore easy to reverse the gains made over time if conflicts are not managed well.*

Box 3

The involvement of public institutions drives successful outcomes (Colombia)

The three major lessons from Colombia are that: (a) the administration of watershed management can work at a larger scale if driven by the Government, (b) devolution of power over watersheds to lower structures aligns their management better with local circumstances, and (c) taxes on heavy users of water can play a critical role in financing payments of ecosystem services schemes with upstream landowners. The Government of Colombia established regional autonomous corporations (RACs) throughout the country and charged them with overall watershed management, whereas municipalities manage watersheds on their own land. The Government established a national funding system to provide funds for watershed management. Municipalities are required to allocate 1 per cent of their budget to purchase land in order to protect hydrological basins on which they rely for their water supply. Similarly, hydroelectric power companies with capacity greater than 10,000 kilowatts are required to transfer 3 per cent of gross electricity sales to the RACs and another 3 per cent to the municipalities in which the hydrological basins and reservoirs used by the power companies are located. Any other corporation using water in its industrial process is also required to allocate 1 per cent of its investment to the RAC for protection of the hydrological basins that provide its water. The RACs and municipalities also receive property taxes in their respective jurisdictions. There is also a mechanism under which 20 per cent of the income from the national electricity sector is pooled into a general fund, from where it is redistributed to the poorer RACs to address equity issues. The main market-based incentives used are payments from RACs and municipalities to private landowners to protect their hydrologically sensitive forests.

5.5 Scientific understanding of the hydrological relationships & associated economic implications drive participation

The scientific understanding of the hydrological relationships in the watershed needs to be strong for market-based incentives to yield results once implemented. In South African watersheds, one of the main lessons is that extensive research on the environmental impact of invasive alien plants has provided the basis for the work developed by the Working for Water (WfW) programme and real improvements in water quantity have already been realized. Also in South Africa, the efforts undertaken by private sector corporations, such as South African Breweries (SAB) Ltd, Sasol and Anglo American, were predicated on a credible understanding of the actual risks from the watershed (case studies 4, 5 and 11). The hydrological relationships in the Australian Murray-Darling case had also been scientifically established and were credible, thereby motivating the association of downstream irrigators to provide budget support to State Forests (see box 4 and case study 23).

It is equally important to get as much information as possible from economic valuation studies to use in addressing opportunity costs, particularly when measures new to the buyer and/or seller are proposed. Whether or not market-based incentives are going to work will largely depend on their ability to compensate stakeholders fairly for the opportunity costs. For example, the estimated costs of the adoption of watershed conservation practices in the Ruvu watershed in the United Republic of Tanzania were evaluated by CARE-WWF upon consultation with discussion groups and village assemblies and an evaluation of the economic returns provided by maize, beans, cassava, rice and bananas, the most common crops in the Uluguru area (Lopa, 2010) (case study 17). In addition, an auction carried out by PRESA (Pro poor Rewards for Environmental Services in Africa) in the Kinole area and subcatchment of the Mbezi River in March 2009 also provided additional information on the estimated opportunity costs related to reforestation activities. In the French Vittel case, the multidisciplinary research conducted by the French National Institute of Agronomic Research enabled the identification of a set of incentives and practices that were mutually acceptable (case study 2). Thus, baseline studies and technical reports are essential to identifying the various aspects of a market-based intervention.[20] Those aspects include mapping services and placing economic values on each.

The key to the success of market-based incentives is being able ultimately to set prices that reflect true

[20] *Lockie (2011) argues that the common pitfalls in PES implementation include poor targeting, offering insufficient incentives to encourage participation, displacing undesirable practices to alternative locations, paying for activities that would have been undertaken anyway, or undermining voluntary action, failing to guarantee long-term environmental improvements and dilution through multiple competing co-objectives, such as poverty alleviation (Lockie 2011; Muradian et al., 2010).*

Box 4

Accepting hydrological relationships drives participation (Murray-Darling, Australia)

Brief description: association of irrigation farmers voluntarily financing the government agency's reforestation budget to reduce water salinity by buying water transpiration credits generated from reforestation.

Type of market-based incentive: creating markets – payment for ecosystem services by irrigation farmers to the State Forests trading enterprise of the New South Wales Government.

Financing of watershed management: private profits of irrigation farmers.

Background: the Murray-Darling watershed is located in the eastern side of the Australian continent, covering more than 1 million km.2 Much of the basin is saline, but land clearing has worsened the situation, especially in the Macquarie River catchment areas. The salinity levels have a negative effect on crop growth and yields. There is need for large-scale reforestation to reverse the salinity trend.

Action: in 1999, Macquarie River Food and Fibre (MRFF), an association of over 600 irrigation farmers, entered into an agreement with the State Forests of New South Wales, which is a government trading enterprise that manages more than 2 million ha of public native forests and the expansion of hardwood and softwood planted forests, to improve the salinity situation in the catchment. The association purchases salinity credits from State Forests based on the amount of water transpired from 100 ha of newly established forests in the upper Macquarie catchment area. Those funds are then used by State Forests to finance strategies aimed at reducing salinity, e.g., pumping and evaporating saline water, planting desalinization plants and replanting trees or other deep-rooted perennial vegetation.

Outcomes: for lands owned by State Forests, the major activity has been tree planting or other vegetation. State Forests, as owners of the upstream land, earn transpiration or salinity reduction credits by planting trees or other vegetation. The MRFF downstream water users purchase those salinity credits. Prices are expressed in $ per million litres of additional transpiration per year, assuming 1 ha of forest generates 5 million litres of transpiration per year. At the present time the farmers pay $A17 per million litres of water transpired or a compensation of $A 85 per ha per year. They agreed to do so for 10 years.

Source: *Brand (2000); Johnson (2000); Perrot-Maître and Davis (2001)*

costs (Renzetti, 2005). The full cost of water and other environmental goods provided by a watershed needs to be recognized on both the demand and supply sides. On the demand side, developing a full cost accounting price rule will promote efficient water usage.[21] In turn, the price of the produce using water as an input should also receive a price covering the full costs, including those associated with watershed management: for example, bottled water from Vittel, coal output from the Anglo American mine and agricultural produce from South African irrigation in the Orange Riet (case studies 2, 11 and 26). On the supply side, the price of water should account for the costs associated with watershed management. Of course, in many cases of PES, the payment is likely to be determined through political negotiation. Accordingly, low payment is usually good enough initially to avoid resistance from buyers, but it could result in shirking by suppliers of watershed services.[22]

In Japan, payments for ecosystem services have been implemented by local government and the private sector. Twenty-nine out of 47 prefectures have introduced earmarked environmental fees levied on beneficiaries of forest ecosystems since 2003, with a percentage of that revenue being reserved for direct payments to landowners for forest management practices that protect critical watersheds. However, the level of taxes earmarked for forest management is too low compared to the willingness to pay and therefore generates little revenue for improving watersheds. Japan needs to have a coordinated national PES framework and taxes that finance PES schemes should be set at a level that approaches the marginal value of the ecosystem services. That is critical to helping raise revenue for effective and sustainable watershed management.

[21] *As observed in the water trading schemes in Australia and South Africa, a precondition for this is the presence of accurate water metering and having in place a management and accounting system that can capture in an accurate way the operation and the external costs.*

[22] *The establishment of a strong business case and of a market mechanism that stakeholders are easily able to engage with for the selling and buying of ecosystem services is also essential. In the Naivasha case in Kenya, there has been little buy-in from buyers because securing commitment from direct beneficiaries of those services is a challenge when they already pay statutory water fees to the regulatory body (case study 19).*

5.6 Institutional platforms enabling regional consultation & dialogue on watershed management are associated with better outcomes

The case studies uncovered varying institutional actors, some self-organized, others organized with the involvement of State agencies and others representing new decentralized levels of formal authority, who are taking action on watershed management at the local level. Most of the innovation in water resources management appears to come from local agencies operating at the user level. Those groups often have names such as "water user association" (e.g., in South Africa) or "water committee" (e.g., in Costa Rica) (case studies 4, 19, 21 and 26). They are motivated by a desire to optimize the quality and quantity of their own water supplies and improve the productivity of their farms while conserving water for sustainable livelihood. It is important therefore to have platforms that enable regional consultation and dialogue on watershed management at the grassroots level. Thus, an essential condition for the effectiveness of market-based incentives is the progressive institutionalization of water resource management to catchment agencies and local-level water user associations. Such devolution, as seen in Colombia, Costa Rica or South Africa, makes it less onerous for the private sector to negotiate interventions (case studies 4, 21, 22 and 26). For example, in Costa Rica, the PES fee was decided through a participatory process in the water committee (case study 21). Political will must support legal and technical processes when reforming economic instruments. Although the methodology for assessing water should be as technical as possible, the scientific results will only be a foundation for motivating the discussion of the norm or policy.

5.7 Private sector partakes where business risks will be reduced

In cases where the protection of watersheds is vital for reducing business risk and increasing the profitability of businesses, as in the French Vittel case and the South African cases involving SAB, SASOL and Anglo American, the private sector is readily available to partake (case studies 2, 4, 5 and 11). Thus, private corporations may make a commitment to help address problems in watersheds if value chain analyses indicate possible risks for their operations. SAB has found motivation in engaging in water conservation by considering the long-term risks to its business emanating from that sector (see box 5). The protection of the ecosystem providing water filtration and purification services in the catchment areas of its springs were also vital for reducing business risks and increasing profitability for Vittel, the bottler of natural mineral water. The company reasoned that doing nothing would have implied closing down the business, losing the brand name and the associated premium.

Many large corporations will have some link to watersheds and hence could naturally be encouraged to engage actively through awareness of potential future risks. However, the existence of opportunities to reduce business risks and increase profits from sound watershed management is not glaringly obvious, so there is a need for relevant government agencies to conduct research and share it with the private sector if their participation is to come sooner rather than later. In fact, the French National Institute of Agronomic Research cofinanced four years of research to identify optimal agricultural practices in the French Vittel case (case study 2).

It is not only private corporates which recognize the value of watersheds in their activities, as illustrated by the Colombia Cali case, where rice and sugar cane farmers were threatened by unstable water supplies and used voluntary water user fees to finance watershed management (case study 22). In the South African Orange Riet case, the major challenge for the water user association was to ensure the financial survival of the farmers (case study 26). The main crops grown in the area (wheat and lucerne) are difficult to grow profitably. They could only achieve viability through increasing farm productivity and improving irrigation efficiency at both the scheme and farm level. The contribution to watershed management has mainly been through displacing additional demands for water through efficiency in use, thereby helping maintain natural water flows in the catchment. The water saving is not trivial given that the water user association supplies water to at least 5 towns, 374 farmers, 1,600 small users, 5 industries and 23 diamond diggers.

5.8 Packaging watershed management to incorporate forward a& backward linkages is essential to attract private sector participation

The private sector plays a major role in providing technical support and credit facilities. In the South African Orange-Riet case, the operation of an efficient water market required a non-trivial initial capital outlay (case study 26). Flows in the canal systems, including the amount taken off at source, are all monitored and controlled through a state-of-the-art telemetric system. In order to facilitate accurate scheduling there has been

Box 5

Private sector partakes where business risks will be reduced (SAB, South Africa)

Background: water is a vital component of beer production and so protecting water resources in the areas in which SAB Ltd (a SABMiller subsidiary) operates also protects the company's ability to produce beer and grow its business. The most significant part of the net water footprint of its value chain of 511,100 million litres relates to water used to cultivate crops, which accounts for over 95 per cent of the total footprint. The next most significant element relates to water used for brewing and soft drink production, accounting for the remaining 5 per cent. The findings of the water footprint assessment identified a number of potential water risks for SAB Ltd. One of the risks prioritized for tackling was the availability of water to hop farms located in the Gouritz watershed in the Western Cape province of South Africa – an area where water availability is precarious. There are approximately 13 commercial hop growers cultivating 483 ha of hops, of which a significant proportion is purchased by SAB Ltd. There is an estimated difference between water demand in the area and the water resources available of 64 million m^3, which is predicted to potentially double in the future (Water Futures, 2012).

Action: As a result of the hop farm risk assessment, two strategic responses have been formulated:

- To develop a local coordinating body to manage a comprehensive catchment rehabilitation and stewardship programme, to safeguard existing water resources and maintain the integrity of the native ecosystem. Once in place, such a coordinating structure could operate over a 10–15 year period and be funded from different sources, including significant contributions from SAB Ltd and the Water Futures Partnership (WWF SAB and the German development agency GIZ).
- To establish a local water user association to provide robust and credible data on water resources in the area and create a monitoring programme that measures groundwater levels on hop farms. That will draw upon specialist support from the Water Futures Partnership and the Department of Water Affairs, catchment management agencies and local municipalities.

Accordingly, the partnership is working with local stakeholders to remove the alien species and replace them with indigenous, less water-intensive vegetation in the region, as well as introducing groundwater monitoring and establishing a water user association. The project in George is the first of its kind in the hop industry worldwide.

a move away from flood irrigation, with 90 per cent of land now under centre pivot or fixed overhead systems. In fact, market-based incentives, such as water trading, will be more successful in cases where the private sector is willing to play a major role in the provision of technical support to irrigators and there is access to credit from banks for farmers wishing to invest in the requisite technology.

The South African eMalahleni case where mine acid water was cleaned up to standards safe for human consumption also illustrates how technology has been used to provide a common solution, by addressing mine closure water quality issues and providing water security to operating facilities and the community now and in the long term.

There is a need for capacity-building in the required conservation technology relevant for watershed management.[23] That should be continuous if it is to realize any meaningful impact in the long term. The Kenyan Naivasha case required terracing, grass strips, tree planting and protection of the riparian land and forests (case study 19). The Tanzanian Morogoro case required farmers to be well versed in a number of conservation practices, including structural, vegetative and agronomic measures (see box 6 and case study 17). The technological farm package for the French Vittel case included extensive pasture-based dairy farming, improved animal waste management and elimination of corn cultivation and agrochemicals (case study 2).

The case studies highlighted demonstrate that, on the one hand, watersheds demand technology, training and credit from the private sector and thus there are backward linkages from watersheds to the private sector. On the other hand, watersheds supply water and other services to the private sector, so there are also forward linkages from watersheds to the private sector. The message about the rationale for more private sector involvement in watershed management needs to go beyond just the ability to address business risks by assuring watershed services for business operations. The message about how watersheds generate business for the private sector through demand for technology, training and finance needs to be told simultaneously. Thus, the ability to package watershed management to incorporate forward and backward linkages with the private sector is essential.

[23] *Of course, watershed improvement programmes could initially face resistance from stakeholders, especially if they involve the adoption of new technologies. It took around 10 years to convince the farmers in the French Vittel case to switch from crops to extensive livestock production (case study 2).*

Box 6

How adoption of new technologies can provide a solution (Morogoro, United Republic of Tanzania)

Brief description: water utility and Coca-Cola paying upstream farmers for undertaking soil and water conservation and agroforestry aimed at controlling run-off and soil erosion.

Type of market-based incentive: creating markets – upstream farmers paid depending on the type of land-use change practice adopted and acreage.

Financing of watershed management: water user fees, external donations.

Background: the Ruvu watershed which provides water to 4 million people in Dar es Salaam has been seriously degraded, causing a rapid decline in water flow and increasing turbidity in the Ruvu River. As a consequence, downstream water treatments are needed, owing to high levels of siltation of the Ruvu River and often downstream water supply needs to be rationed. Unsustainable farming and irrigation practices, encroachment into the forest and water sources and illegal gold-mining activities in the river systems and within forest reserves are some of the lead causes of degradation. The restoration of the Ruvu's hydrologic services is mainly linked to improved upstream land-use management, which is strictly linked to poverty alleviation and livelihood improvements of the people inhabiting the region, which has a very high population density.

Action: a joint CARE-WWF Programme (2006–2011) promoted a PES scheme on the Ruvu watershed between the downstream buyers (the industrial water supply and sewerage corporation (DAWASCO) and Coca Cola Kwanza Ltd.) and the upstream sellers (about 265 farmers) from Lukenge, Kibungo, Lanzi, Dimilo and Nyingwa villages. Farmers received payment for the adoption of agricultural practices aimed at controlling run-off and soil erosion, while improving their crop production. A combined approach was implemented that included structural (bench terraces and fanya juu terraces), vegetative (reforestation, agroforestry and grass strips) and agronomic (intercropping crops with fruit trees, mulching and fertilizing with animal manure) measures to limit run-off, combat soil erosion and increase soil moisture and productivity. The farmers were paid in cash depending on the type of improvement in land-use change practices adopted and acreage.

Outcomes: terraces reduced run-off and improved infiltration within terraces, thus increasing soil moisture and nutrients in the area. The adoption of improved land-use change practices enabled local farmers to improve their productivity. At the baseline in 2009, maize production was 400kg/acre, but by 2012, this had increased four times to 1,600kg/acre. There has been increased land cover in the project area following the planting of over 300,000 timber tree species of Grevillea robusta, Khaya anthotheca, Afzelia quanzensis, Markhamia lutea and fruit trees as agroforestry and reforestation. Continuous hydrological monitoring of the river suggests that there is a significant decrease in sediment load in the river.

Source: *Lopa and Mwanyoka (2010)*

5.9 Water revenues are better spent in watersheds through long-term institutional mechanisms

Even though watershed management programmes can potentially be financed through charging for water, the challenge is to ensure that the revenues are indeed spent in the watersheds to maintain environmental services. Several of the cases reviewed include provisions for using water fees on watershed management (case studies 1, 3, 6, 8, 10, 17, 20, 21, 22 and 24). For example, Costa Rica introduced legislation which paved the way for raising financing for PES schemes (case study 21). There are also several cases where water pricing was adjusted to allow the payment for services provided by forests in watershed areas (see box 2). The water sector is therefore potentially able to raise finance, which could be used for watershed management. However, it is not clear that it has always been disbursed to the producers of the ecosystem services in watersheds. In the Beijing case, the payments are partly made to other municipalities on behalf of their residents (case study 24). It is not clear whether those incentives trickle down to the landowners who are expected to produce the watershed services. However, the creation of endowed water funds guarantees long-term institutional mechanisms for financing watershed management. Furthermore, water funds pull together multi-stakeholder participation on the finance side, which is essential for sustainable watershed management.

The Water Conservation Fund (FONAG) case in Quito is a good example of a public-private partnership that worked well in raising financing for watershed management and human well-being goals (case study 6).[24] In the Beijing case, the establishment of an intermediary in the form of the environmental forest compensation fund that receives funds from cities, which

are beneficiaries of the watershed (Beijing and Tianjin) and make payments to watershed service providers (Fengning County), was a major success factor, as this not only signalled the sustainability of the programme but also the ability of the Government to adapt the programme to meet the needs of farmers (see box 7 and case study 24). In Costa Rica, the green fee is channelled into a fund, into which, together with additional financing from other sources is used to fund watershed conservation projects (case study 21). In Jesus de Otoro, Honduras, the water supplier maintains a water fund financed through donations, a water cleaning levy, and municipal grants (case study 20). In Peru, the Lima and Callao Water Fund was created in 2012 with $500,000 seed capital, but gets additional funds from national and international cooperating institutions, private businesses and citizens (case study 18). The creation of a water fund in the Upper Tana catchment in Kenya brought together actors from the private sector, two government organizations, two NGOs and two main utilities involved in city water supply and power generation. It is estimated that at least $1.5m was expedited within the first two years of implementation (case study 9). In Los Negros, Plurinational State of Bolivia, a water fund was established, into which revenues from a new environmental services tariff are channelled (case study 16). The tariff is negotiated with water users at the general assembly of water cooperatives. Those funds are used by local government to purchase beehives, fruit tree seedlings, irrigation tubes or other development tools, to be given in compensation for upstream forest conservation. The creation of water funds has provided hope for the sustainability of market-based incentives in several instances.

Box 7

The environmental forest compensation fund was a success factor (Beijing)

Brief description: local farmers receive compensation to manage forest resources and to prevent siltation into the Miyun reservoir.

Type of market-based incentive: creating markets – payment for ecosystem services to upstream forest landowners for changing land-use practices.

Financing of watershed management: water user fees, municipality grant.

Background: The Miyun reservoir and a dam were designed as a multi-purpose project for controlling floods, generating power, irrigating farmland and providing drinking water to the population of the city of Beijing. The Miyun reservoir is the main source of drinking water for Beijing (Zheng and Zhang, 2006). The reservoir supplies 80 per cent of Beijing's water and 56 per cent of water flowing into the Miyun reservoir comes from the Chao, Bai and Chaobai Rivers, which originate in Chengde Prefecture. However, the Miyun reservoir was threatened by increasing siltation and pollution, with the average rate of soil erosion being estimated at 1,200–1,600 tonnes/km2/year. In addition, the heavy use of fertilizer and pesticides in surrounding farmlands over time had increased pollution in the area (Wenming *et al.*, 2002). The quality of groundwater had deteriorated since the 1980s.

Action: Beijing municipality has aggressively backed a range of efforts to restore and create forests in the watershed, including "eco-compensation" programmes that pay communities to plant trees. More than 18,000 hectares have been planted around the reservoir. The PES concept was also used to address the problem of the Miyun reservoir and its surrounding forests. Direct negotiations between the recipients of water in the municipalities of Beijing and Tianjin and the suppliers in Fengning County (Chengde Prefecture) resulted in the establishment of an environmental forest compensation fund. The fund receives $120,000 (1 million RMB) from the city of Beijing and $48,000 (400,000 RMB) from the city of Tianjin every year. In addition, a fee of $0.02 (0.2 RMB) per cubic meter of water consumed (equivalent to about 12 per cent of total charges) is collected and transferred to forestry protection activities. Those funds are used to pay farmers and locals to manage forest resources and prevent the siltation of the Miyun reservoir (Wenming *et al.*, 2002). The PES policy for the Miyun reservoir is co-sponsored and organized by different State institutions. The Beijing municipality makes payments to the cities of Chengteh and Zhangjiakou, which are located upstream in the nearby Hebei Province for taking environmental protection measures in the watershed. The aim is to increase the quantity of water and improve the quality of the water in the Miyun reservoir (Zheng and Zhang, 2006). From 1995 onwards, the payments to Chengteh and Zhangjiakou for protecting forests amounted to $250,000 per year and increased the total payments to $2.25 million, of which Zhangjiakou received $1 million.

Source: *Wenming et al. (2002)*

[24] *However, since such funds typically only use interest generated from the endowment, the growth of the investment in watershed management will be slow if the endowment is not big enough to begin with. There is a need for multi-stakeholder participation and some of the stakeholders would need to put forward substantial amounts of finance.*

5.10 Market-based incentives need to be implemented cautiously and in stages

Market-based incentives need to be implemented cautiously and in stages. It is critical to have adaptive management, especially when introducing measures that are highly innovative against the predominant regulatory style. An adaptive approach to watershed management is necessary, especially when new and unanticipated problems that exceed the response capacity of existing institutions are likely to occur. The objective would be to establish a process that provides stakeholders with an opportunity to reconsider values in the light of new information (O'Connor, 2000). For example, in the case of Manila, when environmental user fees were implemented some perverse incentives for effluent dilution were detected, because the variable part of the fee relied on concentration levels (case study 10).[25] When it comes to PES schemes, adaptive management can be used to generate bottom-up policy development opportunities. Watershed PES schemes are usually developed at a local level. Such local schemes generally require less legal guidance from the outset, as they are usually focused on very specific watershed problems. However, by taking a "learning-by-doing" approach, those local PES schemes, if successful, can trigger the development of policies and laws at the national and the regional level. The following four steps can lead to the development of legal and policy frameworks in a bottom-up approach: firstly, PES projects at the very local level are developed and implemented in order to gain experience and build capacity. In the next stage, lessons are drawn from successful PES experiences in order to duplicate those success stories in other local areas and, if possible, at a larger scale. In order to promote such upscaling, a preliminary PES policy at the provincial level can be a useful tool. National framework legislation can then be developed to ensure a common PES vision and understanding, to create legal certainty and to facilitate a coherent and efficient PES approach across administrative, and according to ecosystem, boundaries. Finally, implementing laws and regulations can be developed at the provincial and local level in order to regulate the necessary details and steer the next generation of PES projects and schemes (FAO, 2011). That is the approach that countries such as Kenya are taking (see case study 19). However, the bottom-up approach highlighted above is only one of several possibilities. Enabling legislation need not necessarily develop in a linear way nor start from the bottom. In fact, there is a "chicken-and–egg" problem between enabling legislation and the development of local PES schemes. In some cases, lack of legislative support can mean that there is no opportunity for many local initiatives to be tested. For example, national legislation facilitating PES schemes in countries such as the United Republic of Tanzania has preceded local PES examples (case study 17).

[25] *However, water pollution charges provided incentives for industrial polluters to reduce their wastewater discharges into a large freshwater watershed and raise revenues for programme management.*

5.11 Market-based incentives do not have to work in isolation from "command-and-control" policy instruments

Market-based incentives do not have to work in isolation from CAC instruments. There are cases where market-based incentives need strong support from the CAC approach. In the case of Beijing, the beneficiary states ensured that certain activities with high levels of water consumption and pollution (i.e., paper-making, metallurgy, mining and intensive fish farming and agriculture), as well as grazing activities, were either completely forbidden or severely restricted and monitored (case study 24). In the Republic of Korea, four of the country's five major river basins were targeted in a restoration project because they faced many water-related problems, including floods, droughts, water quality issues and growing demand for recreational water facilities (see box 8 and case study 7). In addition, conflict between the upstream and downstream residents of each river basin had been increasing, rendering negotiations to solve the problems impossible. The major watershed policies adopted included a total water pollution load management system, riparian buffer zones, land purchasing, a water-use charge and resident support measures. The water-use charge applied to all end users of water along the rivers largely depends on the financial requirements for protecting the watershed and relevant water-quality management activities. Thus, the collected revenue supplies the watershed management fund, which subsidizes farmers for livestock wastewater treatment and also supports CAC measures by local governments. Consequently, the Republic of Korea presents a successful model, where market-based incentives and CAC measures complement each other in watershed management.

5.12 Mainstream watershed management in poverty reduction & development strategies

A common theme across many of the case studies, especially those on PES, was the lack of sustainable financing for watersheds. Watershed management is

Box 8

State-led initiative incorporating both CAC measures and market-based incentives (Four River basins, Republic of Korea)

Brief description: a State-led and nationwide initiative that incorporates both CAC measures and market-based incentives and subsidizes waste treatment for livestock farmers.

Type of market-based incentive: price-based – subsidies for treating livestock waste.

Financing of watershed management: revenue from water-use charge.

Background: the Four Rivers project covers four of the country's five major river basins, namely: the Han, Nakdong, Geum and Yeongsan Rivers. The four basins were targeted in the restoration project because they faced many water-related problems, including floods, droughts, water-quality issues and growing demand for recreational water facilities. In addition, conflict between the upstream and downstream residents of each river basin had been increasing.

Action: the following are the key points of the new watershed management measures for the four major rivers.

In the field of industrial waste, the sector-based environmental action plan was established in January 2004. Its contents include (a) allowable emission standards differentiated according to differences in treatment levels and costs between industries and watersheds; (b) an increase in items listed as specific water pollutants; (c) the introduction of testing and management of biotoxins; (d) upgrading the permits system to take into consideration industry and watershed characteristics; and (e) improvements aimed at more efficient monitoring.

Livestock wastewater accounts for 26 per cent of the pollution load in the Republic of Korea, making it a major source of pollution. In accordance with the Act on the Disposal of Sewage, Excreta and Livestock Wastewater, livestock farms above a certain capacity are required to establish and operate proper facilities to dispose of and treat livestock waste. As a precautionary measure, riparian buffer zones are being established for up to 300m-1km from the water edge along the upstream banks of the four major rivers, where the development of new restaurants, lodgings, livestock farming, and industrial facilities is restricted. Currently 1,130 km² have been designated as riparian buffer zones. Moreover, the Government is involved in land purchasing, currently around 3,300 km², to prevent water pollution from non-point sources, among others.

The water-use charge was established in 1999 and is based on the "user pays" principle. It applies to all end users of water along the rivers in proportion to the amount of water used. The charge level differs in different river basins, largely depending on the financial requirements to protect the watershed and relevant water-quality management activities. The collected revenue supplies the watershed management fund, which supports upstream residents and local governments under land-use regulations set forth to protect water resources. The fund supports community projects and provides funding for the construction and operation of basic environmental services, as well as purchasing land.

Outcomes: recent annual revenue from the water-use charge was approximately €570 million, of which, at least 50 per cent was used for infrastructure and other water quality improvements projects; 18 per cent on land acquisition (e.g., riparian zones for conservation purposes); and 15 per cent on community support programmes.

There are currently 200,000 farms in the country, including 174,000 permitted/registered livestock farms. Most permitted/registered farms have established and operate facilities that convert livestock waste into a resource such as compost. Since 1991, the Government has supported the establishment of public treatment facilities for livestock waste from small-scale farms: 60 are currently in operation and 26 are under construction

a long-term activity and therefore requires long-term financing for sustainability. As donor funds are never permanent, internal sources of financing become necessary. The water funds have been highlighted as one form of potentially sustainable financing, if the bulk of the contributors are local, especially water users themselves. In developing countries, Governments tend to make regular appropriations for poverty reduction programmes. Those financial resources could be a good source of finance for watersheds, as the South African case clearly demonstrates.

Working for Water (WfW) is a pro-poor watershed rehabilitation project in South Africa. The initiative was launched in 1995 and was administered by the Department of Water Affairs and Forestry until 2011, when the programme was transferred to the Department of Environmental Affairs. The project stems from the fact that water scarcity due to low

rainfall (65 per cent of South Africa receives less than 500mm annual average rainfall) and significant stream flow reduction owing to the the rapidly spreading invasive alien plants which consume large quantities of water. The plants also cause other environmental problems such as increased flooding, fires, erosion, siltation and put a strain on indigenous species (IIED, 2012).

WfW is a Government-led initiative that seeks to provide environmental benefits while directly tackling poverty issues. The programme aims to alleviate poverty through the provision of temporary work and skills development on watershed enhancement projects, mainly involving the removal of invasive alien plants. The environmental benefits have been confirmed and, although most of the funding comes from the Government poverty relief fund, water users also contribute, either through Government water management fees or through individual regular donations (IIED, 2012).

The stakeholders from the demand side include the national Government, local municipalities and public and private water supply companies. As early as 1996/97, the Department of Water Affairs contributed about $5.65 million (R58 million) annually towards the WfW programme. The water price charged to South African users in 13 of the nation's 19 water management areas includes a "water resource management fee", which partly covers the clearing of invasive alien plants, as well as planning and implementation, pollution control, demand management, water allocation and water-use control. Moreover, the public company, Trans-Caledon Tunnel Authority, which is the specialized liability management body for bulk water supply, has also contributed approximately $1 million (R8 million) to the WfW programme over a three-year period (IIED, 2012).

The annual budget for 2008/9 was estimated to be over $70 million, of which more than 80 per cent is sourced from the Government Expanded Public Works (Poverty Relief) Programme (Ferraro, 2009). Thus, the integration of watershed management with other goals, such as poverty alleviation, has helped to secure huge financing for watershed management from the Government poverty relief programme.

By 2012–2013 more than $750 million had been invested in invasive alien plant management since the inception of the WfW programme. At the time, more than 2.5 million ha had received an initial clearing treatment, with every hectare treated receiving an average of 2.5 follow-up treatments to ensure that the regrowth of the plants was suppressed. Thus, there is a case for mainstreaming watershed management in poverty reduction and other development programmes.

6. Policy recommendations

Many regulations have been issued to promote watershed management in both developed and developing countries, but they have not been able to solve all the watershed problems, as they largely rely on scarce public funds and fail to engage other actors. There are other watershed contexts for which regulatory approaches will not necessarily be the most efficient. Market-based incentives provide a convenient, complementary policy mix to achieve greater protection in watersheds. In this section, the insights from the various case studies reviewed are used in making policy recommendations for upscaling and promoting the uptake of market-based incentives in watershed management by local communities and the private sector. From the analysis of the various case studies, the following policy recommendations are derived:

1. Institute appropriate legal & institutional reforms for market incentives to function properly

In spite of the diversity in the case studies reviewed, they chime in a remarkable way on the need for appropriate legal and institutional frameworks to allow market incentives to function properly. In some cases, legal and institutional reforms are required. In particular, PES needs a special legal framework, as it involves the creation of entirely new markets. PES schemes require: (a) basic contract law, which provides the contracting parties with sufficient legal remedies to enforce contract rights in cases of non-compliance with contract obligations; (b) a legal system based on the legal principle that agreements must be kept, as well as general respect for the rule of law; and (c) the absence of any legal provision which could be interpreted as prohibiting PES contracts and their subject matter. As public institutions can be catalysts, they must be legally empowered to become active and contracting parties in PES schemes. In addition, laws and regulations are expected to guide the generation of financial resources for public investment in PES schemes. For the upscaling of payments for environmental services to be effective, it needs to be legalized in the country concerned, so that it is easily implemented. Another essential condition for the effectiveness of market-based incentives is the progressive institutionalization of water resource management to catchment agencies and local-level water user associations. Such devolution makes it less onerous for the private sector to negotiate interventions. Thus, there is a case for instituting appropriate legal and institutional reforms to allow market incentives to function properly.

2. Promote research on watershed hydrology & associated economic consequences to inspire stakeholder participation

The scientific understanding of the hydrological relationships in watersheds and the associated economic consequences needs to be strong for market-based incentives to inspire stakeholder participation. Whether or not market-based incentives are going to inspire stakeholder participation in watershed management will largely depend on a cost-benefit analysis. Given their inevitable links to watersheds, many corporations could naturally be inspired to engage proactively through awareness of potential future business risks and profit opportunities in watersheds. However, the existence of opportunities to reduce business risks and increase profit from sound watershed management is not glaringly obvious, hence there is a need for research (say, to be conducted by relevant public agencies and others), which would be shared with the private sector if its participation is to come sooner rather than later. Once shared with the private sector, such information can make that sector understand its business risk better and evaluate options for reducing it through active participation in watershed management. Such "exploration or research work" is generally done in the context of mines and should be extended to watersheds. Thus, there is a case for promoting research on watershed hydrology and the associated economic consequences to inspire stakeholder participation.

3. Package watershed management to incorporate forward & backward linkages to attract private sector participation

On the one hand, watersheds supply water and other services to the private sector to enable it to operate and provide livelihoods for multitudes of people; hence there are forward linkages from watershed to the private

sector. In fact, problems associated with watersheds can severely limit economic activity, while their resolution can greatly improve the health of local and regional economies. There is a case for Governments to monitor the value chains of big corporations inasmuch as their operations can affect the welfare of significant portions of their populations and economic activity.[26] On the other hand, the private sector plays a major role in providing technology, training and credit in watersheds; hence there are also backward linkages from watersheds to the private sector. For example, the operation of an efficient water market requires a non-trivial initial capital outlay, as water flows, including the amount taken off at source, all need to be monitored and controlled through a complex telemetric system.[27] Elsewhere, there is a need for capacity-building in the required new conservation technologies that are relevant for watershed management, e.g., improved animal waste management, protection of the riparian land and forests and agronomic measures to limit run-off, combat soil erosion and increase soil moisture and productivity. Accordingly, the message about the rationale for more private sector involvement in watershed management needs to go beyond just the ability to address business risks by assuring watershed services for business operations. The message about how watersheds generate business for the private sector through demand for technology, training and finance needs to be told simultaneously. The ability to package watershed management to incorporate forward and backward linkages with the private sector is essential. Thus, there is a case for packaging watershed management to include both backward and forward linkages to attract private sector participation.

4. Use only market-based incentives which are consistent with local institutional capacity

The two predominant types of market-based incentives in the case studies reviewed are those that either create new markets or are price-based. The success rate of PES schemes in watershed management has been low. In many cases, those schemes were piloted but never graduated to full implementation once donors had left. Besides unsustainable financing, those incentives have largely been implemented in the context of weak institutional capacity and political will, especially at the national level. That has often prevented national agencies from inheriting implementation of the schemes beyond the pilot stage. Institutional limitations and the context in which market-based incentives are implemented can be a drag on their effectiveness. Market-based incentives are not an alternative to planning and governance. As such, they depend on the capacity of the State or other agencies to define and enforce appropriate property rights; identify and mobilize sellers; solicit trust; act on behalf of absent buyers; monitor implementation and outcomes; and reduce information asymmetries and minimize transaction costs. The choice of market-based incentives, and indeed the decision on whether to use market-based incentives at all, needs to take the local context into account. There is a case for Governments to take the local institutional capacity into account in the choice of market-based incentives, in order to promote sustainable watershed management. Where the local institutional capacity is the key constraint, the lessons drawn from the cases reviewed show that the choice of market-based incentives should follow an order of ascending institutional capacity: (a) those enhancing existing markets (e.g. certification); (b) price-based (e.g. taxes, subsidies and water funds); (c) allocation-based (e.g. water trading); and (d) those creating new markets (e.g. PES). In developing countries, where markets are generally still underdeveloped, Governments should prioritize market-based incentives which work through existing markets rather than new markets. Developing countries would do well to embrace market-based incentives such as certification for their export products.

5. Provide more institutional support for both market-based incentives & traditional regulations

Market-based incentives do not have to work in isolation from CAC measures. There are cases where market-based incentives need strong support from the CAC approach. In fact, there is room for market-based incentives and CAC measures to complement each

[26] *An innovative way to track and monitor such impacts is through natural resource accounting. There is therefore a case for Governments to develop natural resource accounts, inclusive of the water sector, to keep track of challenges and opportunities in watershed management, as different watersheds face different problems (e.g., challenges related to water provision, excessive sedimentation, or poor water quality) and therefore require different interventions at specific times.*

[27] *In fact, market-based incentives, such as water trading, will be more successful in cases where the private sector is willing to play a major role in the provision of technical support to water users and there is access to credit from banks for users wishing to invest in the requisite technology.*

other under integrated water resource management, as it provides the framework for integrating all the recommendations in the present report (legislative, institutional, policy environment, governance regimes, market-based incentives, empowerment of the poor and disadvantaged, etc.). Indeed, market-based incentives can in many cases work more efficiently than traditional regulatory policies by better aligning the incentives facing private agents with those of society at large. However, the role of the public sector remains crucial, even with market-based incentive policies. Although that changes the role of the public sector, it does not necessarily reduce it. Monitoring the environmental issues being targeted is crucial if rewards and penalties created by the relevant instruments are going to create the intended incentives. The need for monitoring and enforcement is at least as great with market-based incentives as it is with traditional regulations. Monitoring therefore remains the responsibility of the public sector for most of the market-based incentive schemes studied here. Enforcement can become easier with market-based incentives and can shift into the private sector, depending on the design of the instrument. That means that the local institutional capacity for monitoring and enforcement should inform decisions as to what policies to pursue. However, there is a case for providing more institutional support for both market-based incentives and traditional regulation.

6. Mainstream watershed management in poverty reduction & other development strategies

A common theme across many of the case studies reviewed, especially those on PES, was the lack of sustainable financing for watershed management. Watershed management is a long-term activity and therefore requires long-term financing for sustainability. As donor funds are never permanent, internal sources of financing become necessary. The water funds have been highlighted as one form of potentially sustainable financing, if the bulk of the contributors are local, especially water users themselves. In developing countries, Governments tend to make regular appropriations for poverty reduction programmes. Those financial resources could be a good source of finance for watersheds, as the South African WfW programme demonstrates. Thus, the integration of watershed management with other goals, such as poverty alleviation, helps to secure financing for watershed management from Government poverty relief funds. That means that the linkages need to be well understood so that synergies can be exploited where possible and negative feedback counteracted with additional policies. A natural extension would be to tap into other environmental funds, which are regularly replenished by Governments and other stakeholders, e.g. mining environmental funds, public works funds, forestry rehabilitation funds and carbon tax funds. Thus, there is a case for mainstreaming watershed management in poverty reduction and other development programmes.

7. Integrate gender mainstreaming in watershed management

Men and women in societies and communities globally, and especially in rural areas in developing countries, have distinctly differentiated roles in resource management, both at landscape and household level. Therefore, there is a case for local governments, stakeholders and the private sector to consider integrating gender mainstreaming (i.e., the process of assessing the implications for women and men of any planned action, including legislation, policies and programmes in all areas and at all levels) into market-based mechanisms of watershed management. Given the important role of women in rural land-use management (including in activities such as water and soil conservation in agriculture and afforestation) improving their access, ownership and control over land will enhance investments in the land and increase productivity, welfare and the potential to achieve the desired transition to a green economy and sustainable watershed management. Empowerment of women in watershed management has, therefore, the potential to greatly enhance the enforcement of regulations and thus reduce the higher cost of monitoring under CAC measures.

7. Bibliography

2030 Water Resources Group. "Managing water use in scarce environments: a catalogue of case studies". Washington, D.C., 2013.

Abaio, O. K. 2005. Putting integrated water resource management into practice: Ghana's experience. In *Preparing for the next generation of watershed management programmes and projects*, B. Swallow, N. Okono, M. Achouri and L. Tennyson, eds. Proceedings of the African regional workshop, Nairobi, 8 to 10 October 2003. FAO, Rome.

Agarwal, B. 1994. *A field of one's own: gender and land rights in South Asia*. Cambridge, England, New York, United States of America: Cambridge University Press.

Agarwal, A. and Narain, S. 1999. "Community and household water management, the key to environmental regeneration and poverty alleviation". Mimeo. *Centre for Science and Environment,* New Delhi.

Agarwal, A. and Narain, S. 1999. "Making water management everybody's business: water harvesting and rural development in India". Gatekeeper series No. 87, International Institute for Environment and Development, London. Available from http://pubs.iied.org/pdfs/6339IIED.pdf.

Agarwal, A. and Narain, S. 2000. "Water harvesting: community-led natural resource management" ILEIA Newsletter, March 2000.

Allanson, B. R. and D. Baird, D., eds. 1999. Estuaries of South Africa. Cambridge, Cambridge University Press.

Al-Marshudi, A.S. 2007. "The *falaj* irrigation system and water allocation markets in Northern Oman", *Agricultural Water Management*, vol. 91, pp. 71-77.

ANA-DCPRH-ALA. 2010. *Evaluación de los Recursos Hídricos en la Cuenca del Río Rímac: Estudio Hidrológico y Ubicación de la Red de Estaciones Hidrométricas en la Cuenca del Río Rimac*. December 2010.

Anon. (1999).: "Mechanisms for protecting significant natural areas", Rodney District Council

Arias, V., Benitez, .S., and Goldman, R., (2010) "Water fund for catchment management in Quito, Ecuador".

Aquafondo. 2011. Fondo del agua para Lima y Callao. Líneas estratégicas y proyectos en cartera. 2011.

Barbier, E.. "The value of water and watersheds: reconciling ecological and economic externalities". Paper presented at conference on managing human-dominated ecosystems. St. Louis, Missouri, United States. March 26–28, 1998.

Bass, S. and Geoghegan, T. 2002. "Incentives for watershed management Jamaica: results of a brief diagnostic". Caribbean Natural Resources Institute.

Bayfield, M. 1999. "Protection of natural values on private land". Report to the Winston Churchill Memorial Trust.

Bennett, M.T. 2008. "China's sloping land conversion program: institutional innovation or business as usual?" *Ecological Economics*, vol. 65 (4), pp. 699–711.

Bjornlund, H., 2006. "Water markets - economic instruments to manage scarcity". *Journal of Agricultural and Marine Sciences*, 11 (1), pp. 11–20.

Bond, I., 2008. "Payments for ecosystem services in East and Southern Africa: assessing prospects and pathways forward" in *Scoping of Potential Payment for Ecosystem Service Sites*. East and Southern Africa Katoomba Group.

Brand D. "Integrating landscape management with climate change issues." Paper presented at the Australian Financial Review, third annual emission forum, March 29-31, 2000. Sydney, Australia.

Bräuer, I. *et al*. 2006. "The use of market incentives to preserve biodiversity", final report on a project under the European Union framework contract for economic analysis (ENV.G.1/FRA/2004/0081).

Brown, J. and Bird, N., 2011. "Costa Rica's sustainable resource management: successfully tackling tropical deforestation". London. Overseas Development Institute.

Cannon, P., Hill, B. and McCarthy, C. 2010. "Watersheds of Quito: a consultancy to bolster FONAG'S contribution". United States Agency for International Development (USAID).

CEO Water Mandate. 2012. "Guide to water -related collective action". Available from http://www.pacinst.org/wp-content/uploads/2013/02/wrca_full_report3.pdf.

Chiramba, T., Mogoi, S., Martinez, I. and Jones, T. "Payment for environmental services pilot project in Lake Naivasha basin, Kenya – a viable mechanism for watershed services that delivers sustainable natural resource management and improved livelihoods", Paper presented at the UN-Water international conference on the theme of "Water in the green economy in practice - towards RIO+20", Zaragoza, Spain. 3–5 October 2011.

Chomitz, K. M., Brenes, E. and Constantino, L. 1999. "Financing environmental services: the Costa Rican experience and its implications", *Science of the Total Environment*, vol. 240 (1-3).

Clairs, T. and Young, M. 1995. A*pproaches to the use of incentives to conserve biodiversity.* CSIRO, Division of Wildlife and Ecology.

Collins, B. R. and Russell, E. W. B. 1988. *Protecting the New Jersey Pinelands: a New Direction in Land Use Management,* New Brunswick and London, Rutgers University Press.

Colman, D. 1994. "Comparative evaluation of environmental policies - ESAs in a policy context" in *Incentives for Countryside Management: the Case of Environmentally Sensitive Areas,* M. Whitby, ed. (CABI Publishing).

Cruz, R., Bugayong, L. A., Dolom, P.C. and Espiritu, N.O. 2000. "Market-based instruments for water resource conservation in Mt. Makiling, Philippines". Paper presented at 8th biennial conference of the International Association for the Study of Common Property. Bloomington, Indiana. May 31– June 4, 2000.

Dales, J. H. 1968. *Pollution, Property and Prices.* Toronto, University of Toronto Press.

Davies, B. and Day, J. 1998. *Vanishing Waters.* University of Cape Town Press, South Africa.

Deere, C. and Leon, M. 1998. "Gender, land, and water: From reform to counter-reform in Latin America," Agriculture and Human Values, Vol. 15(4), pp. 375-386.

De Lucia, V. 2013. "Polluter pays principle". Available from http://www.eoearth.org/view/article/155292.

Department of Water Affairs and Forestry, 1997. White paper on a national water policy for South Africa. Pretoria.

Department of Water Affairs and Forestry, 1999. "Water-use licensing: the policy and procedure for licensing stream flow reduction activities". Pretoria.

Department of Water Affairs and Forestry, 2006. Establishment of a pricing strategy for water use charges in terms of section 56 (1) of the National Water Act, 1998. Pretoria.

Diederichs, N. and Mander, M. 2004. *Payment for Environmental Services Baseline Study.* Final report to the Maloti Drakensberg Transfrontier Conservation and Development Programme, appendix 12.

Dungumaro, E.W. 2007. "Socioeconomic differentials and availability of domestic water in South Africa", *Physics and Chemistry of the Earth,* vol. 32 (15-18), pp. 1141–1147.

Echavarría, M. 2000. “Valuation of water-related services to downstream users in rural watersheds: determining values for the use and protection of water resources” in “Land–water linkages in rural watersheds”. FAO Land and Water Bulletin No. 9. Rome.

Echavarría, M. 2001 “FONAG: the water-based finance mechanism of the Condor Bioreserve in Ecuador”.

Echavarría, M. 2002. “Financing watershed conservation: the FONAG water fund in Quito, Ecuador” in *Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development,* Pagiola, S., Bishop, J. and Landell-Mills, N., eds. (Abingdon, Oxon, United Kingdom, Earthscan).

Echavarría, M. « Algunas lecciones sobre la aplicación de pagos por la protección del agua con base en experiencias en Colombia y Ecuador ». Tercer Congreso Latinoamericana de Manejo de Cuencas Hidrográficas, Foro Regional sobre Sistemas de Pago por Servicios Ambientales, Arequipa, Peru, June 9–12, 2003

Echavarría, M. and L. Lochman. 1998. “Watershed Conservation Fund in Quito, Ecuador. Policy mechanisms for watershed conservation: case studies”. Washington, D.C., The Nature Conservancy.

Echavarría, M. and L. Lochman. 1999. “Policy mechanisms for watershed conservation: case studies”. Arlington, Virginia, United States. The Nature Conservancy.

Echavarría, M. and Zuchetti, A. “Estudio de prefactibilidad sobre la posible creación de un fideicomiso para la protección integral agua y los ríos de Lima y Callao como medida de adaptación al cambio climático”. June 2008.

Economic and Social Commission for Asia and the Pacific and Korean International Cooperation Agency. “Good practices on eco-efficient approaches for water resource planning and management in Asia”, June 2011.

Emerton, L. 2001. “Community-based incentives for nature conservation”. International Union for Conservation of Nature.

Enote, J. 1996. “The Zuni resource development plan: a program of action for sustainable resource development”. Zuni Conservation Project annual report.

FAO Investment Centre, 1999. “Incentive systems for natural resources management: the role of indirect incentives”. Environmental report series 2 (99/023 IFAD-RAF).

Food and Agriculture Organization, 2011. *Payments for Ecosystem Services and Food Security.*

Ferraro, P. 2008. “Asymmetric information and contract design for payments for environmental services”. Ecological Economics, vol. 65 (4).

Ferraro, P. 2009. “Regional review of payments for watershed services: sub-Saharan Africa”. *Journal of Sustainable Forestry* vol. 28 (3-5), pp. 525-550.

Fleming, W. 2003. “Volunteer watershed health monitoring by local stakeholders: New Mexico watershed watch”. *Journal of Environmental Education,* 35 (1), pp. 27–32.

Gamez, L. 2010. Internalization of watershed services. Poster presented at the FAO stakeholders consultation on the theme of “Food security through additional income: from PES to the remuneration of positive externalities in the agricultural and food sector”, 27–28 September 2010, Rome.

Greiber, T., ed. (2009) “Payments for ecosystem services: legal and institutional frameworks”. Gland, Switzerland. International Union for Conservation of Nature and Natural Resources.

Grieg-Gran, M. and Porras, I. May 2012. “Paying for watershed services: an effective tool in the developing world?” International Institute for Environment and Development briefing.

Gutman, P. 2007. “Ecosystem services: foundations for a new rural-urban compact”. *Ecological Economics*, 62 (3–4), pp. 383–387.

Hahn, R.W. and R.N. Stavins (1992), “Economic incentives for environmental protection: integrating theory and practice”, *American Economic Review* 82 (May), pp. 464–468.

Hepworth, N., Agol, D., von Wiren-Lehr, S. and O’Grady, K. 2011. “Alliance for Water Stewardship Kenya Case study: exploring the value of water stewardship standards in Africa”. Alliance for Water Stewardship, Marks and Spencer and GIZ.

Hicks *et al.* 2008. *Greening Aid? Understanding the Environmental Impact of Development Assistance.* Oxford University Press.

Hope, R.A. *et al.* 2007. “Negotiating watershed services”. International Institute for Environment and Development. Available from http://www.watershedmarkets.org/

Hubacek, K. and Bauer, W. 1999. “Economic incentive measures in the creation of the National Park Neusiedler See – Seewinkel”. Submission of Austria to the Organization for Economic Cooperation and Development (ENV/EPOC/GEEI/BIO(99)4/FINAL).

International Institute for Environment and Development, 2012. Case study on Ecuador – FONAG. Water Conservation Fund in Quito - watershed protection contracts & land acquisition. Available from http://www.watershedmarkets.org/casestudies/Ecuador_FONAG_E.html.

James, D. (1997): “Environmental incentives”. Environment Australia, Canberra

Johnson, N. “Strategies to build sustainable links between forests, water, and people”. Paper presented at the Environmental markets and forests workshop, 11–12 April 2000, Katoomba, Australia.

Johnson, N., White, A. and Perrot-Maître, D. 2001. “Developing markets for water services from forests”. Washington, D.C. Forest Trends. Available from http://www.forest-trends.org.

Kieser & Associates, LLC, 2004. “Preliminary economic analysis of water quality trading opportunities in the Great Miami River watershed, Ohio”. Prepared for the Miami Conservancy District. Available from http://www.envtn.org/uploads/Great-Miami_Trading_Analysis.pdf.

Kieser & Associates, LLC, WestWater Research, LLC, Environmental Banc & Exchange, LLC, 2009. “Review of market-based schemes for water offset program framework”. Prepared for the Water Footprint working group.

Kieser & Associates. Payment of ecosystem services incubator, Peru, phase I – Identification of common project goals and a common metric for the water fund. Preliminary draft of a technical report, September 2012.

King, N., Damon, M. and Forsyth, G. 2005. “An inventory of current ecosystem service payments, markets, and capacity-building in South Africa”. CSIR, Pretoria and Forest Trends, Washington, D.C. Available from http://www.katoombagroup.org/regions/africa/documents/South_Africa_Inventory.pdf.

Kosoy, N., Martinez-Tuna, M., Muradian, R. and Martinez-Alier, J. 2007. “Payments for environmental services in watersheds: insights from a comparative study of three cases in Central America”. *Ecological Economics*, vol. 61 (2-3), pp. 446-455.

Kosoy, N. *et al.* “Payments for environmental services as an institutional tool for downstream-upstream cooperation in watersheds: lessons drawn from five case studies in Latin America”. Paper presented to the 6th International Conference of the European Society for Ecological Economics. Lisbon, 14-17 June 2005.

Kumar, S.R. 2011. “Environmental governance for carbon neutrality: issues of externality sharing mechanism in Himachal Pradesh”. TERI Information Digest on Energy and Environment, vol. 10 (4), pp. 487 – 496.

Landell-Mills, N. and Porras, I. T. 2002. *Silver Bullet or Fool’s Gold? A Global Review of Markets for Forest Environmental Services and Their Impact on the Poor.* International Institute for Environment and Development, London.

Lashley D.L. 1995. “Guiding mitigation banking” *National Wetlands Newsletter,* vol. 17 (1).

Li, J., Feldman, M.W., Li, S. and Gretchen C. D. 2011. "Rural household income and inequality under the sloping land conversion program in western China". *Proceedings of the National Academy of Sciences of the United States of America*, vol.108 (19), pp. 7721–7726.

Liu, S., Costanza, R., Farber, S. and Troy, A. 2010. "Valuing ecosystem services: theory, practice and the need for a transdisciplinary synthesis". *Annals of the New York Academy of Sciences,* 1185, pp. 54–78.

Lockie, S. 2011. "Market instruments, ecosystem services, and property rights: assumptions and conditions for sustained social and ecological benefits". *Land Use Policy,* vol. 31, pp. 90-98.

Lopa, D. and Mwanyoka, I. 2010. "Equitable payments for watershed services (EPWS) programme: a practical experience in delivering conservation and poverty reduction in the Ulugurus, Morogoro, Tanzania". CARE-WWF.

Lugo, E. 2008. "Ecosystem services, the Millennium ecosystem assessment and the conceptual difference between benefits provided by ecosystems and benefits provided by people". *Journal of Land Use and Environmental Law,* vol. 23 (2). pp. 243–261.

Makukira, H. and Mugumo. M. "Water sector reforms in Zimbabwe: the importance of policy and institutional coordination on implementation". In *Preparing for the next generation of watershed management programmes and projects* (see above).

Manila, A. C., "Philippines' initiatives on the implementation of CBD-Article 11 'incentives measures'". Presentation to the International Workshop on the removal or mitigation of perverse, and the promotion of positive, incentive measures, UNEP, Paris, 6–8 October 2009.

Matthews, G.V.T. 1993. "The Ramsar Convention on Wetlands: its history and development". Gland, Switzerland, Ramsar Convention Bureau.

McCalla, W. and Persaud, W. 2002. "Development of incentives for private sector investment in improved watershed management in Jamaica" (draft). Prepared for the Government of Jamaica and USAID.

McCalla, W. and Persaud, W. 2003. Proposals for encouragement of private sector, public participation and community participation in watershed conservation in Jamaica.

Meinzen-Dick, R. S. and Bruns, B. R. 2000. "*Negotiating water rights*: introduction" In Negotiating Water Rights, Bruns, B. R. and Meinzen-Dick, R. S., eds. London, Intermediate Technology Publications and the International Food Policy Research Institute.

Meinzen-Dick, R. S. and Pradhan, R. 2002. "Legal pluralism and dynamic property rights". CAPRi working paper No. 22, CGIAR Systemwide Program on Collective Action and Property Rights, Washington D.C.

Miami Conservancy District, 2005. Great Miami River watershed water quality credit trading program operations manual. Available from http://www.miamiconservancy.org/water/documents/tradingprogramoperationmanualfeb8b2005secondversion.pdf.

Millennium Ecosystem Assessment (MA). 2005. "Ecosystems and human well-being. Synthesis". Island Press, Washington, D.C.

Muchapondwa, E. *et al.* 2012. "Providing economic incentives for biodiversity conservation in an emerging bioregional context" *Journal of Sustainable Development* vol. 5 (11) pp. 118-129.

Muradian, R. *et al.* 2010. "Reconcilimg theory and practice: an alternative conceptual framework for understanding payments for environmental services". *Ecological Economics*, vol. 69 (6), pp.1202-1208.

Naidoo, T., Vaz, K. and Byaba, L. 2012. "An introduction to adaptation in view of developing a private financing approach for adaptation related projects using the CTI PFAN model", CTI PFAN background paper on adaptation.

National Water Act 1998. Department of Water Affairs and Forestry, Government of South Africa.

Navarrete Le Bas, F. 2009. Annex III: Colombia report. In "Payments for ecosystem services: legal and institutional frameworks", T. Greiber, ed. Gland, Switzerland, International Union for Conservation of Nature and Natural Resources.

Nepomuceno, D. 2004. "The environmental user fee system in the Laguna de Bay region. A pioneer market-based instrument for pollution prevention and abatement in the Philippines". Mimeo. Asian Development Bank.

Nestec Ltd. (2003). "Nestlé and water: sustainability, protection, stewardship", Vevey, Switzerland.

Nestlé (2002). The Nestlé Sustainability Review, Vevey, Switzerland.

Newburn, D. A. and Woodward, R. T. 2011. "An ex post evaluation of Ohio's Great Miami water quality trading program". *Journal of the American Water Resources Association*, vol. 48 (1).

O'Connor, M. 2000. "Pathways for environmental evaluation: a walk in the (Hanging) Gardens of Babylon". *Ecological Economics,* vol. 34 (2), pp. 175–193.

OECD 1996. "Saving biological diversity - economic incentives". OECD Publishing, Paris.

Ostrom, E. 1990. Governing the Commons. *The Evolution of Institutions for Collective Action* Cambridge University Press.

Pagiola, S. "Payments for environmental services in Costa Rica". Paper presented at ZEF-CIFOR workshop, 15–18 June 2005, Titisee, Germany.

Pagiola, S. 2006. "Payments for environmental services in Costa Rica". Munich Personal RePec Archive. Available from http://mpra.ub.uni-muenchen.de/2010/1/MPRA_paper_2010.pdf.

Perrot-Maître, D. 2006. "The Vittel payments for ecosystem services: a "perfect" PES case?" International Institute for Environment and Development, London.

Perrot-Maître, D. and Davis, P. 2001. "Case studies of markets and innovative financial mechanisms for water services from forests". Washington, D.C., Forest Trends.

Porras, I. 2010. "Fair and green? Social impacts of payments for environmental services in Costa Rica". International Institute for Environment and Development.

Porras, I. ed. (2013). "Payments for environmental services: lessons from the Costa Rican PES programme". International Institute for Environment and Development.

Porras, I., Greig-Gran, M. and Neves, N. 2008. "All that glitters: a review of payments for watershed services in developing countries". International Institute for Environment and Development.

Pretty, J.N., and P. Shah. 1997. "Making soil and water conservation sustainable: from coercion and control to partnerships and participation". L*and Degradation & Development* 8(1): pp. 39–58.

Rademeyer, S. 2005. "Processes that will influence resource allocation in the Republic of South Africa". In *Preparing for the next generation of watershed management programmes and projects* (see above).

Ramoeli, P. 2012. "Stewardship in action". South African Development Community.

Reichelderfer, K. and Boggess, W.G. 1988. "Government decision making and program performance: the case of the Conservation Reserve Program", *American Journal of Agricultural Economics*, vol. 70 (1).

Renzetti, S. 2005. "Economic instruments and Canadian industrial water use" *Canadian Water Resources Journal*, vol 30(1), pp. 21-30.

Renzetti, S. and Kushner, J. 2004. Full cost accounting for water supply and sewage treatment: concepts and application. *Canadian Water Resources Journal* vol. 29 (1), pp. 13-22.

Reynaud, A., Renzetti, S. and Villeneuve, M. 2005. "Residential water demand with endogenous pricing: the Canadian case", *Water Resources Research*, vol. 41 (11).

Robalino, J., Pfaff, A. and Villalobos, L. 2011. "Assessing the impact of institutional design of payments for environmental services: the Costa Rican experience" in *Ecosystem Services from Agriculture and Agroforestry. Measurement and Payment,* Rapidel, B., DeClerck, F., Le Coq, J-F. and Beer, J., eds. Earthscan Press.

Rodríguez, M. and Ponce de León, E. 1999. "Financing the Green Plan (Plan Verde) in Colombia: challenges and opportunities". Paper presented at the workshop on financing of sustainable forest management, UNDP Programme on Forests, 11–13 October 1999, London.

Rojas, M. and Aylward, B. 2002. "Cooperation between a small private, hydropower producer and a conservation NGO for forest protection in Costa Rica. The case of La Esperanza". Land and Water Linkages in Rural Watersheds Case Study Series, FAO, Rome.

Rojas, M. and Aylward, B. 2003. "What are we learning from experiences with markets for environmental services in Costa Rica?" International Institute for Environment and Development.

Sanchez-Azofeifa, G.A. *et al.* 2007. "Costa Rica's payment for environmental services program: intention, implementation, and impact". *Conservation Biology*, vol. 21(5), pp. 1165–1173

Santos-Borja, A. and Nepomuceno, D. 2004. "Experience and lessons learned brief for Laguna de Bay". Mimeo.

Sax, J. L. 1993. "Property rights and the economy of nature: understanding *Lucas v. South Carolina Coastal Council*". Stanford Law Review, vol. 45, pp. 1433-1455.

Schreiner, B. and Van Koppen, B. 2001. "From bucket to basin: poverty, gender, and integrated water management in South Africa" in *Intersectoral Management of River Basins, Abernethy*, C.L., ed. International Water Management Institute.

Sengupta, S. *et al.* 2003. "Developing markets for watershed protection services and improved livelihoods in India". Winrock International India, New Delhi, and International Institute for Environment and Development.

Shackleton, C. *et al.* 2008. "Links between ecosystem services and poverty alleviation: situation analysis for arid and semi-arid lands in southern Africa. Consortium on Ecosystems and Poverty in Sub-Saharan Africa (CEPSA).

Sheng, T.C. 1990. Watershed management field manual. Watershed survey and planning, FAO. Available from http://www.fao.org/docrep/006/t0165e/t0165e00.HTM

Southgate, D. and Wunder, S. 2007. "Paying for watershed services in Latin America: a review of current initiatives". Working paper no. 07-07, Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program and Office of International Research, Education, and Development Virginia Tech.

Stern, M. and Echavarria, M. 2013. "Investments in watershed services for the Rimac watershed, Department of Lima, Peru". Washington, D.C. Forest Trends.

Sterner, T. and Coria, J. 2012. Policy Instruments for *Environmental and Natural Resource Management* (Washington D.C. Resources for the Future Press).

Sun, C. and Liqiao, C. 2006. "A study of policies and legislation affecting payments for watershed services in China". China Research Center of Ecological and Environmental Economics, Beijing, and International Institute for Environment and Development.

Sun, G. *et al.* 2006. "Potential water yield reduction due to forestation across China". *Journal of Hydrology* 328 (3–4).

Swallow, S.K., Anderson, C.M. and Uchida, E. 2012. "The bobolink project: selling public goods from ecosystem services using provision point mechanisms". Zwick Centre for Food and Resource Policy, working paper series No 16.

Swedish International Development Cooperation Agency, 2013. "Water resource efficiency". Information brief No 5.

Takaya, C. and Fleskens, L. "Water trading: experiences in and potential for developing countries". Available from http://www.twstt.org.uk/documents/International%20water%20trading.pdf.

Talbolt, M. 2013. Comments on Department of Water Affairs current proposals to amend the National Water Act and other water legislation. Unpublished manuscript.

The Economist Newspaper Limited (2013). "All dried up" in *The Economist*, 12 October.

Tognetti, S, Aylward, B. and Mendoza, G.F. "Markets for Watershed Services". Encyclopedia of Hydrological Sciences, part 16, 2006.

Uchida, E., Xu J. and Rozelle, S. 2005. "Grain for green: cost-effectiveness and sustainability of China's conservation set-aside program". *Land Economics,* vol. 81(2), pp. 247–264.

United Nations (1997). "Report of the Economic and Social Council for 1997". A/52/3. (18 September 1997).

UNEP 2005. *UNEP 2004 Annual Report*, UNEP/Earthprint,.

UNEP 2010. Green economy. Developing countries success stories. Nairobi, Kenya.

UNEP 2011. Towards a *Green Economy: Pathways to Sustainable Development and Poverty Eradication*. Available from www.unep.org/greeneconomy/GreenEconomyReport.

Vairamoorthy, K., Gorantiwar, S.D. and Pathirana. A. 2008. "Managing urban water supplies in developing countries – climate change and water scarcity scenarios", *Physics and Chemistry of the Earth, Parts* A/B/C, vol. 33 (5), pp. 330–339.

Valladares, R.E. 2009. Annex I: Brazil Report. In "Payments for ecosystem services: legal and institutional frameworks", T. Greiber, ed. Gland, Switzerland. International Union for Conservation of Nature and Natural Resources.

Van Koppen, B. (1998). "Water rights, gender, and poverty alleviation. Inclusion and exclusion of women and men smallholders in public irrigation infrastructure development". *Agriculture and Human Values*, 15(4), pp. 361-374.

Wang, H. and Wheeler, D. 1996. "Pricing industrial pollution in China: an econometric analysis of the levy system" Policy Research Working Paper Series, No. 1644 (Washington, D.C., World Bank).

Wang, H. 2002. "Pollution regulation and abatement efforts: evidence from China" *Ecological Economics* 41(1). pp. 85–94.

Water Futures. 2012. South Africa. Available from http://www.water-futures.org/countries/south-africa.html. (14 November 2013).

Wenming, L. *et al.* 2002. "Getting the private sector to work for the public good. Instruments for sustainable private sector forestry in China". International Institute for Environment and Development.

Whitten, S., Carter, M. and Stoneham, G., eds. (2004). "Market-based tools for environmental management. Proceedings of the 6th annual AARES national symposium 2003, Rural Industries Research and Development Corporation, Canberra.

Wichtendahl, C.G. 2009. Annex II: Bolivia report. In "Payments for ecosystem services: legal and institutional frameworks", T. Greiber, ed. Gland, Switzerland. International Union for Conservation of Nature and Natural Resources.

Wilkinson, C. F.1992. *Crossing the Next Meridian: Land, Water and the Future of the West* (Washington, D.C., Island Press).

World Bank. 2006. Honduras - *Pico Bonito Forest Regeneration and Sustainable Livelihoods Project.* Washington, D.C.: World Bank.

Xu, J., Tao, R., Xu, Z. and Bennett, M.T. 2010. "China's sloping land conversion program: does expansion equal success?" *Land Economics* 86 (2), pp. 219–244.

Young, M.D. *et al.* 1996. *Reimbursing the Future: an Evaluation of Motivational, Voluntary, Price-Based, Property-Right, and Regulatory Incentives for the Conservation of Biodiversity,* Department of the Environment, Sport and Territories, Canberra.

Zheng, H. and Zhang, L. 2006. "Chinese practices of ecological compensation and payments for ecological and environmental services and its policies in river basins", report submitted to the World Bank. Available from http://siteresources.worldbank.org/INTEAPREGTOPENVIRONMENT/Resources/ReportPESreviewChinesepracticeCAASFinalENFINAL.pdf

8. Appendix A

Summary of case studies of market-based incentives in watershed management

Table 1

Case number	Case name	Brief description	Type of incentive	Financing	Paying principle	Legal support
1	United States of America (New York City)	Public utility paying private landowners, farmers and timber companies for maintaining quality of forest and soil	Price-based: subsidies, easement purchases; tax rebates	Special tax on water bill; trust funds	Beneficiary	Clearly defined property rights
2	France (Vittel)	Private company paying landowners to switch to more extensive farming practices and watershed reforestation	Price-based: subsidies, easement purchases; debt cancellation	Private profits	Beneficiary	Clearly defined property rights
3	Germany (Stevertal Reserve)	Four local water utilities paying farmers to reduce water pollution from fertilizers and pesticides	Price-based: subsidies	Water user fees; municipal grants	Beneficiary	Clearly defined property rights
4	South Africa (George)	South African Breweries has supported the clearing of alien species in the watershed	Price-based: subsidies	Private profits	Beneficiary	Public-private partnership
5	South Africa (Emfuleni)	Sasol supported sustainable watershed management	Price-based: subsidies	Private profits	Beneficiary	Public-private partnership
6	Ecuador (Quito)	Public utility paying landowners to forego livestock grazing	Price-based: subsidies	Water user fees; external donations	Beneficiary	Clearly defined property rights
7	Republic of Korea (Seoul)	A State-led and nationwide initiative that incorporates both CAC measures and market-based incentives and subsidizes waste treatment for livestock farmers	Price-based: subsidies	Water user fees	Beneficiary	Clearly defined property rights
8	India (Chandigarh)	Public utility paying farmers to forego livestock grazing in the watershed	Price-based: subsidies	Water user fees	Beneficiary	Clearly defined property rights
9	Kenya (Upper Tana)	Water fund subsidizes upstream farmers for undertaking watershed conservation activities	Price-based: subsidies	Private profits, Government grant, external donations	Beneficiary	Clearly defined property rights
10	Philippines (Manila)	Public watershed agency providing subsidies for local environmental projects	Price-based: subsidies	Effluent fees; water user fees; taxes	Polluter	Clearly defined property rights

11	South Africa (eMalahleni)	Anglo American working with municipality on cleaning up water at old mining sites to avoid risk of (costlier) future water contamination	Price-based: liability risk	Private profits	Polluter	Clearly defined liability
12	Kenya (Kapingazi)	Soil and water conservation included as part of certification requirements for eco-labelled export tea and coffee crops from this location	Enhancing markets: eco-labelling	Premium on product price	Beneficiary	International certification schemes
13	Kenya (Lake Naivasha)	Alliance for Water Stewardship certifies exporting cut-flower and vegetable farmers who improve site-level water management	Enhancing markets: eco-labelling	Private profits; external donations	Beneficiary	Clearly defined property rights
14	Australia (Murray-Darling: Goulburn Broken)	Water Stewardship Australia certifies dairy farmers who improve site-level water management	Enhancing markets: eco-labelling	State grant	Beneficiary	Clearly defined property rights
15	Brazil (Camboriu)	Water fund set to pay landowners for forest conservation and restoration activities	Creating markets: PES	Municipal grants; State grants; external donations	Beneficiary	Clearly defined property rights
16	Bolivia (Pampagrande)	Downstream irrigation farmers pay upstream farmers to protect forests in the watershed	Creating markets: PES	Private profits; external donations	Beneficiary	Clearly defined property rights
17	United Republic of Tanzania (Morogoro)	Water utility and Coca-Cola paying upstream farmers for undertaking soil and water conservation and agroforestry	Creating markets: PES	Water user fees; external donations	Beneficiary	Weak institutional buy-in
18	Peru (Lima)	Watershed conservation fund pays upstream landowners to provide watershed services	Creating markets: PES	External donations	Beneficiary	Clearly defined property rights
19	Kenya (Lake Naivasha)	Downstream commercial water resource users associations paying upstream small-scale water resource users associations for sustainable land use	Creating markets: PES	Private profits; external donations	Beneficiary	Clearly defined property rights
20	Honduras (Jesus de Otoro)	Water utility (i.e., NGO) pays upstream landowners for reforestation	Creating markets: PES	Water user fees; municipality grant; external donations	Beneficiary	Clearly defined property rights
21	Costa Rica (Heredia)	Water users pay upstream landowners to provide watershed services	Creating markets: PES	Water user fees	Beneficiary	Clearly defined property rights
22	Colombia (Cali)	Rice and sugar cane irrigation farmers voluntarily financing Government agency watershed management budget, and Government agency then pays upstream forest landowners to provide watershed services	Creating markets: PES	Voluntary water user levy	Beneficiary	Clearly defined property rights

Summary of case studies of market-based incentives in watershed management

Table 1- continued

Case number	Case name	Brief description	Type of incentive	Financing	Paying principle	Legal support
23	Australia (Murray-Darling)	Association of irrigation farmers voluntarily financing Government agency reforestation budget to reduce water salinity	Creating markets: PES	Private profits	Beneficiary	Clearly defined property rights
24	China (Beijing)	Local farmers receive compensation to manage forest resources and prevent siltation into the Miyun reservoir	Creating markets: PES	Water user fees; municipality grant	Beneficiary	Clearly defined property rights
25	United States of America (Ohio)	Wastewater treatment plants purchase nutrient reduction credits generated by agricultural producers in the watershed in lieu of treatment system upgrades	Allocation-based: water quality trading	Private profits	Beneficiary	Clearly defined property rights
26	South Africa (Orange-Riet)	Better water management among irrigation farmers	Allocation-based: water permits	Water user fees	n/a	State-of-the-art telemetric system

9. Appendix B

A summary of outcomes from the international workshop on market-based incentives for watershed management, held on 11 & 12 December 2013 in Stellenbosch, South Africa

Overview

An international workshop was held to review the draft technical report on the use of market-based incentives for watershed management and to provide additional information for consideration and incorporation in the report. Over 30 international experts from all over the world, knowledgeable about the development and application of market-based incentives, attended the workshop.

As a result, most of the case studies outlined in the document were presented by the experts themselves, while cases gathered purely through desktop literature reviews were updated with inputs and comments from the experts. The workshop was extremely important in integrating the facts found in the literature and the field experience and practice in the implementation of market-based incentives for watershed management. All market-based incentives in their diverse forms (price-based, allocation-based, creating new markets and enhancing existing markets) were covered and extensively discussed.

A summary of key considerations

In this section the key considerations in the application of market-based incentives in watershed management, as established by the experts, are set out. As a way of obtaining diverse and high-quality contributions, the workshop was divided into three working groups to discuss a common theme entitled, "Exploring the feasibility of applying market-based incentives in watershed management". In particular, working groups shared experiences in implementing market-based incentives and established their impacts, opportunities and constraints for their wide-scale adoption.

The workshop emerged with a consensus that all market-based incentives as presented in their various forms in the report were in fact feasible for application in watershed management, but were sometimes not politically expedient. There was unanimity on the fact that problems in the implementation of CAC approaches have seen policy makers resort to market-based incentives as one of the tools in watershed management.

The experts agreed that scale of market-based incentives remained a big challenge, with no clear-cut conclusion as to how big the initiatives should be in terms of coverage and what level of operation worked best. It was noted that there were two important levels of operation: national and local, with a clear bias towards the latter by the experts. It was also noted that, while coordination of market-based incentives could be based at the national level, implementation was suitable if located at the local level.

Governments were expected to play a critical role in the implementation of market-based incentives. First, they may invest to get the initiative to take off (given that watersheds are a public good), as initial investments is prohibitive; second, Governments must put in place a conducive regulatory framework to facilitate implementation of market-based incentives. For example, in some developing countries, water-quality trading was simply not workable owing to a lack of the necessary regulatory framework. Third, Governments could play a lead role in hydrological research, modelling and knowledge dissemination. It was emphasized that Governments are the lead agency in monitoring and evaluation in most countries, but for some reason ecosystem services and quantification of environmental goods have not been well developed. Collection of data and the compilation of statistics should include environmental goods and services. Finally, Governments could play a role in championing the use of market-based incentives. In particular, building political will and support for the tools are critical. If Governments take the lead, the private sector will follow suit.

The experts isolated a number of obstacles to the implementation of market-based incentives. They include:

- Lack of full-price discovery and/or methodology to arrive at a price or fees makes it hard to defend initiatives for market-based incentives and demonstrate the feasibility of the programme. The experts emphasized the need to develop solid business cases with proper cost-benefit analysis. It was noted that quantification of ecosystem services remained a challenge.
- Coordination and cooperation among multiple actors, agencies and stakeholders was found to be

incongruent and limiting for the implementation of market-based incentives. The free rider problem was found to be prevalent, with some agencies simply choosing not to take responsibility.

- Implementation of PES exhibited an inability to quantify the service being sold. Measurement of impact was clearly a challenge with most PES schemes masquerading as subsidy schemes.
- Implementation of market-based incentives is a gradual process. Successful case studies indicate that they took between 5 and 10 years to be fully operational. Thus implementation may not lead to quick gains as policymakers may wish.
- Finally, the lack of strong regulation to incentivize action by the private sector was noted as an obstacle in most countries.

In terms of actions needed, the experts stressed the need to adjust the price of water to internalize externalities and remove perverse behaviour in the consumption of watershed services. Furthermore, there was a need to compel everyone to pay a fair amount for watershed services and not just a selected few. Major water users (e.g., bottlers, irrigators etc.) must be forced through legal mechanisms to take into account watershed management issues in their business models and encourage collaboration in conservation efforts. Finally, implementation of PES must be preceded by proper business case studies, with a solid baseline study to boost confidence in the services being sold.

Photo credits: Tim McKulka, Kibae Park, Evan Schneider, JC McIlwaine, Ray Witlin, Carl Purcell, Ky Chung, M Guthrie, Stuart Price, Albert González Farran, Sophia Paris, Victoria Hazou




For more information:
Mr. Joakim Harlin
Chief, Freshwater Ecosystems Unit
United Nations Environment Programme
Email: joakim.harlin@unep.org

ISBN: 978-92-807-3493-5

www.unep.org
United Nations Environment Programme
P.O. Box 30552 Nairobi, 00100 Kenya
Tel: (254 20) 7621234
Fax: (254 20) 7623927
E-mail: uneppub@unep.org
web: www.unep.org

UNEP