EcoCuencas: redistribución financiera en acción

Implementing Redistributive Financial Mechanisms in River Basin Management

Guidance Document

EcoCuencas coordinator

International Office for Water

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Foreword

Water is a key driver for economic and social development, and plays a central role in maintaining the integrity of healthy ecosystems. However, maintaining water-related environmental functions and services for the benefits of society often implies restricting the use of water resources, already under pressure by economic development, population growth, and increasing urbanisation. The sustainable management of water resources is made more complex due to climate change and its impacts on the water cycle and weather extremes.

A river basin's resilience to climate change can be enhanced with improved planning and management, as well as with long term-investments, but these measures require significant resources. The water sector, however, has long been facing a large funding gap: in many world regions water infrastructure is deteriorating and public budgets are already under pressure. In this context, it is important to not only maximise the use of existing resources but also make new sources of financing available. This report addresses the **design and the implementation of two financial instruments** which can help increase the financial resources available for water resources management: '**water charges**' and '**payments for ecosystem services**'. Both instruments involve a greater participation of water users or beneficiaries in covering the costs associated with the provision of the water resources management service.

A key characteristic of these financing instruments is the possibility of their acting as (economic) incentives for actors' behaviour change. They were selected to be presented in this report thanks to this double function: helping fund measures that increase resilience to climate change, and increasing the system's resilience through the instruments' influence on actors' behaviour.

A key point for any source of funding is equity. The financial instruments discussed in this guide can be designed so that they are **redistributive**, as they can ensure affordability for more vulnerable users when users with more resources subsidise those with less means, reflecting a **principle of solidarity**.

Aim and scope of this report

This report provides an introduction to two financial instruments that can support river basin management: '**water charges**' and '**payments for ecosystem services**' **(PES)** – and presents them at a level of detail that would assist water managers aiming to implement them. The guide, which draws on a wide range of international experiences on different continents, aims to support the activities of river basin organisations in establishing or reforming these financial instruments.

This guidance presents **principles**, **practical approaches** and **examples**. The international examples provided are considered to be good practice, so that the guidance can be used both as a toolbox of ideas and as a source of benchmarks.

A partner document, the OECD's 'Review of International Policy Experience with Economic Instruments for Water Management' complements this guidance with an economic discussion of these instruments in water management.

Report structure

Chapter 1 provides a general overview of the financing of water resources management, and describes the context in which the two financial instruments under analysis operate, focusing on key issues for water authorities. Chapter 2 focuses on 'charges', providing in a first step an overview of their different types, then a detailed discussion of design options, and finalizing with governance aspects. Chapter 3 addresses 'payments for ecosystem services', and follows same structure. Chapter 4 addresses key aspects of the implementation of these instruments. International examples considered to be good practice are provided in the annex, so that the guide can be used both as a toolbox of ideas and as a source of benchmarks.

1 Setting the context: the financing of River Basin Management

1.1 What do we mean with River Basin Management?

Large-scale water management can be traced back all the way to Mesopotamia and its famous irrigation system, dating back more than 5,000 years. However, it is only in the 19th Century that water management, traditionally addressed at the local level, sees a shift towards the basin level as its geographical unit of management. This new paradigm was the result of addressing basin-wide issues (e.g. water supply, flood control, navigation) using infrastructure development in the USA and Europe, which required coordination along the entire river.

River Basin Management (RBM) based on infrastructure development, with a typically strong focus on increasing water supply, saw its heyday between the 1920s and the 1970s. With time, however, it became evident that there were limits to a technical, infrastructure-based approach to address continually growing industrial, urban and agricultural demands. The nature of the challenges also changed: reducing water use in over-allocated basins, decreasing waste loads from point and diffuse sources in polluted river basins, and rehabilitating degraded river systems were problems that could not be resolved with the traditional infrastructure-based approach. Water managers now increasingly acknowledge the importance of well-functioning aquatic ecosystems for sustainable water resources management.

In response to these challenges, river basin managers in many regions of the world began addressing a wider range of issues in the second half of the 20th Century. The most significant changes were two. On the one hand a shift occurred in basin planning from a single-issue perspective to an attempt to deal with multiple issues in an integrated way – changing for instance the view of rivers from 'lines' to 'areas' (i.e. including the wider connected land use).[1] On the other hand, water managers realized the importance of ecosystem protection. Integrated Water Resources Management (IWRM) has emerged as an approach that conceptually integrates these new planning requirements.[2]

However, the challenges in different world regions are divergent, and the objectives of RBM will be different according to the context. Pegram et al. (2013) see three fundamental basin-scale issues, one or more of which need to be addressed in river basin planning:

1. **Water allocation and utilization planning**: typically the focus in more arid or seasonally variable basins where population and development has driven water demands.
2. **Water quality planning**: the focus in highly developed urban, industrial or mining dominated basins, as well as those with intensive agriculture.
3. **Flood risk management**: typically the focus in higher rainfall basins, particularly where there is significant downstream development (people and property).

Improving environmental conditions is often the main priority in industrialised economies, due to a backlog of industrial pollution and the impacts of intensive agriculture. However, in many developing and transition countries resource development is often still a significant priority. Whatever approach a country chooses to follow, its RBM should incorporate elements of environmental protection and restoration, possibly in combination with improving its water infrastructure, so as to ensure sustainable development.

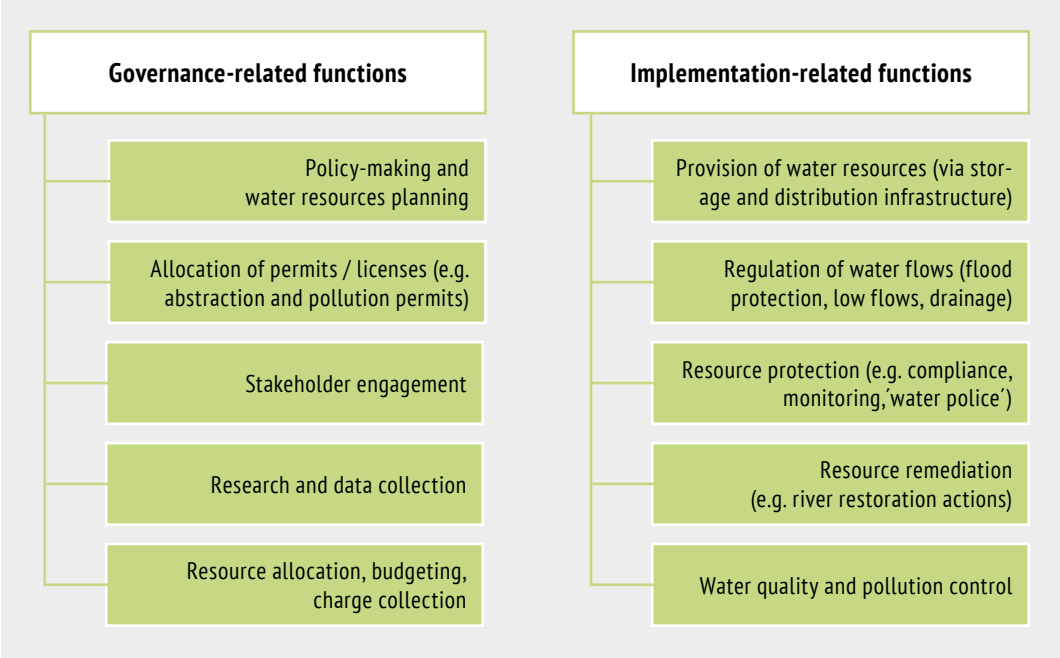
Figure 1 presents a list of common functions of river basin management. A wide interpre-

1 Cf. Kampa (2015) (ecologic.eu/sites/files/presentation/2015/kampa_wfd_rbmp_public.pdf)

2 IWRM has been defined as "a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (GWP, 2000).

tation is used in this document in line with the comprehensive, integrative view of the IWRM approach: it thus includes the funding of water infrastructures (e.g. drinking water and sanitation services, reservoirs, irrigation, drainage, flood prevention schemes) as well as resource protection measures (e.g. pollution control, restoration) and governance-related functions (e.g. planning, permits, stakeholder engagement[3], monitoring).

Figure 1. Overview of typical RBM functions



Common to different contexts is the need for significant resources. However, in many countries RBM is facing a lack of financing and capacity, which restricts countries' abilities to harness water resources for economic growth and prosperity while ensuring the long-term integrity of water resources (OECD, 2012b). This Guidance addresses the design and the implementation of two financial instruments which can help increase the resources available for RBM: '**water charges**' and '**payments for ecosystem services**'.[4]

The lack of financing and capacity in the water sector is compounded by multiple pressures on water resources caused by economic development, population growth, increasing urbanisation, and climate change. The impacts of climate change on water availability and extreme events such as floods and droughts will further compromise the integrity of water resources, pose significant risks to critical infrastructure, and threaten the livelihood of vulnerable communities. RBM can integrate adaptation to climate change into planning and on-the-ground implementation so as to enhance the water system's resilience and local adaptive capacity to both incremental changes and future shocks. When setting up the financing of RBM in a country or region, these needs should be incorporated, focusing on establishing an adaptive scheme. The two instruments presented in this Guidance can contribute towards this goal.

3 Stakeholder engagement is defined in OECD (2015a) as "an umbrella term that broadly refers to an organisation's efforts to ensure that individuals, groups and organisations have the opportunity to take part in the decision-making processes and policy/project implementation that will affect them, or in which they have an interest. It embraces a broad range of inclusive processes, with different intentions and different inputs to the decision-making process."

4 The document "Review of International Policy Experience with Economic Instruments for Water Management", developed by the OECD within the project EcoCuencas, complements this document by providing a more theoretical analysis of these two instruments, the economic principles to be considered in their use, and the problems that can originate in their inadequate design.

1.2 Financing river basin management: principles, sources, and instruments

In discussing the financing of RBM, it is important to distinguish between financial instruments and economic instruments. **Financial instruments** are the different means to raise financial resources and revenues to deliver RBM functions. **Economic instruments**[5] are incentives designed with the purpose of adapting individual decisions to collectively agreed goals, and in themselves have no revenue function. **When financial instruments create incentives for water users, they are also economic instruments**. For instance a well designed system of water charges can simultaneously generate revenues for water resources management and create incentives for users to reduce their water use, thereby increasing the water system's overall resilience. This Guidance focuses on financial instruments, but it should be kept in mind that these instruments can be used to act simultaneously as economic instruments.

1.2.1 Principles for funding river basin management

A number of principles for financing water-related infrastructure and water resources management more generally have become established over time, with relatively broad consensus on their merits. These are:

1. The **user- or beneficiary-pays principle** – a principle behind many forms of charges – is established in a number of legislative frameworks addressing water resources management. Water users (e.g. farmers, energy producers, industries) are charged for on the basis of their water consumption or the monetary benefits they receive from using the water (e.g. revenues from electricity sales from hydropower generation).[6]

2. The **polluter-pays principle** is a further principle established in different legislative systems. Its implementation in the form of pollution charges generates very significant funds for water resources management in a number of countries.

3. Less well-established, but found in a number of national legislations, is the **equity principle** (sometimes called the **principle of solidarity**). This principle can enshrine affordability requirements in legislation. However, affordability can be used unduly by certain user groups to block water reforms.[7] The principle of solidarity can ensure that users in areas less affected by water resources management issues (e.g. flooding) contribute to the financing for areas more affected.

4. Another less well-established principle is that of **policy coherence and alignment of incentives** with those of other sectors. Water resources management is affected by initiatives of other sectors (e.g. agriculture, energy, urban development), and changes in those policies (including their financing components) can in many cases facilitate a decrease in water management costs (OECD, 2012a).

These four principles are advocated by the OECD (e.g. OECD, 2012a) as a framework within which governments can address the financing issue for ensuring effective water resources management. Other interesting principles exist, with partial overlaps with these OECD principles, such as the principle of **water pays for water**, which is to be found in the water legislation of Mexico and other countries.

1.2.2 Sources of financing for river basin management

A large variety of different financial instruments have been developed over the years to fund different RBM functions (Table 1), and there is no gold standard for classifying them. The most well-known approach is the '3Ts' scheme of the OECD, which defines all sources of finance as being either *tariffs*, *taxes*, or *transfers*.

5 Also sometimes called Economic Policy Instruments.

6 There are also many indirect benefits of water resources management which are not charged. Examples are the reduced costs of productive inputs (such as agricultural commodities) faced by industrial producers, and the reduced costs of consumer products (whether agricultural or industrial) bought by households (OECD, 2012a).

7 For instance when farmers and/or industries claim they cannot afford the costs attached to water management.

1 **Tariffs (usually used synonymously with 'charges', 'fees', 'user payments', or 'beneficiary payments')**: Tariffs refer to the price paid for the abstraction and/or consumption of a given quantity of water, for the non-consumptive use of water resources (e.g. hydroelectricity), or for pollution emissions by different users. The concept is that the users or beneficiaries of the services they derive from the water resources cover part or all costs of the services.

2 **Taxes (usually used synonymously with 'government budgets')**: Government grants and subsidies are funded through taxation. These regional or national sources of finance for RBM are thus classified as taxes (OECD, 2009). Taxes can be seen as funds derived from beneficiaries of water services' provision, independently of whether they use the service or not. This will also depend on the geographical definition of the 'community of beneficiaries', which can range from local, river-basin, regional, to national level.

3 **Transfers (usually used synonymously with 'aid' and 'grants from donor agencies')**: Development aid and philanthropy (local and international charities) are examples of transfers. These are resources that do not need to be reimbursed. In some cases, they can help close the funding gap that typically affects RBM. External transfers have often played an important role in water resources management for developing countries, particularly for transboundary river basins (EUWI, 2012). In federal countries, federal-level funds can sometimes be considered transfers despite being financed by taxation, due to their crossing state borders (Lago et al., 2011).

There are also additional sources of finance in addition to the '3 Ts', such as public and private loans, bonds and funds provided by public and private investors, but **all of these have to be repaid**. They would thus help to bridge a funding gap, but the resources to close the funding gap are, in the final analysis, always derived of the 3Ts (OECD, 2009).

Table 1. Some commonly used financial instruments for river basin management[8]

Instrument	Frequency	Countries/examples
Charges and fees: Compulsory payment to the competent body (environmental or water services regulator) for a service directly or indirectly associated with the degradation of the water environment		
Administrative license fees	xxx	Scotland[9]
Water abstraction charges	xxx	Germany[9]; France[9]
Pollution & effluent charges	xxx	France; Spain
Fishing fees	xxx	USA; France; Germany
Stormwater /rainwater fees	xx	USA
Extraction/drainage charges	x	Scotland[9]
Impoundment charges (e.g. weirs and dams)	x	France[9]
Water storage charge	x	France
Taxes: Compulsory payment to the fiscal authority for a behaviour that leads to the degradation of the water environment		
Abstraction tax	xx	Netherlands
Effluent tax	xx	Hungary; Germany
Pesticide tax	x	Denmark

8 In addition to these instruments, large infrastructures for water management such as drinking and wastewater services and flood protection schemes can be funded through a range of financial instruments which commonly raise resources on the financial market.

9 For more details about the implementation of the instrument in this country please consult the Annex.

Table 1. (continued)

Instrument	Frequency	Countries/examples
Voluntary agreements and environmental payments: negotiated voluntary arrangement between parties to adopt agreed practices often linked to subsidies or offset schemes		
Subsidies on practices	xxx	Europe; South Africa
Payment for watershed enhancement	xxx	Costa Rica[9]; United-Kingdom[9]; Ecuador
Green hydropower	x	Switzerland
Trading of permits for using water or polluting water: the exchange of rights or entitlements to consume, abstract and discharge water		
Water use	xx	Colorado (USA); Australia; Chile; Spain
Pollution permits	x	Sweden

The instruments covered in this guidance, 'charges' and 'payment for ecosystem services', can generally speaking be considered examples of 'tariffs' as defined above, as in both cases it is usually the users / beneficiaries of a water resources management service that pay for the provision of the service. However, the differences between the '3 Ts' are not always strict and that there is debate on how to classify some real-world instruments. For example, charges can have features of taxes when revenues are not used to cover the cost of the service provided, but are directed into the general government budget. Also, because tariffs should be levied for a service, some argue that pollution charges are thus not really tariffs since no service is provided, but should rather be considered as a form of environmental tax. The same applies for PES, which can involve the use of revenues derived from the general tax-payer, and not necessarily the particular beneficiary or user of the service.

The history of RBM shows shifts between periods of strong central government involvement, generally accompanied by a focus on public, often national-level funding of RBM, and periods in which users and/or markets have a larger involvement in RBM and play a larger role in its financing. Whereas during the 1960s and 1970s central governments and central regulation played more or less worldwide a strong role in RBM, the 1980s and 1990s saw a shift towards subsidiarity, decentralization and privatization (Pahl-Wostl, 2015). The concept that it should be users and beneficiaries rather than the general tax-payer who should pay for (part of) the costs of providing the services they make use of has been applied to an increasing number of water services over the last few decades. Many countries have established charging schemes in which different types of water users and water polluters are required to contribute to the financing of RBM.

However, there are voices that defend the relevance of taxes as a source of funding for RBM, as there are often indirect benefits for the broad public: pollution regulation, for instance, has positive impacts for all the population. In this understanding, taxes can be seen as funds derived from beneficiaries of water services' provision, independently of whether they use the service or not.

It is only recently that Payment for Ecosystem Services' (PES) schemes have started to play a role in financing water management measures. These are contractual agreements between parties, in which actors (often beneficiaries of a water service) engage directly with other actors to ensure improvements in water management. The beneficiaries can be public bodies and regional governments (meaning that payments for actions may originate in public budgets or be subsidised e.g. by tax rebates for utilities), or private parties (actions are financed without the use of public funds).

9 For more details about the implementation of the instrument in this country please consult the Annex.

Level of public vs. private financing of WRM

The ideal level of financing through public funds (from general taxation) and private funds (from user charges / PES) is a matter of continuous debate.

The principle of 'full cost-recovery' is often aimed for when charging for water services (such as household water and sanitation, wastewater treatment, industry, agriculture, and mining). The concept says that the users or beneficiaries of a water service, through the charges they pay, should finance the complete costs related to the provision of this service. The full-cost recovery principle originally applied only to capital, operation and maintenance costs of water infrastructure, but was expanded to include the costs (impacts) imposed by the water use on the water resources ('resource costs') and on the environment ('environmental costs').[10]

Full-cost recovery may be applied not only in the financing of water services, but also of general water management functions, such as water allocation, the conservation and development of water resources, and research and data collection. For example, water policy in some countries such as South Africa explicitly aims to recover the costs of managing water resources and achieving and maintaining a good resource quality, including governance and administrative costs, through charges.

There are however good arguments for public resources playing a role in financing water management actions. Several key RBM functions display public goods characteristics (EUWI, 2012), for instance the collection and interpretation of meteorological and hydrological data. In addition, there is a general public interest in safe water resources. The principle of 'public money for public goods' would thus suggest a mixed financing between charges and public funds.

Table 2. Public and private good functions of water management

		EXCLUDABILITY **Can an agent be excluded from consuming the good?**	
		YES	NO
RIVALRY Does the consumption by one agent mean that they are fewer goods to be consumed by other agents?	YES	**Private goods** e.g. bulk water supply, water abstraction licenses, point-source effluent discharge	**Common-pool resources** e.g. unregulated groundwater abstraction, unregulated fishing
	NO	**Club goods** e.g. regulated non-consumptive uses of water (recreation, river transport, hydropower)	**Public goods** e.g. water policy-making, water monitoring, flood control, wastewater treatment

Ultimately, the appropriate mix of private and public funding will depend on national characteristics such as the understanding of the role of the public sector, the history of public government and water management, and the functions of water resources management to be financed. Some countries share the understanding that the public sector pays for social investments, whereas the private sector pays for commercial investments – but the answer to the question of what is a social investment and what is a commercial one (for instance for an investment in water storage facilities for farmers) may be very different according to the country's income level. In the final analysis, the question of how large the charges' share should be of the overall financing of RBM is a political one that should be addressed through a transparent, democratic, and participatory process (OECD, 2009).

10 In many contexts the the principle of 'full cost recovery' for the more capital-intensive water services is considered unrealistic, as it has only been achieved in a few developed countries. An alternative concept is that of of 'sustainable cost recovery', which stresses the importance of meeting certain thresholds in the financing of water services and of their affordability. It is considered more realistic and practical than full cost recovery (OECD, 2009).

1.2.3 Other means of achieving financial sustainability

Setting up new financial instruments or adjusting existing ones with the aim of raising resources is not the only means to achieve financial sustainability in RBM. Optimising financial planning is a powerful component of RBM which involves different approaches and strategies for reducing costs while maximising the protection of water resources.

A first approach to optimising the financial planning of RBM is to **use economic analyses to support the selection and prioritisation of measures to be implemented**. In Europe, for example, economic assessment methods such as cost-effectiveness analysis are widely used to help identify the optimal combination of water management measures at the lowest costs possible. Other methods, such as multi-criteria analysis, can help identify the combination of measures that maximises multiple benefits and ecosystem services, so that several objectives are met with the same measure package. Economic assessments during the planning stage of RBM can help identify opportunities to reduce the overall costs of a programme of measures by adapting their scope, by utilising economies of scale, by adapting the geographic area of a measure, or by targeting hotspots of pollution or consumption.

It is important to note that most countries only consider capital and maintenance costs of proposed measures and infrastructures when they use traditional cost-benefit analysis or cost-effectiveness analysis. This is an incomplete view as some measures might lead to an increase in transaction costs (costs linked to implementation, e.g. administrative, enforcement and governance costs) as well environmental and resource costs (linked for example to the negative impacts of environmental degradation and opportunity costs of scarce resources). These costs should also be taken into consideration.

When factoring in climate change adaptation, traditional economic methodologies such as cost-effectiveness analysis may not always be appropriate, as they tend to optimise RBM in view of a single, predictable future and do not offer effective means of dealing with uncertainties arising from future changes. Other planning principles and methods may be useful in this setting (see text box).

Prioritising river basin management measures in the context of climate change

A strategic adaptation programme in RBM should comprise a portfolio of interventions that ideally covers each one of the following aspects:

1. **Addressing current risks**. This area targets the current adaptation deficit, reducing the impacts of climate variability. This often includes interventions termed no- or low-regret measures, which are good to do anyway (even without climate change) but also build resilience for a future with climate change.
2. **Mainstreaming climate adaptation into policy and infrastructure** (e.g. to address future exposure). This area targets short-term decisions with long lifetimes, i.e. which will be exposed to climate change in the future (e.g. infrastructure, development planning decisions). This aspect can be addressed using risk screening and mainstreaming, with early priorities around low-cost robustness or flexibility, supported by the necessary information / capacity development.
3. **Building iterative responses to address future long-term risks**. This aspect addresses the long-term (and uncertain) risks of future climate change by building iterative response pathways (using a framework of decision making under uncertainty) and identifying early action to enable learning for future decisions. This allows responses to evolve over time (with a learning and review cycle) so that appropriate decisions can be taken at the right time, allowing for action to be brought forward or delayed as evidence and field observations (impacts of climate change) emerge.

Source: Watkiss et al. (2014).

A second strategy is to **ensure adequate participation of economic sectors in the financing and implementation of RBM measures** – not only through redistributive mechanisms, but also by maximising synergies between water and sectoral policies. Direct investments by sectors into best available technologies can be encouraged for instance via awareness-raising or the use of certification schemes ensuring higher environmental performance (e.g. water efficient agriculture and industries).[11] Eliminating harmful subsidies, such as subsidies for the development of infrastructure that reduces a system's resilience, will reduce the negative impact of economic development on water resources and incentivise more resource efficient and less polluting water uses, thereby reducing the overall cost of remediating action in RBM.

Applying the user- and polluter-pays principle implies that sectors and water users pay their fair share of the costs associated with their water consumption and with the discharges to the water environment. Similarly, applying the cost-recovery principle in the financing of drinking and wastewater services ensures a fair contribution of users to the costs of building, maintaining and improving the environmental performance of water services. By ensuring that the cost of using water resources is translated into a direct fee on water users, these principles encourage efficient water use.

A third approach to optimising financial planning in RBM is to **save costs at the level of water infrastructure by increasing efficiency or by adapting service levels**. Table 3 presents different approaches that can help avoid the building of new infrastructure and associated investment costs, or may help reduce operational costs. Benchmarking exercises comparing similar management systems (e.g. RBM, water service delivery) can also help to identify and eliminate performance weaknesses.[12]

Table 3. Approaches to cost-saving in different aspects of water infrastructure (OECD, 2009)

Types of costs	Adaptation of service levels	Improvement in efficiency
Supplying water	• Reducing service coverage • Assigning certain times for supplying irrigation water • Changing the standards of the quality of supplied water	• Demand management in water use • Eliminating leakage • Exchanging old pumps or optimizing flow rates
Treating wastewater	• Changing the standards determining the quality of effluents to be reached	• Installing green infrastructure (e.g. constructed wetlands)
Flood control	• Shifting responsibilities for flood protection to private parties and individuals	• Installing green infrastructure (e.g. constructed wetlands)

1.3 Charges and PES in the context of financing river basin management

The scope of RBM functions funded by charges and PES can vary significantly between countries.

Regarding charges, some schemes only aim to recover the administrative costs related to scheme operation (including cost items such as permit authorisation, compliance monitoring, and IT systems), while others finance a strongly varying set of water management functions, ranging from water resources planning, environmental mitigation and remediation, flow regulation, and provision of infrastructure.

For example, charges in Scotland (Annex A.8) only aim to cover the costs of monitoring and regulatory functions related to the issuance of licenses for using the water environment. In

11 An example is the label High Environmental Quality in France, which promotes higher performance regarding water use in buildings. See HQE – Association reconnue d'utilité publique: www.assohqe.org/accueil/?rubrique74

12 For example, the European Benchmarking Co-Operation has established an international benchmarking exercise between water utilities. More broadly for river basin management, the European Peer-Review Network helps organisations to compare and improve their approaches to implementing the Water Framework Directive.

France (Annex A.7), charges aim to fund a wide range of RBM functions, ranging from governance related ones (e.g. river basin planning, stakeholder engagement) to implementation of resource protection measures (e.g. pollution control, water efficiency). An extremely comprehensive charging scheme is that of South Africa, covering functions of water resources management (e.g. catchment strategy and planning, authorization and enforcement, restoration of ecosystems), waste discharge (e.g. mitigation of quality impacts of waste discharge, promoting efficient water use), water resources infrastructure (e.g. capital, operation and maintenance costs, depreciation, debt servicing), water research, and economic regulation.

Due to their flexibility, **PES schemes** can be designed so that they address a number of different functions of RBM. The broad majority of existing PES schemes are designed so as to maintain or improve water quantity, maintain or improve water quality, or deliver a combination of both. There are also examples of PES schemes targeting flood-risk reduction.

In practice, the variety of design features for water-related PES schemes is very high. This is due to the need to adequately incorporate context – environmental, but also economic and social – in scheme design; successful PES schemes are thus typically tailored to local conditions in the way they operate, in the level and in the type of retribution (financial, in kind, or mixed). The water-related ecosystem services that are addressed in a particular scheme are also often coupled with other objectives, such as biodiversity protection, poverty reduction, and carbon sequestration, increasing the variability in PES scheme design. Often additional objectives (such as poverty alleviation) play a role in scheme design. Due to this extreme variety of possibilities it is not viable to provide an overview of the different possibilities of PES scheme design here – for a number of relevant PES examples please refer to the Annex.

One of the strengths of charges and PES is their **redistributive nature** within a river basin. Generally speaking, revenues are generated from water users benefiting from the use of water resources (and related ecosystem services) and distributed to those contributing to the protection of the same water resources. In the case of PES schemes, the link is direct, as payments to service providers are funded through fees on ecosystem service recipients. In charging schemes, grants provided to water users for the protection of the water resources are also funded through charges on the same water users. In this sense, financial investment in RBM (through additional monetary contribution) is associated by direct (non-monetary) benefits.

If a charging scheme or PES is set at a larger scale than the river basin, they can also be redistributive by shifting resources between different river basins according to the basins' resources and the complexity of their challenges. In this way, regions facing a bigger funding gap due to entrenched physical and socio-economic challenges (e.g. more exposure to extreme events such as floods or droughts, economically depressed regions) can receive financial support from other regions (e.g. less exposed, economically more dynamic).

In regions of the world with economically vulnerable communities and large inequalities between social groups, the establishment of charges and PES raises questions of affordability, fairness and equity: who should pay, how much and for what purposes? Charges and PES can be designed so that they are socially redistributive[13] and so that they ensure affordability for more vulnerable users, such as small-scale or subsistence farmers, thus implementing the principle of solidarity between different social groups and economic sectors.

The design and implementation of charges and PES are political processes which should be carefully framed by accountable and legitimate decision-making. For this reason, many charging schemes and PES are usually associated with participatory and transparent governance structures. If they are to finance RBM, it is often beneficial to closely associate their development and implementation with RBM institutions such as river basin authorities (see Annex A.7). The particular governance arrangements of any new charging scheme or PES should reflect existing institutional and socio-economic realities, while ensuring that essential RBM functions are adequately funded.

13 Redistributive policies are an essential component of strategies for reducing inequality and promoting sustainable development. Cf. Köhler (2015)

2 Establishing charges for financing river basin management

As with other elements of water governance, there are no 'one-size-fits-all' solutions in financing of RBM (OECD, 2012a). This applies both to **the role** charges play in a particular country or region (what their share of the funding of RBM is, versus the share of taxes and transfers), and to **the design** of charges.[14]

Charges play a significant and often growing role in the financing of RBM in many countries, but their suitability depends on the policy objectives pursued in each basin. Implementation of charges can have negative as well as positive impacts according to different objectives. This means that attention needs to be paid to the **tradeoffs between the multiple impacts of setting up a charging scheme**, for instance between raising additional resources from users (e.g. following the user-pays or polluter-pays principle) and issues of affordability (e.g. charging poor users such as subsistence farmers, which may be desirable from an economic perspective, but not from a social or food-security one).

Changes to charges schemes also need to consider the existing policy frameworks underpinning the financing of WRM, which have usually evolved organically over time (OECD, 2014a). Beyond this, the local contexts (social, economic, environmental) will also determine which kind of charges are possible and which levels of charges are most appropriate for a particular setting. **The importance of context factors goes to show that charges should be particular responses to local characteristics** – which is why it is important to invest effort in their adequate design.

Two positive aspects of charges are highlighted in the literature on the topic. The first is related to their **revenue function: charges can provide for a comparatively stable and reliable funding stream** which is independent of political or public budget changes. The fact that they can be made independent of changes in public budgetary priorities (e.g. restrictions due to fiscal constraints in the aftermath of financial crises) makes possible more secure long-term planning. This long-term funding security can in itself unlock additional finance streams: Dutch waterboards for instance are considered risk-free in terms of credit risk which due to their funding security and have access to low-interest sub-sovereign loans (OECD, 2014a).

The second key aspect is related to the **incentive function of charges: charges can function as economic instruments that create incentives for certain types of user behaviour.** Historically, charges have been used in water pollution control to create incentives for pollution reductions, but their use in water demand management is currently growing in importance. Both water abstraction and water pollution charges, when well designed and controlled, can provide significant incentives for reducing water use and water pollution and thus increase the system's resilience regarding climate change impacts.

From a practical perspective, there are also arguments for shifting towards a larger participation of users versus public budgets in the financing of RBM by increasing the role of charges. Financing of RBM is lagging significantly behind needs in practically all world regions (EUWI, 2012), and the financing of this gap by public budgets (in times in which they are tightening) or other financial streams does not seem viable. On the other hand, the cost of managing water resources to reach social, economic and environmental goals is increasing due to population and economic growth as well as to new challenges such as climate change (EUWI, 2012).

14 For a more theoretical discussion of the economic principles to be considered when designing charges, please refer to the companion document "Review of International Policy Experience with Economic Instruments for Water Management", developed by the OECD within the project EcoCuencas.

A further argument for charges is that, if the charges generated in a river basin (or part of them) are used to finance RBM actions within it, they can play a significant role in the decentralisation of water management from the state or national level to the river basin level.[15] Reinforcing the investment capacities of local actors, through catchment level bodies or institutions, is also an opportunity to increase stakeholder engagement in water resources management,[16] thus contributing to good governance of natural resources (see Chapter 1).

A closer link can be created between charge levels and the benefits received from RBM actions, which can increase the acceptability of payments amongst local actors (OECD, 2010a). Additionally, their local reinvestment can create important incentives for creating appropriate revenue collection mechanisms within local and regional water authorities, as well as create social pressure from stakeholders upon users that do not pay the charges (OECD, 2013).

Charges' design should take place within the broader context of strategic financial planning of RBM. Strategic financial planning is intended to provide the groundwork for a solid financial base to ensure sustainable development and continued functioning of water resources management. It entails taking a long-term perspective of the financial needs of RBM, the factors affecting them, the main sources of funding and the balance between them, and how needs and potential resources can be reconciled (Lago et al. 2011).

Strategic financial planning builds the link between the water policy objectives, the costs entailed in reaching them, and the funding streams available for this purpose, by following a stepwise approach:

1 Identifying water policy objectives,

2 Costing them,

3 Exploring options to minimize those costs,

4 Assessing the current revenue streams,

5 Assessing the potential of each of the "3Ts" to bring additional revenues to close the financing gap,

6 Adjust policy objectives to fit into the financial realities of the sector

It is defined as an iterative process (OECD, 2009).

2.1 Charges – main features and types

Table 4 presents an overview of different types of charges levied by authorities in charge of RBM (based on EUWI, 2012 and CapNet, 2008). Please bear in mind that this guidance focuses on charges related to RBM and does not cover charges (tariffs) for covering the capital, operational, maintenance costs of water services such as drinking water, sanitation and irrigation schemes. More detailed descriptions of charges' features are presented in Chapter 2.2.

15 This principle has widespread international acceptance and is aimed for by a number of countries, e.g. France, Spain, Mexico, Brazil and Peru. For decentralisation to deliver the expected benefits, increasing funds to be managed at basin level has to be accompanied by measures that enhance the financial capacities of local actors (i.e. prioritisation of projects, accounting skills, etc.), proper co-ordination mechanisms to ensure alignment of investment objectives with upper and lower levels of government, as well as effective monitoring and evaluation systems (OECD, 2014b).

16 Stakeholder involvement, when well-designed, can yield numerous benefits in the implementation process of economic instruments, such as raising awareness on water risks, building capacity and sharing information on related costs and benefits of water charges, and also managing the risks of consultation capture, vested interests and low representativeness (OECD, 2015).

Table 4. Types of possible charges for river basin management

Type	Description	Common objectives
Consumptive water use charges	Charges applied to water users who derive a benefit from the consumptive use of water. 'Abstraction charges' are applied on water uses that abstract water for drinking water (e.g. water utilities), irrigation (e.g. irrigation associations, farmers) or industrial purposes. 'Consumption charges' are applied directly on those consuming abstracted water such as farmers and businesses.	1 To fund (part of) the costs of RBM 2 To reflect the wider costs to society and other potential users of water extraction 3 To encourage water conservation
Non-consumptive water use charges	Charges applied to water users who derive a benefit from non-consumptive use of water, such as hydropower and river transport.	1 To fund (part of) the costs of RBM 2 To fund restorative actions and thereby compensate for the environmental damage produced
Pollution charges	Charges levied on users discharging wastewater effluent into the environment, e.g. into natural watercourses. These charges are either applied to the user directly or to water service providers who provide sewerage, wastewater treatment and/or removal of sludge services to households, industries, etc.	1 To raise funds for improving wastewater treatment, 2 To fund restorative action and thereby compensate for the environmental damage produced 3 To encourage reductions in pollution
Flood control charges	Charges applied on agencies carrying out engineering works in and nearby rivers in order to protect riparian areas against floods. In some cases, charges are levied following the beneficiary-pays principle (e.g. property owners). In other cases, flood control is considered a public good and therefore addressed over the national level via taxes.	1 To fund (part of) the costs of RBM 2 To fund restorative actions and thereby compensate for the environmental damage produced 3 To encourage adoption of alternative measures
Impoundment charges (for e.g. weirs and dams)	Charges applied on users (incl. water service providers) who impound water, thus modifying the flow and morphology of rivers. This may include for example hydropower dams or water reservoirs for drinking water or irrigation.	1 To fund restorative actions and thereby compensate for the environmental damage produced 2 To encourage adoption of alternative measures
River engineering charges	These charges are applied on water service providers who carry out engineering works in and nearby rivers in order to protect riparian areas against floods, to promote navigation or extract material from the river bed (e.g. gravel). Such activities include raising dykes and embankments, dredging, and building structures blocking the flow of water in rivers.	1 To fund restorative actions and thereby compensate for the environmental damage produced 2 To encourage adoption of alternative measures
Licensing charges	Charges applied for the issuance of a permit or license to use the water resources.	1 To recover administrative costs (e.g. processing licences) and compliance control (e.g. monitoring).
Charges for specific activities	A variety of additional charges are imposed on various water services and uses, such as fishing licence fees, charges for the use of locks (e.g. pleasure boats), and entry fees for hikers and hunters in water-related protected areas (e.g. protected wetlands).	1 To recover the costs (administration, compliance control, processing licences) of regulating the service. 2 To recover some of the costs of maintaining the environmental quality of water bodies.
Fines and damage compensation penalties	Fines and damage compensation penalties are levied on regulated parties that do not comply with regulations.	1 To encourage compliance with water regulations 2 To fund the cost of remediation of the damages caused by the illegal behaviour 3 To cover the costs of compliance promotion and enforcement

The charges levied for a particular RBM function are usually designed so that they cover the costs of providing that same function. Economic theory advocates for 'one instrument, one goal' (OECD, 2010a), which implies that each river basin challenge (e.g. organic pollution), water use (e.g. consumption by agriculture), or river basin function (e.g. licensing or abstraction of water) should have its own particular charge. Further, it implies that charges should be designed with specific objectives, for example recovering particular costs (e.g. costs of administering the licensing scheme) or incentivizing efficient water use (e.g. reducing water consumption).

Implementing this approach can, however, lead to precise but highly complex charging systems with a high number of different charges. Whereas such systems have the advantage of being transparent on charge rationale and use of raised revenues, it should be kept in mind that there are significant transaction costs associated with each charge. For instance each charge will require data collection, control of compliance, and an administrative system for its collection. The relevant authorities will have to decide on **where to strike the balance between the economic ideal and the reality in their basin**. In view of the trade-off between precisely targeted charges and the complexity of the charges system, it may prove appropriate to develop a simpler system with a lower transaction cost at the price of its specificity.

The type of costs to be covered will depend on the RBM function in question, and can include:[17]

1. **Governance and administrative costs** for managing the charging scheme and implementing RBM. These may include costs such as those for monitoring, institutional capacity building, devising and implementing policies and management strategies, and enforcement costs.

2. **Investment and running costs** related to the RBM functions, e.g. measures included in a RBM plan. These may include restorative actions of aquatic habitats and new or upgraded infrastructure to reduce pollution loads or improve water use efficiency.

3. Where water authorities are also responsible for providing certain water services (e.g. flow regulation, reservoir management, flood control, etc.), they may include **capital, operational and maintenance costs** of infrastructure. While it is difficult for revenues from water charges to cover the full cost of investment or operation and maintenance (this is typically the role of tariff for water-related services), water charges can contribute to cover some of the total costs.

4. Additional **environmental and resource costs** covering respectively the environmental damage caused by resource use and costs associated with not giving a different use to the water (as a result of e.g. the water abstraction or wastewater discharge). Charging these costs would aim to ensure that charges encourage environmentally-friendly and efficient water use.

When establishing the level of a charge an authority would thus in theory need to set charges so that expected charge revenue is linked with actual costs (current and future) of providing the resource for the particular use. This would require clear data on costs and expenditures related to the different tasks of RBM in the basin, so that the link can be made between a particular charge and the actions it will finance and/or the infrastructure it will help improve, operate and maintain.[18]

17 Other types of costs are included in some countries (e.g. costs for funding water research projects in South Africa), but are not usual.

18 This is often highly relevant from a legal perspective, as in countries where this link is between charge and costs is established in law the level of a charge can be challenged in courts, and authorities may have to prove that funds collected match the costs of providing the service.

Many of these costs will be straightforward to value, but others will be much more difficult to determine, or their evaluation may be viable but time-consuming (generating high transaction costs). For instance, the estimation of environmental costs – e.g. valuating the damage to the environment caused by a certain level of water pollution – is notoriously difficult.[19] In practice, this kind of complete cost data is often lacking and often the charges are set with a less clear link between expected revenue and actual costs, or their level is set based on more pragmatic considerations.

2.2 Design features of charging schemes

From the perspective of their revenue function, all charges need to consider two overarching questions of design (OECD, 2010a):

1 The reliability of their flow, including the possibility of their automatic adjustments (e.g. to inflation; see Annex A.5),

2 The flexibility in adjusting them to unforeseen circumstances (e.g. exogenous shocks, such as devaluation, a surge in the price of inputs, or extreme water-related events such as large-scale floods and droughts; see Annex A.9).

From the perspective of their incentive function, it is important to evaluate if the incentive that is aimed for (e.g. increasing efficiency and reducing water use within a particular sector) is aligned with the priorities of other policies and sectors (e.g. energy, environment, agriculture, mining) in order to avoid conflicting policy instruments or risk ineffective pricing (OECD, 2010a).

Keeping in mind these overarching aspects, design features of (new or revised) charges can be best visualised using process steps.

2.2.1 Identifying the target population

Charges are imposed on the premise that users charged are those making use of or benefiting from water. The question of who should be targeted by charges thus requires identifying who benefits from the different possible uses of water. Additionally, the mapping of users should distinguish between their different types of uses, as different use types may have different status in the legal framework (which may affect the possibility of charges being levied, or their level). Different types of uses may also be subject to different priorities of water provision, e.g. under drought conditions.

This mapping should thus cover:

- Type of users: distinctions should be made between sectors and ideally between sub-sectors. Examples are households, irrigators, particular types of manufacturing industry, mining industry, electricity (for use in hydroelectric plants), electricity (for cooling water), aquaculture, anglers, and recreational uses.
- Types of uses (priority-based if applicable): can include general population use, productive use, use for pollution purposes (i.e. discharge of pollution), etc.

In some frameworks, the spatial distribution of users (e.g. proximity to river, relevant for tourism and flood-protection purposes) may be relevant.

2.2.2 Deciding on the principles of charge design

The different options for the basis on which the charge should be levied all have benefits and drawbacks.

19 For this reason proxies are used: environmental charges in many countries are linked not to the environmental costs, but fixed so as to cover the costs of schemes that make environmental improvements (e.g. build wastewater treatment plants) (Rees et al. 2008).

a. Charging based on capacity to use, on actual use, or on a combination of both

For consumptive and non-consumptive uses alike, charges may be levied based on the capacity to use the resource (e.g. established in a water use right), on the actual resources used (e.g. actual consumption as measured by a water metre), or on a combination of both (see Annex A.1).

For responsible authorities, charging based on the capacity to use is simple, straightforward, and requires no additional infrastructure (e.g. metering) and personnel to make on-site controls. However, charging based on capacity to use may both under- or overestimate actual use of the water resource. Underestimation of actual use is clearly problematic, as additional resources are being extracted without the knowledge of authorities in charge of managing the system, without corresponding charges being levied, and with possible environmental impacts or impacts on other (e.g. downstream) users. Overestimation can also be problematic, however, as it curtails the possibility of assigning the unused water to other users, who could create economic benefits for society with this use.

Charging based on actual use has the benefit of generating more precise information on water uses and the volumes, which allows for a more precise design of the overall RBM scheme. Basing charges on actual use also allows for a better incorporation of incentives (such as demand management) into the charge structure. However, the transaction costs of monitoring (e.g. metering, administration of monitoring scheme) can be high, e.g. requiring significant organisation, equipment and control. In addition, meeting a requirement for water use metering may not be viable for all water users due to the costs of metering equipment. Whereas some approaches have tried to simplify control requirements by relying on users reporting their use levels, this creates significant incentives for underreporting (OECD, 2013)

It is also possible to charge users based on a combination of capacity to use and actual use. Compared to charges solely based on capacity to use, this design has the benefit of incentivising an alignment of water rights with actual water use by creating economic incentives for users to give up unused water rights (Vidaurre et al., 2016).

b. Differentiating according to user type

Charges are typically differentiated according to the economic sector to which the user belongs (see Annex A.5). This differentiation is important both for the instrument's revenue function (higher charges for economic sectors that generate higher added value increase the total of charges collected and thus of resources for water management) and for the incentive function (charges need to be 'felt' by the different users so as to e.g. reduce water consumption). However, it is not always possible to generate an incentive for those industries in whose cost structure water charges only play a minor role.

c. Differentiating according to type of water body abstracted from or emitted to

Charges are often differentiated according to the type of water body being used or polluted. The most frequent distinction is between surface water- and groundwater use/pollution, with rates for groundwater bodies typically higher due to their slow recharge. It is considered desirable that charges for surface water abstraction and charges for groundwater abstraction bear some relation to each other; it could otherwise happen that one becomes overused relative to the other.

A further frequent distinction is based on the environmental status of the water body from which the water is extracted/into which the pollution is discharged. If a water body is considered to be facing environmental pressures, the charges for using or polluting its waters are correspondingly higher. This distinction is mostly used for pollution charges, but can also be used for other types of charges (e.g. abstraction in river basins with water deficits).

2.2.3 Determining rate structure

Different rate structures have very significant impacts on the revenue level, on the incentive level, and on the transaction costs associated with charge implementation.

While schemes exist where users pay a fixed fee for accessing water independent of the level of use (e.g. independent of water volumes abstracted), most schemes differentiate according to level of use. Some charges make use of proxies for this purpose, such as levying a fixed fee per hectare of irrigated land with a certain crop. Fixed fees can be appropriate for charges such as nominal license fees, which often only aim to recover the administrative costs of the licensing scheme itself. However, fixed charges are inappropriate for establishing incentives to reduce use or pollution.

Charges levied according to level of use of service can encourage efficient water use. The rate used to calculate the variable fee can be flat (e.g. same price for the first and last m^3 of water extracted), or be structured as block charges which increase with consumption.[20] The latter can generate bigger incentives for use or pollution reduction.

Depending on the regulatory framework, mixed-fees charges with two or more components may exist. For example, a water pollution charge may be divided into a fixed fee for discharging wastewater in the river environment and a variable fee applied on volumes and/or composition of discharges. This variable component can distinguish between discharge levels that are below any existing regulatory standard (as an incentive to improve performance) and discharge levels that exceed it (thus acting as a punitive fee). Another possible option is to combine into one charge a licensing charge and use charges: the charged fee is in exchange for a licence to extract water up to a pre-defined amount, above which variable use charges apply (CapNet, 2008).

2.2.4 Determining the rate level for the different charge components

The question of the level at which charge components are fixed is dependent on the level of ambition for the revenue function and the incentive function.[21]

The revenue function of a charge (how much resources should be raised) should be put into relation with the various costs for RBM functions – although often the ambition is limited to covering a subset of costs (see Chapter 2.1). When these costs are difficult to determine, the revenue function of a charge can be determined pragmatically by relating the charge to (part of) the resources required for RBM. For instance, given that costs related to environmental pollution are hard to quantify, pollution charges can be related to the costs of measures required to improve the water quality in the river basin up to a certain standard.

The level of a particular charge can also be set based on its impact on the use behaviour of water users (i.e. more or less independently of costs), as in cases when the charge needs to guarantee a certain incentive function. This incentive function can be realised by adopting higher charges (to discourage use for instance) or by incorporating exemptions to the charge (for example by offering a rebate on a water pollution charge when Best Available Technologies are installed).

An example of this is the charges scheme for groundwater extraction in west Flanders (Belgium). The charges' aim is to discourage the use of groundwater from strongly overexploited aquifers, so that they can recover in both quantitative and qualitative terms. To this purpose, charges increase with level of consumption (increasing block charges), and are raised every few years. The charges thus aim to create the economic incentive for users to switch to other water sources (Tröltzsch et al., 2016).

20 Block charges are also an effective means to charge low-income groups and to address equity issues.

21 Cf. introduction to chapter 2 for an explanation of this distinction.

2.2.5 Use of benchmarking and scenarios

Benchmarking of RBM charges between different countries or regions can provide valuable comparative information on charge structure and on charge levels. Comparisons need to ensure that charges correlated are levied for comparable purposes and that the different users charged (for instance economic sectors) have similar characteristics between countries. Comparison is most directly relevant for countries with a similar level of economic development and/or facing similar hydrological or socio-economic challenges related to water. The comparison of institutional set-ups can also provide interesting input on how successful approaches have been designed. As opposed to water utilities, benchmarking information on charges for RBM is still comparably scarce; however, some initiatives are currently addressing this gap.[22]

Scenarios are an often-used tool both in sustainable financial planning and in the design of economic policy instruments. They are useful in that they provide a background for discussing charge parameters and achieving collective agreements on the option to be taken. The different scenarios that inform a discussion can be based on different priorities regarding the objectives and the impacts of the charges (both in their financial and in their incentive function). Scenarios can also be used to help establish a hierarchy of possible options.

2.2.6 Ensuring affordability

Questions of affordability are relevant both for economic sectors and for social groups. For economic activities, the question is if the new charge design will influence significantly the performance of these economic activities, for instance by causing problems of viability of enterprises. The analysis of this question involves identifying the current proportion that water charges make up in the cost structure of companies of a certain sector, and compare it to the situation with a possible new charge.

Questions of affordability can also be of existential nature for social groups, and the parameters determined are typically the affordability of the average level of charges, and the impacts on low-income groups (e.g. poorer 20% of the population). A further relevant question is if the proposed charge level contributes to increase or reduce existing inequalities.

Issues of affordability are typically addressed in three standard manners: (a) using differential charge levels depending on the social group or on water consumption levels, (b) by setting exemptions to charges for specific sectors, and (c) in the case of a new charge, establishing a progressive rate over time so that the water users can have time to adapt to it.

2.2.7 Examples of design features for main RBM charges

This section presents an overview of design features for the main types of RBM charges, based on a review of their application in different countries. The aim is to present the reader with a variety of aspects and approaches that can be integrated in the design of a particular charge. [23]

22 The extensive series of OECD Reports on Water are probably the best source of information for this purpose. Two competent background reports with a variety of interesting examples are the GWP Technical Committee Background Paper 12, "Water Financing and Governance" (Rees et al. 2008) and the rapporteur's summary of the OECD Expert Meeting on Water Economics and Financing (OECD 2010a). Relevant studies have also been performed for African river basins, mainly financed by the GIZ (e.g. the SADC Guidelines for Strengthening River Basin Organisations – Funding and Financing (SADC, 2010)).

23 Many examples refer to examples in OECD countries. This is due to the fact that the data situation for these countries is particularly good, thanks to data-collection initiatives such as the OECD database on instruments used for environmental policy and natural resources management.

Table 5. Design features of consumptive water-use charges

Type	CONSUMPTIVE WATER USE CHARGES (e.g. abstraction and consumption charges)
Who pays	Water users such as drinking water companies, self-abstractors (e.g. irrigators, industries), water users subscribed to water distribution networks.
Rationale	Users who derive an economic benefit from the consumptive use of water (e.g. water abstracted for irrigation) should provide financial compensation for its use.
Design features	• Consumptive water use charges (such as abstraction charges) are **in place in many countries of the world**; their use is widespread in OECD countries. • Abstraction and consumptive water use charges **can develop a very significant revenue function**. The importance of their revenue function for the financing RBM varies: they can be the **main basis for funding RBM** (e.g. Czech Republic), a **major source of finance for RBM** (e.g. Mexico), or **only represent a small share of funding for RBM** (e.g. France). • The **basis for charging** is in some cases **capacity to use** (e.g. water rights), in other cases **actual use** (e.g. measured consumption), and in some cases a **combination of both** (see Chapter 2.1 for a discussion of the benefits and drawbacks of each of these options). • These charges are very often **differentiated by user type**: this is the case in about half of the OECD countries. Users from sectors which generate higher added value typically pay higher charges. • There are examples of countries in which **charges are differentiated in zones according to water availability**. Mexico is divided in nine availability zones with higher prices for more water-scarce zones. Alternatively, the charge can be **modulated based on the proportion of flow being abstracted** to account for the different levels of pressure an abstraction may cause (e.g. the same abstraction has a larger impact when taken from a small river than when taken from a larger river). • **Differentiation between groundwater and surface water is common**: abstraction charges for groundwater are usually higher. • **Differentiation can also be ad-hoc**, for instance for a particularly important or threatened water body: water abstraction from Armenia's Lake Sevan is charged at a higher rate than that from other water bodies. • **Charges can be modulated to account for return flows**, as in many cases part of the abstracted water returns eventually into the water environment in the form of e.g. wastewater or sub-surface flows following irrigation. The length of river section affected by the abstraction (i.e. the section between the abstraction point and the return flow input in e.g. industrial facilities) can also be taken into account as a modulating factor. • **Automatic price adjustments are recommended**: in many countries charges are not revised regularly and are thus **eroded by inflation**. Revision should be automatic, and can be performed annually, or scheduled for when cumulative inflation hits a certain threshold (which reduces the number of revisions and thus their transaction costs). In Portugal, charges are adjusted when cumulative inflation reaches 10%. • **International comparison shows strong variability in level of these charges**. Within the OECD for instance, charges differ over more than two orders of magnitude between Hungary and the Netherlands. Typical values for abstraction charges in OECD countries range between 5–15 US cents/m^3.

Table 6. Design features of non-consumptive water-use charges

Type	NON-CONSUMPTIVE WATER USE CHARGES (e.g. hydroelectricity, transportation)
Who pays	Users/beneficiaries of the service, such as hydroelectric power plants, owners of river freight boats.
Rationale	Users who derive an economic benefit from the non-consumptive use of water should provide financial compensation for its use. In those cases where the non-consumptive use has an environmental impact, users should pay for impact mitigation.
Design features	• Examples of charges include: **charges for hydroelectricity generation**, **provision of cooling water for power plants** and **river navigation**. • **Charges for electricity generation have a very significant revenue potential** in some countries. However (possibly for this reason), examples show that the funds raised through these charges seldom stay in the river basin and are not earmarked for RBM. They are more frequently incorporated into central budgets. • In Spain, a levy of 22% is charged on the economic value of the electricity generated. Of this levy, only 2% are reserved for the river basin agency, while 98% goes into the state's general budget. In Brazil, a 6.75% charge on hydropower generation and distribution is levied. However, only around 10% (59 mio €) of the total resources generated (527 mio €) end up financing water resources management; most of the revenues are not earmarked for the water sector. Moreover, the resources earmarked for RBM do not finance the river basin agencies, but are transferred to the national level's Water Agency (EUWI, 2012). • **There are different approaches for the basis of a charge for hydroelectricity generation**. In Spain charges are based on the economic value of the electricity generated yearly in each installation (total remunerations = market + other remunerations). In France, hydropower is charged on the basis of the volume of water flowing through the turbines. • **Hydroelectricity generation charges are modulated and can face rebates in view of plant type and characteristics**. So as to avoid undue impacts of charges on small hydroelectricity plants and plants of "general interest", the Spanish law establishes exceptions which reduce the charges' value in 90% in a series of well-defined cases. In France the charge is modulated by the height of the dam, the generated electricity and the performance of the power plant.

Table 7. Design features of water pollution charges

Type	WATER POLLUTION CHARGES
Who pays	Water polluters such as wastewater companies, users with own treatment and discharge infrastructure (e.g. industries), water users subscribed to wastewater collection networks.
Rationale	To apply the polluter pays principle, to finance actions to reduce the impact of pollution, to develop incentives for users to reduce pollution.
Design features	• **The use of pollution charges (usually effluent charges) is widespread**. A review for OECD countries shows that pollution charges are even more frequent than water abstraction charges. Water pollution charges can have very significant revenue functions. In France over 80% of the resources derived from charges are due to pollution charges. • **In many countries, pollution charges** (as well as other environmental charges and taxes) **go into environmental funds** which are earmarked solely for environmental improvements (e.g. build wastewater treatment plants). **Charge differentiation** • **The level of pollution charges can be linked to different characteristics of the polluter** (e.g. the sector, treatment processes applied), **the effluents** (their volume or pollutant concentration) or the **recipient water body** (environmental status, carrying capacity) (OECD 2010b). • **Some countries have charges with simple differentiation according to the type of pollution**. In Spain for instance a different price is charged between urban and industrial discharges; an additional factor is applied according to if the discharge has undergone "adequate treatment" or not. (The charge per m^3 without adequate treatment is 5 times higher than for adequately treated discharges, which aims to incentivise pollution reduction.) Other countries charge based on a series of parameters (e.g. BDO, metals). • **Where charges are based on actual pollutant load, the list of pollutants differs strongly**: some schemes only cover Biological Oxygen Demand (e.g. charging per kg/BOD), others include suspended solids, heavy metals, and nutrients. In some countries (e.g. Armenia) these parameters and a list of further chemicals (such as "detergents") form the basis for the charges. **Charge basis** • **Charges based on pollutant load can be levied on the basis of m^3 of polluted water, or on actual pollutant load (e.g. ton of pollutant discharge independent of water volume)**. It is important to make sure that the polluter also has an incentive to discharge enough water to dilute the pollutant load, particularly when discharging into smaller water bodies. **Challenges** • **Charges schemes that use one or few parameters** (e.g. BDO) enable the simple estimation of pollutant load by use of proxies or conversion coefficients (e.g. population served by a certain discharge point; see Annex A.10), but **may fail to charge for potentially more serious pollution** such as that caused by heavy metals or industrial chemicals. **Charges schemes with a more thorough list of parameters raise the question of how to monitor pollutant discharge**. Schemes exist in which the users declare the pollutant load they have emitted (e.g. Armenia), but this creates an incentive to underreport. • **Pollution charges are adequate for point sources of pollution, but usually ineffective for addressing diffuse pollution sources**, such as agricultural diffuse pollution caused by pesticides. The few schemes that address pesticides operate at the national level, in the form of a sales tax on the products, and are thus not a WRM charge. An example is France, where between 0.5–3€/Kg of pesticide is levied, generating revenues of 24 mio. €/year. These funds are typically earmarked for use for environmental purposes, going into environmental funds.

Table 8. Design features of license charges

Type	LICENSE CHARGES (also called "regulatory charges")
Who pays	Users of the regulated service
Rationale	Regulated parties should pay for the regulatory costs (such as administrative costs of organising a service, of controlling compliance and of processing licences)
Design features	• **License charges** (a.k.a. regulatory charges or regulatory levies) **can be levied for a wide variety of regulated activities of water users (e.g. abstraction, pollution discharge, drainage, flood protection)**. • **Examples for license charges** include **fishing licence fees** and **supply of hydrological data**. Some countries such as England and Scotland have established registration and licensing charges on a large range of activities of water users (see Annex A.8). • **License charges typically aim to recover the costs of regulating the activity**, and thus usually do not have a significant revenue function. • In some countries without water abstraction charges, only nominal licence fees linked to an abstraction permit regime are levied, which only cover the administrative and monitoring costs. • License charges can be levied in different ways, e.g. payment for an application for a license, or payment for an issued license. They can be a one-off payment or include an annual fee where licensed activities require on-going monitoring activities to ensure compliance.

2.3 Institutional set-up and governance of charges

As for the overall financing of RBM, there is also no 'one-size-fits-all' model for setting and governing water charges, and there is a great variety of situations and contexts across and within countries that have evolved into different types of governance arrangements for water charges. However, a number of common and overarching governance principles can be followed to ensure that the right framework conditions exist for financial and economic instruments to deliver their intended objectives.

Effective multilevel governance is much needed for setting and governing water charges (OECD, 2011). It is not only about addressing the question of 'what to do?' but also 'who does what?', 'why?', 'at which level of government?' and 'how?'.[24] The charging scheme can be managed at national (by the government or a national water authority), at regional (by regional water authorities, regional waterboards, or river basin organisations) or at local level, but roles and responsibilities across agencies have to be clear. There is a need to identify and address any existing duplications, overlaps, gaps or grey areas across levels of government, particularly if there are multiple governmental agencies involved in the implementation of charges. It is also important to ensure the consultative and deliberative functions of state/interstate River Basin Committees, and state/national water councils are outcome-driven, and not a mere tick-the-box exercise.

When deciding at which scale the design, collection and disbursement of water charges is done it is also important to consider that the appropriate scale should reflect distinctive local capacity, hydrographic situations and water-related risks. An effort should also be put to foster co-ordination between hydrographic and administrative scales, which often do not correspond. The charge, no matter at which level it is implemented, should be aligned with other sectoral policies such as agriculture, energy, spatial planning, land use, and environmental licensing to not undermine the water use efficiency rationale of charges.

24 The OECD Principles on Water Governance provide a useful framework to understand whether governance arrangements for economic instruments are performing optimally and help to adjust them where necessary. The Principles were designed to adapt to different national, local and regional conditions as well as water functions (i.e. water resources management, water supply and sanitation, flood management, etc.) (OECD, 2015b).

An example for a national-level management of charges is the system in place in Scotland (Annex A.8), where the charging scheme is entirely managed by the Scottish Environment Protection Agency, an executive non-departmental public body that as such holds relative independence from the Scottish Government. An example of regional water authorities are the waterboards in the German state of North-Rhine Westphalia, each of which have their own constitution and regulations, including the setting of charges. Table 9 presents some of the possible advantages and disadvantages of a national or regional control in the overall management of the charge scheme.

The **collection of the fee associated with water charges** involves verifying that existing water users properly report the intensity of their water use and pay the required charge. As presented in Chapter 2.2, fees associated with the water charges are based on some physical characteristics of the water use, usually on parameters that provide an indication of the intensity of water use (e.g. volumes of water, mass of discharged pollutant load, length of river sections affected by hydro-morphological modifications) or on characteristics of the water user (e.g. size of household, type of industrial activity, number of cattle). It is therefore key to produce, update and share consistent and comparable data and information to guide, assess and improve the design and implementation of water charges. A way to do this is to ground the level of charges on sound technical criteria, building on economic analysis, and impacts on affordability and competitiveness.

Monitoring of water use and water users is also necessary to ensure that the fees are proportionate and correctly reflect the size of the water use. **Experiences around the world demonstrate that monitoring approaches are very varied**. The primary consideration is how to reduce the cost of monitoring thousands of water users in a given river basin. Charges related to water consumption tend to depend either on the size of licenses issued to water users or on their consumption levels as measured through a water meter. In Armenia, water users are legally required to install water meters when obtaining a license to abstract water. They subsequently have to submit annual reports on volumes of abstracted water. The regulatory agency then calculates the fee to be paid and submits a

Table 9. Advantages and disadvantages of regional and national control (non-exhaustive)

	Advantages	Disadvantages
National control	• Can align funding for water management with national strategic objectives. • May have greater legitimacy in charge collection (direct parliamentary control). • Can ensure inter-basin "solidarity" (increase capacity of river basins with lower receipts) with strategic reinvestment of revenues across river basins, thereby increasing overall efficiency of revenue stream.	• Can create mismatch between funding for water management and local priorities. • Revenues may not be used to tackle problems in the same river basin (i.e. reduced acceptability by water users). • Revenues from charging scheme may be used for other purposes than water management.
Regional control	• Can align funding for water management with local priorities. • Revenues can be reinvested in the same river basin (i.e. increased acceptability).	• Can create mismatch between funding for water management and national strategic priorities. • Can increase inequalities between basins ("richer" river basins can invest more in water management, where "poorer" river basins may have the most significant problems).

corresponding invoice to water users. In case of doubts, the State Environmental Inspectorate has a right to do corresponding inspection checks.

Charges associated with the discharge of contaminants and pollutants are more complex. The Netherlands for example illustrate an interesting mix of monitoring and charging approaches:

- Large firms are obliged to measure and report the oxygen demand of their wastewater, and are also required to store the respective water samples, which can be controlled by the government.
- Households are charged depending on the average family size and small businesses pay based on coefficient tables that establish estimated amounts of pollution for each branch of industry or sector on the basis of easily obtainable data (such as the amount of water used by the production plant and the amount of raw materials it processes). Households and small companies thus pay a flat fee over time, irrespective of the variations in the actual amount of pollution in their wastewater.
- In order to encourage pollution abatement, small business that believes they are overcharged can request their effluent to be sampled and charged on that basis.

Fees may be directly collected by the regulatory authority or by a service provider when water users use an intermediary water service. For example, (public or private) providers of drinking water and wastewater services, or water user associations, are often requested to collect the fee together with the fee of the tariff for covering the costs of running the water service. In such cases, water services are required to monitor water use of customers, collect the fees and transfer the revenues to the regulatory authorities.

Operating a register of water users and ensuring that water charges are paid can be challenging where no established water rights or licensing schemes on water use exist. In these cases, it is essential to improve knowledge of water uses in the river basin and establish effective institutional processes to register and monitor changes to water use.

Ensuring that regulatory frameworks support the efficiency, effectiveness and inclusiveness of water charges and these are effectively implemented and enforced is key for the good functioning of charges. Sound inspection and control mechanisms as well as sanctions and penalties can help in case of non-enforcement and compliance. Especially where authorities rely on self-reporting by water users, compliance levels can be low if monitoring is poor and enforcement weak. Thus, large penalties for delayed or wrong reporting can act as a strong incentive for increasing compliance to monitoring requirements. In France for example, water users are required to declare their water use of the preceding year to the water agency before the 1st April. The declaration form must include all information necessary to calculate the fee. If the information provided is insufficient, inexact or incomplete, or when payment is delayed, interests are applied as well as penalties as defined by law. In Costa Rica (Annex A.5), payments are organised quarterly and an additional charge (fine) is applied if the payment is not made on time. Thanks to this system, it is estimated that 85% of registered water users pay their charges on time.

Other aspects of governance are also important pillars for the implementation of charges. A more in-depth discussion of principles already outlined above and additional principles of water governance can be found in OECD (2015b).

3 Financing River Basin Management using Payment for Ecosystem Services (PES)

Payment for ecosystem services[25] (PES) schemes are market-based policy instruments, which can be applied to different types of ecosystem services (ES) or to a combination of them, including water quality, water quantity, air quality, climate regulation (CO_2), among many others. PES schemes are based on the idea that public or private entities can, through their actions, maintain or enhance an ES and receive compensation by those who benefit from the maintained or enhanced service.[26] Thereby, an economic case is created for land and resource managers to enhance and conserve ecosystem services.

Over the past 20 years, PES schemes have become an increasingly popular policy instrument in the field of conservation, the main arguments in their favour being that they are simple, flexible and efficient, and that they carry a relatively low level of political risk in comparison with other policy instruments. Latin America, for instance, presents to date more than 40 PES schemes; they are among the main actions implemented by the 'Fondos de Agua' (e.g. in Colombia and Ecuador) or the 'Productores del Agua' (in Brazil) which aim to support water security of metropolitan areas via investments in green infrastructure (TNC, 2013).

In general, water-related PES schemes can be developed for a wide range of spatial scales; however, water-related PES schemes are usually implemented within the boundaries of a river basin. For this reason, PES schemes can be an important means to achieve RBM planning objectives. In some contexts, public authorities make available the resources to implement these schemes, in which case PES schemes can become an integral part of RBM actions. In the case that these schemes are conceived independently of RBM considerations (for instance for drinking water protection), they can release significant synergies when work is invested in aligning them with RBM planning objectives.

This chapter presents information on features and set-up of different types of water-related PES schemes, while also incorporating some examples from other sectors.

3.1 PES schemes: main features and types

PES schemes are defined as (a) a voluntary transaction where (b) a well-defined ES (or a land-use likely to secure that service) is (c) being 'exchanged' by at least one 'ES recipient' (d) from at least one 'ES provider'[27] against a compensation, (e) if the ES provider secures ES provision (conditionality) (Wunder, 2005). Every PES scheme will thus consist of one or more ES providers and one or more ES recipients. In addition, intermediaries or brokers can support the creation of PES by facilitating the negotiation process between parties, or by facilitating the (financial) administration of the scheme.

3.1.1 Objectives and principles

The most prominent overall objective of PES schemes is the restoration, conservation or improvement of the ES under consideration. Depending on the issue being addressed, improving the ES can mean improving the value of a single parameter (e.g. achieving nitrate levels under the drinking water limit by reducing nitrogen leaching from agricultural areas to groundwater). This would require implementing a concrete set of actions that pursue the same goal. Improving the ES can also mean improving a series of different

25 Note that in academic and professional literature, the term 'Payments for Ecosystem Services' is used synonymously with 'Payments for Environmental Services'.

26 For a more theoretical discussion of the economic principles to be considered when designing PES schemes, please refer to the companion document "Review of International Policy Experience with Economic Instruments for Water Management", developed by the OECD within the project EcoCuencas.

27 Note that, while the term 'ES-provider' is most widely used in the scientific literature, it is in fact the ecosystem which provides ecosystem services. In order to avoid ambiguity, the term 'ecosystem enhancers' could be used as an alternative.

parameters (e.g. reducing nutrient and pesticide concentrations and suspended solids in a reservoir catchment used for drinking water), requiring different types of actions with different goals which may interfere with each other and require managing the trade-offs.

In practice, PES schemes often have additional objectives to ES enhancement. These can be environmental objectives unrelated to water, for instance when forest conservation for water provision is linked to enhancing biodiversity conservation in these forested areas. They can also be social objectives, which can sometimes be more important than service enhancement. For example, PES schemes often have poverty reduction or the strengthening of the rural economy as an additional objective. It is important to have a clear definition of such additional objectives from the outset, because they will affect scheme architecture and contract design. Tradeoffs between social and environmental objectives often form a challenge for PES scheme design.

Equity and legitimacy issues can be addressed via a PES scheme design that specifically targets the poorest and most disadvantaged land managers, including women and small scale indigenous farmers, and which keeps the interest of large landowner groups at bay. Equity issues can be clustered into three different but overlapping categories: equitable access to scheme participation, equitable decision-making, and equitable distribution of outcome (e.g. payments). Transparency and access to information are important factors contributing to all three categories.

The general principles that underpin PES schemes are:[28]

- **Voluntariness**: Participation in a PES scheme should be voluntary, as PES schemes can only function if there is mutual interest of all parties involved.
- **Beneficiary pays**: The ES recipient benefits from the enhanced or maintained service and provides compensation to the ES provider for the implemented actions. This linking of costs and revenues for ES recipients forms the basis of typical PES schemes.[29]
- **Conditionality**: the payment is only issued if an environmental service is actually provided.[30]

Important conditions for the success of PES implementation are:

- **Ensuring additionality**: environmental services traded should exceed the legal obligations of land- or resource managers.[31]
- **Maintaining permanence**: a continued service should be provided by the ES provider, meaning management interventions should not be readily reversible.
- **Avoiding 'leakage'**: unintentional negative impacts on other ES should be avoided.

Note that the list of principles and important conditions listed above can be considered an idealised version of PES schemes. Real-life PES schemes may for instance implement only some of the principles, while departing from others.

28 Two overview guidances on the design and implementation of PES schemes can be recommended: DEFRA (2013) (aimed at key participants of PES schemes) and Wunder (2005) (presenting design hints and explanations for non-economists).

29 Note that in relation to pollution reduction, the beneficiary-pays principle is widely seen as an exception to the polluter-pays principle (see chapter 1.2). It is therefore mainly applied in situations where the polluters do not have the capacity to pay (Pirard et al., 2010).

30 Assuring conditionality can be challenging, as the complexity of ecosystems means that it is not always possible to quantify the links between actions and change in ES. In practice, the payment is usually linked to the implementation of changed management or land-use practices.

31 In practice, examples of PES schemes which compensate ES providers for abiding by the existing law exist (particularly in situations where the land- or resource managers would otherwise be incapable to do so), but can also conflict with the voluntariness principle.

3.1.2 Types of PES schemes

Various typologies for PES scheme classification exist, most of which distinguish on the basis of the different types of ES recipients. A simple categorization on this basis is one that distinguishes between public payment schemes, private payment schemes and public-private payment schemes (see Figure 2).

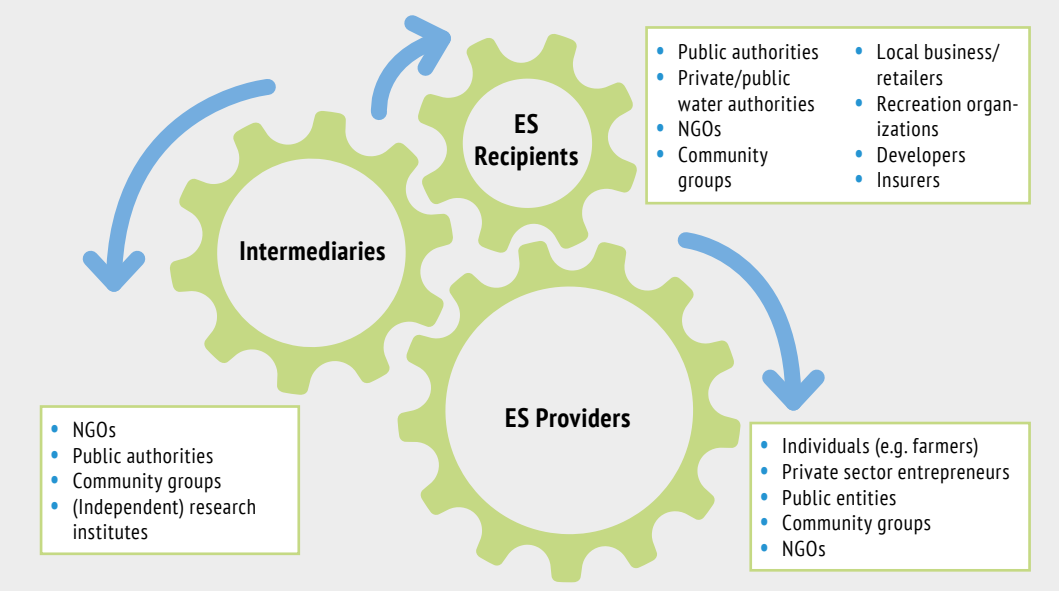
Figure 2. Overview of different types of PES schemes (adapted from DEFRA 2013)

Public payment schemes	PES schemes which involve payments by public entities such as government agencies (who act on behalf of the wider public) to land- or resource managers for enhancing ES, e.g. MEKA tool (see Annex A.17), EcoTender and BushTender Programmes (see Annex A.18)
Private payment schemes	PES schemes which are based on self-organised agreements between private parties, in which ES recipients directly interact with ES providers. In some cases a third party (the so-called intermediary or broker) might also be involved in the contract. E.g.: Pumlumon Project (see Annex A.15)
Public-private payment schemes	PES schemes in which the ES recipient is a combination of both private and public parties, meaning that the money with which the providers of ES are compensated is partly of private and partly of public origin. E.g. Paddy-land into dry-land programme (see Annex A.19)

3.1.3 Scheme architecture

PES schemes involve (one or more) ES providers and (one or more) ES recipients, and can additionally involve an intermediary or broker (with a facilitating role), and third parties (such as knowledge institutes or advisory boards). Figure 3 presents examples of organizations involved in these roles in PES schemes.

Figure 3. Typical entities acting as ES recipients, ES providers and intermediaries in PES schemes



For a PES scheme to function, it is important that ES providers and ES recipients share mutual interests, which will usually mean that they are interconnected by the same ES. Depending on the system's scale, the number of ES recipients involved in PES systems can vary from a few local, direct beneficiaries to multiple beneficiaries all the way to groups of beneficiaries at a potentially global scale (e.g. carbon trading). Strictly water-related PES schemes, however, are usually restricted to the river basin scale or below, which means that ES recipients and providers are generally located within the same (sub-)basin, and ES recipients are usually situated downstream of ES providers.

ES recipients can be any individual or organization with an interest in the ES and who has the financial capacity to pay for its improvement. A beneficiary analysis can help to identify potential ES recipients when setting up a scheme. In order to keep the amount of 'free-riders' not paying for the ES as low as possible, it is recommended to incorporate all potential ES recipients in the scheme.

Potential ES recipients need to be willing and able to compensate the ES providers for their service. Stakeholder participation and capacity building efforts can be of great help to increase the willingness of ES recipients to participate in a PES scheme, e.g. by increasing stakeholder awareness of the value of ES to them. Assuring the commitment of key ES recipients functioning as 'champions' of the ES scheme may also help to enhance willingness of other potential ES recipients.

It should be highlighted that it is difficult to increase the financial capacity of potential ES recipients to remunerate ES providers. If such an intervention is at all desired, authorities may offer tax-reliefs or other financial incentives for ES recipients who engage in PES schemes.

Intermediaries in PES schemes typically carry the task to liaise with both ES recipients and ES providers. They assume the role of an 'ethical broker' promoting fair and equitable negotiations and/or financial transactions between ES recipients and ES providers. Among possible benefits of intermediaries is the fact that ES recipients may prefer to interact with a single intermediary, who then facilitates interactions with multiple ES providers, rather than interacting with numerous ES providers themselves.

A key role of intermediaries in practice lies in enabling trust in a scheme, particularly when the history of the relationship between ES recipients and ES providers is complex. In line with this role, they often facilitate negotiations and are in charge of scheme monitoring and evaluation. Intermediaries may have an interest in one of the PES scheme's objectives and thus may themselves drive the process of PES scheme set up. The role of intermediaries can range from helping to facilitate limited aspects to facilitating the entire PES scheme design and negotiation process.

ES providers potentially willing to engage in a contract with ES recipients are typically located upstream of these. As participation in PES schemes is voluntary, early engagement with ES providers and investing in capacity building efforts where there is a lack of willingness or reluctance to engage are recommended. If poverty reduction is an important objective for the introduction of a PES scheme, participation may be limited to a subset of ES providers, such as more vulnerable farmers or lower-income households.

One type of **third parties** involved in PES schemes are knowledge providers (e.g. research institutes) who can be involved in monitoring or evidence gathering, or in advising on contractual issues. A second form of involvement of third parties is in the form of steering groups and advisory panels, which can strengthen engagement and enhance confidence in the PES scheme's delivery. The need to involve intermediaries or types of third parties sometimes arises only at a later stage of a PES scheme.

3.1.4 Costs associated with PES scheme implementation

There are **short term and longer term costs** to PES scheme implementation. Short term costs are those costs incurred mostly at scheme establishment and include costs of design, research, capacity building and potentially initial investment costs. Longer term costs are incurred over the whole phase of scheme implementation and include, for example, payments to be issued and monitoring costs.

Transaction costs related to the administration, capacity building, stakeholder participation, contract negotiation, monitoring and enforcement of PES schemes can be substantial. Transaction costs can be reduced by aggregating ES recipients or ES providers into homogenous groups and organising scheme negotiations around key representatives. It might prove worthwhile to search for additional funding to compensate for transaction costs; this funding can come from other public and private sources. For example, in Latin America, The Nature Conservancy provides support for establishing 'Fondos de Agua'.[32]

Generally speaking, PES schemes focused on changing land use (e.g. afforestation) tend to be more costly than those focusing on maintaining existing land use (e.g. conservation). Scheme management should evaluate the potential impacts of a PES scheme on land prices in the longer term. In schemes focused on conservation, for instance, land might become less arable (e.g. due to vegetation changes), which will lead to a reduction in land value. This might need to be accounted for in the scheme's compensation structure.

(Evaluating opportunity costs can be relevant to determine the payment level in the scheme; these are discussed in Chapter 3.2.4.)

3.2 Design features and structure of PES schemes

The following sections each discuss a key design aspect of PES schemes.

3.2.1 Combining ecosystem services

Water-related PES schemes typically include services related to water quality (e.g. the MEKA tool, see Annex A.17) or water quantity (e.g. the Paddy-land into dry-land programme, see Annex A.19), or both. However, water related PES schemes also often include other ES such as CO_2 sequestration, reduction of soil erosion and maintenance of soil condition, habitats for plant and animal nursery, and others (carbon sequestration being the most common). An example of the combination of ES into one scheme is the Upstream Thinking PES scheme in England, where funds are provided by a drinking water and wastewater company, a carbon offsetting programme, a harbour dredging company and insurance companies (see Annex A.16).

Combining different ES in one scheme can be an interesting option where the measures that enhance one service simultaneously have a positive impact on another service and where the same ES recipients and/or ES providers are involved. However, a combined implementation of different ES into one scheme may prove more difficult where the ES in question are not as closely linked. PES schemes can combine the multiple ES generated by a plot of land by bundling or layering them:

- **Bundling** occurs when multiple ES generated by the same plot of land are exchanged against compensation as a parcel, or bundle, to a single ES recipient (e.g. a peat land restoration project where water-quality related ES and carbon storage are exchanged in one package).
- **Layering** describes the process where the different ES created by the same piece of land are sold to multiple, different ES recipients.

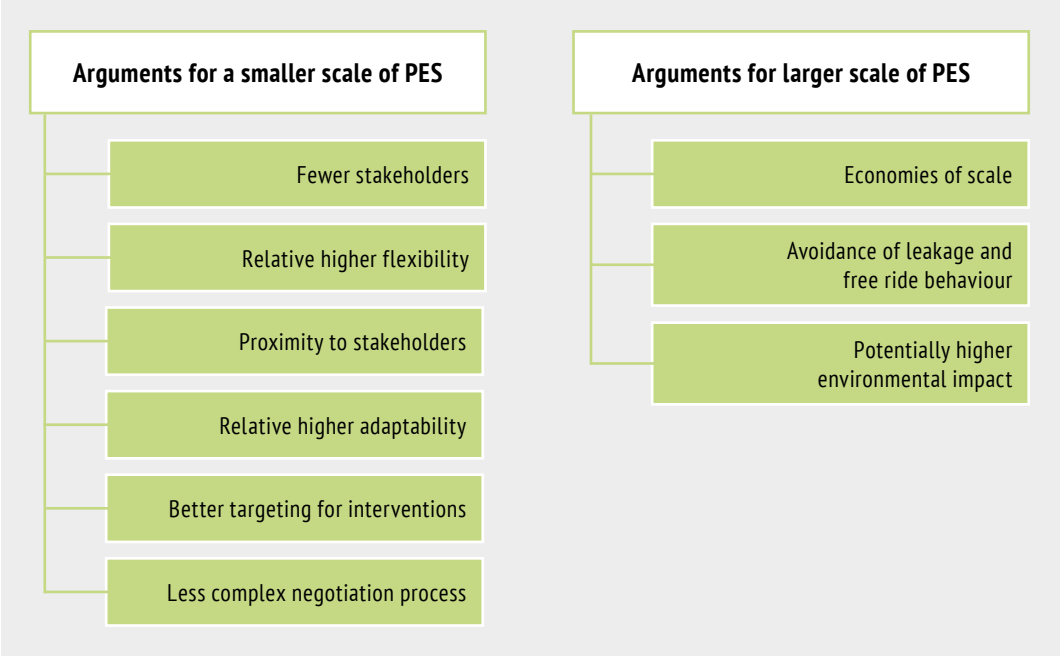
32 Cf. waterfunds.org/en.

When defining which ES are included in a PES scheme, it is important to avoid 'leakage', which means that an enhanced ES within the PES scheme should not result in deterioration of the same service elsewhere, or of another ES within the same scheme. Situations where the promotion of one service is at the expense of overall ecosystem functioning should also be avoided. Bundling and layering can help to avoid situations of leakage. They can also increase level of remuneration to ES providers in cases where the implementation of one measure generates multiple ES.

3.2.2 Spatial and temporal scale

The spatial scale of a PES scheme can range **from international schemes to national programmes to catchment or sub-catchment-level schemes**. A scheme's spatial scale can have multiple implications. Figure 4 presents an overview of arguments in favour of increasing a scheme's spatial scale and arguments against. In situations with a spatial heterogeneity of the costs and of the benefits of ES provision, it is particularly important to target and differentiate payments in order to reach the highest possible gains (OECD, 2010c). The scale can also be subject to adjustment in PES schemes designed to grow over time.

Figure 4. Arguments for smaller and/or larger spatial scale of PES schemes



The temporal scale of a PES scheme is of relevance for planning security for both ES providers and recipients. Ideally, the management interventions introduced by ES providers should introduce a permanent change and result in a permanently enhanced provision of service(s), which extend beyond the scheme's lifetime – otherwise service provision could stall if the scheme ceases to exist. As a minimum, the lifetime of a PES scheme should at least allow enough time for the effects of the scheme to be noticeable.

3.2.3 Output- or input-based compensation

Depending on the interventions included in a PES scheme, compensations can be based on output or input.

In schemes with output-based remuneration, ES recipients only compensate ES providers for the actual service delivery (i.e. only measured changes in ES provision are compensated for). Output-based PES schemes are rare in practice because the effects of

interventions on ES may take a long time to be noticeable, because ecosystem dynamics may be too complex to directly relate an observed change back to the intervention which caused it, and because it may be impossible to quantify the individual contribution of a single ES provider.

For these reasons, most water-related PES schemes rely on **input-based payments**. In such schemes, compensation is linked to the implementation of management interventions likely to result in an enhanced ES, rather than to the exact (measured) change of the ES. For input-based payment schemes it is critical that management interventions have a clear and proven cause-effect relationship with the service in question. Links between land use and erosion, for example, are typically understood with a high level of certainty, while links between land use and flood risk can be more indirect and uncertain.

Evidence on causal links is important as ES recipients must be confident that the service they are paying for will in fact be delivered. The degree of uncertainty tolerated by ES recipients will depend on the specific service and the ES recipients in question. Where scientific evidence for a link is lacking, knowledge providers can play a role in helping to reduce uncertainty and collect evidence.

3.2.4 Mode of payment and level of remuneration

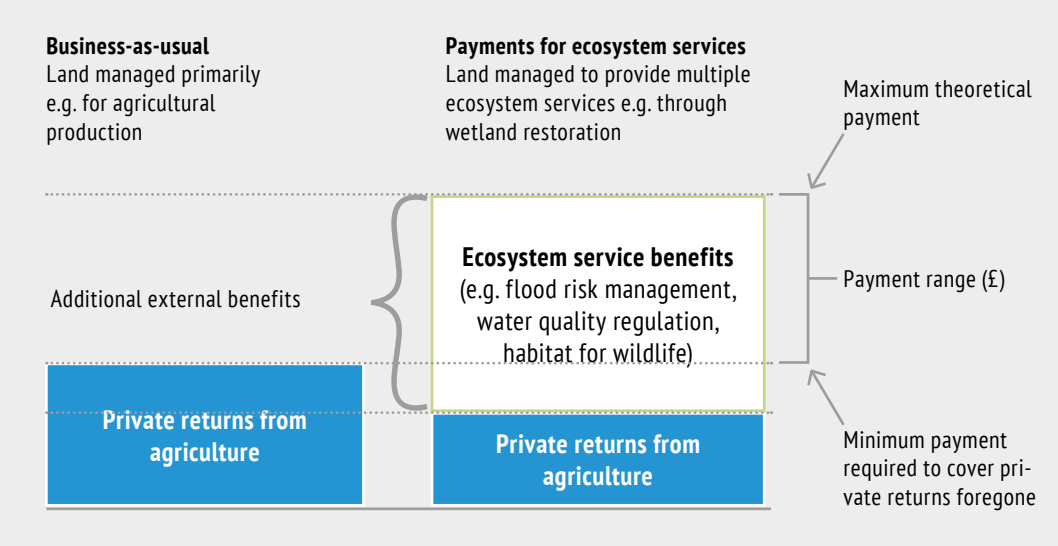
As PES schemes are by nature negotiated purchasing contracts, the process of determining the mode of payment and level of remuneration is central. This requires agreeing on a mode of payment, defining metrics to measure a scheme's impact, and settling for a level of compensation – independently of whether a scheme is based on input or output.

There are two main modes of payment in practice: monetary and in kind. In both cases it is important to agree on the division of the ES into measurable units, to which a value can be attached and which can be bought and sold.

Figure 5 (on the next page) provides a theoretical framework for **determining the minimum and maximum of monetary payments**. Following this framework, ES recipients' willingness to pay will depend on the extra income they can derive from any additional unit of ES provided. This extra income corresponds to the maximum theoretical payment. However, ES recipients may only choose to engage in a scheme if there is no other, more cost-effective way of securing the service. ES provider's willingness to engage in a PES scheme, on the other hand, hinges on the price paid for the ES covering at a minimum the opportunity costs (i.e. the value of any private returns foregone as a result of implementing the agreed interventions instead of previous practice) and any potential costs of initial investments. However, ES providers might be willing to co-fund part of the investment costs, if they expect that the new measures will offer direct benefits to them (e.g. installation of drip irrigation which leads to higher harvests).

It is important to note that the approach presented in Figure 5 is a theoretical one, and other approaches are often used in practice. Opportunity costs, for instance, are often difficult to assess. It can require quantifying the benefit induced by water for all types of use, with benefits that commonly vary from one season to another. This becomes even more difficult when the opportunity cost is related not only to reducing water use, but also to the benefit lost by giving up certain activities. Opportunity costs is also hard to assess in PES schemes aimed at poverty reduction, where subsistence farming is common and products do not enter local or regional markets. Many PES schemes thus diverge from this idealised framework when it comes to **setting the level of remuneration**. In the CuencaVerde scheme, for example, which is directed to subsistence farmers, the remuneration is oriented along the minimum wage level (see Annex A.11), while in the Bush Tender programme the level of remuneration is established through reverse auction (see Annex A.18).

Figure 5. Theoretical framework for determining minimum and maximum payments for ecosystem services in PES schemes. Source: DEFRA, 2013



In PES schemes which entail a high initial investment by the ES providers (e.g. for land conversion or the creation of a new habitat), the terms of payment can be designed to account for the unequal distribution of costs over the years by 'frontloading', meaning that compensation in the early years of scheme implementation is designed to be higher than in the later years.

Although less common, **in-kind PES schemes can work effectively where monetary payments are neither feasible nor desirable**. An example is the 'Los Negros' bees-for-water project, in which bee hives are traded against cloud forest protection (see Annex A.12).

3.2.5 Property rights and other legal considerations

Whether or not an ES is suitable for PES implementation will depend on how well **property rights and land ownership** underlying the ES can be assigned and enforced. It is an advantage if land ownership is formally settled, providing legal security that the ES provider is actually entitled to provide the service they are selling. This can become an issue in countries with informal landownership and unclear property rights, or with incomplete land registries. However, experience shows that even without formal rights to the resources users can receive payments for changes in land or resource use. The 'Los Negros' bees-for-water project in Bolivia addressed this issue by basing compensation on so-called "de facto property and tenure rights", meaning land tenure claims accepted and recognized by local inhabitants and neighbours.

Another way to avoid potential conflicts around property rights when land ownership and land management are distributed over multiple parties is to include all parties with an interest in the land into the PES scheme, and seeking consent of landowners for the involvement of tenants. Such a situation may, however, increase transaction costs.

A brief analysis of the legal framework and current land tenure should be conducted to examine issues of land ownership.

3.3 Institutional set-up and governance of PES schemes

3.3.1 Monitoring

Robust monitoring is of high importance for the smooth functioning and the sustainability of PES schemes, as it serves to build and maintain mutual trust between ES recipients and ES providers. As is the case with charges, compliance can decrease if monitoring is poor and enforcement of PES contracts is weak; this can ultimately lead to scheme failure. Typically the PES scheme's monitoring system, its baseline and the procedures, indicators and criteria applied to its evaluation and review are subject to tailored agreements between the scheme's participants. These may choose to engage a third party to certify the correct collection and interpretation of data, or commission the task to an intermediary who monitors the scheme's evolution. It is important that the actors responsible for monitoring should be endowed with sufficient capacity, resources and instruments (OECD, 2015b).

The monitoring framework should include indicators accounting for the level of implementation of measures as well as indicators capturing the social and economic impacts of the PES scheme (for example on poverty). The appraisal of the actual changes in the supply of ES should also be attempted, since evidence regarding the effectiveness of measures on the provision of ES will strengthen the commitment by all parties. In order to capture changes in ES, indicators need a temporal resolution reflecting the time lag between the implementation of the measure and the emergence of the change in ES. They also need to be designed with a fine enough spatial resolution to capture any relevant spatial heterogeneity in ES.

Ideally, indicators may already be monitored by ongoing data collection efforts at a high enough resolution. However, in many cases it will become necessary to expand existing data collection efforts. Scheme participants can choose to rely exclusively on direct measurements, or to complement data collection with modelling. Typically, the use of models will require a certain investment, which is why they are usually employed for monitoring in medium to large schemes, rather than in small-scale schemes.

A mutually agreed description of the status of the system prior to the implementation of measures, and a **baseline describing future ES provision without the PES scheme**, are key to determining the impact and understanding the additionality offered by the scheme. In practice, collecting such evidence can form a serious challenge for small to medium scale PES schemes.

3.3.2 PES contract negotiation

Successful PES schemes are typically tailored to local circumstances and can be the result of lengthy negotiation processes, such as the ten-year-long negotiation process for the Vittel PES in France (Annex A.14).

It is important to note that **participants in a PES scheme may enter negotiation unequally**: different understandings of the opportunity cost of engaging in the PES scheme or of the legal implications can lead to skewed power relations at the negotiation table and a loss of trust between parties. Intermediaries acting as independent brokers can play an important role here to ensure fair and informed negotiation, and bring greater legitimacy to the process.

Different types of contracts can be used to formalize PES schemes, with signature of contract between ES provider(s), intermediary and ES recipient(s) usually filed in a **local notary registry**. Credit purchases are common in carbon offsetting and typically laid down as **credit purchase agreements**. In contrast, water-related PES schemes rely usually on **service contracts** where payment is linked to the provision of raw materials and labour (i.e. implementation of land management measures). Other forms of PES agreements exist, such as **memorandums of understanding or programme participation**

agreements, which are normally standardized contracts and cannot be tailored as closely to local conditions as the previous types of agreements. In cases where land tenure is unclear, PES schemes typically rely on **informal agreements**.

Contracts will specify the roles, rights and responsibilities of each party, contain articles about security and risk allocation in situations such as *force majeure* or failure to make or accept delivery, and contract duration. A dispute resolution paragraph assigns a court for dispute resolution but often, priority is given to conflict resolution between buyers/sellers and intermediaries.

3.3.3 Long-term sustainability

In schemes where compensation of ES providers is only issued by ES recipients, **both parties usually reserve the right to initiate renegotiation of the PES contract if market conditions change**. Through this mechanism, private PES schemes are relatively adaptive and likely to continue as long as they are socially desirable and both parties draw a benefit from them.

In schemes which depend on external funding, **permanence and financial sustainability can become a serious challenge** and scheme termination can lead to land managers resuming the environmentally undesirable management practices. Generally speaking, it can prove beneficial to introduce mitigation measures before the scheme wraps up so as to help ES providers adapt to the new conditions.

Options include **phasing payments out gradually or shifting from monetary payments to in-kind contributions, training and capacity building**. Schemes such as the Vittel PES scheme have shown that these approaches can have a lasting impact by maintaining beneficial land management measures. In more critical cases, where the beneficial land management should be maintained for the greater public interest, the designation of the preserved areas as legal reserves is an option.

There are some experiences of PES schemes aiming to establish permanent changes in land management practice (extending until after scheme termination) through **profitable sustainable businesses and alternative livelihoods for land managers**. The 'Los Negros' bees–for-water project in Bolivia for example aimed to make the new land management measures profitable by establishing beekeeping and honey production (Annex A.12). However, even in those cases where alternative livelihoods have been introduced, it is unclear whether these are sufficient to prevent land managers from resuming undesirable practices if the programme is terminated.

3.3.4 PES schemes as part of a policy mix

PES schemes are no panacea and are not suited to address every kind of problem in RBM. They are most suited for situations where ES recipients consider that additional ES provision is necessary, and ES providers are not required to provide these ES legally. In addition, ES providers must see the changing land management as an opportunity. Thus, successful PES schemes may need significant investment in raising awareness of these opportunities and benefits to the full range of ES recipients and providers.

As for many policies, **strengthening institutions and existing governance structures, rules and property rights** will have a positive influence on the way landowners or other providers of ES react to the establishment of a PES scheme. In this light, studies on their effectiveness indicate that trust in institutions, a guarantee of conditionality and the controlling of free riding are crucial factors for the success of PES schemes in achieving their objectives.

PES schemes may be used most effectively as complementary mechanisms to reinforce other policy instruments. Minimum environmental requirements for preserving river basins and their water resources will exist in most countries. PES schemes should ideally not be used to ensure compliance (which would go against the 'additionality' principle). In some cases, PES schemes can be combined with other economic instruments, such as water charging schemes in Costa Rica (see Annex A.5).

4 Implementing redistributive financial mechanisms

This chapter presents some key cross-cutting issues to consider when implementing the two redistributive financial mechanisms dealt with in this report. The first section focuses on building capacity for the effective implementation of charging schemes and PES schemes. The second section discusses how to build support amongst river basin actors through a transparent participative process. The third section addresses possible incremental approaches in the implementation of these mechanisms. The fourth and last section discusses options that can be used to ensure that redistributive mechanisms are relevant and effective in the long term.

4.1 Capacity-building and an enabling framework

As presented in Chapter 2 and 3, the management of redistributive financial mechanisms involves a number of technical responsibilities related to the collection of fees, the redistribution of revenues (e.g. in the form of grants and payments), monitoring and enforcement. To achieve the successful implementation of these mechanisms, it is thus important to build the capacity of the organisations involved in the administration of charging schemes and PES.

The first step in building technical capacity is **improving knowledge of the river basin, its water uses and their relative impact on the environment**. This information is usually readily available where RBM plans have been developed, although additional information may need to be collected on a broader set of indicators and for wider spatial and temporal monitoring. Furthermore, relevant information may be monitored by different organisations without a common framework for comparing and sharing data. Thus the implementation of charging schemes and PES should be underpinned by a **comprehensive strategy to compile, homogenise, and expand environmental and water use monitoring** (see also Chapter 2.3 and 3.3).

Additional socio-economic assessments can be carried out to examine:

- How different water uses benefit economically from using the river basin's water resources,
- How much the different water uses contribute to the financing of public and private water infrastructure through charges and tariffs,
- Financial needs to implement effectively the RBM plan, and
- Which new financial resources can cover the funding gap.

These types of analysis can help justify the use and targeting of new or reformed financial instruments for RBM. For example, in the EU, a number of socio-economic assessments are required to inform the selection of measures and funding options for reaching the objectives set out in RBM plans (see text box 1). In reality, it may not be possible to carry out some of these assessments due to the difficulties in accessing data (e.g. multiplicity of sources, confidentiality of economic data, etc). A second, more pragmatic possible approach is outlined as implemented in Armenia (see text box 2).

Text box 1. Socio-economic assessments in the Water Framework Directive to inform RBM

- **The characterisation of water uses** aims to describe the socio-economic significance of different water uses, as well as quantifying how much they benefit from using water in the river basin and how much they impact water resources. This provides an understanding of which sectors can and should contribute more to the protection of water resources in the river basin.
- **The assessment of cost recovery of water services** aims to estimate the costs of building and maintaining water infrastructure (for supplying water, wastewater, irrigation, navigation, etc) as well as the resources raised through water tariffs, taxation and charging schemes. This provides an estimate of the financial sustainability of key water infrastructure.
- **The evaluation of financial needs for river basin management** aims to quantify the costs of implementing a programme of measures and the cost of administrating it. It provides a proxy for the level of resources to be raised to protect effectively water resources in the river basin.
- **The mapping of financial flows** aims to assess how much water users directly contribute (e.g. through charges or PES) to the financing of water infrastructure and the protection of water resources in the river basin, and how much government contributes through general taxation. It can help deciding whether it is more effective to pursue the reform of financing instruments or introduce new ones.

Source: EC (European Commission) (2003).

Text box 2. Evaluating financial needs and assessing instruments for water management

The Armenian government recently assessed options for reforming the basis of the charges and establishing different charge levels. A study was thus performed which provided the following assessments:

- An assessment of **the revenues generated** from existing abstraction and environmental charges and an estimation of current expenditures for water management. This provided an estimation of the financing gap through user charges.
- An evaluation of **who benefits from (complete or partial) exemptions** from paying the charges. This provided an indication of the degree to which the polluter-/user-pays principle is applied.
- An assessment of **priorities for reform**. Three scenarios were used, differentiated in terms of objectives, charge rates and structure, revenue-raising potential, and coherence with existing legislation. This was followed by an evaluation of the financial needs under each scenario.
- **An impact assessment** of each instrument, mostly qualitative in nature, against economic, environmental and social criteria. Specific assessments on equity and affordability issues and an international benchmarking exercise were performed.

The study enabled to indicate the capacity of different instruments to raise funding and recover the costs of water management, their capacity to lead to more efficient water use, and their broader positive or negative social, economic and environmental impacts. It also provided avenues for progressive water reforms and pre-requisites for effective implementation.

Source: Acteon (2014).

An important element for the effective implementation of charging schemes and PES is the compilation of a reliable record of existing water and land rights in the river basin:

- **A register of water rights**, such as licenses for abstracting water or discharging effluents, is useful for ensuring that all water users are paying their water charges. Programmes aiming to establish or improve charging schemes put much emphasis on strengthening the administration of water and land rights through e.g. administrative reform (creating or reinforcing powers to regulate water use or land ownership), the updating of public registers (through field campaigns), and improved monitoring of ongoing licenses.
- Likewise, PES requires information on **land ownership records and leasing agreements** in order to establish land management agreements. However, existing public registers of land rights are often outdated or inexistent. Organisations aiming to implement PES thus often need extensive initial field campaigns to create an accurate record of land ownership and leasing agreements.

Establishing a good knowledge base is costly and should start with the exploitation of existing databases. Organisations involved in administrating charging schemes and PES should thus ideally seek to **build close communication channels** with relevant ministries and governmental agencies. France for example has established a National System for Information on Water which provides via a single point of entry giving access to more than 100 public databases.[33]

To build adequate support across government bodies, authorities and stakeholders, it may be relevant to **closely involve politicians** (e.g. important ministers, mayors). **Strong political leadership and willingness to compromise** appear to be important factors during the establishment or during major reforms of redistributive financial mechanisms.

In Costa Rica (Annex A.5) for example, after four years of negotiation between 2002 and 2006, water charges were significantly modified (GWP, undated). Several procedural factors can explain the success of the reform, but the leadership exercised by the Ministry of Environment in charge of the reform was of particular importance. Ultimately, negotiations had to be carried out at the level of specific economic sectors, and, as a result, the number of categories of water uses was increased to apply more differentiated rates. The final increase in charge rates was significantly lower than the initial proposals. However, one result of the overall increase was the return of nearly 150 million cubic meters of water a year as concessionaries cancelled or adjusted their water rights and improved water use efficiency.

4.2 Stakeholder buy-in

Since participation is voluntary, PES schemes are dependent on participants perceiving the scheme as fair, equitable and legitimate. With charges, the link between users and authorities is usually less direct, but the long-term viability of the charges' scheme – particularly of participants' willingness to pay – also depends on their recognizing the legitimacy of the charges in view of the benefits they receive of them. One way to secure the political/social buy-in, is to engage stakeholders in order to raise their awareness on water risks and the consequences of inaction.

Thus, the successful establishment or reform of redistributive financial mechanisms should be **legitimate**, **accountable and fair** to the range of actors potentially affected by the changes. Relevant authorities and organisations (e.g. intermediaries) can ensure the new or reformed charges and PES are legitimate by following a **transparent approach**, closely informing and engaging with stakeholders, and ensuring extensive outreach to all water users.

33 See: www.eaufrance.fr/donnees

4.2.1 Communication

Preparing a communication plan can be a useful process to identify the key messages to be disseminated and the best way to reach out to different types of stakeholders. An essential goal should first be to increase the general awareness of stakeholders on the benefits of RBM and of redistributive financial mechanisms, in particular in countries where the concept is poorly established and/or known.

Targeted information campaigns should ultimately explain the reasons why a new or reformed charging scheme or PES is needed and how the financial resources raised will be used. Messages can focus on how the protection of water resources can lead to multiple benefits for society and the environment, or why action on particular water pollution problem (e.g. nitrate or heavy metals) is necessary. Information that could be disseminated includes also the costs of implementing RBM plans and proposed strategies on how to finance them. Such a transparent approach raises awareness amongst water users of the scope and level of resources necessary to improve the sustainability of the river basin, thereby underlining the need for new or reformed charges or PES. It is important to emphasise that redistributive financial mechanisms aim to increase the level of investments benefiting the river basin such as securing the provision of potable water, improving water and ecosystem quality, greater preparedness to climate change impacts, droughts and floods, etc.

4.2.2 Engagement

An extensive engagement process with stakeholders is instrumental in order to ensure legitimacy and accountability of decisions taken. Where existent, the role of river basin committees is central in supporting this engagement process and bringing legitimacy. Where non-existent, there should be an attempt to create a piloting group of stakeholders representing the variety of interests in the river basin and actors affected by the changes. It is important to consider their relative power and level of organised social and political activity, in order to ensure fair and equitable consideration and involvement. Greater efforts (e.g. including financial support) are necessary to reach out to poorer, less organised or educated communities.

Informal exchanges may be pursued early on to gather feedback that helps forward the process and facilitates iterative policy refinements. Useful feedback includes the acceptability of proposed reforms, pre-conditions or issues to take into account in the design of the charges or PES (such as fee or payment structure and levels, potential exemptions, etc. Informal exchanges can take the form of one-to-one contacts, small group workshops, surveys and interviews. In Scotland the reform of water charges involved first a broad engagement process, followed by more specific bilateral negotiations (see Annex A.8).

A strategic engagement plan with a clear roadmap presenting the key consultation and decision-making milestones can bring transparency to the process and increase stakeholder appropriation and acceptability. Relevant skills need to be built within the relevant implementing organisation, including workshop design and animation, consultation processes, communication and visualisation (graphic) skills, etc.

4.3 Sequencing and phasing implementation

Evidence from around the world demonstrates that the establishment or reform of redistributive financial mechanisms is usually an **incremental process**. Sequencing implementation can help build trust between stakeholders, showcase good practice, illustrate concretely the benefits and costs of these mechanisms, identify corrective actions, and increase political and sectoral acceptance to a more generalised scheme.

A sequenced implementation can either be realized by:

- **Expanding over time its spatial scope**. In Sri Lanka, the implementation of water charges was gradual, first based on pilot testing on a selected catchments and aquifers, which provided the opportunity for further improvements.
- **Progressively adding more elements or users to a scheme**. Authorities can first establish compulsory registration and licensing of water services or users, then introduce charges for a small number of services or users, and finally expand these to more services. In South Africa, charges for resource poor farmers were phased in over the course of ten years starting from the date of water use registration. The first five years, charges are not imposed and from year six to ten, a 20% yearly increase of charges is applied. In the Philippines (see Annex A.10), the pollution charges focused on the main industrial polluters first, then expanded to include other groups.

Analogously, the catalogue of measures applied in a PES scheme can grow over time, or new sectors can be included. In France (see Annex A.14), the water bottle company Vittel established a scheme originally focused on farming, which was over the last 30 years gradually expanded to different sectors, including forestry, railroad and housing. In Colombia (see Annex A.11), the implementation of a PES scheme in the Rio Grande river basin targets a selected set of farms in order to demonstrate the potential for payments to contribute to improved water quality as well as showcasing personal (successful) stories of farmers engaging into the scheme.

4.4 Adapting to changing environmental and socio-economic conditions

Significant uncertainties and the possibility of rapid change may result in quickly outdated, inefficient and unfair charges or PES schemes. Factors influencing the functioning of redistributive mechanisms in this way include changing socio-economic conditions and market developments, such as fast changes in prices of agricultural commodities. It also includes environmental changes and climate change impacts, including long term changes of the water balance and short term shocks, such as extreme precipitation or drought. This calls for a **flexible and adaptive approach to implementing redistributive mechanisms**. A number of activities can be applied to both charges and PES schemes to make them adaptive to such changing conditions.

Different approaches currently used regarding the management of charges and payments over time are:

- **Fixed charges** increase predictability but also erode the capacity of the charging scheme to raise financial resources (as a result of inflation and changing costs).
- **Scheduling regular adjustments in the level of charges and payments** can help account for a changing environmental context and evolving financial needs for RBM. Some countries such as Armenia update their water charges every two years, others like Peru opt for a yearly adjustment. The challenge of is to ensure that sufficient funds are raised over time while providing predictability to water users on the future costs that charges will impose.
- **Automatic adjustments** (based e.g. on inflation rates) can be used to offset the impacts of some changes; however, their application can be contested in practice. Countries with past experience of hyperinflation can see automatic adjustments critically as automatic adjustments themselves can become a driver of inflation.

In practice, different solutions to balancing the **need for flexibility while maintaining planning security** have been found. In France, fees are increased every year following an agreed 5-year plan. Similarly, water users in the Emscher catchment in Germany agree upon a multi-annual framework agreement over the increase of charges. While the exact level of charges is set every year, a specified benchmark annual increase of around 5% is usually followed. The German and French example show how planning security can be provided to businesses on future costs due to water charges while maintaining some flexibility.

Existing reviews indicate that **regular monitoring and adjustment is also of great importance in PES schemes**. An example for this is the paddy-land into dry-land project in China, where a review found that household income in the area had doubled from 2006-2010 and prices of agricultural goods had changed in such a way that an adaptation of payments became necessary (see Annex A.19). Monitoring also revealed unintended side effects of the scheme which had to be addressed, such as the increased fertilizer application on dry-land corn fields when compared to the previous paddy-land rice crops. Improved knowledge can hence justify updating the catalogue of measures so as to include new measures found to be particularly effective or exclude old ones found to be ineffective in providing service enhancement.

Better-performing charging schemes and PES include clauses that allow the **coordinating body to deal with climate change**. Climate change is typically accounted for in RBM by monitoring, modelling and implementing forward-looking planning to manage a changing baseflow and extreme events. While they may not always be earmarked as such, costs for climate change adaptation are then included in the cost of RBM, which is then reflected in charge levels and payments.

Another dimension linked to climate change adaptation is the **management of exceptional circumstances**. In many countries, regulatory bodies can temporally modify water concessions in order to reduce authorised abstraction during droughts. However, this, together with the reduced consumption, can significantly reduce the income generated by water charges (when these are based on volumes of abstracted or consumed water). In order to avoid a funding gap or sudden increases in charge rates, it may be more necessary **to include the costs of dealing with droughts in the annual fee of the charging scheme**. In countries such as France, specific water charges have been developed to support the management of low flows (see Annex A.9). This charge has further increased users' participation in the cost of securing water supply during drought years while enhancing long-term financing. The charge level takes into account the planned periodicity of "wet" and "dry" years as well as water demand, in order to avoid sudden increases following drought years.

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Annex A: Examples of Redistributive Mechanisms – Charges and Payment for Ecosystem Services (PES) Schemes

Annex A.1 Charges and institutions in the PCJ basins (Brazil)

Overview

The Piracicaba, Capivari and Jundiaí (PCJ) rivers are adjacent; river basin management for the three basins is led by the PCJ river basin agency. The basins' area is situated in south east Brazil, and produces 5% of Brazilian GDP with a population of 5 million inhabitants. It is home to the large Cantareira system which provides about 50% of Sao Paulo drinking water. The basin management for the three basins is discussed in the PCJ committees. A charging scheme addressing water users raises resources for river basin management.

Three sources of charges exist: a federal scheme, managed by the National Water Authority, and two state-managed schemes, of the State of São Paulo and the State of Minas Gerais. The federal resources originate from charges for the use of water resources in the rivers of federal domain, but are transferred in full to the PCJ river basin agency, with resources earmarked at a rate of 7.5% for administrative costs and 92.5% for investments. State resources derive from two sources: charges for the use of water resources of the domain of the state, and economic compensation for the use of water for hydroelectric generation. The PCJ committees receive a portion of the income from power generation (from the state water resources fund FEHIDRO).

The total value derived from the consumptive charges is calculated taking into account the volume of water extracted and the volume of water consumed (the portion not returned to the water bodies). Charges are based on 80% of the volume measured by the user and 20% of the volume granted through licenses (this is a combination of capacity to use and actual use, cf. Chapter 2.2). Effluent discharges are also subject to charges and take into account pollution load measured through organic load (BOD).

Because the PCJ basins' water bodies are the responsibility of two different States and the Federal level, the registration of water users and billing of charges are divided between these three domains: the Federal level, the State of São Paulo and the State of Minas Gerais. The information needed for the licensing process presents some differences between the levels, making the creation of a single database for the basins' management more complex.

Water users can provide to the authorities measured abstracted and consumed volumes from the previous year as well as those planned for the current year. However, this is not a mandatory procedure. If the user does not have a water meter, data contained in the respective licenses will be used to calculate the amount payable in the current year (with possible adjustments depending on previous payments).

Lessons learned/main challenges

Over the last years, state and federal authorities have aligned previously fragmented management policies towards a more unified system, in particular around the application of the charging scheme. The revenues generated by water charges support continuous investments for better integrated water resources management. However, the heterogeneity of administrative processes, monitoring and methodologies make the compilation of data into a database quite complex.

Location	State of Sao Paulo and Minas Gerais, Brazil
Geographical scope	15,377.81 km^2
Managing authority	Fundación Agencia de las Cuencas PCJ / Agencia Nacional de Aguas / Instituto Minero de Gestión de las Aguas

Water users charged	Drinking water and sanitation (domestic), industrial sectors, agriculture
Further information	Yearly management reports of the PCJ basins: www.agenciapcj.org.br Additional information on charges in the PCJ basins: www.agenciapcj.org.br/novo/instrumentos-de-gestao/cobranca-pelo-uso-da-agua/33-instrumentos-de-gestao/cobranca-pelo-uso-da-agua

Annex A.2 Charges and retributive arrangements between institutions in the Catamayo basin (Ecuador)

Overview

The Catamayo-Chira is a transboundary river basin shared between southern Ecuador and northern Peru, with a total surface of approximately 17,200 km2, of which close to 44% are located in Ecuador. The EcoCuencas project aimed to improve the financial redistribution in the Catamayo basin, in order to implement a more integrated water management approach and to improve climate change resilience in the basin. The National Law on the Use and Utilization of Water Resources (2014) stipulates that while a certain volume of water for satisfying basic needs of human consumption and domestic use should be free of charge, if this quantity is exceeded, a 'tariff' (equivalent to 'charges' in the terminology of this report) is to be applied.

In order to prepare an adaptation of the existing tariff for bulk water abstraction, the national ministerial accord 2017-010 was proposed and realized by SENAGUA, stipulating as target that the reformed tariff should yield 25,000,000 USD in the first year (for comparison, the existing national tariff for bulk water abstraction yielded a total of 2,820,403 USD in 2017). A study among larger water users concluded that there was a willingness to pay 275–300% more than what they were currently paying.

In a second instance, an agreement regarding the distribution of the financial flows generated by the reformed tariff between conservation (60%), connecting services (20%) and the operation and management of multipurpose infrastructure (20%) (which are the responsibility of SENAGUA and its subordinate agencies ARCA and EPA, respectively) was achieved, and proposals were made on how to administer the financial flows (i.e. by means of a water fund or using existing mechanisms within SENAGUA).

Additionally, the Hydrographic Directorate Puyango-Catamayo (DCHP in Spanish) developed a proposal for a new formula to establish tariffs for bulk water abstraction, which would form the basis of the tariff reform. The new tariff (Ti) is calculated using the formula $Ti = Tr * (Fu * Fr * Fs)$, and is based on a reference tariff (Tr) which, in line with the requirements of the law, is modulated by three factors:

1. *Fu*: Social and economic use factor, reflecting the economic capacity of the respective users
2. *Fr*: Regional factor, reflecting scarcity or use intensity
3. *Fs*: Factor For solidarity and sustainability

Furthermore, a study identifying and prioritizing the areas in need of protection (the so-called 'fuentes de agua' or 'water sources') was carried out in the Catamayo basin, and a first list of conservation measures was proposed as well as the budget required for their implementation. In parallel, efforts were made to promote international cooperation between Ecuadorian and Peruvian water authorities and supporting the formation of an international river basin organisation.

Lessons learned/main challenges

Considerations of equity and social redistribution of the tariff burden between richer and poorer users are of utmost importance in Ecuador. Consequently, these are manifested through factors in the formula of the bulk water abstraction tariff (this 'tariff' is equivalent to charges in the terminology of this report). Furthermore, the tariff reform went hand in hand with decisions on the distribution of funds between different tasks on national level, and a prioritization of conservation needs on the local level.

Location	Province of Loja, Ecuador
Geographical scope	17,200 km^2
Managing authority	Secretaría Nacional del Agua, Demarcación Hidrográfica Puyango-Catamayo (SENAGUA DHPC)
Water users charged	Drinking water and sanitation (domestic), industry, hydropower, mining, agriculture
Further information	@Agua_Puyango_C

Annex A.3 Pilot project for improving water charges (Peru)

Overview

In Peru, 'economic retributions' (equivalent to what we have called 'charges' in this document) are the payments which users pay to the state for the use of raw water and for the discharge of treated pollution flows into natural water courses. The financial resources generated using this instrument finance the operation of the National Water Authority ('Autoridad Nacional del Agua' – ANA in Spanish), which is responsible for the integrated water resources management (IWRM) of all the country's water resources.

The EcoCuencas pilot project in Peru aimed to identify the potential for improving the process of resource collection for the 'economic retributions', implementing to this purpose a pilot project in the Chira-Piura basin. The project aimed to identify systematically different options to increase resources, to evaluate their potential, and to improve actions in the management of water resources. The work focused on:

1. Assessing capacity to pay and outstanding payments of use charges for groundwater and surface water use
2. Identifying discharge points of treated wastewater that are not paying charges
3. Establishing irrigation water losses in the basin's major and minor irrigation infrastructure, and determining their economic consequences
4. Developing a proposal to include new user groups into the treated wastewater charges
5. Developing a proposal to differentiate charges between different agricultural users (aiming to increase resources derived from high-value and/or export agriculture)
6. Analysing the funding gap for IWRM in the Chira-Piura basin
7. Prioritising measures in the river basin plan according to adaptation to climate change criteria.

The pilot managed to identify several scenarios with a very significant potential to generate additional financial resources. On the one hand, the study established that the fish canning and preserving industry, the fish flour industry and export agriculture industry should be incorporated into the charges scheme. In addition, it was determined that the revenue potential of drinking water and sanitation (domestic) use is much higher than the currently collected revenues.

Lessons learned/main challenges

The pilot project used a modular approach, seeking firstly to determine the potential for increasing financial resources through an improved implementation of existing regulations (e.g. by reducing outstanding payments and incorporating informal users), and in a second step determine the possibility of improving and increasing charges for certain user groups. This last analysis took into consideration the economic impacts of a charge increase for these users. The main challenge proved to be accessing information for certain uses, which can be in the remit of sectoral authorities. These models will be applied in other basins under the responsibility of ANA.

Location	Chira-Piura river basin, Peru
Geographical scope	29,853 km^2
Managing authority	National Water Authority – Central offices ('ANA Sede Central'), AAA Jequetepeque-Zarumilla (deconcentrated organ of ANA in the Chira-Piura basin)
Water users charged	Drinking water and sanitation (domestic), agriculture, industry, mining
Further information	www.ana.gob.pe/etiquetas/retribucion-economica

Annex A.4 Administrating charges for water resource management (Mexico)

Overview

The Mexican National Water Commission – CONAGUA – is the main body in charge of water planning, financing and strategic setting in water management at Federal level. At river basin level, 13 river basin organisations serve as deconcentrated bodies of CONAGUA. They support the state governments and river basin councils (which are essentially stakeholder consultative bodies) with the preparation and implementation of water programmes. In addition, CONAGUA administrates the rights for water use and wastewater discharge, collects water charges, and transfers federal budget resources to support municipalities, water utilities and agricultural water users. The Ministry of Finance sets water abstraction and pollution charge rates, controls the revenues from water charges, and decides upon the overall budget for water policy and management. River basin organisations thus do not have financial autonomy, and depend entirely on the federal budget. In the current system, central government can allocate funding most effectively to public bodies across the country to meet federal water objectives and priorities. Central control also facilitates the development of public expenditure plans at federal, state and local levels. However, as a result, river basin plans are more likely to consist of a collection of projects to be funded by governmental and sub-governmental organisations, rather than of fully integrated, strategic plans responding to river basin priorities. Central control can also create mismatches between allocated funding and real river basin needs. Greater involvement of river basin organisations in the decision-making of water-related investments or the establishment of river basin-specific mechanisms to raise and distribute financial resources may help better account for basin priorities.

Lessons learned/main challenges

Federal control over the setting of charges and the use of their revenues has allowed strategic re-distribution of funding, but has also hindered the development of strong river basin management approaches.

Location	Mexico
Geographical scope	1.97 million km^2
Managing authority	National Water Commission (CONAGUA)
Water users charged	Urban, industrial, aquaculture, hydropower, recreation
Further information	OECD (2013), Making Water Reform Happen in Mexico, OECD Studies on Water, OECD Publishing. dx.doi.org/10.1787/9789264187894-en

Annex A.5 Combining charges and payment for ecosystem services (Costa Rica)

Overview

Costa Rica's water law establishes the obligation that all water use concessions granted must commit to paying a levy as compensation for the use of water. This charge has been collected since the 1940s. However, the rate was too low to cover the range of costs associated with river basin management, as some institutional users were dispensed from paying the charge and the levy was not indexed against inflation. After four years of negotiation between 2002 and 2006, water charges were significantly modified with highly positive outcomes. Several procedural factors can explain the success of the reform. The leadership exercised by the Ministry of Environment and Energy was of particular importance, by involving influential global organisations and building the technical expertise and capacity of its administration. A pilot study served as a test for the implementation of the charge scheme reform and was used to initiate a broad national discussion on the future of sustainable water management. In early 2005, negotiations focused on the implementation of new water charges for productive sectors. This process lasted more than six months and included weekly meetings. Ultimately, negotiations had to be carried out at the level of sub-sectors, and, as a result, the number of categories of water uses was increased to apply more differentiated rates. Final charge rates were significantly adjusted from the initial proposals, and globally the amount was decreased in all of the usage categories (from -23% up to -95% in the different categories). The agreement with the private sector, and an impact assessment and cost-benefit study, paved the way for final approval by sectoral ministries. One result of the increase of charges was the return of nearly 150 million cubic meters of water a year in water rights, as concessionaries cancelled or adjusted their rights and improved water use efficiency.

Furthermore, in its attempt to stop deforestation, Costa Rica opted for a Payment for Ecosystem Service approach that has, over time, been associated with a charging scheme on water uses. The programme is structured around four ecosystem services: capturing and storing atmospheric carbon, protecting water sources, conserving biodiversity, and scenic beauty. The PES scheme initially relied on a fuel tax, international donors and credits from multilateral financial institutions, but a decree adopted in 1996 broadened the scope of water charges to environmental dimensions which enabled their use to fund the PES scheme. The PES is currently also funded through revenues from fuel and from forestry and conservation trusts, international sales of carbon and biodiversity-protection credits, and voluntary deals with private and semi-public companies (e.g. hydro-electric companies aiming to reduce siltation). Overall, the PES scheme relies heavily on (national) public funding, making it potentially vulnerable to shifts in political interest and priorities. However, the scheme has contributed to the protection of nearly one million hectares of forest since 1997. The scheme has also helped to regularise property ownership among smaller landowners and encouraged compliance with social security obligations. Much of its success arose from its synergies with other policy instruments, such as the phasing out of forestry subsidies, prohibition to change forest cover, and the establishment of conservation areas. Stability of key staff and an independent board has allowed experimenting with different selection criteria and contract conditions, and meet new political priorities.

Lessons learned/main challenges

Successful reform for increasing the level of water tariffs required strong political leadership, building of expertise in the administration, regular stakeholder engagement, and differentiated treatment for the establishment of charge levels. Financial instruments for strengthening river basin management financing do not work in isolation. Careful attention to the policy 'mix' involves maximising synergies between policy instruments and avoiding conflicts.

Location	Costa Rica
Geographical scope	51,100 km^2
Managing authority	Ministerio de Medio Ambiente y Energía (MINAE)
Water users	Domestic, industrial, commercial, tourism, agro-industrial, agriculture, aquaculture, hydropower
ES recipients	Government fund, private sector, international banks and bilateral agencies
ES enhancers	Individuals, legal entities (businesses), indigenous communities, development or conservation cooperatives
ES intermediary	domestic, industrial, commercial, tourism, agro-industrial, agriculture, aquaculture, hydropower
Further information	Global Water Partnership (GWP) (undated). Costa Rica: Environmentally Adjusted Levies for Water Use. www.gwp.org/en/ToolBox/CASE-STUDIES/Americas--Caribbean/Costa-Rica-Environmentally-Adjusted-Levies-for-Water-Use-378 Porras, I., Miranda, M., Barton, D.N., Chacón, A. (2012). DE RIO A RIO+: Lecciones de 20 años de experiencia en servicios ambientales en Costa Rica. International Institute for Environment and Development, London. pubs.iied.org/16514SIIED.html

Annex A.6 Charges and other economic instruments (Germany)

Overview

Four types of economic instruments relevant to water management can be differentiated in Germany. For one, businesses amongst others pay a professional tax to the municipality and an income tax whose revenues are shared between the State and Federal Government. Municipalities, State and Federal Government are all involved in water management and will therefore spend some of those revenues through their administration, investments or subsidies to water users. However, revenues from taxes ('Steuern') are not earmarked and are collected into the general budget. There is thus no obligation to use those revenues for water management.

Three types of charges also exist. An 'Entgelt' is a general fee for a governmental service; a 'Gebühr' is a fee for a governmental service related to policing; and an 'Abgabe' is a charge paid in accordance to the intensity of water use (e.g. pollution discharge). Different State administrations will use these charges in different ways depending on local preferences. An 'Entgelt' for example is not earmarked while a 'Gebühr' or an 'Abgabe' are. A 'Gebühr' can only be used to recover costs of the relevant administration, while revenues from an 'Abgabe' must be 'recycled' (in appropriate) form to the community of those who paid it.

In Germany, environmental charges for water abstraction or pollution take the form of an 'Abgabe' regulated by federal law. The law is detailed and sets for example pollution parameters and measuring methods, the amounts payable per unit, and financial rules of implementation. The State authorities thus have very little discretion in the administration of this law, which avoids distortion in competition within Germany. The money collected by each State stays in the State and is earmarked to be spent on measures to improve e.g. waste-water treatment and environmental water quality.

In parallel to publicly managed charges, user charges are applied by water boards in some regions of Germany (e.g. Emscher, Rhur). Working under private law, these associations of water users collect charges from their members in order to finance water development or improvement works. Thus different rules to those of the 'Abgabe' apply with regards to their application and how their revenues can be used.

Lessons learned/main challenges

Water taxes and charges are essentially different economic instruments, which dictate the ways in which their revenues can be used. Different models for the governance of water charges exist, depending on their administrative and public or private nature.

Location	Germany
Geographical scope	357,168 km^2
Managing authority	Federal, State and Municipal Governments, Water Boards
Water users	various
Further information	Möller-Gulland, J., McGlade, K., Lago, M. (2011). WP3 EX-POST Case studies Effluent Tax in Germany. Available at: www.ecologic.eu/sites/files/publication/2015/lago_2011_effluent_tax_0.pdf Rouillard, J.J., Vidaurre, R., Brouwer, S., Damman, S., Antorán Ponce, A., 4, Gerner, N.V., Riegels, N., Termes, M. (2016). Governance Regime Factors Conducive to Innovation Uptake in Urban Water Management: Experiences from Europe. Water, 8, 477

Annex A.7 Charges and stakeholder engagement (France)

Overview

French water management is decentralised at the level of river basins, but coordinated and defined at national (and European) level. RBM is the responsibility of six water agencies employing over 2000 people. Water agencies are public bodies under the supervision of the Ministry of Environment and Sustainable Development. They are responsible for preparing and implementing RBM plans that should be reviewed every six years. This is complemented by a programme of investment which establishes planned income and expenditures.

In France, there is a strong emphasis on integrated management across water uses and strong stakeholder engagement in defining and implementing RBM. Water agencies do not implement measures of the RBM plan by themselves, but mainly work as mediators between public authorities and water users on the one hand, and as financers though its subsidies and loan programme on the other. 'Implementers' include e.g. municipalities, districts and regions, water utilities, etc.

The most important decision body directing the work of water agencies is the Basin Committee, which represents both public and private interests in the river basin. It is composed by 40% of representatives of the municipality, districts and regions, 40% of representatives of society and companies, and 20% of representatives of the national government. The Basin Committee defines the priorities of river basin management and validates the proposals of the water agencies during the development of the RBMPs. For more day-to-day decisions, water agencies are managed by an Administrative Council that includes public and private interested parties in the same way the Basin Committee does, as well as including a range of thematic and geographic committees.

In each programming period (six years), the maximum rates of the charges are defined at the national level by law. However, the rates applied in practice are fixed in each basin by the water agencies, administrative council and river basin committee. Water charges exist on domestic pollution (wastewater discharge), on water abstraction, on lack of modernisation of wastewater collection network, on non-domestic pollution, on diffuse pollution, on impacts on water habitats, on water storage, and on continuity barriers. Charges on domestic water users are listed in the water bill. Overall, charges and other taxes (e.g. VAT) represented 18% of the water bill for domestic users in 2008. In total, about 12 billion EUR are raised through charges every six years (the planning cycle) by the 6 water agencies in France.

The revenues generated by charges are reinvested to support the implementation of the RBM plan and the work of the water agencies and stakeholder groups. As an example, the budget of water agencies for implementing a six year plan (1997–2002) ranged between 1 billion EUR (for a river basin of 20,000 km^2 with 5 million inhabitants) to 5.8 billion EUR (for a river basin of 97,000 km^2 with 18 million inhabitants).

In order to make a good match between the financial needs of the RBM plans and the revenues that come from charges, agencies work with the central government. Simulations of the financial needs in each basin are made, considering the short, medium and long term priorities. It is recognized that it is not possible to implement all measures in the short term as the users' capacity to finance actions is limited. With this information, the central government can decide what is politically and fiscally possible (i.e. the maximum permissible rates of charges). Throughout the six-year planning cycle, adjustments are regularly carried out in order to re-allocate resources between priorities and action programmes. Levels of assistance, type of operations assisted and eligibility requirements can also be reviewed. A Treasury Steering Committee meets every month to conduct a regular follow-up.

In a recent analysis, a number of issues with French RBM financial planning were highlighted:

- The national government collects 230 million € from the water agencies budget to support the national solidarity fund, which serves other purposes than funding water-related investments in the river basin in which the resources were raised. This contradicts the mutualist principle of the charging scheme established in France at the level of the river basin, where "water funds water" in the same river basin.
- There is a net financial transfer from domestic and industrial water users to agricultural water users (when comparing contributions through charges and subsidies received by group of water uses). To restore equitable taxation, the evaluation points out the options of nitrogen taxation and appropriate charge level for irrigation water.

Lessons learned/main challenges

Significant financial resources for RBM can be raised through water charges. However, to be acceptable, water charges need to be carefully designed and implemented through legitimate and accountable processes. National oversight, together with decentralised, participatory RBM involving water users, can provide a good decision framework.

Location	France
Geographical scope	550,000 km^2
Managing authority	Water agencies
Water users charged	Drinking water and sanitation (domestic), industrial sectors (including among others power production), agriculture
Further information	OECD (2011). Le financement de la gestion des ressources en eau en France. OECD, Paris. Report of the Court of Auditors on the water management in France: www.ccomptes.fr/content/download/79146/1980438/version/1/file/112-RPA2015-agences-et-politique-de-l-eau.pdf

Annex A.8 Water charges and risk-based regulation (Scotland)

Overview

In 2006, the Scottish Executive introduced a comprehensive charging scheme to fund the licensing of abstractions, impoundments and engineering affecting rivers and lakes. The scheme was revised in 2016. To develop the 2006 charging scheme, the responsible authority (the Scottish Environment Protection Agency) used a thorough process of stakeholder engagement. Large workshops involving all stakeholders were organised to develop a consensus view of how the scheme should be developed. Discussions became more difficult when water users saw the potential financial implications of the charging scheme. As a consequence, the large stakeholder workshops became difficult to manage as every group had their own particular concerns. When developing the 2016 charging scheme, the Agency took a different approach to the discussions: it ran workshops on a sectoral basis, meeting bilaterally with e.g. the freshwater fish farmers, the waste industry or the chemicals industry. The Agency was thus able to concentrate on the issues that concerned each sector most and find ways to deal with these concerns.

Consultation both in the setup and in the reform provided information on what the scheme's structure should look like and the steps involved in calculating a charge. In addition, a data visualisation tool was made available via the internet. This tool allowed water users to look at individual SEPA licences they held for different sites and the predicted charges over a period of five years. Users could look at individual licences, find out how the charges had been calculated and see the data underpinning these calculations. This gave companies confidence in the scheme because they understood how their charges were calculated, and it provided them with the opportunity to check that the data was correct. This last point was also very valuable from the perspective of the Agency, because data-cleansing is a critical part of developing charging schemes.

The Scottish Water Environment (Controlled Activities) Regulations of 2011 apply regulatory controls over activities which may affect Scotland's water environment. The regulations cover abstractions, discharges, diffuse pollution, engineering works in inland waters, and groundwater. The type of authorisation required and the associated charge depend on the environmental risk of the proposed activity. This dictates the levels of assessment, inspection and monitoring to be carried out by the regulator. Three levels of control exist: i) General Binding Rules (GBRs) provide statutory controls over certain low risk activities; ii) registration is intended to cover low-risk activities which cumulatively pose a risk to the water environment; iii) licences are needed if site-specific controls are required, particularly if constraints upon the activity are to be imposed.

A one-off application charge is applied as well as a 'subsistence' charge for those registrations and licenses that will involve on-going monitoring and compliance-checking by the regulatory agency. The regulatory agency has 30 days to assess an application for registration and four months for a licence.

About 60% of the money raised through charging is used to monitor the environment, and to check whether regulated activities are having an environmental impact, while the remaining 40% supports regulatory activities (inspection and enforcement).

The charging scheme is exemplar in its transparency and clarity: the regulatory agency presents all documents related to the charging scheme on its website, together with detailed guidance, a charge calculator to simulate the potential charge level, and information on compliance procedures. It is also supported by an extensive awareness-raising strategy: leaflets to homes, videos and newsletters, radio shows, river basin walks to check for un-registered activities or to inform river basin inhabitants.

Lessons learned/main challenges

A risk-based approach can offer a consistent methodology for establishing charge levels to the real risk that an activity poses to the water environment. Transparency and active information provision are essential to strengthen enforcement.

Location	Scotland
Geographical scope	80,077 km^2

Managing authority	Scottish Environment Protection Agency
Water users	household, agriculture, hydropower, aquaculture, engineering
Further information	www.sepa.org.uk/regulations/water

Annex A.9 Droughts and charges in Adour-Garonne river basin (France)

Overview

The Adour-Garonne Water Agency has established an integrated framework for managing low flows and droughts. This is based on identified 'nodes' across the whole river basin, where minimum water flows must be met in order to preserve the water environment and fairly share water resources between upstream and downstream water users. Different levels of drought intensity are defined, and are associated with agreed combination of measures, such as promoting water-efficient crops (if drought is forecasted early enough), reservoir releases, and temporary controls and bans on water abstraction. Long-term measures are also promoted such as water efficiency, technological change and water recycling.

The Water Agency has established water charges on abstraction for drinking water, irrigation and industrial activity, charges on hydro-electricity, and charges on water reservoirs stocking water during low flows (to avoid water diversion during low flows). More recently in 2014, the public body responsible for the management of the Garonne Sub-Basin within the Adour-Garonne river basin established an additional charge to support the management of low flows. This new charge has further increased users' participation in the cost of securing water supply during drought years while enhancing long-term financing. The charge level takes into account the planned periodicity of 'wet' and 'dry' years as well as water demand, in order to avoid sudden increases following drought years.

Lessons learned/main challenges

Various charges can be used to manage water scarcity and droughts, e.g. on abstraction, on hydro-electricity or on water reservoirs. Charges can increase sustainable financing of integrated drought management through user participation. It is important to consider the potential frequency of future droughts in order to avoid sudden increases in charge levels.

Location	Adour-Garonne, France
Geographical scope	116,000 km^2
Managing authority	Agence de l'Eau Adour-Garonne, Syndicat mixte d'études et d'aménagement de la Garonne
Water users	agriculture, households, industry, canals, navigation
Further information	Websites of the relevant organisations in the Adour-Garonne basin (in French): www.eau-adour-garonne.fr/fr/quelle-politique-de-l-eau-en-adour-garonne/un-outil-le-programme-d-intervention-de-l-agence/les-redevances-percues-par-l-agence.html www.smeag.fr/recuperation-des-couts-du-dispositif-de-soutien-detiage.html

Annex A.10 Implementation of charges in the Laguna de Bay (Philippines)

Overview

The Philippine Government started to investigate the possibility of implementing pollution charges in the 1990s. A first pilot programme was established around the Laguna de Bay in 1997, followed by a five-year national programme to allow time for necessary changes to the legal and regulatory framework. The pilot charging scheme at the Laguna de Bay was first based only on the BOD content of industrial wastewater and was applied to only 120 industrial firms. This represented nevertheless 90% of the total organic load into the lake. The following year, the charging scheme was applied to all industries that generate process wastewater and, in the third year, it was extended to cover residential subdivisions and commercial establishments including food chains and restaurants. The Philippine Clean Water Act 2004 is now regulating the further establishment of wastewater charges for the whole territory.

Lessons learned/main challenges

The focus on few controllable parameters simplified the application of the pilot and the establishment of a first charging scheme. The pilot helped understand feasibility aspects, administrative and institutional dimensions and acceptability. Progressive extension of the scope and charge levels helped water users adjust to the new costs.

Location	Laguna de Bay, Philippines
Geographical scope	3,800 km^2
Managing authority	Laguna de Bay Development Authority
Water users	industries, households
Further information	Global Water Partnership (GWP) (undated). Philippines: establishing an industrial wastewater effluent fee program, Laguna de Bay. www.gwp.org/en/ToolBox/CASE-STUDIES/Asia/Philippines-Establishing-an-Industrial-Wastewater-Effluent-Fee-Program-Laguna-de-Bay-82

Annex A.11 The CuencaVerde PES Pilot Scheme (Colombia)

Overview

The Ríogrande II reservoir in the Department of Antioquia, Colombia, is the main source of drinking water of the city of Medellín, as well as being an important source of hydroelectric power. Due to several factors the basin that feeds the reservoir is seeing an increase in pressures as a result of the expansion of the agricultural frontier. There is land-use change pressure in the wooded areas of the region, traditionally a milk-production region, due to agricultural crops new to the area (e.g. potato, tamarillo fruit; their cultivation in this area is possible due to climate change) and due to the use of young trees as stakes for fences or for plant support. These factors are causing an upward displacement of the agricultural frontier in the upper areas of the basin, affecting medium and high mountain mist forest areas that are important sources of water and which regulate water quality.

The pilot scheme of payment for ecosystem services of CuencaVerde seeks to conserve these wooded areas through a combination of payments and financing of interventions. In return, livestock farmers agree to preserve existing forest areas in their farms and to let young forest areas grow. The amount of compensation is orientated towards the farmer receiving an amount similar or close to the Colombian legal monthly minimum wage. So as to ensure the continuity and sustainability of the PES scheme, individually developed Farm Plans ('Planes de Finca') will be implemented and have as main aim to improve the livestock farmer's productive

conditions, e.g. by providing refrigerated milk tanks, mobile milking equipment, or solar panels which reduce the electricity costs due to milk refrigeration. By improving production processes, or alternatively by reducing production costs, the aim is to increase livestock farmers' resilience to possible changes (e.g. impacts of climate change, fluctuations in the market prices of their products), so as to prevent the farmer from being forced due to economic reasons to change the land use of (part of) his property.

The scheme presents several interesting aspects. On the one hand there are other PES initiatives active in the region, which has generated a need for cooperation between existing schemes. The idea is to have payments that have similar allocation criteria and levels of compensation, so as to avoid competition between the different PES schemes. On the other hand, it is considered crucial to provide advisory services to livestock farmers, which on the one hand help improve the production processes and economic performance of the farms (and therefore their resilience), and on the other hand convey to farmers the consequences for the long-term yield of their soils that arise from a land-use change from forest to new crops.

Lessons learned/main challenges

The success of a scheme such as that of Corporación CuencaVerde depends on the trust of farmers. To achieve and maintain this trust it was determined that the following factors are important:

- Communicate clearly the objectives of the program, including those of the organisation CuencaVerde (so as to avoid farmers confusing between CuencaVerde and environmental authorities).
- Build trust with livestock farmers through "putting oneself in their shoes", i.e. being aware of their interests and problems and suggest ideas that both improve productivity and are in line with these interests.

A PES scheme should have clearly defined objectives. The CuencaVerde PES scheme is in the first line an environmental scheme which reflects the mission of CuencaVerde as a water fund, with social support defined as a secondary objective.

Location	Río Grande basin, Department of Antioquia, Colombia
Geographical scope	888 ha – area under conservation
ES recipients	Empresas Públicas de Medellín – EPM (the public utilities company of Medellín)
ES enhancers	livestock farmers who own the farms
Intermediary	Corporación Cuenca Verde
Further information	www.cuencaverde.org

Annex A.12 The PES scheme Los Negros - 'Bees for Water' (Bolivia)

Overview

The Los Negros 'Bees for Water' project is an example of a tailor-made approach to PES monitoring, with the creation of a monitoring team which includes representatives of ES enhancers and ES recipients. A second remarkable feature of the scheme is the interesting solution developed for incorporating farmers that do not have legal titles to the land they farm.

In this PES scheme, the downstream agricultural community of Los Negros, which mainly cultivates irrigated vegetables, compensates the upstream agricultural community of Santa Rosa for cloud forest conservation and reforestation efforts, thereby resolving a long-lasting conflict between the two communities. Compensation is provided in kind, in the form of beehives, thus contributing to the establishment of new

livelihoods for upstream farmers. Next to an initial compensation for entering the scheme, a progress-based compensation of 1 hive/10 ha of cloud forest protected per year is granted. The PES scheme bundles several ecosystem services and combines two main objectives: biodiversity and watershed protection. The scheme was initiated in 2002 by the NGO Fundación NATURA. Contracts are short, formulated in simple language and issued directly for 1 to 10 years without automatic renewal. Fundación NATURA found a way to include farmers without formal legal title to their land by applying 'de facto property and tenure rights' (i.e. rights accepted by local inhabitants and neighbours). Yearly monitoring of the implementation of measures is executed by a monitoring team, consisting of a representative of upstream ES enhancers, one of downstream ES recipients, and a technical expert from Fundación NATURA, together with the farmer of the respective piece of land.

Positive side effects of the scheme include a public strengthening and additional recognition of the land tenure position of scheme participants, as well as a strong increase in the production of honey, whose larger scale marketing is facilitated by newly founded centres for commercialization.

Lessons learned/main challenges

An analysis of PES schemes in Bolivia which included the Los Negros 'Bees for Water' project found that in the absence of a specific institutional and legal framework covering PES schemes, it is small and local PES schemes that are more likely to produce results. Limitations encountered in the Los Negros 'Bees for Water' project include unclear land tenure and the concern among Andean communities that PES scheme implementation could imply privatisation of water. Further issues include enforcement of the conditionality of payments and continued dependence on external donors.

Location	Department of Santa Cruz, Bolivia
Geographical scope	2,774 ha
ES recipients	Pampagrande Municipality (on behalf of Los Negros irrigators) and individual irrigators (Fundación NATURA)
ES enhancers	Upstream land owners in Santa Rosa
Intermediary	NGO Fundación NATURA
Further information	Greiber, Thomas (Ed) (2009). Payments for Ecosystem Services. Legal and Institutional Frameworks. IUCN, Gland, Switzerland. xvi + 296 pp.

Annex A.13 The PSAH programme as a PES scheme (Mexico)

Overview

The PSAH programme in Mexico is a good example of how the gradual adoption of a PES scheme can be promoted in practice, and how this can help to better reach programme objectives.

The PSAH programme was started by the Mexican National Forestry Commission (CONAFOR) in 2003, with the primary objective of improving downstream water quality and quantity, combined with the secondary objective of achieving poverty reduction and rural development. To this purpose, CONAFOR agreed on five-year contracts with individual landowners, stipulating a compensation for maintaining forest cover. Payments were issued annually; their level was aligned with the opportunity cost for cultivating maize and depended on the type of forest protected, resulting in a payment of approximately 36 USD/ha for cloud forest and 27 USD/ha for all other types of forest. The programme was combined with funds made available for capacity building and expert advice.

Between 2003 and 2010, more than 3,300 properties were enrolled in the programme, with a total area of over 2.3 million hectares. Adaptive features of the PSAH programme include:

- Starting on a small scale, then expanding gradually to the national scale
- A participatory programme design
- A yearly revision of programme rules by an external body, combined with a yearly internal revision by CONAFOR with input from a multi-stakeholder advisory committee (which included representatives of ES enhancers, ES recipients, government agencies and NGOs)

Lessons learned/main challenges

The programme's adaptation over time enhanced its capacity to fulfil its primary and secondary objectives, and reviewers concluded that the programme's targeting of endangered aquifers and ecosystems also worked well. The programme's success was, however, less clear when it came to incorporating areas with high risk of deforestation in the scheme. Regarding the objective of poverty reduction, it was found that the programme placed emphasis on including poorer communities with a higher percentage of indigenous population.

Crucial for the programme's capacity to adapt were political and financial support, good data availability (of social and environmental data), an environment that encouraged experimentation, and the active participation of stakeholders and external evaluators in the monitoring, evaluation and adaptation of the scheme.

Location	Forest areas relevant for water quality and quantity, Mexico
Geographical scope	2.3 million ha
ES recipients	Mexican National Forestry Commission (CONAFOR)
ES enhancers	Landowners
Intermediary	–
Further information	Sims K.R., Alix-Garcia J.M., Shapiro-Garza E., Fine L.R., Radeloff V.C., Aronson G., Castillo S., Ramirez-Reyes C., Yañez-Pagans P. (2014). Improving environmental and social targeting through adaptive management in Mexico's payments for hydrological services program. Conservation Biology 28(5), pp 1151–1159.

Annex A.14 The Vittel PES scheme (France)

Overview

The Vittel PES scheme in northeast France is a clear example of how time- and resource-intensive the process can be of building mutual trust and of developing a common understanding on measures and compensation when setting up a successful PES scheme. France has a relatively strict regulation for water that carries the label 'natural mineral water', stipulating that drinking water carrying this label cannot undergo treatment other than the removal of unstable natural elements (e.g. iron, manganese). A stable water quality thus has to be achieved naturally, and for companies producing natural mineral water a high business risk is associated with water quality.

Faced with a slow decrease in water quality, in 1989 the de la Motte family (then owners of the brand Vittel) commissioned an intensive, four-year action research on the history, geography and socio-economy of the farmers in the catchment, which also modelled involved farmers. A ten-year-long participatory process of negotiation and trust-building was necessary to overcome conflicts, to agree on how to calculate the cost of introducing changed management measures and to agree on how to set compensation levels.

An important step in the negotiation was the creation by Nestlé Waters (the new owner of Vittel) of Agrivair, an organisation located close to the farmers and which acted as an intermediary, which helped overcome the lack of trust. As a result of the negotiation, 30-year-agreements were settled with every individual farmer, which required the implementation of alternative practices and included compensation as well as financial support and free technical assistance. Farmers were encouraged to modify their practices with the aim that the adjustment be of a definitive, structural character. Farmers participating in the scheme can receive 200€/hectare/year during a five-year transition period. New equipment is supported with up to 150,000€ per farm.

Monitoring plays an important role in the scheme. Agrivair monitors farming practices, including farm accounts (for which it is granted a special right in the PES contracts). Nitrate levels were monitored throughout the basin until 2004, since when chemical inputs are no longer applied. Water quality is monitored on a daily basis by Nestlé Waters. A 2006 evaluation of the scheme showed that by 2004, 92% of the sub-basin was protected, and 1,700 ha of maize had been converted. As a side effect of the scheme, the amount of farms diminished from 37 to 26 and the average farm size increased to 150 ha, because extensive farming practices required additional land.

Lessons learned/main challenges

A review (Perrot-Maître, 2006) identified the following conditions for the success of the scheme: (a) the long-term participatory process preceding scheme implementation, (b) a thorough understanding of the position of farmers regarding land tenure and debt, (c) the substitution of old technical (and social) support networks.

Location	Vittel, northeast France
Geographical scope	1,700 ha
ES recipients	Nestlé Waters
ES enhancers	Land owners and managers (farmers)
Intermediary	Agrivair
Further information	Perrot-Maître, D. (2006). The Vittel payments for ecosystem services: a "perfect" PES case? International Institute for Environment and Development, London, UK. pubs.iied.org/pdfs/G00388.pdf TEEB (The Economics of Ecosystems and Biodiversity), 2011. Rewarding benefits through payments and markets; chapter 5, in: ten Brink, P. (Ed.), TEEB in National and International Policy Making. Earthscan, London. Perrot-Maître, D. (2013). The Vittel Case: A public - private partnership in the mineral water industry. FAO Case studies on Remuneration of Positive Externalities (RPE) / Payments for Environmental Services (PES). www.fao.org/fileadmin/user_upload/pes-project/docs/FAO_RPE-PES_Vittel-France.pdf

Annex A.15 The PES scheme Pumlumon project (UK)

Overview

The Pumlumon project is a good example of an agri-environment scheme with a tailor-made constellation of ES recipients, ES enhancers and an intermediary. This intermediary, the Montgomeryshire Wildlife Trust (MWT), initiated the project and assumed a both powerful and flexible role, which included the facilitation of negotiations between private actors, public agencies, NGOs and land managers, the transfer of payments, and monitoring and evaluation. Furthermore, MWT worked to secure funding from outside the PES scheme (by the Welsh Government) through habitat-based payments issued to farmers engaged in the scheme. The bundled PES scheme incentivises landowners to provide multiple ecosystem services, including carbon storage, recreation, reduced flood risk, improved water quality and wildlife habitat. These services are delivered by restoring peat land, changing grazing patterns in the restored ecosystem and reconnecting habitats.

The project has engaged over 250 farmers and 15,000 inhabitants from 11 local communities in the Cambrian Mountain range. It has promoted scheme awareness among residents and tourists using stakeholder participation and with the installation of a 10 km audio-guided e-trail through the restored habitats. Service delivery is demonstrated to funders using scientifically validated monitoring of impacts on plant community composition, vegetation mapping and monitoring of water quality and depth.

Lessons learned/main challenges

The project had been in place for nearly 10 years in 2014, the time of the most recent evaluation. Stakeholders were in general satisfied with the scheme's achievements. Challenges encountered included securing sustainable funding and engaging farmers in an appropriate way.

Location	Cambrian Mountain range (Wales, UK)
Geographical scope	40,000 ha
ES recipients	A number of different wildlife trusts and other small scale funding institutions
ES enhancers	Land owners and managers (farmers, forestry)
Intermediary	Montgomeryshire Wildlife Trust (MWT)
Further information	Department for Environment, Food and Rural Affairs (DEFRA) (2013). Payments for Ecosystem Services: A Best Practice Guide. URS 6-8, Greencoat Place, London. www.gov.uk/government/uploads/system/uploads/attachment_data/file/200920/pb13932-pes-bestpractice-20130522.pdf Department for Environment, Food and Rural Affairs (DEFRA) / Alison Millward Associates (2014): DEFRA PES Pilot Evaluation of the Pumlumon Project 2014. An Alison Millward Associates report. Birmingham, 07.05.2014. www.assembly.wales/en/bus-home/committees/sustainable-land-management/Pages/pumlumon-project.aspx

Annex A.16 The 'Upstream Thinking' PES scheme (UK)

Overview

The Upstream Thinking project is a PES scheme between South West Water (a private water utility) and farmers in the Tamar river basin in southwest of England. It is managed by the Westcountry Rivers Trust (WRT), a local charity promoting integrated catchment management. In addition to the WRT's work as an 'ethical broker', regulatory intermediaries ensure that baseline regulation is met and thus that the ecosystem services paid for within the scheme are additional to regulatory requirements. This is to avoid the 'moral hazard' of rewarding heavy polluters, i.e. the risk that PES payments would pay to reduce pollution that should be tackled through existing regulations. In the Upstream Thinking project, the regulatory intermediaries are the Environment Agency and other UK regulatory agencies. Independent technical and knowledge providers – legal advisors, planning and building consultants and university based researchers – also provide necessary information such as values of ecosystem services provided, maps, adequate costing, etc.

The scheme aims to reduce agricultural pressures through improved land management, in order to preserve raw water resources for drinking water and reduce treatment costs for public water supply. Two key pressures are targeted: drained moorlands (which have reduced water storage capacity) and diffuse pollution (nutrients, pesticides, sediments and faecal microorganisms) from intensive livestock farming. The scheme was initiated when South West Water sought to ensure reliable and sufficient water supply in a strategic supply area by building a reservoir estimated to cost around £ 90 million. It was assessed that the alternative of restoring upland function by blocking drainage ditches on the moorland – which slows down the water flow and increases the time water takes to get to the river – only required £ 5–10 million. The scheme is based on the willingness of drinking water users to pay for the protection of water resources beyond minimal regulatory requirements set by the government. An evaluation of the benefits from ecosystem services of restoration in one of the catchments included in the Upstream Thinking PES has shown that the benefit-to-cost ratio of restoration work was 109 (£ 65 million in benefits versus £ 0,6 million in costs).

Multiple benefits are commonly sought. A visualization tool based on participatory ecosystem services mapping has been developed to prioritise land-use change in different areas. These ecosystem service maps have been developed to be informative at the scale of the whole catchment and, when combined, reveal that there are many multifunctional areas of land delivering multiple ecosystem services. The five broad services mapped are: provision of water quality and water resources, regulation of climate gases, provision of habitat and ecological networks, and provision of adequate recreation.

Measures with farmers include the establishment of an Integrated Farm Resource Management Plan which sets out the specific changes in land use and agricultural practices to be implemented. These include for example on-going technical advice, capital works (e.g. wastewater and rainwater collection), and annual payments for land abandonment (e.g. buffer strips, wetland creation). There are also parallel initiatives funded by South West Water and delivered with other partners which focus on the restoration of peat moorlands in upland catchment areas and restoration of floodplain wetlands.

Payments are based on action through the provision of improved farm infrastructure and agricultural practice. Longevity is ensured through a 10- or 25-year contract (based on the economic life of farm infrastructure improvements) and restrictive covenants that specify conditions for improved farm infrastructure usage and specific land-management practices. Payments have in some cases been offered through reverse auction, in which farmers bid for funds from South West Water to support those capital investment projects that provide most environmental benefit.

The PES should be seen as an additional instrument to protect water resources from agricultural activities in the context of the Tamar river basin. First, appropriate advice can be used to encourage uptake of best land-management practices where there are win-win situations for the farmer and the environment. Second, a number of regulations imposing certain land-management practices on farmers exist, such as cross-compliance (minimum land management) requirements in exchange for European agricultural subsidies, adoption of certain practices in areas vulnerable to nitrogen pollution, and restrictions affecting areas important for the provision of drinking water. It is only in a third stage that incentives such as those provided by the PES scheme incentivise land management practices; they do so where the previously listed mechanisms do not lead to an adequate protection of water resources.

Furthermore, the payments through the PES scheme aim to cover environmental services currently not paid for by the market, such as supporting services, regulating services and cultural services. Supporting and regulating services are currently targeted by the Upstream Thinking PES through South West Water investments. Other markets could feed in the PES, e.g. carbon offsetting, harbour dredging (reduced sediment deposition paid for by harbour users), insurance (insurance companies paying for reduced flood risk), and tourism (visitors paying for improved amenities).

Lessons learned/main challenges

An ethical broker can be essential in managing disagreements and conflicts between local actors and establishing appropriate payment systems. Accountability and legitimacy can be brought to the process by ensuring 'additionality' of payments (i.e. payments should be based on actions above regulatory standards) and supporting selection of measures with a strong evidence-based approach. Visualisation tools may be necessary to explain complex concepts of ecosystem services to a non-technical audience.

Location	Tamar river basin, UK
Geographical scope	1,300 ha (target)
ES recipients	South West Water
ES enhancers	farming community
Intermediary	Westcountry Rivers Trust
Further information	Westcountry Rivers Trust (undated). Water – Restoring river catchment function using payments for ecosystem services. www.broads-authority.gov.uk/news-and-publications/publications-and-reports/conservation-publications-and-reports/water-conservation-reports/4.-Water-PES-Guide-A3.pdf Westcountry Rivers Trust (undated). Participatory Ecosystem Services Visualisation Framework. Making effective use of data and evidence to inform catchment management planning. www.northsearegion.eu/media/1472/wrt_ess_visualisation_manual_v1-0.pdf

Annex A.17 The MEKA tool as a PES scheme (Germany)

Overview

The MEKA tool ('Market Relief and Cultural Landscape Compensation for Farmers') in the German state of Baden-Württemberg is a good example of a public payment scheme that promotes water and soil quality in combination with biodiversity. In the scheme, farmers who chose to implement selected measures from a catalogue of environmentally friendly farming measures are financially compensated. Measures have to be implemented over five years as a minimum.

The financing of the programme is guaranteed partly through the European Regional Development Fund (ERDF), partly by the German Federal Ministry of Food and Agriculture and partly through the water abstraction charges raised on state level. Since 2011, investments enhancing water quality or quantity in the area can lead to a discount in water abstraction charges levied. Over the years, the programme has lead to a significant reduction in nitrate contamination of groundwater bodies.

Lessons learned/main challenges

Initially high transaction costs, monitoring and enforcement.

Location	State of Baden-Württemberg, Germany
Geographical scope	Entire state of Baden-Württemberg, Germany
ES recipients	State of Baden-Württemberg, Germany
ES enhancers	Land owners and managers (farmers, forestry)
Intermediary	Waterboards, including landowners and land managers (mostly farmers)
Further information	Müller-Gulland, J. Lago, M. (2011): WP3 EX-POST Case studies Water Abstraction Charges and Compensation Payments in Baden-Württemberg (Germany). EPIWATER Evaluating Economic Policy Instruments for Sustainable Water Management in Europe (2011). Deliverable no. D3.1 – Review reports 15.11.2011. ecologic.eu/sites/files/publication/2015/abstraction_charge_and_compensation_payments_baden-wurttemberg_revised.pdf

Annex A.18 The EcoTender and BushTender Programmes (Australia)

Overview

The EcoTender and BushTender Programmes in Victoria, Australia, are examples of a less common PES setup, in which the relationship between ES recipients and ES enhancers is formed through a competitive tendering procedure and the level of remuneration is established through reverse auction. Both schemes aim to improve ecosystem services at local and catchment scale by implementing land management measures (e.g. management of grazing, invasive herbivores, weed control, fire prevention, revegetation, etc.) and (re)establishing native vegetation on private land.

Tender procedures include a call for expressions of interest by the Victoria State Government. The expressions of interest are followed up with on-site assessments and the development of management plans together with land managers, which then enter a second phase of bidding. Bids are assessed based on the estimated contribution to desired environmental changes (including biodiversity, reduced soil salinisation, water quality and quantity, carbon storage), the expected significance (value of assets affected by proposed interventions) and the cost. Those bids offering the best value for money are selected, and the State of Victoria enters into contracts of three to six years with the land managers. Payments are conditional to yearly reports submitted by ES enhancers.

Lessons learned/main challenges

BushTender and EcoTender have significantly enhanced ecosystem services on private land. The competitive bidding procedure is a successful way of ensuring a targeted and efficient spending of public resources.

Location	State of Victoria, Australia
Geographical scope	State of Victoria

ES recipients	Government of Victoria (now taken over by regional organizations, such as catchment authorities and landcare management networks).
ES enhancers	Land owners and managers
Intermediary	–
Further information	Department for Environment, Land, Water and Planning, Victoria State Government (undated). EcoMarkets – valuing our environment. Information brochure. www.environment.vic.gov.au/__data/assets/pdf_file/0034/49858/4397-DSE-Introduction-Brochure-Final.pdf

Annex A.19 The PES programme 'Paddy Land-to-Dry Land' (China)

Overview

The Paddy Land-to-Dry Land (PLDL) programme is an interesting example of a PES scheme which combines water quality and quantity objectives, and which underwent a revision process in which changes in the livelihood of participating households and unintended ecosystem impacts were documented (the shift to dry-land corn cultivation was accompanied with an increase in fertiliser input) and compensated for.

The PLDL programme started in 2006 and had the purpose of enhancing water quality and quantity of the Miyun surface water reservoir supplying the city of Beijing. The programme's basis was an administrative agreement between the city of Beijing and two municipalities in the Heibei province, in which Beijing committed to compensate farmers for converting rice paddies into dry land. Most participants of the PLDL programme switched from rice paddies to corn fields. The compensation per ha was calculated based on market land-use values, resulting in a payment per converted ha equalling 1.2 times the opportunity cost incurred for planting corn instead of rice. Costs for downstream beneficiaries were the costs of the direct compensation payment (approx 1,031 USD/ha) plus the transaction and administrative costs of running the programme (approx. 132 USD/ha). A comparison of hydrological data and household survey data showed that the benefits for water quality and quantity created by the PLDL program outweighed the costs of reduced agricultural output (overall benefit-cost ratio = 1.5). Due to the PLDL programme, 6,870 ha of rice paddies were converted into dry-land crops between 2006 and 2010. The increase in water yields was 5% of the average runoff in Miyun Reservoir as measured between 2000 and 2009, and estimations show that nutrient loads decreased by 10.36 tons/year of total nitrogen and 3.34 tons/year of total phosphorus.

As an unintended side-effect of the PLDL programme, however, fertiliser application per ha increased in participating households. Although the overall nutrient load of water reaching the Miyun reservoir still decreased (due to the relatively lower nutrient export from dry agriculture in comparison with paddy land), other negative environmental impacts associated with an increased fertilizer application ensued (including soil acidification, greenhouse gas emissions, etc).

Lessons learned/main challenges

This PES demonstrated the importance of adapting PES schemes to livelihood changes, which can alter the total effect of a programme by causing changes in an area's economic structure (doubling of income from 2006–2010 in participating and non-participating households alike, changes in prices of agricultural goods) or in other natural capital assets (e.g. increased fertilizer application). Furthermore, the project showed how inter-sectoral and inter-provincial upstream-downstream coordination was crucial for establishing PES contracts.

Location	Heibei province and city Beijing, China
Geographical scope	6,870 ha in two municipalities in the Heibei province
ES recipients	City of Beijing
ES enhancers	Farmers in two municipalities in the Heibei province
Intermediary	Province of Heibei
Further information	Zheng,H., Robinson, B.E., Liang, Y.-C., Polasky, S., Ma, D.-C., Wang, F.-C., Ruckelshaus, M., Ouyang, Z.-Y., Daily, G.C. (2013). Benefits, costs, and livelihood implications of a regional payment for ecosystem service program. PNAS vol. 110, no. 41, pp 16,681–16,686. www.pnas.org/content/110/41/16681.full.pdf

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