Chapter 2

Valuing and Managing Watershed Services

Understanding connections is critical to developing payment schemes for watershed services. Payment schemes have to link watershed management to downstream impacts, and therefore the interests and motivations of upstream and downstream stakeholders. Values for watershed services have to be linked to decision-making in watersheds. There are key issues that must be understood before these connections can be used to construct a payment scheme. How does watershed management relate to sustainable use of watershed services, and how can the condition of watershed services be monitored? These are critical questions because identifying the cause-and-effect links between watershed management and changes in the delivery of watershed services is a fundamental building block of payment schemes. Who are the beneficiaries of watershed services, and who are the suppliers or providers of services? Creating economic incentives for watershed management demands that the influence of values for watershed services on the choices and behaviour of these stakeholders is understood. Connecting watershed management to valuations for watershed services and to decision-making helps to build a case for payment schemes. Raising interest, awareness and understanding of these connections is vital to ensuring that paying for watershed services can be justified to stakeholders.

2.1 Linking land and water use to downstream benefits

The relationship between the condition of ecosystems in a watershed and its capacity to provide watershed services is fundamental to the concept of payments for watershed services. It is the basis for linking the needs and welfare of downstream users of water or aquatic resources to the actions of managers responsible for upstream waterways, vegetation cover, soil use and land management. It is what links the economic interests of downstream fishers, irrigators, dam operators and water supply companies to decision-making by distant upstream farmers, foresters and land-use planners. Recognition of the downstream benefits of watershed services is the motivation for trying to influence decision-making and management upstream. Schemes supporting payment for watershed services are designed as one means of using economic incentives to influence how watersheds are managed.

"CONNECTING WATERSHED MANAGEMENT TO VALUATIONS HELPS TO BUILD A CASE FOR PAYMENT SCHEMES."

2.1.1 Watershed management

Indicators for watershed services

In identifying approaches for managing watershed services, a useful question to ask is how much of the services needed downstream can be supplied by the watershed? What is the capacity of the watershed to meet the demand for services? Capacity for service provision depends on biotic and abiotic characteristics of the mix of ecosystems in the watershed. Different ecosystems in the watershed (e.g. forests, grasslands, rivers) provide different combinations of services, in different amounts and at different times of the year.

"DIFFERENT ECOSYSTEMS PROVIDE DIFFERENT COMBINATIONS OF SERVICES."

The challenge for managers who have to decide on the optimal mix and intensity of land use in watersheds is to define and quantify indicators to track the delivery of watershed services (see Table 2.1). For example, the capacity of the watershed to provide fish can be measured by maximum sustainable harvest levels, the capacity to deliver water throughout the dry season can be tracked by hydrological parameters and the attractiveness for recreational use can be monitored by the willingness to pay of visitors or potential visitors. It is important to remember, though, that most functions and processes in ecosystems are inter-linked. Thus, to be meaningful, indicators of sustainable use of watershed services need to provide information on both the status and the dynamic interaction between ecosystem components (e.g. land cover) and processes (e.g. water flow).

In preparing the development of a payment scheme for watershed services, sources of appropriate indicators and data need to be identified. The data needs to be acquired and organized into formats useful for the planning, negotiation and monitoring of payment schemes. The type of data required is determined by the criteria chosen for allocating payments and monitoring impacts. Where the availability or quality of data is inadequate, design of the payment scheme will have to include plans for new or improved data collection on a limited set of key indicators and targets.

Photo 2.1 Village led, research discussions on water flows (Thailand).

Table 2.1 Watershed services and examples of indicators of the state of services and sustainable use levels

Watershed services	Service attributes	State indicator	Sustainable use indicator
Provisioning services			
Water supply	• Precipitation, infiltration, soil water retention, percolation, streamflow, groundwater flow • Biotic and abiotic effects on water quality	• Water storage capacity (m^3/m^2) • Pollutant concentrations	• Discharge (m^3/year)
Food provision	• Crop, fruit and livestock production • Edible plants and animals (e.g. fish, algae, invertebrates)	• Agricultural water use (m^3/ha) • Fish stock (kg/m^3)	• Maximum sustainable water use for irrigation (m^3/year) • Net Productivity (kg/ha/year)
Non-food goods	• Production of raw materials (e.g. timber, reeds) • Production of medicines	• Amounts available (kg/ha/year)	• Maximum sustainable harvest (kg/ha/year)
Hydroelectric power	• Flow for energy generation	• Storage capacity of riverbeds and lakes (m^3/km^2) • Slope (deg), elevation (m)	• Maximum sustainable energy production (kWh/year)
Regulating services			
Regulation of water flows	• Retention of rainfall and release (especially by forests and wetlands) • Water storage by rivers, lakes and wetlands • Groundwater recharge and discharge	• Infiltration capacity (mm/h) • Water storage capacity of soils (m^3/m^3)	• Baseflow volume (m^3/year);
Hazard mitigation	• Reduced flood peaks and storm damage • Coastal protection • Slope stability	• Maximum natural water storage capacity (m^3/m^2)	• Size (km^2) and economic value (US$/$km^2$/year) area protected from flooding
Control of soil erosion and sedimentation	• Protection of soil by vegetation and soil biota	• Infiltration capacity (mm/h) • Slope length (m) • Barren land (%)	• Soil loss (kg/ha/year) • Sediment storage (kg/ha/year)
Water purification	• Reduced siltation of streams and lakes • Nutrient uptake and release by ecosystems • Removal or breakdown of organic matter, salts and pollutants.	• Nitrogen amount (kg/ha) • Total dissolved solids (kg/m^3) • Electric conductivity (μS/cm)	• Denitrification (kg/ha/year)
Supporting services			
Wildlife habitat	• Wildlife and nursery habitats	• Resident and endemic species (number) • Surface area per ecosystem type (ha)	• Increase or decline in species population size (number)
Environmental Flows	• Maintenance of river flow regime	• Area of critical habitats (ha) • Discharge for each season (m^3/day)	• Fish species and population • Total fish catch (t/year)
Cultural & amenity services			
Aesthetic and recreational services	• Landscape quality and features	• Stated appreciation • Recreational value (e.g. entrance fees (US$/visit)	• Houses on lakeshore (number/km) • Visitors (number/year)
Heritage and identity	• Landscape features or species	• Cultural significance and sense of belonging	• Visitors (number/year) • Pilgrims (number/year)
Spiritual and artistic inspiration	• Inspirational value of landscape features and species	• Books and paintings using watershed as inspiration	

Relating land use and management to watershed services

Having measures of sustainable-use levels for watershed services does not, however, provide enough information to create a payment scheme. Clear targets need to be set for maintaining or improving critical indicators. Once defined, these targets provide a simplified description of the desired state of the watershed. The payment scheme can then be designed to either maintain or restore the target level for a particular indicator.

"TARGETS ARE A SIMPLIFIED DESCRIPTION OF THE DESIRED STATE OF THE WATERSHED."

To create a payment scheme, there are four key questions:

- What should be invested in?
- Where should investments be made?
- How much should be invested?
- Who should be investing?

Answers to the last two questions are discussed in Chapters 3 and 4, respectively. To decide what to invest in and where, knowledge is needed about how the quantity, quality, timing and duration of watershed services responds to changes in the type of land cover, land use and management regimes.

Table 2.2 Simplified relationship between land-cover type and the watershed services they provide[5]

	Land cover type					
Watershed services	Grasslands	Forest	Cultivated land	Rivers & streams	Lakes	Marshes, swamps, foodplains
Provisioning						
Water supply	medium +	medium +	negative	high +	high +	low +
Food	high +	low +	high +	low +	high +	high +
Non-food goods	low +	high +	low +	low +	low +	medium +
Hydropower	medium +	low +	negative	high +	high +	low +
Regulating						
Regulation of flow	medium +	low +	medium +	high +	high +	high +
Hazard mitigation	medium +	low +	medium +	low +	high +	high +
Control of soil erosion & sedimentation	medium + / -	high +	negative	medium +	medium +	medium +
Water purification	medium +	low +	negative	low +	low +	high +
Supporting						
Wildlife habitat	medium +	low +	medium +	high +	high +	high +
Environmental flows	medium +	high +	negative	high +	high +	high +
Cultural and amenity						
Aesthetic & recreational services	medium +	low +	medium +	high +	high +	low +
Heritage & identity	medium +	low +	low +	high +	high +	low +
Spiritual & artistic Inspiration	medium +	high +	medium +	high +	high +	low +

Table 2.2 helps to identify what land-use and land-cover types are most favourable to given watershed services. Comparing columns in the table indicates how the mix of services available shifts as a result of changes in land cover or use. For example, clearing forests to expand the area of cultivated land in a watershed will increase the provision of food and some other products but will change and often reduce the availability of many other services, such as hazard mitigation, control of sediment runoff and wildlife habitat. Payment schemes aiming to maintain a particular watershed service or set of services need to create incentives that prevent changes in land cover that will degrade service provision. Where schemes aim to restore specific watershed services, they need to create incentives that promote change to land uses and management practices that improve provision of these services.

"PAYMENT SCHEMES CREATE INCENTIVES TO IMPROVE PROVISION OF SERVICES."

In the Murray-Darling Basin in Australia, a payment scheme is used to finance restoration of natural vegetation as a strategy for controlling dryland salinization (Case 1).

Case 1 Salinity credits used to finance upstream reforestation in the Murray-Darling Basin, Australia [4]

Widespread land clearing for agricultural development in the Murray-Darling Basin has caused salinization of soils and irrigation water in many areas, resulting in severe loss of agricultural productivity. Clearing natural vegetation means that less water is transferred to the atmosphere, causing the water table to rise and deposit mineral salts in the soil and surface waters. Dryland salinity severely affects 40% of private land managers in New South Wales, and saline water is estimated to affect 15% of irrigated land, with a further 70 to 80% of irrigated land threatened.

In 1999, State Forest of New South Wales (a government agency), entered into a 'Pilot Salinity Control Agreement' with Macquarie River Food and Fibre (MRFF), an association of 600 farmers in the Macquarie River watershed. The agreement provides financing for tree planting as a cost-effective strategy for reducing salinity in river systems. The MRFF purchases salinity credits from State Forests based on water use by restored forests in the upper watershed. Farmers pay US$ 45/ha/year. The funds generated are used for restoring natural vegetation on public and private land. The aim is to restore 40% of the cleared forest, which is necessary to reverse the salinization process.

In reality, it is not possible to simply replace undesirable characteristics of land cover or management with desirable ones. Trade-offs are inevitable. These may be between watershed services, types of benefits and different beneficiaries. For example, planting of fast-growing trees in a degraded area will increase erosion control and reduce downstream sedimentation, but may also reduce water yields. Incomes of land users or employment opportunities may also change.

It is vital that watershed services included in a payment scheme are selected in close consultation with the main stakeholders, and are based on the best available analysis of the potential impacts of proposed changes in land-cover type or management. A useful step to support identification of trade-offs is to describe the various services available from each of the main land-use types or ecosystems in the watershed (e.g. grassland, forest, river, wetland, or lake) in detail, and to then map the spatial distribution of the ecosystems and the main groups of stakeholders involved. Results from the stakeholder analysis (Chapter 4) can then be used to understand how the interests of different groups may be impacted by proposed changes in land cover and management.

Information provision and negotiation among stakeholders are essential to deciding *where* investments financed by payment schemes should be made. The information used by stakeholders in this process has to enable them to agree on what changes in land use or management need to be promoted or avoided by financial incentives. Evidence that relates change to levels of watershed services forms an important basis for creating transparency and trust in the effectiveness of a payment scheme.

"EVIDENCE OF WATERSHED SERVICES IS IMPORTANT FOR TRANSPARENCY AND TRUST."

For certain land use and land cover types the relationships with downstream water flow regimes are well established. For example, soil loss and river sedimentation is reduced in cultivated areas by farming systems using zero-tillage or agroforestry compared to cropping systems that leave the soil bare for parts of the year. Also it is well established that intact old growth forest provides higher water quality.

Thus, there is a well established knowledge base around the link between land use or management practices and water quality and sedimentation.

A more varied picture has emerged around the relationship between forest cover and water quantity. Traditionally many have assumed a universal hydrological 'benefit' from forests for downstream water users. Increasingly, it has been demonstrated that this is not always the case. For example, forest cover in arid and semi-arid areas has negative impacts on the dry season flow available downstream, as water is 'lost' through evapotranspiration. In many cases it is important to establish the relationship between forest cover and water yield before starting with the development of a payment scheme. Where knowledge is inadequate, payment schemes can be undermined by generalized assumptions that can be misleading and result in unintended impacts and unexpected outcomes from changes in land use or management (Box 2.1).

"LOCATION-SPECIFIC ANALYSIS IS CRITICAL FOR SETTING UP PAYMENT SCHEMES."

To make payment schemes for watershed services successful, misunderstandings over relationships between land-use management and watershed services need to be avoided. Careful and location-specific analysis of information on watershed services, land use and management practices forms a critical step in developing payment schemes. The best available data and up-to-date knowledge of how land cover characteristics change watershed function should be brought together. Expert analysis can then provide the evidence base for decisions on actions to be supported by the payment scheme and their likely impacts on watershed services. Where there is not sufficient data, expert panels can be used to analyse and provide a 'best estimates' of likely responses to interventions in land use and management aimed at improving watershed services.

Box 2.1 The impacts of forests on watershed services

There is a widely-held and persistent idea that retaining forest cover is always a good thing and deforestation always a curse for watershed management. This assumption leads, however, to management decisions that do not always work out as expected. In some situations, the real impacts of afforestation or forest removal can be rather different. For example:

- It came as a great surprise to foresters in Fiji when it was discovered that planting fast-growing exotic pine trees to boost timber and paper pulp production from otherwise marginally productive, fire-climax grasslands more than halved dry season streamflows. Water security for numerous villages situated downstream from the forest estate was unintentionally jeopardised as a result.
- Planting exotic trees in sub-humid parts of South Africa is no longer considered a merely positive act because of their detrimental effects on water availability. A 'water tax' is now being charged if such income-generating activities are likely to reduce streamflows.
- Montane cloud forests are known for their very high water production capacity, which has been traditionally ascribed to stripping of water by the forest canopy from frequent fog. It was feared therefore that clearing of cloud forest would cause streamflows to diminish. Recent evidence from Costa Rica has shown, however, that the overall hydrological impact of cloud forest conversion was close to neutral, because reduced cloud stripping was more or less balanced by the lower water use of grassland.

Overcoming assumptions about forest hydrology should not, however, dictate decisions about how forests are used in watershed management. Evidence of the relationship between montane cloud forest and streamflow, for example, should not be taken to mean that cutting cloud forests has no adverse impacts. Erosion and landslide incidence can be expected to increase after conversion, and numerous rare and endemic species would be lost. It is critically important, therefore to include all relevant watershed services when assessing the impacts of change in land cover, not just the effects of forests on streamflows.

"BENEFICIARIES OF WATERSHED SERVICES INCLUDE DOWNSTREAM ECOSYSTEMS."

2.1.2 Who are the service providers and who are the beneficiaries?

Watershed services are provided by land and water managers upstream whose decisions, either individually or collectively, impact on flow regimes and the quality and quantity of water available downstream. The beneficiaries of watershed services are those downstream whose interests and livelihoods depend directly or indirectly on the amount of water available and on the level of sediments, nutrients or other chemicals in the water. Direct benefits of watershed services include, for example, timely availability of high quality water for irrigation or drinking water supply. Indirect benefits include the appropriate flow regime to maintain a downstream wetland that supports a subsistence, commercial or recreational fishery. Thus, beneficiaries of watershed services include downstream ecosystems, and those who use and value those ecosystems.

When designing a payment scheme for ecosystem services, however, such a general definition of service providers and beneficiaries is not adequate. To discover who the relevant upstream and downstream stakeholders are, the water-related problem or security issue must be clearly defined. Downstream stakeholders must then be identified through analysis of who will have sufficient financial interest in particular watershed services to be motivated to pay for their upkeep. Upstream stakeholders should be equally carefully identified, to be sure that those who take part in the scheme and are eventually paid for managing watershed services are actually able to administer the desired controls on the use or management of land and waterways. Upstream service providers must be situated in the targeted areas in the watershed and able to implement decisions that will make a difference to downstream water quality, quantity and flow regime.

Scale is a critical issue in linking watershed services and stakeholders, and thus in designing payment schemes. Downstream beneficiaries may be interested in watershed services that are relevant to large areas – for example provision of sufficient water for hydropower generation. Upstream managers may, however, operate only on very small areas of land and thus individually have almost no influence on the service in question. Design of a payment scheme for watershed services then has to include assessment of the costs and benefits and trade-offs relevant to managers working at such a scale and to mechanisms for ensuring that sufficient impact is possible through collective action to justify payment. For example, using a payment scheme to support maintenance of ecosystem services provided by the upper watershed will put restrictions on use of this area by local stakeholders. The impacts of these restrictions on local livelihoods have to be assessed when planning potential payment schemes.

"PAYMENT SCHEMES HAVE TO REFLECT A COLLECTIVE INTEREST AND CAPACITY TO PAY."

Very different scenarios for payment schemes are possible where there are shifts in the scales relevant to service providers and beneficiaries. For example, large-scale establishment of fast-growing tree plantations for timber and pulp production in areas that do not have sufficient rainfall to support evergreen forest has often led to major reductions in annual and seasonal streamflow available to downstream users.[6] If downstream water users are small-scale irrigators or fishers, any payment scheme would have to reflect their collective interest and their capacity to pay, and perhaps therefore involve public institutions. Thus, in addition to knowing who the upstream and downstream stakeholders are, it is critical to understand how their interests and capacity for action relate to the scale of the desired impacts and action needed in the watershed.

2.2 Valuation of watershed services

2.2.1 Justifying investment in watershed services

Investments in watershed services must be supported by sound economic and financial analysis. Without this analysis, investments are difficult to justify and potential investors are unlikely to be motivated to invest sufficiently. Understanding the economic value of watershed services enables more informed decision-making on investment and development in watersheds. It helps to ensure that decisions are justified in the context of a more complete picture of the values and benefits at stake when water services are impacted by change in a watershed. To better understand the economic value of watershed services, a range of methods can be used.[7] The information derived from such valuation of watershed services helps to determine the true costs and benefits of various land uses and trade-offs involved in deciding between them. Making values for watershed services explicit also helps to motivate people to consider these services in decision-making in the first place. Failure to recognise these values often leads to under-investment in watershed services at the cost of degradation of the entire ecosystem.[8]

"INVESTMENTS MUST BE SUPPORTED BY SOUND ECONOMIC AND FINANCIAL ANALYSIS."

Valuation of ecosystem services is based on the concept of *Total Economic Value* (TEV), which has become a widely used framework for looking at the value of ecosystems. Total Economic Value is typically disaggregated into two categories *use values* and *non-use values* (Figure 2.1). Use value is composed of three elements:

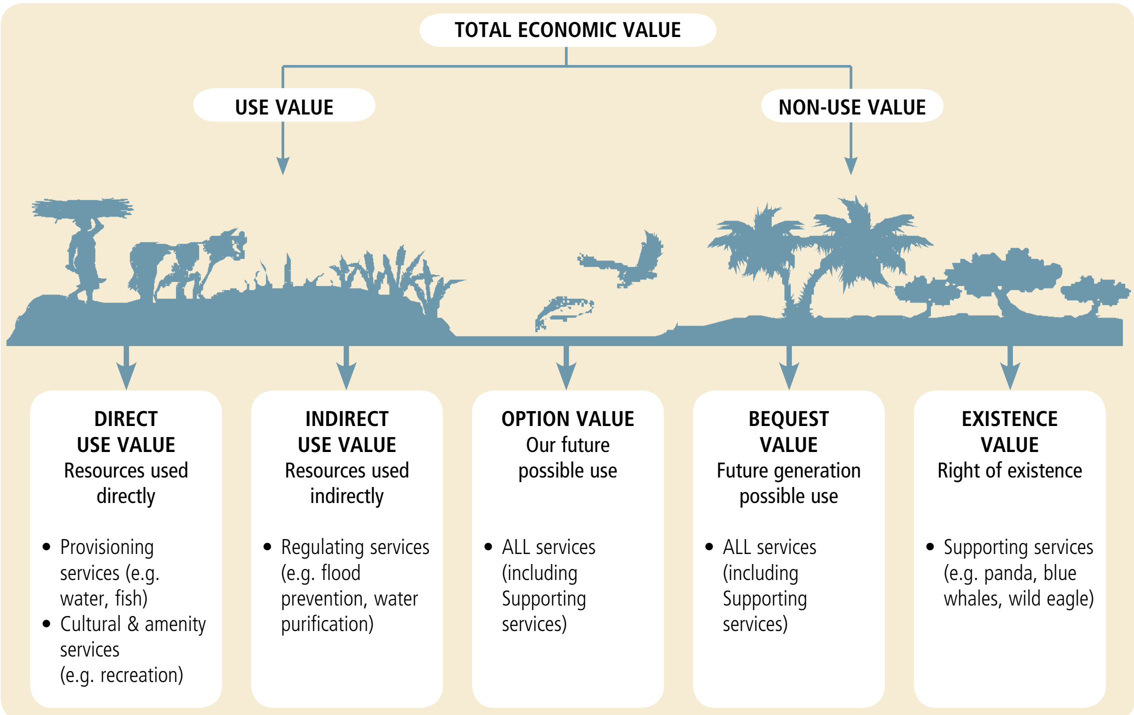
- *Direct-use value*, which is also known as the extractive, consumptive or structural use value, is mainly derived from goods that can be extracted, consumed or enjoyed directly. Examples of these goods include drinking water, fish and hydropower, as well as recreation activities.
- *Indirect-use value*, which mainly derives from the services that the environment provides, including regulation of river flows, flood control and water purification.
- *Option value*, which is the value attached to maintaining the possibility of obtaining benefits from ecosystem goods and services at a later date, including from ecosystem services that appear to have a low value now, but could have a much higher value in future because of new information or knowledge.

Photo 2.2 Downstream fisheries are dependent on quality water derived from upstream watershed services (Barra de Santiago, El Salvador).

Non-use values, on the other hand, derive from the benefits the environment may provide that do not involve using it in any way, whether directly or indirectly, and comprise:

- *Existence value*, which is the value people derive from the knowledge that something exists, even if they never plan to use it. Thus people place value on the existence of blue whales or pandas, even if they have never seen one and probably never will, as demonstrated by the sense of loss people would feel if they ever became extinct.
- *Bequest value*, which is the value derived from the desire to pass on ecosystems to future generations.

Figure 2.1 The Total Economic Value of ecosystems[9]



Investment decisions for development projects in intact watersheds have conventionally focused only on direct-use values and ignored the other components of TEV. As a result, there are many instances where development has ultimately led to the need for restoration of watersheds and watershed services at high cost. In the Netherlands for example, where there is a long tradition of draining wetlands, dikes have been the preferred choice for managing water and preventing flooding. With the protection offered by these dikes, infrastructure, agriculture, housing and industry are now concentrated in former wetlands, and the cost of flooding in these areas is therefore very high. However, as the cost of restoring lost wetlands is much less than the cost of the infrastructure needed to avoid floods, a programme of river restoration has commenced and includes broadening floodplains, (re) creating water retention areas in natural depressions and (re)opening secondary channels of rivers.[10]

"PAYMENT SCHEMES NEED TO RELATE TO THE CHANGES IN THE BENEFITS FROM SERVICES."

Another example of using valuation of watershed services in planning investment decisions comes from New York City (Case 2). New options for investment in infrastructure for water filtration resulted from better understanding of indirect-use values of the watersheds supplying water to the city.

Case 2 Sustainable water management in the Catskill and Delaware watersheds, USA[11]

The Catskills and Delaware watersheds provide New York City's 9 million residents with 90% of their drinking water supply. The watersheds have a population of 77,000 and cover an area of 4,000 km^2. Historically, these watersheds have supplied high quality water, but in the 1980s concerns about pollution increased. In 1989, the United States Environmental Protection Agency initiated a requirement that all surface drinking water supplies had to be filtered. This could be waived if there were existing treatment processes or natural watershed services that provided safe water. In 1992, the City of New York decided to invest in protecting watersheds rather than new water filtration facilities, which would have cost US$ 6 to 8 billion to build and US$ 300 million annually to operate.

The costs of investing in watersheds to maintain and restore natural filtration are much lower. Diverse mechanisms for investment in the watersheds are used. Investment of US$1 to 1.5 billion over 10 years was financed by a 9% tax increase on New York City water bills. In comparison, a new filtration plant would have required a two-fold increase in water bills.

Funds have been used to finance a US$ 60 million trust fund for environmentally sustainable projects in the Catskill watershed. The City has provided US$ 40 million in compensation to cover the additional costs of dairy farmers and foresters who adopted best management practices. Foresters who adopted improved forest management, such as low impact logging, received additional logging permits for new areas. Forest landowners with 20 ha of land or more that agree to commit to a 10-year forest management plan are entitled to an 80% reduction in local property tax. The City is also purchasing development rights for sensitive land near reservoirs, wetlands and rivers at market price. Farmers and forest landowners are able to enter into 10 to 15-year contracts with US Department of Agriculture to remove environmentally sensitive land from production.

Incorporating ecosystem services into decisions on watershed management thus changes the range of options available, and may also change the choices made. Increasingly, it is being shown that options which accommodate sustainable use of multiple ecosystem services are not only more ecologically sound but can also be economically more beneficial.[12] Investments in watershed development and management therefore need to be scaled on the basis of returns measured in terms of TEV. Similarly, payment schemes for watershed services need to be related to the changes in the value of benefits from the watershed services they are designed to maintain or restore. If these values are low, payment may not be justified and a payment scheme may not be an appropriate incentive for sustainable management of watershed services. Awareness of the value of watershed services (Table 2.3) – and the justification for creating incentives – is needed to build understanding and support for payment schemes.

Table 2.3 Estimates of economic values of watershed services[13]

Service type	Service provided	Developed economies (US$/ha/year)	Developing economies (US$/ha/year)
Provisioning services	Water for people Fish/shrimp/crabs Agriculture and grazing Wildlife (for food) Vegetables and fruits Fibre/organic raw material Medicinal plants Inorganic raw material	45 - 7500 200 40 - 520 40 - 520 40 - 470 45 15 - 160	50 - 400 6 - 750 3 - 370 0.02 - 320 1 - 200 1 - 40 6 0.1
Regulating services	Water quality control Flood mitigation Groundwater replenishment Erosion control Carbon sequestration Microclimate stabilization	60 - 6700 15 - 5500 130 - 270 	20 - 1400 2 - 1700 10 - 90 20 - 120 2 - 2000 10
Supporting services	Biodiversity conservation		0.6 - 3600
Cultural and amenity services	Recreation and tourism Cultural/religious activities	230 - 3000 30 - 1800	20 - 260 80

2.2.2 Methods to determine monetary values

There are a variety of approaches used for assessing and quantifying the economic value of watershed services. There is no best method. The choice depends on the context, types of ecosystem services taken into account and funding available for the assessment. However, selecting the approach most suited to a particular assessment should be based on knowledge of the characteristics, strengths and limitations of each method. Detailed explanations of the methods and practical case studies are provided in the WANI toolkit VALUE.[14]

Where constraints on the availability of human or financial resources mean that new valuation studies are not done, values are sometimes taken from previous studies that focused on a different region or time period. However, each decision-making situation is unique, and therefore data obtained from one location may not always be applicable in another place. Thus, caution should be used when applying results from elsewhere to approximate the value of a watershed service in a specific area.

"VALUATION OF ECOSYSTEM SERVICES IS AN IMPORTANT TOOL IN THE PROCESS OF DEVELOPING PAYMENT SCHEMES."

It is also important to consider the scale at which studies are done. Valuation studies undertaken at a small scale (e.g. a small sub-catchment) may underestimate watershed values on a larger scale (e.g. the entire basin), as not all of the downstream effects are considered. However, the larger the scale, the more difficult is the task of assessing the value of watershed services.[15]

The Total Economic Value of ecosystems is a very useful instrument for raising awareness of the importance of ecosystems to human society and for increasing the acceptability of payment schemes. However, to design payment schemes, it is knowledge of the change in benefits to stakeholder groups resulting from changes in watershed services that must guide establishment of appropriate levels of compensation.

2.3 Moving from valuation to setting up a payment scheme

2.3.1 Distinguishing valuations from prices

Valuation of ecosystem services is an important tool in the process of developing payment schemes. Valuations are used to demonstrate the contribution of watershed services to the local and national economy and how payment schemes can be economically beneficial to stakeholders. They help to increase awareness of the existing benefits that water-related ecosystems provide to people, and thus build support among local stakeholders and politicians for the establishment of payment schemes. They also enable a comparison of the economics of payment schemes with other alternatives.

However, valuations do not determine the prices paid by beneficiaries of watershed services to service providers. As in any transaction between contracting parties, prices paid for watershed services under payment schemes are the subject of negotiations guided by the interests and preferences of the beneficiaries and service providers.

"PRICES PAID FOR WATERSHED SERVICES ARE THE SUBJECT OF NEGOTIATIONS."

For downstream beneficiaries, the price they are willing to pay will be measured against the added cost that would result from a detrimental change in the watershed services supplied from upstream. This is the marginal cost downstream of watershed degradation – resulting from loss of benefits or the cost of replacing benefits – and it will not be worthwhile for beneficiaries to pay a price for watershed services that is any higher. For example, dam operators would not pay more to maintain flows in a river than the income they would lose if flows were reduced. Similarly, water utilities would not in principle have an incentive to protect a wetland from destruction if it was cheaper to obtain the same water purification benefits by building a filtration plant.

The price upstream service providers are willing to accept is determined by either the added costs they must bear to increase service provision, or the income they must forego – the opportunity cost – if they elect to give up management practices or changes in land use that degrade watershed services. For example, re-vegetating and excluding cattle from streambanks can help to reduce erosion and downstream sedimentation of waterways, but will increase costs for ranchers upstream, because of re-vegetation works and the need for fencing. A payment scheme offering a price that is lower than these costs will not be attractive to ranchers. Similarly, a payment scheme aiming to provide an incentive for landowners to retain forest on sloping land will have to offer a price that replaces income that would otherwise have been obtained from converting forest to pasture or cropping.

2.3.2 The ingredients of payment schemes

The basic elements of a payment scheme for watershed services are summarised schematically in Figure 2.2. Here, upstream land-use and management practices are related – through a series of steps and using an array of information and data – to payments from downstream service buyers to upstream service providers.

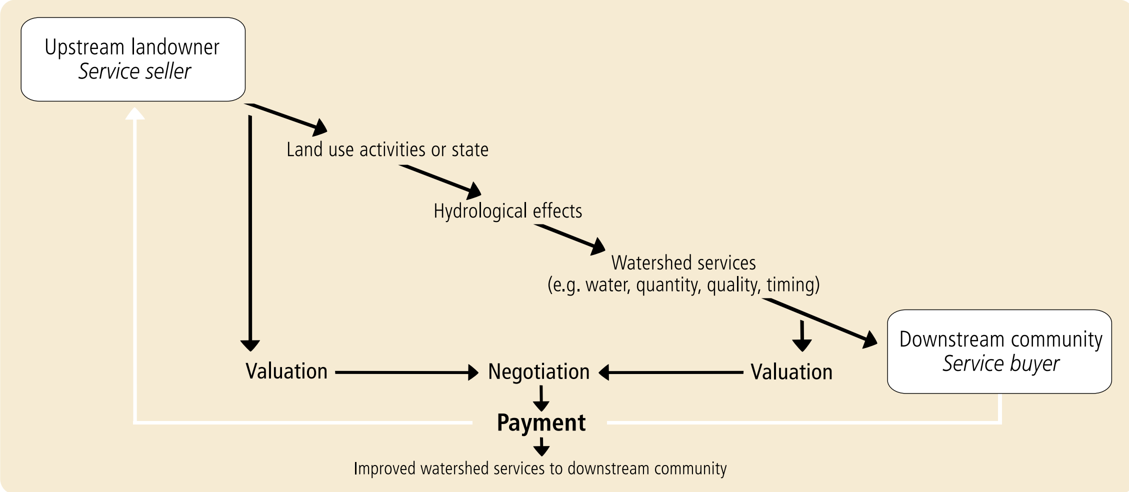
These steps begin with activities (or potential activities) by upstream land users that modify hydrological processes controlling water quality, water quantity and the timing of flows. In turn, these impact the watershed services available downstream, which affect the welfare of individuals and communities and the profitability of industries and business. Where impacts on watershed services are negative (e.g. increased pollution) and where regulations do not impose controls on upstream activities, downstream stakeholders then need to think of options for reducing or counteracting the loss of services they face. They can use valuation studies to compare the costs and benefits of alternate means of restoring or maintaining watershed services. They can then identify which potential solutions are most cost effective. If paying upstream stakeholders to either apply desired management practices or prevent detrimental change in land use proves to be a cost-effective option, then the potential service providers upstream need to evaluate the financial profitability of complying. This can be done by comparing the net profits generated by alternative land uses or management practices, taking into account potential payment schemes.

The economic and financial studies undertaken by downstream service buyers and upstream service providers are used to inform and support the design and negotiations of a payment scheme. These studies help to relate the interests and obligations of stakeholders in a payment scheme to real costs and profitability. Negotiation between the contracting parties then determines the price paid by service buyers to compensate service providers. Economic valuation can thus provide justification for investment in watershed services and enable identification of the most profitable options for delivering needed services. However, social perceptions, political views and bargaining power play a crucial role in complex negotiations among stakeholders over the final prices paid for services. Therefore it is critical to disseminate, as widely as possible, available information relating to existing linkages between land use and water-based ecosystem services, valuation studies and the economic efficiency of undertaking a payment scheme. The aim should be to raise awareness and the interest of different stakeholder groups in participating, and to facilitate the decision-making process.

"SOCIAL PERCEPTIONS, POLITICAL VIEWS AND BARGAINING POWER DETERMINE FINAL PRICES FOR SERVICES."

During negotiations, agreement is also needed on how to cover the costs of the entire scheme, not only the payments between buyers and service providers. Besides the actual payments, there are many other costs involved in setting up a payment scheme. The costs for designing and operating payment schemes (see Chapter 3) should not be underestimated. Preliminary costs include studies to identify watershed services and links with land use, stakeholder consultations, economic valuation studies, etc. Transaction costs include attracting buyers and sellers, negotiations, and monitoring of compliance. Transaction costs are often significant, especially when high numbers of stakeholders are involved.

Figure 2.2 Payments link upstream and downstream stakeholders in watershed services.



2.4 Checklist: building a case for payment schemes

Link upstream land and water use and downstream benefits

- Identify the ecosystem services most relevant to watershed management.
- Establish clear cause-and-effect relationships between land use and the provision of watershed services. Use up-to-date scientific knowledge and, where needed, expert analysis and new data collection.
- Assess trade-offs expected in the watershed because of changes in land-use or management.
- Utilize these relationships and data to select and prioritize locations for intervention.

Use indicators to define baselines and track progress

- Identify indicators for measuring and monitoring watershed services.
- Acquire and organize the data needed to support planning, negotiation and management of a payment scheme.

Understand the needs and capacities of stakeholders

- Identify the major stakeholders in the watershed, including potential buyers and sellers.
- Compare the scale at which watershed services are supplied and the scale of action possible by landholders.
- Undertake analysis of the socio-economic characteristics and interests of stakeholders, to help ensure that payment schemes are appropriate to their needs.

Build a case for investment in watershed management

- Assess the value of watershed services.
- Use information on the values identified to raise awareness of the importance of watershed services and create support for the concept of a payment scheme.

Plan what needs to be done to develop a payment scheme

- Include: a design phase; planning of sustainable financing; negotiation of a fair price between buyers and sellers; establishment of an enabling legal and institutional framework; and processes for building public awareness and leading change.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