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MEETING OF THE PARTIES TO THE CONVENTION ON THE PROTECTION AND USE OF TRANSBOUNDARY WATERCOURSES AND INTERNATIONAL LAKES

Fourth meeting
Bonn, Germany, 20–22 November 2006
Item 6 (b) of the provisional agenda

PAYMENTS FOR ECOSYSTEM SERVICES IN INTEGRATED WATER RESOURCES MANAGEMENT

Submitted by the Chairperson of the Working Group on Integrated Water Resources Management

1. Ecosystems provide a wealth of services that are fundamental for proper environmental functioning and economic and social development. While the demand for these services, including provision of clean freshwater, is continuously increasing, the capacity of ecosystems to provide such services is hampered by their ever-growing degradation, which diminishes the prospects of sustainable development. This has many causes (e.g. economic growth, population growth and further demographic changes), not least the fact that the value of such ecosystem services is often not captured in decision-making. Such decisions tend to prefer investments in water-related infrastructure (e.g. dams for flood control, water filtration plants for drinking water) rather than improving the capacity of water-related ecosystems to, for example, mitigate floods and purify water.

2. At their third meeting (Madrid, November 2003), the Parties decided to include in the 2004–2006 work plan two seminars related to the ecosystem approach in water management: the first on the role of ecosystems as water suppliers (Geneva, 13–14 December 2004) and the second on environmental services and financing for the protection and sustainable use of ecosystems (Geneva, 10–11 October 2005). Government officials and experts from international

organizations, non-governmental organizations (NGOs) and the private sector attended both seminars.

3. As a follow-up to the two seminars, the seminar participants proposed to draw up a code of conduct on payments for ecosystem services in integrated water resources management for endorsement by the Working Group on Integrated Water Resources Management and final adoption by the Parties to the Water Convention at their fourth meeting in November 2006.

4. At its second meeting, the Working Group on Integrated Water Resources Management endorsed in principle the recommendations of the draft code (ECE/MP.WAT/WG.1/2006/3) on the understanding that the outcome of the discussion during its meeting and further suggestions for amendments and additions by representatives of the Parties to the Water Convention would be incorporated, and that the document, which sets out policies, principles and procedures, would be given another title.

5. The thus amended document, entitled “UNECE Rules on payments for ecosystem services in integrated water resources management” consists of a set of strategic, rather than technical, recommendations for the various steps involved in the establishment and operation of various schemes for payments for ecosystem services (PES) and a set of other annexes, which are of a technical nature: annex I on guidance for the decision-making process in PES establishment, annex II on valuation of water-related ecosystem services, annex III on types of PES arrangements and financial arrangements, annex IV on examples of PES schemes applied in the UNECE region, and annex V on recent decisions of high-level meetings in support of PES.

6. The Meeting of the Parties may wish to:

(a) Examine and adopt the “UNECE Rules on payments for ecosystem services in integrated water resources management”;

(b) Express its gratitude to the Swiss Federal Office for the Environment for its leadership in the development of the UNECE Rules and the financial contributions made;

(c) Express its appreciation to the representatives of the Swiss Federal Office for the Environment; the designated experts from Finland, Germany, Hungary, Italy and the Netherlands; the representatives of the UNECE Timber Committee secretariat; the United Nations Environmental Programme (UNEP); the Food and Agriculture Organization of the United Nations (FAO); the Ramsar Convention secretariat; the World Conservation Union (IUCN); the Liaison Unit of the Ministerial Conference on the Protection of Forests in Europe (MCPFE); the Regional Environmental Centre for Central Asia (CAREC); WWF; and the Water Convention’s secretariat for the substantive work done;

(d) Invite relevant organizations and forums, such as the UNECE Timber Committee, UNEP, FAO, OECD, the Ramsar Convention on Wetlands, MCPFE, the Convention on Biological Diversity, the Council of the Pan-European Biological and Landscape Diversity Strategy (PEBLDS), the Regional Environmental Centers, IUCN, and WWF and other NGOs, to consider the UNECE Rules on payments for ecosystem services in integrated water resources management as a tool for the implementation of the relevant parts of their programmes of work;

(e) Review at their fifth meeting the experience in the application of the UNECE Rules on payments for ecosystem services in integrated water resources management and decide, if need be, to update these UNECE Rules in the light of the practice and lessons learned (see document ECE/MP.WAT/2006/3); and

(f) Request the secretariat to print and distribute this document as widely as possible.

UNECE RULES ON PAYMENTS FOR ECOSYSTEM SERVICES IN INTEGRATED WATER RESOURCES MANAGEMENT

Contents

INTRODUCTION

Payments for ecosystem services (PES) have the potential to be an environmentally effective, economically efficient and socially equitable tool for implementing integrated water resources management (IWRM). PES schemes complement other approaches, such as command-and-control and structural measures.

The UNECE Rules brought forward in this document reflect good practices in order to support Governments at all levels of decision-making (global, regional, transboundary, national and local) in the implementation of PES. They also address joint bodies, such as international river and lake commissions, and other appropriate institutional arrangements for cooperation between riparian countries.

These UNECE Rules should also guide other actors, such as suppliers and users of ecosystem services, in the protection, restoration and sustainable use of water-related ecosystems and the establishment of PES.

One of the UNECE Rules' basic functions is to serve as a point of reference, particularly until such time as Governments have adapted their national legislation and applicable bilateral and multilateral agreements on transboundary waters.

These UNECE Rules were specifically prepared to assist Governments, joint bodies and other actors in the UNECE region. However, they could also be applied, as appropriate, in other regions.

The UNECE Rules are not legally binding, and they do not supersede the legal obligations arising from the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) or other agreements on transboundary waters.

Governments and other actors are encouraged to apply the UNECE Rules according to their needs and conditions.

I. OBJECTIVES

The main objective of these UNECE Rules is to provide guidance on the establishment and use of PES to implement IWRM through the promotion of the protection, restoration and sustainable use of water-related ecosystems at all levels, from local to transboundary.

The UNECE Rules are intended to provide guidance in the further implementation of the provisions of the Water Convention and its related Protocols to prevent, control and reduce impacts, whether transboundary or not, on the environment, including human health and safety, taking into account biodiversity conservation and restoration.

These UNECE Rules specifically intend to support the establishment of well-designed PES schemes and thereby to:

(a) Raise awareness among all stakeholders, including landowners, land users and water users, of the benefits of using PES to protect, restore and sustainably use water-related ecosystems;

(b) Improve the quality of, and facilitate the integration of, relevant policies at all levels and sectors pertaining, among other things, to agriculture and forestry, urban development, water, energy and transport, thereby promoting efficiency, effectiveness and equity;

(c) Take into account of the value of ecosystems and contribute to the establishment of markets for ecosystem services (see annexes II and III); and

(d) Broaden and diversify the financial basis for ecosystem protection, restoration and sustainable use.

The UNECE Rules also intend to improve the overall framework for the protection, restoration and sustainable use of ecosystems and their services by present and future generations. They are an important contribution towards achieving the Millennium Development Goals (MDGs), the targets of the Johannesburg Plan of Implementation, and more generally the recommendations of Agenda 21. They also contribute to achieving the goals of multilateral environmental agreements, such as the Convention on Biological Diversity, and promote synergies and interlinkages among them.

II. DEFINITIONS

For the purpose of these UNECE Rules,

"Ecosystem" means a dynamic complex of plant, animal and microorganism communities and their nonliving environment interacting as a functional unit. Ecosystems vary from relatively undisturbed ones, such as natural forests, to landscapes with mixed patterns of human use and ecosystems that are intensively managed and modified by humans, such as agricultural land and urban areas.

"Water-related ecosystems" means ecosystems such as forests, wetlands, grasslands and agricultural land that play vital roles in the hydrological cycle through the services they provide.

"Ecosystem services" means the benefits people obtain from ecosystems. These include *provisioning services* such as food, water, timber and fibre; *regulating services* that affect climate, floods, disease, wastes and water quality; *cultural services* that provide recreational, aesthetic and spiritual benefits; and *supporting services* such as soil formation, photosynthesis and nutrient cycling.

"Water-related ecosystem services" means such services as flood prevention, control and mitigation; regulating runoff and water supply; improving the quality of surface waters and groundwaters; withholding sediments, reducing erosion, stabilizing river banks and shorelines and lowering the potential of landslides; improving water infiltration and supporting water storage in the soil; and facilitating groundwater recharge. Water-related ecosystem services also

include cultural services, such as recreational, aesthetic and spiritual benefits of forests and wetlands.

"River basin" means the area of land from which all surface runoff flows through a sequence of streams, rivers and possibly lakes into the sea at a single river mouth, estuary or delta, or the area of land from which all surface runoff ends up in another final recipient of water, such as a lake or a desert.

"Sub-basin" means the area of land from which all surface runoff flows through a sequence of streams, rivers and possibly lakes to a particular point in a river, normally a lake or a river confluence.[1]

"Payments for ecosystem services (PES)" means a contractual transaction between a buyer and a seller for an ecosystem service or a land use/management practice likely to secure that service.[2]

"Local" refers to all relevant levels of territorial unit below the level of the State.

"Institutional arrangements" means arrangements among legal persons having public responsibilities or functions or providing public services. Such legal persons include national and local ministries and agencies, joint bodies for transboundary cooperation, and institutions of regional economic integration organizations.

III. SCOPE

These UNECE Rules apply to payments for water-related ecosystem services.

They mainly deal with forests, wetlands and grasslands as the main ecosystems, which can provide water-related services. Other ecosystems, such as agricultural land and urban areas, also affect the water cycle within the basin and are referred to.

The UNECE Rules laid down in this document cover the following types of PES schemes: public, private (self-organized) and trading schemes. These schemes are described in section C of chapter V and in annexes III and IV.

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[1] Synonyms commonly used for basins and sub-basins are "catchment" and "watershed".

[2] The term "payments for ecosystem services" is not universally adopted. Depending on the cultural and political context, other terms such as "recompense", "compensation" or "reward" may be used. PES projects are also referred to as "improved management of hydrological resources" or "reciprocal arrangements". Payments for ecosystem services are sometimes called "incentive-based cooperative agreements", "stewardship payments", "compensatory schemes" or even "performance payments".

IV. WATER-RELATED ECOSYSTEM SERVICES

A. Water management problems and links with ecosystem services

In river basins, their sub-basins or the recharge areas of groundwaters, various water uses may compete or even be in conflict with each other, thus creating management problems, particularly if water is scarce and/or its quality is deteriorating. Knowledge about economic development patterns is important for understanding how water management problems may worsen in the future. Examples of water management problems include competing forms of water use in a country (e.g. drinking water, water for industry, water for irrigation, and water for the maintenance of ecosystems' functions) and differing upstream-downstream interests of riparian countries (e.g. hydropower production in an upstream country and irrigational water use or navigation in a downstream country). Examples also include the adverse impact of flooding on human health and safety; the effects of excess nutrients, heavy metals and other chemicals in surface water or groundwater on drinking-water use; the effects of pollution by hazardous substances, such as pesticides, on aquaculture; and the effects of suspended and bottom sediments on hydropower production.

To address these water management problems, existing ecosystem services or their enhancement can be helpful. Water-quantity-related ecosystem services, such as flood protection and water regulation (run-off, infiltration, retention and storage), could be provided through forestation, conservation agriculture[3] and flood plain restoration. Water-quality-related services, such as curbing water pollution, could be provided through extensification of (agricultural) land use, integrated pest management; pollution quotas and conversion or restoration of natural land cover. Other water-quality-related services, such as water purification services, can be provided through wetlands' restoration or creation and paddy cultivation. "Bundling" of services may also be considered: for example, water-related services of forested land can be bundled with carbon sequestration; and services of wetlands and flood plains can be bundled with biodiversity services of these forms of land use.

Recommendations

1. Water management problems in a given basin, sub-basin or groundwater recharge area including threats to water quantity and quality, should be identified and listed. All relevant data should be collected, including data on areas of high nature value (e.g. areas that are especially able to deliver ecosystem services). This information is usually available, for example, as part of river basin management plans as well as monitoring and assessment activities.

[3] Conservation agriculture refers to a range of soil management practices that minimize effects on composition, structure and natural biodiversity and reduce erosion and degradation. Such practices include direct sowing/no-tillage, reduced tillage/minimum tillage, non- or surface-incorporation of crop residues and establishment of cover crops in both annual and perennial crops. As a result, the soil is protected from rainfall erosion and water runoff; the soil aggregates, organic matter and fertility level naturally increase; and soil compaction is reduced. Furthermore, less contamination of surface water occurs and water retention and storage are enhanced, which allows recharging of aquifers.

2. The next step is the search for information to find out what was done in the past to address these water management problems and to ascertain what has worked and why a given solution failed. After that, it is necessary to decide which problems should be addressed first.

3. Once priorities have been established, an analysis should be made to see through which measures or combinations thereof these water management problems could be addressed, i.e. exclusively by command-and-control, by command-and-control in combination with an ecosystem solution (e.g. enhancing ecosystem services through changing land use/management practice), by water construction work (e.g. building dams and dykes), by construction of drinking-water filtration plants, or by other appropriate combinations of command-and-control with ecosystems' services and structural measures.

4. If ecosystem services could contribute to solving the water management problem(s), a number of additional activities, outlined below, should be undertaken to lay the groundwork for the establishment of PES.

5. The geographical location and size of the various forms of land use in a basin, such as water bodies, forested areas, wetlands, grassland, agricultural land and urban areas should be identified. Existing land use inventories and soil maps are very helpful in this regard, and the use of geographic information systems could be considered.

6. A further sub-division of land use forms into hydrological units may be necessary. These units are relatively small areas within a river basin that are characterized by a certain type of soil (e.g. sand, silt, clay), a certain type of land use (e.g. coniferous forest, broadleaf forest, pasture, cropland) and a certain groundwater level (e.g. groundwater level within the reach of roots). As hydrological units of the same type have similar hydrological behaviour related, for example, to infiltration, evaporation and water storage, they help to clarify the "hydrological relations" in river basins and are one of the preconditions for determining whether ecosystem services in a given situation can be enhanced by changes in land use, restoration of ecosystems or by management practices.

7. The biophysical relationships (i.e. the interactions in a basin between water, flora and fauna, soil, climate, landscape and the human population and settlements) should be analysed to the extent possible, and the water-related ecosystem services available in the river basin should be identified.

8. It is important to remember that ecosystems services change with time under the influence of factors such as vegetation growth and hydro-meteorological conditions. The use of average data (e.g. mean annual data on precipitation, evapotranspiration, run-off) and/or maximum and minimum values are often insufficient to describe biophysical relationships and ecosystem services, particularly those related to flood control and groundwater recharge. Therefore, real-time data are needed.

9. It is also important to remember that scale effects are important. For example, the area of the basin/sub-basin and/or the area covered by a given form of land use is relevant for an assessment of flood protection services from forest ecosystems or the effect of extensification in agriculture on water quality. The effects of land use changes will be more pronounced if small

sub-basins are considered; in large sub-basins or even transboundary basins, such effects may not be observed easily. In these cases, models to simulate the effects of changing land use or management practice are useful.

10. Apart from scale effects, the specifics of the hydrological regime in basins and sub-basins in arid and semi-arid areas should be taken into account. The effects of a change in land use (e.g. afforestation and rehabilitation of wetlands) or management practice on the quality and quantity of water-related ecosystem services are more evident in the upper mountainous parts of the basin, where the runoff is formed, rather than in the arid or semi-arid lowland parts.

11. Inter- and intra-sectoral cooperation are necessary to gather the needed information, including information about economic development patterns to estimate future pressures on water resources. Such cooperation is crucial for optimizing societal benefits.

B. Economic analysis of water-related ecosystem services

Economic analysis is an essential tool for efficient decision-making regarding the establishment of PES schemes (see section C of chapter V and annex III). It provides a coherent framework that allows a comparison of the costs and benefits of changes in water-related ecosystem services in an integrated manner. It also provides a framework for assessing the distributional incidence of these costs and benefits among relevant stakeholders and the compensation which may be necessary to make sure that projects (such as a change in land use) and the associated use of PES schemes do not cause inequitable outcomes.

Cost-benefit analysis is the traditional tool for guiding decision-making in such matters. However, depending on the information available and the overall circumstances of the evaluation, other analytical tools like multi-criteria analysis,[4] cost-effectiveness analysis[5] and cost-utility analysis[6] may also be useful and appropriate. These tools should be considered within a medium/long-term timeframe, which should be defined.

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[4] Multi-criteria analysis (MCA) is a decision-making tool for a complex situation where overall preferences among options have to be determined and where each option accomplishes several desirable objectives selected by decision-makers. For each option there are predefined “criteria” (e.g. environmental and social indicators) which help to achieve the option. The measurement of these “criteria” need not be in monetary terms. The key output is the scoring, ranking and weighting of these options based on expert judgement. MCA is especially helpful in a context where the monetary valuation of environmental and social impacts is not possible.

[5] Cost-effectiveness analysis (CEA) allows selection among alternative strategies to achieve a given environmental objective by comparing the costs of each strategy (measured in monetary units) with its environmental impact (measured in physical units). It allows ranking of policies (or projects) based on cost-effectiveness ratios in the context of a fixed budget, with the important implicit assumption being that all of these policies (or projects) are worth undertaking or that at least one of the projects must be undertaken.

[6] Cost-utility analysis (CUA) is a tool used to guide decisions concerning the allocation of health services by comparing their costs with the associated health effects in terms of additional life years. But these health effects are converted based on some measure of the personal preferences of (or utility for) persons to be treated (quality-adjusted life-years, or QUALY).

An economic analysis is a multi-step process that should involve:

(a) The identification of the relevant water-related ecosystem services (see section A above);

(b) The identification of the major stakeholders (see section B of chapter V);

(c) The assessment of the net benefits of changes in water-related ecosystem services that would result from a change in the use or management of the ecosystems; and

(d) The analysis and assessment of the distribution of costs and benefits among major stakeholders and the design of any necessary compensation packages.

Recommendations

1. Once the ecosystem services that can address existing or future water management problems have been identified (see section A above), the next step is to value the changes in the identified ecosystem services – that is, to weigh the total net benefits associated with specific scenarios (e.g. the conversion of cropland into grassland, or afforestation). Various valuation methods are available (see annex II), but uncertainties surrounding valuation outcomes may be large and require a precautionary approach (such as setting a safe minimum standard) in the decision-making. A precautionary approach is also mandatory in view of the risk that a change in ecosystem management may create irreversible effects. It is also important to find out whether valuation studies have been made in the past in the same area and for the same services, so that the outcome of previous studies can be used for comparisons and, possibly, for the transfer of benefits. This requires close examination of the previous studies and their overall economic, social and environmental context.

2. In carrying out a valuation exercise, it is important to keep in mind that:

(a) Scale effects are important. Valuation studies for small sub-basins often underestimate ecosystem values on the scale of the entire basin, because not all of the downstream effects are considered. However, the larger the size of the relevant water basin, the more difficult it is to assess the economic value of ecosystem services, and the more caution is needed when using results from model simulations of land use changes;

(b) The results of ecosystem valuation studies are site-specific but could be informative for other locations in the same basin or in a different basin;

(c) The values of many water-related ecosystem services can often be estimated only by means of indirect methods of valuation, because the services are not traded in actual markets. Depending on the method applied, the economic valuation of the same ecosystem service in a given water basin may therefore vary, even though the assessment is based on the same set of environmental and other data. Therefore, if possible, a range of values from different methodologies should be used. This may be comparable to the application of scenario techniques;

(d) Some ecosystem services cannot be easily measured or quantified because the necessary scientific, technical or economic data and/or the necessary budget to carry out a comprehensive and detailed valuation study are not available. In such cases, it may be necessary to adopt values from similar studies, adapting these values to local conditions using appropriate benefits transfer methodologies applied in other studies. In any case, the resulting values need to be treated with caution, and the sensitivity of recommendations to changes in these values derived from benefits transfer procedures should be examined;

(e) Ecosystem benefits that are related to attributes such as human life and safety or are of cultural or religious significance cannot be easily integrated into the economic valuation process. Ecosystem valuation may be inappropriate for addressing issues and qualities that cannot or should not be valued in monetary terms, because doing so can raise serious ethical questions.

3. Comparison of the net benefits of maintaining the status quo with the net benefits associated with the alternative scenarios provides the basis for deciding whether any of the scenarios is worth implementing. The latter will, in general, be the case when the change in net benefits is positive and sufficiently large, taking into account the precautionary principle.

4. It is important to identify who would benefit from the change in ecosystem services and who would bear the costs (i.e. how the costs and benefits would be distributed among the various stakeholders using the services). Concurrently, one can address the issue of project financing and the need for compensation of those groups whose access to natural resources or water-related ecosystem services will be restricted. This assessment should allow for participation by all stakeholders.

5. Valuation should assist stakeholders in negotiations concerning the use of water-related ecosystem services and in reaching an agreement on the price of these services. These negotiations should, to the extent possible, be an expert-informed process driven by potential market partners, taking due account of social and political circumstances.

6. As the value of ecosystem services can change over time, the earlier assessment may need to be revised periodically.

V. ESTABLISHMENT AND OPERATION OF PES

A. Basic conditions and core principles

PES schemes are context-driven (tailored to the context of the specific basin or sub-basin under consideration), as their design is influenced by the ecological, social, economic and institutional conditions prevailing in the area where the scheme is to be implemented. There are basic conditions and core principles for the successful establishment and operation of PES.

(a) Basic conditions

1. To promote the establishment of PES, political support should be created and maintained at all levels and across all sectors. Political support is also needed to adapt legislation, institutional arrangements and policies, where needed, and to provide an attractive political and legal environment for the private sector's participation (see section D below).

2. Potential buyers and sellers should be identified and their willingness to pay and sell, respectively, should be ensured.

(b) Core principles

1. The design and implementation of PES schemes should be considered as an adaptive learning process, taking into account lessons learned from other PES schemes.

2. The contracting parties to a given PES scheme should strive for environmental effectiveness by making sure that the PES scheme contributes to the sustainability of the water-related ecosystem services targeted by the scheme.

3. The contracting parties to a given PES scheme should strive for economic efficiency by making sure that the PES scheme is designed and implemented in the most cost-effective manner. This would include ensuring not only that the net benefits are maximized in the economic analysis, but also that the transaction costs of implementing the PES scheme are minimized. Contracting parties should explore the possibility of taking advantage of any synergies among ecosystem services by creating PES for bundles of ecosystem services (e.g. bundling services related to carbon sequestration or eco-tourism with services related to water retention and regulation) in order to minimize transaction costs.

4. The contracting parties to a given PES should make sure that no social inequities arise from the scheme. They should ensure that at the minimum no stakeholders are left worse off in absolute terms socially than before the PES were implemented, and that the social welfare relative distributive gap between stakeholders is no greater than it was before the PES was implemented.

5. Transparency should be ensured throughout the design and implementation of any PES scheme in order to promote trust between service sellers and buyers. Sharing of information and stakeholder participation in decision-making are imperative for a successful negotiation of PES contracts. The responsibility to ensure compliance with these principles lies with the entity, which administers the PES scheme.

6. The contracting parties to a given PES scheme should also ensure that payments are made only if the agreed terms of the contract are respected.

7. The above steps require monitoring of the ecosystem services (see section A of chapter VI). They also require mechanisms to be built into the PES scheme that allow for a revision of the PES contract.

8. Countries' fulfilment of obligations under transboundary and international agreements should not be conditional upon a payment for services provided by upstream ecosystems.

B. Stakeholder involvement

Policies, programmes and PES schemes are multi-stakeholder affairs involving national and local governments, community groups, individual landowners, commercial enterprises, non-governmental organizations (NGOs) and donors. Making decisions on the most appropriate measures to achieve the objectives of river basin management plans, including the protection of water-related ecosystems, also involves balancing the interests of stakeholders. Therefore it is essential that the decision-making process be open to scrutiny by those who will be affected. Furthermore, transparency contributes to enforceability. The greater the transparency in establishing objectives, deciding on measures and reporting on achievements, the more care stakeholders will take to implement decisions in good faith, and the greater the power of the public will be to influence decision-making and implementation, whether through consultation or, if disagreement persists, through dispute settlement procedures and courts.

Recommendations

1. Policymakers should create favourable conditions for a dialogue at all levels and should facilitate public participation in decision-making, including at the local level, where most action takes place, thus building trust, ensuring ownership and improving cooperation. At the same time, public notification and public participation should be ensured already at an early stage of PES development, when all options are open and effective public participation can take place.

2. A shared vision of the desired conditions for water and other related natural resources needs to be developed. Multidisciplinary teams should be set up and local consultations organized, both involving user groups and other stakeholders, to draw up such a shared vision, embedded in strategies for ecosystem protection and help with implementing water management plans.

3. Involving all stakeholders, including women, ensures ownership, upstream/downstream solidarity and the integration of local experience and traditional knowledge. Thus benefits for local populations, including indigenous people, and effects on economic and social development can be better demonstrated.

4. It is important to recognize that the private sector can make an important contribution, not only financially but also by sharing its wealth of practical experience. Commercial enterprises are important buyers of ecosystem services, as when hydroelectric companies buy "water flow and sediment-free waters" through payments of user fees. They play intermediary roles and provide ancillary services, such as fund management services.

5. In the case of transboundary waters, participation in the work of joint bodies should not be restricted to the Parties to bilateral and multilateral agreements on transboundary waters. Competent NGOs and the private sector should be encouraged to participate. Joint bodies thus become a platform for dialogue and joint action to ensure the protection and restoration of ecosystems and can better serve as a forum for the exchange of information on existing and

planned uses of water and related installations that are likely to cause transboundary impacts, as is stipulated in the Water Convention.

C. Types of PES and financial arrangements

PES schemes have emerged in a multitude of forms related to the contractual arrangements, the methods of charging and payment, and the participation of contracting parties, namely the buyers and sellers of ecosystem services. The general classification of PES distinguishes the following major types of PES schemes: public schemes, private (self-organized) schemes and trading schemes.[7] The type of buyers, i.e. States, public/private utilities, business or others, will influence the type of PES and the type of financial arrangements.

Public schemes are schemes in which a municipality or a local or national government acts as the sole or primary purchaser of a specified ecosystem service or, more commonly, a related land use or management practice. Public schemes may operate at the local or national level. In private (self-organized) schemes, both buyers and sellers are private entities (companies, NGOs, farmers' associations or cooperatives, private individuals). Private self-organized schemes are typically local schemes. Trading schemes refer to the establishment of markets in which established rights (or permits) and/or quotas can be exchanged, sold or leased. The existence of a strong, well-defined and functioning legal and regulatory framework is a prerequisite for trading schemes to operate.

Public and private PES schemes may adopt different financial arrangements regarding the compensation to sellers and the collection of buyers' contributions. The six most common financial arrangements include (for sellers) direct compensation, investment or development funds, and land purchasing and (for buyers) customer-charged payments, lump-sum contributions and tax-based contributions (for details see annex III).

Recommendations

1. Governments should develop explicit policies and strategies for the development and implementation of PES schemes in their diverse forms in the water, environment/nature, agriculture/forestry and (public) utilities sectors. These policies and strategies should also refer to the establishment of PES and other measures to improve ecosystem services under existing and future river basin management plans and IWRM plans (whether transboundary or not), wetland management plans and national forest programmes.

2. Governments should facilitate PES by issuing guidelines relating to the content and registration of PES contracts and entities that manage PES. PES should be considered an incentive for transboundary cooperation and a means for implementation of transboundary agreements; joint bodies could act as the entities that manage PES in a transboundary context.

3. To facilitate the participation of public utilities in PES schemes, Governments should issue specific policies, strategies and guidelines governing their public utilities' participation in PES schemes as potential buyers of ecosystem services.

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[7] See annex III for a more detailed description of types of PES and financial arrangements and annex IV for examples of PES.

4. Governments should encourage the establishment of private schemes by acting, where possible, as facilitators and mediators between potential buyers and sellers in the establishment of private PES.

5. To attract the participation of (public) utilities and private industry, Governments could provide tax incentives (or exemptions) for financial contributions by these utilities and industries to PES schemes.

6. The type of financial arrangement should be clearly stipulated in PES contracts. In the case of direct compensation to sellers, the PES contract should stipulate (a) the land use, management practice or service that is paid for by the PES; and (b) the established rates for that specified land use, management practice or service.

7. Governments should issue norms for minimum finance standards and practices, which PES should fulfil (e.g. balance of income and expenditure accounts, the maximum percentage of income that transaction costs may constitute).

8. Governments should make sure that the above guidance does not impose detailed or specific restrictions on the contents of PES schemes and contracts that may unnecessarily restrict or scare off potential buyers and sellers contemplating entering into PES arrangements.

D. Legal and institutional frameworks

To facilitate the establishment of PES, legally binding environmental standards, judicial and compliance review mechanisms, enforcement procedures and appropriate institutional frameworks should be provided. This is without prejudice to the use of existing or future informal arrangements.

Recommendations

1. For the establishment and operation of PES, Governments should establish appropriate legal frameworks at the national, transboundary and international levels. Appropriate institutional arrangements at the national and local levels as well as joint bodies, such as international river and lake commissions, at the transboundary level should support these legal frameworks.

2. Provisions for the protection, restoration and sustainable use of water-related ecosystems should be incorporated into national laws and regulations, transboundary water agreements and, where appropriate, other international agreements.

3. Legislation should recognize the role of water-related ecosystems in water management, taking into account the fact that water-related ecosystems are both water users and genuine suppliers of ecosystem services.

4. Legislation should be drawn up and applied to reduce fragmentation between, and improve coordination among, government departments and institutions. This requires a clear

definition of the shared responsibilities of institutions responsible for, *inter alia*, planning, water, environment, nature conservation, agriculture, forestry, economy and finance.

5. Legislation should ensure access to information and a participatory approach for the involvement of all stakeholders in decision-making.

6. Sectoral rules and regulations should be harmonized in order to reduce conflicts of objectives and counterproductive incentives. Rules and regulations that subsidize overuse of natural resources and, consequently, lead to decline of ecosystem health should be repealed.

7. Rules and regulations should ensure individual and communal property/usufruct rights/permits for groundwater, surface water and land. Supportive legislative action should cover formalization and registration of rights, land use registers, coordination among departments in allocating rights, and dispute resolution mechanisms.

8. Governments should review and, where appropriate, amend their legislation to ensure that there are no obstacles to the establishment of PES in all their diverse forms and scopes. Existing rules and regulations that may restrict the participation of public utilities in PES schemes should also be amended.

9. Public law, contract and corporate law, and procedural law should all provide a clear framework for the establishment and implementation of PES. Governments should issue guidance on the legal requirements which PES contracts have to meet in order to conform fully with the country's corporate and contract law.

10. Governments should issue guidance regarding the law under which a PES management entity should most suitably be registered in order to be recognized as a corporate entity that can issue and administer the PES contract; the legal/institutional form(s) the entity may take; and the requirements it has to fulfil under the law.

11. Governments should encourage the establishment of private schemes by ensuring that no legal obstacles deter private entities from entering into contractual arrangements to sell or buy ecosystem services or their derived land uses and management practices.

12. When embarking on or promoting trading schemes, Governments should ensure that the preconditions for the legal and regulatory framework – that is (a) clearly defined quotas and rights/permits and (b) and their economic transfer – are met in their legislation as well as in their natural resources management environment. To safeguard the principle of social equity, Governments may set specific regulatory limits and caps on trading.

13. Dispute arising in connection with the interpretation or application of legal agreements implementing PES, whether subject to national or international law, may be submitted to a competent court or tribunal. Therefore, PES administrators should have legal personality for them to have *locus standi*[8] before domestic courts or arbitral tribunals. When, subject to international law, consideration should be given to the possibility of submitting disputes thereof

[8] *Locus standi* means that a given subject has the legal capacity (a) to bring a case before a court as a plaintiff or claimant, and (b) to be brought before a court as a defendant.

to arbitration under the 2001 Permanent Court of Arbitration Optional Rules for Arbitration of Disputes Relating to Natural Resources and/or the Environment. State Parties should ensure the enforcement of awards rendered under such rules.

VI. ACCOMPANYING MEASURES

A. Information needs analysis and monitoring

Developing and implementing a PES scheme tailored to the specific basin or sub-basin under consideration and evaluating its socio-economic impact principally requires two sets of information.

One set of information is related to the functioning of ecosystems and ecosystem services, depending on land use or management practice (see section A of chapter IV). Under the Water Convention, numerous guidelines on monitoring and assessment of water and water-related ecosystems[9] have already been developed which help in setting up such monitoring systems, based on a thorough analysis of information needs, taking into account stepwise approaches if money is scarce.

The other set of information is related to the design, operation and supervision of PES schemes; the effectiveness of the ecosystem service(s) provision of the PES (the ecosystem impact); and the economic efficiency and social equity (the socio-economic impact). Such information is essentially needed to facilitate compliance by sellers with the agreed service provision or land use practice. Such type of monitoring has proven to be one of the most critical aspects of PES schemes, yet it is often very limited or even absent. Monitoring of, and monitoring under, PES schemes also tends to be severely restricted due to cost considerations, as monitoring costs increase transaction costs, which, when high, can easily undermine the economic viability of the PES scheme itself.

Recommendations

1. The monitoring of ecosystem services (e.g. the effectiveness of the agreed land use/management practices in delivering improved ecosystem services) should be recognized as one of the most critical aspects of establishing and operating PES. It is needed to ensure the sustainability of PES, since in the long term buyers may not be willing to pay for a service that has not been measured or proven to exist.

2. Monitoring of the compliance of sellers with the agreed terms of the PES contract should be considered a minimum requirement and a prerequisite for PES schemes.

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[9] See, for example, the UNECE Guidelines on Monitoring and Assessment of Transboundary Rivers, Groundwaters and Lakes, available at http://www.unece.org/env/water/publications/documents/guidelinestransrivers2000.pdf; http://www.unece.org/env/water/publications/documents/guidelinesgroundwater.pdf; and http://www.unece.org/env/water/publications/documents/lakesstrategydoc.pdf.

3. The establishment of monitoring systems for ecosystem services should follow the approaches set out in the "Strategies for Monitoring and Assessment of Transboundary Rivers, Lakes and Groundwaters", including an information needs analysis, developing an information strategy, monitoring and data collection, data management and assessment, and reporting and information utilization.[10] These steps may be adapted, as appropriate, to the specificity of monitoring ecosystem services, particularly regarding the involvement of the appropriate institutions and people, the securing of long-term funding and the use of stepwise approaches, if resources are scarce.

4. Surveys can give preliminary insight into the functioning of the water-related ecosystem. The use of low-cost monitoring techniques and of bio-indicators should also be considered. Local knowledge of the river basin may help in selecting alternative techniques. In the end, monitoring of biophysical relationships and ecosystem services may require remote sensing, modelling and other decision-support systems.

5. Establishing participatory monitoring and evaluation systems with service providers and buyers may be cost-effective alternatives worth exploring and supporting for (small-scale) local PES schemes.

6. Information needs for the design and establishment of PES schemes should be carefully identified and specified for the selected PES scheme. To specify information needs, the information users and the information producers should interact closely. This information needs analysis should lead to clear requirements to monitor/gather information on the economic and social impacts, including poverty impacts, of PES schemes. Information needed on socio-economic aspects includes not only income data but also data related to equity, poverty, livelihoods, conflicts, land tenure and land markets, and local economies.

7. Any information needs analysis should be made, and the resulting monitoring/data-gathering systems should be developed, in partnership with institutions that will use the monitoring results for PES management.

8. The exchange of data and information among upstream and downstream populations, national institutions and other sectors, also in a transboundary context, is crucial and should be free of charge. Reasonable charges for collecting and, where appropriate, processing data or information may be made if the data/information is not readily available.

9. Mechanisms such as clearing houses are to be set up to provide local managers with appropriate information on the protection, restoration and sustainable use of water-related ecosystems.

B. Awareness raising, communication and strengthening of capacities

Policies, strategies and action are shaped through an informed exchange among all stakeholders on the ecosystem approach as a development opportunity and on the benefits that water-related ecosystems can provide to upstream and downstream populations.

[10] See ECE/MP.WAT/2006/12.

To convert the principles of the ecosystem approach into policies, strategies and action, and to set up and implement PES schemes, awareness raising, better communication and capacity building are needed. For example, suppliers need to know the value of their ecosystem services and how much buyers are willing to pay for them. Potential beneficiaries need to know the value of these services and the conditions for continued provision. Environmental education and training programmes can be helpful in building capacity and stimulating public demand for action.

Increasing awareness and understanding of the linkages between ecosystems and the services they can often provide at a lower cost than infrastructure development is important for society at large, for policy makers and for the potential beneficiaries. Taxpayers and water users will be more willing to pay if they know what the payment is intended for and how much they will benefit from ecosystem protection. Greater awareness of, and understanding by, all the concerned parties, including the public and the mass media, is also essential for establishing trust as one of the premises underlying PES schemes.

Recommendations

1. Governments should ensure capacity building with regard to PES in the relevant institutions, in particular local institutions, and joint bodies. Training programmes on the protection, restoration and sustainable use of water-related ecosystems are also needed as part of local and national action programmes.

2. The results of the valuation studies and the economic analysis of water-related ecosystem services should be disseminated as widely as possible in order to raise awareness of alternative and innovative ways of water management. This includes measures to attract the media for information dissemination.

3. Decision-making should involve public participation. This requires that the public be informed about environmental matters, including the protection, restoration and sustainable use of water-related ecosystems.

4. Information should be directed at all levels of society and not merely at those who are already aware of the situation, as is often the case. In particular, efforts should be made to address the younger generation, who are the decision makers of the future.

5. Water engineering, water management and economic curricula should be broadened to develop awareness and skills regarding the protection and sustainable use of ecosystems, including innovative financing mechanisms, and specifically PES.

6. Governments at the appropriate levels should promote initiatives, such as pilot projects, to increase awareness among children from all types of schools regarding water-related problems and ecosystem services. This could include partnerships between “upstream” and “downstream” schools to work on water-related ecological problems.

7. Governments at the appropriate levels should also encourage and support NGOs, associations and other groups in efforts to set up or contribute to the setting up of clearing houses, the organization of "green schools", the holding of thematic competitions, contributions to dedicated websites and other innovative ways to promote a basic understanding of integrated water resources management, the benefits of wetlands and forests for upstream and downstream populations, the protection, restoration and sustainable use of these ecosystems, and the benefits of establishing PES.

8. Governments should draw on the expertise of international organizations in developing the capacity required to design and implement PES.

C. Research needs

Governments, including the Parties to transboundary water agreements, should intensify and promote scientific research carried out by public and private research institutions regarding the biophysical relationships in river basins, the valuation of ecosystem services and the establishment and operation of PES. Pilot projects should also be initiated. This requires allocation of sufficient funds.

Recommendations

1. To better understand the roles and functions of water-related ecosystems and their ability to provide a specific service, research is needed on the relationship between vegetation, soil types, geomorphology, landscapes, land use and management practices.

2. With respect to flood protection services from forest ecosystems and the influence of other ecosystems in the basin, research and pilot projects should be promoted to simulate the effects of land use changes on medium-sized basins (of approximately 500 to 1,500 km^2). The time-dependent flood protection services of forests and effects of other ecosystems can be quantified with an interlocking system of hydrological, hydraulic and economic computer simulation models.

3. Research is also needed on the role and functions of groundwater-dependent ecosystems, such as wetlands, particularly in relation to groundwater recharge, water purification and the ability of these ecosystems to temporarily store water.

4. Research and pilot studies to estimate the economic values of water-related ecosystem services should be promoted in order to make stakeholders and political actors aware of these values and thus improve the quality of political decision-making. Research should reveal the change in economic benefits caused by a change in the ecosystem service provided, rather than the static or stock value of ecosystems as it was in the past.

5. In line with the basic conditions and core principles for PES (see section A of chapter V), further research is also needed on the design of equitable PES schemes as well as the reduction of transaction costs.

6. As eco-tourism is an important service of some water-related ecosystems, research should reveal the benefits generated by healthy water-related ecosystems. There is a need for better understanding of which stakeholders would profit from eco-tourism and which stakeholders should invest in maintaining healthy and attractive to eco-tourism ecosystems. Research should also highlight the profit generated by healthy water-related ecosystems to eco-tourism entrepreneurs (such as providers of accommodation, food and guiding) and the payments, which these private companies make for these services, for example, in the form of taxes.

7. International organizations as well as the public and the mass media should play a role in bringing together and disseminating the results of research.

D. Financing

Political actors, decision makers and managers are increasingly aware of the capacity of PES schemes to mobilize local financial resources through a direct provider-user relationship, and they increasingly recognize the enormous achievement represented by putting ecosystem services at the centre of natural resource management.

Recommendations

1. Parties to transboundary water agreements should urge international financial institutions and regional organizations to allow the establishment of PES schemes or to carry out pilot projects.

2. In addition to the establishment of PES schemes and pilot projects, funds obtained through GEF, the World Bank and bilateral funding agreements should be used for the protection, restoration and sustainable use of water-related ecosystems.

3. Given the private sector’s important role as a potential buyer, its participation in funding public schemes should be explored, particularly in cases where a municipality or a local government decides to undertake and finance upstream activities to improve ecosystem services, such as safe drinking water or a sustainable water flow.

4. For PES schemes to be sustainable, it is important that, even if donors support the setting up of the scheme, they do not provide funds for its core functioning.

5. PES should be viewed as a valuable financing mechanism for implementing national sustainable development strategies and Poverty Reduction Strategy Papers and achieving the Millennium Development Goals.

Annex I

GUIDANCE FOR THE DECISION-MAKING PROCESS IN PES ESTABLISHMENT

Payments for ecosystem services (PES) are a new approach to internalizing the positive environmental externalities associated with ecosystem services. They involve financial transfers from the beneficiaries of these services (i.e. those who are demanding them) to others who are conducting activities which generate these environmental services (i.e. are supplying them). These payment schemes can be designed and introduced in a context where there are already well-defined and measurable links between a certain activity (or conservation practice) and the quantity and quality of ecosystem services. They can also be introduced in a context where there is a change in conservation practice (e.g. land use) which will lead to a change *cum* improvement of ecosystem services.

Although PES schemes can be linked to poverty alleviation strategies, their major objective is to achieve a given environmental goal at least cost, using the market price mechanism.

Part I of this annex presents a flow chart illustrating some questions to be answered and analyses to be carried out before deciding on the establishment of a PES scheme. Part II broadly sketches an integrated framework for analysing the impact of a particular project (e.g. a change in land use) on the quantity, quality and value of ecosystem services and the establishment and operation of PES schemes. The focus is on water-related ecosystem services.

I. A BASIC FLOW CHART

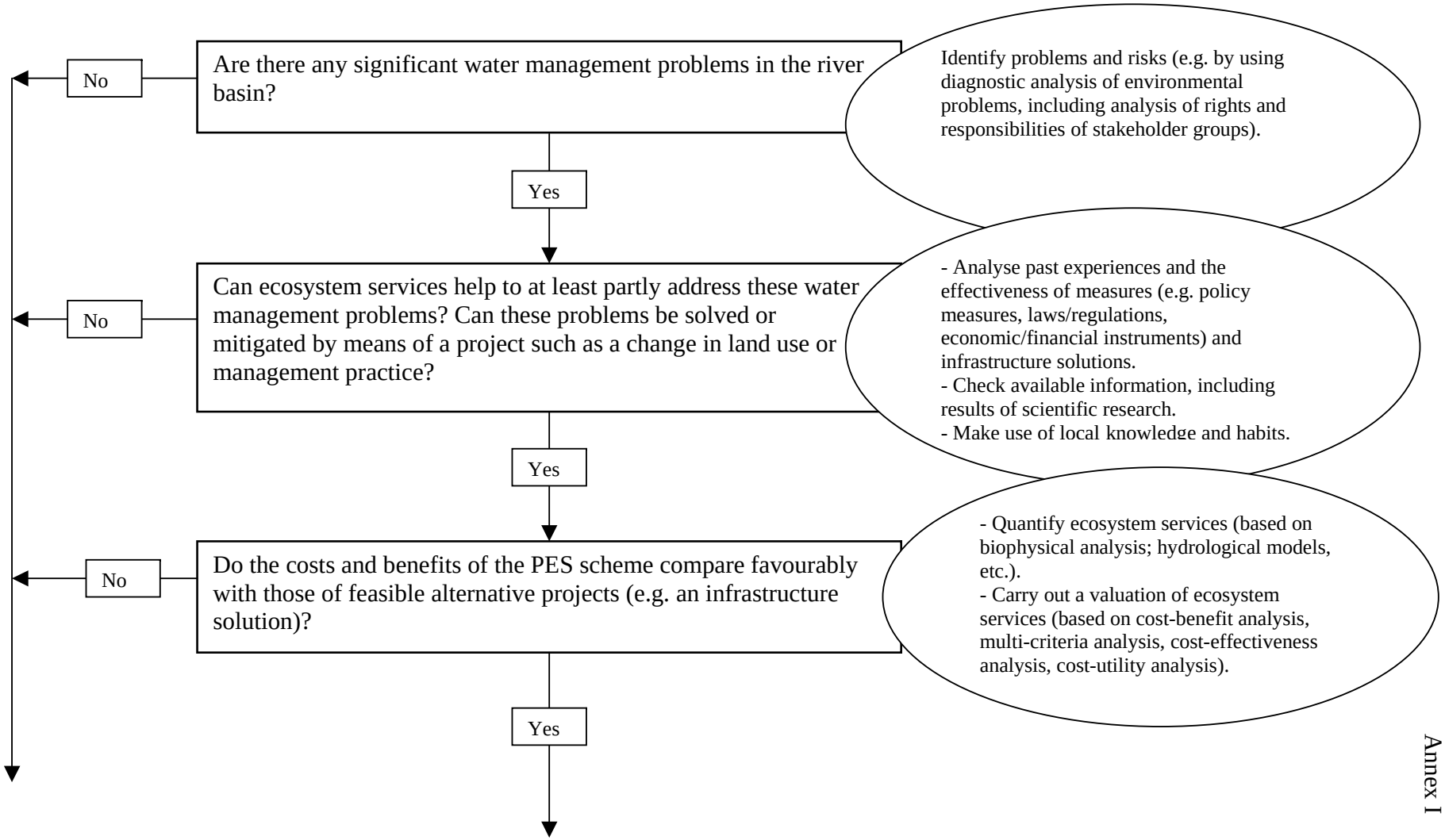
Figure 1 presents a set of questions that have to be addressed and analyses that have to be undertaken in the process of deciding whether the establishment of a PES scheme is feasible and useful.

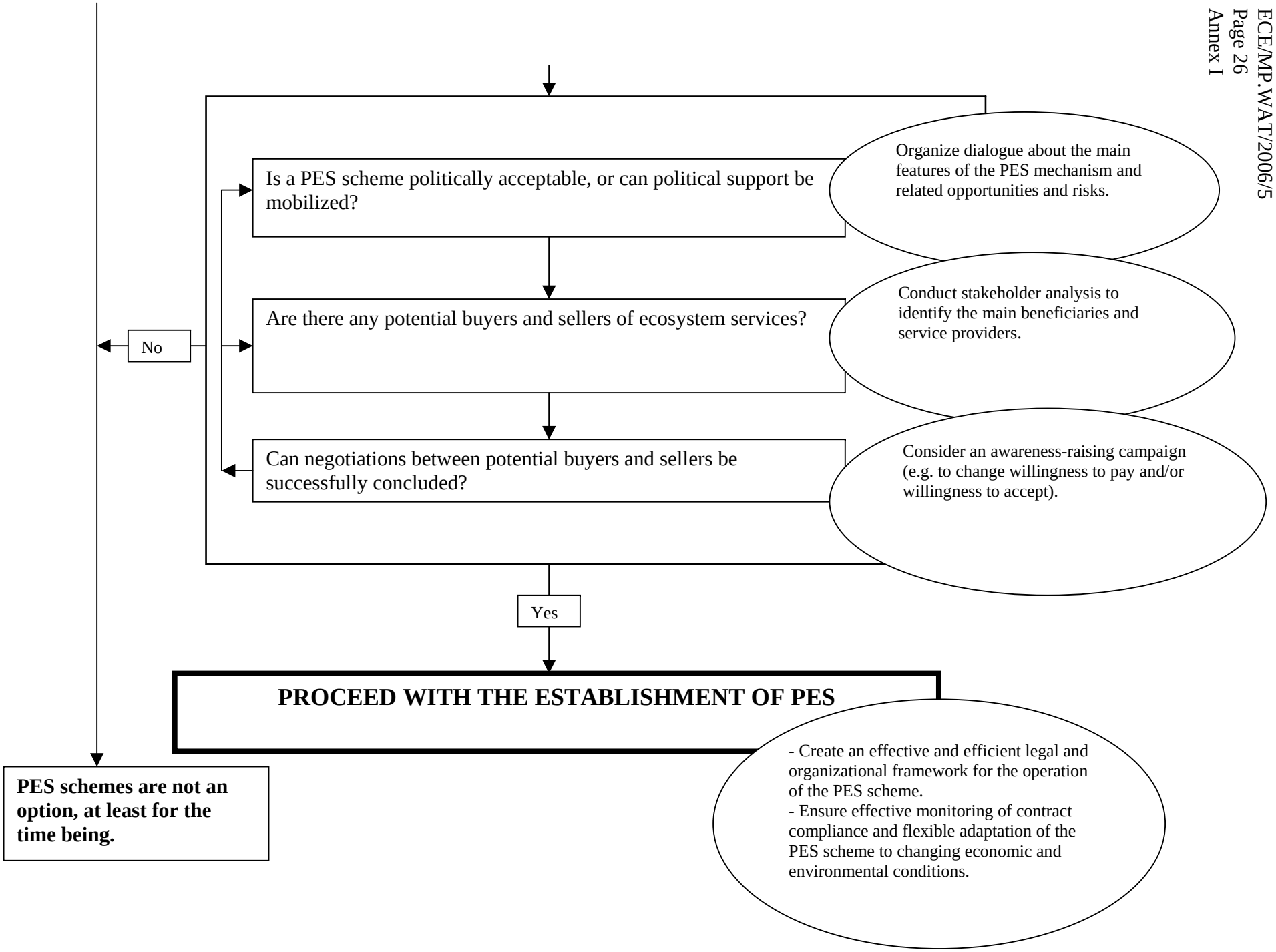
Any decision to go forward with a PES scheme will be based on an imperfect understanding and measurement of the complex biophysical interrelationships of ecosystem processes in a river basin. As a result there will be some uncertainty regarding the scale at which a given management practice or change in land use could provide the desired ecosystem service(s) over a given time horizon.

The flow chart does not represent a rigid sequence of decisions to be taken as a means of establishing a PES scheme. In practice, the decision procedure is not a linear process, given the relationships between the main issues to be addressed. (Examples are the mobilization of political support and the identification of buyers and sellers of ecosystem services.) Also, some issues to be dealt with at an earlier stage will reappear at later stages (illustrated by the differently shaped text boxes in the chart) but may then have different priority.

Although it is desirable for an economic analysis to be at the core of the decision-making process, in practice, lack of political acceptability, obstacles created by the policy process and legal requirements can be important constraints that may prevail over economic and/or other considerations. In any case, there are basic conditions and core principles for the establishment and operation of PES schemes (see chapter V of the main body of the UNECE Rules), and these include that PES schemes must be politically acceptable and that there must be an explicit demand for a given ecosystem service.

Figure 1. Major issues in the process of establishing PES




Is a PES scheme politically acceptable, or can political support be mobilized?
Organize dialogue about the main features of the PES mechanism and related opportunities and risks.
Are there any potential buyers and sellers of ecosystem services?
Conduct stakeholder analysis to identify the main beneficiaries and service providers.
Can negotiations between potential buyers and sellers be successfully concluded?
Consider an awareness-raising campaign (e.g. to change willingness to pay and/or willingness to accept).
No
Yes
PROCEED WITH THE ESTABLISHMENT OF PES
- Create an effective and efficient legal and organizational framework for the operation of the PES scheme.
- Ensure effective monitoring of contract compliance and flexible adaptation of the PES scheme to changing economic and environmental conditions.
PES schemes are not an option, at least for the time being.

II. AN INTEGRATED FRAMEWORK FOR ANALYSING THE IMPACT OF A PARTICULAR PROJECT

The following is a broad sketch of an integrated framework for analysing the impact of a specific project (e.g. a change in land use) on the quantity, quality and value of ecosystem services and the establishment and operation of PES schemes. The focus is on water-related ecosystem services.

First step: Project evaluation

What is the main issue?

- Gauge the net benefits (i.e. benefits less costs) of the project and compare them with the net benefits of maintaining the status quo.

What are the main requirements for this analysis?

- Identification of relevant water-related ecosystem services in the river basin;
- Identification of major stakeholders (providers, beneficiaries, local/national authorities, etc.);
- Assessment of the impact of the project on the quantity and quality of relevant water-related ecosystem services;
- Valuation of changes in ecosystem services related to the project;
- Assessment of distributional incidence of costs and benefits on major stakeholders.

What are the main tools?

- Quantifying ecosystem services: biophysical analysis, hydrological models;
- Valuation of ecosystem services: cost-benefit analysis, multi-criteria analysis, cost-effectiveness analysis, cost-utility analysis.

Second step: Examination of the feasibility of a PES scheme[1]

What is the main issue?

- Establishment of an effective market for water-related ecosystem services by creating a financial transfer mechanism that ensures compensation of activities which supply these services by other activities which demand these services.

What are the main conditions to be met?

- Quantification of the link between a conservation activity (e.g. type of land use) and the water-related ecosystem services;
- Clear definition of environmental services to be provided;
- Identification of actual/potential demand for these services;
- Willingness to pay of the actual/potential beneficiaries of these services;
- Willingness to accept of actual/potential suppliers of these services;
- Identification of potential supplementary sources of financing for the PES (including start-up and management costs) to ensure the long-term sustainability of the scheme.

[1] It is assumed that the project has been deemed worth carrying out.

What are the main tools?
- Biophysical analysis;
- Consultation and negotiation mechanisms;
- Cost-benefit analysis, cost-effectiveness analysis.

Third step: Institutionalization of the PES scheme

What is the main issue?
- Creation of an effective and efficient legal and organizational framework for the operation of the PES scheme.

What are the main requirements?
- Adaptation of the framework to a specific local economic, social and environmental context;
- Review and, if necessary, reform of relevant existing regulatory and fiscal provisions;
- Existence of well-defined property and tenure rights (for land use and forestry resources);
- Setting up a cost-effective governance structure for a financing, payment and monitoring mechanism;
- Involvement of all major stakeholders;
- Establishment of (collective) contracts between providers and buyers of ecosystem services.

What are the main tools?
- Regulatory and fiscal legislation;
- Property and tenure rights;
- Consultation and negotiation mechanisms;
- Pilot projects.

Fourth step: Operation of the PES scheme

What is the main issue?
- Ensure effective monitoring of contract compliance and flexible adaptation of the PES scheme's operation to changing economic and environmental conditions.

What are the main requirements?
- Monitoring of contract compliance (service provision, land use, payments);
- Cost-effectiveness (minimize transaction costs);
- Regular review of the scope for improving the effectiveness, efficiency and equity of the PES scheme.

What are the main tools?
- Adequate human, financial and technical resources;
- Capacity-building (at the local, national, transboundary and/or regional levels);
- Technical assistance;
- Socio-economic analysis.

Annex II

VALUATION OF WATER-RELATED ECOSYSTEM SERVICES

Valuation studies play an important role in the design and implementation of PES. They provide information on the economic value which individuals and society place on environmental assets and changes in ecosystem services. Valuation studies also help in:[1]

- Assessing the overall contribution of ecosystems to social and economic well-being;
- Understanding how and why economic actors use ecosystems as they do;
- Assessing the relative impact of alternative actions so as to help decision-making;
- Making the wide range of services provided by ecosystems comparable to each other, using a common metric.

Conducting a valuation study is neither conceptually nor practically simple. However, the past decade has seen substantial progress in developing the conceptual framework and valuation techniques for environmental cost-benefit analysis.

I. TOTAL ECONOMIC VALUE OF ECOSYSTEM SERVICES

The valuation of ecosystem goods and services is based on the concept of total economic value. In the context of these Rules, the total economic value of ecosystems encompasses the value of goods and services that ecosystems are generating or will generate in relation to water.

Total economic value is divided into two main categories: use values and non-use values. Typically, use values involve some human "interaction" with the ecosystem service, whereas non-use values do not.

A. Use values

Use values can be broken down into direct use values, indirect use values[2] and option values.

Direct use values are derived from the actual use of ecosystem services for a given purpose. They include, among others, use of forests (e.g. for logging, collection of fuel wood, medicinal plants, recreation) and use of wetlands (e.g. harvesting reeds for construction and other uses, fishing)**.** These direct uses can involve both commercial and non-commercial activities, with some of the latter often being important for the subsistence needs of rural populations in low-income regions or countries. In general, the value of services of different ecosystems in existing markets is easier to measure than the use value of services derived from

[1] Millennium Ecosystem Assessment (2003), *Ecosystems and Human Well-Being* (Washington D.C.: Island Press) (see http://www.millenniumassessment.org).

[2] The distinction between indirect use values and non-use values is ambiguous. A recent OECD study divides use values only into two subgroups: actual use values and option values. See chapter 6 in D. Pearce et al. (2006), *Cost-Benefit Analysis and the Environment* (Paris: OECD).

transactions in non-existing markets. This may be one of the reasons why policymakers often fail to consider these non-marketed uses of ecosystems in development project decisions.

Indirect use values refers to indirect benefits derived from ecosystem services that are related to the maintenance and protection of natural and human systems, including maintenance of water quality and flow. These indirect benefits include, for example, groundwater recharge, flood control and storm protection, carbon sequestration, nutrient retention and microclimate stabilization.

O*ption values* refer to the value placed by individuals on preserving an existing ecosystem service in order to maintain the option for them to use it in the future.[3] This includes, for example, the valuation of the option of future availability of medicinal plants for drugs and pharmaceutical uses.

Bequest value refers to the willingness to pay for preserving the environment in a given state for the benefit of the next generation or future generations, thereby leaving them the option to make use of the ecosystem services according to their preferences.[4] Bequest values may be particularly high among the local populations using a wetland, reflecting a strong preference to see the wetland and their own way of life that has evolved in conjunction with it passed on to their heirs and to future generations in general.

B. Non-use values

Benefits can also be derived from the conservation of ecosystem services "in their own right". This non-use or passive value is traditionally referred to as *existence value*. The existence value reflects individuals' willingness to pay to ensure the continued existence of a given ecosystem.

The existence value is different from the "intrinsic" value. By definition, the latter does not depend on human preferences; therefore, economic valuation is not possible. But individuals' notions of intrinsic value could nevertheless be reflected in their willingness to pay, and it is a challenge for the valuation exercise to make explicit this possible influence on the individual's valuation of the existence of the ecosystem.

II. VALUATION METHODOLOGIES[5]

A number of techniques have been developed to value the environment using information derived from existing or hypothetical markets (see figure 1). The principal distinction is between

[3] Some classifications (e.g. OECD, 2006) consider option value to be a type of use value, as it focuses on the willingness to pay for preserving the option to use the environmental asset in the future.

[4] Some classifications (e.g. OECD, 2006) place bequest value in the category of non-use value given that it reflects the willingness of individuals to pay for not using the environmental asset.

[5] The following websites provide useful technical documentation on the various valuation methodologies:
http://www.env-econ.net/2005/11/measuring_the_v.html
http://www.ecosystemvaluation.org/dollar_based.htm
http://www.csc.noaa.gov/coastal/economics/envvaluation.htm

revealed preference methods and stated preference methods. Revealed preference methods rely on observations of people's actual behaviour in a real-world context. In contrast, stated preference methods reflect people's responses in a hypothetical market context. Use values are typically estimated via the revealed preference method, but stated preference approaches can also be employed. Non-use values, however, can only be estimated by stated preference methods.

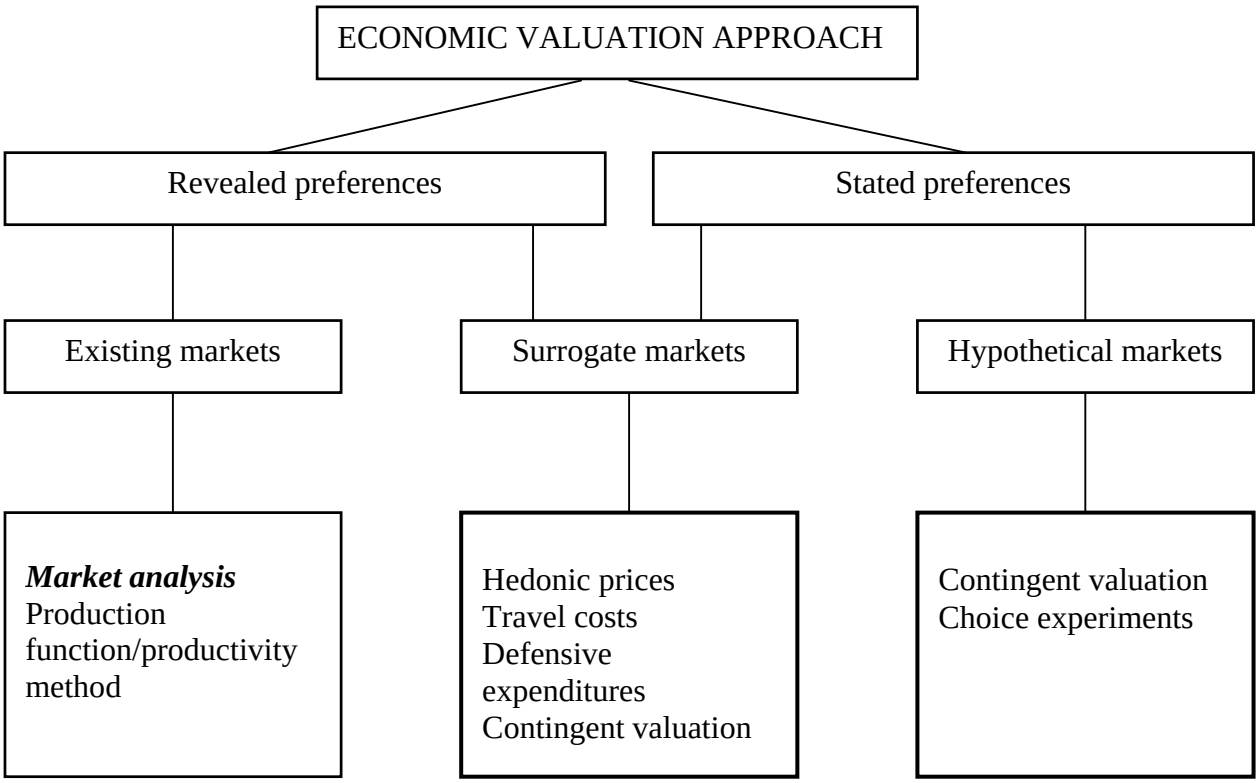


Figure 1. Approaches to economic valuation

A. Revealed preferences

Within revealed preferences, there are two major groups of techniques: the first group uses the existing markets to find the values of ecosystem services, while the second group uses surrogate markets to find the corresponding values.

Existing markets

Some ecosystem products (e.g. timber or fish) are directly traded in existing markets. Their values (i.e. the consumer and producer surplus) can be estimated on the basis of the existing market prices and the changes in quantities demanded in response to variations in prices. Other ecosystem services (e.g. provision of clean water) are used as intermediate inputs in the production process – for example, for irrigation of agricultural land or for processing purposes in industry. Changes in the quality of water (or other environmental inputs) affect the price and quantity of outputs produced. The benefits of changes in the quality of the ecosystem good can

be estimated in terms of changes in market variables related to the specific industry (i.e. productivity, factor costs and net revenues from sales). This valuation approach is known as the productivity method or the production function approach.

Surrogate markets

Most environmental goods and services are not traded in actual markets. Revealed preference methods therefore focus on estimating the value of implicitly traded non-market environmental goods and services (i.e. in surrogate markets), based on actual purchasing decisions by individuals and households for products that either are substitutes for or have a complementary relationship with the environmental goods and services. The main valuation methods used in this context involve the estimation of hedonic prices, travel costs and defensive expenditures.

The *hedonic price method* aims at determining the impact that a specific qualitative environmental characteristic of a given market good has on the price of this good. The basic idea is that these qualitative characteristics are implicitly traded *via* the market good. The technique has been applied mainly to the property market in order to determine the impact on property values of various features of houses, including environmental qualities such as air pollution, water pollution, noise, and distance to recreational areas.

The *travel cost method* strives to value the use of natural areas or specific locations for recreational purposes. The main underlying assumption is that the recreational value is reflected in the monetary costs incurred by individuals for travelling to these areas.

Defensive expenditures are part of the avertive behaviour of individuals and households designed to cope with the effects of adverse environmental externalities (e.g. noise, air pollution, water quality). An estimate of these expenditures can be seen as a lower bound of the value of the benefits that would be created if the negative externality were removed. A typical water-related example of these expenditure types is water purification devices such as filters for drinking water.

B. Stated preferences

The second group of techniques is *stated preferences methods*. These methods have to be used for the estimation of non-use values related to ecosystem services, namely in cases when the costs and benefits of a particular ecosystem service cannot be inferred from observed behaviour in existing markets. The only possibility is to use direct surveys of individuals to estimate their willingness to pay for changes in the provision of these services.

The traditional approach, the *contingent valuation method*, allows gauging, on the basis of a set of specific questions, the willingness to pay (or willingness to accept payment) for a *hypothetical* change in the provision of a certain ecosystem service such as water quality.

Another survey-based approach, *choice experiments* (or *choice modelling*), involves the ranking, scoring and selection by individuals of a set of well-defined environmental attributes,

including their monetary costs. This makes it possible to value multidimensional changes in ecosystem services and related environmental policy options.[6]

III. METHODOLOGICAL FRAMEWORK FOR THE VALUATION OF ECOSYSTEM SERVICES

The context within which valuation of ecosystem services occurs, its purpose and the appropriateness of a given methodology are the key considerations when valuation studies are undertaken. Table 1 summarizes the methodological framework for the valuation of ecosystem services.

Table 1. Valuation of ecosystem services: when, why and how[7]

Approach	**Why do we do it?**	**How do we do it?**
Determining the total value of the current flow of benefits from an ecosystem	To understand the contribution that ecosystems make to society	Identify all mutually compatible services provided; measure the quantity of each service provided; multiply by the value of each service
Determining the net benefits of an intervention that alters ecosystem conditions	To assess whether the intervention is economically worthwhile	Measure how the quantity of each service would change as a result of the intervention, as compared to the quantity without the intervention; multiply by the marginal value of each service
Examining how the costs and benefits of an ecosystem are distributed	To identify winners and losers, for ethical and practical reasons	Identify relevant stakeholder groups; determine which specific services they use and the value of those services to that group (or changes in values resulting from an intervention, such as a change in land use or management practice)
Identifying potential financing sources for conservation	To help make ecosystem conservation financially self-sustaining	Identify groups that receive large benefit flows from which funds could be extracted using various mechanisms

[6] Choice experiments were used to assess water supply options for the Australian Capital Territory. The objective of the choice experiment study was to examine community preferences relating to various options for meeting the water demands of the area's growing population, while focusing attention on resulting environmental costs. The study examined five policy options, including damming, water recycling and demand management, and assessed community preferences relative to (a) water availability for household use, (b) water quality, (c) the cost of water to households, (d) the impact on the aquatic and riparian environment, (e) the maintenance of animal habitats, and (f) the impact on the urban environment.

[7] Based on the work of S. Pagiola and others, for example, the publication by Pagiola, S., von Ritter, K., and J.T. Bishop, J. T. (2004), *Assessing the Economic Value of Ecosystem Conservation*, World Bank Environment Department Paper No. 101, published in collaboration with The Nature Conservancy and IUCN.

IV. CHALLENGES TO ECONOMIC VALUATION

Economic valuation studies rarely take into account the functioning state of ecosystems. Standard economic valuation methodologies derive ecosystem service values based on marginal analytic methods that assume relatively intact and stable ecosystems.[8] However, ecosystems are dynamic and stochastic[9] systems which can shift to entirely new states of equilibrium.[10] There may therefore be a need for a periodic re-evaluation of the costs and benefits of providing the various ecosystem services in a river basin.[11]

Another important issue is the aggregation of individual values (preferences) to determine overall societal values (preferences). There is a risk that the values of some individuals, especially the disenfranchised, will be marginalized in the aggregation process. A considerable body of recent literature therefore favours adoption of a discourse-based approach to valuation of ecosystem services.[12]

While the methodologies for determining monetary values in cases when goals are limited to economic efficiency and environmental effectiveness are comparatively well developed, there is also a need to consider issues related to distributional justice or equity, that is, the distribution of benefits and costs among different groups of persons affected by the project.

In addition to the more fundamental concerns regarding the use of economic valuation methodologies, table 2 highlights some common pitfalls to avoid when carrying out a valuation study.

Table 2. Avoiding common valuation pitfalls [13]

Advice for action	**Rationale**
Use net benefits, not gross benefits	Failure to consider the costs involved in using resources (the cost of harvesting products, for example, or the cost of piping water from its source to the user) results in an over-estimate of the value of ecosystem services.

[8] Limburg, K. E., O'Neill, R.V., Costanza, R., and Farber, S. (2002), Complex systems and valuation. *Ecological Economics* 41: 409–420.
[9] See the example on modelling stochastic ecosystems in annex V.
[10] Holling, C. S. (2001), Understanding the Complexity of Economic, Ecological and Social Systems. *Ecosystems* 4: 390–405.
[11] See also the section on research needs in section C of chapter VI of the Rules.
[12] Wilson, M. A., and Howarth, R. B. (2002), Discourse-based valuation of ecosystem services: establishing fair outcomes through group deliberation. See http://www.sciencedirect.com/science/article/B6VDY-45RFMW5-1/2/960857329a7f80cf11e25a612bdb37f6.
[13] Slightly adapted from Pagiola et al. (2004) (op. cit.).

Advice for action	**Rationale**
Include opportunity costs	The costs of an action (e.g. change in land use or management practice) are not limited to the out-of-pocket costs involved in implementing it. They also include the opportunity costs resulting from forgoing the benefits of alternative actions (or inaction). Omitting opportunity costs makes actions seem much more attractive than they really are.
Do not use replacement costs	…unless you can demonstrate (i) that the replacement service is equivalent in quality and magnitude to the ecosystem service being valued; (ii) that the replacement is the least costly way or replacing the service; and (iii) that people would actually be willing to pay the replacement cost to obtain the service.
Do not use benefits transfer	…unless the context of the original valuation is extremely similar to the context you are interested in. Even then, proceed with caution. However, it is a good idea to compare your results to those obtained elsewhere.
Do not use value estimates based on small changes in service availability to assess the consequences of large changes in services availability	Economic value estimates are not independent of the scale of the analysis. Value estimates are almost always made for small (‘marginal’) changes in service availability, and should not be used when contemplating large changes.
Be careful about double-counting	Many valuation techniques measure the same thing in different ways. For example, the value of clean water might be measured by the “avoided health care costs” or by a survey of “consumers’ willingness to pay for clean water”. However, the consumers’ willingness to pay for clean water is due to (at least in part) their desire not to fall sick. Thus, these two results should not be added, if they are, the value of clean water would be over-estimated.

Advice for action	**Rationale**
Do not include global benefits when the analysis is from a national or local perspective	More generally, only consider benefits (or costs) that affect the group from whose perspective the analysis is being undertaken. Including benefits, which are primarily global in nature in analysis undertaken from a national perspective is a particularly common mistake, and results in an over-estimate of the benefits to the country/local area.
Adjust for price distortions	…when concluding the analysis from the perspective of society as a whole, but not when conducting the analysis from the perspective of an individual group.
Avoid spurious precision	Most estimates are by necessity approximate. Round the results appropriately, avoiding excessive precision. When there is substantial uncertainty, report the results as ranges.
Submit results to sanity checks	Are the results consistent with other results? Are they reasonable in light of the context? Extraordinarily results are not necessarily wrong, but must be checked carefully. Extraordinary results require extraordinary proof.

Annex III

TYPES OF PES ARRANGEMENTS AND FINANCIAL ARRANGEMENTS

I. TYPES OF PES ARRANGEMENTS

A. Public schemes

Under public schemes, a public entity (e.g. a municipality, a local government or a national government) acts as the sole or primary buyer of a specified ecosystem service or, more commonly, a related land use or management practice. This public entity also acts as the administrator and executor of the PES scheme. Not only do the funds originate from public entities, they are also administered and paid out by the public entities to the service providers *cum* sellers. Typically, public schemes target water-related services to secure water supply (water-quality and water-quantity services), flood protection and erosion control through the provision of financial compensation or incentives to induce land users to refrain from changing practices or to change to specific practices.

Public schemes may operate at the local or national level.

Local public schemes are PES schemes in which municipalities or local governments fund, administer and pay for ecosystem services in a specific "local" part of a basin that will yield specific water-related benefits at the local level.

National public schemes are equivalent to subsidy mechanisms of national Governments. However, in the case of PES, government financial incentives are directed towards specific ecosystem services that are deemed to be beneficial not only at the local level but also at the national level. The distinguishing characteristic of a national public scheme is that it concerns a PES that is applicable sector- and nation-wide. The financial incentive for the specified land use or ecosystem service is applicable to anyone who can apply/provide it, and not dependent on the locality it is offered. National public schemes thus tend to be river-basin independent.

B. Private (self-organized) schemes

In private (self-organized) schemes, both buyers and sellers are private entities (companies, non-governmental organizations, farmers' associations or cooperatives, private individuals). Private (self-organized) schemes are typically local schemes where the buyers and sellers have been able to identify an agreed ecosystem service and negotiate and settle upon an agreed price. The buyers make payments on a voluntary basis by commitment to the stipulations of the agreed contract.

The distinguishing feature of private schemes is the manner in which the PES contract and funds are administered and disbursed. In private schemes, this is typically taken care of by a PES administration (or management) entity (either registered as an NGO or trust fund) that has been established specifically to manage the PES. These PES management units administer the PES contracts with buyers and sellers, collect the funds from buyers, disburse the funds to

sellers, and hold them accountable for their service provision. In practice, PES management entities may prefer to outsource the collection and disbursement of fees and monitoring to a fourth (specialized) party, usually against a service charge.

Public-private schemes, a specific subset of private schemes, in principle have the same features as a private scheme, except that the buyer (or one of the principal buyers) is a public utility (e.g. a municipal water-supply company or a public power utility). The feature which distinguishes public-private schemes from local public schemes is the role of the participating public utilities in public-private schemes. This role is limited to that of providing funds to the PES schemes in the role of a service buyer, just as any other private buyer would do. This means that the utility is not involved in the administration and management of the PES contract, as in local-public schemes, but participates as a contracting party of service buyers. In public-private schemes, the PES contract is thus administered by a third-party PES-management entity in the same manner as in private schemes.

C. Trading schemes

Trading schemes refer to the establishment of markets on which established rights (or permits) and/or quotas can be exchanged, sold or leased. For example, environmental pollution quotas for nitrate, phosphorus and/or salt discharges may be sold or traded by low polluters to high polluters. Also within the realms of water management, trading schemes can be very promising mechanisms for effectively trading, banking or leasing water quantities among urban/industrial, agriculture and ecosystem users/uses. A prerequisite for trading schemes is a strong, well-defined and working legal and regulatory framework that (a) clearly defines the pollution quotas or water rights/permits; and (b) allows and enables the (economic) transfer, whether temporarily or permanently, of these among different users and uses, including nature or ecosystems.

II. FINANCIAL ARRANGEMENTS

A. Financial arrangements for sellers

Direct compensation

Direct compensation to sellers (i.e. ecosystem service providers) is the most frequently applied financial arrangements in PES. In most cases, compensation (or incentive) rates are set and defined for a specified land use or management practice, which is deemed to deliver the desired ecosystem service, per unit of hectare (e.g. US$/ha). A PES scheme may adopt different rates for different classes of land use or management practices that are valued to provide different degrees of ecosystem services. Alternatively, the scheme may compensate specific practices (e.g. non-application of nitrates, restrictive mowing or draining) or ecosystem indicators (e.g. number of flora and fauna species per ha, provision of habitat for specified species).

Investment or development funds

Alternatively, PES schemes may establish a development or trust fund instead of issuing direct compensations to sellers. In such cases, the payments collected from the buyers are accumulated in a trust fund, which in turn is deployed by the PES schemes in investing in practices or activities enhancing ecosystem services. The advantage of this mechanism is that (a) the PES funds can be deployed in a variety of ecosystem service practices and activities; and (b) the mechanism provides the flexibility to adapt investments as opportunities and needs arise. The associated disadvantage is that buyers committed to financing the trust fund do not explicitly know what types of services and benefits they will receive in return. This disadvantage can be partly overcome by having buyers become the trustees (or members of the board) of the trust fund, through which they are granted authority to make decisions regarding the deployment of the funds.

Land purchasing

Land purchasing is, strictly speaking, not a PES payment but an ordinary market transaction. It is, however, frequently used in PES schemes as an additional, single-transaction means to enhance the ecosystem services demanded. In such cases, the land acquisitions are made with the explicit purpose of enhancing the ecosystem service. Typically, converting the land use back to low-use or natural vegetation enhances such services as water retention and improving water quality. From a PES point of view, land purchasing has the advantage of diminishing the transaction cost of otherwise required direct compensation to land owners. The disadvantage is that PES thereby becomes a competing land user that seeks to out other land uses/users; it is thus not suitable in all socio-economic contexts.

B. Financial arrangements for buyers

The financial contributions of service buyers to PES schemes, whether public or private, may take different forms.

Customer-charged payments

Participating utilities (e.g. water supply and electricity companies) and, to a lesser extent, industries (e.g. the beverage industry) may charge their PES contributions directly, and explicitly, to their customers. In general, this is done by charging an explicitly set premium for electricity or water supply which is then used to fund the utility’s PES contribution. This method is frequently applied by public utilities, which usually research and/or negotiate the PES premium with their customer base.

Lump-sum contributions

Alternatively, participating buyers may contribute annual lump sums (or even one-off payments in case of trust funds). These contributions may (a) be set arbitrarily as an outcome of negations under the PES agreement, reflecting how much buyers are willing to pay and how

much funding is needed to acquire enough services; or (b) be set as a fraction of the turnover or profit of participating utilities or industries.

Tax-based contributions

Public schemes may be financed through taxes. However, to qualify as a “payment” and be different from ordinary subsidies, the tax must be explicitly raised and spent for the purpose of the ecosystem service to be acquired.

Annex IV

EXAMPLES OF PES SCHEMES IN THE UNECE REGION

Parts I–III of this annex describe PES schemes used in the UNECE region.[1] Part IV gives an introduction to the establishment of PES schemes for preventing and mitigating adverse impacts from floods, using approaches to simulate the effects of land use changes on stochastic flood protection services from ecosystems.

I. PUBLIC PAYMENT SCHEMES

A. Public PES scheme at the local level

The New York City–Catskill watershed management programme (see table 1) is a striking example of a public payment scheme. The Catskill and Delaware watersheds provide 90 per cent of the water consumed by the city of New York. As the quality of water decreased in the 1990s, the United States Environmental Protection Agency (EPA) required that all surface water be filtered, unless safe water could be provided under natural conditions. It was estimated that building a filtration plant would cost US$ 6 billion to 8 billion and its yearly operation US$ 300 million to 500 million. Instead of building a filtration plant, the city authorities decided to invest US$ 1.5 billion over 10 years in a watershed programme to be administered by the Catskill Watershed Corporation, a non-profit organization. The programme is based on improvements in farm and forestry practices in order to reduce water pollution. The PES scheme was initiated with money from the city of New York, the state of New York and the Federal Government. Now the scheme is financed by a tax included in New York water users' bills.

Table 1. Example of a local-level public PES scheme

Project summary	
Title of the project	New York City–Catskill watershed management programme
Type of PES	Public payment scheme (local scheme)
Significant water management problem	Microbial pathogens and phosphorus in surface water requiring special treatment by municipal water-supply company

[1] The descriptions are based on an earlier work by Danièle Perrot-Maître and Patsy Davis, Esq. (Case studies of markets and innovative financial mechanisms for water services from forests, May 2001) as well as inputs from the Swiss Federal Office for the Environment; experts from Finland, Germany, Hungary, Italy, the Netherlands; the United Nations Environmental Programme (UNEP); the Food and Agriculture Organizations of the United Nations (FAO); the Ramsar Convention secretariat; the World Conservation Union (IUCN); the Liaison Unit of the Ministerial Conference on the Protection of Forests in Europe (MCPFE); and the Regional Environmental Center for Central Asia (CAREC).

Water-related ecosystem service	Provision of high-quality drinking water for New York City (NYC) through natural filtration rather than construction of a new filtration plant
Purpose of the project	Improvements in farm and forestry practices to significantly reduce the presence of microbial pathogens and phosphorus in the water
Supplier	Upstream forestry landowners, farmers and timber companies
Buyer	NYC municipal water-supply company
Source of funding	Additional taxation on NYC water bills, NYC bonds, trust funds set up and financed by NYC
Types of instruments	(a) Compensation to landowners (subsidies to farmers and forest landholders for any additional costs associated with the adoption of good management practices; government grants logging companies additional logging permits in return for improvement of forest management services; property tax reduction for better land management practices) (b) Property transfer (distribution of government-owned land development rights to farmers and landowners in exchange for agreements to follow good management practices; government's purchase of conservation easements from private landowners that require retirement of certain ecologically significant land from production; purchase of hydrologically sensitive land) (c) Development of markets (new markets for non-timber products; timber product certification)
Amount of payment	Dairy farmers and foresters adopting good management practices were compensated with US$ 40 million, which vowed their additional costs. Foresters who improved their management practices (e.g. by using low-impact logging) received additional logging permits for new areas. Forest landowners owning 50 acres or more and agreeing to commit to a 10-year forest management plan were entitled to an 80% reduction in local property taxes.
Laws/regulations	A number of Federal, state and local regulatory changes were necessary to implement the programme: (a) The US Environment Protection Agency's agreement to waive the filtration requirement provided time to develop a cost-effective alternative to achieving water quality. (b) A 10-year permit from the State Department of Environmental Conservation enabled NYC to acquire land. (c) The long-standing New York State Watershed Rules and Regulations were revised to establish new standards for water facilities and construction projects and require NYC review and approval of activities with potential adverse effects on water quality.

Role of the public sector	Though NYC led the project, both the Federal and state governments provide financial and technical assistance. The US Department of Agriculture provides technical assistance and financial incentives to farmers under its Farm Bill Conservation Program. New York State grants financial help to the Conservation Enhancement Program, and the State Department of Conservation conducts water-quality research and nutrient monitoring.
Equity concerns	Farmers decided to participate in the programme because of their concern that they might be put out of business by stringent command-and-control measures. Many farmers had lost land when the New York City reservoirs were built, and they were not willing to risk losing more land. Landowners who owned small areas of forests were concerned because the 80% local property tax reduction would benefit only those forest landowners with 50 acres or more.
Lessons learned for designing similar systems	The approach used by NYC was cost-effective and politically acceptable, as the cost of the programme was lower than the cost of the additional filtration plant, and water users were willing to be taxed to support the cost of the programme. The approach may not be applicable for catchment areas that are more commercially and industrially developed and more densely populated than in the Catskill/Delaware area.[2]

B. Public PES schemes at the national level

In Switzerland, precipitation generates drinking water to the value of about € 3,500 per hectare of agricultural land. As intensive farming not adapted to local conditions is the main cause of groundwater nitrate pollution, further measures were needed in addition to strong legislation on water protection and agriculture; these include voluntary programmes promoting extensification.

The objective of the PES scheme (see table 2) was to change management practice in order to decrease nitrate pollution in groundwater, with an emphasis on groundwater used for drinking water. As stipulated by the Federal Water Protection Ordinance of 28 October 1998, authorities are required to initiate measures if the maximum level of 25 mg NO_3/l is exceeded in groundwater used for drinking water or intended as such. Based on article 62 (a) of the Federal Law on the Protection of Waters, farmers taking part in a coordinated nitrate-reduction project within the area of contribution of a contaminated drinking-water well are compensated for the additional costs following contractually fixed water protection measures which go beyond legal requirements and good agricultural practice and are sufficient to

[2] This was the case of the Groton catchment, which also supplies water to NYC. In this case, the city invested in a new filtration plant because the high population density and the level of development in the area precluded using any approach centered on the protection/enhancement of ecosystem services.

lower the nitrate concentration below 25 mg/l (see below). The Federal State establishes the conditions for compensation, while the cantons enforce the relevant measures (contracts with farmers, payments and control/evaluation).

Compensation can be given in case of restrictions of exploitation and in case of new/required investments or disinvestments, including income reduction due to the change of agricultural practice, provided the measures go beyond legal requirements and good agricultural practice. Financial support is allocated by a contract and a one-time payment per year during a maximum of six years, after which the project is evaluated and required follow-up activities/funding are examined.

Table 2. Example of a national-level public PES scheme

Project summary	
Title of the project	Nitrate strategy of Switzerland
Type of PES	Public payment scheme (national scheme)
Significant water management problem	Pollution of groundwater aquifers with nitrates, with priority focus on groundwater used for drinking-water supply
Water-related ecosystem service	Reduction of nitrate charges in groundwater and consequently of nitrate input into the North Sea via the river Rhine; provision of high-quality drinking water
Purpose of project	Change of management practice in agriculture beyond legal requirements and good agricultural practice
Supplier	Farmers
Buyer	Federal Government, cantons and water supplier
Type(s) of instruments	Compensation for contractually fixed changes in agricultural practice beyond legal requirements and good agricultural practice
Source of funding	Federal government, cantons and water supplier
Amount of payment	From € 130 per hectare and year for measures in open cultures to € 1,250 for enhancing the meadow's surface
Laws/regulations	Federal Law on the Protection of Water, Water Protection Ordinance and Federal Law on Agriculture (The Federal State establishes the conditions for compensation, while the cantons enforce the relevant measures (contracts with farmers, payments and control/evaluation).)
Role of the public sector	Launching an information campaign "ActionN – Fewer Nitrates in Water", contacting all relevant institutions, holding farmers' lobbies, issuing newsletters and creating a website (www.nitrat.ch)

Equity concerns	Apply to farmers located within the area of contribution of a contaminated drinking-water well, who need to take water protection measures which go beyond legal requirements and good agricultural practice
Lessons learned for designing similar systems	At present, some 20 "local" projects are under way in a number of Swiss cantons for a total of 3,000 hectares of agricultural land. Similar projects could be carried out in Switzerland for a total of an estimated 50,000 hectares. More projects are in preparation.

C. Public PES schemes at the subregional level

The EU Common Agricultural Policy and agri-environmental measures (AEMs) are incentives to encourage farmers to protect and enhance the environment on their farmland. Farmers are paid in return for a service. They sign a contract with an official institution (administration) and are paid for the additional cost of implementing such commitments and for loss of income due, for example, to reduced production. The two main objectives are to reduce environmental risks and to preserve nature and cultivated landscapes. AEMs go beyond usual good farming practice (the legal obligations and levels of environmental care that each farmer routinely has to comply with, compiled in "regional" codes submitted by Member States to the Commission for approval).

Some AEMs concern productive land management, such as input reduction (reduction of fertilizers and plant protection products, crop rotation measures, organic farming, extensification of livestock, conversion of arable land to grassland, under-sowing, cover crops, farmed buffer strips, prevention of erosion and fire and rotation measures, conversion of arable land, and actions such as late mowing in areas of special biodiversity/natural interest), genetic diversity, maintenance of existing sustainable and extensive systems, farmed landscape and water use reduction measures. Other AEMs concern non-productive land management, such as setting aside land, upkeep of abandoned farmland and woodland, and upkeep and maintenance of the countryside and landscape features.

Table 3. Example of a public subregional PES scheme

Project summary	
Title of the project	Agri-environmental measures to encourage farmers to protect and enhance the environment on their farmland
Type of PES	Public payment scheme (subregional application for EU member countries)
Significant water management problem	Water pollution by fertilizers and pesticides
Water-related ecosystem service	Improving the quality of surface waters and groundwaters

Purpose of the project	Change of management practice in agriculture Examples of commitments covered by agri-environmental schemes: (a) environmentally favourable extensification of farming; (b) management of low-intensity pasture systems; (c) integrated farm management and organic farming; (d) preservation of landscape and historical features such as hedgerows, ditches and woods; and (e) conservation of high-value habitats and their associated biodiversity
Supplier	Farmers
Buyer	Government authorities
Type(s) of instruments	Farmers receive payments that compensate for additional costs and loss of income that arise as a result of altered farming practices.
Source of funding	EU taxpayers
Amount of payment	After the 2003 mid-term assessment of AEMs, the average agri-environmental payment was € 89 per hectare and year (ranging from € 30 to € 240), and for organic farming € 186 per hectare and year (from € 40 to 440). Apart from the above-mentioned payments, compensatory allowances are given in less favoured areas (LFA) and areas with environmental restrictions (vulnerable environments or areas of high ecological value). Such areas include mountain areas and areas where the soil or climate limits the production. The 2003 mid-term assessment of AEMs showed that the average annual compensatory allowances for LFA amounted to € 2,319 per holding and € 71 per hectare.
Laws/regulations	EU water-related legislation, such as the Nitrates Directive[3] and the Water Framework Directive,[4] EU Common Agricultural Policy and agri-environmental measures
Role of the public sector	Launching information campaigns, including substantive information on the Internet (see, for example, http://ec.europa.eu/agriculture/envir/index_en.htm)
Equity concerns	Applies to farmers who commit themselves, for a five-year minimum period, to adopting environmentally friendly farming techniques that go beyond usual good farming practice.

[3] Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC) (http://europa.eu.int/eur-lex/en/consleg/main/1991/en_1991L0676_index.html).

[4] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (http://europa.eu.int/eur-lex/pri/en/oj/dat/2000/l_327/l_32720001222en00010072.pdf).

Lessons learned for designing similar systems	The 2003 midterm assessment of AEMs showed that these measures had improved soil and water quality, although it was difficult to quantify all their benefits. In their rural development programmes for 2000–2006, EU country profiles list agri-environmental measures among their main priorities; examples include Germany, Italy, the Netherlands, Spain and the United Kingdom. The enthusiasm for AEMs varies among regions within a country. It depends on, among other things, the farm's structure, its size, the age of the owners, and their level of skills.

II. PRIVATE (SELF-ORGANIZED) DEALS

An example of a private (self-organized) deal comes from Nestlé waters' practice in France (see table 4). Nestlé, which owns the natural mineral water sources of Vittel in north-eastern France, protected the spring catchment area, which was intensively farmed (with resulting nutrient run-off and pesticide residues), by purchasing agricultural land and reforesting it. It also reduced further non-point pollution by signing 18-to-30-year contracts with the local farmers to reduce nitrate pollution by adopting extensive and optimal cattle-ranching practices and replacing corn crops with alfalfa. The yearly payments are based on the opportunity cost and the actual costs of technological change.

Table 4. Example of a private (self-organized) deal

Project summary	
Title of the project	Vittel S.A.'s payments for water quality
Type of PES	Private (self-organized) deal
Significant water management problem	Nutrient run-off and pesticides
Water-related ecosystem service	Provision of high-quality mineral drinking water
Type of project	Change of management practice
Supplier	Dairy farmers
Buyer	Nestlé Waters, which owns the natural mineral water sources of Vittel S.A. in north-eastern France
Funding source	Vittel financed all compensation payments and costs of technological and land use change. The Government of France financed research to identify alternative land management scenarios.
Types of instruments	(a) Property acquisition (b) Compensation for changing management practice

Amount of payment	Vittel financed investment costs and paid US$ 230 per hectare and per year for a period of seven years to cover the reduced profitability.
Laws/regulations	The scheme was possible because existing French water legislation provided a suitable regulatory framework and a framework conducive to enforcing contracts.
Role of the public sector	Though no formal partnership was established between the private and public sectors, the public sector played a fundamental role in implementing the regulatory framework, ensuring the enforceability of contracts and granting limited financial aid.
Equity concerns	Equity was respected, as farms of all sizes had access to the PES. All farmland in the sub-catchment is enrolled in the programme.
Lessons learned for designing similar systems	When Vittel purchased Perrier and Contrexeville, it "exported" the approach to these companies, considering (a) that the conditions at the Contrexeville springs were similar to those of the Vittel springs; and (b) that the Perrier springs were located in an area of vineyards and intensive wheat cultivation. The scheme is feasible because of the limited number of farms and the high profitability of the business.

III. TRADING SCHEMES

In many rivers in the United States, increasingly high nutrient loads have had a significant adverse impact on water quality. Government regulations have traditionally tried to control water quality by establishing fixed standards for quality and/or fixed levels of allowable discharge for particular pollutants from particular point-source polluters. Point-source polluters are those who discharge nutrients from a precisely localized source (often an industrial site or municipal sewage plant). To meet the regulatory standards for water quality, point polluters often have to invest in expensive waste-reduction technology.

Legally set allowances for "discharges from non-point sources", such as fertilizer run-off from agricultural fields, have not been fixed. This is mainly due to the difficulty of measuring or estimating pollution by non-point sources, which depends on such factors as the pathway of the pollution, the type(s) of polluting substances, vegetation growth and hydro-meteorological conditions.

As an alternative to regulation, nutrient trading has been instituted in several catchment areas in the United States as a flexible, cost-effective and equitable way to comply with water-quality standards and give non-point sources a financial incentive to participate in pollution control.

Table 5. Example of a trading scheme

Project summary	
Title of the project	United States nutrient trading
Type of PES	Trading scheme
Significant water management problem	High nutrient loads in surface waters
Water-related ecosystem service	Improved water quality
Type of the project	Nutrient trading to comply with water-quality standards and to give non-point sources a financial incentive to participate in pollution control
Supplier	Point source polluters discharging below allowable levels and non-point unregulated sources reducing their pollution through, for example, adopting ecologically sound agricultural practices
Buyer	Polluting sources with discharges above allowable level
Sources of funding	(a) Credit buyers (b) United States Government to finance transaction costs required to implement the scheme
Type of instruments	Trading of nutrient reduction credits among industrial and agricultural polluting sources or among non-point sources (e.g. agriculture)
Amount of payment	In south-central Minnesota, the cost of running a trading programme was estimated at US$ 12 to US$ 15 per pound of expected phosphorus load reduction. This amount was about two or three times the estimated unit cost of phosphorus removal from municipal water treatment systems. *Notes:* (a) Costs for trading appear to be higher than expected. (b) Transaction costs associated with the design of trading mechanisms (regulatory framework, information gathering, identification of potential traders) and administrative costs (water-quality monitoring) may be higher than those associated with traditional ways of treating water. In fact, when incentive payments (US$5 to US$ 10 per acre) were included in the above example, the cost rose to between US$ 48 and US$ 70 per pound. This amount did not include transaction and enforcement costs or the costs of an educational programme to encourage landowners' participation.

Laws/regulations	A strong regulatory framework is a prerequisite for trading. A monitoring system, standards and trading rules must be established to ensure that credits traded are really associated with ecological improvements. A legal remedy must be available to ensure that a credit traded by a polluter corresponds to a true reduction in nutrient discharge.
Role of the public sector	Although the exchange is between private entities, the public sector plays an essential role. Trading requires both strong regulations and sufficient financial resources to cover the associated high design and transaction costs; these resources usually come from the public sector.
Equity concerns	A trading scheme transfers the burden of management and transaction costs from regulatory authorities to polluting sources (which can be point sources or non-point sources). Since industry bears most of the burden while the agricultural sector is the main contributor to the nutrient problem, it would arguably be more equitable to treat and control agriculture as "a point source" and link the provision of agricultural subsidies to ecological improvement. The main reason for establishing trading schemes is that one believes it would be generally more cost efficient and more effective than command-and-control measures. The approach takes into account the different cost structures of the polluters and give them a choice between reducing their pollution by changing their production technology and paying those who reduce their pollution level below recommended levels, so that the level of water quality requested by law is reached.
Lessons learned for designing similar systems	Point source/non-point-source trading programmes have been used in the United States for the Dillon and Cherry Creek Reservoirs, which provide about half of the city of Denver's water supply, and in North Carolina's Tar-Pamlico catchment area. Such trading appears to be feasible only in highly site-specific circumstances. The use of water-quality trading schemes has so far been limited to highly developed countries.

IV. ESTABLISHMENT OF PES SCHEMES BASED ON SIMULATION OF LAND USE CHANGES TO ASSESS AND VALUATE STOCHASTIC FLOOD PROTECTION SERVICES FROM ECOSYSTEMS

A. Simulation models

Flood protection is an important service that different ecosystems – forests and wetlands in particular – provide within a given basin. These flood protection services are stochastic services as they affect the probability of flood events.[5]

Such flood protection services of ecosystems can be assessed and valuated by means of an interlocking system of hydrologic-hydraulic and economic computer simulation models, illustrated in figure 1.

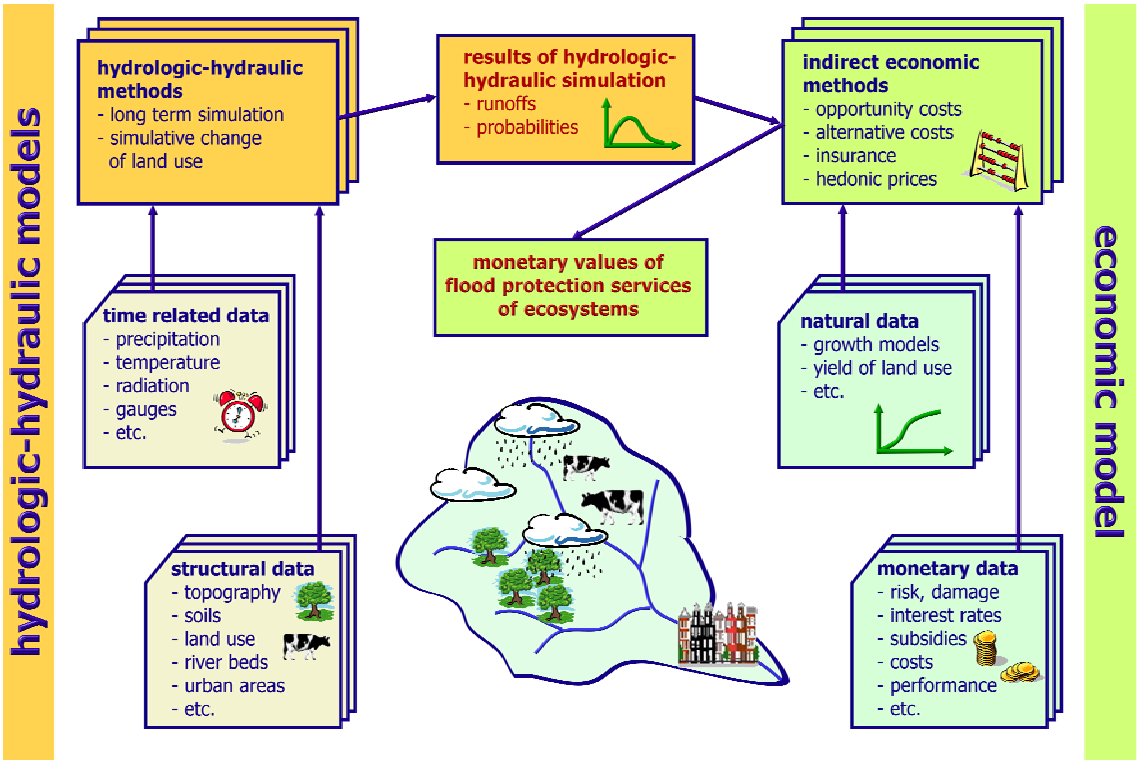


Figure 1. Interlocking system of hydrologic-hydraulic and economic models for monetary valuation of flood protection services of ecosystems[6]

Quantifying the probability of flood events requires a two-step approach. First, the probability of flood events under a given pattern of land use needs to be calculated by means of

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[5] Ecosystems providing flood protection services have a measurable impact on the probability of flood events in downstream parts of the basin. They have an influence on the quantity of runoff and the recurrence interval of different runoff events – for example, a flood event expected every 50 years or every 100 years.

[6] Provided by the MIRO Institute (www.miro-institut.de).

hydrologic-hydraulic models (long-term simulation). Second, the impact of changing the particular pattern of land use on the probability of runoff within the basin needs to be simulated.

The hydrologic-hydraulic models that use numerous time-related data, such as climate variables and structural data on land use, soils and topography, need to be calibrated by comparing calculated runoff with runoff measured at river gauges.

The simulation of land use changes provides a powerful tool for estimating the biophysical impact of different types of land use, such as forests and wetlands, on the probability of runoff in a given basin.

In a subsequent step, the monetary values of the flood protection service can be calculated in order to establish a PES system. The economic model, capable of applying different methods (see figures 2 and 3 and annex II), provides important information to upstream sellers and downstream buyers.

To achieve economic efficiency, it is most important to reduce transaction costs. It is recommended that sellers and buyers in a given basin establish "flood protection clubs" comprising groups of upstream farmers and groups of downstream settlers, which considerably facilitates negotiations on prices and contracts.

B. Application in a catchment area in Germany

The interlocking system of hydrologic-hydraulic and economic models described above was developed for the basin of the river Vicht, located in the Eiffel Mountains in the western part of Germany adjacent to Belgium. The main types of land use in the catchment area of 104 km^2 were forests (55%) and grassland (31%). Eight percent of the catchment area was paved.[7]

The long-term simulation of precipitation-runoff events under the given pattern of land use and employing properly calibrated hydrologic-hydraulic computer simulation models showed close correlation with runoff measured at river gauges. The effects of changing land use on the probability of runoff were also simulated.

These models can show how many hectares of grassland at different locations within the catchment need to be converted into forests in order to compensate for the additional runoff generated from paving one hectare of grassland. The economic values of such changes of land use can be calculated by means of opportunity costs that indicate how much income from dairy farming a farmer in the region loses by converting grassland into forests.

[7] See Grottker T. (1999), Erfassung und Bewertung regionaler Hochwasserschutzleistungen von Wäldern – dargestellt am Beispiel des Wassereinzugsgebietes der Vicht [Identification and evaluation of regional flood protections services of forests – the case of the Vicht River catchment area]. *Schriften zur Forstökonomie* 19 (Frankfurt: Sauerländer).

Following are the lessons learned for designing similar systems:

- Simulating precipitation-runoff events and changes of land use is a powerful tool and can be applied in any basin. It provides valuable information and contributes to improved political decisions on land use within the basin.
- The stochastic ecosystem service of flood protection varies greatly from basin to basin and within the same basin depending on both biophysical and economic data. Thus, the results calculated for one basin cannot be assumed to hold true for another basin.
- Land owners giving up farming have opportunity costs which need to be compensated if trees are to be planted to provide flood protection services.
- The establishment of flood protection clubs of upstream farmers and downstream settlers could be a feasible instrument for making payment systems for ecosystem services work without high transaction costs, if the institutional framework is provided by the Government.
- Pilot studies in mountainous areas with high rainfall should be carried out in order to locate effective areas for establishing flood protection forests and testing the instrument of flood protection clubs.

Annex V

RECENT DECISIONS OF HIGH-LEVEL MEETINGS IN SUPPORT OF PES

This annex summarizes recent decisions by UN member States and, if applicable, the European Community at high-level meetings supporting PES. For easy reference, relevant text passages are emphasized in bold italics.

I. FOURTH MINISTERIAL CONFERENCE ON THE PROTECTION OF FORESTS IN EUROPE

(Vienna, Austria, 28–30 April 2003)[1]

Paragraph 4 of the Vienna resolution 2 on "Enhancing Economic Viability of Sustainable Forest Management in Europe", the Signatories States and the European Community recognizes "***that forests provide a broad range of social, cultural and environmental values to society, striving to improve the economic viability of sustainable forest management through income generated from marketable goods and services as well as, where appropriate, from revenues from currently non-marketed values*** ".

With this resolution, the Signatories States and the European Community committed themselves to:

> "improve enabling conditions for ***the market-based provision of a diversified range of non-wood goods and services from sustainably managed forests***, *inter alia*, through identifying and removing unintended impediments and setting appropriate incentives" [paragraph 9];
>
> "work towards common approaches to the ***practical application of the valuation of the full range of goods and services*** provided by forests and contribute to existing information systems, in cooperation with relevant organizations; incorporate the outcome of these valuations in relevant policies and programmes" [paragraph 10];
>
> "*promote the use of innovative economic instruments* for achieving forest related goals and targets" [paragraph 17].

[1] http://www.mcpfe.org/mcpfe/resolutions/vienna/Vienna_Resolution_2.pdf.

II. STATEMENT OF THE MINISTERIAL MEETING ON FORESTS

(Rome, Italy, 14 March 2005)[2]

The Ministers responsible for forests, meeting in Rome on 14 March 2005 at the Ministerial Meeting on Forests to consider international cooperation on sustainable forest management, including on forest fires, called on "FAO to further develop studies and assist countries, upon request, in the design and implementation of ***projects on payment for environmental services from forests*** as well as in the assessment of the various benefits (water, carbon, biodiversity) of these projects".

III. UNITED NATIONS COMMISSION ON SUSTAINABLE DEVELOPMENT, THIRTEENTH SESSION ON WATER, SANITATION AND HUMAN SETTLEMENTS

(New York, United States, 30 April 2004 and 11–22 April 2005)

Resolution 13/1 on policy options and practical measures to expedite implementation in water, sanitation and human settlements in its paragraph 3 "calls upon Governments, and the United Nations system, within existing resources and through voluntary contributions, and invites international financial institutions and other international organizations, as appropriate, working in partnership with major groups and other stakeholders, to take action as follows: …concerning the means of implementation, mobilize adequate resources to meet the water, sanitation and human settlements goals and targets, tapping both domestic and international sources through a range of financing approaches, such as [paragraph x]:… ***Enhancing the sustainability of ecosystems that provide essential resources and services for human well-being and economic activity and developing innovative means of financing for their protection*** [paragraph x, subparagraph (iii)].[3]

IV. NINTH MEETING OF THE CONFERENCE OF THE CONTRACTING PARTIES TO THE CONVENTION ON WETLANDS[4]

(Kampala, Uganda, 8–15 November 2005)

A. Resolution IX.3: Engagement of the Ramsar Convention on Wetlands in ongoing multilateral processes dealing with water

In paragraph 20, the Conference of the Contracting Parties "INSTRUCTS the Ramsar Secretariat to promote and implement, with Contracting Parties, relevant and key elements of the decision taken at CSD13 on Integrated Water Resources Management, including *inter alia* enhancing the sustainability of ecosystems that provide essential resources and benefits/services for human well-being and economic activity and ***developing innovative means of financing***

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[2] http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=6201&sitetreeId=26480&langId=1&geoId=0.

[3] See E/2005/29-E/CN.17/2005/12.

[4] http://www.ramsar.org/res/key_res_ix_index_e.htm.

their protection; protecting and rehabilitating catchment areas for regulating water flows and improving water quality, taking into account the critical role of ecosystems; and supporting more effective water demand and water resource management across all sectors, especially in the agricultural sector; and ALSO INSTRUCTS the Secretariat to report to the 34th meeting of the Standing Committee on an action plan for the Convention in promoting these themes in order for the Standing Committee through the Secretary General to provide input to the CSD report-back session in 2008".

B. Resolution IX.14: Wetlands and poverty reduction

In paragraph 8, the Conference of the Contracting Parties, "FURTHER URGES all Contracting Parties, bearing in mind the examples outlined in Ramsar COP9 DOC. 33, to take or support action to….review and improve existing financing mechanisms and encourage new thinking in finance institutions, such as the Global Environment Facility, for wetland management to help address poverty reduction, and ***new ideas such as local agreements with wetland communities to enable the maintenance of ecosystem benefits/services***.

In paragraph 10, the Conference of the Contracting Parties, "ENCOURAGES Parties to work with the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP), the UN Department of Social and Economic Affairs, the Ramsar International Organization Partners, national and international NGOs and others to…***undertake assessments of the economic, social, cultural and livelihood values of individual wetlands and wetlands in general and the benefits/services they deliver***, with a view to enhancing sustainable livelihoods utilizing a wise use approach.

V. INTERNATIONAL TROPICAL TIMBER AGREEMENT[5]

(Geneva, Switzerland, 27 January 2006)

In the Preamble, the Parties to the agreement recognize, *inter alia*, the "***importance of the multiple economic, environmental and social benefits provided by forests, including timber and non-timber forest products and environmental services***, in the context of sustainable forest management, at local, national and global levels and the contribution of sustainable forest management to sustainable development and poverty alleviation and the achievement of internationally agreed development goals, including those contained in the Millennium Declaration" [preamble, paragraph f]

Article 1 states that the objectives of the agreements "are to promote the expansion and diversification of international trade in tropical timber from sustainably managed and legally harvested forests and to promote the sustainable management of tropical timber producing forests by "***promoting better understanding of the contribution of non-timber forest products and environmental services*** to the sustainable management of tropical forests with the aim of enhancing the capacity of members ***to develop strategies to strengthen such contributions in the***

[5] http://www.unctad.org/en/docs/tdtimber3d12_en.pdf.

context of sustainable forest management, and cooperating with relevant institutions and processes to this end" (art. 1, paragraph q).

VI. SIXTH SESSION OF THE UNITED NATIONS FORUM ON FORESTS[6]

(27 May 2005 and 1324 February 2006)

The sixth session of the United Nations Forum on Forests prepared a draft resolution for adoption by ECOSOC on the outcome of its session. This draft resolution suggests, *inter alia,* "(k) ***Further developing innovative financial mechanisms for generating revenue to support sustainable forest management"*** and "(l) ***Encouraging the development of mechanisms which may include systems for attributing proper value, as appropriate, to the benefits derived from goods and services*** provided by forests and trees outside forests, consistent with relevant national legislation and policies.

VII. EIGHTH ORDINARY MEETING OF THE CONFERENCE OF THE PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY[7]

(Curitiba, Brazil, 20–31 March 2006)

A. Decision VIII/9: Implications of the findings of the Millennium Ecosystem Assessment

In paragraph 19, the Conference of the Parties states: "Aware also of the need to improve knowledge of trends in biodiversity, and understanding of its value, including its role in the provision of ecosystem services, as a means of improving decision-making at global, regional, national and local levels, and also recognizing cross-scale interactions in ecosystems, *urges* Parties, other Governments and relevant organizations, including scientific bodies, to increase support for and coordinate research, *inter alia*, to improve: basic knowledge and understanding of biodiversity and its components; monitoring systems; measures of biodiversity; ***biodiversity valuation***; models of change in biodiversity, ecosystem functioning and ecosystem services; and understanding of thresholds."

In paragraph 21, the Conference of the Parties "requests the Subsidiary Body on Scientific, Technical and Technological Advice to take note in its deliberations of the linkages between biodiversity and relevant socio-economic issues and analysis, including economic drivers of biodiversity change, ***valuation of biodiversity and its components***, and of the ecosystem services provided, as well as biodiversity's role in poverty alleviation and achieving the Millennium Development Goals.

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[6] United Nations Forum on Forests, Report of the sixth session (27 May 2005 and 13–24 February 2006), E/2006/42-E/CN.18/2006/18, advanced unedited version, Economic and Social Council, Official Records, 2006, Supplement No. 22, available at http://www.un.org/esa/forests/pdf/session_documents/unff6/unff6-advanced-report.pdf.

[7] http://www.biodiv.org/decisions/default.aspx?m=COP-08&id=11023&lg=0

B. Decision VIII/17: Private-sector engagement

In this decision, the Conference of the Parties notes, *inter alia*, "that contributions from business and industry towards the implementation of the Convention and its 2010 target could be facilitated by further work under the Convention to develop … (b) tools for assessing the ***value of biodiversity and ecosystem services, for their integration into decision-making.***

C. Other decisions

Two other decisions are in their entirety important regarding the establishment and operation of PES. These are Decision VIII/25 (Incentive measures: application of tools for valuation of biodiversity and biodiversity resources and functions) and Decision VIII/26 (Incentive measures: preparation for the in-depth review of the programme of work on incentive measures).