

Analytical summary

Ressources naturelles

eau, éléments chimiques, sédiment, température...

Ressources matérielles, sociales

Identification d'un ensemble écologiquement fonctionnel (écosystème ou paysage)

BENEFICES / Pêche, navigation...

Examen du degré de détermination interne, de l'économie du service

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The key issues and their acknowledgement

In a nutshell, the recent history of water management in France can be summed up by the transition from "small-scale" to "large-scale" cycle management. Management of the "small-scale" cycle set objectives focusing above all on the availability and quality of the water resource alone. To meet these objectives, the Water Agencies and stakeholders in the water industry developed a technical governance model that became a benchmark at international level. Management of the "large-scale" water cycle shifts attention to the quality of natural environments – especially their ecological quality. This transition from the "small-scale" to the "large-scale" water cycle poses a technical and organisational challenge for the French water industry, discussed in the first section of this work.

First of all, the main challenges brought about by the transition from the "small-scale" to "large-scale" cycle are summarised:

- stakeholders must equip themselves with suitable means for observing and understanding the dynamics of natural environments for guiding their action effectively. This involves adapting their working methods to the change in management focus called for by the transition to the "large-scale" cycle. Various points are mentioned before being expanded on later on in the publication: definition of the pertinent spatial management units in both ecological and socioeconomic terms, necessity to take on board the functionalities of environments without sticking solely to follow-up of indicators or results rundown-style approaches, importance of having long-term records of the ecological status of environments and, lastly, of taking explicit account of their dynamics and changing trajectories;
- water managers must also have access to ecological engineering tools for crafting and conducting the programmes of measures required to achieve good ecological status pursuant to the Water Framework Directive (WFD);
- lastly, they must adapt their governance system to involve stakeholders more in political decision-making and users and citizens more in the protection of aquatic environments.

The presentation of these various challenges suggests that there should be several purposes to the assessment of ecological services in their consideration by water stakeholders. This is because it meets two complementary expectations of stakeholders, namely to help them in their decision-making and actions whilst shedding light on the key issues of the public debate on protecting aquatic environments. The second and third sections go into the different procedures in more detail

Secondly, the general expectations mentioned previously are compared with what managers actually do in practice through two specific actions. We look at the way in which ecosystem services are defined and taken on board in the National Biodiversity Strategy (SNB) and Water Management and Development Master Plans (SDAGEs). We also consider how they are assessed and included in decision-making processes and we identify the intervention tools used in this regard:

- the National Biodiversity Strategy adopted in 2004 certainly incorporates the notion of ecosystem service as defined by the Millennium Ecosystem Assessment (MA). It is important to recognise the value of these services and assess the contribution they make to human well-being and economic activity at the same time as drafting and setting up all the SNB action plans. The notion is also a strong feature of initiatives raising the awareness of economic and social stakeholders and consultations and intervention tools (which are not clarified in the SNB) likely to influence the behaviour of biological diversity. Aquatic environments are clearly factored into the SNB objectives which stress the pressures affecting water quality (diffuse and point source pollution) and habitats

(modification of morphology). Major priority is given to preserving wetlands, mainly because of their fragility. In terms of the ecological services provided by aquatic environments, the SNB highlights their importance for making the water resource available for multiple uses and for good aquatic ecosystem functioning. However, the operational phase of action plans only makes limited reference to aquatic environments, although a significant breakthrough has been made with the French Environment Round Table (Grenelle de l'Environnement), which makes water and aquatic environments the cornerstone of the ecological continuity restoration initiative (green and blue corridors), in keeping with the WFD. The assessment conducted in 2010 led to the new SNB (2011-2020) which seeks to resolve the problems identified during its first phase and encourage public and private stakeholders to take account of the biodiversity stakes;

■ the Water Management and Development Master Plans (SDAGEs), drawn up by the Basin Committees pursuant to the 1992 Water Law and the 2006 Law on Water and Aquatic Environments, are decentralised planning tools for a balanced approach to managing the water resource. The very process of writing the SDAGEs, which closely involves local stakeholders, is a good example of how the consideration of ecological services is gradually being grasped whilst maintaining a highly operational view of the means and courses of action to take. Accordingly, after two or three decades focusing on combating major point source pollution, the 1992 Water Law defines water as a common heritage, establishes the principle of balanced management and defines wetlands. The first SDAGEs, scaled to the six large basins in mainland France and the basins in the overseas départements, are thus a landmark step that we shouldn't ignore: since some of them define the concept of "free space" for rivers to move within; and wetlands, in sharp decline, are brought to the fore and must be the subject of proactive policies. In parallel, the Water Management and Development Plans (SAGEs), drawn up on a more local scale, take over and contribute to recognition of the diverse functions of aquatic environments.

The notion of ecosystem services, or ecological services, does not appear as such in the 2000 Water Framework Directive. That said, "good ecological status" – required for all surface aquatic environments by 2015 – is not completely unrelated to this concept. The new 2009 SDAGEs clearly refer to the environment's functions (purifying, storing, water regulation), as well as what is at stake with regard to wetlands, biological reservoirs, migratory fish and biodiversity. The social value of ecological services is acknowledged for supplying us with drinking water, existing and potential economic activity (tourism, leisure, etc.) and for human health. These values back up lines of thought in documents intended for public consultation;

■ the new SDAGEs, together with the French Environment Round Table, also set highly specific objectives for challenges directly associated with ecological services: preservation of river mobility spaces and good functioning spaces, protection of abstraction point supply areas and preservation of flood control areas. The intervention tools at the disposal of SDAGEs have a regulatory bearing and must also be used by other planning initiatives (local town planning, regional coherence plan), which ensure that the functions of aquatic environments are taken into account at local level. Compensation measures are also planned should functions be lost.

However, in methodological terms, although the Water Framework Directive has stepped up stakeholders' efforts to increase economic studies (costs of action programmes, collection of the cost of services, justifications for disproportionate costs), the fact is that the assessment of ecological services is still in its very early stages for two reasons: the lack of precise assessment protocols, defined according to suitable spatial and temporal scales, as well as the absence of explicit mention of assessment in the procedures for negotiating environmental objectives and for making decisions in terms of public environmental policy.

It appears clear today that water management stakeholders increasingly appreciate the merits of taking ecological services into account. And yet, it seems that some debates would certainly gain clarity and some ambitions political clout if aspects of assessment methods – such as procedures for involving stakeholders in the use of such methods – were to allow better qualification of such services.

Analysis of concepts relating to service assessment

The second section of this publication casts a critical eye over the various concepts called on by the notion of ecological service.

It starts by questioning the relevance of the concept of ecosystem as a unit producing these services. The analysis highlights – particularly in France – the past and present importance and diversity of interactions between the physical, biological and socioeconomic dimensions of an aquatic environment and the difficulty in drawing a concrete distinction between what comes under the "natural" dimension and what reflects the "anthropic" dimension of these environments. This is why we recommend using the broader concept of "hydrosystem" to acknowledge how closely interlinked these different compartments are.

The question of the concrete limits of this hydrosystem – i.e. the spatial unit that we shall seek to identify and whose services we wish to assess – is then explored, for while the different physical, biological and socioeconomic compartments are closely interlinked, they nevertheless have different spatial limits. Moreover, the importance of the relations between aquatic and terrestrial environments must also be considered – particularly the key role played by the interfaces between both these complexes in the development of countless ecological services (denitrification, mitigation of erosion, etc.). There is therefore a choice to be made when defining the hydrosystem for operational purposes. An iterative step-by-step approach is proposed to identify this spatial unit, with the result that the hydrosystem represents both a functional unit in ecological terms and an explicit or implicit "space for governing" these services.

Several clarifications are then given between notions that are often viewed as one and the same:

- an initial, minor, distinction is to be made between "ecological services" and "ecosystem services". The first term strikes as more generic as it can be applied to composite spatial units grouping together a variety of ecosystems;
- a second, much more significant, distinction is made between "ecological services" and "environmental services". The latter can include services provided by the physical compartment (mineral resources, transport capacity, etc.) but that do not depend on the way the biological compartment functions. We place particular emphasis on the need to make this distinction so as to reveal any contradictions arising in a general assessment between the use of these two types of services, such as the possible reduction in ecological services due to greater use of physical resources;
- the third, essential, distinction must be made between "ecological services" and "benefits obtained from (or created) by ecosystems". Indeed, the latter notion includes human investments – sometimes to a considerable extent – to benefit from ecological services, which is the case for many recreational activities in aquatic environments. These expenses – even if some of them can be used to measure the value attached to these services – cannot be viewed as a "production" of the hydrosystem. Although it slashes the estimation of the ecological service in the strict sense of the term, this distinction appears worthwhile. Firstly, for taking account of the fact that investments made to increase the created benefits can sometimes deteriorate the ecological service (for example some tourist developments that become too popular for their own good) and, secondly, to avoid the assumption that estimating the ecological service will define the "best choice" for using this service (as in the case of arbitration between recreational and professional fishing for migratory fish).

More succinctly, this publication also mentions the "green GDP" issue, which leads to the definition of a third complex: that of benefits obtained from ecosystems (as elements of well-being) but which are not included in the "conventional" GDP since they are not subject to market trade (think walks along riverbanks). We stress that the

purpose of this distinction between ecological services, created benefits and contribution to the green GDP is not to define the "right notion" to use, merely to require explanations to be given as the choices made for economic valuation.

Lastly, the merits of introducing a distinction between end or intermediate ecological services and ecological processes or functions are examined from an economic and ecological angle. As regards economic analysis, it seems difficult – and hardly relevant – to identify, and assess, the upstream processes contributing to the production of services. However, in ecological terms, it is clear that the notion of functional analysis – i.e. of examining the ability of aquatic environments to provide services in a sustainable manner – needs developing since the direct, short-term, assessment of services completely ignores their sustainability. We do, for all that, highlight the complexity of identifying these different functions and the need to develop summary indicators of "ecosystem health" summing up this functional analysis, particularly by perfecting the current indicators of "good ecological status".

This section will end by identifying the different ecological services that can be assessed from the diverse lists we find in the literature and by addressing the question of their typology. Even if the four-group typology (supporting, provisioning, regulating and cultural services) put forward in 2005 by the Millennium Ecosystem Assessment is by far the most widely used, it is more of educational than operational use because of the many instances in which "double counting" is possible when assessing services. To give an example, two other, more political, typologies are suggested and discussed:

- one is based on identifying the public or private nature of services by comparing two traditional criteria – that of rivalry (their use by some may or may not restrict their use by others) and of exclusion (whether or not it is possible in practice to prevent use by some). Taking fishing as an example, we point out that attributing a service to one of the four categories thus created is not an intrinsic property of the service, rather it can depend on the public policies likely to alter its status and which must therefore be considered;
- the second distinguishes services depending on where they are used – from services produced and used in a given territory (like many "local" recreational services) to services that are mainly of benefit to other territories. This is again a matter of asking the "political" question – for a given typology – of the weight that should be accorded to these different services (simply adding the values together is not enough) and, through this, of ecological solidarity, i.e. the transfers of benefits to be carried out at different scales (between countries, regions, towns, etc.), between producers and users of these services.

Economic valuation of services

The third section of this publication looks at the economic valuation of services. The notion of ecological services is more complex than it first appears and this section endeavours to shed light in this regard. It also sets out an operational framework for conducting the economic valuation of ecological services.

We begin by defining the notion of ecological service as precisely as possible – viewing nature both as a capital and an area in which environmental goods and services are produced. Then the merits of this notion with respect to the more traditional categories of "natural heritage" or "environmental good" are illustrated. The notion of ecological services enables a more precise approach to be taken to the question of environmental property. It encompasses in a common perspective the production of both environmental goods and complex services by nature. Lastly, it allows the problems posed by the joint dynamics of natural environments and societies to be tackled with more precision.

We then turn our attentions to the link between natural capital and ecological services. We argue in favour of an open approach to this question, given the great complexity of the natural and social phenomena in play. The ecological services that are genuinely appreciated in society are, for the most part, developed or "secondary" services, obtained by bringing together different primary supporting, provisioning or regulating services - as described in the MA's typology.

It therefore seems fairly pointless working back to the value that can be attributed to these primary services by assessing secondary services since it is impossible to pinpoint the specific contribution a primary service makes to a developed service. The purpose of economic service valuation is to tie the ecological status of environments in with the different sociological categories concerning human "well-being" in the broad sense: utilisation of natural resources, health, quality of life, aesthetic satisfaction, etc. This correlation is not direct however, but based on the historical, anthropological and social architecture organising our mediation with nature. **In the context of economic service valuation, this mediation can be analysed as a supply-demand type relationship.** This point is expanded upon next. Regarding supply, the importance of enhancement infrastructure providing access to ecological services needs noting. Here again, the assessment of ecological services comes up against an identification issue: in general it isn't possible for all practical purposes to distinguish the intrinsic value of services provided by nature from the value of manmade equipment enabling society to make use of them. Regarding demand, it appears that individual and social behaviours largely influence the economic values attributed to nature. These behaviours may be poorly informed or subject to distortions in perception, which expose socioeconomic valuations to sudden changes in environmental attitudes or behaviours.

Assessing assumes having criteria for judging a given situation and thus leads fairly naturally on to questions of choosing decision and policy lines – an aspect we discuss fourth in this section. For decision-making purposes, economic service valuation is one of the steps taken in a cost-benefit analysis of public choices in favour of the environment. In turn, cost-benefit analysis is just one stage in the broader context of policy definition and implementation that we call a "collective environmental responsibility system" – a political system established by law and social practice. Under such a system, we are no longer dealing with "one"

assessment but "assessments" in the plural since both private and public stakeholders express diverse assessment needs for conducting their actions. These various needs are grouped into three main areas: utilisation and protection of natural resources; regulation of the behaviour of economic stakeholders, households and businesses; and funding of nature protection or ecological damage compensation policies. Assessment therefore meets two complementary expectations of social stakeholders: having operational tools for making environmental decisions on the one hand and enlightening the political debate on the nature protection stakes on the other – which means supporting changes made to the collective environmental responsibility system.

After identifying these expectations, **we go on to discuss the existing assessment types** which we split into three categories: "eco-centred" assessments borne by environmental sciences, "socio-centred" assessments performed in the field of human and social sciences, and "co-assessments" – multidisciplinary approaches aimed at making integrated diagnoses of the relations between humans and nature.

Our sixth subject of interest will be the more specific problems posed by the economic valuation of ecological services. Our intention is not to provide a detailed inventory of existing economic valuation methods since there are many methodological guides that have already done this.

Instead, we endeavour to pinpoint what these methods have in common and what sets them apart and to gauge their potential for application in various contexts as well as their limits. Alongside a summary of the usual environmental valuation methods (travel cost methods, hedonic pricing approaches or contingent valuations), we go into more detail about the opportunity cost approaches which, although not as well-known as the aforementioned methods, have potential for managing the supply of ecological services through the cost-effectiveness angle advocated by the WFD.

We end by **putting forward an operational framework for conducting the economic valuation of ecological services for hydrosystems.**

Conclusion

The conclusion reiterates the fact that the new requirements of the WFD for protecting natural environments call for significant changes to be made to public water management initiatives. Assessment of ecological services should therefore help to bring about these changes by identifying courses for action that are both pertinent in ecological terms and realistic from an economic and social viewpoint.

Since the work of the Millennium Ecosystem Assessment in 2005, assessment of ecological services has gradually gained acceptance within the scientific community and among decision-makers. Pavan Sukhdev's report on "The Economics of Ecosystems and Biodiversity" at the United Nations Conference in Nagoya, as well as the discussions sparked by it, are a fairly effective illustration of the importance attached to ecological service assessment in the environmental political debate today.

These changes bring with them two complementary challenges however:

- first of all, the scientific communities concerned must adapt and update assessment methods accordingly and improve the reliability and relevance of the values produced. This is a scientific challenge calling for disciplinary and cross-disciplinary research combining environmental and living sciences more closely with human and social sciences than is currently the case;
- secondly, environmental managers and stakeholders must fully comprehend the stakes entailed in the assessment of ecological services, for producing assessments and assessment methods of genuine use to public decision-making does not merely involve transferring scientific knowledge to users, but requires fully committed efforts from scientists and managers to working together.

If these two challenges are to be met, suitable scientific programming is necessary as well as the creation of a dialogue interface between scientists and managers – with the long-term in mind.

