

Methods and reference values for valuation of services provided by wetlands

In order to carry out economic analyses on Wetlands (cost-benefit analysis), CGDD (General Commission for Sustainable Development) made a methodological study to evaluate the services provided by wetlands in the Regional Natural Park of Cotentin and Bessin (Normandy). It was thus able to establish reference values based on a solid methodology. The value of all the services was established in a range of 2,400-4,400 Euros per hectare. The study adopted a new approach combining different monetary valuation methods, including enquiries involving the population, to obtain values as comprehensive as possible. It demonstrates the relevance of using the willingness-to-pay method, particularly to value biodiversity, and of its complementarity with other methods.

Wetlands (marshes, estuaries, lagoons, bogs, lakes and ponds ... see glossary) are diverse, complex, fragile and extremely rich environments providing a variety of services. Threatened by human activities, these wetlands should be preserved. In order to prevent their artificial development, commitment No. 112 of the "Grenelle of the Environment" thus plans the purchase of 20,000 hectares of wetlands by 2015 by the Coastal Protection Service and Water Agencies. Then it may be useful to give a monetary value to the services provided by these areas; these values can be integrated into cost-benefit analyses. To achieve the latter, it will be necessary to establish baseline scenarios in which the type of land use after disappearance of wetlands should be defined.

A reference value per hectare

The present study has estimated the Total Economic Value (TEV), i.e. all services provided by wetlands (see glossary), the wetlands of the Regional Natural Park (RNP) and marshes of the Cotentin and Bessin, straddling the Departments of Calvados and Manche (Normandy). It concludes with a total economic value being in a range between 117 and 218 million Euros a year for an area of 49,000 hectares. The value per hectare, without differentiating the types of wetlands, is thus between 2,400 and 4,400 Euros (Figure 1). The differences in the ranges are due to the calculation assumptions used: population bases for services with aesthetic and recreational value and biodiversity, prices for the services provided to groundwater recharge (aquifer) and agriculture.

A new valuation of the Total Economic Value

On the average, these results are well above the figures recorded by a previous study carried out in 2009 by CGDD which obtained a range between 900 and 3,100 Euros on the basis of two approaches [4 and 5]:

- Bibliographical review of fifteen French studies estimating these benefits between 900 and 3,100 Euros per hectare ;
- A meta-analysis conducted by a Dutch team (Brander et al.) on 89 sites worldwide establishing the value of benefits at 1,600 Euros per hectare.

This difference between the results obtained for the RNP and those recorded in 2009 is largely due to the fact that the new study expands the number of services taken into account by adding climate regulation, inputs to agriculture and shellfish farming, educational and scientific value in particular.

A methodology that aims to avoid double counting

The new valuation was inspired by the work done as part of the Millennium Ecosystem Assessment (MEA) which classifies the ecosystem services provided by wetlands into four categories :

- Support services : soil formation, nutrient cycle, water cycle, habitat for animal species,



Figure 1 - Values per hectare of the services provided by RNP's wetlands and marshes of Cotentin and Bessin (in Euros) *

Services provided by wetlands	Min.	Max.
Regulation services		
➤ Aquifer recharge and support to low water	190	370
➤ Water purification	830	890
➤ Climate regulation	1,800	1,800
Production services		
➤ Agriculture	585	750
➤ Shellfish farming	120	120
Cultural services		
➤ Hunting	170	340
➤ Amateur angling	165	230
➤ Educational and scientific value	10	15
➤ Aesthetic and recreational value	290	1,170
➤ Association with the site	Not valued	Not valued
➤ Biodiversity (non-use)	225	870
Total Economic Value of wetlands	2,400	4,400

* The Total Economic Value per hectare is obtained by simply dividing the Total Economic Value by the number of hectares of wetlands on the site. It is not the sum of individual values per hectare of different services, the latter being unevenly provided on the surface areas.

Source: CGDD

- Regulation services : climate regulation, flood alleviation, aquifer recharge, erosion control, waterpurification, protection against storms and floods,

- Production service: freshwater, food and materials, fuel, genetic resources, pharmaceutical and medical resources,

- Cultural services: recreational, aesthetic, educational activities, spirituality and inspiration.

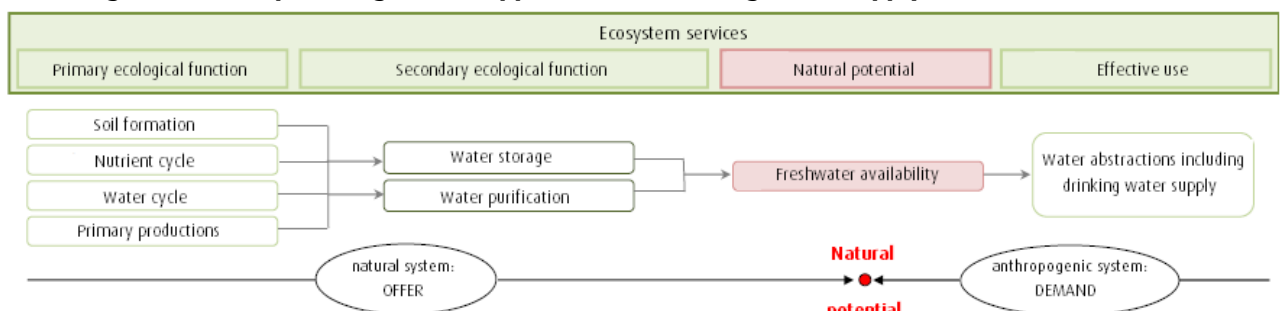
Structuring these services was then developed in order to avoid double counting. While the list of services offers a clear vision of the advantages (or benefits) provided to Man by wetlands, it does not value the maximum efficiency in economic terms. For example, the services of water purification, groundwater recharge and freshwater production overlap, the first two allow the expression of the latter, which could generate double counting.

Ecosystem services have been organised in a "logic chain" which reflects the passage from ecosystem functionality to service provision and its use (and thus benefit) by mankind (Figure 2). As an example, the economic valuation of the drinking water production service will then be done through the use (actual use) or through the services that contribute to this use (water purification and water storage).

Taking into account the natural potential

This structuring also helps highlight the notion of "natural potential" bordering the provision and demand for services. This concept of potential especially allows understanding, in an operational manner, the option value (rarely explained in the usual economic analysis), which would result from possible future use of the natural potential after human interventions that would facilitate its access (see glossary).

Figure 2 – Principle of logic chain applied to the drinking water supply service



An extensive use of evaluation methods

This work carried out on the RNP allowed combining for each service all the existing monetary valuation methods to finally keep the most appropriate for each type of service. The following methods were used:

- Methods based on the cost which infer the value of wetland (or more often of one of its functions) from the costs that would be incurred if it were to disappear. These methods have been used for one component of the water purification service;
- The revealed preference methods that infer the value of services provided from actual decisions made by individuals and observed on a market. These methods have been used for the service of aquifer recharge in particular;
- The benefit transfer methods, using the results of similar existing studies. These methods have, for example, been used for the service of educational and scientific value;
- The stated preference methods were also used to supplement the economic values obtained when using other methods. They were selected for the evaluation of services of aesthetic value and (non-use) value of biodiversity.

A stated preference articulation with other methods

Methods based on costs or revealed preferences allow measuring use values (see glossary), or possibly option values. For non-use values (existence values and bequest values) that cannot be determined by these methods, it is necessary to ask directly to the people to declare their willingness to pay to preserve the environmental goods and services studied.

A stated preference survey was therefore conducted to estimate willingness to pay. Its objective was to measure the values that could not be estimated by other methods (biodiversity) and to check the robustness of these results on other services (water purification, aesthetic and recreational value) by comparing them to the use values measured by other methods, a priori more robust. The survey used the method of joint analysis.

A survey using joint analysis proposed to respondents to choose between several scenarios consisting of different arrangements of the study site. Each scenario was proposed with a price that the respondent should pay if he kept that scenario. Prices and attributes of the scenarios are randomly chosen to obtain, after the enquiry, the average value given to each attribute.

Willingness to pay depending on the services

The questionnaire was drafted to distinguish the willingness to pay for different services in order to

link the survey results with those of other monetary valuation methods used. It was selected to propose scenarios related to biodiversity, purification capacity, status of the landscape and accessibility. Biodiversity was selected by making the assumption, *a priori* reasonable, that this concept would mainly cover non-use values that could be legitimately added together with other calculated values with no risk of double counting. Indeed, the use value of biodiversity is largely or entirely evaluated through ecosystem services. Willingness to pay for purification services could be directly compared with the values obtained with other methods. The introduction of landscape into the scenario attributes aimed to estimate use and non-use values for the service of aesthetic and recreational value. Willingness to pay for maintaining the services provided (services of water purification, aesthetic and recreational value, biodiversity) by the marshes of Cotentin and Bessin is, on the average, 39 Euros per year per person for the sample of people surveyed (Figure 3). Multiplied by the population (population of Basse-Normandie for the low case, and population of Basse-Normandie + neighboring departments for the high case), this figure provides the value for the whole study area.

Figure 3 : Valuing biodiversity and water purification services, the aesthetic and recreational value of the marshes of Cotentin and Bessin (Per person per year)

Service	Willingness to pay
Biodiversity	9 Euros
Water purification	15 Euros
Aesthetic and recreational value	15 Euros
Total	39 Euros

Source: CGDD

A significant contribution of willingness to pay

For the purification service, subject to reasonable assumptions about the population to be taken into account to allow passing from individual willingness to pay to total willingness to pay, the values provided by the survey are of an order of magnitude quite comparable with the values provided by other methods. This validates the use of this method. Thus, adding the values obtained by different methods on different services seems legitimate.

The use of willingness to pay largely allows obtaining the total value (20 to 45% depending on the extreme ends of the range in this case). It provides a significant supplement, which cannot be substituted, to other monetary valuation tools. Its use here has been proven to be complementary to methods using the costs to approximate the value of services corresponding to non-

use values (biodiversity) or use values in the case when a market equivalent is not easy to build (aesthetic and recreational value).

This study shows that the use of different monetary

valuation methods, including a survey to measure willingness to pay, is possible and allows the best use of the advantages of the different methods without suffering from their disadvantages.

Glossary

Total economic value (TEV): The concept of total economic value provides an overall measure or the economic value of any environmental goods or services.

It is divided into use and non-use values (which are themselves broken down into subcategories).

Use-value: value related to the satisfaction of using or being able to use environmental goods in the future.

Option value: use value given to the conservation of an asset for future use (for example, the preservation of a plant known for its medical value). It belongs to both categories, use value and non use value.

Non-use value: the value related to the satisfaction of knowing that an asset or a desirable state of affairs exists. These values are often linked to notions of justice or respect for nature and help justify the protection of species or known natural sites.

Existence value: non-use value merely related to the fact that something exists.

Bequest value: non-use value associated with the will for conservation for future generations.

Wetlands: Wetlands are transition zones between terrestrial and aquatic environments. They are characterised by the permanent or temporary presence of fresh, salt or brackish water on the surface or at very shallow depth in the ground. This interface explains that wetlands are among the richest natural environments in ecological terms. They host a wide variety of specific plant and animal species.

For more information :

[1] **Evaluation économique des services rendus par les zones humides – Enseignements méthodologiques de monétarisation**, Etudes & documents n°49 - CGDD septembre 2011 - Studies and Documents No. 49 - Economic valuation of the services provided by wetlands – methodological findings for monetary valuation, CGDD September 2011

[2] **Evaluation économique des services rendus par les zones humides - Complémentarité des méthodes de monétarisation**, Etudes & documents n°50 - CGDD septembre 2011 - Studies and Documents No.50 - Economic valuation of the services provided by wetlands – Complementarity of monetary valuation methods, CGDD September 2011

[3] **Donner une valeur à l'environnement : la monétarisation, un exercice délicat mais nécessaire**, La revue du CGDD - décembre 2010 - The CGDD journal - Giving a value to the environment: monetary valuation, a delicate but necessary exercise, CGDD December 2010

[Donner une valeur à l'environnement : la monétarisation, un exercice délicat mais nécessaire](#)

[4] **Evaluation économique des services rendus par les zones humides**, Etudes & documents n°23 - CGDD 2010 - Studies and Documents No. 23 - Economic valuation of the services provided by wetlands, CGDD 2010

[Evaluation économique des services rendus par les zones humides](#)

[5] Le point sur n°62 - **L'évaluation économique des services rendus par les zones humides, un préalable à leur préservation**, CGDD septembre 2010 – Review on No. 62 - Economic valuation of the services provided by wetlands, a prerequisite to their preservation, CGDD September 2010

[L'évaluation économique des services rendus par les zones humides, un préalable à leur préservation](#)

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