Economic Valuation of Environmental and Resource Costs: the Case of Germany

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Abstract

In the implementation of the EC Water Framework Directive, the concept of environmental and resource costs applies above all to the cost recovery of water services. Article 9 of the Directive stipulates that „Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs.“ However, environmental and resource costs were not sufficiently defined in the Directive. In order to further clarify the concept of environmental and resource costs, and in order to discuss their assessment in practice, a European working group (DG Eco 2) was set up in September 2003.

The paper “Economic Valuation of Environmental and Resource Costs: the Case of Germany” first summarises some of some main results of the DG Eco 2 working group. It then moves on to describe how environmental and resource costs are currently dealt with in Germany, and examines how the results of the DG Eco 2 can be put to use in the German context. A further point is the link between the assessment of environmental and resource costs and the selection of cost-effective combinations of measures. Two options are discussed here: first, addressing the question whether and how information obtained through the selection of measures can be used to assess environmental and resources costs; and secondly, discussing how the selected measures themselves can help to achieve cost recovery for environmental and resource costs. In this way, the results of the DG Eco 2 are linked to a previous research project, in which Ecologic developed a handbook for the cost-effective selection of measures under the WFD.

Keywords: Water Framework Directive, environmental costs, resource costs, externalities, cost-effectiveness, economic valuation

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Introduction

In the implementation of the EC Water Framework Directive (WFD), the concept of environmental and resource costs (hereafter ERC) applies above all to the cost recovery of water services. In this context, Article 9 stipulates that

> *Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in accordance in particular with the polluter pays principle.*

This serves the following two objectives in particular:

- „that water-pricing policies provide adequate incentives for users to use water resources efficiently"; and
- that an „adequate contribution of the different water uses", [...], to the recovery of the costs of water services" is ensured. In this way, the principle of cost recovery should contribute to implementing the polluter-pays-principle.

Apart from cost recovery, environmental and resource costs are also of relevance for

- the designation of water body status and the application of derogations under Article 4 of the WFD, providing a possible economic justification for such derogations;
- the selection of the most cost-effective combinations of measures under Article 11 and Annex III of the WFD, which was the central objective of the research project "Basic principles for selecting the most cost-effective combinations of measures for inclusion in the programme of measures as described in Article 11 of the WFD", for which this document was produced.[2] The relation between environmental and resource costs and the selection of measures is explained in greater detail below.

In the WATECO guidance's glossary of terms, **environmental costs** are defined as

> *the costs of damage that water uses impose on the environment and ecosystems and those who use the environment (e.g. a reduction in the ecological quality of aquatic ecosystems or the salinisation and degradation of productive soils).*

[2] This paper is based on results of a research project commissioned by the German Federal Environment Agency. The project was supported through the Environmental Research Plan, Research Grant (FKZ) 202 21 210.

Resource costs are defined as

> *the costs of foregone opportunities which other uses suffer due to the depletion of the resource beyond its natural rate of recharge or recovery (e.g. linked to the over-abstraction of groundwater).*

In order to further clarify the concept of environmental and resource costs, and in order to discuss their assessment in practice, a European working group (DG Eco 2) was set up in September 2003. The main results of this working group are presented below. The principal aim of this document is to discuss how ERC are currently dealt with in Germany, and how the results of the DG Eco 2 can be put to use in the German context. Finally, this paper discusses how the assessment of ERC is influenced by the process of selecting cost-effective combinations of measures, and vice versa, in order to relate the DG Eco 2 results to the research project on selecting measures for which this document was produced.

The Conclusions of the Drafting Group Eco 2

In order to further clarify the concept of environmental and resource costs, a European Drafting Group (DG Eco 2) was set up in September 2003 under the Common Implementation Strategy (CIS) Working Group 'Integrated River Basin Management' (WG 2B).[3] WG 2B asked the DG Eco 2 to prepare a non-binding information sheet on the definition and assessment of environmental and resource costs in the context of the implementation of the WFD and to present practical examples for the calculation of ERC from the Member States. This information sheet was put forward by the Drafting Group in June 2004, edited by Roy Brouwer of the Dutch Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling (RIZA). It incorporates the results of three meetings of the Drafting Group, and an international workshop that was held in Amsterdam in March 2004.

Several main points can be identified from the information sheet prepared by the DG Eco 2:

- The document provides clearer definitions of the concepts of environmental costs and resource cost than the WATECO Guidance Document does. In particular, the distinction and the interdependence between environmental costs and resource costs is addressed in some detail.

[3] The Common Implementation Strategy (CIS) was agreed at the EU level to facilitate a coherent and harmonious implementation of the WFD in the Member States. More than 15 European expert and working groups have been set up within the CIS on different areas of the WFD.

- Especially in the case of resource costs, the information sheet represents a significant development in comparison to the definitions provided in the WATECO guidance document. At the same time, it should also be noted that the concept of resource costs that is put forward in the information sheet is not so much a clarification of the WATECO definition, but rather embraces a different logic, which interprets resource costs as a result of a misallocation of water resources, rather than their overexploitation.

- Furthermore, chapter 4 of the information sheet elaborates on the distinction between external and internal ERC, along with a discussion of the different measurement methods that can be applied in both cases.[4] The document also discusses the relation between ERC and the "financial cost" category identified in the WFD, arguing that the financial costs are closely related to the part of ERC that is already internalised.

- Concerning the choice of methods for the estimation of ERC, the information sheet merely provides a general discussion of the methods and some suggestions, but no concrete guidance. ERC can be assessed as environmental damage cost or as damage avoidance cost (or environment protection cost).[5] For the assessment of the internal ERC, these two approaches are presented as non-exclusive and equally valid. For the external proportion of ERC, however, the information sheet is more cautious about using environmental protection costs.

- In the context of the WFD implementation process, the information sheet foresees different points where ERC would come into play: above all, cost recovery according to Article 9 (including the setting of incentives for an efficient water use and the implementation of the polluter-pays-principle), furthermore the selection of cost-effective combinations of measures as mandated by Article 11 and Annex III of the WFD, and finally the issue of derogations (pursuant to Article 4), which involve a judgement on whether the cost of reaching the WFD targets can be considered as disproportionate.

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[4] Following the textbook definition by Pearce and Turner 1990, external costs arise where an activity by one agent causes a welfare loss to someone else, which is not compensated – e.g. in the case of a factory discharging polluted wastewater and causing damage to downstream fishermen. If the damage is compensated – either through a direct payment to the fishers, or through a wastewater charge, the cost is said to be internalised. If the polluter installs pollution abatement measures such as wastewater treatment, the cost of these measures can also be counted as internalised costs.

[5] The damage cost approach is also referred to as a "benefit-based approach", as it typically assesses the cost of a damage through the benefits that are lost if the damage occurs. By contrast, a cost-based approach assesses the cost of measures that are necessary to prevent the damage from occurring. While a benefit-based approach is more in line with standard environmental economic procedures, the cost-based approach is more pragmatic as the necessary data is more readily available.

Thereby, the DG Eco 2 argues for a comparatively broad scope for applications of ERC, which is not confined to the original context of cost recovery. This wide approach should generally be welcomed.

Following this general summary of some main results, a few points about the information sheet would warrant further, critical discussion:

- In general, and following the results of the DG meetings, the document focuses on explaining the theoretical economic background for the assessment of ERC, but provides quite little hands-on guidance on how to assess ERC in practice, and how to proceed with the results obtained. In particular, the document does not address the substantial challenges involved in an area-wide assessment of ERC across all Member States. This shortcoming can be explained through the limited knowledge and experience in applying economic valuation methods, as well as the diverging views on a common approach within the DG. Nonetheless, the use value of the document would have been larger if it had contained more practical recommendations.
- The definition of resource costs that is contained in the document, as a refinement and development of the original WATECO definition, appears to be too much oriented towards economic theory. While the definition has the advantage of being theoretically sound and unambiguous, concerns may arise in relation to its practical use. At least in the German context, there is a concern that the advantages of applying this definition will not justify the substantial data requirements associated with its application.
- While the information sheet is generally well-written, concise and well-grounded in environmental economic theory, a sceptical side note can be added on the distinction between use-values and non-use values in relation to ERC. Applying the concept of the Total Economic Value to the ERC, the report suggests (on p. 2) that “the environmental damage costs refer to non-use values attached to a healthy functioning aquatic ecosystem, while the costs to those who use the water environment refer to the corresponding use values.” However, the non-use values of a resource are notoriously difficult to measure, and it is even harder to communicate the concept to non-economists or to the general public. It is therefore highly debatable whether ERC should indeed be regarded mainly as a question of non-use values, as the paragraph above seems to suggest. In addition to this, a reference to the concept of ecosystem services could have been included (e.g. following Turner et al. (2000), who classify the ecosystem services as “indirect use values”. See also Constanza et al. (1997) and Balmford et al. (2002)).

The DG Eco 2 Conclusions: Implications for Germany

The treatment of environmental and resource costs in Germany currently differs markedly, depending on whether the academic or the political level is considered. At the political level, more pragmatic approaches prevail, also given the fact that the estimation of environmental and resource costs will not be a central element of the 2004 reporting on the economic analysis. Substantial work on this is only anticipated for the time after 2004. At the academic level, there is some theoretically sound evidence, however the integration of academic work with the objectives and the requirements of the WFD remains incomplete.

Treatment of ERC at Political and Administrative Level

The German Approach for the 2004 Reporting

On the political level, the amount of work that has been devoted to assessing environmental and resource costs has been limited. This is due to a number of reasons:

The calculation of environmental and resource costs is not a necessary component of the 2004 reporting on the economic analysis. For 2004, the degree of cost recovery has to be roughly estimated, as well as the level of cross-subsidies between different water uses in paying for water services. However, elaborated calculations of ERC and their recovery are not expected, not least because no new data collection is foreseen for 2004, and existing data on ERC is patchy. Instead, the 2004 reporting on ERC should rather identify data gaps and research needs, and possibly suggest a methodology for the future assessment of ERC (see e.g. DG Eco 1 information sheet on cost recovery 2004, LAWA 2003).

At least in some of the German Federal States (*Länder*), there is a perception that environmental and resource costs are not a major issue, and will not be decisive in the assessment of cost recovery or in assessing the adequate contribution of water uses to the cost recovery of water services. Against this background, the expediency of investing time and effort into the estimation of ERC is disputed. This applies in particular to resource costs, which are barely discussed or considered. Likewise, the connection between ERC and the selection of cost efficient measures is sometimes doubted or not seen as a major issue.

In Germany, the chosen approach for the assessment of cost recovery in the 2004 reporting is to base the calculations on three exemplary pilot regions (sub-basin area of Mittelrhein, sub-catchment area of Lippe, administrative district of Leipzig) (Pielen and Interwies 2004). In these regions, ERC have so far only been assessed as internalised ERC; i.e. the proportion of

costs that is recovered through environmental taxes and charges (wastewater charges and water abstraction payments, possibly also compensation payments for nature conservation and leisure fishing). It is acknowledged that this is only a first step towards the assessment of environmental and resource costs, and that further work will be necessary.

The approach of focusing on existing charges and payments is supported by the DG Eco 2 information sheet (p. 14) as a way of assessing the proportion of environmental (protection) cost that are already internalised. In this context, economic instruments (such as the wastewater charge and the groundwater abstraction charge) are mentioned explicitly. In addition, the information sheet also refers to the cost of technical measures as a way of estimating internalised ERC.

However, in following this approach, several caveats apply:

- The information sheet maintains that an approach focusing on the already-internalised costs would be regarded as sufficient only if the existing measures succeed in achieving the environmental target of the WFD (i.e. the good ecological status by 2015). As the achievement of this target cannot be guaranteed on the basis of existing measures in Germany, it follows that the non-internalised remainder of environmental and resource costs will need to be considered as well.
- From an economic perspective, the part of the total costs that is not recovered through existing charges or payments (i.e. the externalities) is more relevant for cost recovery and for decision-making, as the existence of external effects points to market imperfections and inconsistencies with the polluter-pays-principle.
- It can be argued that the existing charges considered in Germany (the wastewater charge and groundwater abstraction payments) fail to address some of the more pressing concerns for the WFD implementation or for cost recovery. Thus, some relevant pressures (such as diffuse pollution or morphological changes) are not addressed through taxes and payments.
- Also, in contrast to economic theory, it would appear that the level of environmental taxes and charges in Germany is strongly influenced by political expediency and budgetary necessities, rather than reflecting the true cost of environmental damage. One example of this is the spread of groundwater abstraction charges between the German *Länder*. This means that the information value of the revenue raised is limited.

Perspectives for the Assessment of ERC beyond 2004

The general understanding is that the preliminary assessment of environmental and resource costs envisaged for 2004 is only a first step – since it assesses only the part of ERC that is already internalised, it tells only half the story. It should be acknowledged that, given the recommendation that the initial assessment should be based on already available data, a more elaborated quantitative treatment would not have been feasible at this stage. However, a possibility would be to focus on a qualitative assessment of ERC, e.g. by identifying sectors and activities that are most likely to be further investigated after 2004, or by roughly estimating the approximate proportion of ERC that is already internalised through the described measures.

The approach that will be followed after the 2004 reporting is still unclear at this stage. As other parts of the WFD implementation, the assessment of ERC falls into the responsibility of the *Länder*; currently there are still different perceptions about the role and relevance of ERC. However, the aim is to arrive at a harmonised approach for their assessment. To this end, initial brainstorming is expected to take place in the second half of 2004 / 2005 in the sub-working group on economics of the German *Länder* (*LAWA-EU ECON*). This discussion will also incorporate the results of the DG Eco 2.

While the definitive approach remains to be discussed, it is likely that most of the *Länder* will opt for a two-tiered approach. While the already-internalised costs will be assessed through the wastewater charge, groundwater abstraction payments and compensation payments for nature protection, as it is done for the 2004 reporting, the remaining (external) costs will be assessed through other means, e.g. through economic assessment field studies or through a benefit transfer.

In the discussion of potential methods to assess ERC, concerns have been expressed about the expediency of employing elaborated methods to assess ERC. The general impression is that the effort spent onto estimating ERC has to be guided by the actual use of the information obtained. This position is also supported by the WFD, which refers to the proportionality of the costs of data collection in Annex III. There, it is maintained that in gathering the information for the economic analysis, and in choosing the amount and level of detail of this information, Member States should “[take] account of the costs associated with collection of the relevant data". In addition, the WATECO guidance document (on p. 42) states that “Overall, the analysis should remain proportionate and not entail extensive collection of new data.” Also, given the limited administrational capacity and the widespread scepticism

towards the use of (some of the) economic methods, the chosen approach would have to be robust and practicable.

One possibility that is considered involves a benefit transfer, whereby economic information on environmental damage costs is transferred from valuation studies conducted in other regions. However, the existing data base that could be used to this end is not very extensive, and may not suffice to conduct a benefit transfer in a methodologically sound way.

Concerning the use of the information obtained in this way, at least some of the German Länder perceive ERC as relevant and potentially decisive information. This is not only the case for the assessment of cost recovery levels, but more so for the implementation of the polluter-pays-principle and for the estimation of the "adequate contribution" of water uses to the cost recovery of water services.

As expressed in Article 9 of the WFD, and as also discussed in the conclusions of the DG Eco 2 (p. 9), the assessment of the degree of cost recovery should also provide information on the extent to which the polluter-pays-principle is applied. Having assessed to which degree the costs of water services, including ERC, are covered, the next question is then whether the costs are indeed covered by the water uses that caused them – or, in WFD terminology, whether water uses make an "adequate contribution" to the cost recovery of water services. To answer this question, the origin of the ERC needs to be investigated more closely – even if the initial assessment of cost recovery should reveal that the ERC are fully recovered.

One main issue that remains to be addressed in implementing the polluter-pays-principle is the diffuse pollution from agriculture, which currently represents one of the main pressures in Germany (see e.g. Interwies et al 2004). Through diffuse immissions, agriculture as a water user causes substantial costs for water services such as drinking water supply; these costs would therefore need to be addressed in the cost recovery for water supply. A problem arises in connection with the second main pressure category affecting water bodies in Germany, morphological changes. In this context, there appears to be no major role for the recovery of ERC as a way of implementing the polluter-pays-principle, since shipping and hydropower generation are usually considered as water *uses* with no water services to which they can be related.[6] Thus, the cost recovery requirement cannot be applied to morphological changes in the same way as to other pressures and impacts.

[6] There is also the opinion that a water use may be considered as a water service in such cases where it has a significant impact on a water body (see e.g. the guidance document produced by the German LAWA 2003)

Apart from the issue of cost recovery and the polluter-pays-principle, some of the German *Länder* argue that ERC will also be relevant when it comes to selecting the most cost-effective combinations of measures. To this end, pilot projects that are currently planned and implemented on the Lippe river in North-Rhine-Westphalia and on the Ulster river in Hesse may provide additional insights and experiences.[7]

Relevance and Assessment of Resource Costs in Germany

While the methods and approaches discussed above mainly relate to the estimation of environmental costs, the situation with regard to resource costs is somewhat unclear. The LAWA guidance for the implementation of the WFD maintains that "Environmental and resource costs can be used as a dual term that covers all the externalities of water services." While the DG Eco 2 document offers a clear distinction between environmental and resource costs, it also notes that environmental and resource costs are closely related. The example provided in the document is structured as follows: resource costs can be calculated if the value of current water uses is compared to the value of alternative, next-best water uses. These water uses can also be "environmental uses", if a high value is attached to maintaining an aquatic ecosystem in an undisturbed state. In this sense, resource costs can arise if a water body is put to an economic use (through water abstraction, or as a transport route), while the general public would place a much higher value on conserving the water body.

It should be noted that the initial understanding of resource costs in the German discussion differed from the definition put forward in the conclusions of the DG Eco 2, a discrepancy that was also reflected in internal discussions within the drafting group. The current definition expressed in the DG document argues that resource costs arise where water resources are not put to their optimal use, so that alternative water uses could generate a higher economic value. Following this interpretation, resource costs are the result of a misallocation of water. With this definition, resource costs would arise e.g. if the development of tourism in an area is hindered because the limited water resources are used for irrigation, or if a brewery cannot extend its production, as water resources are allocated to a nearby steel mill. In this case the foregone earnings of tourism (respectively of the brewery) would count as resource costs – under the assumption that tourism (beer production) creates a higher revenue than agriculture (steel production) per m^3 of water.

[7] While research is ongoing at the river Lippe, Orth (2003) provides first insights.

By contrast, the argumentation expressed in the WATECO definition and the Commission communication on pricing policies saw the resource costs as resulting from a depletion of scarce water resources beyond the natural rate of recovery (WATECO 2002, European Commission 2000). In line with this definition, the German discussion followed an interpretation of resource costs that hinges on overexploitation and the resulting scarcity of water resources. Following this line of interpretation, resource costs would arise since, in the case of overexploitation, it is not the flow of new water resources that is being tapped (i.e. abstraction below the natural rate of recovery), but rather the stock of water resources (all abstraction exceeding the natural rate of recovery). Following this interpretation, it has often been maintained that resource costs are not a major concern in Germany, as there are few scarcity situations where water resources are overexploited.[8] In a small number of cases the locally available water resources are insufficient, so that water has to be transferred over long distances. The costs of these water transfers could be regarded as resource costs, at least under the "old" interpretation.

There is, however, a growing awareness that resource costs may become more relevant in the future due to climate change. The experiences of the summer of 2003, where insufficient cooling water supply restricted the operation of thermal power plants, provided evidence of this. In the future, water scarcity may also become a more recurrent concern in parts of Eastern Germany. Also, it should be underlined that scarcity of high-quality water is not merely a question of sufficient quantities; instead, scarcity may also be the result of pollution.

For the 2005 reporting, resource costs will not be addressed separately, but will be treated as part of the joint category of environmental and resource costs. On the basis of the "old" interpretation, which sees resource costs induced through overexploitation, it could be argued that the groundwater abstraction charge represents internalised resource cost. However, following the new interpretation, which defines resource costs as the costs of misallocating water resources, this is not necessarily the case.[9]

The definition of resource costs put forward by the DG Eco 2 is greeted with some scepticism in the *Länder*. It was noted that the implementation of the WFD takes place on the local level – therefore suggested approaches should also be practicable on a local scale. It can be doubted

[8] Along these lines, the *LAWA* guidance document on the WFD implementation (p. 117) argues that "We may generally assume that in Germany resource costs are not incurred in most regions, since there are not water shortages under normal conditions and therefore no competition over uses. However, individual cases in regions where water shortage does occur may involve significant resource costs."

whether this is the case for the approach suggested in the DG Eco 2 document, which sees resource costs as the results of a misallocation of water resources. To follow this approach on the local level might require microeconomic data on the efficiency and productivity of water uses on the firm or household level. However, the knowledge gained from this data would hardly justify the costs of gathering it.

Treatment of Environmental and Resource Costs at Academic Level

Looking at academia, a mixed picture emerges for the assessment of environmental and resource costs. The favoured approach in economic valuation study is certainly the benefit approach, the standard routine in environmental economics. This approach assesses environmental damage through surveys of individuals' willingness to pay (WTP) for environmental improvements, or their willingness to accept (WTA) compensation for suffering damage to the environment. Other approaches, e.g. cost-based approaches or the assessment of ecosystem services, are applied less frequently.

- Compared to English-speaking countries, the economic valuation of environmental goods and services does not have a long tradition in Germany. Consequently, studies that have assessed the economic value of water uses are few and far between.
- In recent years, the number of studies that have been conducted has increased somewhat: socioeconomic aspects are now addressed in most water-related research projects. A non-exhaustive overview of recent water related valuation studies is given in Table 1 below. Box 1 below presents a recent study by Dehnhardt and Meyerhoff (2002) on the valuation of floodplains on the river Elbe, representing one of the most elaborated recent works. The table and the Box are also part of the DG Eco 2 information sheet (p. 15 and 17).
- However, the number of studies still cannot be regarded as a sufficient basis for a countrywide assessment of ERC, of the implementation of the polluter-pays-principle or of the adequate contribution of water uses to the recovery of costs of water services. The data that currently exists in Germany is also clearly insufficient for a methodologically sound *benefit transfer*. It remains to be discussed whether this can be amended by using transfer values from other European or Non-European Countries, e.g. from the Swedish ValueBase^{SWE} data base, the Canadian-based EVRI data base or the Australian EnValue.

Also, the approach followed in many academic studies is ill-suited for WFD purposes:

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[9] See examples given above (tourism/brewery)

- A problem is that it lies in the nature of academic research to address new challenges and to develop new methods, and to find the most elegant solution rather than the most practical one. This means that the comparability of approaches and results is limited.
- Furthermore, most valuation studies tend to focus rather on the absolute value of (aquatic) ecosystems and their uses. However, the valuation of an entire ecosystem is not the same as valuing the environmental damage that is caused by a particular use. To amend this, it would be necessary to identify the reference points of the analysis more clearly.
- Valuation studies conducted in recent years were generally not closely aligned with the economic issues and approaches suggested by the WFD and the CIS documents. This is partly because the WFD is too recent to have had a major impact on long-term research plans. However, it is also because Germany has not committed significant resources to extend the data basis for the economic valuation of aquatic ecosystems.

Table 1: Overview of Recent German Economic Valuation Studies

Study	Object	Methodology	Result (examples)
Holm-Müller (1991)	Environmental quality (e.g. drinking water, surface water)	Contingent valuation	Improvement of 1 quality class (€/household*a): 48 (surface water) 24 (drinking water)
Hampicke, Schäfer (1994)	Isar estuary floodplains	Market prices (timber), contingent valuation	500 to 650 €/ha*a
Jung (1996)	Environmental quality (e.g. drinking water)	Contingent valuation	
Schönbäck (1997)	Danube floodplains, national park	Travel costs, Contingent valuation	Value of national park (11.500 ha): 8,3 billion €
Waibel, Fleischer (1999)	Costs and benefits of agricultural pesticides	Market prices (drinking water), Contingent valuation (biodiversity)	Drinking water supply: 65,9 Mio € p.a. for Germany (51% of total external cost)
Muthke (2001)	Quality of water bodies for recreation	Contingent valuation	Improvement of 1 class: 30 – 43 €, 2 classes: 34 – 53 € / household*a
Wronka (to be published)	Biodiversity, drinking water	Contingent valuation	Improvement of drinking water quality: 22 - 75 €/household*a
Dehnhardt, Meyerhoff (2002) (see below)	Elbe floodplains (biodiversity, nutrient retention)	Contingent valuation, market prices (nutrients)	Area of 10.000 to 15.000 ha: net present value 850 - 1.080 Mio €

Box 1: Sustainable Development of the River Elbe

One of the most comprehensive recent works on the valuation of water resources in Germany was done by Dehnhardt and Meyerhoff (2002), who estimated the value of floodplains along the river Elbe. Background, methods and results of this study are discussed in the following.[10]

Background

The creation of floodplains involves substantial environmental benefits. Besides their role in curtailing damages from floods, floodplains contribute in particular to the conservation of biological diversity and to nutrient retention. Against this background, the German Ministry for Education and Research commissioned a project on the monetary valuation of the sustainable development of the River Elbe, which formed part of the interdisciplinary research cluster Elbe-Ecology. The project focused on a cost-benefit analysis for the proposed restoration of 15,000 ha of floodplains, including effects on biodiversity and water quality.

Methodology

Two distinct methodologies of analysis were used in the study. A contingent valuation study was conducted to evaluate the willingness to pay for the protection of biodiversity and endangered species in the Elbe floodplains through a set of measures. The interviews included people living nearby as well as people in other river basins, and users as well as non-users.

In addition, the ecosystem services of floodplains in improving water quality were assessed using the replacement cost method, whereby services provided by ecosystems are priced on the basis of technical substitutes. To this end, the floodplains' capacity for nutrient retention was valued based on the costs of otherwise needed investments for water treatment plants, as well as policy measures to reduce agricultural fertiliser input.

Results

The results of the contingent valuation study demonstrated that 22,5 percent of people interviewed were willing to financially support the creation of floodplains. An average willingness to pay of € 11,90 per household per annum yielded a theoretical total contribution of € 153 million in the first year and € 108 million in the second year, as some of the interviewed were only willing to pay once. While the willingness to pay was significantly

[10] This summary of the project results was written by B. Görlach and appeared in identical form in the DG Eco 2 information sheet. The original project was carried out by the Technical University of Berlin and the Institute for Ecological Economic Research, Berlin. See also Dehnhardt and Meyerhoff (2002).

higher for users than it was for non-users, there was no significant difference between people living close to the Elbe and respondents in other river basins.

With respect to the beneficial effects of floodplains on water quality, it emerged that the effects strongly depended upon the local conditions. In general, it was calculated that all planned measures for floodplain restoration would reduce the total nitrogen load of the Elbe by 4%, resulting in annual savings of € 8,8 million. This equals a value of approximately 585 € per hectare and year. In comparison to the costs of floodplain creation, it emerged that the estimated benefits far exceeded the costs. Under different scenarios, the benefit-cost-ratio ranged from 2,5:1 to 4,2:1. For these results, a sensitivity analysis was conducted, which did not affect the general outcome of the analysis.

Although the study was not closely embedded into the WFD implementation, it does provide some examples of how to approach the economic aspects of the WFD. Apart from demonstrating how environmental costs can be included in the selection and design of measures, it also provides evidence of the benefits (= environmental damage avoided) that users and non-users of the river would derive from a sustainable development of the Elbe.

Linkage of the DG Eco 2 Conclusions with the Selection of Measures

In assessing the relation between environmental and resource costs and the selection of cost-effective combinations of measures, three different types of interrelations can be discerned:

- First, the calculation of ERC can be useful in assessing the cost-effectiveness of measure combinations, at least if a “wide” notion of cost-effectiveness is applied;
- Secondly, if a cost-based approach is followed in the calculation of ERC, the information obtained in the process of selecting measures can be used as a lower-bound proxy for the ERC;
- Thirdly, it is to be clarified if there is a link between the ERC that are recovered (according to Article 9), and the financing of the programme of measures.

These three are briefly discussed in the following.

The Role of Environmental and Resource Costs in Assessing the Cost-Effectiveness of Measures

The information sheet prepared by the DG Eco 2 refers explicitly to the role of environmental and resource costs in the selection of the most cost-effective combination of measures. This view is also expressed in the handbook on the selection of measures that was published by the German Federal Environment Agency (Interwies et al. 2004). The handbook argues for a wider interpretation of cost-efficiency, that incorporates not only the direct costs of the measures and instruments implemented, but also their second-order economic effects. The role of ERC for measure selection was also acknowledged as central by the *Länder* officials that were contacted in the course of this study.

According to the information sheet prepared by the DG Eco 2 (p. 8), one function of the estimated ERC is to "signal to what extent existing or new environmental standards are met [...] and what the associated costs are, including (residual) environmental damage costs and any costs arising as a result of an inefficient allocation of water and pollution rights."

If the measures that are selected and implemented succeed in achieving the good ecological status for all water bodies, this would also serve to internalise the residual environmental damage costs.[11] Depending on the measures chosen, the implementation of the programme of measures can also lead to a more efficient allocation of water and pollution rights and thereby reduce the resource costs of water uses.

The passage on the function of ERC in the selection of measures cited above suggests that ERC could help to assess the level of target achievement in monetary terms. However, given the limited data base and the uncertainties involved in estimating ERC, it is questionable whether ERC are indeed useful for this role. Whether or not this is the case depends also on the types of measures considered. Whereas the handbook focuses on measures that are primarily designed to achieve the ecological objectives of the WFD, it is also possible to conceive of measures that are primarily aimed at redistribution and compensation, or at the assessment of cost recovery levels, in order to ensure correct price incentives and the

[11] The question whether there are residual environmental damage costs after the good ecological status is achieved has been the subject of some debate at DG Eco 2. Following standard environmental economic assumptions, the optimal state would never be the point where all pollution is abated (and hence environmental damage brought to zero), but rather the point where the cost of reducing pollution by one additional unit is equal to the benefits this brings.

implementation of the polluter pays principle.[12] If the latter type of measures are given more weight, the use of ERC for assessing target achievement would be more suitable.

The allocation of water and pollution rights has not been a central issue in the German handbook on the selection of measures, although the issue was also touched upon. Instead, the main focus of the handbook is on traditional, technical measures to improve the situation of water bodies, and on instruments to correct incentives for the use of water resources. In terms of their results, however, instruments affecting the allocation of water and pollution rights tend to have a very similar effect to instruments targeted at changing incentives for water use.

The Cost of Measures as a Proxy for Environmental and Resource Costs

The second linkage between the selection of measures and the assessment of ERC follows a different logic. For the assessment of ERC, either a benefit-based approach or a cost-based approach can be followed (see p. 12 ff. in the DG Eco 2 information sheet). If a cost-based approach is applied in the estimation of ERC, it is possible to use information on the cost of measures in order to provide a proxy for ERC. This information can be obtained from fact-sheets on specific measures – such as those contained in the German handbook. It is to be expected that the existing information on measures, their costs and effectiveness, will be refined and extended, e.g. through the establishment of databases on measures. Alternatively, information can also be inferred from the measure selection process itself.

While the use of such a cost-based approach is uncritical for the estimation of *internalised* environmental costs, it is more controversial with regard to the *external* proportion of ERC. A cost-based approach uses environmental *protection* costs as a lower-bound proxy for the external environmental *damage* costs. This is based on the assumption that the value of environmental damage is at least as much as the cost of fixing this damage. However, from an economic viewpoint, this approach appears inconsistent at first, as it seems to mix what should be two sides of a cost-benefit-comparison. It is important to note the inequality here: it is not alleged that environmental damage costs are *equal* to the cost of environmental protection measures, but that the damage cost is *at least as large* as the protection cost. This assumption is consistent with the assumptions of environmental economics: in a sub-optimal state, the cost of protection (or pollution abatement) will always be lower than the cost of damage (or the benefit of reducing this damage). The optimum is reached where the two are

[12] It should be noted that this is not a clear separation; indeed, many instruments and measures will contribute both to the achievement of the ecological objectives and to the "economic objectives" such as cost recovery and

equal. In the context of the WFD, the optimum has been defined externally as the good ecological status for all water bodies. Since this target is not achieved, the current situation is below the optimum. Nonetheless, cost-based approaches are often favourable with decisionmakers as the data availability tends to be better.

The DG Eco 2 information sheet takes a cautious approach on the use of cost-based approaches in assessing ERC. On page 14, it is maintained that, "For the purpose of cost recovery, the costs of these additional measures can be used under certain circumstances as a proxy for the *external* environmental costs" (emphasis in the original). However, the "certain circumstances" under which a cost-based approach may be applicable are not elaborated further.

As specified in the DG Eco 2 information sheet, the immediate use of the information gained through the selection of cost-effective measures lies in assessing the cost of reaching the ecological objectives of the WFD, possibly including the external ERC. In addition to this, the selection of measures will also provide important input for the design of water-pricing policies. If these are to „provide adequate incentives for users to use water resources efficiently", as mandated by Article 9 of the WFD, it is crucial that these pricing policies reflect the costs of measures needed to restore the ecological status.

Cost Recovery as a Source of Funding for the Programme of Measures

The previous considerations aimed at using the *information* obtained in the selection of measures as a basis for the assessment of ERC. However, it is also possible to think one step further and to argue that the income generated by the recovery of ERC could be used to finance the actual *costs* of measures.

This linkage, however, is not explicitly mentioned in the DG Eco 2 document. Neither is it explicitly mandated by Article 9 of the WFD: the article only mentions the incentive functions of the cost recovery, i.e. implementing the polluter-pays principle as well as providing incentives for efficient water use. However, the financing function of cost recovery is not addressed.

In principle, using the revenue raised through cost recovery to finance the programme of measures would appear to be in line with the considerations above. The programme of measures serves to achieve the ecological objectives of the WFD. Therefore it can be seen as

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incentive pricing.

a way of internalising the external costs, as long as the costs can indeed be related to the originator of the environmental damage. Consequently, contributing to financing the programme of measures by charging polluters would be in line with the polluter-pays-principle.

Conclusions

The information sheet that has been prepared as a conclusion to the work of DG Eco 2 is a well-written, concise and comprehensive set of recommendations on the notion and the assessment of Environmental and Resource Costs and their role in the Water Framework Directive. The recommendations made in the document are well-grounded in economic theory on the one hand, but on the other hand they also pay attention to the needs of the practical implementation.

However, what the information sheet does not do is to provide guidance on the actual estimation of environmental and resource costs – for example, it does not specify which measurement techniques should or should not be used under which conditions. Therefore the document will be helpful in summing up the current state of the discussion, and provoking further thought. However it will not suffice to bring about a coherent and harmonised European approach to the assessment of ERC.

For the further WFD implementation in Germany, the following points merit consideration:

- The expediency of carrying out extensive assessments may appear doubtful in some cases, if one considers the practical value of the information obtained in this way. Thus, what is called for is a ***"meta-Cost-Benefit Analysis (CBA)"*** in order to assess whether the expenditure required to estimate ERC is really justified by the information gained in the process, and by the consequent improvements in decision-making.[13] This meta-CBA might take the form of an initial screening, combining qualitative judgements and expert knowledge, in order to estimate where detailed ERC calculations would be most useful.
- In regard to the costs and benefits of obtaining information on environmental costs, ***benefit transfer*** is often named as an option to gather the needed information at a low cost. The underlying idea of benefit transfer is to estimate economic values for water uses by transferring available information from studies already completed in another location

[13] This aspect will be further investigated in a research project commissioned to Ecologic by the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER), results of which will be available in 2005.

and / or context. The impression is that, among practitioners, benefit transfer has come to be regarded as a multi-purpose gadget that can provide the answer to all questions. However, given the limited number of economic studies that have been conducted in Germany so far, the data base is still far too small for a successful and methodologically sound benefit transfer. It remains to be assessed whether this could be amended through more research on the national level, or through the establishment of a European database for economic valuation studies.

- One main concern for the assessment of ERC is that recommended strategies for the internalisation of ERC may not be feasible due to ***political constraints***. When it comes to implementing the polluter-pays-principle to and assessing adequate contributions from say agriculture, shipping and hydropower, it is unlikely that effective mechanisms for cost recovery will be implemented. While it is not a new phenomenon that political realities trump economic necessities, it does raise further questions about the expediency of extended calculations of ERC. A sceptical observer might question the point of conducting elaborated and expensive research into ERC, while the root causes for many environmental problems have been identified for some time, but cannot be addressed.
- Finally, it may be discussed to what extent the DG Eco 2 conclusions are obligatory in all respects for the implementation of the WFD in Germany. While the recommendations are obviously not binding in a legal sense, it would also be unrealistic to pursue an approach in Germany that stands in a marked contrast to the approaches of other Member States. One point where the discussion in Germany differs from the approach suggested in the information sheet concerns the assessment of resource costs: here, it may be worth discussing how to proceed with the recommendations in the future.

Apart from these considerations, which are specific to the German context, there are also some concerns of a more general nature, mainly linked to the actual implementation of Article 9 and the linkages between Article 9 and the selection of measures. The tasks implied by Article 9 – the setting of incentives for efficient water uses, as well as the achievement of cost recovery and the implementation of the polluter pays principle – will require targeted actions, such as fiscal measures or measures to achieve pricing policy. In order to ensure coherency, such measures should either be integrated into the programme of measures according to Article 11, or should at least be planned in a coordinated way.

The programme of measures is the only part of the WFD where **measures to achieve cost recovery and to correct incentive**s can be implemented, yet the question remains how this

can be done most efficiently. The programme of measures according to Article 11 will be aimed primarily at achieving the environmental targets of the Water Framework Directive (i.e. good ecological status or potential). This is different for the measures needed to implement Article 9, which aim at correcting incentives for water uses, achieving cost recovery and implementing the polluter-pays-principle. In many cases, the objectives of these two types of measures will overlap, in others they may not.

In order to integrate the assessment of ERC and their recovery into the process of selecting measures, three options would be feasible in principle.

- The **methodologically soundest option** is to include the recovery of ERC among the objectives that measures are expected to achieve, along with the ecological targets. Applied to the methodology described in the German handbook (Interwies et al. 2004), ERC would then be assessed as part of step 5, which calculates the costs of potential measures – direct costs as well as wider economic impacts. This would mean that step 5 would also need to cover an assessment of how the selected measures and instruments affect the internalisation of ERC. The combinations of measures would thus have to fulfil both objectives: reaching good ecological status, and achieving the recovery of ERC.

  With regard to the wider economic impacts, the handbook suggests that the official in charge should judge whether these impacts are significant enough to affect the outcome of the decision. If it is decided that this is *not* the case, the motivation for this decision has to be explained. This judgement might also include an initial screening of whether significant ERC exist, and whether the selected (combination of) measures does have any effect on them. If neither of the two holds true for the water bodies in question, ERC would not need to be considered any further. Such an initial screening might take the form of a "meta-CBA" as mentioned above.

- A **more pragmatic approach** would be to assess the contribution of measures and instruments to the recovery of ERC after they have been selected. In the context of the German handbook on the selection of measures, this would mean that measures and instruments are first chosen on the basis of their cost and their ecological effectiveness. At the end of the selection process, an additional feedback loop would need to be integrated: having identified the most cost-effective combination of measures, the official in charge would then assess whether the selected combination does internalise (part of) the existing environmental and resource costs. If this is not the case, additional measures and instruments would need to be introduced to deal specifically with the internalisation of

ERC (such as water abstraction charges). However, these additional measures and instruments may affect the functioning of the measures and instruments already selected. Where this is the case, the other steps of the selection process may need to be reiterated.

- Finally, regarding the linkage between cost recovery and the selection of measures, it may also be discussed whether the recovery of ERC can (or should) contribute to financing for the programmes of measures. As argued above, there is an economic point for connecting the two, i.e. that the programme of measures can be seen as internalising the external share of the ERC, and as contributing to the implementation of the Polluter-Pays-Principle. However, it may be disputed whether this connection also holds in the practical implementation.

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