Policy Research Brief

Value Transfer and
Environmental Policy

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Front cover: Value transfer is applied by taking money values from one site to another (across space, time and culture). Shown here on the left is a river basin in Wyoming, USA, where many CVM studies have been carried out; on the right is a site in Scotland to which the same values might be applied. Photos by Clive L. Spash (left) and Stockbyte (right).

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Overview

Cost-benefit analysis (CBA) is now routinely used to assess new European Commission policy proposals. In many countries, original valuation studies are conducted using CBA to help evaluate environmental policies and projects with environmental impacts (see Policy Research Brief 1 for a review of CBA methods). Other uses of environmental valuation include greening national accounts (see Policy Research Briefs 3 and 9), environmental accounting at the firm level, estimating marginal damage costs in order to determine socially optimal pollution levels and taxes, and determining the size of compensation payments after pollution accidents. CBAs are often based on a damage function approach where transfers of natural science data are required (e.g. use of experimental results). The emphasis in terms of monetary valuation has been on original valuation studies specific to the environmental problem under consideration.

> When applying benefit transfer a crucial question becomes 'What level of accuracy is acceptable, and how does the need for accuracy vary with the intended use of the value?'

However, due to limited time and resources new environmental valuation studies often cannot be performed, and therefore estimated values are transferred from previous studies of similar changes in environmental quality. This procedure is often termed **benefit transfer**, but can also relate to the transfer of damage estimates. Thus, a more precise term is **value transfer**. The site where the original valuation study was conducted is often termed the *study site*, and the site where the new value estimate is needed is termed the *policy site*. Value transfer can be across different sites (spatial value transfer) or at one specific site over time (temporal value transfer).

Two approaches are generally used in benefit transfer studies, unit value transfer and function transfer (see pp. 5–9). When applying such methods a crucial question becomes 'What level of accuracy is acceptable, and how does the need for accuracy vary with the intended use of the value?' Results from validity tests show that the uncertainty of spatial and temporal value transfers can be large (see pp. 10–11). Therefore value transfer should only be applied to uses of environmental valuation where the demand for accuracy is relatively low. The following section discusses current applications of value transfer and difficulties faced in using this approach in environmental decision-making (pp. 12–13). Next, potential ways of how users can respond to these challenges are outlined (pp. 14–15). A summary of key points concludes this policy research brief (p. 16).

Transfer of Information

C BAs require monetary values, whereas Environmental Impact Assessments (EIAs) use quantitative physical and qualitative data. Both methods often use the damage function approach (DFA). Figure 1 illustrates the application of DFA to air and water emissions using atmospheric and marine dispersion models, dose-response and exposure-response functions or expert assessments of environmental and health impacts. In many cases such models and data do not exist or are fraught with uncertainties. Therefore, expert assessments are used to go directly from step 1 to step 3. Uncertainty in value transfer can therefore originate from both monetary valuation and scientific data. This means several disciplines are required to analyse environmental value transfer, including economics, statistics, decision theory, ecology, geography, sociology, social psychology and philosophy.

> Uncertainty in value transfer can originate from both monetary valuation and scientific data.

Step 1:   Emissions and other residuals   ‡

Step 2:   (Transport model) ‡   Changed concentrations and other conditions   ‡

(Dose-response functions (environment) & Exposure-response functions (health))   ‡

Step 3:   Physical impacts   ‡

Step 4:   (New environmental valuation study or Database of existing studies + Benefit transfer techniques)   ‡   Damages or benefits
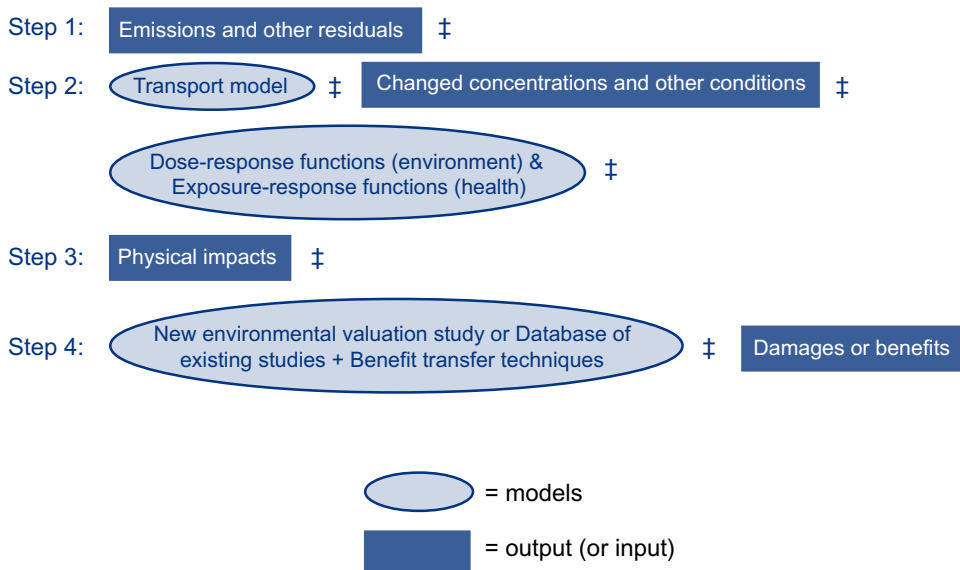
Figure 1. Application of damage function approach (DFA) to air and water emissions.

( ) = models

▬ = output (or input)

Typology of Value Transfer Methods

There are two main approaches to value transfer which include two sub-categories each:

1. Unit Value Transfer
   (i) Simple unit transfer
   (ii) Unit transfer with income adjustments

2. Function Transfer
   (i) Benefit function transfer
   (ii) Meta-analysis

Transfer of values across places, over time and between generations is difficult. Many remain sceptical of its applicability.

Unit Value Transfer

Simple unit transfer is a very basic approach of transferring benefit estimates from one site to another. This approach assumes that the well-being experienced by an average individual at the study site is the same as that which will be experienced by the average individual at the policy site. Therefore, mean monetary value estimates – for example, mean willingness to pay (WTP) per year per household – are directly transferred from the study site to the policy site.

Problems arise if, for example, individuals at the policy site value recreational activities differently from the average individual at the study site(s). There are two principal reasons. First, people at the policy site might be different from individuals at the study site(s) in terms of income, education, religion, ethnic group or other socio-economic characteristics that affect their demand for recreation. Second, even if individuals' preferences for recreation at the policy and study site(s) were the same, their recreational opportunities might differ.

Unit values obtained from contingent valuation (CVM) studies for non-use values of nature are even more difficult to transfer than recreational (use) values for at least two reasons. First, the appropriate unit of transfer is unclear. Recreational use values can be defined in terms of consumer surplus (CS) per activity day, but for non-use values both WTP and time period can vary widely. WTP values can be obtained for households or for individuals; payments can be set as a one-off payment, an annual amount for a

Box 1: The Use of Value Transfer in the USA

The US Oil Spill Act (August 1990) recommends transfer of unit values for assessing the damages resulting from small 'Type A' spills or accidents using the National Resource Damage Assessment Model for Coastal and Marine Environment. This model transfers value estimates from various sources to produce damage assessments based on limited physical information from the spill site.

For the past few decades simple unit transfer has largely been used in the US to estimate the recreational benefits associated with multipurpose reservoir developments and forest management. The selection of these unit values are based on estimates from either one or several valuation studies that are considered to be close to the policy site, or mean values from reviews of previous studies (e.g. Walsh *et al.* 1992).

limited time period, or an indefinite time, or monthly payments. Second, the WTP is reported for one or more specified discrete changes in environmental quality, and not on a marginal (i.e. per unit) basis. Therefore, the magnitude of the change in the study and policy sites should be similar in order to get valid transfers of estimates of mean WTP (see also Boxes 1 and 2). Furthermore, the level of environmental quality *before* the change matters, as the physical impact and/or the economic value per unit of the impact might not vary proportionally with the change in environmental quality, but could for example increase as the environmental quality deteriorates (i.e. increased marginal impacts and/or economic value of the impacts with a marginal decrease in environmental quality).

As shown in Figure 1, the valuation step is often part of a larger damage function approach, where values are sought for endpoints of dose-response in the case of environmental impacts, and of exposure-response functions for health impacts. For example, when looking at changes in emissions of air pollutants, a linkage has to be developed between the physical unit that the endpoints are expressed in and the unit of the economic estimates. This has been done successfully for changes in the visibility range (Smith and Osborne 1996) but is more difficult as complexity of changes in environmental resources increase.

The simple unit transfer approach is unsuitable for transfer between countries with different income levels and standards of living. Therefore, unit transfer with income adjustments has been applied, by, for example, using Purchase Power Parity (PPP) indexes. However, such adjustments fail to account for differences in preferences, environmental conditions, and cultural and institutional conditions between countries (see Figure 2).

Figure 2. WTP for a 'standard' individual based on estimates from country-specific models. Source: Ready *et al.* 1999

Key to EPISODES:

EYES: One day with mildly red, watering, itchy eyes. A runny nose with sneezing spells. Patient is not restricted in their normal activities.

COUGH: One day with persistent phlegmy cough, some tightness in the chest, and some breathing difficulties. Patient cannot engage in strenuous activity, but can work and do ordinary daily activities.

STOMACH: One day of persistent nausea and headache with occasional vomiting. Some stomach pain and cramp. Diarrhea at least twice during the day. Patient is unable to go to work or leave the home, but domestic chores are possible.

BED: Three days with flu-like symptoms including persistent phlegmy cough with occasional coughing fits, fever, headache and tiredness. Symptoms are serious enough that patient must stay home in bed for the three days.

CASUALTY: A visit to a hospital casualty department for oxygen and medicines to assist breathing problems caused by respiratory distress. Symptoms include a persistent phlegmy cough with occasional coughing fits, gasping breathing even when at rest, fever, headache and tiredness. Patient spends four hours in casualty ward followed by five days at home in bed.

HOSPITAL: Admission to a hospital for treatment of respiratory distress. Symptoms include persistent phlegmy cough, with occasional coughing fits, gasping breath, fever, headache and tiredness. Patient stays in the hospital receiving treatment for three days, followed by five days home in bed.
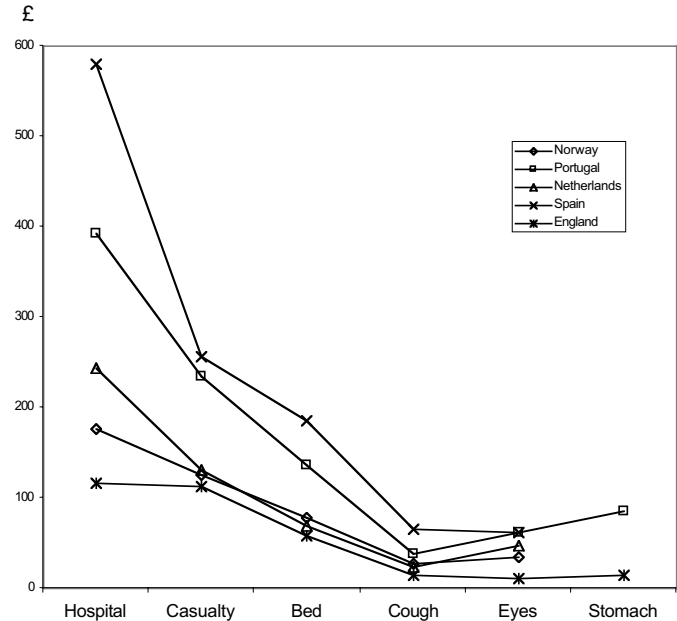
Ready *et al.* (1999) in their international transfer study (see also p. 11) compared the pooled regression including all responses from all countries with the country-specific regressions, to test whether differences in WTP among the countries can be explained by the differences in the demographics. Likelihood ratio tests rejected a common model with high confidence (p < 0.001) for each of the six episodes, suggesting that preferences vary among countries in ways not related to measurable differences in the individuals.

If WTP is not consistent across the countries, does it follow some consistent pattern? To investigate this, calculated expected WTP for a 'standard' individual was calculated – with explanatory variables equal to the average value across the five samples – using each country's value model. Clear patterns emerged, with Spain and Portugal having the highest WTP, England having the lowest WTP, and Norway and the Netherlands having intermediate WTP. This pattern held for all six episodes valued. Statistical tests based on Monte Carlo simulation showed that the WTP value for England was always significantly lower than that for either Portugal or Spain. The values for Norway and the Netherlands were significantly lower than Spain and Portugal on 12 of 20 tests. Those for Norway and the Netherlands were never significantly different, and Spain and Portugal were significantly different in only 1 of 5 tests. Norway and the Netherlands had significantly higher WTP than England only for the episode 'Eyes'. Ready *et al.* concluded that, for a given individual with average characteristics, WTP to avoid ill health is highest in Spain and Portugal, and lowest in England.

Function Transfer

Instead of transferring individual benefit estimates, the entire benefit function can be transferred. This approach is conceptually more appealing because more information is transferred. The benefit relationship to be transferred from the study site(s) to the policy site could again be estimated using either revealed preference approaches – such as Travel-Cost Method (TCM) and Hedonic Pricing (HP) – or stated preferences approaches – such as CVM and Choice Experiments (CE) (see Policy Research Brief 1).

For a CVM study, the benefit function is:

$$WTP_i = b_0 + b_1 G_{ij} + b_2 H_i + e \qquad\qquad (1)$$

where WTP_i = the willingness to pay of household i; G_{ij} = the characteristics of the environmental good and site j; and H_i = characteristics of household i; b_0, b_1 and b_2 are parameters; and e is the random error. This approach requires finding a case study in the existing literature with estimates of the parameters b_0, b_1 and b_2. Then data has to be collected on the two groups of independent variables G and H at the policy site and added into equation (1) to calculate households' WTP at the policy site.

When the estimation is based on observations from a single study a lack of variation in some of the relevant independent variables usually prohibits their inclusion in the benefit function. This exclusion of methodological variables makes the benefit function approach susceptible to methodological flaws in the original study. This problem is tackled by choosing a study site as similar as possible to the policy site.

Meta-analysis

Instead of transferring the benefit function from *one* valuation study, results from *several* valuation studies can be combined in a *meta-analysis* to estimate one common benefit function. Meta-analysis has been used to synthesise research findings and to improve the quality of literature reviews of valuation studies by producing adjusted unit values. In a meta-analysis, results from each study are treated as a single observation in a new analysis of the combined data set. This allows the evaluation of the influence of (i) the characteristics of the environmental good, (ii) the features of the samples used in each analysis (including characteristics of the sampled population),

Box 2: Problems in Defining Units of Value for Health

For light respiratory symptoms (such as coughing, headaches and itchy eyes) symptom days, defined as a specified symptom experienced one day by one individual, are often used. Values for more serious illnesses are reported in terms of value per case. However, the description of symptoms and illnesses can vary. Another alternative is to construct values for episodes of illness defined as type of symptoms, duration and severity (e.g. described in terms of restrictions in activity levels and whether one would have to go to the hospital).

and (iii) the modelling assumptions. The resulting regression equations, explaining variations in unit values, and data collected on the independent variables in the model that describe the policy site, can then be combined to construct an adjusted unit value. The regression from a meta-analysis would look like equation (1), but with one added independent variable C_s = characteristics of the study 's' (and the dependent variable would be WTP_s = mean willingness to pay from study 's').

The first attempts to apply meta-analysis to environmental valuation were conducted in the early 1990s for recreation demand modelling using TCM and CVM studies for the US Forest Service's resource planning programme. This was followed by applications to HP models valuing air quality and aircraft noise, CVM studies of both use and non-use values of water quality improvements, and TCM studies of freshwater fishing. CVM studies have also been conducted for morbidity using Quality of Life Years (QUALY) indexes, endangered species and wetlands (Brouwer *et al.* 1997). Only two studies have been international meta-analyses, including both European and North American studies; others tend to be US-based.

Many of these meta-analyses concern relatively homogenous environmental goods and health effects and are not particularly useful for benefit transfer, being designed for methodological analysis. Methodological variables such as payment vehicle, elicitation format and response rates (a general indicator of quality of mail surveys) in CVM studies, and model assumptions, specifications and estimators in TCM and HP studies are almost useless in predicting values for a specified change in environmental quality at the policy site. Also, published studies often contain insufficient and/or inadequate information on characteristics of the study site, the change in environmental quality valued, and socio-economic characteristics of the sampled population. Particularly, the last class of variables would be necessary in international benefit transfer, assuming cross-country heterogeneity in preferences for environmental goods and health effects.

In most meta-analyses, secondary information is collected on some of these initially omitted variables describing site and population characteristics, or for some proxy for them. Such secondary data is generally readily available at the policy site without having to do a new survey. However, the use of secondary data and/or proxy variables adds uncertainty (e.g. using income data for a regional population to substitute for income data for fishermen at the study site).

Validity and Reliability

While there are detailed, although disputed, guidelines on producing CVM studies (see Policy Research Brief 1) no such authoritative guidelines exist for benefit transfer. Some have called for the development of a standard protocol and recent studies comparing value transfers with new CVM studies of the same site, to test the validity of benefit transfer, could provide valuable input. Different problems are liable to occur at national as opposed to international levels, although both seem to suffer from unreliability.

National Transfer

Bergland *et al.* (1995) tested benefit transfers spatially by conducting the same CVM study simultaneously at two Norwegian lakes (let us call them A and B for simplicity) assessing use and non-use values for water quality improvements. They constructed benefit functions for lakes A and B, and then transferred the benefit function of lake A to value the water quality improvement in lake B, and *vice versa*. The mean values were also transferred and compared with the original CVM estimate, since the two lakes are of similar size and suffer from similar pollution. Two approaches were used for selecting the independent variables for the demand function: (i) selecting those variables which give the largest explanatory power, and (ii) selecting those variables for which it is possible to obtain secondary data at the policy site without having to do a costly survey. The latter approach is cheaper, but was found to provide less reliable estimates. Also, several tests which were conducted all found a lack of transferability on statistical grounds (i.e. transferred and original values were significantly different at the 5 per cent level). The transfer error, defined as the difference between predicted (transferred) mean WTP and observed mean WTP (in original study) in percentage of the observed mean WTP was 20 to 40 per cent.

Others have also found benefit transfer statistically unreliable based on results from CVM studies. For example, an original CVM study might give a significantly higher value than the transferred CVM estimate.

Downing and Ozuno (1996) tested benefit transfer both spatially and intertemporally through CVM and TCM models of recreational angling at eight bays along the Texan coast. Using a 5 per cent significance level, they found that 91 to 100 per cent of the

estimates were not transferable across bays, but 50 to 63 per cent of within-bay estimates were transferable across time. Like Bergland *et al.* (1995) they concluded that geographical benefit transfer was largely statistically unreliable but transfer errors were 'only' between 1 and 34 per cent.

International Transfer

Ready *et al.* (1999) conducted the same CVM study in cities of five European countries: Amsterdam in the Netherlands, Oslo in Norway, Lisbon in Portugal, Vigo in Spain, and a random sample of several English towns in the United Kingdom. They found that the transfer error in valuing respiratory symptoms (that could be caused by air pollution) was ± 37 to 39 per cent in terms of predicting mean WTP to avoid the symptom in one country from the data of the other countries. In comparison, the variability in the original estimate within a country was ±16 per cent (estimated using Monte Carlo simulations). Unit value transfer with income adjustment (using PPP city indexes since national PPP indexes were unrepresentative) and benefit function transfer performed equally well (or poorly). The remaining differences in valuation between countries were due to education level, age, gender, number of children in the household and health status variables. Thus, cultural and attitudinal factors seem to be important in explaining differences in valuation across countries (see also Figure 2).

Photo: Digital Vision

Amongst other uses, benefit transfer studies have been applied to value national and international impacts of air pollution on human health and damage to ecosystems (e.g. from acid deposition).

Policy Use of Value Transfer

O verall, results from validity tests show that the uncertainty in value transfers, both spatially and temporally, can be quite large. Thus, value transfer should be applied to uses of environmental valuation where the demand for accuracy is relatively low.

Environmental valuation studies and benefit transfer have four main types of use:

- *Cost-benefit analysis (CBA)* of investment projects and policies;
- *Environmental costing* to map the marginal environmental and health damages of e.g. air, water and soil pollution from energy production, waste treatment and other production and consumption activities. These marginal external costs can be used in investment decisions and operations (e.g. as the basis for 'green taxes');
- *Environmental accounting* at the national level (green national accounts) and firm level (environmental reporting and accounting);
- *Liability for environmental damages;* i.e. compensation payments for natural resource injuries from e.g. pollution accidents.

There is an increased interest within the European Commission (EC) in using environmental valuation and benefit transfer for all four potential policy uses. However, moving down the list of potential policy uses of valuation studies the accuracy needed increases, and thus the applicability of benefit transfer techniques decreases (Navrud and Pruckner 1997).

Five main difficulties or challenges in using value transfer have been identified:

- Insufficient quality and/or availability of existing studies.
- Valuation of new policies or projects are difficult because:
    - the expected change resulting from a policy is *outside the range* of previous experience;
    - most previous studies valued a *discrete* change in environmental quality; it is not yet clear how this can be converted into *marginal* values to value the new policy;
    - most previous studies value a *gain* in environmental quality; it is not yet clear how this can be converted to value *losses* in environmental quality.

> Benefit transfer should be applied to uses of environmental valuation where the demand for accuracy is relatively low.

■ *Differences in the study site(s) and policy site* that are not accounted for in the specification of the valuation model or in the procedure used to adjust the unit value.

■ Determination of the *extent of the market.* In order to calculate aggregated benefits the mean benefit estimate has to be multiplied by the total number of affected households (i.e. households that find their well-being affected by the change in the quality of the environmental good). Guidelines are needed to advise on how to determine the size of the affected population.

■ While original valuation studies can be constructed to value many benefit (or cost) components simultaneously, value transfer studies would often involve transfer and *aggregation of individual components.* Addition of these components assumes independence between them. If, however, components are substitutes or complements, this simple aggregation procedure would over- or under-estimate the total benefits (or costs), respectively. Thus, correction factors to take these interdependencies into account have to be applied. Another uncertainty is whether it will be possible to construct general sets of correlation factors for groups of environmental goods.

A contaminated stream making its way into an estuary. – Work is currently undertaken to assess whether environmental valuation and value transfer studies can be used to value damages in environmental liability cases.

Despite many problems policy has increasingly favoured monetary valuation and benefit transfer. For example, the EC adopted the White Paper on Environmental Liability on 9 February 2000 (COM(2000) 66 final), and on 30 March 2000 the Environmental Council meeting supported the construction of a community framework directive on environmental liability that covers contamination of sites and damages to biodiversity, health and property. EC DG Environment has now started work to assess the applicability and adequacy of environmental valuation and benefit transfer techniques to value biodiversity damages for the purpose of environmental liability. International organisations such as the OECD, the World Bank, regional development banks and UNEP have produced guidelines on environmental valuation techniques. In many cases they have used benefit transfer techniques as an integral part of project appraisal.

Photo: Digital Vision

Future Potential

Generally, using benefit transfer in CBAs for projects and policies tends to be regarded as acceptable by policy-makers. However, more problematic is the use of transferred values in environmental costing and accounting exercises, and in calculating compensations for natural resource damages.

The policy response to these main challenges in value transfer could be development of:

- *improved value transfer techniques* and a *protocol for benefit transfer*; including guidelines on how to determine the size of the market and correct for interdependencies among components of the environmental good; and

- a *database* of environmental valuation studies.

Based on a review of value transfer studies and validity tests, Brouwer (2000) proposed a seven-step protocol as summarised in Table 1. *Step 1* involves the identification of the relevant ecological functions of the goods and services under consideration and their importance for sustaining ecosystems and hence human systems. *Step 2* focuses on identifying beneficiaries of the ecological functions/services preserved or forgone and is interdependent with *Step 3*, which identifies values held by different stakeholder groups in order to be able to sketch out the reasons why they value the environmental good/service under consideration. *Step 4* assesses the scope, acceptability and legitimacy of the valuation process(es): monetary and/or deliberative. In *step 5* appropriate studies are selected and study quality assessed by looking at their internal and external validity. *Step 6* looks at the research design of the selected studies and tries to assess comparability between them and what kind of adjustments may be chosen to account for the differences in design/approach of each chosen study. In *step 7* values as obtained through the previous 6 steps are discussed with (representatives of) stakeholders, before they are extrapolated over the relevant population affected by the environmental change under consideration. Finally, the economic aggregate is included in a CBA.

Also, Decision Theory and Bayesian Analysis could be used to assess the need for further information about both monetary values and other steps in the DFA (see Figure 1). This could entail a requirement for performing a CBA, comparing the

Table 1. Towards a protocol for good practice. Source: Brouwer 2000

Step 1:	Defining the environmental goods and services
Step 2:	Identifying stakeholders
Step 3:	Identifying values held by different stakeholder groups
Step 4:	Stakeholder involvement in determining the validity of monetary environmental valuation
Step 5:	Study selection
Step 6:	Accounting for methodological value elicitation effects
Step 7:	Stakeholder involvement in value aggregation

additional costs of performing a new small-scale or full-scale valuation study instead of a benefit transfer exercise, and the expected value of the benefits of avoiding a 'wrong' decision when using an original valuation estimate; much along the lines suggested by Barton (1999).

The web-based Environmental Valuation Reference Inventory (www.evri.ec.gc.ca/ EVRI/) is a database with currently over 700 valuation studies. The majority of these studies are from North America, and only about 10 per cent are European. There is, however, a need to increase the number of existing valuation studies captured in this database, especially European ones. Other shortcomings include that many valuation studies are old and use outdated methodology; there are few studies for many environmental goods (Navrud 1999).

Therefore new, original valuation studies are needed which use state-of-the-art methodology and are designed with benefit transfer in mind. Furthermore, European-wide studies of environmental amenities, cultural assets and health are needed in order to construct an improved set of values that could be used for CBA and other policy uses by the EC. Studies that can reduce the uncertainty in other stages of the damage function approach, often applied in CBA, should also be conducted.

Key Points

Value transfer, as most valuation efforts, is less than ideal in the sense that better estimates could be obtained if more time and money were available. Analysts must constantly judge how to provide policy advice facing short time horizons and resource constraints. The cost of doing a new, original valuation study has to be compared with the risk of making the wrong decision when using a transferred estimate.

Value transfer appears to be on the policy agenda but remains a highly uncertain art.

The list below summarises the key points of this policy research brief:

- Value transfer methods may be particularly useful in policy contexts where a rough and ready indication of economic benefits may be sufficient to reach a judgement regarding the advisability of a policy or project. However, one should be more careful in using transferred values in environmental costing and accounting exercises at the national and firm levels, and particularly when calculating compensation payments for natural resource injuries.

- In the cases of (interim) losses in environmental quality and natural resources alternative techniques (e.g. community judgements using scales of importance) should be explored (see Policy Research Briefs 1, 2, 4 and 10).

- Difficulties and challenges in using value transfer include:
    - the quality and/or availability of existing studies is insufficient;
    - the expected change of new projects or policies is outside the range of previous experience;
    - how to convert a discrete change in environmental quality into marginal values to value the new policy;
    - how to convert a gain in environmental quality to value losses in environmental quality;
    - differences in the study site(s) and policy site cannot be or are not accounted for in the transfer model or procedure;
    - the lack of guidelines on how to determine the size of the affected population; and
    - aggregation of individual components in a benefit transfer study over- or under-estimating total value if components are substitutes or complements respectively unless correction factors can be calculated and applied.

Overall, value transfer appears to be on the policy agenda but remains a highly uncertain art.

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EVE Concerted Action

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Webpage: http://www.landecon.cam.ac.uk/eve/

Concerted Action on Environmental Valuation in Europe (EVE)

This policy briefing series communicates the findings from nine workshops and three plenary meetings under the EVE programme. These showed the diversity of research currently being undertaken in the area of environmental values and their policy expression. The type of information relevant to the decision process extends from ecological functioning to moral values. Thus a range of approaches to environmental valuation, from ecology to economics to philosophy were presented.

EVE was a 30 month project which started in June 1998 funded by the European Commission, Directorate General XII within Area 4, Human Dimensions, of the Environment and Climate RTD programme, Contract No. ENV4–CT97–0558.

The project was co-ordinated by Clive L. Spash and managed by Claudia Carter, Cambridge Research for the Environment (CRE) in the Department of Land Economy, University of Cambridge. The following research institutes were partners in the concerted action:

> Bureau d'Economie Théorique et Appliquée (BETA), University Louis Pasteur, Strasbourg, France
> Cambridge Research for the Environment, Department of Land Economy, University of Cambridge, UK
> Centre for Human Ecology and Environmental Sciences, University of Geneva, Switzerland
> Centre d'Economie et d'Ethique pour l'Environnement et le Développement (C3ED), University of Versailles Saint-Quentin-en-Yvelines, France
> Centre for Social and Economic Research on the Global Environment (CSERGE), University of East Anglia, Norwich, UK
> Department of Economics and Economic History, Autonomous University of Barcelona, Spain
> Department of Economics and Social Sciences, Agricultural University of Norway, Åas, Norway
> Department of Environmental Economics and Management, University of York, UK
> Department of Philosophy, Lancaster University, UK
> Department of Rural Development Studies, Swedish University of Agricultural Sciences, Uppsala, Sweden
> Department of Applied Economics, University of Laguna, Tenerife, Canary Islands, Spain
> Environmental Economic Accounting Section, Federal Statistical Office, Wiesbaden, Germany
> Ethics Centre, University of Zurich, Switzerland
> Fondazione Eni Enrico Mattei (FEEM), Milan, Italy
> Istituto di Sociologia Internazionale di Gorizia (ISIG), Gorizia, Italy

The purpose of this concerted action was to analyse effective methods for expressing the values associated with environmental goods and services, ecosystem functions and natural capital, with a view to the achievement of the goals summarised in the concept of sustainability. The appropriate role of decision-makers and citizens in environmental policy-forming became a central focus in the debate over how different values should be expressed.

Titles in the EVE Policy Research Brief Series: