Guidelines for the application of benefit transfer method

A step-by-step application guide for the application of benefit transfer techniques could be as follows:

1.   Make sure that benefit transfer is the appropriate method. This usually happens if the goal is to estimate the economic value of a non-market ecosystem service, it is not feasible to perform an original valuation study due to budget or time constraints, and there exist robust primary valuation studies performed at similar study sites.

2.   Select the primary valuation studies, on the basis of the applied valuation method (suitable to reflect exchange value), robustness of the estimation, and biome similarity. Two sources of information clearly stand out due to the breadth of studies they contain:

-       The Environmental Valuation Reference Inventory (EVRI), developed by the Government of Canada, and accessible at https://evri.ca/. It is a searchable compilation of summaries of environmental valuation studies, covering their most relevant features, including economic value. Data are not parametrized; hence the analyst is expected to create her own set of variables from the text summaries.

-       The Ecosystem Services Valuation Database (ESVD), sponsored by the Foundation for Sustainable Development, and accessible at https://www.esvd.net/. Unlike the former, the data at ESVD are parametrized, so it returns a downloadable (CSV) list of studies with their most relevant features as variables, including the economic value. In contrast, it does not provide non-parametrized information as text summaries.

3.   Choose the benefit transfer method. If a study site has been selected because of its close similarities to the target site, it will be possible to apply a unit value transfer method, either plain or adjusted for differences in context variables such as income or density. If the similarities between the study and the target sites are not so close, it will be needed to estimate a value function or to perform a meta-analysis using the data from study sites.

4.   Adjust the value, if needed, to take into account special features at the study or target sites that might push values upwards or downwards within the confidence interval of the estimated value of the target site, in accordance with the insights of the corresponding biome and ecosystem service literature.

5.   Where appropriate, scale the estimated value for the target site to its area and population, following returns to scale criteria and best practices established for welfare analysis.

6.   Report method, sources, assumptions, identified limitations, and confidence intervals along with the estimated target site value.

There are different approaches (methods) to perform benefit transfer, which can be classified into four groups:

- Unit value transfer. The policy site is considered to be quite similar (or similar enough) to the study site, so values are assumed to be transferable, be it as point estimates or as measures of central tendency (mean or median), without requiring

any further adjustment. If V_j is the value for a certain ecosystem service at a study site j, then

$$VBT_i = V_j \qquad (1)$$

where VBT_i is the estimated value by benefit transfer at policy site i.

- Adjusted unit value transfer. The socioeconomic context r at the policy site i is considered to be different from the context s and the study site j, so values are adjusted for differences in income or wealth to be transferred:

$$VBT_{ir} = f(V_{js}) \qquad (2)$$

where $f(\cdot)$ is a suitable adjustment function. In its simplest form, this adjustment function might be:

$$f(V_{js}) = P \cdot V_{js} \qquad (3)$$

where P is an appropriate price index to account for differences in purchasing power.

- Value function transfer. This approach is based on the existence of validated value functions constructed on ecological and socioeconomic parameters identified for study sites and observable for policy sites. The corresponding parameters at the policy site are then incorporated into the value functions to estimate its economic value. In the simplest form, the value function is estimated from a single primary study, which implies the strong assumption that the implicit value drivers are identical at the study and policy sites. If this assumption cannot be sustained, more complex forms of value functions must be considered, usually combining information from multiple sites applying statistical methods to provide a range of possible values for the policy site. In both cases, the value function $g(\cdot)$ is of the form:

$$V_{js} = g(E_{js}, S_{js}, B) \qquad (4)$$

where V_{js} is the estimated value at site j with context s (say WTP estimates from revealed or stated preferences), E_{js} is the corresponding vector of ecological variables, S_{js} is the corresponding vector of socioeconomic variables, and B is the vector of value parameters to be estimated by statistical regression. Then, the benefit transfer estimated value VBT for policy site i and socioeconomic context r would result from

$$VBT_{ir} = g(E_{ir}, S_{ir}, B) \qquad (5)$$

where E_{ir} and S_{ir} are the corresponding vectors of ecological and socioeconomic variables at site i and context r, and B is the vector of value parameters estimated from equation (4).

- Meta-analysis. It can be defined as a quantitative synthesis of evidence on a certain empirical outcome, with evidence gathered from prior primary studies. For benefit transfer, meta-analysis is usually undertaken by applying meta-regression models, using the results from existing primary studies as observations. Dependent variables are the values obtained in primary studies, and explanatory variables may include all sorts of relevant attributes from the primary studies suitable to generate influence, including ecological and socioeconomic characteristics as well as, in this case, study characteristics related to the valuation method and its exercise. The value function $h(\cdot)$ is of the form:

$$V_{js} \ = \ h \, (\, E_{js}, S_{js}, T_{js}, B \,) \tag{6}$$

where V_{js} is the estimated value at site j with context s, E_{js} is the corresponding vector of ecological variables, S_{js} is the vector of socioeconomic variables, T_{js} is the vector of study method variables, and B is the vector of value parameters to be estimated by statistical regression. The benefit transfer estimated value VBT for policy site i and socioeconomic context r would result from

$$VBT_{ir} \ = \ h \, (\, E_{ir}, \ S_{ir}, T_v, B \,) \tag{7}$$

where E_{ir} and S_{ir} are the corresponding vectors of ecological and socioeconomic variables at site i and context r, T_v is a vector of standardized values to compensate for possible method bias, and B is the vector of value parameters estimated from equation (6).