Cost-effective restoration measures that promote wider ecosystem and societal benefits

Introduction

River restoration projects make use of scarce public funds, and two important policy questions therefore are: (1) how to select between alternative plans for river restoration based on their cost-effectiveness and (2) how to convince policymakers and the public that river restoration provides value for money? Economists have developed methods and tools that aim to inform on the societal costs and benefits of public investment projects such as river restoration. The first question can be answered with the help of a cost-effectiveness analysis, while the second question is answered with the help of a cost-benefit analysis (CBA). However, despite the existence of many manuals on the calculation of costs and benefits of water related projects, no specific guidance exists related to river restoration. There is also not much experience across Europe with social cost-benefit analysis in this particular area. To this end, REFORM researchers developed a guidance document (D5.2) on '*Cost-effective restoration measures that promote wider ecosystem and societal benefits*', targeted at practitioners, that takes account of the specific characteristics of the costs and benefits of river restoration.

Key methodological issues in the estimation of river restoration costs and benefits

The guiding principle underlying a CBA to inform policy and decision-making is rather simple, namely that the net benefits (i.e. total benefits minus total costs) of a river restoration project should be positive. If not, the costs exceed the benefits and it would hence not be beneficial to carry out the project. To get to a comparison of costs and benefits of river restoration projects, one has to go, however, through a number of important steps and sometimes make heroic assumptions, as outlined below:

Steps in cost-benefit analysis (Brouwer and Pearce, 2005):

1. Problem definition
2. Definition project and baseline scenario ('with' and 'without' situation)
3. Identification of exogenous developments
4. Estimation of investment costs and running costs
5. Identification of project impacts
6. Estimation and valuation of project impacts
7. Set-up cost-benefit balance sheet
8. Sensitivity and uncertainty analysis

One of the key methodological issues in carrying out a CBA for a river restoration project is found in the *ex ante* assessment of the causal link between the restoration measure, its hydrological and ecological impacts, and the final effects on the delivery of ecosystem services and their economic valuation.

The question what the local ecosystem and wider societal benefits of river restoration are, as for example depicted in the picture below, is often not easily answered. This requires insight in the interaction between hydro-morphological and ecological processes on the one hand, and the identification of different beneficiaries of the river restoration project and the plurality of values they may hold for river restoration on the other hand. The broader societal value is often not just found in the recreational value of a restored river trajectory to local visitors, but may also be related to important indirect values such as reduced flood risks downstream or the value attached by people living outside the restored area to the mere fact that a river's integrity is restored, maintained or kept intact. The latter is also referred to as so-called 'non-use' values by environmental economists.

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The difficulty in measuring and quantifying such non-use values in monetary terms is much harder than the direct, tangible use benefits such as increasing fish catch rates (provisioning service), indirect use values such as a river's improved nutrient or storm water retention capacity (regulating services), or its recreational use benefits (cultural service).

Figure 1: Restored river Chiese in Italy (Source: Panoramio.com)

Other challenges include in step 2 the definition of the baseline or reference scenario 'what would happen with ecological quality and ecosystem services over time *without* the restoration measures' or the assessment of the broader economic costs of changes in, for example, flow rates on commercial shipping or hydropower generation. The latter make up the so-called opportunity costs of river restoration, i.e. the benefits that will be foregone when restoring river stretches. Related to this, an important question in the context of the European Water Framework is when costs become disproportionate.

Costs of river restoration

Water policies are often evaluated primarily on the basis of their financial or budgetary costs. These are the financial means and monetary flows needed to carry out river restoration projects over a certain time period to pay for the labour, machinery, fuel and other material costs. These financial costs can generally be assessed relatively easily compared to the broader economic costs of river restoration, related for instance to shipping or hydropower. The deliverable addresses the important question what costs of river restoration projects should be accounted for and how should they be assessed? There exist various and partly overlapping classification and assessment schemes. The WFD embraces the concept of 'full cost' assessment that would include the above mentioned direct financial costs, the costs associated with damage to the water environment, associated costs caused to other users and the opportunity costs of water use.

In D5.2 a practical cost typology has been developed with an emphasis on the distinction between recurring and non-recurring costs in order to allow for insight into how costs develop over time. An example of non-recurring costs of river restoration is to carry out the restoration works at a single time, through "one-off" measures. A river restoration project may, however, also require significant future maintenance (recurring costs), which are often not budgeted for.

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Estimating the wider array of non-recurring and recurring costs and taking into account discount rates and depreciation forms the basis of a proper cost assessment. After the respective cost data have been gathered, they can inform a cost-effectiveness analysis to support the selection of the least cost-way to restore alternative river stretches or different rivers.

Benefits of river restoration

The calculation of all costs and benefits, including environmental effects, often also referred to as the broader social costs and benefits, is a more difficult task. Social CBA is a widely applied method for evaluating public policies, since government interventions are often related to the provision of public goods, having an impact on society as a whole. Such impacts should consequently be valued and evaluated from society's perspective, not only from the perspective of the investor like a government or water authority. Restored or 'natural' river corridors typically have the potential to provide a wide range of ecosystem services. It is the wider social value attached to these ecosystem services that is often missing in information that aims to support river restoration policy and decision-making.

Many of these ecosystem service benefits related to restored rivers can only be estimated in monetary terms using non-market valuation techniques. Examples include the travel costs of recreational visitors to restored sites or the use of so-called stated preference methods where visitors and also non-visitors are asked in surveys for their hypothetical willingness to pay (WTP) for river restoration benefits. This WTP is used as an indicator of the economic 'non-market' value attached to the goods and services provided by restored river systems to society as a whole.

A limited number of such non-market valuation studies exists, which were summarized and synthesized in a structured way in a meta-analysis in the deliverable D5.2. Four groups of variables were identified that represent different determinants of the variation in the nonmarket values found in the literature, namely (i) the characteristics of the ecosystem services provided by river restoration, (ii) the characteristics of the river and the location where the restoration took place, (iii) the socio-economic characteristics of the population of ecosystem service beneficiaries, and (iv) the characteristics of the valuation methodology. The mean WTP value in these existing studies is €70 per household per year (in 2013 price levels), while the median value is just over half of this, namely €43 per household per year. This implies that a wide variation in the values is found in the existing literature. This is illustrated in Figure 2 at country level, where mean WTP varies from €11 for Korea to €118 for Scotland. The values demonstrate at the same time another important challenge in making costs and benefits comparable: contrary to the unit costs of river restoration measures, which are expressed per m, m^2 or m^3, the associated unit values for the benefits are expressed in euros per household per year.

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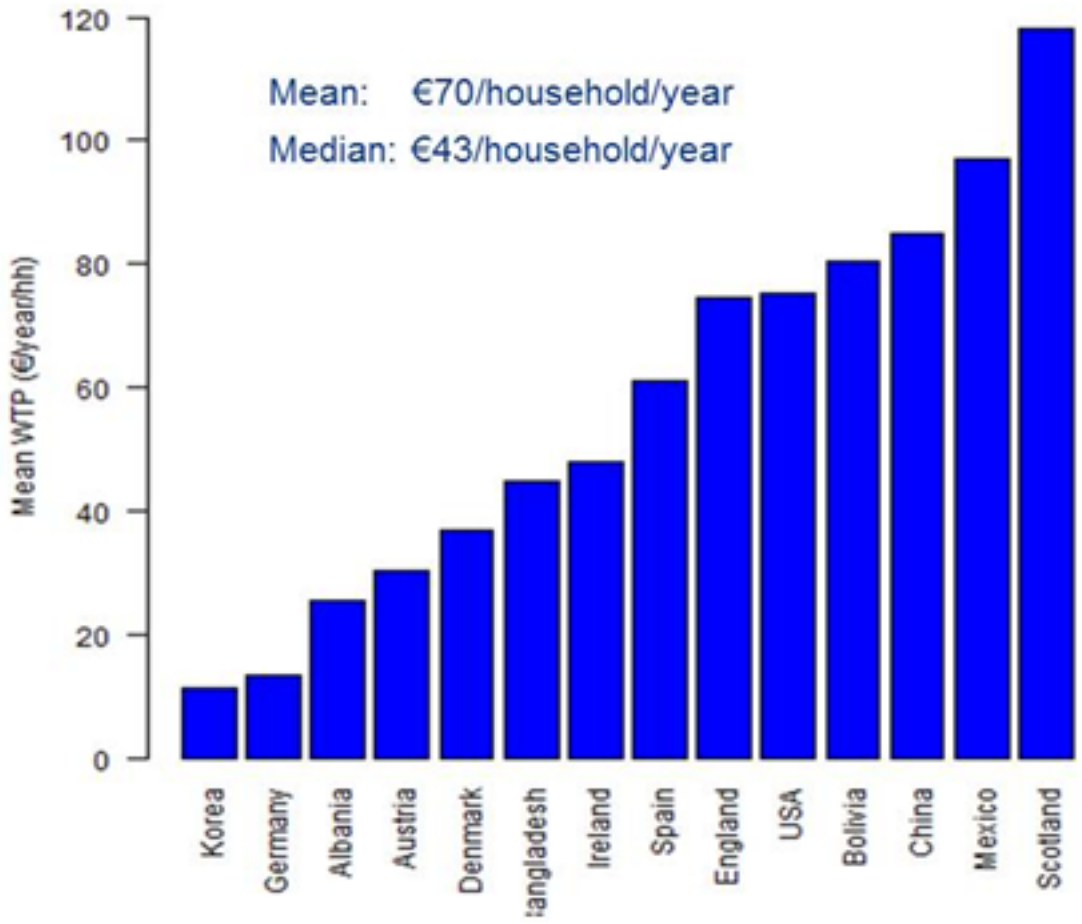

Figure 2: Mean willingness to pay (WTP) for river restoration found in the existing literature across countries (Brouwer et al., 2015)

References

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