

Environmental and Economic Impact Assessment of River Restoration in Switzerland

Summary

In Switzerland there are plans to implement large-scale river restoration measures over the next several decades. Despite this, a lack of both environmental and economic impact assessments of river restoration projects has been identified. This paper aims at closing these gaps by assessing the ecological effects of river restoration measures and estimating economic values of the resulting improvements in river ecosystem services. The former objective is achieved by carrying out on-site measurements of the physical, chemical and biological states of two different rivers. The latter goal is fulfilled by conducting a survey among the local residents. The survey applies stated preference methods (choice experiment and contingent valuation) to elicit people's willingness to pay for further restoration projects at these two rivers. Moreover, we test for the existence and measure the extent of distance-decay and substitution effects between the two rivers.

Extended Abstract

Many rivers in Switzerland have in the course of the previous century been managed by means of channelization, which had negative impacts on their morphological state, biodiversity and in some cases also on river water quality. Now there are plans to return rivers into their natural state through river rehabilitation measures. The Swiss Federal government has set up as an objective to restore 4000 kilometers of rivers in the country until 2090, which corresponds to approximately one third of the total river length in Switzerland. For this purpose, the government has allocated 40 million CHF annually. However, at the moment there is no systematic monitoring of the success of river restoration measures in the country - neither from an ecological nor from an economic perspective.

The main objectives of this paper are (1) to assess ecological impacts of river restoration measures, (2) to translate these ecological impacts into economic values, (3) to test for the distance-decay and substitution effects between different rivers, and (4) to compare the estimated economic benefits of improved ecosystem services provided by restored river sections with the costs of restoration measures. These objectives were fulfilled by carrying out on-site measurements and conducting surveys at Thur and Töss Rivers located in the Canton of Zurich. The two study sites differ in several aspects. The restored section of Thur River is 600 meters long and is mainly surrounded by agricultural area, whereas the restored stretch of Töss River is 200 meters long and is located within a forest. Thur is also a somewhat larger river compared to Töss.

The assessment of ecological impacts was based on a comparison of the physical, chemical and biological states of rivers before and after the restoration measures took place. This analysis has shown that the major effects of restorations undertaken at Thur and Töss Rivers include an improved river ecomorphology (e.g. increased habitat diversity, landscape beauty, and access to both rivers) and an increased biodiversity in terms of the richness of flora and fauna species (including macroinvertebrates, macrophytes, ground beetles, riparian vegetation, and fish population). However, the restoration measures did not lead to the improvement in river water quality or to a reduced flood risk at neither of the two case study sites.

The second step involved estimating the economic values of the identified improvements in river ecosystem services. For this purpose, the results of the ecological impact assessment were translated into a stated preference survey. The questionnaire used in this study consisted of four main parts. The first part included questions about people's awareness of, and knowledge about, river restoration projects (both in general and in relation to our two case study sites). In addition, a question that enables to distinguish between visitors and non-visitors of the restored river sites was included. People who have visited one of the two restored river sites were asked several additional questions, for example about the activities that they undertake when visiting the site and their evaluation of the site itself.

In the second part of the survey, the respondents were shown a map of the area where they live, in which the restored river sections were clearly marked. They were then told that plans exist for further restoration projects on the same river just upstream from the already restored river section. Next, they were informed about the ecological impacts of river restoration measures and explained that the level of the ecological improvement

depends on the costs of the investment, which are to be paid by the households through an increased annual cantonal (state) taxes. This was followed by the choice experiment questions, which served for eliciting people's willingness to pay for additional river restoration measures. A D-efficient choice experiment design was generated with a total of six different choice sets. Each respondent has received six different choice tasks, which consisted of two policy alternatives and a status quo alternative (representing the current situation and involving no additional costs). The choice experiment design (attributes and attribute levels) and an example of a choice card are shown in Figure 1. After the choice experiment, the open-ended contingent valuation question was posed. Applying the contingent valuation method in addition to the choice experiment allows for a comparison of willingness to pay values elicited by two different stated preference techniques.

The third part of the questionnaire gathered information about the socio-economic characteristics of the respondents, while the fourth part included follow-up questions about the questionnaire itself. The questionnaire design underwent careful pretesting to optimize understandability and length. The final survey will be administrated in person during November 2014 among people who live in the area close to the two restored river sites.

In order to test for and measure the extent of distance-decay and substitution effects between Thur and Töss Rivers, different versions of the questionnaire were created. Two questionnaire versions focus on each of the two rivers separately, while the third version captures respondents' preferences for both rivers. An unlabeled choice experiment is applied in the two versions addressing individual rivers and a labelled choice experiment (where the rivers represent labels) is used in the third version that includes both rivers. All three versions are expected to provide insights on whether and how the distance of respondents' residence to the river sections that would be restored in the future affects their preferences and stated willingness to pay values. The third version furthermore allows us to measure the degree of substitution between the two river sites.

Finally, economic benefits derived from this survey will serve as inputs for performing the first cost-benefit analysis (CBA) of river restoration projects in Switzerland. The results obtained with two different stated preference valuation methods (choice experiment and contingent valuation) will be used to test the robustness of the estimated economic values and to perform the sensitivity analysis of the CBA results.

Figure 1. Choice experiment design and an example of a choice card

	Option A	Option B	No change
Biodiversity Maximum, High, Medium	Maximum 	High 	
Walk along the river Yes, No	Yes 	No 	
Swim in the river Yes, No	Yes 	No 	
Barbecue on the river bank Yes, No	No 	Yes 	
Length of the river section that will be restored 0.5, 1, 2 km	2 km 	0.5 km 	
Increase in cantonal taxes 25, 50, 75, 100, 125, 150 CHF	100 CHF / year	50 CHF / year	0 CHF / year
Which option would you prefer?	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> Neither A nor B