Summary of the case study on valuation of the forest ecosystem services

Title of the valuation study: **Analysing the social benefits of soil conservation measures using stated preference methods**
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Objectives of the study

In the south of Spain, soil erosion rates are extremely high due to climatic conditions, soil characteristics and the tillage systems. The paper estimated the benefits of programs to mitigate the off-site impacts of soil erosion for a watershed in Spain. Choice experiments (CE) and contingent valuation (CV) were used to obtain estimates of the social benefit from soil erosion reduction. Moreover, a convergent validity test was calculated out of both approaches. The attributes used in the choice experiment included impacts of soil erosion on water quality, wildlife and flora quality and landscape desertification.

The main objective of the study was to provide useful inputs to policy design by identifying people's preferences towards reducing the effects of soil erosion. It should offer estimations for costs of environmental consequences and suggest upper limits on per hectare payments for soil conservation programs to local farmers. The two stated preference methods (CE/CV) were thus designed to be directly comparable with each other in terms of valuing a given policy scenario.

Scope of the study

The ecosystem services valuated in the study were provisioning services (water quality), regulating services (erosion prevention), habitat services (fauna and flora quality) and cultural services (landscape desertification).

The geographical scope covered by this paper is local. The study area "Alto Genil" is a watershed located in Andalusia (Spain).

Valuation method(s) applied

Contingent Valuation (CV) takes a "whole good"-approach and asks WTP for a discrete change in some environmental good. The CV method does not estimate values for these individual attributes. Contrarily, in the **Choice Experiment method** (CE) an environmental good is characterised as a collection of attributes, and the levels these take.

At first, the respondents elicited the relative importance of soil erosion next to other four areas of public interest and among three other areas of environmental concern in a questionnaire. The information gathered was used in the CV exercise to reduce the effect of **budgetary substitutes bias**.

Choice Experiments: The main off-site effects of soil erosion were ascertained in a **literature research**. The CE attributes were the area of project execution (sensitivity to spatial scope), landscape impacts, wildlife impacts, effects on water quality and effects on rural employment. By means of the **experimental design techniques** an orthogonal fraction of the complete factorial was drawn, yielding 108 combinations. The 108 profiles were then split into 27 blocks, minimizing the number of blocks and intra block correlation. In the end, four choice sets were presented to each respondent.

For the analysis, a **conditional logit model** was applied. In addition, willingness to pay (WTP) could be obtained by applying **the economic surplus**. **Model I** represented the regression coefficients of an attributes-only conditional logit model. In the meanwhile, **model II** included socioeconomic and attitudinal characteristics of respondents. This was one way of incorporating preference heterogeneity next to the implementation of a **random parameter logit model** (RPL/**model III**). The coefficients of the qualitative environmental attributes were calculated from dummy variables and hence reflect the relative utility with respect to the status quo situation.

Contingent Valuation: In the CV exercise, 345 representative respondents were asked to state their maximum WTP to have a certain environmental situation for a duration of 50 years on an area of 330 km² (watershed size). The environmental situation designed included a reduction of landscape desertification, a medium quality of the surface and ground waters, a medium quality of flora and fauna and the creation of 100 jobs.

Convergent validity test: The significance of the difference between the two sets of stated preference estimates (CV/CE) were tested following the **convolution test** with a series of 1000 random draws.

Key results

- **Social benefits of reducing soil erosion** could be valued between **3.1 and 15.5 million euros per year (i.e. about 95−160 €/ha)**. Water quality and landscape benefits were valued highly relative to wildlife and employment benefits.

- People who allocated a higher share of the public budget were also more likely not to choose the SQ option. Residents older than 50 years were more likely to choose the SQ alternative. Moreover, marital status and occupation status influenced individual´s preferences.

- Both CE and CV were suitable to evaluate the off-site effects of soil erosion. Welfare estimates did not differ markedly between the two approaches (Table 1).

Table 1 Comparison between CV and CE mean estimates

Statistics	CV estimate	CE (model II)	CE (model III)
	WTP erosion project	WTP Scenario 1	WTP Scenario 1
Mean	16.18	10.77	14.56
95% Confidence interval	(13.08; 19.28)	(4.37; 16.87)	(9.67; 19.40)
		95% Confidence interval of the difference (€)	Sign
Poe et al. (1997) test[a]	CV-CE(model II)	−1.37, 12.77	0.065
	CV-CE(model III)	−18.13, 6.71	0.177

[a] H_0: WTP CV=WTP CE; H_1: WTP CV>WTP CE.

- Respondents showed a positive WTP for increases in the quality or quantity of each attribute. **WTP for the reduction of the external effects of soil erosion extended over the 11−53 € per year**.

Table 2 Implicit prices and confidence intervals

	Model II[a]	Model III[a]
	Implicit price (€)	Implicit price (€)
Attribute coefficients		
Landscape desertification: small improvement	17.78 (12.02; 25.21)	14.09 (9.67; 19.87)
Landscape desertification: improvement	26.51 (20.05; 35.76)	23.25 (18.53; 29.79)
Surface and ground water quality: medium	18.39 (12.67; 25.96)	15.72 (11.03; 21.47)
Surface and ground water quality: high	26.27 (20.10; 34.67)	21.67 (17.02; 27.26)
Flora and fauna quality: medium	13.53 (7.96; 19.54)	10.87 (6.87; 15.56)
Flora and fauna quality: good	18.34 (13.11; 24.57)	13.16 (8.86; 18.26)
Jobs created	0.119 (0.088; 0.160)	0.089 (0.065; 0.123)
Degraded area treated	0.014 (0.007; 0.023)	0.005 (− 0.004; 0.013)

[a] 95% Confidence interval in parenthesis.

- Incorporating heterogeneity influenced the model fitting significantly in a positive way. RPL estimates were more statistically precise than the CL model estimates.