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

Title of the valuation study: Valuing riverside wetlands: The case of the "Donau-Auen" national park
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Objectives of the study

In the planning process of the national park "Donau-Auen" in Austria, several variants of the national park area including hydroelectric power stations and engineering concepts have been worked out. Within the planning process a cost-benefit analysis was carried out to estimate the economic impacts of the four proposed development projects. One important objective was the valuation of the ecological quality of wetlands.

The main objective of the cost-benefit analysis on several variants of the national park was to achieve results which are highly certain and in the meanwhile have a low sensitivity to changes of parameters of the model. Thus, the aim of the paper was to review the main results of the cost-benefit analysis concerning all variables. Furthermore, determinants of the respondents' choice to national park and of the willingness to pay (WTP) were identified by a contingent valuation (CV) approach. Moreover, this information was added to the calculation algorithm of the cost-benefit analysis and influenced the overall economic efficiency of the considered project variants.

Scope of the study

The study evaluated provisioning services (water supply, renewable energy production, shipping, forestry, hunting, farming and fishing), regulating services (stabilization of the river bed), cultural services (recreation and tourism) and habitat services (biodiversity maintenance). The geographical scope covered was regional.

The planning area was the section of the River Danube between the cities of Vienna and Bratislava (Figure 1). It was about 50 kilometres long and up to 5 kilometres wide (about 12000 ha floodplain forests). This river section is one of the remaining free-flowing sections along the Danube in Austria. Besides, the area is the largest single riverside wetland and flood plain forest of its kind in Europe.

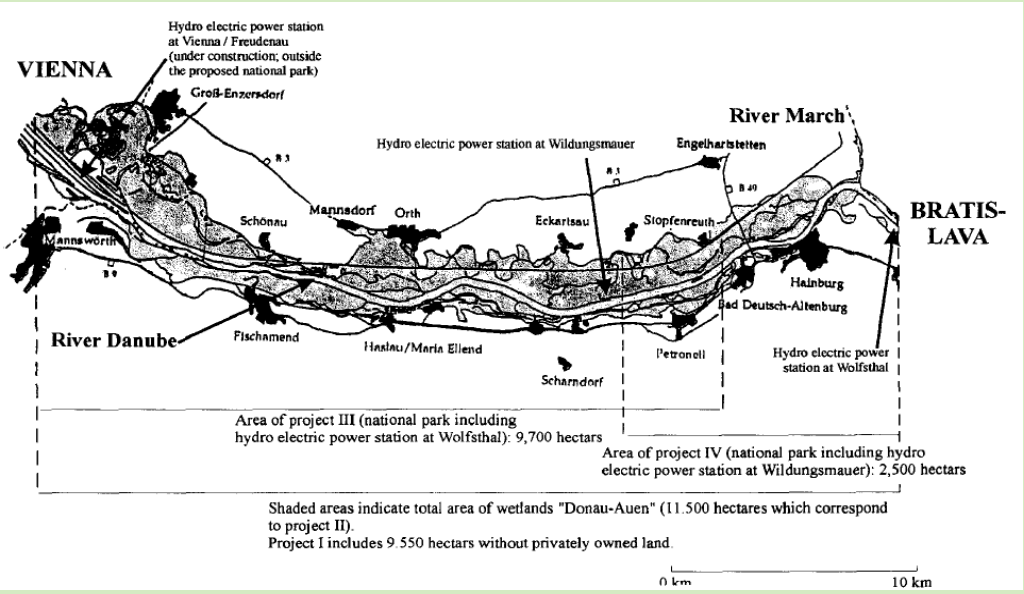

Figure 1 The "Donau-Auen" riverside wetlands between Vienna nd Bratislava and areas of alternative development projects.

Valuation method(s) applied

The estimations of the **contingent valuation method (CVM)** were made under the following conditions: The relevant economic reference area was the Austrian economy. The time span chosen was 72 years with a (real) discount rate of 2%. One essential part of the cost-benefit analysis was the monetary valuation of natural goods for use-values and non-use values.

Electricity: On the cost-side of the calculation, the internal and external costs of building a hydroelectric power station were kept separate from operating and maintenance costs. The external costs of constructing a hydroelectric power station were estimated with the help of the amount of energy consumed for producing the materials needed and the transportation intensity. The benefits of the construction of hydroelectric power stations were split into internal and external elements.

Founding a national park: Besides the costs of buildings, personal, exhibitions and other infrastructure, the direct losses of value added in the economic sectors of agriculture, forestry, hunting and fishing were included. These losses were calculated by the amount of compensation payments to avoid economic losses for the property owners.

Concept for hydraulic engineering: One the one hand internal costs of constructing, operating and maintaining a stable layer of gravel to resist the tractive force of the river to thus stop further deepening of the river bed were calculated. On the other hand, external costs of transportation and setting stones into the river bed were taken into account by the help of emitted air pollutants during these activities.

Protection of groundwater reserves: In the case of constructing a hydroelectric power station the costs of maintaining the quality of the groundwater were considered. This was done by the present value of investment, operating and maintenance costs of securing water quality. In an additional scenario, the costs of preventing future use of groundwater reserves were calculated by hypothetical compensation payments for property owners.

Benefits of visiting the national park: The recreational benefits of visiting the national park were estimated by the results of a willingness to pay (WTP) survey with 962 Austrians chosen by randomly-quota procedure. One of the questions valued the acceptance of paying an entrance fee. This value was multiplied by estimated 1.1 million visitors a year to get the overall use value of a national park for the different projects.

Approach:
Step 1: Calculation of the present value of all elements based on anthropocentric use ("use values") as a measure of the **absolute economic rentability** of each project.
Step 2: Calculation of the internal interest rate and the benefit-cost ratio of all elements based on anthropocentric use ("use values") as a measure of the **relative economic rentability** of each project.
Step 3: Calculation of the "break-even point" for the **present value.**
Step 4: Calculation of the "break-even point" for the **internal interest rate**.

Key results

- The WTP varied with the different land-use options (Table 1). Nevertheless, it depended significantly on the professional standing and the age of the respondent.

Table 1 Willingness to pay values for 3 different variants of a "Donau-Auen" national park

Project	Willingness-to-pay values in ATS per respondent (standard deviation in brackets) [median WTP in brackets]	Willingness-to-pay values in ATS per respondent including zero responses (standard deviation in brackets) [median WTP in brackets]
"Donau-Auen" national park (project No. II) over an area of 11 500 ha.	919.80	329.25
	(1.594.63) [500.00]	(1.050.32) [100.00]
Hydroelectric power station Wolfsthal-Bratislava II (project No. III) incl. a national park over an area of 9 700 ha	694.9	122.21
	(1.308.35) [300.00]	(607.96) [0.00]
Hydroelectric power station Wildungsmauer (project No. IV) incl. a national park over an area of 2 700 ha	689.85	69.63
	(1.426.19) [200.00]	(496.62) [0.00]

- A break-even analysis showed that around 20 percent of respondents' WTP would be necessary to make the economic efficiency equal to both the national park and the hydroelectric power station in terms of the net present value.

- The present value of these costs and benefits showed that, without ecological values, it would be highly efficient for the Austrian economy to build a hydroelectric power station. But including ecological values, the largest national park project is the best in terms of the benefit-cost ratio. Moreover, the largest national park project and the largest hydroelectric power variant had nearly the same interest rate (Table 2).

Table 2 Results of the cost-benefit analysis of several variants of a "Donau-Auen" national park

		Var. I [b]	Var. II	Var. III	Var. IV	Var. II	Var. III	Var. IV
			Results assumed that the concept of hydraulic engineering works			Results assumed that the concept of hydraulic engineering does not work		
Main calculation scenario	[1]	− 802	11.452	16.454	37.727	− 1.000	1.578	30.333
(benefits of a hydroelectric power	[2]	n. a.	7.76%	5.60%	7.45%	n. a.	2.53%	5.57%
station are defined as savings	[3]	− 0.50	2.12	0.90	1.50	− 0.56	0.10	0.88
of thermal electricity	[4]		64.00			60.50		
production)	[5]		− 3.00			20.00		

[a] Numerous sensitivity analyses have been carried out to show the stability of the results obtained. Because of space restrictions, only the main results are shown.
[b] Variant I is independent of the assumption whether the concept of hydraulic engineering works.
n. a. = not available.
[1] Present value (in million ATS).
[2] Internal interest rate (in%).
[3] Benefit-cost ratio.
[4] Amount of WTP per Austrian over 14 years to make the present value of variant II equal to that of variant IV.
[5] Amount of WTP per Austrian over 14 years to make the internal interest rate of variant II equal to that of variant IV.

- Economic valuation methods can contribute substantially to transparent decision processes.