

# Environmental services from irrigation water: a combined economic evaluation in the Renana Bureau of Reclamation and Irrigation basin

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## Introduction and objectives

Water management is a primary issue in Italy, especially during the summer period, due to the lower precipitation amount and the higher irrigation demand. This is made more relevant by recent climate change trends (IPCC, 2014). During the dry season, local Drainage and Irrigation Boards (RIB) are entitled to supply water to farmers, which allow higher quality and yields for irrigated crops, located within their basin area (L.R. 7/2012). The costs for the water delivery should be entirely covered through water charges, related to the benefit received by farmers (according to Italian and regional law and in compliance with 2000/60/EC) (WATECO, 2003). Nevertheless, the presence of water in the irrigation canals provides other environmental, social and aesthetic benefits, as well, which are enjoyable by people living in the residential areas located nearby. According to the new D.M. 39/2015, these costs, in fact, should be shared also by residential citizens, which are indirect users of the delivered irrigation water. The aim of this study is to assess the economic value of **Environmental Water Services** (EWS) perceived by residents in the area of the Renana Bureau of Reclamation and Irrigation, due to the artificial presence of water in the canal during the summer.

## Description of the area selected as case study

The Renana Bureau of Reclamation and Irrigation is a reclamation and irrigation basin located Emilia-Romagna Region, and distributed mostly in the Bologna province. It covers almost to 341,953 hectares (3,419 km<sup>2</sup>), of which 42% in the plains and 58% in the mountains. The watershed of Reno River identifies the basin borders. Heavy precipitations during autumn and spring and water scarcity during summer characterize the rainfall patterns in this area. In fact, the average monthly value for July and August is around 35-38 mm of rain, but 60% of the observations assumes values close to zero. A dense network of irrigation canals distinguishes the plain area: about 88% are free-surface ground channels, 4% are by gravity, and 8% are pressure pipes.

## Methodology

The methodology consisted in the evaluation of the residents' willingness to pay (WTP) for EWS, as well as the WTP associated with a defined environmental, or recreational attribute, on equal terms of income and other aspects. The study applied the contingent valuation (CV) estimation method, based on a survey carried out in January 2016. It has also been used a revised version of the hedonic price (HP).

The phases in the adopted methodology are as follows: (1) Literature review; (2) Identification of the target population (beneficiaries); (3) Survey design; (4) Data analysis; (5) Interpretation of the results.

Outcomes from the CV gave an estimation of the maximum willingness to pay (WTP) for maintaining water in canals, during summer as a mean to assess EWS (Rupérez-Moreno et al., 2015). Whereas, by the revised HP estimation method it was possible to determine the respondent's perception of added value in their home market price, in relation to the presence of irrigation canals.

## Sample characteristics and results

The sample of the survey included 300 families, made by an average of four (3,58) persons. Interesting for the evaluation of the WTP, was its correlation with the characteristics of the sample. In particular, 47% of respondents are men (53% women), 27% of respondents, at the time of the survey, is aged between 65 and 74 years. The 13% of respondents have a farmer in their family: of these, 5% are willing to pay, 6% are not willing to pay, and 2% do not know or do not answer (Tab. 1). The most frequent class of average family income is between € 1.500 and 3.000€ per month (Tab. 2). One third of the respondents declared an annual fee paid to the Consortium, between 35 and 60 € (Tab. 3). These two ranges of income and annual fee paid to the Consortium are the ones where the frequency of a positive WTP is higher.

**Table 1:** WTP and presence of a farmer in the family. Note that DK = I do not know; and DR= I do not respond.

Presence of a farmer in the family	WTP				
	Yes	No	DK	DR	Total
Yes	16	17	3	3	39
No	112	120	29		261
<b>Total</b>	<b>128</b>	<b>137</b>	<b>32</b>	<b>3</b>	<b>300</b>
Yes %	5	6	1	1	13
No %	37	40	10	0	87
<b>Total %</b>	<b>43</b>	<b>46</b>	<b>11</b>	<b>1</b>	<b>100</b>

Source: own elaboration

**Table 2:** WTP and net declared revenue. Note that DK = I do not know; and DR= I do not respond.

Considered variable	Monthly family income (€)						
	<800	800-1500	1500-3000	>3000	DK	DR	Total
Observed number	11	66	92	33	17	81	300
Observed %	4	22	31	11	6	27	100
Number of WTP	3	31	51	16	6	21	128
Number of No-WTP	8	35	41	17	11	60	172

Source: own elaboration

**Table 3:** WTP and yearly fee payed to the Renana RIB. Note that DK = I do not know.

Considered variable	Yearly fee payed to the Renana RIB (€)								
	<30	31-60	61-90	91-120	121-200	201-300	>350	DK	Total
Observed number	47	106	14	8	7	2	2	144	300
Observed %	16	35	5	3	2	1	1	38	100
Number of WTP>0€	19	51	8	4	4	1	1	40	128
Number of WTP<0€	28	55	6	4	3	2	1	74	172

Source: own elaboration

The analysis of results allowed identifying some possible characteristics of the sample, which may influence the WTP of the entire population, such as knowing the drainage contribution fee, the perception of benefits due to the canal presence, and the presence of a farmer in the family. The two proximal economic values of EWS, obtained vary in a range from 300.000 euros/year to 1,2 millions of euros/year.

## Conclusions

Considering the values obtained, EWS appear of great relevance, but until now supported only by farmers. Therefore, if residents would pay a water charge to cover part of irrigation costs, the sustainability of the RIB basin would probably increase. This is due to a better matching between costs and benefits per group of users and would provide more efficiently EWS.

As a parallel effect of this improved costs efficiency, there would be a higher support to irrigated agriculture, as confirmed by Thiene and Tsur (2013) and articles citing this study (Mustaq, 2016; Mushtaq et al, 2014). In particular, Thiene and Tsur (2013) highlight that, as the demand for water by other sectors increases with population growth and higher living standards, water is becoming the limiting factor for agricultural production. This is true in many regions, especially for perennial crops, where losses are larger when lower water availability occurs. Consequently, the danger is of a transfer of cultivated area into fallow or urban areas; a process very difficult to reverse. Therefore, it

is of primary importance to understand the links between farmland policies and the demand for irrigation water. AGGIUNGERE COMMENTO SU BILANCIO/COSTI IRRIGUI.

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