

GEVAD Code Number	GV65
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Title	Costs and benefits of preserving farm animal genetic resources from extinction: CVM and Bio-economic model for valuing a conservation program for the Italian Pentro horse
Reference	Ecological Economics 45 (2003) 445- 459
Country	Italy
Location	Southern Italy, Molise region
Date of reference	2003
Environmental Good or Service Valued	
- General	Fauna
- Specific	Farm animal – Pentro horse
Activity involved	Conservation program for the Pentro horse.
Environmental change	<p>The two possible alternatives to consider with regard to the conservation of Pentro horse were the following:</p> <ul style="list-style-type: none"> Alternative A: The respondent's family, along with all Molisan families, does not make a donation. The “Pentro horse” protection project is not carried out. The “Pentro horse” could become extinct. Alternative B: The respondent's family, together with all Molisan families, makes a donation. The “Pentro horse” protection program is carried out. The Pentro horse is saved from extinction.
Survey information	
Location characteristics	<p>Pentro horse is bred in Southern Italy for the production of meat and is currently facing extinction. At the present time, this horse is not included, in any conservation program even though it is an important element of the history and traditions of the land in which it lives; it characterises, in a unique fashion, the landscape in which it is reared in a wild state. There are presently 150 horses registered for assessment, all of which live in a wild state in Pantano della Zittola, a wetland area of 2200 ha of considerable naturalistic relevance located in the Molise Apennines, in Southern Italy. The importance of this area has been recognised both nationally and at the European level. In fact, it has been placed amongst the CORINE BIOTOPES, the most important sites for the conservation of nature amongst the EU countries. The Pantano della Zittola is one of only two peat moss sites in the Apennines. The area is very important because of its low altitude (800 m). This indicates that the area is a post-ice ages relict and this geological phenomenon contributed to the local preservation of some relict species that are elsewhere extinct. The Pantano della Zittola was inhabited in pre- Roman times by Sanniti Pentri, from which the name of the horse is derived. Thus, the origins of this animal are thought to be very old.</p>
Socio-economic characteristics	No information was provided on the socioeconomic characteristics of the population in the area.
Type of survey	Primary
Date of survey	Not specified – (Guess 2001)
Valuation method	Contingent valuation method; Cost – benefit analysis
Survey size	552 completed questionnaires
Collection of information	Telephone survey
Payment vehicle	Sponsorship by means of a single donation
Economic measure	Willingness to pay – close ended questions (one and one-half bound procedure)
Econometric model	A bio -economic model was used to estimate the costs of conservation. A mixture model was used to estimate the distribution of willingness to pay.
Other information	<p>The costs of the conservation program for the Pentro horse were estimated based on a model built to calculate the number of years necessary to reach the threshold of 1000 horses and to calculate the costs linked to its conservation.</p> <p>A questionnaire has been distributed to Pentro horse breeders to collect technical - economic information used to estimate the costs and profits related to rearing.</p>
Results	
	<p>Estimation of costs of the conservation program</p> <p>The breeding costs revealed were quite low because the horses are raised in a wild state. In fact, the breeding cost for the colts is only 3 €/year, while for the adult horse the cost rises to 82 €/year. If a conservation program is adopted, the breeding costs rise, because intervention is required in order to improve the present breeding techniques. The costs are estimated at about 258 €/horse per year. In particular, the breeders would pay a rent to the municipality to guarantee access to grazing in the Pantano della Zittola (17 €/horse per year) and they would also pay for the prophylaxis (42 €/horse per year). Moreover, in order to avoid that the extra load of livestock impoverishes the Pantano della Zittola resource, a major alimentary supplement will be necessary, which adds an extra 116 €/horse per year. Finally, it is estimated that the manpower requested for this type of breeding is 83 €/horse per year (Table 1).</p>

Table 1. Estimation of costs with and without conservation program

	With	Without
Rent to Municipality	17	17
Prophylaxis	-	42
Alimentary supplement	23	116
Manpower	42	83
Total	82	258

The estimate of lost revenues is based on the revenues that the breeder would have obtained if the conservation program were not activated. Assuming that the size of horse population remained constant over the years, the breeders would continue to sell 54 horses, 48 colts and six end-of-career horses each year. The age at which the colts are sold is influenced by the climatic conditions and this causes some variation in terms of costs and gains. In this case, it was hypothesised that 70% of the colts would be sold at 6 months and 30% the following year. As the number of horses increases, the breeders have the possibility of selling the surplus colts (both male and female). The value of these new sales, net of the costs, is subtracted from the lost revenues and from the breeding costs sustained. A break-down of the resulting prediction in cost structure is summarised in Table 2, for a period of 14 years.

Table 2. Conservation cost per lost income, production cost and new sale (values in Euro)

Years	Lost incomes	Production costs	New sale	Conservation cost
0	20820	38734	11572	47982
1	20820	42298	14578	48540
2	20820	44211	15238	49794
3	20820	46029	15864	50985
4	20820	53799	18542	56076
5	20820	66252	25650	61422
6	20820	76713	29700	67833
7	20820	87217	33766	74270
8	20820	99616	38567	81869
9	20820	117824	45616	93027
10	20820	138782	53730	105872
11	20820	162369	62862	120327
12	20820	189116	73217	136718
13	20820	220898	85522	156196
14	20820	258427	100052	179195

Estimation of benefits of the conservation program

The parameter estimates for the WTP distribution are shown in Table 3 (model 1). Table 3 also shows the estimates of mean and median WTP values, with their respective confidence intervals approximated using the Krinsky and Robb (1986) procedure.

The truncated mean value is 33 € while the median value is 19 €. Multiplying the mean and the median by the number of families living in Molise (117 138) an estimate of the aggregate value is derived, which amounts to 3.8 million € for the mean and 2.2 million € for the median. While the first value is to be considered in a Kaldor-Hicks cost-benefit test, the second value may be important to local politicians, given the interest in median-voter behaviour in a referendum context.

Model 2 in Table 3 differs from model 1 because of the covariates. The number of observations for which the analysis was conducted was reduced to 417 because 17% of the sample (87 interviews) had to be excluded due to incomplete information regarding the income of the respondents. The socio-economic covariates that show significance include the degree of education, family income, knowledge of the Pentro horse prior to the interview (Horse), and the indicator variable for the respondent being a member of environmental associations (Environmentalist).

Both the mean and median values are higher than those from the model estimated without covariates. The truncated mean is equal to 35 € and the median is equal to 24 €. The estimate for the aggregated mean has a value of 4.1 million € and that for the aggregated median is 2.8 million €.

Table 3. Estimates of variables and parameters

Estimates of variables (figures in parentheses are standard errors)		
Variable	Model 1	Model 2
Constant	4.04 (0.30)	3.77 (0.42)
LogBid	-1.27 (0.10)	-1.51 (0.12)
Gamma	0.13 (0.01)	0.06 (0.01)
Environmentalism		0.93 (0.49)
Income		0.02 (0.01)
Education		0.69 (0.23)
Horse		0.35 (0.22)
No. of observations	522	417
Loglik	-745	-491.51
Average Loglik	-1.35	-1.18
Parameters of the WTP distribution (values in Euros, aggregate values in parentheses)		
Parameter	Model 1	Model 2
<i>IC0.05 (truncated mean at 103 Euro)</i>		
Lower bound	30 (3464972)	31 (3652948)
Median	33 (3872582)	35 (4095730)
Upper bound	37 (4280222)	39 (4538511)
<i>IC0.05 (median)</i>		
Lower bound	17 (1936197)	21 (2452476)
Median	19 (2225372)	24 (2792589)
Upper bound	22 (2550602)	27 (3168455)

Results of the cost benefit analysis

The comparison of costs and benefits of the conservation program for the Pentro horse must take into account that the latter are present value estimates, while the estimated costs refer to various moments in time across a 14-year time period.

In the context of CBA for environmental programs, particular attention is given to the discount rate through which the costs and benefits present values are computed. In this specific case study, the rate of choice is the discount rate

suggested by government authorities to evaluate public investments. The present value of costs for the conservation program over the 14 years discounted at both 3.5% (discount rate suggested by the Italian government) and 0% are shown in Table 4, while in Table 5 the data supporting the CBA computed by considering different parameter estimates (mean and median) of the WTP distribution are presented. It can be seen from the NPV that the benefits are always greater than the costs, even when the discount rate is equal to 0.

Table 4. Conservation total costs at 3.5 % and 0% discount rate (values in Euro)

	3.5%	0%
New sales	451498	624476
Lost income	248183	312300
Production cost	1193759	1642284
Conservation cost	990444	1330108

Table 5. Cost benefit analysis (values in Euro)

	Base model		Covariates model	
	Mean	Median	Mean	Median
<i>Discount rate 3.5%</i>				
Total benefits	3872582	2225372	4095730	2792589
Total costs	990444	990444	990444	990444
Net present value	2882138	1234928	3105286	1802145
Benefit to cost ratio	3.91	2.25	1.14	2.82
<i>Discount rate 0%</i>				
Total benefits	3872582	2225372	4095730	2792589
Total costs	1330108	1330108	1330108	1330108
Net present value	2542474	895264	2765622	1462481
Benefit to cost ratio	2.91	1.67	1.08	2.10

According to the results even in the worst scenario the benefit/cost ratio equals to 1.67, justifying a conservation policy.