The Socio-Economic Value of Natural Riverbanks in the Netherlands

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NOTA DI LAVORO 64.2004

APRIL 2004

NRM - Natural Resources Management

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Summary

Ecologists and economists both use a different approach to determine the value of nature. Its ecological value can be measured using criteria like rarity and diversity of species in an ecosystem. The economic value can be determined using non-market valuation techniques. This paper focuses on an empirical application of the Contingent Valuation Method (CVM) to find out whether this valuation method is a suitable method to estimate the economic value of natural riverbanks in the Netherlands. Natural riverbanks will provide habitat for species that particularly depend on the land water transit area. Since common riverbanks do not provide this habitat, natural river banks increase biodiversity in the Netherlands. On the basis of technical and ecological characteristics nine different types of natural riverbanks were distinguished. For each type a laymen description was made. This description served as a basis for economic valuation by means of CVM.

The results of the CVM study shows that the average willingness to pay for non-use of a natural riverbank varied between 16 and 25 Dutch guilders per household year. The willingness to pay for recreational use ranged from 1,07 to 2,50 guilders per visit. The generated outcomes proved to be consistent with results from other studies. At first sight, the economic value of natural riverbanks seemed to be higher than their construction and maintenance cost.

Keywords: Nature friendly river banks, Land water interactions, Economic value, Nature, CVM, Non-use value

This paper has been presented at the 4th BioEcon Workshop on "Economic Analysis of Policies for Biodiversity Conservation", Venice, Italy, August 28-29, 2003, organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL).

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1 Introduction

Management of riverbanks has long been a key concern within Dutch water management policies. The Dutch ministry now aims to have a clear indication of when, and to what extent the riverbanks should regain their natural form and course. To be able to make a trade-off between costs of creating natural river banks and the benefits, such as increased biodiversity and increased recreational opportunities, these benefits need to be expressed in monetary terms. Amongst others, the contingent valuation method (CVM) is a technique commonly applied within the field of environmental economics to assess the economic value of nature. The aim of this study was to investigate whether the CVM can be used to include the benefits of increased nature quality in cost-benefit-analyses for natural riverbanks. First, a pilot study has been undertaken for two typical types of riverbanks. Results appeared to be consistent and reliable, and a sequential study has been executed to value six other types of riverbanks.

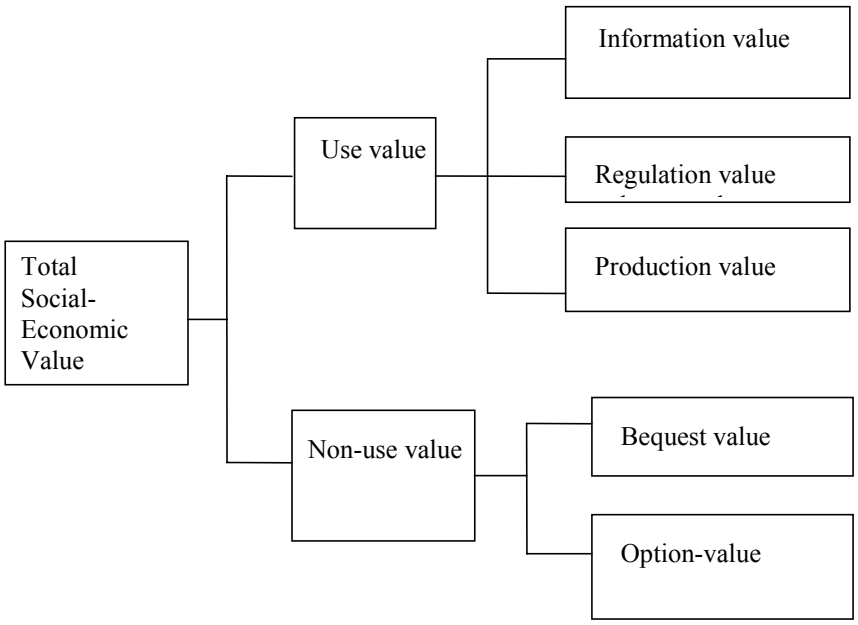
2. Valuation by means of the Contingent Valuation Method

This chapter presents a short introduction to the socio-economic valuation of nature. In paragraph 2.1 it is explained which components of the total economic value of increased nature quality are measured in this study. Paragraph 2.2. introduces the Contingent Valuation Method and in paragraph 2.3 the limitations of this method are briefly discussed.

2.1 Valuation of natural of natural riverbanks

Natural riverbanks have several benefits, the most important being increased biodiversity and the amenity of recreational enjoyment. The value of natural riverbanks can be determined by investigating which welfare functions nature can perform better when a natural riverbank is constructed or maintained, compared to non-natural, steep riverbanks. Figure 2.1.1 provides an overview of the different welfare functions that make up the total economic value of nature.

Figure 2.1.1 The components of the total economic value of nature



Source: Ruijgrok, 2000.

Nature generates welfare for society by means of use and non-use functions. Consequently, the total economic value of nature consists of several components (Pearce and Moran, 1994; Hanley and Spash, 1997). The total economic value is the sum of the use value and the non-use value. The use value comprises a direct use value and an indirect use value. The non-use value consists of an option value, an existence value and a bequest value.

Direct use values pertain to tradable goods such as fish and wood (production values) and to services such as the possibilities for recreationists to enjoy natural beauty (information values). Indirect use values refer to supportive features of ecosystems for direct use, such as climate regulation (regulation values). Option values are values that people attach to keeping the possibility of particular kind of use open for the future, whereas quasi-option values concern some kind of unknown future use. Bequest values pertain to the value people attach to preserve natural assets for future generations. Existence values refer to the fact that people simply want certain functions or species to exist, regardless of whether or not they will ever use them.[1]

Natural riverbanks do not contribute substantially to the value of production or regulation functions compared to common river banks. Natural banks mainly perform the non-use function and the information function (read: the recreational perception function) better than common banks. Therefore only these two functions are taken into consideration in this study. Both these functions can be valued by means of CVM.

It seems worth noting that the economic value of nature only pertains to human welfare. Since rational people are willing to pay more for things that bring them much welfare than for things that do not, willingness to pay is an appropriate measure for the value of nature. People from other disciplines and even certain economists (e.g. Dietz *et al.*, 1992) have raised the question whether welfare for humans is the only measure of the value of nature, and whether welfare for other organisms should also be acknowledged? Economic valuation is purely anthropocentric. It does not include an intrinsic value. The latter requires an ecocentric approach. The socio-economic value of nature only captures human welfare, and not welfare of other organisms. Consequently, it seems reasonable not to solely base environmental policies on economic values. The benefits of increased nature quality due natural riverbanks are larger than the economic benefits determined in this study. It might be useful to determine the ecological or intrinsic value of natural riverbanks in addition to its economic value.

2.2 What is CVM?

CVM is a survey method in which respondents are asked how much they are willing to pay for the use or conservation of natural goods[2]. Their stated preferences are assumed to be contingent upon the alternative goods that are offered in a 'hypothetical market'. Essential elements of the survey are: description of the natural good that is to be valued, description of the payment vehicle and description of the hypothetical market (Mitchell and Carson, 1989; Hoevenagel, 1994). *Describing the natural good* includes identifying all valuable attributes of the good. In the case of nature quality related to natural riverbanks, this entails a clear description of the difference between the natural riverbanks and the common riverbanks. The *payment vehicle* pertains to how the money will be paid. For example, one can pay for a good in cash every time it is used or by means of an increased income tax. The *description of the hypothetical market* should include an identification of who will provide and who will pay for the nature improvement. It should be made clear that the payment is a collective action; everybody else will also pay, otherwise respondents may refuse to pay although they appreciate the good. Respondents should also be reminded of the possibility of spending their income on goods other than nature, to prevent overestimates (Hoevenagel, 1994).

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[1] Option and quasi-option values may be regarded as use values due to the future use possibilities they imply. They can also be regarded as non-use values, since these values are not realised through actual use.

[2] Or what compensation they need to be given (i.e. their willingness to accept) in order to accept not being able to use or losing a natural good.

CVM measures stated preferences and it includes the consumers' surplus. It is said to be an appropriate economic valuation method for environmental goods that have no indirect effects on other goods. It is therefore very suited for the valuation of amenities or other easy to perceive aspects of nature, such as natural beauty. CVM does not produce valid measurements when it concerns goods that people are not familiar with. Since natural river banks are not easy to perceive (one can hardly visit them, except by boat) and people are not very familiar with them and their contribution to biodiversity, it is very important to explain the effects of natural riverbanks very well in the CVM-questionnaire.

2.3 Limitations and biases

Although CVM-studies are known to have large data requirements, they do not require secondary data. One can gather all necessary data, i.e. the willingness to pay and its explaining variables such as income and attitude towards nature, by means of one survey (Hoevenagel, 1994).

In CVM-surveys one can encounter various sources of bias, such as samples which are not representative, strategic behaviour of respondents or confusion about the size of the good that is to be valued (part-whole bias). Three main categories of bias can be distinguished:

1. The respondent does not state his or her actual willingness to pay;
2. The design of the questionnaire influences the answers;
3. Unfamiliarity with and difficulty of the questions.

Category 1: The respondent does not state his or her actual willingness to pay

Sometimes respondents do not state their true willingness to pay because they wish to influence the results of the study. This strategic behaviour can be minimised by choosing a realistic payment vehicle. Other times respondents may answer to please the interviewer or in a socially desirable way. This is difficult to prevent, but one can pay attention to giving respondents the opportunity to simply say that they do not agree or are not willing to pay. This is done in the survey design of this study: e.g. repondents are explicitly asked whether they think it is a good idea natural riverbanks are being constructed throughout the Netherlands.

Category 2: The design of the questionnaire influences the answers

The information provided in the questionnaire may influence the willingness to pay. This may happen with closed questions. The starting bid and the range of monetary bids may result in a different willingness to pay than the respondent's actual willingness to pay. To prevent this type of bias, open-ended questions were used in the survey of on natural riverbanks. Of course open-ended questions introduce the risk of relational bias, which means that respondents relate their bids to the prices of other goods. In principle it is okay when they relate entrance fees of nature areas with entrance fees of museums. They can only spend their money once, so they have to choose between different goods. But it becomes problematic when they relate their bid to other things that do not cost anything, such as rain or friendship. Also the payment vehicle may be a source of bias. One must however choose at least one vehicle. When using more vehicles one can determine the sensitivity of the results to the vehicle. One can also register respondents who protest against the selected vehicle. The latter was done in our survey.

Category 3: Unfamiliarity with and difficulty of the questions.

Sometimes respondents do not fully grasp the budget constraint on which they should base their willingness to pay. When it concerns small payments, such as entrance fees for areas, the risk of budget bias is rather small, but when it larger bids are made, such as yearly donations for nature conservation, the risk becomes larger too. Respondent may produce bids they that could never live up to in reality. In the CVM-design of this study, respondents are reminded of the fact that there are other things on which they may wish to spend their income. Other sources of bias pertain to mentioning symbolic values and to not realising that they would actually have to pay the amount (elicitation bias). Also combining questions on the non-use and the (recreational) use value, may lead to biased results, as the answer to the first question influences the answer to the second question. It does, however, save research cost to determine two values in one survey. Finally, an important type of bias is the part-whole bias, which occurs when people value more than they were supposed to. For example, they were asked to value a tree, but they valued the whole forest instead. This can be prevented by using a filter: first, they are asked to value the forest, and than to value the tree. Even if this is done, one cannot fully exclude part whole bias, especially not when valuing such a difficult good, such as natural riverbanks. In the survey design of this study, respondents who are likely to have valued more than just one riverbank, were registered as 'whole bidders'. It is, however, debatable that part-whole bias can be ascribed to the survey design, because respondents may simply not have additive preferences (Bateman, *et.al*, 1997). In that case one should not even use the word bias.

3 A CVM survey for natural riverbanks

In this chapter, a CVM-survey is set up to determine the non-use value and the recreational perception value of nine different types of natural river banks in the Netherlands. Paragraph 3.1 describes the goods to be valued and the hypothetical market. Paragraph 3.2 provides information about the questionnaire.

3.1 Description of the good and the hypothetical market

A CVM questionnaire was designed to estimate non-use value and the recreational use value of nine different types of natural riverbanks that exist in the Netherlands. The most important ingredients of the questionnaire were a description of natural riverbanks to be valued and the hypothetical market, including a payment vehicle.

Natural riverbanks

A natural riverbank is non steep sandy bank. It is mostly constructed by creating an extra bank inside the river parallel to the existing bank. The protection material (stone or concrete) of original bank material is removed. The extra bank, which is mostly made of stone, separates the river (or canal or lake) from a quiet shallow water area. Depending on the type of bank, the shallow water strip is connected with the river or not.

In the Netherlands nine types of natural banks are distinguished. For each type a location has been selected where the bank can be found. The following types of banks and locations were used in the CVM-study:
- Type 1: River with jetty: Engelse werk
- Type 2: River with extra bank and shallow water strip behind it: Loevesteijn
- Type 3: River without extra bank and with a steep edge: Bocht van Linne
- Type 4: Canal with extra bank and narrow shallow water strip behind it: Helmond
- Type 5: Canal with extra bank and wide shallow water strip behind it: Spaarnwoude
- Type 6: Canal with a perforated dam construction and shallow water area: Noord Hollands Kanaal
- Type 7: Lake with extra bank: Volkerakzoommeer
- Type 8: Tidal water with extra bank: Huys den Donck
- Type 9: Tidal water with nature friendly materials directly applied to the bank: Dijktuin II.

We have chosen to do personal interviews within the vicinity of the chosen locations. We interviewed inhabitants and people who happened to pass by.

Non-use value

The good to be valued was the construction and maintenance of natural riverbanks. For the estimation of the non-use value, which in this case primarily consisted of increased biodiversity, the specific effects on flora and fauna first needed to be assessed. This was done by ecological experts, to ensure that an economic analysis of nature would be based on sound ecological theory. However, it was expected to be too difficult for respondents to grasp all the (technical) effects a natural riverbank might impose on biodiversity. Therefore, the ecological expert description was translated into a laymen description, by means of clear examples of effects on species.

The hypothetical market was kept simple, respondents were asked whether they would be willing to pay an annual donation, to construct and maintain at least one natural riverbank per year.

Perception value

The perception value that is estimated in this CVM-study pertains to recreational use. It is the welfare effect of recreational enjoyment, and not the income generating effect for the recreation sector.

The good to be valued was described and shown on pictures. Respondents were shown one picture of a natural riverbank in the pilot study to visualise the idea of a natural riverbank. The sequel included several pictures of natural riverbanks. Respondent were then requested to rank them for analytical purposes which will be explained in paragraph 3.2.

The hypothetical market included the assumption that an entrance fee was installed for visiting all nature areas in the Netherlands. This was done to indicate that others would also have to pay and that evasion was not possible.

3.2 Questionnaire

The questionnaire for the pilot study included the environmental good, hypothetical market, and payment vehicle as presented in paragraph 3.1. The questionnaire consisted of eight open-ended questions. It started with some general questions like respondents' attitude towards nature, their domicile and postal code. The first introductory question on natural riverbanks is: Do you know what a natural riverbank is? This question is posed to give respondents the opportunity to think about the issue of natural riverbanks, and to perform statistical tests later on to check whether there would be any difference in willingness to pay of people who were already familiar with the concept of natural riverbanks before the interview was held, and those who were not. After this question, respondents are asked several questions concerning the non use value. They were asked whether they considered it a good idea for natural riverbanks to be constructed and maintained throughout the Netherlands. The next question was asked to determine whether or not people would be willing to pay (by means of an annual gift) for construction and maintenance of one specific natural riverbank. If so, they were asked to state the maximum amount they would be willing to pay per year.

Subsequently, respondents were shown a picture of a different natural riverbank which would provide more habitat for species than the first riverbank would. Respondents were asked if they would be willing to pay an equal, higher or lower amount for the construction of this type of riverbank, and if the amount would be different, they were requested to explain the difference.

This was followed by the question whether respondents would be willing to pay for a natural riverbank that would be far away from their own neighbourhood. If not, they were requested to state any reason for not willing to. If they would be willing to pay, they were asked to state the maximum amount.

After this line of question, some questions were asked to make a shift towards the perception value. For example: Do you think there is sufficient nature in the Netherlands, followed by what respondents themselves would consider to be nature.

In order to determine the perception value, several questions were posed: Do you think natural banks contribute to the beauty of rivers and canals? Do you ever use specified natural walking or cycling tracks? Followed by the hypothetical question that in case a walking or cycling track runs through a natural area, or follows a natural riverbank, how much would you be willing to pay to use one of these tracks? And would

the frequency of using one of these tracks remain the same, if you would have to pay the stated amount each and every single time?

Finally, some questions were asked about the respondents' age and income.

The sequel also focussed on comparison between the different riverbanks. Instead of a comparison between two locations like has been done for the pilot study (i.e. the location of Helmond versus Spaarnwoude) several pictures of different types of natural riverbanks were shown, and respondents were requested to rank them according to their preference. An additional question followed in which they were requested to explain their ranking. Otherwise, the questionnaire of the sequel was equal to that of the pilot study.

4 Survey results

On- site interviews for the pilot study were held at two locations during summer of 1999. Interviews for the pilot study in Helmond were held at the housing area and walking and cycling tracks in the proximity of the natural canalbank. Some interviews were held in the towncenter. This was done to find out whether visitors of nature areas respond differently than others. Interviews for Spaarnwoude were held at the recreational area and along a cycling track.

The sequential study took place during summer 2000 at six different locations all in the proximity of the natural riverbank. Data for the pilot have been combined with that of the sequel and was entered into an excel database. In the analysis a distinction has been made between non-use and recreational use values.

4.1 Non-use values

Overall, the majority of respondents (58,8%) was willing to pay for the construction and maintenance of a natural riverbank in the Netherlands. 16% appeared to be a zero bidder, and another 19% was a protest bidder.

Average willingness to pay for all riverbanks is shown displayed in Table 1. The minimum as well as the maximum willingness to pay are shown as well.

Table 1 Average Willingness To Pay for non-use (guilders per household per year)

Riverbank and location	WTP	Sdev	N	MIN	MAX
Type 1: Engelse werk	28.83	29.63	45	0	500,00
Type 2: Loevestein	23.51	28.68	47	0	255,00
Type 3: Bocht v. Linne	15.85	23.48	47	0	250,00
Type 4: Helmond	26.10	28.51	97	0	1000,00
Type 5: Spaarnwoude	24.19	28.14	99	0	120,00
Type 6: NH Kanaal	14.88	27.46	49	0	500,00
Type 7: Volkerak	24.62	27.38	50	0	25,00
Type 8: Huys d. Donck	21.20	27.57	48	0	100,00
Type 9: Dijktuin II	18.42	31.81	49	0	1000,00
Overall	22.52	28.29	531	0	1000,00

Acronyms: WTP= willingness to pay, SDev= standard deviation, N= number of measurements, Min=minimum, Max= maximum.

According to table 1 the average willingness to pay (wtp) for non-use for each household varies between 14,88 guilders for NH Kanaal to 28,83 guilders for Engelse werk. These amounts are similar to those of earlier studies. Several Dutch CVM-studies with respect to nature conservation reported willingness to pay ranging from 25 guilders to 45 guilders per household (See for example Hoevenagel, 1994; Brouwer and Slangen, 1997)

T-test have been performed to check whether WTP differed significantly between any of the selected river-bank types. It appeared that there was only a significant difference between the willingness to pay for

Engelse werk and Bocht van Linne, and between Engelse werk and NH Kanaal. Differences between other types of riverbanks appeared not be statistically significant due to high standard deviations.

Demographic characteristics like attitude, sex, income, age, and annual visits have been included in the analysis to find out whether they are determinants for the difference in willingness to pay. None of them showed significant correlation with the willingness to pay. Only 'age' and 'attitude' were positively correlated.

The sequential study included a question in which respondents had to rank the different types of riverbanks according to their preference. The results of ranking were more or less in compliance with people's willingness to pay.

Costs and benefits

In order to determine the economic non-use value of natural riverbanks the average willingness to per household per year was multiplied by the number of households in the Netherlands willing to pay this average amount. This resulted in an economic non-use value of 150 million guilders per year. Since constructions costs of natural banks amount to several millions per location, one can conclude that the benefits of investing in biodiversity clearly surpass the costs.

4.2 Recreational use values

The majority (58.1%) of respondents was willing to pay for recreational use of a riverbank. 20.1% appeared to be zero bidders, while 19.1% were protest bidders.

Average willingness to pay for recreational use of a natural riverbank has been displayed in table 2.

Table 2 Average willingness to pay for recreational use (guilders per visit)

Riverbank	WTP	SDEV	N	MIN	MAX
Type 1: Engelse werk	1.37	1.61	47	0	10,00
Type 2: Loevestein	1.81	1.68	48	0	7,50
Type 3: Bocht v. Linne	2.50	1.28	49	0	7,50
Type 4: Helmond	1.13	1.52	99	0	10,00
Type 5: Spaarnwoude	1.41	1.50	101	0	5,00
Type 6: NH Kanaal	1.17	1.48	46	0	12,50
Type 7: Volkerak	1.55	1.68	47	0	30,00
Type 8: Huys d. Donck	1.29	1.72	47	0	10,00
Type 9: Dijktuin II	1.07	1.62	42	0	100,00
Overall	1.30	1.55	526	0	100,00

Acronyms: WTP= willingness to pay, SDev= standard deviation, N= number of measurements, Min=minimum, Max= maximum.

Table 2 shows that that the average willingness to pay for the different natural riverbanks ranges from 1.07 guilders for Dijktuin II to 2.50 guilders for de Bocht v. Linne. This is a somewhat remarkable result, as this was amongst the least valued types for non-use. Again, a t-test was performed to test whether the difference would be significant. This appeared not so. With standard deviations generally larger than the coefficients, it then was considered useless to distinguish between the willingness to pay for each type of riverbank. Instead, the overall average of 1.30 guilders was used. Comparing this figure to results from other studies reveals that this is rather low. Ruijgrok (1998) for example reported a willingness to pay ranging from 2 to 4 guilders, for a visit to any of the Dutch coastal zones. Kuik (1991) even found WTP as high as 10 to 15 guilders. The low figure in our case can be however explained by the fact that a riverbank does hardly provide for any recreational opportunities, since it is difficult to access them.

Again, demographic characteristics were being tested for their possible influence on the willingness to pay. Only the variable 'annual visits' appeared to be significantly negatively correlated with the willingness to pay. This seems a logical result as willingness to pay is expressed per visit. People who often visit the bank

are likely to pay less than those who only visit once a year. Summed over an entire year the total amount people would have to pay for each and every single visit, would then be extraordinary high.

5. Conclusion

This study aimed to value non-use value pertaining to biodiversity and the recreational perception value of natural riverbanks in the Netherlands. Results showed that some types of riverbanks are valued significantly higher than other types for as far as non-use is concerned. It is therefore recommended for to make a distinction between high-and low valued riverbanks. For the recreational perception value no such distinction could be made. The sample size was sufficient to generate reliable results with respect to non-use values, i.e. results were consistent with those reported from other studies. The sample size was however not sufficient to determine the explaining variables.

The total economic value can eventually be generated by adding up non-use and the recreational perceptions values. However, checking with the empirical results from ranking revealed that beauty was an important criterion for non-use, which implies that recreational perception and non-use cannot be distinguished anymore. On top of this the recreational opportunities are rather limited and the willingness to pay was found to be very low. We therefore recommend to restrict the total economic value calculation to the non-use value. A brief comparison with the costs of constructing and maintaining natural riverbanks, indicated that the economic value of the biodiversity increase provided by natural riverbanks, surpasses the costs. From this, we may conclude that investing the provision of habitat for species dependent on the land water transit area, is an economically sound activity.

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(lxii) This paper was presented at the ENGIME Workshop on "Communication across Cultures in Multicultural Cities", The Hague, November 7-8, 2002
(lxiii) This paper was presented at the ENGIME Workshop on "Social dynamics and conflicts in multicultural cities", Milan, March 20-21, 2003
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(lxv) This paper was presented at the EuroConference on "Auctions and Market Design: Theory, Evidence and Applications" organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003
(lxvi) This paper has been presented at the 4th BioEcon Workshop on "Economic Analysis of Policies for Biodiversity Conservation" organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL) , Venice, August 28-29, 2003
(lxvii) This paper has been presented at the international conference on "Tourism and Sustainable Economic Development – Macro and Micro Economic Issues" jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003
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