

# Reducing acidification: the benefits of increased nature quality

## Investigating the possibilities of the Contingent Valuation Method

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### Summary

Can the Contingent Valuation Method (CVM) be used to include the benefits of increased nature quality in cost benefit analyses for different acidification abatement scenarios?

This study shows that CVM can be used to estimate two specific benefits of increased nature quality: the non-use value and the recreational perception value. For other benefits, other valuation methods are needed. This study also shows that CVM is not suited for specifying benefits of different acidification scenarios, which differ little in physical effects. It was found to be practically impossible to estimate the non-use value and the perception value of nature per abatement scenario, when the physical differences in nature quality are rather small and hardly visible nor explicable to layman; when it mainly concerns differences in biodiversity; small differences in the occurrence of certain species in certain ecosystems. If abatement scenarios are rather extreme, it may be possible to differentiate benefits per scenario. Policy makers could then make agreements or decision rules on how to derive benefit estimates for less extreme scenario's from the benefit estimates of more extreme scenario's (e.g. through interpolation).

In order to find out the possibilities of CVM for estimating the benefits of increased nature quality related to acidification, a CVM-survey was designed and a pre test was conducted. The design of the survey was improved on the basis of the pre test. A striking result of the pre test was that all respondents were familiar with the environmental theme of acidification.

For a reliable benefit estimate, a large sample should be drawn from the Dutch population. It is recommended to use separate questionnaires for the non-use value and the recreational perception value, since combining these questions in one interview may cause mutual influencing. When carrying out the survey special attention should be paid to registering the arguments provided by respondents when stating their willingness to pay as this may help to detect part-whole bias. For application at a European scale the questionnaire should be adapted on the basis of a new pre test.

In order to determine the benefits of increased nature quality due to acidification, one needs to determine the difference between the welfare generation of healthy ecosystems not suffering from acidification and unhealthy ecosystems affected by acidification. This means that the CVM-survey set up in this study, is not a standard valuation study. The purpose is not to simply determine the non-use and recreational perception value of a nature area, but to determine the effect of acidification on the non-use and perception value of all nature in the Netherlands.

The reason behind the wish to monetarize the benefits of increased nature quality due to acidification abatement are to enable a complete cost benefit analysis of acidification policies. So far, several benefits of acidification abatement, such as reduced health risks and less damage to agricultural crops, had been determined, but the benefits of increased nature quality were lacking, although nature is actually one of the most important reasons for abating acidification in the Netherlands. The results of the pre test presented in this study suggest that the benefits of nature may be quite large and that they should therefore not be overlooked.

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# 1. Introduction

Acidification and continental air pollution is one of the main themes of the Dutch national environmental policy. This theme pertains to chemicals (SO<sub>2</sub>, NO<sub>x</sub>, NH<sub>3</sub> and VOS) in the air which form acids and nitrogen when deposited on the soil or in water. Also ozone and certain organic compounds are incorporated in the environmental theme of acidification. The abatement of acidification leads to costs, but at the same time it results in several benefits, such as reduced risk of mortality and morbidity, less damage to historical buildings, less damage to agricultural crops and increased nature quality.

In 2001, consultant Witteveen en Bos did a study investigating the socio-economic benefits of increased nature quality due to acidification abatement (Ruijgrok en Nieuwkamer (a), 2001). In this study the benefits of increased nature quality were determined by finding out which functions nature can perform better when is not affected by acidification compared to when it is. The study resulted in a first rough benefit estimate of Euro 245 million per year. This estimate was based on the fulfillment of several ecosystem functions. The regulation function 'fixation of heavy metals in the soil' accounted for the largest part of the total benefits. The calculations of the benefits related to this function were, however, very uncertain due to a lack of information on the physical effects of acidification on the behavior of metals. Besides this regulation function, the non-use value of increased biodiversity and vitality of nature, was identified as an important component of the total benefits.

In October 2001 a national workshop was organized in which the results of the initial study were discussed. This workshop resulted in a program for further research. The first three research activities of this program were (Ruijgrok en Nieuwkamer (b), 2001):

- estimating the reduced cost of drinking water production due to acidification abatement;
- estimating the reduced costs of nature management due to reduced acidification;
- estimating the non-use value of increased nature quality by means of the Contingent Valuation Method.

This study concentrates solely on setting up a CVM-survey to determine the non-use value of increased nature quality (i.e. increased biodiversity and vitality) due to acidification abatement. Since CVM can also be used to determine the recreational perception value of increased nature quality, this is also included in this study. The aim of this study is to investigate the possibilities of CVM in determining the socio-economic benefits of acidification abatement scenarios.

## 2. Valuation by means of the Contingent Valuation Method

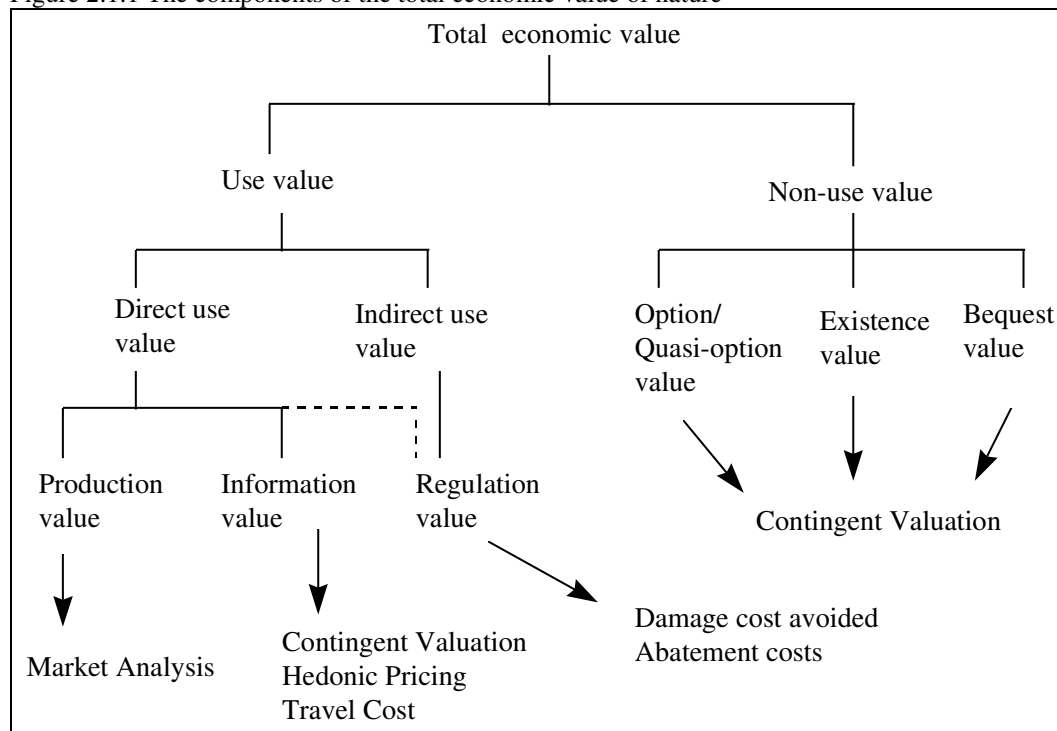
This chapter presents a short introduction to the socio-economic valuation of nature. In paragraph 2.1 it is explained which components of the total economic value of increased nature quality are measured in this study. Paragraph 2.2. introduces the Contingent Valuation Method and in paragraph 2.3 the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

### 2.1 Valuation of nature

Acidification abatement has several benefits, such as reduced health risks and increased natural qualities. The value of increased natural qualities can be determined by investigating which welfare functions nature can perform better when it is not affected by acidification compared to when it is. The results of an earlier study (Ruijgrok and Nieuwkamer (a), 2001) indicate that the non-use function is probably positively influenced by acidification abatement.

To enable a cost benefit comparison for acidification scenarios, the effect of acidification abatement on the non-use value of nature needs to be valued in monetary terms. The only method available for the monetarisation of the non-use function is the Contingent Valuation Method. Figure 2.1.1 gives an overview of the different ecosystem's functions and appropriate valuation methods.

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 tradeable goods such as fish and wood (production values) and to services such as the possibilities for recreators 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<sup>2</sup>.

Figure 2.1.1 shows that only the non-use function and the information function (read: the recreational perception function) can be valued by means of CVM. Therefore only these two functions are taken into consideration in this CVM-pilot. For the valuation of other ecosystems' functions that are influenced by acidification, separate studies are done using other valuation methods.

It is important to note here that economic value of nature only reflects the amount of welfare that society derives from nature. Because rational people are willing to pay more for things that bring them much welfare than for things that do not, willingness to pay is a logical measure for the value of nature. Scientists from other disciplines and also some economists (e.g. Dietz *et al.*, 1992) may, however, raise the question whether welfare for humans is the ultimate measure of the value of nature. What about welfare for other organisms? The economic interpretation of value is purely anthropocentric. In principle, it does not allow for a value of nature in itself. An intrinsic valuation of nature requires an ecocentric approach.

In other words: the socio-economic values of nature only capture human welfare, and they do not include welfare of other organisms. Therefore, it seems reasonable to suggest that environmental policies should not be based solely on economic values. The benefits of increased nature quality due to acidification abatement are larger than the economic benefits determined in this study. It might be useful to determine the ecological or intrinsic value of nature 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<sup>3</sup>. 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 acidification, this would entail a clear description of the negative effects of acidification on natural qualities, such as reduced biodiversity and vitality of ecosystems. 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).

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 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 people are probably not very familiar with the effects of acidification on nature (although acid rain is widely known), it is very important to explain the effects of acidification on nature very well. CVM also does not work when people reject responsibility for the good in question (de Boer *et al.*, 1997). If people are asked, for example, about their willingness to pay for clean soil, they may state that it is zero, because they feel the polluter should pay. This does not mean that they do not appreciate clean soil.

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<sup>2</sup> 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.

<sup>3</sup> 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.

## 2.2 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. respondents are explicitly asked whether they find the issue of nature and acidification important and it is particularly pointed out to them that there are other things they might prefer to spend their money on, thus inviting them to speak their mind.

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 nature and acidification. 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 the survey on nature and acidification.

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 then 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 the effects of acidification on nature quality. In the survey design of this study, respondents who are likely to have valued more than just acidification effects, 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 Setting up a CVM-survey**

In this chapter, a CVM-survey is set up to determine the effects of acidification abatement on the non-use value and the recreational perception value of nature in the Netherlands. In paragraph 3.1 the good to be valued and the hypothetical market are described. In paragraph 3.2 the questionnaire is discussed and in paragraph 3.3. the results of the pre test are summarised.

#### ***3.1 Description of the good and the hypothetical market***

CVM can be used to estimate non-use value and the information value, from here on referred to as perception value of nature. In order to estimate the effect of acidification on both the non-use and the perception value of nature in the Netherlands, a CVM- questionnaire was made. The most important ingredients of the questionnaire were a description of the good to be valued and the hypothetical market, including a payment vehicle.

##### Non-use value

The good to be valued was the effect of acidification on nature quality. For the estimation of the non-use value, it was described by means of a short story explaining what acidification is and how it affects the quality of nature in the Netherlands. In this description the effects on species of forests, heath, grass lands, fens and dunes were explained by means of examples. Difficult expert words, such as biodiversity, were not used to ensure that respondents could fully understand the issue.

The hypothetical market was kept extremely simple, but two variants were introduced in order to find out which variant is most suited for the Dutch situation. The first variant stated that it would be possible to reduce acidification in the Netherlands through extra environmental measures to such an extent that all nature in the Netherlands would be completely healthy again in the year 2030 (i.e. all the negative effects as indicated in the short story would not come true). Respondents were asked if they would be willing to donate a yearly amount of money to actually make that happen. The second variant stated that without extra measures to abate acidification, the quality of nature would be reduced greatly in the year 2030 (i.e. all the negative effects described in the short story would come true). Respondents were asked how much they would be willing to pay in the form of a yearly donation to prevent this deterioration of nature quality.

In the hypothetical market no special effort was made to point out that acidification abatement is a collective action. Previous experience (i.e. Ruijgrok en Vlaanderen, 2001) has indicated that Dutch respondents do not find this important. Whether others pay or not does not influence their willingness to pay when it comes to non-use (although it does when it concerns recreational use!). When respondents say they feel that they have already paid taxes for the abatement of acidification, extra information is given. In the case of the tax argument, respondents are confronted with the assumption that this issue is no longer paid for through national taxes. If this does not produce a willingness to pay, the respondent is registered as a protest bidder, because he may actually be willing to pay, but he does simply not agree with the proposed payment vehicle of a donation.

The description of the hypothetical market does clearly indicate that there are other things, good causes, where the respondent might wish to spend his money on. This is specifically mentioned to both reduce part-whole bias (there are more environmental problems than acidification) and budget constraint bias ('you can only spent your money once') and to prevent an overestimation of the willingness to pay due to socially correct answering.

##### 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 not described in words but shown on pictures. Respondents were shown pictures of healthy forests, health lands, grass lands, fens and dunes and of unhealthy ones suffering from the effects of acidification. The pictures were selected in such a way that they give a realistic impression of the Dutch situation. They were not too technical, nor too extreme. In other words: they did not show dead trees in fall at bad weather conditions versus beautiful trees in spring in good weather conditions.

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. The assumption continued by saying that the fees differ per area. Then respondents were asked if they would be willing to pay more for a visit to a healthy, unaffected area than for a visit to an area suffering from acidification. Respondents were offered the opportunity to indicate that their willingness to pay was not influenced by the effects of acidification. After all, this study investigates the valuation of the effects of acidification on nature and not the valuation of nature in general.

#### Distinguishing different levels of acidification

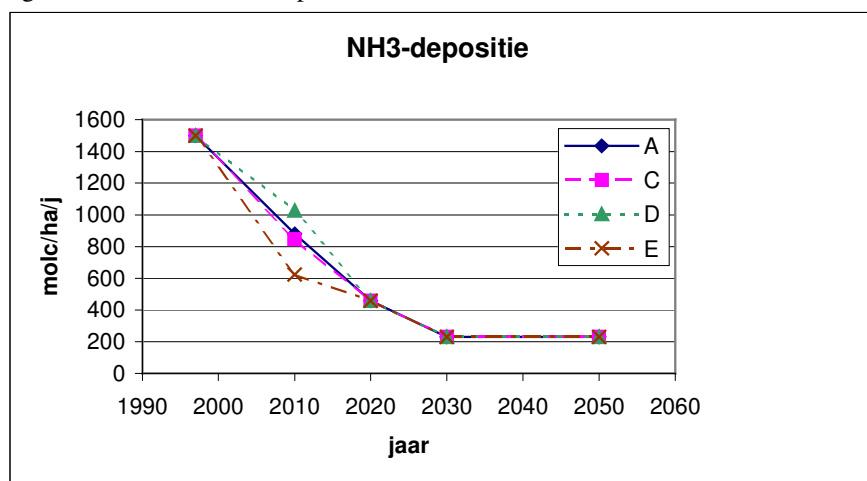
The aim of the Dutch Ministry of Housing, Spatial Planning and Environment is to determine the effects of acidification on both the non-use and the perception value of nature for different deposition levels. This was however found to be practically impossible within a CVM-questionnaire when it concerns small exceedances of critical loads.

For the non-use value the distinction of different deposition levels would entail different descriptions of the effects of acidification. This would have to result in different little stories per acidification scenario for the respondents. These stories would then, however, only differ in the species that were mentioned. For respondents the difference between those stories would become unnoticeable. An alternative to different stories, would be extra questions, asking respondents for their willingness to pay to make nature 50 % healthier, 25 % healthier etc. This was not done, because one can be sure that respondents will not understand this and simply divide their original willingness to pay for healthy nature by two or by four out of courtesy to the interviewer.

In order to introduce different levels of acidification in the questions on the perception value, it would be necessary to show pictures reflecting different levels of acidification. After visiting Dutch experts on nature and acidification, it was concluded that this is not possible for the Dutch situation.

Instead of trying to distinguish different levels of acidification, by explaining the different physical effects on nature at different deposition levels, it was decided to add an extra question concerning the time span for nature quality to either ameliorate or deteriorate. The different acidification scenarios used by the Ministry to derive environmental quality objectives and emission objectives for the year 2010, actually represent different time paths to one and the same deposition level from the year 2020 and onwards. Figure 3.1.1 shows the ammonium deposition for the different scenarios in the period 1997- 2050.

Figure 3.1.1 Ammonium depositions for different emission scenarios



Source: Kros *et.al.*, 2000.

Scenario A: The Netherlands adhere to the National Emission Ceiling, while the rest of Europe follows the Gothenburg protocol;

Scenario B: Emissions as in A, but ammonium emissions are spatially optimised per province, i.e. minimisation of the effects of nitrogen deposition on nature (not shown in Figure 3.2.1);

Scenario C: Emissions of EU nations according to the NEC, while other countries follow the Gothenburg protocol;

Scenario D: All countries follow the Gothenburg protocol;

Scenario E: The Netherlands adopt an extra strong policy, while other countries conform to the Gothenburg protocol;

Figure 3.1.1 shows that all scenarios result in the same deposition level and thus in the same effects on nature from the year 2020 onwards. The final deposition level is reached in 2030. In the year 2010 the scenarios differ. In accordance with this picture, respondents were asked about their willingness to pay to realise a good nature quality (i.e. the quality that is expected when critical loads are not surpassed) in 2030. On top of that they were asked whether they would be willing to more to reach this quality sooner, in 2010. If respondents react positively to that question, this is an indication that Scenario E is preferred to the other scenarios, as E is the scenario that leads to the lowest deposition levels in 2010. It represents the fastest path to the final deposition level.

From the above one can conclude that CVM is only suited to distinguish nature benefits of acidification abatement scenarios, when these scenarios differ much in physical effects on nature; so much that they clearly present different stories and different pictures. If one wishes to differentiate the benefits of several scenarios that rather limited in physical effects on nature, one could come to agreements or decision rules on how to derive the benefits of these non-extreme scenarios from the extreme scenarios, e.g. by extrapolation. Of course, benefit estimates derived in such a way cannot be validated.

### 3.2. Questionnaire

The complete Dutch CVM-questionnaire (adapted on the basis of the pre test) including the environmental good, hypothetical market and payment vehicle as described in paragraph 3.1, is presented in Appendix I. The questionnaire consists of open ended questions and was designed for personal interviews on the street, in nature areas or at home. Open ended questions were used to prevent starting point bias. An average an interview took 10 to 15 minutes. The interviews were kept short because this increases the number of people willing to participate (when asked for an interview, Dutch respondents always ask how much time it will take before agreeing) and to prevent the break off of interviews before they are finished.

The interview starts with some questions concerning general information on the respondents such as their attitude towards nature, their domicile and postal code (which enables researchers to perform detailed statistical tests on difference responses related to different neighbourhoods). The first introductory question on acidification is: Have you ever heard of the environmental problem which is



called acidification? This is followed by: Did you know that acidification has negative effects on the quality of nature in the Netherlands? These questions are posed to give respondents the opportunity to start thinking about the issue of acidification and to later perform tests on differences in willingness to pay of people who were and who were not aware of acidification and its effects on nature before the interview.

After these introductory questions respondents are given a short explanation on acidification and its effects on the quality of different ecosystems (forests, heath, grass lands, fens and dunes). After that they are asked whether they find it important to abate acidification and its negative effects on nature, and why. This question gives respondents a chance to first think about the issue of nature quality and acidification before they take the next step which is determining whether they are willing to pay for this. Regardless of the answer they are subsequently asked about their willingness to pay. But the previous question makes it relatively easy for them to simply say that they are not willing to pay for this issue, because they actually do not find it important. This form of questioning helps to prevent the leading on of respondents in the line of argumentation that acidification is bad, and they should pay for it.

In order to determine the willingness to pay, two different questions were used to find out which one works best. Fifty percent of the respondents was asked how much they were willing to pay to make the Dutch nature healthy again in 2030 (i.e. an improvement in quality because depositions are equal to the critical loads) and fifty percent was asked how much they would be willing to pay to prevent further deterioration of nature quality and thus to have the same quality in 2030 as today. This was done because it was expected that some respondents might react negatively to questions considering an improvement in quality as they feel that the present quality is sufficient. For such respondents a question pertaining to the prevention of a quality reduction seems better. To check whether it was actually the non-use value and not the use value that was measured by this question, respondents were asked whether they were willing to pay the amount they just mentioned when it was spent on areas that are not accessible to visitors.

The next question pertained to the time span, since the acidification scenarios of the Ministry of Housing, Spatial Planning and Environment represent different time paths to reach one and the same lower deposition level (equal to the critical loads). Respondents were asked whether they find it important that the proposed improvement in quality or prevention of deterioration (depending on the previous question) would be realised sooner in 2010 instead of in 2030. If so, how much extra they would be willing to pay for that.

So far, all the questions pertained to the non-use value. In order to make the shift to the perception value (i.e. recreational use value) respondents were asked about their visits to nature areas. They were also asked whether they had seen the effects of acidification on nature in reality. After that they were shown five sets of photos:

- a healthy forest and a forest suffering from acidification;
- a healthy grass land and a grass land suffering from acidification;
- a healthy heath land and a heath land suffering from acidification;
- a healthy fen and a fen suffering from acidification;
- a healthy dune area and a dune area suffering from acidification.

After looking at the photos they were asked whether they find the healthy ecosystems more beautiful than the ones suffering from acidification. The photos were selected in such a way that the unhealthy ecosystems were not depicted unnecessarily badly. All photos were of comparable quality and representing a realistic picture of the Dutch situation.

Subsequently, respondents were asked whether they agreed with the assumption of a paying an entrance fee to all nature areas in the Netherlands, and whether they agreed with paying a higher fee for beautiful nature, not suffering from acidification than for less beautiful, affected nature. If they did not agree to this their arguments for not agreeing were noted. They were not asked about their willingness to pay because this study was purely aimed at finding out the willingness to pay for the effects of acidification on nature (i.e. the difference between healthy and unhealthy nature) and not at the willingness to pay for nature in general. If they did, they were asked how much they would be willing to pay for a visit to a beautiful, unaffected area because of their increased recreational enjoyment and how much they would be willing to pay for a visit to a less beautiful, affected area because of their

reduced recreational enjoyment. The difference between those two amounts is the effect of acidification.

On the questionnaire the interviewers were warned for respondents stating that they are willing to pay more for unhealthy, affected nature, because it needs more money than healthy nature. This was noted on the form, because these respondent did not really answer the question. They did not give any indication of their own recreational enjoyment, but instead argued from the perspective of the needs of different areas, which is close to non-use.

The interview ended with some questions concerning age, education and income.

### **3.3 Test results**

In order to test the questionnaire described in paragraph 3.2, twenty interviews were held: ten at the nature reserve Meijndel along the Dutch coast near The Hague and ten at a shopping area in Zoetermeer. This was done to find out whether visitors of nature areas respond differently to the questions than other people. The response rate was approximately 70 %.

The pre test resulted in numerous reactions and findings, which were used to adapt the questionnaire (see Appendix 1).

#### **Non-use value**

Most people had little difficulty in distinguishing recreational perception values (i.e. use) from non-use values. They quite openly weighed their willingness to pay against their ability to make use of nature areas. The willingness to pay for non-use values varied from Euro 0 to Euro 100 per household per year. The average was Euro 30 per household per year. The willingness to pay could not be related to any of the respondents characteristics such as income, education, affiliation with nature and the acidification problem etc. Of course this was not surprising, since only 20 test interviews were held. It was, however, striking to find that all but one respondent stated that they were familiar with the problem of acidification and that they were also aware of the negative effects that acidification has on nature quality.

Another interesting observation was that some respondents attached conditions to their willingness to pay, demanding that the policy to reduce acidification is consistent and effective and can be shown to be so. Others wanted to be assured that their contribution will indeed be used to reduce acidification and not be spent on other things.

Although the photos were shown to ask questions on the recreational perception value, this did not refrain one respondent to adjust his bid for non-use after he had seen the pictures. His reaction was that "things were not quite so bad in reality". This may be regarded as an indication that it is better to both use the short explanation and to show pictures before asking about the willingness to pay for non-use. This will however introduce overlap with the perception value.

In a similar way, some respondents argued that acidification is hardly the biggest threat to nature in the Netherlands, or that the decline of certain species is part of long-term natural dynamics. This argument provided by a respondents who had a positive willingness to pay, raises the suspicion that part-whole bias cannot be fully excluded. The bids of some respondents probably pertained to more than just the effects of acid deposition in particular, but they concerned a broader idea of ecosystem's health or nature quality in general. It is practically impossible to design a CVM-survey in such a way that part-whole bias is excluded. The best one can do is to register respondents who are apparently (judged by their arguments) valuing more than just acidification as 'whole bidder', so that the magnitude of this bias is known. In the survey designed in this study a distinction is therefore made between bidders, zero bidders, protest bidders and whole bidders. This way, it is always possible to excluded a specific category of bidders from the analysis. Of course this works best when doing personal interviews, so that the interviewer can carefully register the arguments. In case of a mailing of interview, additional questions are needed to determine the type of bidder.

When asked about attaining a better nature quality (or a stop of the deterioration) in 2010 rather than 2030, half of the respondents were prepared to raise their willingness to pay for non-use if acidification could be reduced sooner. Contrary to the expectations, this was found for both the users (5 out of 10 people interviewed in the Meijendel, a nature area) and the non-users (also 5 out of 10 people interviewed in a shopping area in Zoetermeer). Several respondents stressed that they doubted whether eight years would be enough to have much of an impact on emissions and the recovery of nature.

The willingness to pay for improvement of nature quality and the willingness to pay for conservation of the present quality appear to divert less than expected. The pre test results indicate, judged by the high standard deviations, that the average willingness to pay for improvement and the average willingness to pay for conservation do not differ. This may be because of the limited number of respondents. However, it may also have something to do with the questioning, in particular question number 7 option B, in which respondents were asked to value the prevention of a further decline of ecosystem health in the face of continued acidification. The latter may not be credible to people who believe that acidification is not a serious problem anymore and, anyway, that the government wouldn't allow it to worsen again. This finding leads to the conclusion that one might as well choose option A, willingness to pay for improvement, since that is what the present acidification policies and the scenarios used by the Ministry of Housing, Spatial Planning and Environment aim to realize.

#### Perception value

Most respondents claimed to have seen the negative effects of acidification on nature in reality. They also stated that they find unaffected nature more beautiful. Only one respondent had a different opinion. These answers were, however, given after they had already seen the photos of healthy and unhealthy nature. This leads to the suspicion that the photos may have stimulated respondents to revise their opinion based on their own experience that “most nature actually looks pretty healthy”, to “yes, I see that unaffected nature looks better”. To prevent an overestimate of their true willingness to pay it was decided to show the photos two questions later than in the original pre test.

The pre test showed that approximately half of the respondents were willing to pay more for a visit to an unaffected site than to an affected site. The extra willingness to pay for visits to unaffected beautiful sites compared to less beautiful sites ranged from Euro 0 to Euro 5 per visit per person. One respondent was willing to pay user fees only if these would be invested in nature in the concerning area. Two respondents argued that they would pay more for affected areas that need higher investments. Interestingly, one respondent argued that it would be unfair to make people pay more for less healthy nature areas, as it would discriminate against people who are already unfortunate enough to live near such areas. As to people's willingness to pay to visit less beautiful and unhealthy areas, a logical reply came in the form of “we simply wouldn't go there”.

People often compared their bids for unaffected areas to what they are used to pay to enter museums and other attractions. Willingness to pay for recreational use therefore seem fairly robust. It is, however, essential to emphasize that recreational use values concern utility to the visitor.

The amounts people claim they are prepared to pay to visit nature areas were not checked against the visiting frequency cited before. It may well be that with entry fees of Euro 6 per person, people will reduce the number of visits per year. A question could be added asking respondents if they would reduce their number of visits if they had to pay the amount they just mentioned. This was done in other studies (e.g. Ruijgrok and Vlaanderen, 2001), but did not provide any extra information as the vast majority claimed not to change their visiting frequency. Therefore it seems better to check for frequency effects during the data analysis.

#### Currency effect

Previous CVM-studies on the recreational perception values (e.g. van der Veeren, 2000; Ruijgrok en Vlaanderen, 2001; Ruijgrok, 2000) resulted in bids varying from Dfl. 1 to Dfl. 5 per visit. This pre test resulted in bids of Euro 1 to Euro 5 per visit. People appear to bid Euros as if they were Guilders, inflating their willingness to pay with a factor 2.2 (even after they were asked to confirm their bid in *Euro*). This is a phenomenon that affects actual spending too. Since the Euro was introduced earlier this year, people appear to have difficulty judging prices.

## Implementation at a European scale

The CVM-survey that was designed in this study cannot be applied on a European scale without adjustments. After translating the questions, a new pre test should be conducted. Cultural differences may cause totally different reactions and may require serious adaptations of a questionnaire that was clearly designed for the Dutch situation.

Most likely, the use of other methods than CVM, such as the Travel Cost Method and the Hedonic Pricing Method, is not an option. For the Dutch situation these methods were not suited, because the effects of acidification are not clear enough to layman: present depositions do not deter recreators from visiting certain areas, and they do not negatively influence the prices of houses anywhere. If this is the case in the Netherlands, it is probably even more so in other European countries, since the Netherlands have relatively high deposition levels.

## 4. Conclusions and recommendations

From this CVM-pilot one may conclude that CVM can be used to estimate the non-use and recreational perception benefits of increased nature quality due to acidification abatement. It can therefore contribute to completing cost benefit analyses on acidification policies. CVM is, however, less suited for determining these benefits for different abatement scenarios, especially when scenarios do not differ much in terms of physical effects on nature. If one wishes to estimate the nature benefits of non-extreme scenarios, agreements or decision rules on how to derive those from the benefits of more extreme scenarios may be an acceptable solution.

When carrying out a CVM-survey as designed in this study, one should pay special attention to the possibility of overlap between the recreational perception value and the non-use value, due to the showing of photos and the explanation of the effects of acidification on nature. It is probably safer to ask half of the respondents about non-use and the other half about perception. Of course, this will increase the costs of carrying out the survey. It is also recommended to carefully register the arguments that respondents give when stating their willingness to pay, as this may help to reveal part-whole bias. When respondents indicate that they are willing to pay for healthy nature, regardless of whether this is realized by acidification abatement or any other measure, it is clear that these respondents value the whole and not just the effects of acidification on nature. It is even more clear when a respondent indicates to be willing to pay for nature quality related to acidification, but that he or she does not believe that acidification is a big threat to nature.

The design presented here, is for personal interviews. For a mailing of written interviews some questions need to be added concerning the type of bidder, in particular to determine 'whole bidders', respondents who are actually valuing more than they were asked to. This, in order to detect and maybe even reduce part-whole bias. Also the questionnaire should be transformed in to a sort of leaflet suited for filling out, including the photos.

For a reliable estimate of the benefits of increased nature quality due to acidification abatement a large sample should be drawn from the whole Dutch population. In case of personal interviews, interviewers need to be trained. The set up of the data base of the pre test can be used for registering the collected data. During the data analysis special attention should be paid to the willingness to pay for visits and the visiting frequency. For a Europe wide application of CVM, the survey design should be tested and adapted.

The pretest, presented in this study resulted in an average willingness to pay for non-use of Euro 30 per household per year. Multiplied with the 6.9 million households of the Netherlands, this results in a first rough estimate of Euro 207 million per year. This is just a first impression of the expected magnitude of the nature benefits of acidification abatement in the Netherlands. It is an indication that the benefits of increased nature quality due to acidification abatement are worth taking into account.

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## **Appendix 1. Other CVM-studies**

A historical overview of CVM-studies in the Netherlands is presented in:

Ruijgrok, E.C.M., Valuation of Nature and Environment; A historical overview of Dutch socio-economic valuation studies, Rotterdam: Platform for Economic Valuation of Nature (2002).

Relevant foreign valuation studies are:

Moons, E, K. Eggermont, M. Hermy, S. Proost, Economische waardering van bossen, een case study van Heverleebos-Meerdaalwoud, K.U. Leuven, Garant (2000).

Welle, Patrick G, Potential Economic Impacts of Acid Deposition: A Contingent Valuation Study of Minnesota, University of Wisconsin - Madison (1986).

## Appendix 2. Survey form and pictures

Naam enquêteur:

RESPONDENT NR.:

Datum:

Locatie:

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1. Geslacht: 1. Man 2. Vrouw (omcirkel)

2. Bent u lid van een natuur- of milieubeschermingsorganisatie? 1. Ja 2. Nee (omcirkel)

3. Wat is uw woonplaats? .....

En wat is uw postcode? .....

4. Heeft u wel eens van het milieuprobleem Verzuring gehoord? 1. Ja 2. Nee (omcirkel)

5. Weet dat verzuring negatieve effecten heeft op de gezondheid van de natuur in Nederland?

1. Ja 2. Nee (omcirkel)

Vertel de respondent het volgende:

Verzuring heeft betrekking op stoffen in de lucht die, wanneer zij terecht komen op de bodem of het water, zuren kunnen vormen. Deze zuren leiden tot aantasting van de natuur. De gezondheid van bossen gaat er door achter uit. En het aantal verschillende plant- en diersoorten op de hei, in het bos, bij graslanden en vennen neemt er door af. Vooral zeldzame soorten verdwijnen. Het gaat slecht met paddestoelen zoals de cantharel, met mossen, naaldbomen en eiken. De beeldbepalende heide met haar paarse bloemen verdwijnt langzaam. Ook waterplanten zoals sieralgen en kiezelwieren nemen af in aantal. Sommige planten krijgen last van schimmelaantastingen en vraat door insecten. Het verdwijnen van plantensoorten heeft ook gevolgen voor sommige diersoorten. Zo hebben onder andere de rode bosmier, de zandhagedis, de specht, de nachtzwaluw, de tureluur, de kleine heidvlinder en de venwitsnuitlibel het moeilijk.

6. Vindt u het belangrijk dat er iets gedaan wordt tegen verzuring om de aantasting van de natuur in Nederland tegen te gaan? 1. Ja 2. Nee (omcirkel)

Zo ja, waarom? .....

Zo nee, waarom niet? .....

7. Optie A:

Stel dat de overheid door extra milieumaatregelen de verzuring in Nederland dusdanig terug dringen, dat de Nederlandse natuur in het jaar 2030 weer helemaal gezond is. Zou u bereid zijn om daar middels bijv. een jaarlijkse donatie iets aan bij te dragen? 1. ja 2. nee (omcirkel)

Natuurlijk zijn er veel goede doelen waaraan u uw geld kunt besteden.

Hoeveel zou uw huishouden maximaal per jaar willen betalen voor verbetering van de kwaliteit van de Nederlandse natuur door de verzuring te bestrijden? Euro .....

Wilt u dit bedrag ook betalen wanneer het besteed wordt aan gebieden die niet toegankelijk zijn voor bezoekers? 1. ja 2. nee (omcirkel)

Zo nee, waarom niet? ..... Lager bedrag: .....

Codering:

1. Bieder nuv = ja; ja of ja; nee, maar lager bedrag genoemd

2. Bieder uv = ja; nee

3. Nul bieder = nee, ik heb er niets voor over

4. Protest bieder = nee, ik betaal al belasting; ik vindt dat vervuiler moet betalen

5. Totaal bieder = dit wil ik in z'n algemeenheid voor natuur betalen, niet specifiek voor verzuringsbestrijding



7. Optie B:

Wanneer de overheid geen extra maatregelen treft om de verzuring te bestrijden, zal de kwaliteit van de natuur in Nederland in het jaar 2030 aanzienlijke verslechterd zijn. Zou u bereid zijn om middels een donatie iets te betalen om de huidige kwaliteit te behouden? 1. Ja 2. Nee (omcirkel)

Natuurlijk zijn er veel goede doelen waaraan u uw geld kunt besteden.

Hoeveel zou uw huishouden maximaal per jaar voor willen betalen om de huidige kwaliteit te behouden door de negatieve effecten van verzuring te voorkomen? Euro .....

Wilt u dit bedrag ook betalen wanneer het besteed wordt aan gebieden die niet toegankelijk zijn voor bezoekers? 1. ja 2. nee (omcirkel)

Zo nee, waarom niet? ..... Lager bedrag: .....

- Codering:
1. Bieder nuv = ja; ja of ja; nee, maar lager bedrag genoemd
  2. Bieder uv = ja; nee
  3. Nul bieder = nee, ik heb er niets voor over
  4. Protest bieder = nee, ik betaal al belasting; ik vindt dat vervuiler moet betalen
  5. Totaal bieder = dit wil ik in z'n algemeenheid voor natuur betalen, niet specifiek voor verzuringsbestrijding

8. A Ik heb u zojuist gevraagd naar een verbetering van de natuurkwaliteit in het jaar 2030. Dat is nog ver weg. Vindt u het belangrijkste dat de kwaliteitsverbetering al eerder, bijv. in 2010, gerealiseerd wordt? 1. Ja 2. Nee (omcirkel)

Zo ja, zou u daarvoor iets extra's willen betalen ten opzichte van het bedrag dat u zojuist noemde?

1. Ja, ..... extra per hh per jaar 2. Nee (omcirkel en vul in)

8. B Ik heb u zojuist gevraagd naar het behouden van de huidige kwaliteit, hetgeen overeenkomt met het voorkomen van een verslechtering van de natuurkwaliteit in het jaar 2030. Dat is nog ver weg. Vindt u het belangrijkste dat de verslechtering al eerder, bijv. in 2010, een halt wordt toe geroepen?

1. Ja 2. Nee (omcirkel)

Zo ja, zou u daarvoor iets extra's willen betalen ten opzichte van het bedrag dat u zojuist noemde? 1.

Ja, ..... extra per hh per jaar 2. Nee (omcirkel en vul in)

9. Bezoekt u wel eens natuurgebieden in Nederland? 1. Ja 2. Nee (omcirkel)

Zo ja, ongeveer hoeveel keer per jaar? ..... maal per jaar

10. Heeft u zelf de effecten van verzuring gezien in Nederland? 1. Ja 2. Nee (omcirkel)

Laat de respondent foto's zien:

Dit is een foto van een gezond bos/heide/grasland/ven.

Dit is een foto van een zelfde bos/heide/grasland/ven dat last heeft van verzuring

11. Vindt u natuur die niet door verzuring is aangetast mooier dan natuur die wel door verzuring is aangetast? 1. Ja 2. Nee, .....

(vul reden in als respondent die noemt en sla vraag 12 over)

12. Stel dat u voor het bezoeken van alle natuurgebieden in Nederland toegangsgeld zou moeten betalen. De toegangsprijzen verschillen echter per gebied. Vindt u het goed wanneer de prijzen voor mooie, onaangestaste gebieden hoger zijn dan die voor minder mooie door verzuring aangestaste gebieden? 1. Ja 2. Nee (omcirkel)

Zo ja, hoeveel zou u willen betalen voor een bezoek aan een mooi, niet door verzuring aangestast gebied omdat u er meer van geniet? ..... per bezoek per persoon

En, hoeveel zou u willen betalen voor een bezoek aan een minder mooi, wel door verzuring aangestast gebied, omdat u er minder van geniet? ..... per bezoek per persoon

Zo nee, waarom niet? .....

- Codering
1. Bieder: ja
  2. Nulbieder: nee, ik heb er niets extra voor over; ik ga wel ergens anders heen
  3. Protest bieder: nee, ik ben tegen het heffen van toegangsgeld

Let op: soms willen mensen juist voor de lelijke natuur meer betalen, omdat die volgens hen geld nodig heeft voor een opknapbeurt. Noteer dit s.v.p!

13. Wat is uw leeftijd? ..... jaar

14. Wat is uw hoogst genoten opleiding? .....

15. Het een erg persoonlijke vraag, maar zou u aan willen geven in welke inkomensklasse uw huishouden zit?

	Guldens	Euro's
Klasse 1.	<2500	<1140
Klasse 2.	2500-4000	1140-1820
Klasse 3.	4000-6500	1820-2950
Klasse 4.	>6500	>2950

Hartelijk dank voor uw medewerking.

