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Scope sensitivity tests for preference robustness: An empirical examination of economic expectations regarding the economic valuation of politices for reducing acidity in remote mountain lakes

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SCOPE SENSITIVITY TESTS FOR PREFERENCE ROBUSTNESS: AN EMPIRICAL EXAMINATION OF ECONOMIC EXPECTATIONS REGARDING THE ECONOMIC VALUATION OF POLICIES FOR REDUCING ACIDITY IN REMOTE MOUNTAIN LAKES.

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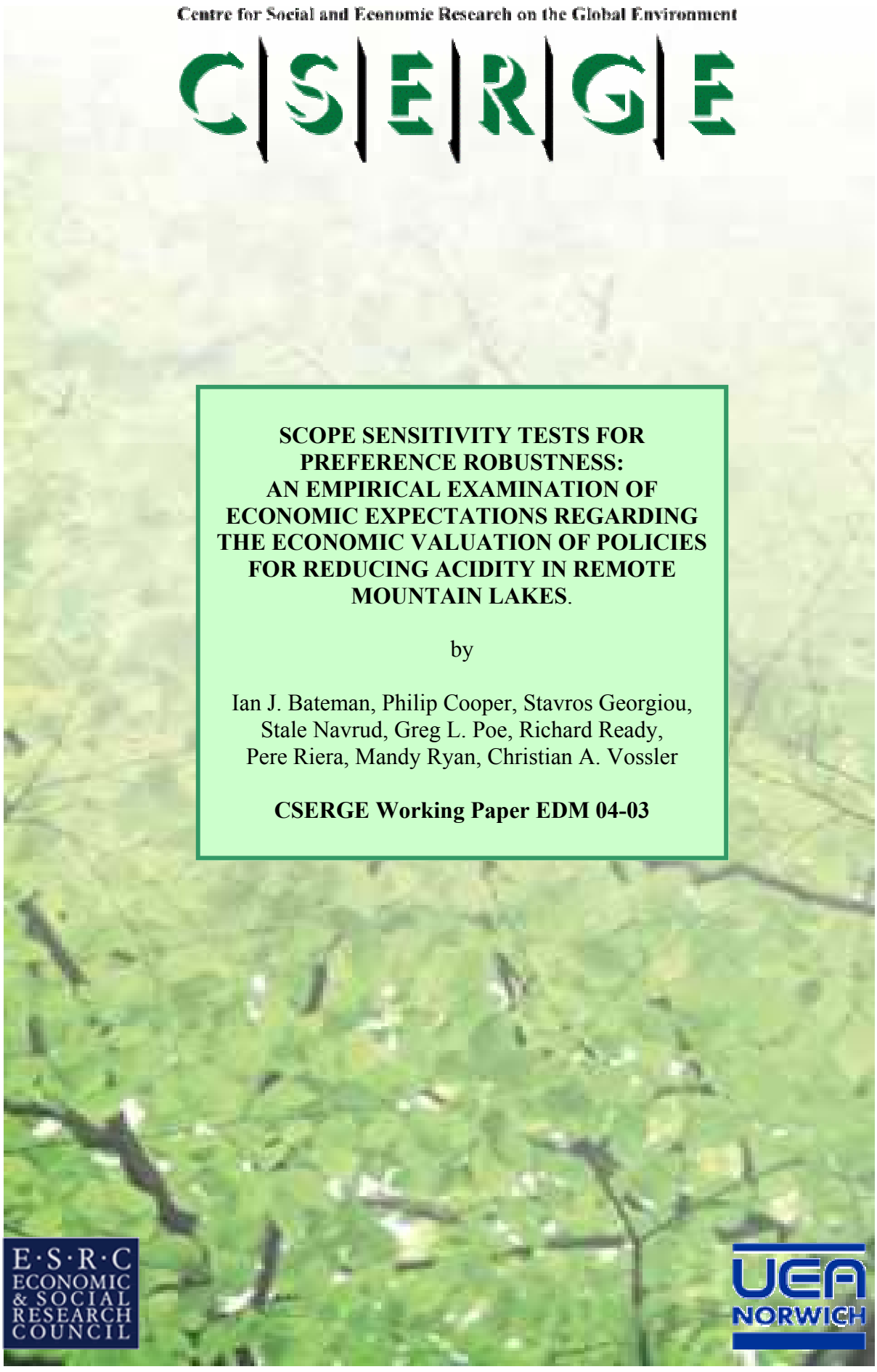

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Abstract

The paper introduces the reader to the contingent valuation method for monetary valuation of individuals' preferences regarding changes to environmental goods. Approaches to the validity testing of results from such studies are discussed. These focus upon whether findings conform to prior expectations, in particular regarding whether valuations are sensitive to the size (or 'scope) of change being considered and whether they are invariant to changes in study design which are irrelevant from the perspective of economic theory. We apply such tests to a large sample study of two possible changes to the acidity levels of remote mountain lakes. Results suggest that robust values can be observed for a policy which would prevent further acidification of such lakes, but that values associated with measures to reduce acidity below present levels fail validity tests. Interestingly, values associated with preventing further acidification of lakes appear to be significantly lower for individuals who live further away from such lakes and there may even be a national component to this distance decay suggesting that those who live in the same country as the lakes in question hold higher values for their improvement.

Keywords: Economic valuation, environmental preferences, contingent valuation, scope sensitivity, procedural invariance, distance decay, lakes, acidity.

Introduction: Valuing Environmental Preferences

The term 'environmental economics' may seem to some an oxymoron, yet the past fifty years has seen a steady expansion of research into methods for the incorporation of environmental costs and benefits into economic analyses. This initiative has in part been spurred on by the realization that, unless such values are explicitly assessed via the money units that decision makers understand, then they will tend to be ignored. Such concerns have resulted in the development of a considerable variety of methods for valuing environmental preferences[1]; that is approaches which attempt to assess the value which members of the public (who are considered the rightful arbiters of value[2]) associate with changes in those goods and services provided by the environment. These approaches can broadly be categorized into two types. 'Revealed preference' methods measure values for environmental goods as revealed in related behaviour, for example, by examining the relationship between the differing characteristics of recreational sites and individuals' expenditures to visits those sites. Alternatively, 'stated preference' methods directly elicit values by asking questions, say, regarding individuals willingness to pay (WTP) for changes in the provision of those goods (for a recent review of both revealed and stated preference methods see Champ et al., 2003). A limitation of revealed preference methods is that they can only be applied to environmental goods which are directly used by individuals. This can be problematic where it is suspected that non-users may value changes in the provision of the good under investigation. Thus, for policy issues such as protecting the quality of remote mountain lakes, 'stated preference' methods are required.

Amongst the stated preference techniques the most widely applied approach is the contingent valuation (CV) method, which has been used in literally thousands of instances to value preferences for a bewildering array of environmental goods across almost every country in the world (Carson et al, 1995; Carson, 2004). The method entails the construction of a hypothetical market for the provision change under investigation and asking individuals, via a questionnaire survey, questions regarding the value of that provision change. The most common form of such questions asks survey respondents to state their WTP for some gain in provision of the good, or to avoid some loss in its provision[3]. This technique can readily be adapted to a wide variety of contexts and environmental goods.

[1] Note that these methods do not claim to 'value the environment' but rather they attempt to place monetary values upon individuals' preferences for differing states of the environment.

[2] Note that this has fundamental implications for decision making. Economic analyses move the decision out of the hands of experts and into the realm of public preferences. This has both advantages (in that it reflects the strength and direction of those preferences) and drawbacks (in that the public are by definition less well informed than experts). Partly for this reasons economists tend to see their analyses as an input to the decision making process (telling decision makers what individuals prefer) rather than the final decision itself.

[3] Other variants include asking respondents to state their willingness to accept (WTA) compensation either to suffer a specified loss in provision, or to forgo some prospective gain in provision. For a comparison of the four measures of value described by combining the WTP and WTA measures of gain and losses see Bateman et al (2000a) while Hanemann (1999) and Sugden (1999) give contrasting accounts of the differing forces which may be brought into play through adoption of these various measures.

Examining the validity of stated preference values: Comparing findings with prior expectations.

Given the hypothetical nature of CV markets a key issue concerns the validity of the WTP amounts stated by survey respondents. Unlike a private good, bought and sold in the marketplace, there is no readily available 'criterion' measure (Mitchell and Carson, 1989) against which the outcome of a CV study can be assessed. While a number of studies have attempted to compare hypothetical CV contributions with actual cash contributions through simulated market experiments, contributions in private and public goods, these results are mixed and, but at this point in time, at least, can not be generalized (Bishop, 2003). Therefore, 'best practice' manuals commissioned by authorities in both the USA (Arrow et al., 1993) and UK (Bateman et al., 2002) have therefore highlighted the role of tests which compare CV survey results with prior expectations as the principal manner by which findings should be validated. These expectations are derived from two main sources; theory and intuitive empirical regularities.

The guidance provided for tests of expectations by economic theory is typically considered to be of particular importance, although only a few expected relationships are highlighted through this route (Muth, 1966; Hanemann, 1996). Notably, theory suggests a likely positive relationship between the amount individuals are WTP and their ability to pay (typically proxied by respondents' income levels) and indeed this is often observed in many CV studies (see, for example, Kristrom and Reira, 1996). A second expectation concerns a further positive relationship between total WTP and the use a given respondent has for the good in question. Again this is often observed in CV studies (see, for example, Desvousges et al., 1987). A third, expectation, which has been a focus of consistent debate throughout the past decade, concerns the relationship between stated WTP and the 'size' or 'scope' of the good in question (Kahneman and Knetsch, 1992; Fisher, 1996; Carson, 1997; Carson et al., 1998; Bateman et al., forthcoming). Here one might expect that, for any given good, WTP would increase with the scope of the provision change being considered. However, even theory is circumspect regarding this relationship noting that the sensitivity of WTP to changes in scope is an open empirical question dependent upon the nature of the provision change in question. To illustrate this, consider even the most mundane private good such as the consumption of bottled water in a single sitting[4]. While an individual may have a substantial WTP for their first bottle of drinking water, their extra (or 'marginal') WTP for a second bottle might be substantially smaller[5]. This pattern of diminishing marginal WTP is likely to continue for subsequent increases in the consumption of additional bottles of water until the point where marginal WTP finally declines to zero (let's suppose that this happens somewhere between the fifth and sixth additional bottles, i.e. even if these bottles were given away for free then the average person would only consume five bottles). Here we see clear insensitivity to the scope of the good once a given quantity has been consumed; this process is known as satiation. Decades of research into peoples' WTP for environmental goods shows that preferences for such public goods often exhibit the same diminishing marginal WTP characteristics[6]. This paper presents a study of WTP for improvements in the quality of

[4] A 'single setting' is specified so that there is no possibility of saving one or more bottles for consumption at a latter time.

[5] Note that the total WTP associated with any specified level of consumption is simply the sum of the marginal WTPs for each of the units up to and including that level of consumption.

[6] Indeed there are very few goods for which we might not expect diminishing marginal WTP. One exception might be values for additional life expectancy. However, here a second factor may come into play as WTP values may encounter budget constraints as the proffered gains in life expectancy are increased. This problem of respondents effectively running out of available funds may apply to more mundane goods if

certain remote mountain lakes. Given the above, while we might generally expect that improving the quality of such lakes might result in positive marginal WTP amounts for the first few lakes improved, we should not be surprised if the amount individuals state that they are WTP for each extra lake begins to decline. Indeed it might well be that this marginal WTP eventually becomes insignificantly different from zero.

While marginal WTP may decline with increases in scope (as total WTP is simply the summation of marginal WTP) what should we conclude if we find that the former does not change as the scope of the good increases? One possible explanation might be that the marginal value of increments is so small that it is masked by statistical error. However, an alternative explanation might be that respondents simply do not value gains of the good in question (for example where individuals do not feel that the type of lake improvement under investigation is valuable). In such situation it is often highly illuminating to carry out qualitative research, typically conducted via focus groups, regarding whether increments of a given good are indeed valued by the relevant population. Such work is typically carried out as part of the study development process and can lead us to form prior expectations regarding whether we should, or should not, expect to observe scope sensitivity regarding changes in a given good. In the present study we utilise such developmental work to isolate two different scenarios, one of which focus groups suggested would yield significant sensitivity to scope (a WTP to avoid loss scenario) and the other of which seemed of lesser concern to focus group participants (a WTP for a gain scenario) and was therefore expected to provide less sensitivity to scope. These scenarios were presented to separate samples of respondents and are discussed in greater detail in the following section.

Further, even when an individual is truly insensitive to the scope of a public good offered to them in a CV survey (i.e. it does not matter if the provision change offered is 'large' or 'small') they may still state some non-zero WTP amount. The reasons for this can basically be placed into two categories. First they may experience a variety of emotions which can loosely be termed 'other-regarding behaviour' (Ferraro et al., 2003). This includes elements of altruism and a notion that everyone should pay their fair share for public goods. These factors may indeed be related to the scope of the good on offer but only weakly so. However, while their detection may represent a statistical challenge and it may be difficult to separate out values associated with other-regarding behaviour (which might be triggered by a variety of public goods) from values which are specific to the good in question, their presence does not undermine the use of CV methods. Indeed, such motivations have been demonstrated in actual contributions settings, and hence should be regarded as real values. However, a more fundamental problem arises where we find non-zero WTP values which are insensitive to scope and are the product of respondents not responding to the good in question but rather simply enjoying the "warm glow of giving" to any good cause (Kahneman and Knetsch, 1992) or are the unconsidered reaction of individuals faced with a survey question. In such a case, stated values have nothing to do with the good being assessed. Because of these various problems, values which do not exhibit significant sensitivity to the scope of the good generally cannot be incorporated within economic analyses of proposed environmental changes as they would convey the message that the value of a project is constant irrespective of the change in the environment which it will deliver.

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respondents effectively compartmentalize their income into a series of 'mental accounts' (e.g. for housing, food, recreation, environment, etc.) and do not shift disposable income across these headings (Thaler, 1985). However, standard economic theory does not allow for such effects, assuming that individuals treat all money equally rather than allocating it to different non-substitutable headings and thereby effectively ruling out income constraints as a cause of scope insensitivity for most CV applications.

While scope sensitivity analyses are a relatively common feature of validity testing applied to many CV exercises, this study introduces an additional economic-theoretic test for evaluating the validity of stated WTP values. This innovation develops out of our earlier work within the EMERGE project (Bateman et al., forthcoming) which examines the impact which changes in prior knowledge of the set of goods under evaluation (the 'visible choice set') can have upon resultant valuations of those goods. To illustrate this consider a CV study in which the researchers are seeking values for two goods, A and B. Following our previous research we show that when respondents are told in advance that they will be valuing both of these goods (even though only one will eventually be provided to them)[7] then irrespective of which order they are presented to respondents, values remain the same. However, when the set of goods is revealed in a stepwise manner (i.e. respondents are asked to state values for one good prior to them being presented with a second good) then presentation ordering does have a significant effect upon resultant values. Building upon this work, in the present study we applied the advance disclosure approach to ask each respondent to value, in turn, each of two lake improvement schemes which differed only in terms of the numbers of lakes which would be improved. By randomly varying the pairs of lake numbers shown to differing respondents (e.g. one respondent might be presented with schemes to improve either 40 or 200 lakes while another could be presented with schemes to improve say 200 or 400 lakes) and repeating this process across a large sample we obtain a substantial volume of observations concerning individuals' WTP for lake improvement schemes.

Advance disclosure allows the test of one of the precepts of economic theory, that preferences should be robust against irrelevant information. A good example of such irrelevancy is provided by the random process through which a given respondent is assigned a particular pair of values for the numbers of lakes improved in the two schemes they are asked to value (so, in the previous example, economic expectations are that a respondent's WTP for a scheme to improve 200 lakes should be the same whether it is paired with a scheme to improve 40 lakes, or a scheme to improve 400 lakes). Provided that stated WTP reflects underlying preferences, this random assignation should have no impact upon responses. However, if in fact responses are devoid of such a foundation then, following research by a number of psychologists[8], we might expect that respondents could change their values for a specific scheme depending upon the nature of the alternative scheme with which it was (randomly) paired. We formulate this additional validity test as the hypothesis that, when a respondent is presented with two alternative policy programmes, the scheme affecting the higher number of lakes will be accorded a higher WTP than if it had been presented as the lower of two schemes (e.g. this would happen if WTP for a scheme to improve 200 lakes was higher when it was paired with a scheme to improve 40 lakes than if it were paired with a scheme to improve 400 lakes). In such a situation WTP becomes partly a function of whether a given number of lakes is the higher or lower of a pair. Such a result would raise questions about the validity of the valuation estimates.

This discussion highlights the fact that we cannot take the outputs of any CV or other valuation study at face value unless we first perform a number of validation tests, notably

[7] This caveat is important. If respondents were in fact going to purchase both goods then, according to the mental accounting notion mentioned previously (Thaler, 1985), we might expect the value of those goods to vary according to the order in which they are purchased. This is because available income will decline between the purchase of the first and second good.

[8] Our hypothesised context effects building upon the so-called 'anchoring effect' (see the recent review by Kahneman et al., 1999) and the 'affect' heuristic (Slovic et al, 2002).

those concerned with the degree to which findings conform to prior economic-theoretic expectations. Theses various tests are applied to our study of the value of improving the quality of lakes. Specifically we set out to estimate, in monetary terms, the value generated by schemes to address the acidification problems affecting remote mountain lakes in the Scottish Highlands. We examine whether such values are robust to the types of economic-theoretic based validity tests outlined above.

Specifically we conduct the following examinations. A split sample approach is used to estimates our two valuation measures: (i) WTP to avoid a loss; preventing a deterioration below the current quality of lakes; and (ii) WTP for a gain; improving upon the current quality of lakes For both of these measures tests of sensitivity to scope were undertaken, however prior focus group work suggested that values for measure (i) would exhibit greater scope sensitivity than those for measure (ii). Within each sample, the robustness of values were further tested by asking each respondent to value two schemes improving either a lower or a higher number of lakes and examining whether the WTP stated for improving any given number of lakes varied according to whether it was the higher or lower of the pair valued by each respondent. Again our expectation is that responses for measure (ii) (WTP for a gain), because they are based upon weaker preference, will be less robust against such 'anomalies' than responses for measure (i) (WTP to avoid loss) as our focus groups suggested that respondents would have more definite preferences regarding the latter scheme. In addition to these tests we also examine values for expected associations with economic-theoretic based variables such respondents income levels and usage (if any) of such lakes and other expectations based on previous empirical research.

Development of the contingent market

The first stage of any CV study involves the development and definition of the contingent market through which the good being offered to survey respondents is described. Where the object under investigation is a change in some environmental good then the basis of that contingent market is provided by the scientific understanding of that good and the consequences of any policy designed to affect its provision. This stage of the research involved close cooperation between the economists and natural scientists involved in the EMERGE project. This interaction focused initially upon issues such as the number and location of remote mountain lakes, the historical record of environmental change for such lakes, the impacts of such change, the current condition of the lakes and potential future change. An early issue concerned the methods to be used for representing to the public both the quality status of lakes and changes to that status. Research within the field of cognitive psychology has shown that this is achieved most accurately and with least bias through reliance upon pictorial rather than textual or numeric information (Slovic et al, 2002, Bateman et al, 2003). Following this line, a variety of visual aid approaches to information provision were tested in the developmental stages of this research.

Discussions with natural science partners in EMERGE highlighted the association between the historical industrialisation of the world economy and the accompanying significant increase in acidification levels affecting remote mountain lakes. Furthermore, temporal analysis of this trend by EMERGE scientists showed that the level of acidification reached a plateau roughly in the middle of the 20th century. There was some debate concerning whether recent years had seen a decline in acidity levels, but the general consensus seemed to be that any such shift had not yet proved statistically significant. Discussion also considered the

impacts of this acidification upon flora and fauna. In the context of Scottish mountain lakes these been relatively minor and it was deliberately decided to adopt more extreme estimates of impact both so that these might be considered non-trivial by the public (given that we know in advance that trivial changes are associated with trivial values and are therefore of no research interest). This also allowed inspection of whether values might be significant in other areas of the EU, where acidification impacts have indeed been more substantial. Further discussions concerned the expected impacts of future increases or decreases in acidity arising from either natural processes, changes in pollution loading or direct policy intervention.

This foundation of scientific information was then presented to members of the public through a series of focus groups. Five such groups were convened with between three and six members in each (25 participants in total), the median discussion time being 3.5 hours. One of the groups consisted of members of a Scottish walking and climbing club (i.e. users of the areas around remote mountain lakes in the UK), while the other groups comprised members of the general public. A similar protocol was applied in each of the focus groups, addressing the key issues of what information individuals needed in order to understand the concept and effects of acidification in remote mountain lakes. The focus groups also considered related issues such as the acceptability of alternative methods of remediation and ways in which related polices might be funded (the 'payment vehicle').

The focus group discussions were vital in shaping the contingent market to be presented to respondents in a subsequent CV survey. Most fundamentally they suggested that both the 'avoided loss' and 'gain' scenarios should be investigated (via separate samples) so as to reflect uncertainty regarding the future levels of acidification in remote mountain lakes. The first of these would consider a future in which, in the absence of any policy intervention, acidification levels might increase. Here the appropriate measure for economic analysis would be to assess the value (measured as WTP) associated with avoiding this loss. The second scenario considered a future in which, in the absence of any direct policy intervention, there would be no change in lake acidity away from current levels. This baseline allows us to assess the value generated by a policy which improves the situation by lowering the acidity level (i.e. measuring the WTP for gain). This measure can, in theory, also be used to assess the value lost by not implementing such a policy[9].

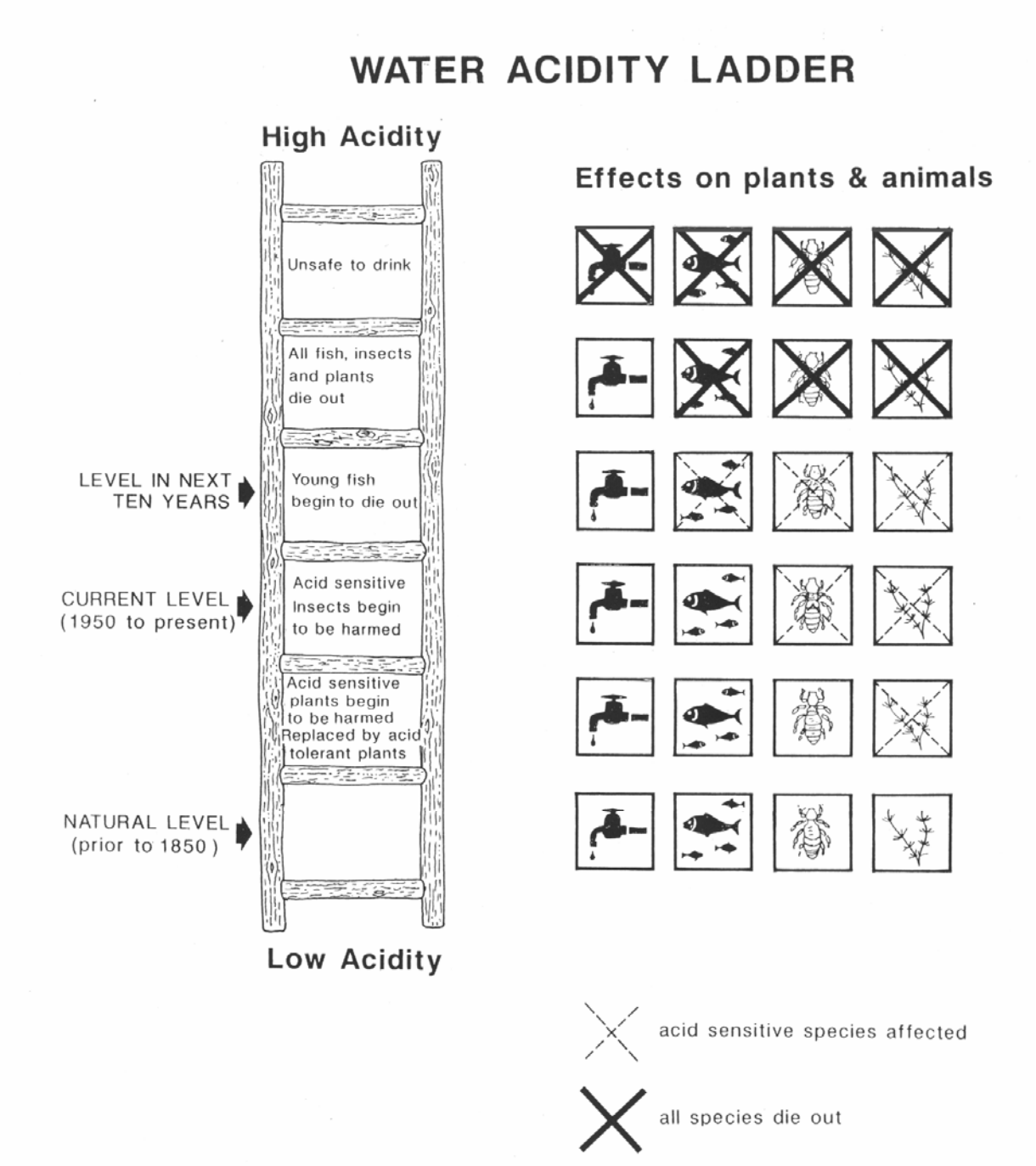
This expansion of the research objectives required definition of the future levels of acidification envisioned in our two valuation scenarios. For the WTP to avoid a loss scenario we need to define a situation which is worse than the present day using terms which can be understood by the general public. Similarly for the WTP to secure a gain scenario we need to convey an improved situation relative to the present day. Our focus group exercises confirmed our prior expectations that presenting data on pH or similar objective measures would serve only to confuse members of the public[10]. Conversely members of the public found it relatively easy to comprehend changing situations in terms of their impacts upon flora and fauna. EMERGE partners again provided information regarding these impacts using pictorial and schematic representations which were readily comprehended by the public.

[9] However, note that there is a non-standard view, supported by significant empirical research (including our own; Bateman et al., 1997), which suggests that the value of a unit gain may be less than the value of a loss of the same unit of provision of a good.

[10] This was particularly the case regarding pH measures where an increase in acidity is denoted by a decrease in pH.

This information, together with that prepared by EMERGE partners, led to the development of an acidity impacts ladder of the type illustrated in Figure 1. Here the symbol of a ladder is used to overtly indicate increases or decreases in acidity levels and is in fact directly related to pH. The consequences of any such changes are then depicted in terms of impacts upon flora and fauna. This allows researchers to depict particular levels of acidity which are of focal research interest without overt resort to pH or similar measures.

Figure 1: The water acidity ladder



Notice that the current level of acidification indicated in the ladder is toward the upper end of estimates for the Scottish Highland. This is a deliberate attempt to avoid the triviality issue outlined above. Indeed, even at this level, focus group investigations suggested that many participants considered the present degree of acidification as an unavoidable and relatively minor consequence of economic development. As noted previously, this suggested that values for remediation of current impacts (i.e. WTP to secure a gain) might be quite low. To examine the extreme of such values we decided that the potential future level of acidification presented under this scenario should be the lowest that survey respondents would find credible. Focus group discussions suggested that this lower level would be most clearly

represented as a return to pre-industrial levels of acidification (described as the 'natural' level in the acidity ladder)[11]. While this is the most substantial gain which can be plausibly presented to survey respondents, given the equanimity expressed regarding current levels of acidification, this raises considerable prior concerns regarding whether values for the WTP to secure a gain scenario will be economically significant or whether they will consist purely of the 'other-regarding behaviour' discussed previously and hence fail to exhibit sensitivity to scope. We therefore have prior concerns about whether these values might satisfy validity testing.

Partly as a result of the above concerns, when considering the WTP to avoid a loss scenario, it was felt interesting to envision a future level of acidity which entailed significantly greater (although scientifically plausible) impacts upon flora and fauna. As before, this reference level of acidification was fixed both with respect to scientific advice from EMERGE partners regarding the limits of likely acidification changes and focus group feedback concerning perceptions of any such impacts. While the former suggested that acidity levels were unlikely to rise as much in the future as they had since pre-industrial times[12] it was considered feasible that lakes may suffer capacity overload under which their assimilative capacity threshold could be exceeded. Although resulting impacts upon macrofauna would be limited to effects upon younger fish, this was viewed as a 'watershed' impact by focus group participants.

Therefore, the future scenario for the WTP to avoid a loss measure envisages impacts upon young fish. Failure to detect valid (scope sensitive) values for this measure would suggest that the public does not value changes in the acidification levels of remote mountain lakes.

Finally, the focus groups highlighted the importance of the time period over which changes occurred, exhibiting the commonly observed discounting effect that, as impacts become further delayed so their present day importance becomes diminished (Pearce, 1983). Given this it was decided that, in the subsequent survey, impacts would be presented as the endpoints of a ten year process. This period, it was felt, would balance the concerns of plausibility (policies clearly cannot have immediate effect) with the discounting effect. It should be presumed that if these changes occurred over a longer period then associated values would be smaller than that stated in the survey. Conversely if these changes occurred more rapidly then associated values should be expected to rise.

The CV Questionnaire

The questionnaire elicited a wide variety of information concerning the characteristics of the respondents, their households', their knowledge and experience of Scottish Highland lakes and other factors which might reasonably be expected to explain stated WTP values for improvements in those lakes. The full questionnaire is reported in Annex 1 of this paper, however, it is the valuation questions which are central to the present analysis.

[11] We recognise the scientific objections to the term 'natural' within any fluctuating ecosystem. However, this term was found most readily acceptable to focus group participants.

[12] Hence the acidity ladder shows that the pH shift from pre-industrial ('natural') to current levels is less than that from current to the upper level (accepting that this is a logarithmic scale).

Two versions of the survey questionnaire were refined corresponding to the 'WTP to avoid a loss' and 'WTP for a gain' valuation scenarios outlined above[13]. The water acidity ladder (appropriately adapted[14]) was used to convey the various acidity levels specified in each scenario and in all other respects the questionnaires were identical. Survey respondents were randomly allocated to one of the valuation scenarios and were at no time made aware of the competing scenario.

The description of remote mountain lakes involved their definition and the respondent being shown a map of Europe highlighting areas containing remote mountain lakes. Attention was drawn to the Highlands of Scotland as the only such area in the UK, with respondents being told that there are 400 such lakes there and about 10,000 in Europe as a whole. Thus, respondents were given a concept of scale and reminded of substitutes available both within the UK and outside. Respondents were then shown photographs of a single illustrative lake in Scotland[15] taken in summer and winter, followed by photos of various of the flora and fauna currently found within such a lake.

Respondents were then introduced to the concept of lake acidification by airborne pollutants[16] and, via the acidity ladder, its consequences. The acidity ladder was also used to explain historical changes in acidity, emphasising the rapid rise associated with early industrialisation and the stabilisation of acidity levels during the latter half of the 20th century. The relevant change in acidity envisaged under the allocated valuation scenario was then presented.

Both of the valuation scenarios were motivated by discussion of a relevant possible policy option. In both cases a policy to reduce acidity levels (either from future high levels to the current level, or from the current level to the lower 'natural' level) was discussed. Following one of the very few prior studies to estimate economic values for reductions in lake acidity (Navrud, 2001), the policy presented centred upon the introduction of programmes to control acidity via liming (a further major motivation for adopting this approach was to focus respondents upon the ecological effects in the lakes, and not bring in broader health and ecological values associated with long distance air transport of pollutants). Respondents were informed about the use of such approaches in Scandinavia and were asked to consider the application of such methods to address excess acidity within Scottish highland lakes[17]. For the 'WTP to avoid a loss' scenario, respondents were informed that the liming programme would prevent acidity rising over the next ten years and ensure that the current level of acidification was maintained. For the 'WTP for a gain' scenario, respondents were told that

[13] We also considered the effect of varying the probability of each scenario occurring however this proved an insignificant determinant of WTP values and is not considered further here.

[14] For the 'WTP for a gain' scenario the water acidity ladder used was as per Figure 1. For the 'WTP to avoid a loss' scenario the label indicating the upper future acidity level was deleted as this is superfluous to this scenario.

[15] The lake used for this purpose was Lochnagar (although it was not named in the interview), chosen as it is one of the most closely studied remote mountain lakes in the UK, with scientific measurements of water quality stretching back over ten years.

[16] So as to avoid problems associated with tying pollutants to any particular emission source (possibly encouraging respondents to state that polluters other than themselves should pay) it was made clear that emissions were a consequence of general economic development from which all benefited. Hence respondents were made aware that all members of society are in part responsible for general airborne pollution and its consequence.

[17] Discussions with natural science partners in EMERGE highlighted the fact that there may be negative effects from liming. This was allowed for in the survey via a number of routes. However, there was little if any evidence of any reservations expressed by respondents regarding the impacts of such a programme.

liming would reduce acidity from its current day level to the pre-industrial 'natural' level discussed previously.

In order to effect valuation of these scenarios respondents were told that the costs of the liming programme would be met through a fixed addition to domestic electricity bills. This addition would be maintained throughout the period covered by the treatment programme, which was set to the length over which changes in acidity were described, namely ten years. The electricity tariff vehicle was chosen due to its attractive properties with regard to inclusiveness (there could be few non-payers) and its link as a contributor to air pollution, which in turn emphasised the point that members of the public were in part responsible for this pollution. Respondents were informed that the charge would be clearly itemised on electricity bills and that the money thus collected would be passed on to the Department of the Environment, which would use it only to fund the water treatment programme.

Respondents were then told that two de-acidification programmes were being considered, differing only in terms of the number of lakes that would be limed. The number of lakes limed in each programme was specified to respondents. Respondents were then shown a WTP response card as illustrated in Figure 2. This consisted of two 'payment ladders', next to each other, with the lower number of lakes [L] specified at the top of the left hand columns and the higher number of lakes [H] at the top of the right hand columns. Respondents were asked to work their way down the L column first, placing a tick (□) next to all those amounts they were definitely prepared to pay, leaving blank amounts they were uncertain of, and placing a cross (□) next to amounts they definitely were not prepared to pay. Once this task was completed respondents they repeated the exercise for the H column thereby expressing WTP for both schemes.

Figure 2: Payment. Low and High

Scheme to lime [L] lakes

Amount (each year)	Prepared to pay ? ✔= yes ✗ = no
0	
20p	
40p	
75p	
£1	
£1.25	
£1.50	
£1.75	
£2	
£2.50	
£3	
£3.50	
£4	
£4.50	
£5	
£6	
£7	
£8	
£9	
£10	
£12	
£14	
£16	
£18	
£20	
£24	
£28	
£32	
£36	
£40	
£48	
£60	
£80	
£100	
more than the above	

Scheme to lime [H] lakes

Amount (each year)	Prepared to pay ? ✔= yes ✗ = no
0	
20p	
40p	
75p	
£1	
£1.25	
£1.50	
£1.75	
£2	
£2.50	
£3	
£3.50	
£4	
£4.50	
£5	
£6	
£7	
£8	
£9	
£10	
£12	
£14	
£16	
£18	
£20	
£24	
£28	
£32	
£36	
£40	
£48	
£60	
£80	
£100	
more than the above	

Following focus group investigations, six pairs of L and H values were used for the above valuation exercise as specified in Table 1. These pairs were varied across respondents and selected at random for each respondent prior to the survey.

Table 1: Combinations of numbers of lakes (L, H) used in the survey.

Scheme L	Scheme H
5	40
40	400
40	200
200	400
40	360
360	400

For both the 'WTP for a gain' and 'WTP to avoid a loss' samples, the above process yields two valuations from each respondent, these relating to a lower and higher number of lakes treated with lime. However, we cannot accept these values as being reliable enough for use in policy and decision making unless we first subject them to validity testing. As discussed previously, one of the central planks of subsequent validation analysis concerns whether stated WTP is sensitive to the scope of the good. In this study we analyse scope-related issues in three ways. First, we compare values for the two scenarios presented (for which we already suspect, on the basis of focus group responses, that values will be more significant for the 'WTP to avoid a loss' measure than for the 'WTP for a gain' measure). Second, we examine the sensitivity of stated values to the number of lakes to be included within a given liming scheme. Here, scope sensitivity would be demonstrated if respondents stated higher WTP amounts for greater number of lakes being treated (although as noted, the marginal value of liming an extra lake is likely to decline as the total number treated rises). Thirdly, we examine whether respondents change their stated WTP for treating a given number of lakes dependent upon whether it is the 'higher' or 'lower' of the pair of lake schemes valued by each respondent. Our prior expectations are that WTP to avoid a loss will exceed WTP for a gain (based on focus group responses); that we will consequently find less scope sensitivity in the latter responses and; that these will be more prone to the 'context' effect arising from the pairing of schemes of differing sizes.

Survey Implementation

It is perfectly plausible that values for those who live further away from the Highlands will differ from those expressed by individuals who live within their vicinity. In some part this may reflect the fact that those living near the lakes are more likely to use them as a place to visit[18]. This 'distance decay' (Bateman et al, 2000b) effect may be exacerbated, we hypothesise, by a previously untested factor related to the national identification of certain

[18] Note that considerable care was expended to reinforce the fact that the deacidification process would have very little impact upon the visual amenity of the surrounding areas. However, we cannot completely rule out the possibility that respondents will nevertheless infer some such changes.

goods. It is possible that those that live in the same country as a specified environmental resource, may feel some particular ownership or responsibility for that good. Conversely, those in other countries may feel that they are less responsible for its upkeep. This might be observed by contrasting values stated by those who live in Scotland with those stated by people who live elsewhere. As the distance decay and national identity relationships are inevitably correlated separate testing is required to ascertain which of these factors plays a large role in determining WTP responses. In order to collect the data necessary to undertake such tests, sampling was undertaken over almost the full length of the UK with interviews being conducted both at the very edge of certain Highland lakes and as far afield as the south coast of England[19]. In total these provided a sample of 1,275 questionnaires with completed valuation responses[20]. However, this sample size is reduced because of factors such as omitted responses to other questions (such as income levels) resulting in a final sample of 1,096 respondents which were used in our validation modelling exercises.

Validation analysis: The WTP modelling framework

The validation of our valuation responses, consisting of the various scope sensitivity and 'context' tests described previously, is conducted by statistical analysis of the WTP stated by responses. However, in so doing we need to take care that we apply statistical models which are appropriate to the type of data we have collected. Remember that WTP values were elicited separately for 'low' and 'high' lake protection scenarios using the payment card format depicted in Figure 2. For each payment card valuation question we can define an interval bracketing the respondent's maximum WTP. The lower bound of this interval is the sterling amount corresponding with the highest "✔**= yes"** indicated by a respondents. The upper bound is the next higher sterling amount, equivalently being the lowest amount that an individual marks "✗**= no"**. The width of the interval in most cases is less than or equal to £2, and so we take the midpoint of the interval as a reasonable approximation of stated WTP.

In modelling these WTP values, we assume that a respondent's WTP for the liming program is a linear function of a vector (X) consisting of variables that are not endogenous to the WTP decision process (e.g. we could not include a question asking how much a respondent likes visiting the lakes as a variable explaining their WTP for the lakes as both are measures of the pleasure or 'utility' which the lakes provide to the respondent). Therefore we examine exogenous variables, including those identified by economic theory, such as the number of lakes to be included in a programme, the income of the respondents, their use of/experience with the resource. We also include variables externally defined by the survey design (e.g. the location of the interview) as well as other individual characteristics (e.g. participation in environmental organizations). Letting β_j be a vector of parameters to be estimated, ε_j depict a

[19] Sampling was principally conducted in the area around the Highland lake of Lochnagar (including the nearby Loch Muick Visitor Centre), in the Scottish cities of Aberdeen (closest to the highlands) and Glasgow and in the English cities of (ordered by increasing distance from the Highlands) Leeds, Norwich and London and the south coast.

[20] In addition to these a further 60 respondents were interviewed but subsequently dropped from our analysis, being cases where the respondent refused to give a WTP, terminated the interview prematurely or entered a protest zero bid (Bateman et al., 2002) for at least one of the schemes (L or H). For this purpose protest responses were identified using the reasons cited by respondents for their WTP decisions (i.e. they bid zero but gave a reason for so doing other than that they would not derive any benefit from the proposed scheme).

mean zero error term and j denote the high (H) or low lakes (L) scenario then our model of WTP responses can be written as per Equation (1):

$$WTP_{ji} = X_{ji}\beta_j + \varepsilon_{ji} \quad (1)$$

As indicated previously, each respondent answers two WTP questions, one corresponding to a low lakes scenario and the other to a high lakes scenario. As such, the two WTP responses are jointly endogenous. Assuming that the error terms ε_L and ε_H are correlated and normally distributed, their joint density is assumed to be bivariate normal as per Equation (2):

$$f(\varepsilon_L, \varepsilon_H) = \frac{1}{2\pi\sigma_L\sigma_H\sqrt{1-\rho^2}} e^{-1/2[(\frac{\varepsilon_L^2}{\sigma_L^2}+\frac{\varepsilon_H^2}{\sigma_H^2}-2\rho\frac{\varepsilon_L}{\sigma_L}\frac{\varepsilon_H}{\sigma_H}/(1-\rho^2)]} \quad (2)$$

where $\varepsilon_j = WTP_j - X_j\beta_j$, σ_L and σ_L are the standard deviations of the marginal distributions of ε_L and ε_H, and the correlation coefficient, ρ, indicates the degree of correlation between ε_L and ε_H. The unknown parameters (β_L, β_H, σ_L, σ_H, ρ) can be estimated via maximum likelihood, where the log-likelihood function is as given in Equation (3):

$$\ln L = n\left[-\ln(2\pi) - \ln(\sigma_L) - \ln(\sigma_H) - \frac{1}{2}\log(1-\rho^2)\right] - \sum_{i=1}^{n} \frac{1}{2}\left[\left(\frac{\varepsilon_{Li}^2}{\sigma_L^2} + \frac{\varepsilon_{Hi}^2}{\sigma_H^2} - 2\rho\frac{\varepsilon_{Li}}{\sigma_L}\frac{\varepsilon_{Hi}}{\sigma_H}\right)/\left(1-\rho^2\right)\right] \quad (3)$$

This model was estimated with user-defined maximum likelihood procedures written using the LIMDEP statistical package (Greene, 1997). Because they relate to different changes in the quality of the lakes[21], separate log-likelihood functions are specified for the 'WTP for a gain' and 'WTP to avoid a loss' scenarios. The various scope sensitivity and context tests are then conducted by imposing corresponding restrictions/hypothesis tests upon estimated coefficients using standard t-statistics and likelihood ratio tests.

Although analytical solutions exist for characterizing the distribution of WTP estimates, parametric bootstrapping methods were used to generate empirical distributions of conditional mean WTP values in a manner that accounts for the correlated error terms as characterized by the bivariate normal distribution in Equation (2) (Krinsky and Robb, 1986; Poe et al. 1997). This facilitates tests of hypotheses regarding mean WTP values using independent and correlated mean WTP distribution following the empirical convolutions methods analogous to standard difference of means tests (Poe et al. 1994, 1997). 10,000 bootstrap samples were computed for each of the estimated WTP values.

[21] They both differ in terms of 'reference' levels which will occur if nothing is done (in the 'WTP for a gain' scenario the situation will stay as it is currently whereas in the 'WTP to avoid a loss' scenario if nothing is done then the lakes will become more acid) as well as 'target' levels which arise if the programmes are implemented (in the 'WTP for a gain' scenario the programme reduces acidity below current level, whereas in the 'WTP to avoid a loss' the programme ensures that acidity stays at current levels).

The Data and Validation Testing

As indicated previously, possible variables in the model include economic-theoretic variables, survey design variables, and socio-economic conditioning variables characterizing the individual. The list, and a description, of the variables used in the analysis is provided in Table 2. As expected the distance variable was substantially correlated with use (visitation) of Highland lakes with the latter being preferred within our statistical analysis. However, we define three broad brush distance groups which correspond in part to the 'national identity' groupings discussed previously. These are 'English' (those interviewed offsite, in England), Onsite (those interviewed at the Highland lakes) and Scottish Offsite (not explicitly detailed in Table 2 as this is the default category defined by the other two). With the exception of the variable relating to the number of lakes being valued in any given WTP question, each of these is included in the model as a simple linear function. The lakes variable was specified in logarithmic form, which allows the possibility of diminishing marginal WTP as discussed in the introduction[22].

Table 2: Definition and Descriptive Statistics for Variables Used in Regressions

Variable Name	Description	Mean Value of Variable	
		"WTP to Avoid Loss" Scenario	"WTP for a Gain" Scenario
Onsite	Binary variable = 1 if survey conducted on-site, 0 otherwise.	0.263	0.527
English	Binary variable = 1 if survey conducted in England, zero otherwise.	0.256	0.141
Ln – Lakes	Continuous variable - the natural log of the number of lakes.	3.57	3.87
Income	Continuous variable – the midpoint of income brackets in £'000s.	28.7	31.8
Env. Org.	Binary variable = 1 if indicated membership in an environmental organization (e.g. Greenpeace, World Wildlife Fund), 0 otherwise.	0.388	0.475
Visit	Binary variable = 1 if the respondent has visited the lochs before, 0 otherwise.	0.619	0.771
N	Number of observations.	734	362

The estimated models for the "WTP to avoid a loss" and "WTP for a gain" scenarios are provided in Table 3, using the Scottish Off-site as the base case. Within each of these scenarios the models return estimates for both the WTP responses for programme concerning the 'low' number of lakes [L] WTP responses and for the 'high' [H] number of lakes. We discuss comparisons between the 'low' and 'high' lakes models subsequently, considering first the comparison across the "WTP to avoid a loss" and "WTP for a gain" scenarios.

[22] Quadratic forms for lakes and other variables such as income were explored, but did not significantly improve the estimated models.

Table 3: Bivariate[23] Normal Models, Avoided Losses and Gains

Question	Variable	Estimated Coefficients (s.e.)	
		"WTP to Avoid Loss" Scenario	"WTP for a Gain" Scenario
Low Lakes	Constant	3.61 (2.91)	8.67 (4.78)
	Onsite	-0.298 (2.32)	-4.17 (3.26)
	English	-2.25 (2.27)	-1.53 (4.18)
	Ln-Lakes	2.23 (0.50)**	0.578 (0.651)
	Income	0.220 (0.060)**	0.171 (0.091)
	Env. Org	1.95 (1.88)	3.37 (2.58)
	Visit	3.21 (2.17)	7.10 (3.83)
High Lakes	Constant	3.41 (5.06)	12.42 (8.41)
	Onsite	-3.59 (2.72)	-8.45 (4.07)*
	English	-5.09 (2.67)	-0.92 (5.22)
	Ln-Lakes	2.55 (0.83)**	0.45 (1.27)
	Income	0.274 (0.070)**	0.218 (0.113)
	Env. Org	4.13 (2.21)	2.74 (3.22)
	Visit	3.62 (2.56)	9.82 (4.78)*
	σ_1	23.72 (0.61)**	24.11 (0.90)**
	σ_2	27.92 (0.73)**	30.13 (1.12)**
	ρ	0.869 (0.009)**	0.904 (0.010)**
	Log-Likelihood	-6,333.87	-3103.58

Note: * and ** indicate 5 and 1 percent levels of significance respectively.
Figures in parentheses are standard errors.

The difference between the models for the two valuation scenarios is notable. At the 1% significance levels the "WTP for a gain" responses fail to be predicted by any of the factors which either economic theory or empirical regularity might expect. By contrast the "WTP to

[23] In line with previous research (Poe et al., 1997; Bateman et al., 2001) the WTP values are highly correlated between low and high lake responses, as indicated by the correlation coefficient ρ.

avoid a loss" are significantly related (at the 1% level) to both the number of lakes being valued and the respondents income level (with expected positive signs in both cases). These are important findings as both of these relationships can be derived directly from standard economic theory and are characteristics of well formed preferences. Similarly the absence of these relationships in the "WTP for a gain" responses suggests poorly formed preferences. These findings strongly accord with our prior focus group investigations which suggested that members of the public were relatively unconcerned about the present level of pollution and therefore did not have clear values for reductions in such pollutions levels (as described in the "WTP for a gain" scenario) but where concerned about potential increases in acidity and valued programmes to prevent such deteriorations (as described in the "WTP to avoid a loss" scenario). Indeed we have to lower our confidence levels to the 5% mark before we observe any predictors of "WTP for a gain" responses with the additional caveat that one of these two actually conflicts with prior expectations (the negative coefficient on the 'Onsite' variable).

Our key tests of scope sensitivity focus upon the estimated relationship between WTP responses and the number of lakes to which they relate as described in the estimated coefficient on the Ln Lakes variable. In line with the above findings, we find that the estimated coefficients for the "WTP to avoid loss" responses are very substantially larger than those for the "WTP for a gain" responses. Furthermore, while the former are in statistical terms highly significant, the latter fail significance tests. A graphical depiction of these results is provided in Figures 3 and 4 which uses these estimated coefficients to map out corresponding WTP for the Onsite, Scottish Offsite and English respondents calculated over the respective range of values for both the 'low' lake (5 to 360) and 'high' lakes (40 to 400) responses (setting all other covariates at their mean values)[24]. Considering the shape of these valuation functions we can see that, for the "WTP to avoid loss" scenario, shown in Figure 3, these curves show a very clear increase as the number of lakes limed rises. This increase is at a steadily decreasing rate demonstrating the expected diminishing marginal WTP for successive lakes as discussed early on in the paper. However, by contrast, the valuation curves for the "WTP for a gain" responses, shown in Figure 4, are effectively flat lines, being relatively unresponsive to the number of lakes to which each question corresponded.

[24] WTP value for differing lake improvement schemes can be read directly off these Figures. Alternatively, Annex 2 tabulates these estimates and provides corresponding confidence interval estimates.

Figure 3: Scope sensitivity in the "WTP to avoid a loss" responses

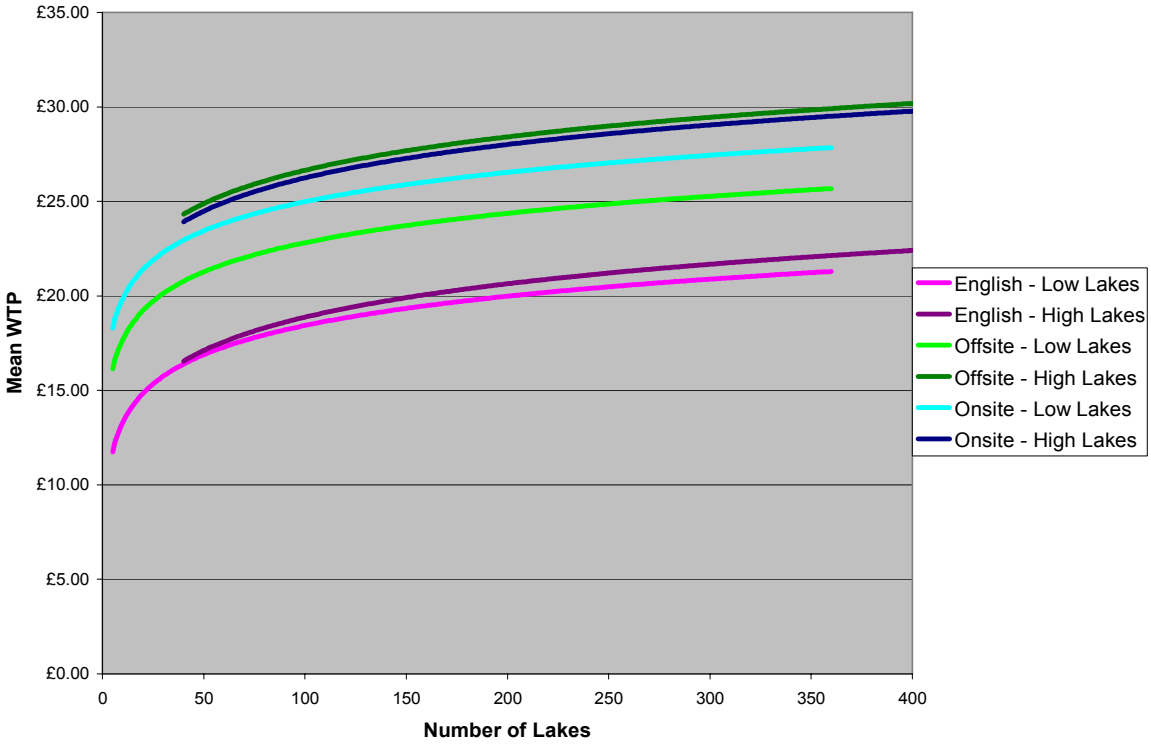
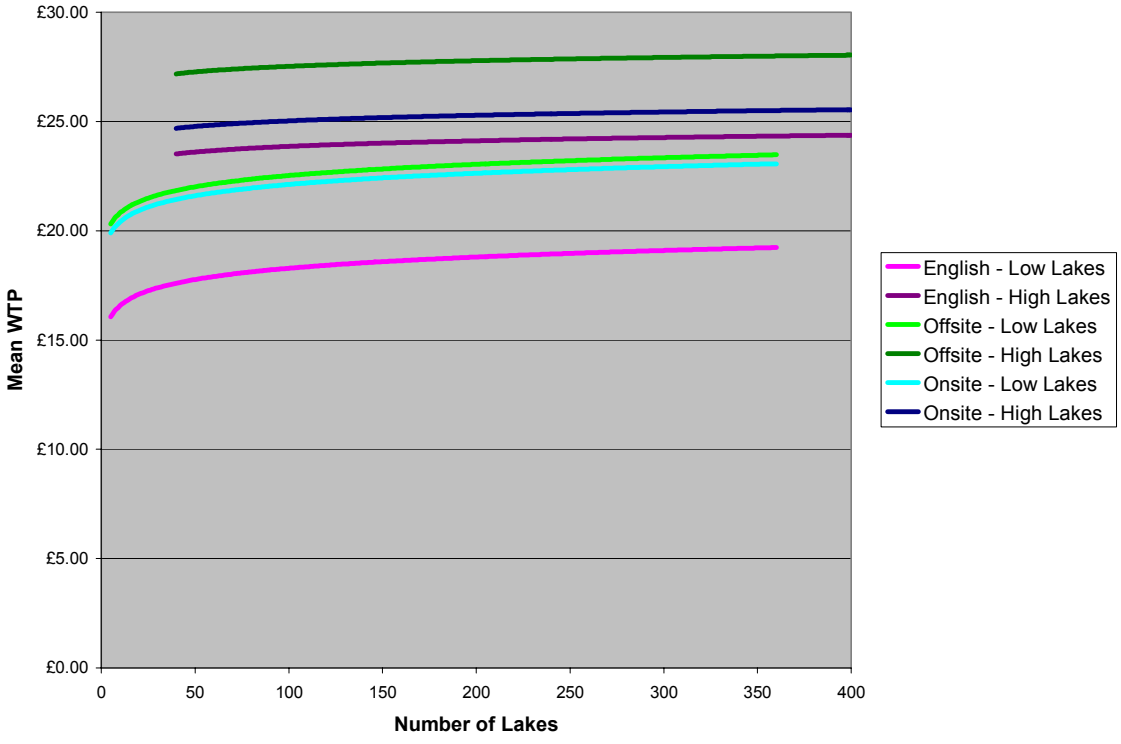


Figure 4: Scope sensitivity in the "WTP for a gain" responses



Turning from the shape of these curves to consider their relative positions, we note that, for both scenarios, the estimates from these multivariate models (which simultaneously control for the impact of all explanatory variables) show that 'low' lake values for the 'English' respondents are consistently below those for the Scottish 'Offsite' respondents which are in turn below those for the 'Onsite' respondents. The same pattern is observed for the 'high' lake values and together these give considerable credence to the 'national identity' hypothesis put forward previously.

Although it should be noted that the 'English' variable is statistically insignificant in Table 3 the impact of this factor is somewhat muted by the presence in the model of the 'Visit' variable with which it is negatively correlated. Allowing for this the null hypothesis that the coefficients on visits and English are equal to zero can be rejected for both scenarios at the five percent significance level. To further explore locational effects, we computed the distribution of mean WTP for each model using the bootstrapping methods described previously, and tested the null hypothesis of equality of WTP between the English and the Scottish Off-site, and On-site respondents. This approach accommodates the fact that other attributes controlled for in the model (e.g. visitation, income etc.) vary across samples. The results of these comparisons are provided in Table 4. As can be seen, for the "WTP to avoid a loss" scenario there is a significant decay in values between the On-site and Scottish Off-Site and the English samples. This in itself is am important finding as it suggests that values may experience some step-function as they cross national (and with them cultural) borders in addition to distance degradation associated with visits. Turning to consider responses to the "WTP for a gain" scenario we find that these are unresponsive to survey location which, alongside our previous findings of scope insensitivity, further reinforces the picture of these responses as being the product of poorly formed, unresponsive preferences.

Table 4: Differences in Mean Willingness to Pay (£) Across Survey Locations

Comparisons	"WTP to Avoid Loss" Scenario		"WTP for a Gain" Scenario	
	'Low' Lakes	'High' Lakes	'Low' Lakes	'High' Lakes
English versus Scottish Off-Site	-4.38*	-7.77**	-3.79	-3.96
English versus On-Site	-6.55**	-7.37**	-3.90	-1.14
Scottish Off-Site versus On-Site	-2.17	0.40	-0.12	2.81

Note: * and ** indicate 5 and 1 percent levels of significance respectively.

Returning to consider Figures 3 and 4 we also note that, for both scenarios we see that the valuation curves derived from responses to 'high' lakes questions appear to be elevated relative to those for the low lakes questions. This suggests the presence of the 'context' effects described previously whereby WTP to improve a given number of lakes becomes elevated when it is paired with a scheme to improve a lower number of lakes, but is depressed when paired with a scheme to improve a larger number of lakes (i.e. WTP for the 'high' lake exceeds WTP for the 'low' lakes even when these are in fact the same number of lakes!).

To test the null hypothesis of no context effects, we generated and compared bootstrap samples of conditional WTP from responses to 'high' and 'low' questions. The differences in WTP and corresponding statistical significance levels are provided in Table 5. The Subscripts L and H indicate whether WTP responses derived from 'low' or 'high' questions. For example 40_L denotes the stated WTP for improving 40 lakes when presented as the lower effect programme in a pair of two liming schemes. In contrast 40_H denotes the stated WTP for improving 40 lakes when presented as the higher of a pair of two liming schemes.

Table 5: Differences in WTP (£) by context (WTP for the same number of lakes presented as either the lower or higher of a pair of schemes)

Scenario	Survey Location	WTP Comparison		
		40_L v. 40_H	200_L v. 200_H	360_L v. 360_H
WTP to avoid a loss	English	-0.15	-0.66	-0.84
	Scottish Off-Site	-3.54*	-4.05**	-3.65**
	On-Site	-0.97	-1.48	-1.66
WTP for a gain	English	-5.81*	-5.61**	-5.33**
	Scottish Off-Site	-5.98*	-5.78**	-5.70**
	On-Site	-3.05	-2.85*	-2.77*

Note: * and ** indicate 5 and 1 percent levels of significance respectively.

As indicated in Figures 3 and 4 and confirmed in Table 5, in all cases the direction of the effect is that average WTP for improving a given number of lakes presented as higher of a pair is greater than WTP for the same number of lakes presented as the lower of a pair. Therefore, stated WTP for a given level of protection is lower when it is paired with a more preferred option than with a less preferred option. We find that these context effects are significant in virtually all cases for the "WTP for a gain" scenario. This further reinforces the picture of these responses as poorly formed. Here it seems that respondents faced with this scenario do not have a clear idea of their value for it and so hunt for heuristic clues as to its value, in this case clearly seizing upon the (theoretically irrelevant) relationship of the two programmes on offer as an indicator of their value. Consequently such respondents give significantly higher values to the larger of the two schemes on offer, irrespective of the actual number of lakes under consideration. Turning to consider the "WTP to avoid a loss" scenario we can see that, on the whole, respondents are resistant to context effects. This gives further credence to the notion that these values are generally reflecting reasonably well formed preferences robust to heuristics such as those provided by the contextual paring of schemes. However, a clear exception to this rule is provided by the responses of the Scottish Off-site sample which demonstrates significant context effects. This result remains somewhat puzzling. We conjecture that the On-site and English samples each constitute internally homogenous (although externally differing) samples, the former all being visitors while the latter are dominated by non-visitors[25]. By contrast, the Scottish Off-Site sample is far more heterogeneous consisting of about 60 percent visitors in both valuation scenarios. In the aggregate this suggests more varied preferences for the resource. To the extent that this

[25] In the English sample the proportions of visitors are 0.27 for the "WTP to avoid a loss" scenario and 0.31 for the "WTP for a gain" scenario.

carries over to poorly defined preferences at the individual level this could lead to greater susceptibility to procedural variation, such as context effects.

Summary and Conclusions

This paper describes the development and execution of a study to value, in monetary terms, preferences regarding schemes to improve the water quality of remote mountain lakes. In so doing we have focussed in particular upon the rigorous validation testing which must be carried out if valuations estimates and to be established as robust for subsequent policy use. We have designed a study so as to permit us to conduct a variety of such tests.

Our design considers two valuation scenarios, relating to differing possible future states of the world. In the first of these we consider a scenario in which, if nothing were done, lake acidity levels would increase. Here we evaluate "WTP to avoid a loss" associated with this change. In our second scenario we consider a situation in which, if nothing were done lakes acidity would stay at its current level. Here we assess "WTP for a gain" derived from lowering that acidity level. Within each of these scenarios we have asked respondents to value two schemes, differentiated by the number of lakes they would improve.

Validity testing proceeds through a number of avenues but at all times is informed by prior expectations derived principally from economic theory and supplemented by empirical regularities observed in the literature. In particular we identify sensitivity to the scope of the good and procedural invariance as key tests of validity. The study was implemented through a large sample survey conducted throughout the length of the UK, itself intended to permit examination of various forms of distance decay in values.

Our results broadly suggest that respondents had reasonably robust preferences and consequently statistically significant values for the "WTP to avoid loss" scenario. However, interestingly these seemed to change significantly as we sampled across national boundaries suggesting that there is come cultural 'national identity' or ownership element within values for certain environmental resources in addition to distance decay effects associated with visitation patterns. However, values for the WTP for a gain" scenario failed virtually all validity tests. In summary it seems that respondents were prepared to pay to avoid further deterioration in remote mountain lakes and, in general, their responses were consistent with economic-theoretic expectations: the sole violation being the context effects found in the Scottish Off-Site group. Consistency with economic-theoretic expectations was not found in the values associated with improvements from the current condition. Hence, although there was a positive WTP exhibited for this group, we do not believe that such responses are reliable. This in itself is an important finding suggesting that our additional context independence test allows a way to distinguish between response patterns that are likely related to unconsidered positive responses associated with a survey situation and responses that are meaningful reflections of underlying values but do not exhibit scope.

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Appendix 1: Survey questionnaire

In this annex we report in full the questionnaire and showcards used with the English sample interviewed for this study. This was virtually identical to the Scottish Offsite questionnaire but was adjusted appropriately for the On-site sample. The questionnaire also contains questions used in a choice experiment valuation study concerning the same issue.

This questionnaire may not be abstracted or used in other research or consultancy work without the written permission of the lead author, Ian Bateman.

EMERGE: SURVEY QUESTIONNAIRE: ENGLISH VERSION

- **Bold = to be read out by interviewers to respondents;**
- CAPITALISED TEXT = instructions to interviewers;
- *CAPITALISED ITALICS* are comments to design team;
- Footnotes are further information for interviewers to help answer questions from respondents

INITIAL IMPRESSIONS ARE VITAL, INTERVIEWERS SHOULD BE SMARTLY DRESSED (SMART CASUAL I'M AFRAID!), THEY SHOULD BE APPROACHABLE AND (WITHIN LIMITS) FRIENDLY IN THEIR MANNER - SMILING DOES HELP!

HOWEVER - THE NUMBER 1 CONCERN IS SAFETY OF THE INTERVIEWERS. AS DISCUSSED IN TRAINING YOU SHOULD WORK IN PAIRS, CARRY AN ALARM AND TELEPHONE AND ALWAYS ENSURE THAT SOMEONE KNOWS WHERE YOU WILL BE AT WHICH TIME AND WHEN YOU WILL RETURN.

A SIMPLE (!) SERIAL NUMBER CODING SYSTEM IDENTIFIES THE VERSION AS WELL AS THE RESPONDENT AS FOLLOWS:

- *THE FIRST SERIAL NUMBER DEFINES WHICH OF THE FOUR REFERENCE (DO NOTHING) LEVELS DEPENDING ON THE PROBABILITY (p) OF FISH IMPAIRMENT (FI) AS FOLLOWS:*
    1. *pFI (p =1; FI certain)*
    2. *pFI (p=0.75) – WILL BE USED IN PILOTING*
    3. *pFI (p=0.25) – WILL BE USED IN PILOTING*
    4. *pFI (p=0; NC certain)*

  NOTE THAT TYPES 1, 2 AND 3 ARE GIVEN A WATER ACIDITY LADDER WITH AN INDICATION OF THE FUTURE POSITION. FOR TYPE 4 THE FUTURE POSITION IS THE SAME AS THE CURRENT POSITION

- *THE SECOND SERIAL NUMBER DEFINES WHICH OF THE TWO WITH PROGRAMME LEVELS APPLY AS FOLLOWS:*

    1. *NO CHANGE (NC) ACIDITY MAINTAINED AT CURRENT LEVEL (NC<FI) – WILL BE USED IN UEA TRAINING*
    2. *ALMOST PRE-INDUSTRIAL (PIA), 'NATURAL' LEVEL (PIA<NC)*

- *THE THIRD SERIAL NUMBER (OPTIONAL) DEFINES THE QUANTITATIVE SCOPE COMBINATION OF LAKES TREATED (THE LOW [L] AND HIGH [H] NUMBERS USED). GIVEN THE FIVE LEVELS AGREED AT OUR MEETING IN MAY (5, 40, 200, 360, 400) THERE ARE 10 POSSIBLE LOGICAL COMBINATIONS OF L<H. I HAVE SELECTED THE FOLLOWING JUST ON A HUNCH ABOUT WHICH PAIRS MAY BE OF GREATEST INTEREST - HOWEVER THIS MAY BE TOO MANY FOR PRACTICALITY SO COMMENTS VERY WELCOME - ESPECIALLY REGARDING TRIMMING THIS DOWN.*

    1. *L=5; H=40 – WILL BE USED IN PILOTING*
    2. *L=5; H=200*
    3. *L=40; H=360*
    4. *L=40; H=400 – WILL BE USED IN PILOTING*
    5. *L=200; H=400*
    6. *L=360; H=400*
    7. *Open valuation questions omitted; only choice questions*

- *THE FOURTH SERIAL NUMBER IDENTIFIES THE SET OF CHOICE QUESTIONS TO BE USED:*
    1. *SET A ("Choice questions 1")*
    2. *SET B ("Choice questions 2")*
- *THE FIFTH AND SIXTH SERIAL NUMBERS IDENTIFY THE INTERVIEWER (WHICH IN TURN SHOULD ALSO IDENTIFY APPROXIMATE INTERVIEW LOCATION – SPECIFIC LOCATION BEING DEFINED IN THE CALL LOG)*
- *A FURTHER 3 SERIAL NUMBER SPACES DEFINE THE NUMBER OF THE RESPONDENT WITHIN THAT TREATMENT STARTING FROM 001*

SURVEY QUESTIONNAIRE: CONFIDENTIAL

QUESTIONNAIRE TYPE 1 - HOUSEHOLD SURVEY

TIME INTERVIEW STARTED (24 HOUR CLOCK) | | | : | | |

COMPLETE THE REMAINDER OF THIS PAGE AT THE END OF THE INTERVIEW

TIME INTERVIEW ENDED (24 HOUR CLOCK) | | | : | | |

WAS THE INTERVIEW CONDUCTED (please circle number):

1. INDOORS
2. AT DOORSTEP
3. OTHER LOCATION (please give details).....

INTERVIEWER INSTRUCTIONS:

1. Statements and questions to be read out are shown in **bold** type;
2. Items in CAPITALS give you instructions or tell you that a new section is starting - do not read out;
3. When recording answers, circle the number of the appropriate response or fill in boxes as indicated;
4. You should not normally interview those under 18;
5. If interviewing a family group you should aim to interview the head of household;
6. Circle the code number 99 if an interviewee gives a 'Don't Know' response - BUT it is VERY IMPORTANT to try and avoid these unless they are really completely unsure; do try to probe and give time for answers, do not hurry them into a don't know response.

TO COMPLETE THIS QUESTIONNAIRE YOU NEED:

WATER ACIDITY LADDER CARD:

TYPE	FRONT SIDE	REVERSE SIDE
A	BASE VERSION WITH 'NATURAL' AND 'CURRENT' LEVEL LABELS ONLY	BLANK
B		BASE PLUS LABEL 'POSSIBLE LEVEL IN NEXT TEN YEARS'
C		BASE PLUS LABEL 'LEVEL IN NEXT TEN YEARS'

PAYMENT CARD WITH L= ….. AND H= …..

CHOICE CARDS SET A (D1A to D5A)/B (D1B to D5B)

INTRODUCTION

Hello/good …. {depending on respondent and time of day}, **I'm from the University of** {**Aberdeen/East Anglia**} [SHOW I.D. CARD] **and I'm conducting a survey of people's <u>opinions</u> about pollution and the environment. It's for University research only, all answers are confidential and I'm not trying to sell anything!**

The survey takes about 15 minutes. Would you be willing to help me with this?

[IF YES: ACCEPT INVITATION FOR ENTRY, IF MADE, AND CONDUCT INTERVIEW IN A ROOM SELECTED BY THE RESPONDENT AS QUIET AND CONVENIENT. IF NO INVITATION FOR ENTRY, CONDUCT INTERVIEW ON DOORSTEP.]

[IF NO: **Is there another time that would be more convenient for me to call?**
IF YES: ARRANGE CALL BACK TIME AND ENTER DETAILS IN CALL LOG.
IF NO: **Thank you and I'm sorry to have bothered you. Goodbye.** ENTER REFUSAL DETAILS IN CALL LOG. THESE ARE: SEX, APPROXIMATE AGE, PROPERTY TYPE]

A. GENERAL ATTITUDES

A-1. **To start off I am going to read out a list of issues and I want you to use the scale shown on this card** [SHOW CARD A-1,2] **to tell me whether or not you think each issue is important in the UK at present. The scale goes from number 1** [INDICATE]**, which means NOT AN IMPORTANT ISSUE IN THE UK, to number 5** [INDICATE]**, which means A VERY IMPORTANT ISSUE IN THE UK. The issues are:**

(READ FROM LIST AND CIRCLE NUMBER OF RESPONSE - BUT EACH TIME YOU INTERVIEW A NEW PERSON START AT A DIFFERENT POINT ON THE LIST; CIRCLE THE NUMBER IN SQUARE BRACKETS [ ] OF THE QUESTION YOU START AT AND THEN MOVE DOWN THE TABLE TO THE END BEFORE GOING BACK TO THE TOP OF THE TABLE AND ASKING THE REMAINING QUESTIONS)

Starting question	Issue	Not an important issue in the UK				A very important issue in the UK	Don't know
[1]	**Crime**	1	2	3	4	5	99
[2]	**Pollution**	1	2	3	4	5	99
[3]	**Education**	1	2	3	4	5	99
[4]	**The health service**	1	2	3	4	5	99
[5]	**Public transport**	1	2	3	4	5	99

A-2. **I'm now going to read a list of several types of pollution. Using the same scale as before** [CONTINUE TO SHOW CARD A-1,2] **please tell me whether or not you think each source of pollution is an important issue in the UK at present. The types of pollution are:**

(AS BEFORE - READ FROM LIST AND CIRCLE NUMBER OF RESPONSE - BUT EACH TIME YOU INTERVIEW A NEW PERSON START AT A DIFFERENT POINT ON THE LIST; CIRCLE THE NUMBER IN SQUARE BRACKETS [ ] OF THE QUESTION YOU START AT AND THEN MOVE DOWN THE TABLE TO THE END BEFORE GOING BACK TO THE TOP OF THE TABLE AND ASKING THE REMAINING QUESTIONS)

Starting question	Pollution type	Not an important issue in the UK				A very important issue in the UK	Don't know
[1]	**Pollution in drinking water**	1	2	3	4	5	99
[2]	**Air pollution**	1	2	3	4	5	99
[3]	**Household rubbish disposal**	1	2	3	4	5	99
[4]	**Pollution in lakes and rivers**	1	2	3	4	5	99
[5]	**Pesticides in food**	1	2	3	4	5	99

B. MOUNTAIN LAKES

BACKGROUND INFORMATION

OK, so far we have been discussing general issues concerning pollution. Most of the other questions I am going to ask you concern a particular type of pollution and that is pollution in mountain lakes. But before I come to that I would like to tell you about mountain lakes as you may not be familiar with them.

Mountain lakes are located at such a height above sea level that trees and large plants don't grow beside them, because the climate is too harsh. This map [SHOW 'MAP'] **shows where in Europe this type of lake is found; this is where we are** [INDICATE BLACK DIAMOND]**. There are 400 mountain lakes in the UK all of which are in the Highlands of Scotland** [INDICATE RED DOT IN NORTHERN SCOTLAND]**. There are about ten thousand in Europe** [INDICATE ALPS AREA, THEN SCANDINAVIAN AREA]**.**

This photo shows a typical mountain lake in the winter [POINT TO UPPER PICTURE ON PHOTO CARD 1 'LAKE PICTURES'] **and in the summer** [POINT TO LOWER PICTURE ON PHOTO CARD 1 'LAKE PICTURES']. **As you can see, even in the summer little grows around the lake because of the harsh mountain conditions, and the land can't be used by farmers even for sheep grazing. The only large animals seen near the lake are occasional birds and deer but they do not rely on the lakes as a source of food.**

The harsh conditions mean that only a few types of plants and animals are found in the lakes themselves including microscopic plants called algae which are too small to see, but also small aquatic plants [SHOW PHOTO CARD 2 'PLANTS AND ANIMALS' AND POINT TO PICTURE OF PLANTS]**, insects such as water beetles and stoneflies** [INDICATE TO BOTH]**, and fish such as brown trout** [INDICATE]**.**

Because they are so remote, few people visit the areas round the lakes although walkers are more common in some areas than others. Even then the lakes are hardly ever used directly by walkers although they are a feature of the landscape.

B-1: [SHOW CARD B-1] **Which of these statements best describes how much you knew about these mountain lakes in the Scottish Highlands before today?** [PLEASE CIRCLE THE APPROPRIATE RESPONSE NUMBER BELOW]

1. I had never heard of them.
2. I had heard of them but never visited any of them.
3. I had heard of them and hope to visit them one day.
4. I had visited at least one of them.

   If so then ask:

   How many times have you visited them?

   .....……..…

   over what period? (past year; 10 years; lifetime)

   .....…….....…….....

   Can they remember the names of any lakes visited?

   …….....

5. I don't know

OK, turning to consider the pollution issue; scientists have found out that air pollution, mainly from electricity generation, has increased the acidity of the rainwater which feeds these lakes. Now all water has some natural level of acidity, and when this changes it affects the plants and animals which live in the water. While all water is affected to some extent the mountain lakes in the Scottish Highlands are particularly vulnerable to changes in acidity[26] and to see these effects please take a look at this card which shows what is known as a 'Water Acidity Ladder'

[SHOW 'WATER ACIDITY LADDER' HANDOUT CARD ENSURING THAT THE SIDE WITHOUT THE FUTURE POSITION ARROW IS UPPERMOST - EITHER LET THE RESPONDENT HOLD THE CARD OR YOU HOLD IT SO THAT THE RESPONDENT CAN CLEARLY SEE EVERYTHING ON THIS SIDE]**.**

[26] If asked, this is because the rock they are formed in does not naturally counteract the affect of acidity increases as would be the case in many lowland lakes.

Now there is a lot of information on this card so I am going to go through it with you explaining how changes in acidity [INDICATE UP AND DOWN THE LADDER] **have affected the plants and animals** [INDICATE THE SYMBOLS] **in these lakes.**

Before the mid 1800s [INDICATE LABEL 'NATURAL LEVEL (PRIOR TO 1850)'] **the natural level of acidity in the Scottish mountain lakes was about here.** [NOW START TO INDICATE ALONG THE BOTTOM ROW OF SYMBOLS FROM LEFT TO RIGHT] **The water was, of course safe to drink** [INDICATE TAP SYMBOL] **and fish such as trout lived in them** [INDICATE FISH SYMBOL] **as did certain types of insects** [INDICATE INSECT SYMBOL] **and plants** [INDICATE PLANT SYMBOL]**.**

From about 1850 [INDICATE 1850 LABEL NEXT TO LADDER] **to about 1950** [INDICATE 1950 LABEL NEXT TO LADDER] **the growth of industry and people's increasing use of electricity produced air pollution which raised acidity in the lakes.**

- **This first** [INDICATE RUNG NEXT TO THE SECOND ROW OF SYMBOLS, I.E. IN BETWEEN 1850 AND 1950] **affected acid sensitive plants,** [INDICATE LAST (PLANT) SYMBOL ON SECOND ROW] **as indicated by these lighter crosses, and these were increasingly replaced by plants which could tolerate the acidity.**
- **As acidity rose further** [INDICATE THE 1950 LABEL AND RUNG (THIRD ROW)] **acid sensitive insects** [INDICATE INSECTS SYMBOL ON THIRD ROW] **also began to be affected in a similar way.**

From about 1950 onwards [AGAIN INDICATE THE 1950 LABEL NEXT TO LADDER] **controls on pollution and improvements in technology have meant that acidity has stayed at about this level with the same effects on plants and animals. So, to date, acidity has not risen to the level at which fish would be affected** [INDICATE THE FISH SYMBOL ON THIS THIRD ROW]**.**

B-2. **OK, now please take a look at the scale on this card** [SHOW CARD B-2] **and tell me what number best describes how concerned, or not, you are about this increase in water acidity in the mountain lakes in Scotland?**

[CIRCLE NUMBER BELOW]

1	2	3	4	5
Not at all concerned		Concerned		Very concerned

FUTURE POSITION WITHOUT SCHEME (REFERENCE LEVEL)

THERE ARE FOUR REFERENCE LEVELS DEPENDING ON THE PROBABILITY OF FISH IMPAIRMENT[27]

pFI (p =1; FI certain)

OK, to discuss the outlook for the future [FLIP OVER ACIDITY LADDER TO SIDE INCLUDING 'FUTURE LEVEL' ARROW] **this shows exactly the same ladder as before but with this arrow** [INDICATE 'FUTURE LEVEL', FOURTH ROW] **providing information about the future.**

Although the acidity level has stabilised, the lakes have now reached their capacity to absorb further pollution. As a result scientists agree that over the next 10 years, acidity will increase to this level[28] [INDICATE FISH SYMBOL ON FOURTH ROW - LIGHTLY CROSSED OUT] **so that the overall numbers of fish will drop substantially.**

Note that the acidity would not rise to the level [INDICATE FIFTH RUNG] **at which all fish and other living things would die out during the next 10 years, as indicated by these symbols,** [INDICATE HEAVILY CROSSED OUT FISH, INSECT AND PLANT SYMBOLS ON FIFTH ROW] **and there is no prospect of acidity rising to the even higher level at which the water would be unsafe for people to drink** [INDICATE TOP ROW AND TAP SYMBOL THEREON]

pFI (p=0.75)

OK, to discuss the outlook for the future [FLIP OVER ACIDITY LADDER TO SIDE INCLUDING 'POSSIBLE FUTURE LEVEL' ARROW] **this shows exactly the same ladder as before but with this arrow** [INDICATE 'POSSIBLE FUTURE LEVEL', FOURTH ROW] **providing information about the future.**

Although the acidity level has been relatively stable in recent decades and might remain so, the lakes are near their capacity to absorb further pollution and it's possible that acidity levels in the lakes will begin to increase. Scientists agree that over the next 10 years acidity levels in the lakes will most probably increase to the level[29] [INDICATE FISH SYMBOL ON FOURTH ROW - LIGHTLY CROSSED OUT] **at which fish would be affected. By probably scientists mean that there is about a 75% chance, that's a three out of four chance, of fish being affected. If this did happen their numbers would drop substantially.**

Note that the acidity would not rise to the level [INDICATE FIFTH RUNG] **at which all fish and other living things would die out during the next 10 years, as indicated by these symbols,** [INDICATE HEAVILY CROSSED OUT FISH, INSECT AND PLANT SYMBOLS ON FIFTH ROW] **and there is no prospect of acidity rising to the even**

[27] If asked, the increased acidity weakens fish eggs and baby fish (fry) such that fewer survive than normal.
[28] If asked, the main increase in acidity will be because the lakes have a natural capacity to absorb some pollution but this is on the edge of being exceeded.
[29] If asked, the main increase in acidity will be because the lakes have a natural capacity to absorb some pollution but this is on the edge of being exceeded.

higher level at which the water would be unsafe for people to drink [INDICATE TOP ROW AND TAP SYMBOL THEREON]

pFI (p=0.25)

OK, to discuss the outlook for the future [FLIP OVER ACIDITY LADDER TO SIDE INCLUDING 'POSSIBLE FUTURE LEVEL' ARROW] **this shows <u>exactly</u> the same ladder as before but with this arrow** [INDICATE 'POSSIBLE FUTURE LEVEL', FOURTH ROW] **providing information about the future.**

Although the acidity level has been relatively stable in recent decades and might remain so, the lakes are near their capacity to absorb further pollution and it's <u>possible</u> that acidity levels in the lakes will begin to increase. Scientists agree that over the next 10 years acidity levels in the lakes will most <u>probably not</u> increase to the level[30] [INDICATE FISH SYMBOL ON FOURTH ROW - LIGHTLY CROSSED OUT] **at which fish would be affected. By <u>probably not</u> scientists mean that there is about a 25% chance, that's a one out of four chance, of fish being affected. If this did happen their numbers would drop substantially.**

Note that the acidity would not rise to the level [INDICATE FIFTH RUNG] **at which <u>all</u> fish and other living things would die out during the next 10 years, as indicated by these symbols,** [INDICATE HEAVILY CROSSED OUT FISH, INSECT AND PLANT SYMBOLS ON FIFTH ROW] **and there is no prospect of acidity rising to the even higher level at which the water would be unsafe for people to drink** [INDICATE TOP ROW AND TAP SYMBOL THEREON]

pFI (p=0; NC certain)

Although the acidity level has stabilised and the lakes are near their capacity to absorb further pollution[31]**, scientists agree that, over the next 10 years, acidity <u>will not</u> increase and fish will not be affected. So acidity will <u>not</u> reach this level at which fish start to be affected** [INDICATE FISH SYMBOL ON FOURTH ROW - LIGHTLY CROSSED OUT] **nor will it reach this even higher level at which all species die out** [INDICATE HEAVILY CROSSED OUT FISH, INSECT AND PLANT SYMBOLS ON FIFTH ROW]**, and it goes without saying that it never reaches the point at which the water is unsafe to drink** [INDICATE TOP ROW AND TAP SYMBOL THEREON]**.**

[30] If asked, the main increase in acidity will be because the lakes have a natural capacity to absorb some pollution but this is on the edge of being exceeded.

[31] the lakes have a natural capacity to absorb some pollution but this is on the edge of being exceeded.

TREATMENT PROGRAMME

Program to ensure current level of acidity is maintained (No Change; NC)

The Department of the Environment is presently considering a way of preventing this potential rise in water acidity in the Scottish mountain lakes, keeping it at its current level, so that's here [INDICATE 'CURRENT LEVEL' ON ACIDITY LADDER] **for the next 10 years and so avoiding any risk of effects on fish. There is a well tried and tested method for controlling water acidity which has been used successfully for many years in the rivers and lakes of Norway; this is called liming which simply means using a naturally occurring[32] mineral called lime which reduces acidity[33,34].**

Program to reduce level of acidity to almost pre-industrial levels (PIA)

The Department of the Environment is presently considering a way of reducing water acidity in the Scottish mountain lakes to roughly the natural level which occurred in the mid 1800s, so that's here [INDICATE 'NATURAL LEVEL' ON ACIDITY LADDER]**, for the next 10 years. There is a well tried and tested method for controlling water acidity which has been used successfully for many years in the rivers and lakes of Norway; this is called liming which simply means using a naturally occurring[35] mineral called lime which reduces acidity[36,37].**

B-3. **Prior to this had you heard of using lime to reduce acidity levels in rives and lakes?** [CIRCLE RESPONSE NUMBER]

0 = No

1 = Yes

2 = Perhaps a little

3 = Don't know / unsure

Write down any comments but don't explicitly ask for these……

[32] Lime is also a by-product of producing sugar from sugar beet (which is itself grow in large quantities in the UK).
[33] If asked, the lime would be added to the lakes and would then gradually dissolve and control the acidity.
[34] If asked, the lime would be brought to the lakes via helicopter.
[35] Lime is also a by-product of producing sugar from sugar beet (which is itself grow in large quantities in the UK).
[36] If asked, the lime would be added to the lakes and would then gradually dissolve and control the acidity.
[37] If asked, the lime would be brought to the lakes via helicopter.

WTP QUESTIONS (COMMON FORMAT BUT WITH DIFFERING L AND H)

Two water quality treatment schemes are being considered; one to lime L lakes and the other to lime H lakes. In either case the lakes to be limed would be selected from across the Highlands of Scotland. Now, if either scheme goes ahead it would be paid for by a fixed supplement[38] added to every UK household's electricity bills for the next ten years from the start of next year. This amount would be listed as a separate item on the bills. The Electricity Companies would pass this money on to the Department of the Environment who would only use it for liming the lakes[39].

We are trying to find out how much, if anything, these two schemes are worth to people. Some people might be willing to pay for these schemes while others might not. At present the cost of the schemes is being assessed, but what we are interested in is how much you might be prepared to pay through higher electricity bills for these schemes to go ahead. We can then compare this with the costs when they are known and decide if it is worth doing.

So to work out how much, if anything, you might be prepared to pay for these schemes please take a look at this sheet [GIVE THE LAMINATED PAYMENT CARD TO THE RESPONDENT TO HOLD] **which shows a list of money amounts from 'nothing'** [INDICATE] **on upwards** [INDICATE DOWN AMOUNTS ON RESPONDENTS VERSION OF THE PAYMENT CARD]. **These are calculated as yearly amounts** [INDICATE 'PER YEAR'] **but any actual payment would be spread evenly across your electricity bills. There are two sets of columns** [INDICATE]**. I am going to use the first set** [INDICATE] **to ask you how much you might pay for the scheme to lime L lakes** [INDICATE NUMBER L]**, and then use the second set** [INDICATE] **to ask you how much you might pay for the scheme to lime H lakes** [INDICATE NUMBER H]**.**

When you're thinking about your answers, please bear in mind that only one of these schemes would be implemented, there are 400 mountain lakes in Scotland, and that there may be other things that you would rather spend your money on.

B-4. **First lets think about the scheme to lime L lakes** [INDICATE L]**. To start off, <u>ask yourself</u>, "If the scheme to lime L lakes cost me 20p** [INDICATE AND KEEP INDICATING THROUGHOUT THIS SECTION] **per year extra on my electricity bill, would I be <u>in favour</u> of the scheme, or <u>not in favour</u> of the scheme?**

If you're <u>in favour</u> of the scheme at this price then I will tick this amount on this identical version in the questionnaire [INDICATE WHERE YOU WILL PLACE THE TICK ON THE PAYMENT LADDER IN THE QUESTIONNAIRE]**. If you're <u>not in favour</u> of the scheme at this price, or you are unsure, then I will put a cross here** [INDICATE SAME PLACE]**.**

[38] If asked, "fixed" does mean same per household and same amount for each of the 40 quarters.

[39] If asked, the money would be passed to the relevant part of the Environment Agency (the Scottish Environment Protection Agency). Also, <u>only</u> if asked (do <u>not</u> offer this information unrequested), any excess funds collected would be rebated to customers. Tick here if this information is given …….

TO INTERVIEWER: IF RESPONDENT SAYS 'YES' TO 20p GO TO QUESTION B-5 IF RESPONDENT SAYS 'NO' TO 20p GO TO QUESTION B-6

FOR 'YES' RESPONSES (TICKS):

B-5. **OK, now we can go down the card from 40p per year on to the higher amounts** [INDICATE]**. I will read each amount out and please tell me if you would be in favour of the scheme at that cost, and when you reach an amount at which you would not be in favour of the scheme or are uncertain then just say 'no'.**

[READ OUT AMOUNTS AND FILL IN TICKS UNTIL RESPONDENT REACHES AN AMOUNT AT WHICH THEY SAY 'NO'. PUT A CROSS NEXT TO THAT AMOUNT.

IF RESPONDENT REACHES BOTTOM 'MORE THAN THE ABOVE' BOX THEN ASK THEM WHAT THE MAXIMUM AMOUNT THEY ARE WILLING TO PAY PER YEAR IS AND WRITE IN AMOUNT IN BOX.

THEN GO TO QUESTION B-7]

B-6 [ONLY FOR THOSE WHO SAID 'NO' TO THE LOWEST AMOUNT OF 20p]. **Is there any amount above zero that you would be prepared to pay?** [CIRCLE RESPONSE]

0 = No

1 = Yes. If so ask:

What would be the most you would pay per year? £ ☐☐ . ☐☐ p

2 = don't know, unsure.

[THEN GO TO QUESTION B-7]

B-7. **Thanks very much for that. In your own words can you tell me the reasons behind your answer(s)?** [WRITE IN SPACE BELOW LIST - TRY TO BE AS VERBATIM AS POSSIBLE. FOR THOSE WHO SAID 'NO' TO THE LOWEST AMOUNT PLEASE ENSURE THAT THEIR ANSWERS DISTINGUISH WHETHER OR NOT THE SCHEME IS WORTH SOME POSITIVE AMOUNT - ASK THIS SPECIFICALLY IF NECESSARY]

……

……

……

Thanks again. I would now like to repeat this process for the Scheme to lime H lakes.

B-8. **Starting with the value 20p per year** [INDICATE]**, if you would be in favour of the scheme to lime H lakes if it cost that amount say 'yes', if not or you are uncertain say 'no'.**

TO INTERVIEWER:
IF RESPONDENT SAYS 'YES' TO 20p GO TO QUESTION B-9
IF RESPONDENT SAYS 'NO' TO 20p GO TO QUESTION B-10

FOR 'YES' RESPONSES (TICKS):

B-9. **……...and now for the other amounts, 40p per year? ……**

[READ OUT AMOUNTS AND FILL IN TICKS UNTIL RESPONDENT REACHES AN AMOUNT AT WHICH THEY SAY 'NO'. PUT A CROSS NEXT TO THAT AMOUNT.

IF RESPONDENT REACHES BOTTOM 'MORE THAN THE ABOVE' BOX THEN ASK THEM WHAT THE MAXIMUM AMOUNT THEY ARE WILLING TO PAY PER YEAR IS AND WRITE IN AMOUNT IN BOX.

THEN GO TO QUESTION B-11]

B-10 [ONLY FOR THOSE WHO SAID 'NO' TO THE LOWEST AMOUNT OF 20p]. **Is there any amount above zero that you would be prepared to pay?** [CIRCLE RESPONSE]

0 = No

1 = Yes. If so ask:

What would be the most you would pay per year? £ ☐☐ . ☐☐ p

2 = don't know, unsure.

[THEN GO TO QUESTION B-11]

B-11. **Thanks very much for that. In your own words can you tell me the reasons behind your answer(s)?** [WRITE IN SPACE BELOW LIST - TRY TO BE AS VERBATIM AS POSSIBLE. FOR THOSE WHO SAID 'NO' TO THE LOWEST AMOUNT PLEASE ENSURE THAT THEIR ANSWERS DISTINGUISH WHETHER OR NOT THE SCHEME IS WORTH SOME POSITIVE AMOUNT - ASK THIS SPECIFICALLY IF NECESSARY]

……

……

……

Scheme to lime [L] lakes

Amount (each year)	Prepared to pay ? ✔= yes ✗ = no
0	
20p	
40p	
75p	
£1	
£1.25	
£1.50	
£1.75	
£2	
£2.50	
£3	
£3.50	
£4	
£4.50	
£5	
£6	
£7	
£8	
£9	
£10	
£12	
£14	
£16	
£18	
£20	
£24	
£28	
£32	
£36	
£40	
£48	
£60	
£80	
£100	
more than the above	

Scheme to lime [H] lakes

Amount (each year)	Prepared to pay ? ✔= yes ✗ = no
0	
20p	
40p	
75p	
£1	
£1.25	
£1.50	
£1.75	
£2	
£2.50	
£3	
£3.50	
£4	
£4.50	
£5	
£6	
£7	
£8	
£9	
£10	
£12	
£14	
£16	
£18	
£20	
£24	
£28	
£32	
£36	
£40	
£48	
£60	
£80	
£100	
more than the above	

C. MOTIVATION QUESTIONS

Thank you for the answers you gave to the previous questions. We are aware that asking you to express your answers solely in financial terms might over simplify your attitudes to this issue. So we would like you to look at some reasons that might have influenced your answers. Some of these reasons may not be relevant to your answers. Alternatively, you may have different reasons for the answers you gave. You will have the opportunity to tell us about these other reasons later.

Please think again about the scheme to lime L lakes, we will come to the larger scheme later.

C-1. **This table** [SHOW CARD C-1] **lists reasons that might have caused you to**

[FOR THOSE WHO DID NOT PAY:] **not pay at all for this scheme.**

[FOR THOSE WHO DID PAY:] **reduce the amount you would otherwise have paid for this scheme.**

Please tell me whether each one was either: not relevant, [INDICATE] **somewhat relevant** [INDICATE] **or very relevant** [INDICATE] **to your answers.**

[CIRCLE THE CORRECT RESPONSE NUMBER]

Reason	Was not relevant	Somewhat relevant	Very relevant
"These lakes are of no concern to me".	1	2	3
"What I say won't affect whether or not the scheme goes ahead".	1	2	3
"The government can't be trusted".	1	2	3
"The effects of the pollution might not be as bad as described".	1	2	3
"Liming the lakes might not achieve the intended results".	1	2	3
"Other things are more important".	1	2	3

C-2. **This table** [SHOW CARD C-2] **lists reasons that might have caused you to**

[FOR THOSE WHO DID NOT PAY:] **consider paying for the scheme, even though on balance you decided not to.**

[FOR THOSE WHO DID PAY:] **increase the amount you wished to pay for this scheme.**

Please tell me whether each one was either: not relevant, [INDICATE] **somewhat relevant** [INDICATE] **or very relevant** [INDICATE] **to your answers.**

[CIRCLE THE CORRECT RESPONSE NUMBER]

Reason	Was not relevant	Somewhat relevant	Very relevant
"I enjoy visiting the Highlands".	1	2	3
"I might enjoy visiting the Highlands in the future".	1	2	3
"Other people enjoy visiting the Highlands".	1	2	3
"I should pay towards any good cause."	1	2	3
"I would like the lakes to be returned to their natural state".	1	2	3
"I like showing that I care about the environment"	1	2	3
"Lakes and the life in them have a right to exist."	1	2	3

[THOSE WHO WOULD NOT PAY ANYTHING SHOULD BE ASKED C-3 AND THEN GO TO C-5. THOSE WHO WOULD PAY SHOULD SKIP C-3 AND CONTINUE FROM C-4 ONWARDS.]

C-3 [ONLY FOR THOSE WHO WOULD NOT PAY]. **Finally, for these reasons** [SHOW CARD C-3, INDICATE REASONS] **please tell me whether they were either not relevant to your answer** [INDICATE]**, or made you less inclined to pay** [INDICATE] **or made you more inclined to pay** [INDICATE] **even though on balance you did not wish to pay.**
[CIRCLE THE CORRECT RESPONSE NUMBER]

Reason	Was not relevant	Made me less inclined to pay	Made me more inclined to pay
"The distance to the lakes from where I live."	1	2	3
"My responsibility for improving the water quality in these lakes".	1	2	3
"That these lakes are part of the national heritage."	1	2	3

GO TO QUESTION C-5

C-4. [ONLY FOR THOSE WHO WOULD PAY] **Finally, for these reasons** [SHOW CARD C-4, INDICATE REASONS] **please tell me whether they were either not relevant to you** [INDICATE]**, or decreased the amount you would otherwise have paid** [INDICATE] **or increased the amount you would otherwise have paid** [INDICATE]**.**

[CIRCLE THE CORRECT RESPONSE NUMBER]

Reason	Was not relevant	Decreased the amount I would pay	Increased the amount I would pay
"The distance to the lakes from where I live."	1	2	3
"My responsibility for improving the water quality in these lakes".	1	2	3
"That these lakes are part of the national heritage."	1	2	3

QUESTIONS FOR ALL RESPONDENTS

C-5. **You have now looked at a series of possible considerations but were there any other things that you considered when you were thinking about how much the scheme to lime L lakes was worth to you?**

……

……

……

C-6. **When you were thinking about how much the scheme to lime H lakes was worth to you, did you consider anything other than the things you thought about in respect of the scheme to lime L lakes? Or did you change your way of thinking about the issue?**

……

……

……

D. CHOICE QUESTIONS

WE HAVE THE FOLLOWING ATTRIBUTES AND LEVELS:

ATTRIBUTE	*LEVELS*	*NOTES*
REFERENCE LEVEL (OUTCOME OF DO NOTHING STRATEGY)	*pFI (p=1, 0.75, 0.25, 0)*	*THIS WILL NOT VARY WITHIN SUBJECT, ONLY ACROSS SUBJECTS (FOR SIMPLICITY / CREDIBILITY)*
POLICY OUTCOME	*NC, PIA*	*WE MAY BE ABLE TO VARY THIS WITHIN SUBJECT - COMMENTS RE TIME, CREDIBILITY, ETC.*
No. OF LAKES	*5, 40, 200, 360, 400*	
COST (INCREASE IN ANNUAL ELECTRICITY BILL)	*5 AMOUNTS*	*WILL GUESS AT FIRST AND THEN REVISE QUICKLY AS CV INFORMATION COMES IN*

[VERSION FOR P=1]

Now, because we are uncertain about the costs of the liming schemes, it is possible that the numbers of lakes involved might be different from those we've just looked at. To find out what you think about these possibilities, I'm going to ask you to choose between schemes for liming different numbers of lakes, each with a different cost in terms of increases to your electricity bill. You can also choose to have neither of these schemes in which case your bill will not increase but the level of acidity will rise to here [INDICATE 'FUTURE LEVEL', FOURTH ROW ON WATER ACIDITY LADDER] **and fish and other plants and animals would be affected as shown.** [LEAVE THE WATER ACIDITY LADDER CLEARLY VISIBLE THROUGHOUT ALL CHOICE QUESTIONS].

[VERSION FOR 0<P<1]

Now, because we are uncertain about the costs of the liming schemes, it is possible that the numbers of lakes involved might be different from those we've just looked at. To find out what you think about these possibilities, I'm going to ask you to choose between schemes for liming different numbers of lakes, each with a different cost in terms of increases to your electricity bill. You can also choose to have neither of these schemes in which case your bill will not increase but the level of acidity may rise to here [INDICATE 'POSSIBLE FUTURE LEVEL', FOURTH ROW ON WATER ACIDITY LADDER] **in which case fish and other plants and animals would be affected as shown.** [LEAVE THE WATER ACIDITY LADDER CLEARLY VISIBLE THROUGHOUT ALL CHOICE QUESTIONS].

[ALL VERSIONS READ THE FOLLOWING]:

When thinking about these choices, as I said earlier, some people might be willing to pay for these schemes, while others might not, and please remember that any choice which increased your electricity bills would mean that that money would not then be available for other purchases you would rather spend your money on.

NOTE THAT THERE ARE TEN CHOICE QUESTIONS IN TOTAL (INCLUDING TWO DOMINATED CHOICES PROVIDING CONSISTENCY CHECKS). AS THIS IS TOO MANY FOR A SINGLE RESPONDENT THESE HAVE BEEN DIVIDED INTO TWO SETS OF FIVE (EACH INCLUDING ONE DOMINATED CHOICE). BELOW ARE THE FIRST SET OF FIVE CHOICES AFTER WHICH THE SECOND SET ARE PRESENTED.

CHOICE QUESTIONS – SET A

So in this first choice [SHOW CARD D-1A] **Scheme A** [INDICATE TOP CELL OF THIS COLUMN] **would involve liming 400 lakes** [INDICATE] **ensuring that acidity in these lakes did not rise above its current level so that there are no effects on fish or other plants and animals over the next 10 years. This would cost you an extra £8 per year on your electricity bill for 10 years.**

Under Scheme B [INDICATE TOP CELL OF THIS COLUMN] **200 lakes would be limed** [INDICATE] **again ensuring that acidity in these lakes did not rise above its current level for 10 years. This would cost you an extra £1 per year on your electricity bill for 10 years**.

Alternatively neither scheme could be implemented [INDICATE 'DO NOTHING' COLUMN] **so that no lakes are limed** [INDICATE]**. This results in higher acidity and effects on fish, plants and animals as discussed. But there would be no increase in your electricity bill.**

OK, so just ask yourself "which out of Scheme A, Scheme B or the Do Nothing option would I choose?" [TICK APPROPRIATE BOX]**.**

- Question D-1A

	Scheme A	Scheme B	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	400	200	0
Cost to you (increase in your electricity bill over a year)	£8	£1	£0
	Choose Scheme A	Choose Scheme B	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

Fine, here is another choice [SHOW CARD D-2A]. **Here Scheme C** [INDICATE TOP CELL OF THIS COLUMN] **would involve liming 40 lakes** [INDICATE] **and would cost you an extra £5 per year. Alternatively under Scheme D** [INDICATE TOP CELL OF THIS COLUMN] **360 lakes would be limed** [INDICATE] an**d this would cost you an extra £8 per year. As before, there is the option of doing nothing** [INDICATE 'DO NOTHING' COLUMN].

Which of these would you choose? [TICK APPROPRIATE BOX]**.**

• Question D-2A	Scheme C	Scheme D	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	40	360	0
Cost to you (increase in your electricity bill over a year)	£5	£8	£0
	Choose Scheme C	Choose Scheme D	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

OK, there are just a few more of these cards. Here is the first [SHOW CARD D-3A]**. Scheme E** [INDICATE] **involves liming 400** [INDICATE] **lakes at a cost of £1** [INDICATE] **while Scheme F** [INDICATE] **involves liming 360** [INDICATE] **lakes at a cost of £5** [INDICATE]**. Alternatively we could Do Nothing** [INDICATE].

Which of these would you choose? [TICK APPROPRIATE BOX]**.**

• Question D-3A	Scheme E	Scheme F	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	400	360	0
Cost to you (increase in your electricity bill over a year)	£1	£5	£0
	Choose Scheme E	Choose Scheme F	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

[SHOW CARD D-4A]**. Here, Scheme G** [INDICATE] **involves liming 5** [INDICATE] **lakes at a cost of £8** [INDICATE] **while Scheme H** [INDICATE] **involves liming 40** [INDICATE] **lakes at a cost of £12** [INDICATE]**. Alternatively we could Do Nothing** [INDICATE].

Which of these would you choose? [TICK APPROPRIATE BOX]**.**

- Question D-4A

	Scheme G	Scheme H	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	5	40	0
Cost to you (increase in your electricity bill over a year)	£8	£12	£0
	Choose Scheme G	Choose Scheme H	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

And this is the last of these cards. [SHOW CARD D-5A]**. Here, Scheme I** [INDICATE] **involves liming 5** [INDICATE] **lakes at a cost of £5** [INDICATE] **while Scheme J** [INDICATE] **involves liming 200** [INDICATE] **lakes at a cost of £12** [INDICATE]**. Alternatively we could Do Nothing** [INDICATE].

Which of these would you choose? [TICK APPROPRIATE BOX]**.**

- Question D-5A

	Scheme I	Scheme J	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	5	200	0
Cost to you (increase in your electricity bill over a year)	£5	£12	£0
	Choose Scheme I	Choose Scheme J	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CHOICE QUESTIONS – SET B

So in this first choice [SHOW CARD D-1B] **Scheme A** [INDICATE TOP CELL OF THIS COLUMN] **would involve liming 200 lakes** [INDICATE] **ensuring that acidity in these lakes did not rise above its current level so that there are no effects on fish or other plants and animals over the next 10 years. This would cost you an extra £8 per year on your electricity bill for 10 years.**

Under Scheme B [INDICATE TOP CELL OF THIS COLUMN] **360 lakes would be limed** [INDICATE] **again ensuring that acidity in these lakes did not rise above its current level for 10 years. This would cost you an extra £12 per year on your electricity bill for 10 years**.

Alternatively neither scheme could be implemented [INDICATE 'DO NOTHING' COLUMN] **so that no lakes are limed** [INDICATE]**. This results in higher acidity and effects on fish, plants and animals as discussed. But there would be no increase in your electricity bill.**

OK, so just ask yourself "which out of Scheme A, Scheme B or the Do Nothing option would I choose?" [TICK APPROPRIATE BOX]**.**

• Question D-1B	Scheme A	Scheme B	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	200	360	0
Cost to you (increase in your electricity bill over a year)	£8	£12	£0
	Choose Scheme A	Choose Scheme B	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

Fine, here is another choice [SHOW CARD D-2B]. **Here Scheme C** [INDICATE TOP CELL OF THIS COLUMN] **would involve liming 400 lakes** [INDICATE] **and would cost you an extra £5 per year on your electricity bill. Alternatively under Scheme D** [INDICATE TOP CELL OF THIS COLUMN] **360 lakes would be limed** [INDICATE] **and this would cost you an extra £1 per year. As before there is the option of doing nothing** [INDICATE 'DO NOTHING' COLUMN]**.**

Which of these would you choose? [TICK APPROPRIATE BOX]**.**

- Question D-2B

	Scheme C	Scheme D	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	400	360	0
Cost to you (increase in your electricity bill over a year)	£5	£1	£0
	Choose Scheme C	Choose Scheme D	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

OK, there are just a few more of these cards. Here is the first [SHOW CARD D-3B]**. Here, Scheme E** [INDICATE] **involves liming 5** [INDICATE] **lakes at a cost of £12** [INDICATE] **while Scheme F** [INDICATE] **involves liming 40** [INDICATE] **lakes at a cost of £8** [INDICATE]**. Alternatively we could Do Nothing** [INDICATE].

Which of these would you choose? [TICK APPROPRIATE BOX]**.**

- Question D-3B

	Scheme E	Scheme F	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	360	40	0
Cost to you (increase in your electricity bill over a year)	£5	£8	£0
	Choose Scheme E	Choose Scheme F	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

[SHOW CARD D-4B]**. Here, Scheme G** [INDICATE] **involves liming 40** [INDICATE] **lakes at a cost of £1** [INDICATE] **while Scheme H** [INDICATE] **involves liming 400** [INDICATE] **lakes at a cost of £12** [INDICATE]**. Alternatively we could Do Nothing** [INDICATE].

Which of these would you choose? [TICK APPROPRIATE BOX]**.**

• Question D-4B	Scheme G	Scheme H	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	40	400	0
Cost to you (increase in your electricity bill over a year)	£1	£12	£0
	Choose Scheme G	Choose Scheme H	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

And this is the last of these cards. [SHOW CARD D-5B]**. Here, Scheme I** [INDICATE] **involves liming 200** [INDICATE] **lakes at a cost of £5** [INDICATE] **while Scheme J** [INDICATE] **involves liming 5** [INDICATE] **lakes at a cost of £1** [INDICATE]**. Alternatively we could Do Nothing** [INDICATE].

Which of these would you choose? [TICK APPROPRIATE BOX]**.**

• Question D-5B	Scheme I	Scheme J	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level ensuring no effects on fish, etc. (out of a total of 400)	200	5	0
Cost to you (increase in your electricity bill over a year)	£5	£1	£0
	Choose Scheme I	Choose Scheme J	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

E. SOCIO-ECONOMIC QUESTIONS

To finish off, I just have a few more questions about your background. These will only be used for statistical purposes to see if we have interviewed a fair range of people and please remember that all of these answers are completely confidential.

E-1. PLEASE RECORD RESPONDENT'S GENDER: [CIRCLE CODE NUMBER]

Female	0
Male	1

E-2. **Can could you tell me your full post code?** (This is simply to see if we have a representative spread of people across the country. Note that we are not asking for their house number and they will not be receiving any mail)

(Get full postcode) | | | | | | | | |

IF RESPONDENTS ARE INTERVIEWED AT HOME THEN GO TO QUESTION E-4.

Alternatively, if you do not know your full post code could you tell me your approximate address ignoring the house number and street name (typical examples are area in a city and that city name [not just city name], or village or nearest town. In all cases also elicit the county name).

Village or area within a

Town/City_____

Town/City_____

__

Country_____

__

E-3. **Roughly how far away is that?**

distance in miles | | | | |

E-4. **Could you tell me approximately how long you have lived in this area?**

years | | |

If less than one year where did they live previously?…….

E-5. **Could you tell me which letter** (SHOW CARD E-5) **corresponds to your age group?**

[CIRCLE LETTER]

LETTER	AGE IN YEARS
A	Under 18
B	18-25
C	26-35
D	36-45
E	46 – 55
F	56 – 60
G	61-65
H	66-75
I	76 +

E-6. **How many people are there in your household, including children and yourself?** [WRITE ANSWER IN BOX] ☐

E-7. **Of them, how many are 16 years of age or younger?** ☐

[WRITE ANSWER IN BOX]

E-8. **Which of these educational levels have you completed?**

[SHOW CARD E-8 CIRCLE ALL THAT APPLY]

Primary School (up to 10 yrs)	1
Secondary School (up to 16 yrs)	2
Upper Secondary School (up to 18 yrs)	3
University degree or equivalent	4
Professional qualification	5

E-9. **What is your current employment status?**

[SHOW CARD E-9 AND CIRCLE ONE CODE]

Self-employed	1
Employed full-time	2
Employed part-time	3
Student	4
Unemployed	5
Looking after the home full-time	6
Retired	7
Unable to work due to sickness or disability	8
Other (please specify)_____	9

E-10. **Looking at this card** [SHOW E-10 CARD] **could you tell me which letter best approximates your total household income before tax.**

[IF NECESSARY DO REASSURE THEM THAT ALL INFORMATION IS COMPLETELY CONFIDENTIAL AND THIS OS THE BEST INDICATOR OF WHETHER WE HAVE INTERVIEWED A REPRESENTATIVE RANGE OF PEOPLE]

PER YEAR	PER MONTH	
Up to £6,000 per year	Up to £500 per month	A
£6,001 to £12,000 per year	£501 - £1,000 per month	B
£12,001 - £18,000 per year	£1,001 - £1,500 per month	C
£18,001 - £24,000 per year	£1,501 - £2,000 per month	D
£24,001 - £30,000 per year	£2,001 - £2,500 per month	E
£30,001 - £36,000 per year	£2,501 - £3,000 per month	F
£36,001 - £42,000 per year	£3,001 - £3,500 per month	G
£42,001 - £48,000 per year	£3,501 - £4,000 per month	H
Over £48,000 per year	Over £4,000 per month	I
	Don't know	99
	Refused	9999

E-11. **Please take a look at this final card and tell me which, if any, of these organisations are you or other adults in your household members of?**

[SHOW CARD E-11, CIRCLE ALL THAT APPLY]

1	Any sports club
2	Any church/religious/charity group
3	School fund raising group
4	Scout / Guide group
5	Lions/Rotary etc
6	Women's Institute
7	Climbing Club
8	Angling Club
9	Ramblers Association
10	National Trust
11	RSPB
12	Greenpeace / Friends of the Earth
13	World Wide Fund for Nature
14	Other local or County nature trust, society or volunteers
15	Other social group (please specify)_____
16	Other not covered above (please specify)_____

G. CLOSING

G-1. **That is the last of my questions. This survey will continue for several weeks. At the end of that time there is a possibility that my supervisor might have some follow up questions about which he would like to call you. Could you please give me a telephone number where you can be contacted and your first name. This will be kept strictly confidential and will not be given to anyone else.**

Telephone number

(| | | | | |) | | | | | | | | |

First name

| | | | | | | | | | | | | | | |

G-2. **We will in the near future be conducting some meetings to further discuss some of the issues in this survey. The meetings would only last for 1-2 hours and you would be paid for attending. Would you be interested in participating in such a meeting.**

[CIRCLE ONE ONLY]

1 = Yes/Yes depending on payment 2 = No

That's the end of the interview!

Thank you very much for your time and help, it is very much appreciated!

H. INTERVIEWER'S EVALUATION

NOT TO BE READ OUT TO RESPONDENT – TO BE COMPLETED AFTER INTERVIEW

H-1. How well did the respondent understand what he or she was asked to do in the valuation questions? [CIRCLE ONE ONLY]

Understood completely	1
Understood a great deal	2
Understood somewhat	3
Understood a little	4
Did not understand very much	5
Did not understand at all	6

Other (specify)_____

H-2. How serious was the consideration given by the respondent to arrive at a value for the water quality improvement schemes? [CIRCLE ONE ONLY]

Extremely serious	1
Very serious	2
Somewhat serious	3
Slightly serious	4
Not at all serious	5

H-3. For interviews at home please record property type (CIRCLE ALL THAT APPLY; e.g. detached & bungalow)

Flat in multiple occupancy building	1
Terrace	2
End terrace	3
Semi-detached	4
Detached	5
Bungalow	6

Other (specify)_____

Please add any other comments you feel would help us regarding this interview

……
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NOW COMPLETE THE REMAINDER OF THE FRONT COVER

The following pages reproduce the showcards used in the survey (with the exception of the colour photographs used which are omitted for reproduction purposes). Where necessary the size of showcards has been reduced to fit the format of this working paper.

CARD A-1,2

1	2	3	4	5
Not an important issue in the UK				**A very important issue in the UK**

‘MAP’ (LOCATION OF MOUNTAIN LAKES IN EUROPE)

PHOTO CARD 1 ‘LAKE PICTURES’

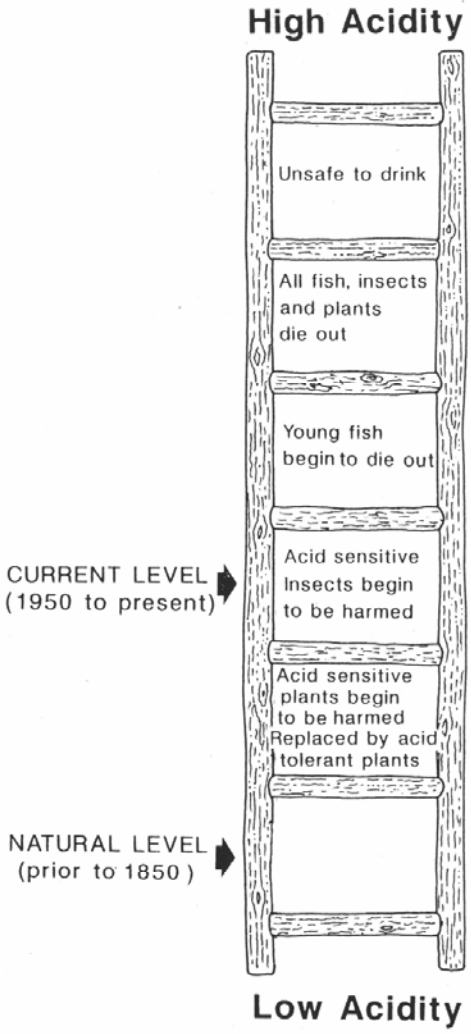
PHOTO CARD 2 ‘PLANTS AND ANIMALS’

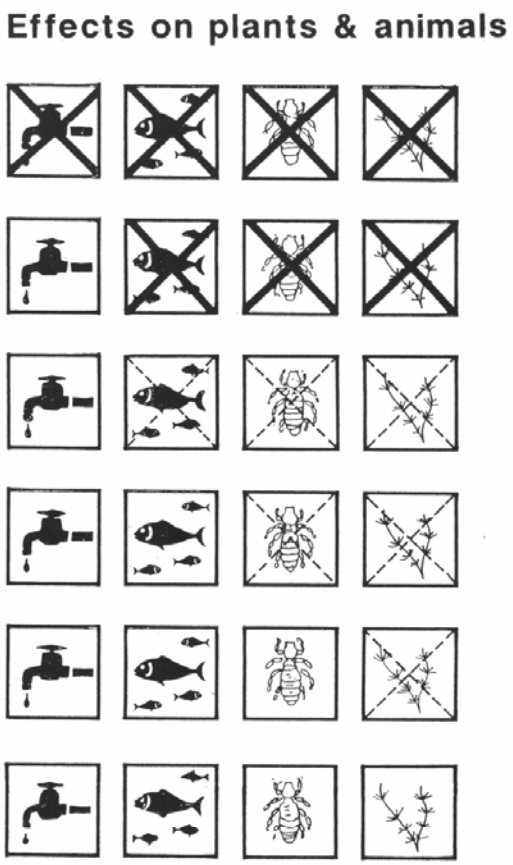
CARD B-1

Which of these statements best describes how much you knew about these mountain lakes in the Scottish Highlands before today?

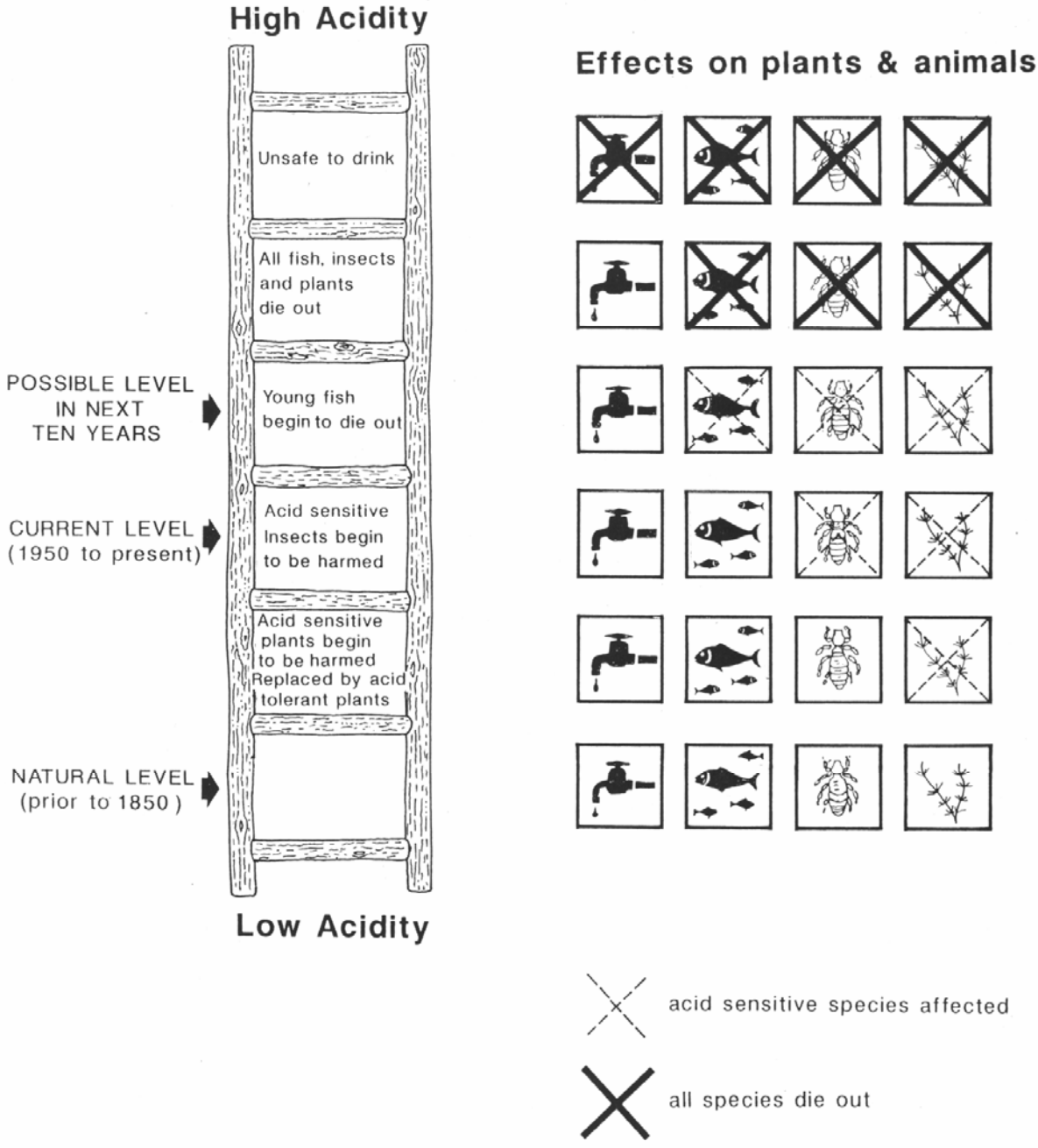
1. I had never heard of them.
2. I had heard of them but never visited any of them.
3. I had heard of them and hope to visit them one day.
4. I had visited at least one of them.
5. I don't know

WATER ACIDITY LADDER

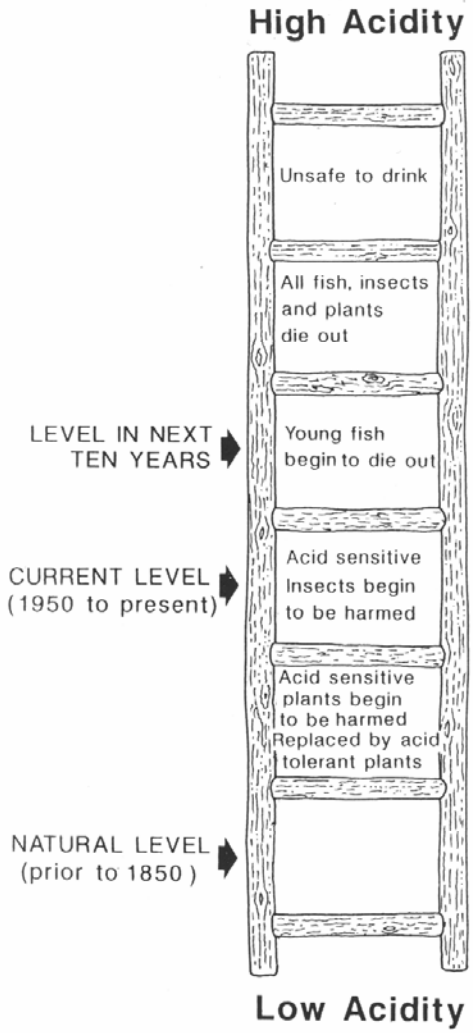




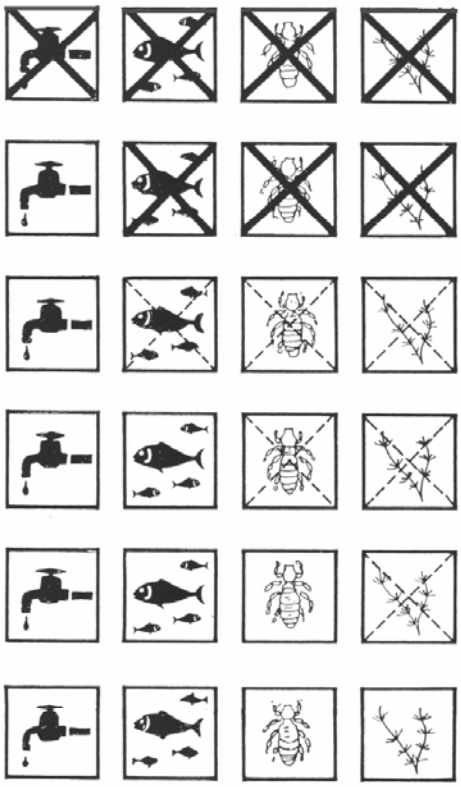
WATER ACIDITY LADDER

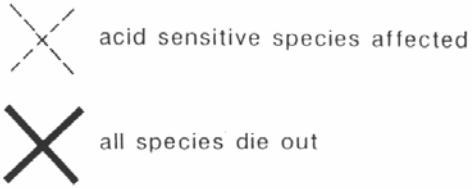


WATER ACIDITY LADDER



Effects on plants & animals





CARD B-2

1	2	3	4	5
Not at all concerned		**Concerned**		**Very concerned**

Scheme to lime [L] lakes

Amount (each year)	Prepared to pay ? ✔= yes ✗ = no
0	
20p	
40p	
75p	
£1	
£1.25	
£1.50	
£1.75	
£2	
£2.50	
£3	
£3.50	
£4	
£4.50	
£5	
£6	
£7	
£8	
£9	
£10	
£12	
£14	
£16	
£18	
£20	
£24	
£28	
£32	
£36	
£40	
£48	
£60	
£80	
£100	
more than the above	

Scheme to lime [H] lakes

Amount (each year)	Prepared to pay ? ✔= yes ✗ = no
0	
20p	
40p	
75p	
£1	
£1.25	
£1.50	
£1.75	
£2	
£2.50	
£3	
£3.50	
£4	
£4.50	
£5	
£6	
£7	
£8	
£9	
£10	
£12	
£14	
£16	
£18	
£20	
£24	
£28	
£32	
£36	
£40	
£48	
£60	
£80	
£100	
more than the above	

CARD C-1

Reason	Was not relevant	Somewhat relevant	Very relevant
"These lakes are of no concern to me".	1	2	3
"What I say won't affect whether or not the scheme goes ahead".	1	2	3
"The Government can't be trusted".	1	2	3
"The effects of the pollution might not be as bad as described".	1	2	3
"Liming the lakes might not achieve the intended results".	1	2	3
"Other things are more important".	1	2	3

CARD C-2

Reason	Was not relevant	Somewhat relevant	Very relevant
"I enjoy visiting the Highlands".	1	2	3
"I might enjoy visiting the Highlands in the future".	1	2	3
"Other people enjoy visiting the Highlands".	1	2	3
"I should pay towards any good cause."	1	2	3
"I would like the lakes to be returned to their natural state".	1	2	3
"I like showing that I care about the environment"	1	2	3
"Lakes and the life in them have a right to exist."	1	2	3

CARD C-3

Reason	Was not relevant	Made me less inclined to pay	Made me more inclined to pay
"The distance to the lakes from where I live."	1	2	3
"My responsibility for improving the water quality in these lakes".	1	2	3
"That these lakes are part of the national heritage."	1	2	3

CARD C-4

Reason	Was not relevant	Decreased the amount I would pay	Increased the amount I would pay
"The distance to the lakes from where I live."	1	2	3
"My responsibility for improving the water quality in these lakes".	1	2	3
"That these lakes are part of the national heritage."	1	2	3

CARD D-1A

	Scheme A	Scheme B	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	400	200	0
Cost to you (increase in your electricity bill over a year)	£1	£1	£0
	Choose Scheme A	Choose Scheme B	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-2A

	Scheme C	Scheme D	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	40	360	0
Cost to you (increase in your electricity bill over a year)	£5	£8	£0
	Choose Scheme C	Choose Scheme D	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-3A

	Scheme E	Scheme F	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	400	360	0
Cost to you (increase in your electricity bill over a year)	£1	£5	£0
	Choose Scheme E	Choose Scheme F	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-4A

	Scheme G	Scheme H	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	5	40	0
Cost to you (increase in your electricity bill over a year)	£8	£12	£0
	Choose Scheme G	Choose Scheme H	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-5A

	Scheme I	Scheme J	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	5	200	0
Cost to you (increase in your electricity bill over a year)	£5	£12	£0
	Choose Scheme I	Choose Scheme J	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-1B

	Scheme A	Scheme B	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	200	360	0
Cost to you (increase in your electricity bill over a year)	£8	£12	£0
	Choose Scheme A	Choose Scheme B	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-2B

	Scheme C	Scheme D	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	400	360	0
Cost to you (increase in your electricity bill over a year)	£5	£1	£0
	Choose Scheme C	Choose Scheme D	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-3B

	Scheme E	Scheme F	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	5	40	0
Cost to you (increase in your electricity bill over a year)	£12	£8	£0
	Choose Scheme E	Choose Scheme F	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-4B

	Scheme G	Scheme H	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	40	400	0
Cost to you (increase in your electricity bill over a year)	£1	£12	£0
	Choose Scheme G	Choose Scheme H	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD D-5B

	Scheme I	Scheme J	Do Nothing
Number of lakes limed and for which acidity does not increase above its current level, ensuring no effects on fish, etc. (out of a total of 400 lakes)	200	5	0
Cost to you (increase in your electricity bill over a year)	£5	£1	£0
	Choose Scheme I	Choose Scheme J	Choose to Do Nothing
Which would you choose? (*tick one box only*)			

CARD E-5

Could you tell me which letter corresponds to your age group?

LETTER	AGE IN YEARS
A	Under 18
B	18 - 25
C	26 - 35
D	36 - 45
E	46 - 55
F	56 - 60
G	61 - 65
H	66 - 75
I	76 +

CARD E-8

Which of these educational levels have you completed?

Primary School (up to 10 yrs)	1
Secondary School (up to 16 yrs)	2
Upper Secondary School (up to 18 yrs)	3
University degree or equivalent	4
Professional qualification	5

CARD E-9

What is your current employment status?

Self-employed	1
Employed full-time	2
Employed part-time	3
Student	4
Unemployed	5
Looking after the home full-time	6
Retired	7
Unable to work due to sickness or disability	8
Other (please specify)	9

CARD E-10

Which letter best approximates your total household income before tax?

	PER YEAR	PER MONTH
A	Up to £6,000 per year	Up to £500 per month
B	£6,001 to £12,000 per year	£501 - £1,000 per month
C	£12,001 - £18,000 per year	£1,001 - £1,500 per month
D	£18,001 - £24,000 per year	£1,501 - £2,000 per month
E	£24,001 - £30,000 per year	£2,001 - £2,500 per month
F	£30,001 - £36,000 per year	£2,501 - £3,000 per month
G	£36,001 - £42,000 per year	£3,001 - £3,500 per month
H	£42,001 - £48,000 per year	£3,501 - £4,000 per month
I	Over £48,000 per year	Over £4,000 per month

CARD E-11

Which, if any, of these organisations are you or adults in your household members of?

1	Any sports club
2	Any church/religious/charity group
3	School fund raising group
4	Scout / Guide group
5	Lions/Rotary etc
6	Women's Institute
7	Climbing Club
8	Angling Club
9	Ramblers Association
10	National Trust
11	RSPB
12	Greenpeace / Friends of the Earth
13	World Wide Fund for Nature
14	Local or County nature trust, society or volunteers
15	Other social group (please specify)
16	Other not covered above (please specify)

Annex 2: Scope sensitivity of WTP estimates

The following tables detail estimated WTP and corresponding confidence intervals for differing numbers of lakes improved under the two valuation scenarios.

Table A2.1: Scope sensitivity of WTP estimates: from "WTP to avoid a loss" scenario

					95% Confidence interval	
Sample location	'Low' lake number	'High' lake number	mean WTP	std. err.	Lower	Upper
English	5		£11.75	£1.97	£7.89	£15.60
English	40		£16.39	£1.73	£12.99	£19.78
English	200		£19.98	£1.96	£16.14	£23.82
English	360		£21.29	£2.12	£17.14	£25.44
English		40	£16.54	£2.39	£11.86	£21.22
English		200	£20.64	£2.04	£16.64	£24.63
English		360	£22.13	£2.12	£17.99	£26.28
Scot_off	5		£16.13	£1.55	£13.10	£19.16
Scot_off	40		£20.77	£1.27	£18.28	£23.26
Scot_off	200		£24.36	£1.59	£21.24	£27.48
Scot_off	360		£25.67	£1.79	£22.17	£29.18
Scot_off		40	£24.31	£1.93	£20.53	£28.09
Scot_off		200	£28.41	£1.49	£25.49	£31.33
Scot_off		360	£29.91	£1.60	£26.77	£33.05
Onsite	5		£18.30	£2.10	£14.19	£22.41
Onsite	40		£22.94	£1.72	£19.58	£26.30
Onsite	200		£26.53	£1.83	£22.95	£30.11
Onsite	360		£27.84	£1.95	£24.02	£31.67
Onsite		40	£23.91	£2.50	£19.01	£28.81
Onsite		200	£28.01	£2.02	£24.06	£31.96
Onsite		360	£29.50	£2.04	£25.51	£33.50

Table A2.2: Scope sensitivity of WTP estimates: from "WTP for a gain" scenario[40]

Sample location	'Low' lake number	'High' lake number	mean WTP	std. err.	95% Confidence interval Lower	Upper
English	5		£16.39	£3.62	£9.30	£23.48
English	40		£17.59	£3.38	£10.97	£24.21
English	200		£18.52	£3.55	£11.55	£25.48
English	360		£18.86	£3.69	£11.62	£26.09
English		40	£23.40	£4.63	£14.33	£32.47
English		200	£24.13	£4.22	£15.85	£32.40
English		360	£24.39	£4.32	£15.93	£32.85
Scot_off	5		£20.17	£2.61	£15.05	£25.30
Scot_off	40		£21.37	£2.20	£17.06	£25.69
Scot_off	200		£22.30	£2.42	£17.57	£27.04
Scot_off	360		£22.64	£2.60	£17.55	£27.73
Scot_off		40	£27.35	£3.46	£20.56	£34.14
Scot_off		200	£28.08	£2.75	£22.69	£33.47
Scot_off		360	£28.35	£2.84	£22.78	£33.91
Onsite	5		£20.29	£2.35	£15.69	£24.89
Onsite	40		£21.49	£1.76	£18.04	£24.94
Onsite	200		£22.42	£1.93	£18.63	£26.21
Onsite	360		£22.76	£2.13	£18.59	£26.93
Onsite		40	£24.54	£3.16	£18.34	£30.74
Onsite		200	£25.27	£2.19	£20.97	£29.57
Onsite		360	£25.53	£2.24	£21.14	£29.93

[40] As there was insufficient sample to be sure that the change in probability level did not affect WTP, this table omits responses from the p=0.75 sub-sample.