ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

ΤΜΗΜΑ ΔΙΕΘΝΩΝ ΚΑΙ ΕΥΡΩΠΑΙΚΩΝ ΟΙΚΟΝΟΜΙΚΩΝ ΣΠΟΥΔΩΝ

WETLAND MANAGEMENT IN POLAND: A CHOICE EXPERIMENT

ΣΥΡΙΓΟΣ ΝΙΚΟΛΑΟΣ

ΑΡ ΜΗΤΡ :4050025

ΕΠΙΒΛΕΠΩΝ ΚΑΘΗΓΗΤΗΣ: ΦΟΙΒΗ ΚΟΥΝΤΟΥΡΗ

ΑΘΗΝΑ, 2007

CONTENTS

i Introduction

Wetlands are among Earth's most valuable and sensitive ecosystems. They provide habitats for many species of plants and animals, but they also perform several functions useful for human communities such as improved water and air quality, better climate conditions and several recreational opportunities. Due to several industrial, agricultural or commercial reasons the environmental value of such wetlands has been overlooked and as a result, these areas have been drained, polluted and in general they have lost their potential.

Lately, there has been interest, in EU policies and projects level, regarding the protection and preservation of the wetlands. The growing numbers of valuation projects contribute to the recognition of the wetlands' value to our lives and our planet. In this thesis, we will conduct a Choice Experiment in Poland. To my knowledge, this is the first such study in Poland and we will focus on a wetland created by the overflow of the Biala Przemsza river, in the area of Sosnowiec. This wetland is imminently threatened by industrial activities in the nearby area. Due to the danger of floods, the mining industries are compelled to fill the wetland area with waste rock, effectively destroying the habitats of unique species of birds and animals that have taken refuge there.

The purpose of this survey is to provide vital information regarding the wetland's value to the locals and what are they willing to pay in order to preserve it or what kind of compensation are they willing to accept in they are affected by floods.

The structure of the thesis is as follows:

ii. Structure of the thesis

In the first part of the thesis, after a short literature review, I present case study as well as the fundamentals of the choice experiment. When applying the discrete choice experiment in the field of environmental economics (or any other field of economics), it is essential to understand the theoretical foundation of the method. The discrete choice experiment is founded in random utility theory (RUT) and is consistent with Lancaster's theory of characteristics and neoclassic economics. RUT plays a key role in the understanding and interpretation of the behavioural processes examined in the Discrete Choice Experiments.

The application of a DCE requires many issues to be taken into consideration, such as the perspective of the DCE, decisions about attributes and levels, experimental design, data collection and so forth. The questionnaire design issues we faced are discussed in section 2. The DCE belongs to the class of stated preference methods which implies that actual individual behaviour is not observed, but instead individuals are asked to consider a hypothetical scenario. The sample must be carefully chosen as it is often for the interviewees to present several biases towards the proposed research and thus providing inconsistent data. The structure of the questionnaire can also have an effect on people, positive or negative, thus rendering the research invalid. All these issues are dealt with in the second section.

The descriptive statistics, econometric analysis and tests in order to verify the significance of our estimators follow in section 3. This is the last section of the thesis, which includes the policy implications and the results of the case study.

Section 1

1.1 Groundwater quality literature review

Edwards (1988) estimated WTP for protection of groundwater from nitrates in Cape Cod, Massachusetts, obtaining mean WTP values of $363 to $1437 per household per year. Jordan and Elnagheeb (1993) also focused on nitrate contamination; for the state of Georgia, they obtained mean WTP estimates of $120.84 to $148.56 per household per year. Poe (1993) estimated mean WTP values of $224.72 to $684.95 per household per year for protection from nitrates in Wisconsin. Sun (1990) examined WTP values for protection from nitrates and pesticides, obtaining a mean WTP value of $641 per household per year in Doughtery Co., GA. McClelland et al. (1993) estimated a mean WTP of $146.76 per household per year for protection of groundwater contaminated by landfills for US households. Schultz and Lindsay (1990) obtained a WTP of $129 per household per year in Dover, New Hampshire for protection of groundwater from general contamination. Powell (1991) elicited WTP values for groundwater resources in the Northeast. In the states of Massachusetts, New York and Pennsylvania, he obtained mean WTP estimates of $55.79 to $81.86 per household per year. Caudill (1992) obtained mean WTP estimates of $45.07 to $64.52 in Michigan in an analysis of the benefits of groundwater protection.

Boyle, Poe and Bergstrom (1994) conducted a meta-analysis of the eight groundwater quality studies discussed above; the econometric techniques used in meta-analysis allow for the control of the factors that differ between the studies. The point estimates from each study are treated as observations, and used as the dependent variable; this resulted in a sample of 52 WTP estimates. The independent variables attempted to capture the environmental commodity, respondent characteristics, and methodological procedures. The authors caution that the estimated coefficients should not be viewed as exact marginal values, but are more generally useful due to the information provided by their signs and significance. The authors note that their analysis is limited by the lack of a consistent definition of groundwater contamination across the eight studies. However, their results show that the following variables positively and significantly affect willingness-to-pay for groundwater quality: the mention of nitrates as a potential contaminant, an increase in the probability of contamination, income level of respondents, and the mention of a possible shortfall in the water supply due to contamination.

Stevens, Barrett and Willis (1997) attempted to determine both use and non-use values associated with groundwater protection in Massachusetts using CE analysis techniques. Their 1995 mail survey of western Massachusetts residents presented information about five options for groundwater protection: an aquifer protection district, a town-wide water treatment facility, a private pollution control device, the purchasing of bottled water, and doing nothing (maintaining the status quo scenario). These options were characterized by three attributes: the method of protection, cost to the individual, and length of payment. Three types of CE models were estimated: traditional CE (where the rating for a particular program is the dependent variable), a ratings difference model, and a binary response model. The estimation results indicate that the binary response model produced lower mean WTP values than the ratings difference or traditional models. In addition, respondents were willing to pay more for the aquifer protection program (regardless of model specification), suggesting that the respondents were willing to pay extra if the groundwater source was protected, which may be indicative of significant non-use value for groundwater protection. However, this study did not specify the type of contaminants the various protection options would address, nor did it specify the status quo level of risk, or the specific risk reduction each option could achieve.

Kuriyama (1998) conducted a study on an internationally important national park in Hokkaido, Japan. The Kushiro Wetland National Park covers 26,861 ha and is endowed with thousands of animals, birds, and plant species. The researcher attempted to measure the environmental value of the ecosystem in the wetland using Choice Experiments (CEs) and Conjoint Analysis (CA). By talking 845 residents and visitors, the researcher shows that protecting the wetland and all lands including forests around the wetland has a significant economic value of 16,414 yen/year/household or an aggregate amount of 36 billion yen. An internal scope insensitivity test also shows that it is consistent with economic theory in that the WTP changes with the change in the quantity of the economic good under discussion.

Hope, et al., 2005a & b, designed and implemented a Choice Experiment in the Kolans watershed, in India. The aim of this research was to identify incentives that worked for farmers and wetlands by experimental exploration of a range of organic farming adoption scenarios that would reduce agro-chemical runoff and leaching into surface and groundwater sources. Results would allow any

implementation strategy to more fully respond to the opportunities and constraints of farmers committing agricultural land to organic farming across a range of likely scenarios.

Hasler, Lundhede, Martinsen, Neye and Schou perform a CE in Denmark in order to evaluate the effects on both drinking water quality and the quality of surface water recipients, expressed by the quality of the living conditions for wild animals, fish and plants in lakes and waterways. They find that the WTP for protected groundwater which is naturally clean and not in the need for purification, is 245 EUR/year, which should be interpreted as an additional payment to the average water bill for a household, being approximately 530 EUR/year. The WTP for good conditions for flora and fauna in waterways and lakes is 152 DKK/year, and the WTP for purified water is 114 DKK/year. It is very important that their findings support the current Danish groundwater policy.

As far as the risk of flooding is concerned, there are interesting CEs carried out by Holway & Burby, Eves and Eves & Brown. Holway & Burby (1990) estimated a loss of 18% of the land value (not real estate!) in areas with high risks compared with low risk areas. The moment real estate is introduced on a larger scale than scattered farms, the estimated loss is 7%. Eves (2002) compared house sales data from flood-prone versus flood-free areas over a 17-year interval and found that the difference had been decreasing, with the peak a 22.4% difference in 1991. Eves & Brown (2002) estimated an added value of 10% for nearby safe rivers and a loss of 10% for nearby risky rivers.

This concludes the literature review and I am proceeding to the case study

1.2 The Polish Case Study

For our research, we focused in the region of Upper Silesia, Poland. Our local partner was the Cracov University of Technology. The problem is defined as follows. Mining activity in this area has resulted in land deformation. To add to this problem, all the mining sites are located near rivers and effectively, the entire area is rendered vulnerable to floods, even in the case of light rainfalls. During the floods of 1997, most of the afflicted areas were near active or former mining sites, where the river beds had been deformed. This kind of deformation can lead to exceeding full bank stage, even during normal conditions. The current regulation dictates that the mining corporations have to refund the locals in case of floods.

Flood risk caused or intensified by mining activities occurs especially in vicinities of Klodnica valley (upstream from Gliwice) in the area of city Knurów situated near Bierawka valley, in Bobrek catchment (city Sosnowiec), in mining subsidence areas of villages Kopania, Bijasowice and city Bieruń, in Sławków (vicinities of river Biała Przemsza), in commune Bobrowniki (vicinities of river Brynica), commune Wojkowice (near rivers Jaworznik and Wielonka), city Czeladź (near river Brynica). There are also numerous areas at risk of local flood events caused by mining activities in Katowice (river Rawa), Bytom, Gieraltowice and Dabrowa Górnicza, to name a few. Approximately 50000 people can suffer from such a flood.

Fifteen years ago, the Polish government decided to deal with this problem. Barriers of concrete and iron were raised in several points of the river in order to protect nearby communities. The mining industries were also forced to create 'spoil hips' in order to protect the mining sites from floods. However, this regulation had a twofold negative effect. Using concrete to form barriers, in conjunction with the deformed river beds in certain sectors of the rivers, created a much faster water flow and an imminent threat to the following river sector. Also, concrete and vertical barriers prohibited locals from accessing the water. Polish people seem to have a special bond with the water, as they frequently enjoy going fishing, boating or washing their clothes in the river. Another negative effect was that the concrete and the spoil hips deprived nearby fauna from the watering it required, leading to diminishing levels of several plant species.

In the years that followed the above regulation, there have been severe floods. Not mentioning the obvious negative effects of these incidents, we will focus on the positive ones. In the flooded regions, soil watering has increased and new, unique ecological habitats have been formed. New species of both animals and plants live in these habitats and ecological organizations argue that they should be protected. These new habitats are now of high recreational value to people living in the nearby cities

and they can be used for recreational activities (e.g. creation of a environmental park), which might render these areas an attractive tourism location in Poland.

Under the current regulation, the newly formed habitats will be filled with waste rock and as a result, obliterated. We should also stress out that destruction of these overflow lands is the cheapest way of action for the mining companies. It is obvious that there is a conflict among social, economic and ecological outcomes. The objective of our study was to understand and estimate in monetary values the locals' preferences with regard to the above conflict. We aim to find out if and how much are they willing to pay in order to preserve these habitats.

1.3 The Method

Passive value is the economic value arising from a change in environmental quality that is not reflected in any observable behavior. Since passive values are not reflected in any observable behavior, stated preference approaches are used for the elicitation of such values. The most common approaches are the Choice Experiment and the Contingent Valuation Method, the first being an extension of the second. We will be using the CE Method for a variety of reasons, both theoretic and empirical.

When compared to the CVM, the CE provides a richer description of the attribute trade-offs that individuals are willing to make and the welfare values it produces have smaller variances. CE modeling is based on Random Utility theory (McFadden, Ben-Akiva and Lerman). Rather than asking people to choose between a base case and a specific alternative, as in the CVM framework, CEs ask people to choose between cases that are described by attributes. These combinations comprise specific scenarios that are selected from the universe of the possible ones. Thus, CEs involve considerable effort in design, in development of the relevant scenarios.

As the CEs are based on attributes, they allow the researcher to value these attributes as well as the situational changes. The multiattribute evaluation information that is measured by the CEs could be elicited using repeated CVM questions. However a large number of CVM would make it difficult to maintain some degree of orthogonality in the design as well as carry out such a research. Moreover, CVM focuses on a precise scenario and attempts to gather information about the choices regarding the specific scenario. In contrast the CE approach attempts to understand the respondents' preferences over the attributes rather than the scenario itself. In this way, trade offs among a broader set of attributes can be elicited.

As far as the problems are concerned, CEs and CVM share the same difficulties. Issues such as information provision, survey design and survey administration are as important in both methods.

1.4 Random Utility Theory

The origins of probabilistic discrete choice modeling go back to the work of (Thurstone 1927) in psychometrics (*Law of Comparative Judgment*), in which an alternative *i* with true stimulus level is perceived with an error of $Vi + \varepsilon_i$. Thurstone proposed the modeling of individual choice as the outcome of a process in which the random variable is associated with each alternative, and the alternative with the greatest realization is the one selected (hence belonging to the second family of choice models). When the perceived stimuli are interpreted as levels of satisfaction, or utility, this can be interpreted as a model for economic choice in which the individual chooses the option yielding the greatest realization of utility (Anderson et al. 1991;McFadden 2001). Marchak introduced Thurstone's work into economics in 1960, by exploring the theoretical implications of choice probabilities for the maximization of utilities that contained random elements (named *Random Utility Models*, RUM). This idea was later taken up and further developed by other economists including Manski and McFadden (e.g. Manski 1977;McFadden 1974). Consider an individual who has to choose one alternative from a choice set of alternatives. Neoclassical economic theory supposes that the individual has perfect discriminatory power and unlimited information-processing capacity, allowing the individual to rank the alternatives in a well-defined and consistent manner. The individual can thus determine his or her best choice and will repeat this choice under identical circumstances (Anderson et al. 1991). The link with probabilistic choice theory arises from the researcher's lack of information about the individual's true utility function. Probabilistic choice theory is thus introduced not to reflect a lack of rationality in the individual, but to reflect a lack of information regarding the characteristics of the alternatives and/or the characteristics of the individual on the part of the researcher (ε_i) (Manski 1977). The researcher only observes that part of the utility that makes up the alternative. This implies that the utility function is deterministic from the individual's point of view and hence is in accordance with neoclassical economics. The indirect utility function is decomposed into a utility function that depends solely on factors that are observed by the researcher and another utility function that represents all the factors that influence the consumer's choice. Again

$$Ui = Vi + \varepsilon_i$$

and, for individual *n*, utility becomes $U_{in} = V_{in} + \varepsilon_{in}$

Ui is the true but unobservable (latent) utility for alternative *i*, *Vi* is the observable systematic component of utility, and ε_i is the factor unobservable to the researcher and treated as a random component (Hanemann 1984). *Vi* thereby becomes the explainable proportion of the variance in choice and εi the non-explainable. RUT assumes that the individual **acts rationally** and chooses the alternative with the highest level of utility - i.e. that the individual is a **utility-maximizer**. As the researcher cannot observe the individual's true utility function, a probabilistic utility function is used in the estimation. The most appropriate probabilistic choice model to apply depends on the assumptions made about the random parameter. This is discussed more fully later in this chapter. Assuming that the individual can choose between two alternatives, *i* and *j*, then the probability that alternative *i* is chosen is given by

$$Pi = \text{Prob}(Ui > Uj) = \text{Prob}(Vi + \varepsilon i > Vj + \varepsilon j) = \text{Prob}(Vi - Vj > \varepsilon i - \varepsilon j)$$
$$\square\ i \neq j$$

From this it can be seen that the higher the probability for choosing an alternative, the larger the difference in observed utility. Since probability is defined on a cardinal scale, so are the estimated utility scores (which is the reason why we obtain meaningful WTP estimates). The input of the model is the observed choices, while the output, i.e. what is to be estimated, is the difference in utility for the two alternatives, (*Vi–Vj*), characterized by the utility for each attribute. Every respondent makes a discrete choice and has chosen either alternative i or alternative *j*. As the choices are aggregated over individuals (taking personal characteristics into account, if possible), the total *observed per cent of the sample* that chooses alternative *i* is interpreted as the *probability* that *an individual* with specific personal characteristics chooses alternative *i*. Thus the choice is transformed to a continuous curve (sigmoid-shape depending on the distributional assumption of the error term) that characterizes the trade-off between the two alternatives. As the quality of the attributes in alternative *i* increases compared to alternative *j*, the probability converges towards 1. This is the same as saying that the probability of choosing alternative *i* increases as the difference in estimated utility between the two alternatives increases. The shape of the sigmoid curve ensures that changes in the utility difference when the individual is very uncertain about which alternative to choose, create large changes in the probabilities which means that the model is very sensitive to changes with probabilities of around 50%.

On the other hand, changes in the utility difference have little effect on the overall probability when the individual is more certain of his or her choice.
It follows from the above that the probabilities can be interpreted as *preference strengths* for each alternative. Consider a situation in which the probability of choosing alternative *i* is 50%. In this case the utility for each alternative will be the same, i.e. the difference in utility will be zero, and it is impossible to say which of the alternatives individual *n* will choose. No information is contained in this situation as the choice is interpreted as random. In conclusion, the interpretation of the probabilities is what makes it possible to achieve a cardinal utility scale. Such a cardinal scale is necessary to compare the achievable benefits, i.e. to transform the utilities into monetary welfare measures.
The random utility theoretical approach, formalized by Manski (e.g. Manski 1977) and further extended to the modeling framework by McFadden (e.g. McFadden 1974;McFadden 1980;McFadden 1986;McFadden & Train 2000), is in line with neoclassical consumer theory.

Manski (1973, Ben-Akiva & Lerman 1985) identifies four distinct sources of randomness:

- **Measurement errors and imperfect information** (i.e. when the data used to estimate the model parameters are not true measures of their theoretical counterparts)
- **Instrumental variables** (the use of closely related variables)
- **Unobserved attributes** (i.e. the choice of alternative is not only determined by the given attributes, but also by some underlying attributes)
- **Unobserved taste variation** (i.e. heterogeneity in preferences). Heterogeneity is a key element to randomness and implies that preferences differ among individuals; the researcher does not know which type of preferences an individual holds and thus cannot perfectly predict the choices made.

DCE draws upon Lancaster's economic theory of value (Lancaster 1966). This is an extension of the neoclassic consumer theory in that "*goods possess, or give rise to, multiple characteristics in fixed proportions and that it is these characteristics, not goods themselves, on which the consumer's preferences are exercised*" (Lancaster 1966). Lancaster's approach regards a unit of any good as a given bundle of attributes of characteristics (for example, a particular type of food will consist of specific flavors, calories, vitamins, etc.) and a combination of goods will produce a vector of quantities of these characteristics. The consumer's preferences are defined over bundles of characteristics and the demand for goods is a derived demand. Consumption is the activity of extracting characteristics from goods. Lancaster's approach is thus very suitable for dealing with the DCE. The amount of an attribute yielded by one unit of a good is fixed, regardless of the level of consumption of this or any other good. Behind this assumption lies the recognition that attributes are objectively measurable and fully known. The inclusion of Lancaster's theory does not violate the neoclassical foundation, simply instead of describing the relation between two goods, we describe the relation between two attributes.

Section 2

2.1 Choice Experiment Design and Case Study

The first step in CE design is to define the good to be valued in terms of its attributes and their levels. In our case, the good is the wetland (overflow land) ecosystem. After a field trip and several discussions with our partners in the Cracow University of Technology, environmentalists, engineers as well as several groups of locals, we managed to identify the final set of attributes as follows:

1) Surface and underground flooding danger: This attribute refers to the risk of flooding in the area. As a result of the intensive mining activity, floods are an imminent danger to the local community. Many households have suffered damage which exceeds their annual income due to floods, so the inclusion of this variable was more or less compulsory, as it affects directly the respondents. Diminishing the flood risk can create benefits for the area, such as a feeling of safety, better living conditions and in general with less flood risk, the value of the area will increase

Levels are I) **HIGH**: This is the case where no measures are taken and it also reflects the current flood risk level. Danger of flooding is imminent in case of rainfall. No barriers of any kind will be formed in order to protect from flooding. Currently, the flooding risk is high. II) **LOW**: Both underground and surface barriers are set in place. The material is proposed to be wood for the surface barriers and concrete for the underground ones, so that the area will maintain its aesthetic value. With the use of wood as a material for the construction of the barriers, the flow of water will slow down. After a research from the Cracow University of Technology, it has been shown that the quality of water in the rivers has increased. Lower flow speed along with higher water quality can greatly benefit the value of the surrounding area. Flooding danger is minimal.

2) Water Accessibility: This attribute refers to public's access to the river for recreational purposes. As a result of wrong regulation in the past, barriers have been raised in a wrong way and in the wrong locations. Locals are unable to reach the river for their every day needs. In our field trip, we saw people doing their laundry in the river, fishing as well as swimming. Canalization of the river in a different way than before may allow locals to enjoy easier access to the river, facilitating their everyday activities

This attribute has two levels I) **EASY**: Canalization of the river is very similar to the natural one. Materials such as concrete will not be used. Access to the river's water will be possible and easy for everyone. II) **DIFFICULT**: Rivers will be canalized by forming vertical walls, the same measure that has been used a few years ago. Concrete will be used and it will be impossible for locals to access the river. In the current situation, the level of this attribute is DIFFICULT.

3) Biodiversity: This attribute refers to the number of different species of plants and animals; their population levels and the number of different habitats and their size present in the wetland ecosystem in the next 10 years. A higher level of biodiversity can contribute to a better quality of life. The value of the entire area can be affected by biodiversity. An increasing number of plants and animals can offer great research and commercial opportunities, such as the establishment of an environmental park. This attribute has two levels:
I) LOW: Due to the present regulation, companies are allowed to create spoil hips from the remnants of their mining activities. This poses a threat to the newly formed habitats, which are being filled with litter. If the current situation prevails, the number of different species of plants and animals, their population as well as the number of different habitats and their size will reach a minimum level. This is a major negative effect for the whole region, as it will lose its aesthetic value and its use for recreational purposes. The economic value of the region will also decrease. This is the status quo.II) **HIGH:** As a result of reclamation activities on the existing spoil heaps especially afforestation in the wetlands (including river Bobrek), the number of different species of plants and animals; their population levels and the number of different habitats and their size will reach a higher level within the next 10 years. This will have a positive effect on the entire area, as its aesthetic and economic value will increase.

We revised the vocabulary and the language used in questionnaire several times before deciding upon its final version, as we did not want to influence the respondents towards a specific choice. The fifth attribute included in the CE is a monetary one, which is required to estimate welfare changes.

2.2 Inclusion of a cost attribute

The cost attribute plays an important and distinct role in the DCE. The inclusion of a cost attribute provides the DCE with a special quality as it becomes an elicitation procedure for willingness-to-pay (WTP). This implies that benefits are estimated in monetary terms and causes the DCE to be consistent with welfare economics (i.e. the potential Pareto improvement condition). Results from different studies can then be compared and used in priority-setting. Inclusion of a cost attribute makes it possible to indirectly obtain the respondent's WTP for either the good in its entirety (an alternative) or the

respondent's WTP for the attribute respectively, i.e. marginal WTP (also termed part worth or implicit price) (Bennett & Blamey 2001). The method is indirect in the sense that respondents are not directly asked their WTP, but instead have to trade cost for improvements in an attribute.

Costs can take many different forms in a DCE, including options such as consumer price, transportation cost, salary, donation, tax payment, tax payment in a referendum context, etc. The form in which cost (payment) is specified in the survey, the conditions under which it is required and the link between response and potential payment is termed the 'payment vehicle' (Green et al.1998b). The choice of payment vehicle depends on the circumstances and conditions of each case.

In our case study, we included a cost variable as our aim was to calculate how much the Polish people were willing to pay in order to enjoy higher flood protection measures and at the same time protect the environmental value of the study area. Taxation was preferred as a payment vehicle for the project, so that we can rule out the possibility of free riding, which could take place if we used another vehicle, such as donations.

In order to come up with the final version of the scenarios, we used experimental techniques (Louviere 2000), which are based on the following principles:

- Level balance
- Orthogonality
- Minimal overlap
- Utility balance

Level balance

Level balance simply means that the levels of an attribute occur with equal frequency in the design, each level of a four-level attribute should occur in precisely one-fourth of the included alternatives. This ensures that all levels are weighted equally in the trade-off options that the respondent faces (Huber & Zwerina 1996). If all alternatives are given to each respondent, then level balance is already ensured. However, with the use of a block design or a fractional factorial design, level balance needs to be taken into consideration in order to optimize efficiency.

Orthogonality

Orthogonality can with reason be considered the most important aspect of *D*-efficiency. Orthogonality is satisfied when the joint occurrence of any two levels of different attributes appears in profiles with frequency equal to the product of their marginal frequencies (Huber & Zwerina 1996). Orthogonality is thus satisfied when the difference in the levels of each attribute varies independently over choice sets, meaning that the levels of the attributes vary in a criss-cross manner. As 'pure' optimal orthogonal designs are only available for a very small number of very specific problems, the primary purpose is to optimize the design as best one can, to make it as efficient as possible, by minimizing multicollinearity. (Kuhfeld et al. 1994). A high degree of multicollinearity will result in a design in which unique estimates of the parameters cannot be obtained, making it impossible to draw any statistical inferences, i.e. hypothesis testing, from the sample.

Minimal overlap

Minimal overlap relates to the statistical properties when pairing the alternatives. A design has minimal overlap when a level does not repeat itself in a choice set. In order to optimize orthogonality of the level differences, the scenarios are matched to ensure minimal overlap (i.e. optimal orthogonality ensures minimal overlap). Minimal overlap is important in choice designs, because the contrast between attribute levels is only meaningful as differences within a choice set. Minimal overlap ensures that the probability of an attribute level repeating itself in each choice set is as small as possible, and thus maximizes the information obtainable from the choice sets. The cost of violating this criterion can be seen most clearly when the levels of one attribute are the same across all alternatives within a choice set. The choice set then provides no information on the value of the attribute in question (Huber & Zwerina 1996).

Utility balance

Utility balance is a relatively new approach that has not yet had much attention. It can be rather problematic to incorporate in the design as it demands a priori knowledge of respondents' preferences. A choice set is utility balanced when the utilities of alternatives within each choice set are approximately equal. To achieve this, the researcher needs to take the utility weights of the attributes into account when designing the DCE. The rationale for this principle is to ensure that respondents are actually trading. The efficiency gain arises because choices between alternatives that have similar utility provide better information about the coefficients. This means that two alternatives that differ in their levels but have approximately the same utility are more likely to ensure that the respondents are placed in a situation in which they are forced to trade. Application of the utility balance concept thus implies that the impact on choices of small differences in utility is registered resulting in more precise parameter estimates.

We prepared 4 different versions of the questionnaire, each with 8 different sets. Every set contained 3 scenarios, one of which is the current situation, e.g. no action is taken. The respondents were explained that by choosing the status quo option, they would not have to pay any more taxes, however the situation regarding the overflow lands would remain the same.

2.3 Data collection

When conducting a DCE it is important to consider the data collection procedure. The main methods for collecting data are the following (Bennett & Blamey 2001):

- Face-to-face interview
- Telephone interview
- Mailed questionnaires
- E-mail/internet
- Gathering in 'central facilities'
- Combination of the above

Each method has its own advantages and disadvantages. In order to collect our data, we conducted face to face interviews. Face-to-face interviews are characterized by the interviewer and respondents sharing both time and space. Besides generating very high response rates, the advantage of this method is that the interviewer can lead the respondent through the hypothetical scenario and elaborate if the respondent does not understand the task.

The data collection took place from March 20th to April 15th 2007. The respondents were from the area of Sosnowiec, where the wetland is located. Due to the taxing system in Poland, where people pay standard state taxes and then extra taxes for any extra service they are provided, it would be meaningless to interview people from different areas, as we would be inflicting a free rider bias on research. The enumerators explained the situation and the attributes carefully and from all aspects, both positive and negative, to the respondents. The enumerators reminded the respondents of their budget constraints as well as the payment vehicle. The respondents were also provided with maps and exact location of the wetland with reference to their residences.

Apart from the data directly relevant to the wetland, data on the respondents' social and economic characteristics were collected. Using GPS devices, the enumerators marked the position of the respondents' residences. Analyzing the above data, we can compare the answers of people with similar incomes or people who live in the same area and conclude whether factors such as income or location of the household play an important part in the respondent's choice.

Section 3
3. Econometric Analysis

3.1 Multinomial Logit Model

The MNL model, developed by McFadden (1974), is by far the most used multinomial model and can be considered as the origin of multinomial models. The degree of estimation complexity increases rapidly as one moves away from MNL and relaxes the assumptions for the variance-covariance matrix. The MNL model has a special property as it assumes *independence of irrelevant alternatives* (IIA). This implies that the ratio of the probabilities of choosing one alternative over another is unaffected by the presence or absence of any additional alternatives in the choice set. The IIA assumption provides some clear advantages as it makes the MNL model very simple to operate. However, the IIA assumption also has some serious shortcomings. This is the case when observed and unobserved attributes of utility are not independent of one another and/or if the unobserved components of utility are correlated among alternatives, leading to biased utility parameters and forecast errors.

The IIA restriction implies that the odds ratio of two alternatives *i* and *j* are the same, regardless of which other alternatives are available. Louviere (Bennett & Blamey 2001, chapter 2) argues that even with the strong assumption of IIA, the MNL model is still very useful and robust; the violation of IIA can be avoided by the inclusion of interaction variables such as sociodemographics. The assumption of IIA can be avoided by using a more complex model such as nested logit, multinomial probit and mixed logit. Due to the increased computer capacity and development of new models that solve the problem of IIA, these models (especially the mixed logit model) are gaining terrain, although the MNL remains a popular choice modeling framework.

LOGIT MODEL

| Log likelihood function -1498.707 |

Rsqrd .11186

| Number of obs.= 1536, skipped 0 bad obs. |

| Variable | Coefficient | Standard Error | b/St.Er. | P[\|Z\|>z] |

ASC	.38141488	.09828879	3.881	.0001
BFR	.34275214	.03998820	8.571	.0000
BBD	.07570193	.03713867	2.038	.0415
BRA	.13748482	.03894630	3.530	.0004
BTAX	-.02865421	.00284471	-10.073	.0000

BFR: Flood risk reduction

BBD: Biodiversity

BRA: River Access

BTAX: Taxes

The fit of the model, as measured by R squared is not that high (values of .2 to .4 are considered extremely good fit), however the coefficients are all significant at a=5% and they all have the expected

signs. Keeping all other factors constant, an increase in biodiversity and in river access, increase the probability that the scenario will be selected. On the other hand, an increase in flood risk or in taxation decreases the probability that the scenario will be selected. In other words, the respondents prefer higher levels of flood protection, biodiversity and easier river access, while they dislike higher taxes. When the monetary variable is used as a normalizing variable, the most important attribute is flood risk reduction, followed by river access and biodiversity. Positive sign on the ASC coefficient implies a positive change in utility if we move away from the status quo.

The logit model relies heavily on the IIA property, which states that the relative probability of two options being chosen remains unaffected by the removal of other alternatives. If this property does not hold, then our model produces biased coefficients.

IIA test

Drop option 1

Discrete choice (multinomial logit) model |

| Hausman test for IIA. Excluded choices are |

| OPT1 |

| ChiSqrd[4] = 24.5527, Pr(C>c) = .000062 |

|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] |

BFR .49067829 .06530178 7.514 .0000

BBD .25436631 .06499960 3.913 .0001

BRA .30135132 .06845613 4.402 .0000

BTAX -.04365275 .00566842 -7.701 .0000

When dropped 1, IIA cannot be accepted

Drop 2

| Discrete choice (multinomial logit) model |

| Hausman test for IIA. Excluded choices are |

| OPT2 |

| ChiSqrd[4] = 21.2766, Pr(C>c) = .000279 |

|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] |

BFR .45742266 .06918174 6.612 .0000

BBD .18025112 .06693851 2.693 .0071

BRA .03215906 .07473285 .430 .6670

BTAX -.04256513 .00546725 -7.785 .0000

When dropped option 2, IIA cannot be accepted

Drop 3

| Discrete choice (multinomial logit) model |

| Could not carry Hausman test for IIA. |

| Difference matrix is not positive definite. |

|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] |

BFR	.34470703	.04395749	7.842	.0000
BBD	.07355503	.03952946	1.861	.0628
BRA	.16462468	.04317204	3.813	.0001
BTAX	-.02256308	.00304646	-7.406	.0000

Hausman test doesn't converge.

It is obvious from the above results that the IIA property does not hold. As a result, our estimators which where derived using the Mulinomial Logit model are biased.

3.2 Random Parameters logit

The RPL appears to have some advantages over other discrete choice models as it provides the researcher with valuable information regarding the interpretation of the unobserved part of utility, and provides unbiased estimates even if unobserved heterogeneity is present in the data. Train (1998) noted that logit and nested logit specifications have many advantages, including simplicity of estimation, but that the same models also impose several and well-known restrictions that are not always desirable. Among these are:

- Coefficients of variables that enter the model are assumed to be the same for all respondents, i.e. that respondents have homogeneous preferences. This implies that respondents with the same observed characteristics (when accounting for these in the estimation) value the attributes equally.
- Logit and nested logit assumes IIA; this implies that the models necessarily predict that a change in the attribute of one alternative changes the probabilities of the other alternatives proportionally.
- Logit models (including nested logit) assume that unobserved factors are independent over time for each respondent. In a discrete choice experiment setting, this implies that unobserved factors are independent over the choice sets faced by each individual. However, it is likely that these unobserved factors that influence respondents choices are persistent (correlated) over choice sets. This assumption - along with the assumption of constant observed factors for each individual - gives rise to the assumption of stable preferences for each individual, i.e. the same tastes are used by the respondent to evaluate each choice set (alternative). This assumption is in line with the economic theory of rational behaviour.

A parameter that is found to be insignificant can be interpreted in two ways:

1. That the variable (the attribute) associated with the parameter did not influence the respondents' choices. This implies that this attribute (as it appears in the experiment with the ascribed levels) is not considered important to the respondents.
2. That preference heterogeneity exists. In this case, the attribute does affect respondents' choices, but with some respondents preferring one attribute level and some respondents preferring a different attribute level (and so forth depending on the number of levels). The attribute level effects off-set each other and result in an insignificant parameter estimate.

The advantage of the random parameters model is its ability to separate these effects and thus to allow correct interpretation of insignificant parameters (e.g. Train 1998).

| Random Parameters Logit Model |

| Replications for simulated probs. = 500 |

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]
Random parameters in utility functions				
BFR	.77722847	.16840118	4.615	.0000
BBD	.18295448	.07499739	2.439	.0147
BRA	.27383594	.07479176	3.661	.0003
BTAX	-.10144890	.01892848	-5.360	.0000
Nonrandom parameters in utility functions				
ASC	.02336510	.16089900	.145	.8845
Derived standard deviations of parameter distributions				
NsBFR	.66139498	.36672251	1.804	.0713
NsBBD	.69027338	.27711150	2.491	.0127
NsBRA	.30299586	.44481702	.681	.4958
NsBTAX	.17920544	.03291956	5.444	.0000

Interpreting the results with the RPL model, we see that all the coefficients are still significantly different from zero at level of significance a=5% , while they have the same signs with the case of the Logit Model. In general, individuals prefer higher levels of flood protection, biodiversity and easier river access while they prefer paying fewer taxes. However, there is something we must note in this analysis. If we look at the standard errors of the Flood Risk Protection, the Biodiversity and the Taxes, we see that they are significant and very large. As far as the Flood Risk Protection coefficient sign is concerned, it does not change, implying that at all cases individuals prefer higher flood protection. On the other hand, the signs of the Biodiversity and Tax coefficients do change. This means that there are people who prefer lower to higher level of biodiversity. Regarding the Taxes coefficient, we can say that there are people who require compensation, if the government takes any specific measures in the area.

We have also run the following likelihood ratio test in order to make sure that the Random Parameters Logit fares better than the Conditional Logit we used earlier. Under the null of IIA both models provide us with consistent estimates, while under the alternative, only the RPL produces consistent results.

Log likelihood ratio test: -2(1435.446- 1498.707)= 126. 522 is significantly (at 0.005% significance level) larger than chi square value of 14.86 at 4 degrees of freedom. Therefore the RPL model is an improvement over the LM.

3.3 Random Parameters Logit with Interactions

With the Random Parameters Logit we do not rely on the IIA property and we have also managed to account for the individual heterogeneity. However, we have not specified the sources of this heterogeneity. This is the reason we have included in our survey the socioeconomic interactions. By inserting them in our model, we allow for the RPL to specify the sources of the heterogeneity, such as personal preferences and characteristics.

As the last part of our research, we have used the data we collected from the social interactions part of our questionnaire in order to construct some additional variables, namely BFF, BRF, BTF, BBV, BRV, BTV, BFI, BRI, BBI, BTI. Every such variable comes from multiplying the original variables (FR, BD, RA, TAX) with an indicator function in some conditions are met. For example, if the house has suffered a flood in the past, then we have the new variables, BFF, BRF, BTF. Mathematically, BFF= FR* I(x=Flooded). We have also constructed such variables depending on the income class of the respondent(BFI, BRI, BBI, BTI) and on whether they have visited the wetland or not (BBV, BRV, BTV).

| Random Parameters Logit Model with interactions |

Rsquared .16384

Random parameters in utility functions

BFR	.28917270	.13833010	2.090	.0366
BBD	-.43349187	.14369714	-3.017	.0026
BRA	-.11225404	.14967854	-.750	.4533
BTAX	-.17576381	.02925886	-6.007	.0000

Nonrandom parameters in utility functions

ASC	.07941523	.14832815	.535	.5924
BFF	.84950272	.21183481	4.010	.0001
BRF	-.34653998	.17807323	-1.946	.0516
BTF	.05651810	.02605485	2.169	.0301
BBV	.41689675	.11736332	3.552	.0004
BRV	.25728641	.12155885	2.117	.0343
BTV	.04327338	.01561523	2.771	.0056
BFI	.00012461	.529115D-04	2.355	.0185
BBI	.00017230	.507433D-04	3.396	.0007
BRI	.00013694	.554945D-04	2.468	.0136
BTI	.190180D-04	.657169D-05	2.894	.0038

Derived standard deviations of parameter distributions

NsBFR	.36095453	.35958719	1.004	.3155
NsBBD	.45654348	.23231793	1.965	.0494
NsBRA	.29213270	.40787366	.716	.4738
NsBTAX	.13872348	.02159878	6.423	.0000

Looking at the r squared of this model, we see a significant improvement, as it is higher than any previous model. The Log likelihood ratio test: -2(1351.822 -1498.707)= 293.77 is significantly (at 0.005% significance level) larger than chi square value of 31.32 at 14 degrees of freedom. Therefore the RPL with interactions model is an improvement over the RPL.

In this framework, the coefficient of river accessibility becomes insignificant. At a=5%, all the interaction coefficients are significant, with one exception, the coefficient of interaction between river access and the flooded/nonflooded dummy. The positive interaction between flood protection and the flooded dummy as well as the taxation and the flooded dummy reveals that residents who have been affected in the past by a flood would prefer the government to take action even if this means paying higher taxes. The interactions between dummy for having visited the wetland and biodiversity, river access and taxation are positive which means that people who have visited the site are willing to pay taxes in order to protect the habitats (resulting in higher biodiversity) and facilitate the access to the whole wetland. The interactions between income and the wetland attributes are also significant, which means that the respondents take seriously into account their financial status when deciding on a scenario.

3.4 Estimation of Willingness to Pay/ Policy Implications

The CE method is consistent with utility maximisation and demand theory. When the parameter estimates are obtained by the use of the appropriate model, welfare measures, in the form of marginal willingness to pay (WTP), can be determined by estimating the marginal rate of substitution between the change in the wetland management attribute in question and the marginal utility of income represented by the coefficient of the payment attribute. Using the Wald procedure, we have calculated estimates for every model.

Logit WTP

| WALD procedure. Estimates and standard errors |

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]
Fncn(1)	-13.3109525	3.97316353	-3.350	.0008
Fncn(2)	-11.9616663	1.65971997	-7.207	.0000
Fncn(3)	-2.64191269	1.25586165	-2.104	.0354
Fncn(4)	-4.79806624	1.25012522	-3.838	.0001

Fncn 1 is asc, 2 is flood risk protection, 3 is biodiversity, 4 is river access

Random Parameters Logit WTP

| WALD procedure. Estimates and standard errors |

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]
Fncn(1)	-.81461942	1.55491736	-.524	.6003
Fncn(2)	-7.26666282	.84028867	-8.648	.0000
Fncn(3)	-2.28526244	.64648192	-3.535	.0004
Fncn(4)	-3.31894358	.61491501	-5.397	.0000

If we disregard fncn(1), which is a constant, in both models our choice variables are significant at a=5% and negative. From the above estimates we can infer that the respondents are not willing to pay any extra taxes in order to protect the wetland. Instead, they are willing to accept compensation for the wetland to be protected, as the resulting floods may pose a serious threat to their welfare and safety.

In light of the above results, it is up to the government to take any measures it judges fit. By protecting the wetland, it is obvious that an environmental asset is protected, an asset which may be used in various ways and may provide considerable profits in the future, of environmental, commercial or recreational, as it may be utilized as a theme park. However, in addition to the cost of that project, the government has to consider the cost of compensating the locals, as well as figuring a way of covering the expenses without imposing extra taxes, which is a vehicle clearly unaccepted by the public.

REFERENCES

1. Jordan J. Louviere, David A. Henscher and Joeffre D. Swait, Stated Choice Methods, 2000
2. Adamowicz, W., Boxall, P., Williams, M. and Louviere, J. : Stated Preference approaches for evaluating passive use values: choice experiments and contingent valuation. 1998, American Journal of Agricultural Economics
3. Adamowicz, W., Louviere, J and Swait J: An introduction to stated choice methods for resource based compensation, 1998.
4. Ben-Akiva, M.E ,Bolduc, D. and Bradley, M. (1993) :'Estimation of travel Choice models with randomly distributed values of time'
5. Ben-Akiva, M.E and Lerman, S. (1985) : Discrete Choice analysis: Theory and application to travel demand, MIT Press.
6. Boxall, P., Adamowicz, W, Williams, M. ,Swait, J. and Louviere, J (1996) : ' A comparison of stated preference approaches to the measurement of environmental values, Ecological Economics
7. Hanemann, W.M (1984) : Welfare evaluations in contingent valuation experiments with discrete responses, American Journal of Agricultural Economics
8. Hausmann, J.A. and Mcfadden, D. (1984a) : Specification tests for the multinomial logit model, Econometrica
9. Maddala, G. (1983) : Limited-dependent and qualitative variables in economics.
10. Manski, C.F. (1977) : The structure of random utility models
11. McFadden, D. (1974): Conditional logit analysis of qualitative choice behaviour
12. McFadden, D. (1981): Econometric Models of Probabilistic Choice
13. McFadden, D. (1984): Econometric Analysis of qualitative response models, Hndbook of Econometrics
14. McFadden, D. and Train K. (1977) : Mixed MNL models for discrete response, University of California at Berkeley
15. Birol E, Karousakis K and Koundouri P ; Using a choice experiment to account for preference heterogeneity ni wetland attributes: The case of Cheimaditida wetland in Greece

WETLANDS MANAGEMENT SURVEY

Dear Sir/Madam

My name is _____ and I work for AGH University of Science and Technology, Cracow University of Technology and University of Piraeus under a European Union funded project called Aquastress. The purpose of this research is to investigate Polish public's perceptions and preferences on the new wetland systems that have been formed in the Upper Silesia region in order to be able to inform the policy makers on how best to manage these wetlands.

As a part of this project, we are carrying out this survey, in which we would like you to take part. Participation in this survey is voluntary and you have the right to not to answer the questions that you do not feel comfortable with. By participating in this survey you are contributing immensely to the successful development of our research project. The survey is anonymous, your answers will be treated in the strictest confidence and there are no right or wrong answers. We would be most grateful if you could take about 30 minutes to participate in this survey. Thank you in advance for your cooperation.

Presenting the problem

Scientific evidence from Central Mining Institute, Silesian University, AGH University of Science and Technology, and Cracov University of Technology reveals that mining activity in the Upper Silesia region has resulted in land deformation. This situation has made the surrounding areas extremely vulnerable to flooding.

Some of the areas, which were affected by the flood of 1997 were near active or former mining sites, where the river beds had been deformed. This deformation might lead to exceeding of the full-bank stage, even during the normal water conditions.

Flood risk caused or intensified by mining activities occurs especially in vicinities of Klodnica valley (upstream from Gliwice) in the area of city Knurów situated near Bierawka valley, in Bobrek catchment (city Sosnowiec), in mining subsidence areas of villages Kopania, Bijasowice and city Bieruń, in Sławków (vicinities of river Biała Przemsza), in commune Bobrowniki (vicinities of river Brynica), commune Wojkowice (near rivers Jaworznik and Wielonka), city Czeladź (near river Brynica). There are also numerous areas at risk of local flood events caused by mining activities in Katowice (river Rawa), Bytom, Gieraltowice and Dabrowa Górnicza, to name a few. Approximately 50000 people can suffer from such a flood.

Deleted: ¶

Land deformation and the resulting floods, however, had another consequence. In the overflown lands that have been created, soil watering has increased and new, unique ecological habitats have been formed. New species of both animals and plants live in these habitats and ecologists from Silesian University argue that they should be protected. These areas are now of high recreational value to the people living in the nearby cities and they can be used for recreational activities, which might render this area an attractive tourism location in Poland

There is a conflict between the social, economic and ecological outcomes .The current regulation system aims to achieve the survival of these newly formed habitats. Mining industries are obligated to compensate the locals that have suffered from the floods. These industries are also required by law to refill the deformed riverbeds in order to protect the locals from future floods. Consequently, the overflow lands and the waterlogged areas are filled with waste rock, and vertical concrete barriers are erected.

The aim of this project is to understand the local's preferences/opinions with regards to this conflict between protecting the area from flooding and conservation of the ecological habitats, which came about as a result of flooding. We will present you with different alternatives of management of the wetland and will ask you to choose your most preferred wetland management programme among these alternatives. These wetland management programmes are characterised by 3 different management attributes in addition to a payment by or compensation to your household in the form of increase/decrease in the state tax. More specifically the attributes and their possible levels depending on wetland management measure chosen include:

1) Surface and underground flooding danger: This attribute refers to the risk of flooding in the area. Levels are I) **HIGH**: This is the case where no measures are taken and it also reflects the current flood risk level. Danger of flooding is imminent in case of rainfall. No barriers of any kind will be formed in order to protect from flooding. Currently, the flooding risk is high. II) **LOW**: Both underground and surface barriers are set in place. The material is proposed to be wood for the surface barriers and concrete for the underground ones, so that the area will maintain its aesthetic value. With the use of wood as a material for the construction of the barriers, the flow of water will slow down. After a research from the Cracov University of Technology, it has been shown that the quality of water in the rivers has increased. Lower flow speed along with higher water quality can greatly benefit the value of the surrounding area. Flooding danger is minimal.

2) Water Accessibility: This attribute refers to public's access to the river for recreational purposes. This attribute has two levels I) **EASY**: Canalization of the river is very similar to the natural one. Materials such as concrete will not be used. Access to the river's water will be possible and easy for everyone. II) **DIFFICULT**: Rivers will be canalized by forming vertical walls, the same measure that has been used a few years ago. Concrete will be used and it will be impossible for locals to access the river. In the current situation, the level of this attribute is DIFFICULT.

3) Biodiversity: This attribute refers to the number of different species of plants and animals; their population levels and the number of different habitats and their size present in the wetland ecosystem in the next 10 years. This attribute has two levels:
I) LOW: Due to the present regulation, companies are allowed to create spoil hips from the remnants of their mining activities. This poses a threat to the newly formed habitats, which are being filled with litter. If the current situation prevails, the number of different species of plants and animals, their population as well as the number of different habitats and their size will reach a minimum level. This is a major negative

effect for the whole region, as it will lose its aesthetic value and its use for recreational purposes. The economic value of the region will also decrease. This is the status quo.

II) **HIGH:** As a result of reclamation activities on the existing spoil heaps especially afforestation in the wetlands (including river Bobrek), the number of different species of plants and animals; their population levels and the number of different habitats and their size will reach a higher level within the next 10 years. This will have a positive effect on the entire area, as its aesthetic and economic value will increase.

Deleted: ¶

4) State tax: The levels are as follows, 10% less than the present level, 5% less than the present level, 5% more than the present level, and 10% more than the present level. If no action is taken then your local tax will remain as it is today. We would like to stress out that this tax attribute helps us understand your trade-offs with respect to different attributes explained above.

Now we will present you with eight sets of three alternatives we have prepared. The last alternative represents the current situation and what will happen in the future if no measures are taken. While choosing please keep in mind how the attributes described above will influence your family's position in every aspect. We would also like you to consider that your answers may affect management policy of the wetland, and as such we would like you to be as honest as possible.

SHOW THEM THE CHOICE SETS HERE.

CHOICE SETS

Question 1- Version 1

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	Low	High
Biodiversity	Low	High	Low
River access	Difficult	Easy	Difficult
Council tax	5% decrease	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 2- Version 1

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	High	High
Biodiversity	High	High	Low
River access	Difficult	Easy	Difficult
Council tax	10% decrease	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 3- Version 1

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	Low	High
Biodiversity	High	Low	Low
River access	Easy	Easy	Difficult
Council tax	5% increase	10% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 4- Version 1

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	Low	High
Biodiversity	High	Low	Low
River access	Easy	Easy	Difficult
Council tax	10% decrease	10% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 5- Version 1

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	Low	High
Biodiversity	High	Low	Low
River access	Difficult	Easy	Difficult
Council tax	5% increase	5% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 6- Version 1

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	High	High
Biodiversity	High	Low	Low
River access	Difficult	Easy	Difficult
Council tax	5% decrease	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 7- Version 1

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	Low	High
Biodiversity	Low	Low	Low
River access	Difficult	Easy	Difficult
Council tax	5% decrease	10% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 8- Version 1

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	Low	High
Biodiversity	High	Low	Low
River access	Difficult	Difficult	Difficult
Council tax	10% increase	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 1- Version 2

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	Low	High
Biodiversity	High	High	Low
River access	Easy	Difficult	Difficult
Council tax	10% increase	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 2- Version 2

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	Low	High
Biodiversity	High	High	Low
River access	difficult	Easy	Difficult
Council tax	5% increase	10% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 3- Version 2

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	High	High
Biodiversity	Low	High	Low
River access	Easy	Easy	Difficult
Council tax	5% increase	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 4- Version 2

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	High	High
Biodiversity	Low	High	Low
River access	Difficult	Easy	Difficult
Council tax	5% increase	10% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 5- Version 2

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	High	High
Biodiversity	High	High	Low
River access	Easy	Difficult	Difficult
Council tax	5% decrease	10% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 6- Version 2

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	Low	High
Biodiversity	Low	High	Low
River access	Difficult	Easy	Difficult
Council tax	5% increase	10% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 7- Version 2

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	Low	High
Biodiversity	Low	Low	Low
River access	Difficult	Difficult	Difficult
Council tax	5% decrease	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 8- Version 2

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	Low	High
Biodiversity	Low	High	Low
River access	Difficult	Difficult	Difficult
Council tax	10% decrease	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 1- Version 3

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	Low	High
Biodiversity	High	Low	Low
River access	Easy	Difficult	Difficult
Council tax	10% increase	10% increase	Same as now
I prefer (Please tick as appropriate)	- Management Programme A	Management Programme B	Management Programme C

Question 2- Version 3

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	High	High
Biodiversity	Low	High	Low
River access	Difficult	Difficult	Difficult
Council tax	10% increase	10% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 3- Version 3

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	Low	High
Biodiversity	High	High	Low
River access	Easy	Difficult	Difficult
Council tax	10% increase	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 4- Version 3

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	High	High
Biodiversity	Low	High	Low
River access	Easy	Difficult	Difficult
Council tax	5% decrease	5% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 5- Version 3

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	High	High
Biodiversity	High	High	Low
River access	Difficult	Easy	Difficult
Council tax	10% decrease	10% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 6- Version 3

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	Low	High
Biodiversity	Low	High	Low
River access	Easy	Difficult	Difficult
Council tax	10% decrease	10% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 7- Version 3

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	High	High
Biodiversity	Low	Low	Low
River access	Easy	Easy	Difficult
Council tax	10% increase	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 8- Version 3

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	Low	High
Biodiversity	Low	Low	Low
River access	Difficult	Easy	Difficult
Council tax	10% decrease	5% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 1- Version 4

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	High	High
Biodiversity	Low	High	Low
River access	Easy	Difficult	Difficult
Council tax	10% increase	5% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 2- Version 4

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	High	High
Biodiversity	High	Low	Low
River access	Difficult	Easy	Difficult
Council tax	5% decrease	10% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 3- Version 4

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	High	High
Biodiversity	High	Low	Low
River access	Easy	Difficult	Difficult
Council tax	10% increase	5% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 4- Version 4

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	High	High
Biodiversity	High	Low	Low
River access	Difficult	Difficult	Difficult
Council tax	5% decrease	10% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 5- Version 4

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	**Management strategy A**	Management strategy B	**Management strategy C: Status Quo Present situation**
Flood risk	High	**High**	**High**
Biodiversity	Low	**Low**	**Low**
River access	Easy	**Difficult**	**Difficult**
Council tax	5% increase	**5% decrease**	**Same as now**
I prefer (Please tick as appropriate)	Management Programme A	**Management Programme B**	Management Programme C

Question 6- Version 4

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	**Management strategy C: Status Quo Present situation**
Flood risk	High	Low	High
Biodiversity	Low	High	Low
River access	Easy	Easy	Difficult
Council tax	5% decrease	10% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 7- Version 4

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	High	High	High
Biodiversity	Low	Low	Low
River access	Difficult	Easy	Difficult
Council tax	10% decrease	5% increase	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

Question 8- Version 4

Assuming that the following three wetland management strategies were the only choices you had, which one would you prefer?

Management strategy Characteristics	Management strategy A	Management strategy B	Management strategy C: Status Quo Present situation
Flood risk	Low	High	High
Biodiversity	High	Low	Low
River access	Difficult	Difficult	Difficult
Council tax	5% increase	10% decrease	Same as now
I prefer (Please tick as appropriate)	Management Programme A	Management Programme B	Management Programme C

WATER MANAGEMENT SURVEY: ANSWER SHEET

Name of the Enumerator: _____
Date: _____
Time Started: _____
Time Ended: _____
CE version (circle one): 1 2 3 4
Village/City: _____

Distance between house and river (coordinates)
Respondent's house:
Site:

A. Choice sets

1. Choice experiment answers, enumerator please tick as appropriate:

Choice Set	Option A	Option B	Option C
1	☐	☐	☐
2	☐	☐	☐
3	☐	☐	☐
4	☐	☐	☐
5	☐	☐	☐
6	☐	☐	☐
7	☐	☐	☐
8	☐	☐	☐

2. If you chose neither management programme (option C) in any one of the choice sets above, could you please tell us on a scale from 1 (strongly disagree) to 5 (strongly agree) what you think about the following statements?

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)	Don't know (-999)
A. I don't think I should pay higher taxes for reduction of flooding risk in the area	☐	☐	☐	☐	☐	☐
B. I don't think I should pay higher taxes for increasing biodiversity in the area	☐	☐	☐	☐	☐	☐
C. I don't think I should pay higher taxes for increasing access to riverbank in the area	☐	☐	☐	☐	☐	☐
D. I do not believe that the strategy to reduce flooding risk will succeed	☐	☐	☐	☐	☐	☐
E. I do not believe that the strategy to increase biodiversity in the area will succeed	☐	☐	☐	☐	☐	☐
F. I do not believe that the strategy to increase access to riverbank will succeed	☐	☐	☐	☐	☐	☐
G. I do not have the financial capability to pay higher taxes	☐	☐	☐	☐	☐	☐
H. I would only pay higher taxes if other locals definitely do	☐	☐	☐	☐	☐	☐
I. I do not care for the environmental issues in the area	☐	☐	☐	☐	☐	☐
J. I do not care for the flooding issues in the area	☐	☐	☐	☐	☐	☐
K. I do not care for access to the riverbank	☐	☐	☐	☐	☐	☐

3. Any other reasons as to why you have chosen neither management programme (option C) above?

_____

_____

Deleted: ¶

B. Social Interactions

4. As a member of the local community, could you please tell us on a scale from 1 (completely disagree) to 5 (completely agree) what you think about the following statements?

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)	Don't know (-999)
A. Other locals will not agree to pay higher taxes	☐	☐	☐	☐	☐	☐
B. Other locals would not believe that the flood reduction strategy would be successful	☐	☐	☐	☐	☐	☐
C. Other locals have no interest in higher levels of biodiversity in the area	☐	☐	☐	☐	☐	☐
D. Other locals have no interest in access to riverbanks in the area	☐	☐	☐	☐	☐	☐
E. Other locals do not have the financial capability to pay higher taxes	☐	☐	☐	☐	☐	☐
F. Other locals do not care for the environmental issues in the area	☐	☐	☐	☐	☐	☐
G. Other locals do not care for the flooding issues in the area	☐	☐	☐	☐	☐	☐
H. Other locals do not care for the access to riverbank in the area	☐	☐	☐	☐	☐	☐

C. Respondents' environmental behaviour and attitudes

5. How often does your household do the following?

Environmentalist Behaviour	Always (1)	Often (2)	Sometimes (3)	Rarely (4)	Never (5)	Don't know (-999)
A. Buy organic produce						
B. Give charitable donations to environmental organizations for public benefit (e.g. Salamandra, Liga Ochrony Przyrody)						
C. Buy environmentally based journals (for example "Aura", "Zielona Liga", "Przyroda Polska" or National Geographic		☐	☐	☐	☐	☐
D. Recycle household waste (glass, paper, tin, etc)	☐	☐	☐	☐	☐	☐

6. Could you please tell us on a scale from 1 (strongly disagree) to 5 (strongly agree) what you think about the following statements?

Environmental Concerns	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)	Don't know (-999)_
A. The earth is like a spaceship with very limited room and resources						
B. The balance of nature is very delicate and easily upset						
C. The so-called 'ecological crisis facing human kind' is exaggerated		☐	☐	☐	☐	☐
E. The situation of rivers in Poland is as good as can be expected	☐	☐	☐	☐	☐	☐
F. Humans are severely abusing the environment	☐	☐	☐	☐	☐	☐
G. When humans interfere with nature it often produces disastrous consequences	☐	☐	☐	☐	☐	☐

D. Respondent Characteristics

7. Age: _____

8. Gender: Female ☐ Male ☐

9. Highest level of education
   a) Less than upper secondary school (up to 18 years) ☐
   b) Upper secondary school (up to 18 years) ☐
   c) University Degree ☐
   d) Postgraduate ☐
   e) Doctorate Degree ☐
   f) Other (please specify) _____

10. Occupation
   a) Full-time job ☐
   b) Part-time job ☐
   c) Unemployed ☐
   d) Pensioner ☐
   e) Student ☐
   f) Other (please specify)_____

11. Number of people in your household including yourself: _____
12. Do you have children? Yes ☐ No ☐
13. Number of dependent children in your household: _____

14. Could you please tell us on a scale from 1 (strongly disagree) to 5 (strongly agree) what you think about the following statements?

Perceived flooding risk (any other questions we can ask other than the three below?)	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)	Don't know (-999)_
A. The frequency of flooding in this area will increase in the next 10 years						
B. The extend of flooding in this area will increase in the next 10 years						
C. Unless action is taken the economic damage caused by flooding in this area will increase in the next 10 years						

15. Have you visited the wetland area in the past? Yes ☐ No ☐

16. If yes, how many times?_____

17. For what purpose have you visited the wetland (can tick more than one)
    a) Fishing ☐
    b) Bird watching ☐
    c) Education/Scientific ☐
    d) Recreational (picnic, walk etc) ☐
    e) Swimming ☐
    f) Other (please specify)_____

18. Would you like to visit the wetland in the future? Yes ☐ No ☐

19. For what purpose would you like to visit the wetland in the future (can tick more than one)
    a) Fishing ☐
    b) Bird watching ☐
    c) Education/Scientific ☐
    d) Recreational (picnic, walk etc) ☐
    e) Swimming ☐
    f) Other (please specify)_____

20. Has your house been affected by flooding in the last 10 years? Yes ☐ No ☐

Deleted: ¶
¶

21. If yes, fill in the table below:

A. Year in which flooded	B. Approximate total financial damage suffered (in zloty)	C. Have you been compensated for the financial losses suffered?	D. If compensated, who has compensated you? (can tick more than one)	E. If several sources of compensation, what %age came from each source?

1.		Yes ☐ No ☐ Somehow☐	a) Insurance company☐ b) The government ☐ c) Mining industry ☐ d) Local Community ☐ e) Other (please specify)	a) Insurance company:_____% b) The government::_____% c) Mining industry:_____% d) Local Community _____% e) Other (please specify)_____%
2.		Yes ☐ No ☐ Somehow☐	a) Insurance company☐ b) The government ☐ c) Mining industry ☐ d) Local Community ☐ e) Other (please specify)	a) Insurance company:_____% b) The government::_____% c) Mining industry:_____% d) Local Community _____% e) Other (please specify)_____%
3.		Yes ☐ No ☐ Somehow☐	a) Insurance company☐ b) The government ☐ c) Mining industry ☐ d) Local Community ☐ e) Other (please specify)	a) Insurance company:_____% b) The government::_____% c) Mining industry:_____% d) Local Community _____% e) Other (please specify)_____%
4.		Yes ☐ No ☐ Somehow☐	a) Insurance company☐ b) The government ☐ c) Mining industry ☐ d) Local Community ☐ e) Other (please specify)	a) Insurance company:_____% b) The government::_____% c) Mining industry:_____% d) Local Community _____% e) Other (please specify)_____%
5.		Yes ☐ No ☐ Somehow☐	a) Insurance company☐ b) The government ☐ c) Mining industry ☐ d) Local Community ☐ e) Other (please specify)	a) Insurance company:_____% b) The government::_____% c) Mining industry:_____% d) Local Community _____% e) Other (please specify)_____%

22 Tenure status:

a) Home owner ☐
b) Renter ☐

Deleted: ¶
¶

c) Other (please specify) _____

23. Does your household own a car? Yes ☐ No ☐

24. What is total of your local taxes/fees (property tax, dog tax, water consumption, sewage disposal rate, waste collection rate) **per month?** _____

Deleted: ¶

25. In which one of the following categories of income brackets does your monthly gross household income lie?

a) less than 900 zloty ☐
b) 901 - 1250 zloty ☐
c) 1251 - 1500 zloty ☐
d) 1501 - 1750 zloty ☐
e) 1751 - 2000 zloty ☐
f) 2001 - 2250 zloty ☐
g) 2251 - 2500 zloty ☐
h) 2501- 2751 zloty ☐
i) 2751-3000 zloty ☐
j) 3001- 3250 zloty ☐
k) 3251- 3500 zloty ☐
l) 3501- 3750 zloty ☐
m) 3751- 4000 zloty ☐
n) 4001- 4500 zloty ☐
o) 4501- 5000 zloty ☐
p) 5001 zloty and above ☐

Thank you very much for you for your time and cooperation.


ΒΙΒΛΙΟΘΗΚΗ