Applications of the Choice Experiment Method in Europe: A Review

Ekin Birol, Phoebe Koundouri and Yiannis Kountouris

Introduction

This chapter reviews several noteworthy applications of the choice experiment method undertaken in the European Union (EU) countries to this date. The review summarises choice experiment studies implemented in various EU countries, covering a wide geographical area, including those EU countries located in the West (e.g., France, Germany and UK), South (e.g., Greece, Italy, Spain and Portugal) and North (e.g., Finland and Sweden) of the EU, as well as those countries located in East and Central Europe which have recently joined the EU (e.g., Romania and Hungary).

Choice experiment studies presented in this chapter cover a wide array of environmental, natural resource, agricultural, food and energy issues, ranging from conservation of wetlands and biodiversity to efficient management of water resources, and from labelling of foodstuff to alternative energy sources. These studies are aimed at informing the design and implementation of various EU level environmental, natural resource, agricultural, food and energy policies and directives, such as the Agri-environmental regulation (EC No 2078/92), food labelling systems (EC No 2081/92 and EC No 2082/92), Water Framework Directive (EC No 2000/60), Birds Directive (79/409/EEC), Habitats Directive (92/43/EEC) and Landfill Directive (1999/31/EC) to name a few.

The review presented in this chapter is by no means exhaustive, however, it aims to present the status of the choice experiment application in the EU to date, with details on the attributes valued in each study; monetary values estimated; implications for the design and implementation of various EU level policies, directives and regulations; econometric models and survey modes employed. Next section presents those choice experiment studies on biodiversity, agri-environmental schemes and agriculture. Choice experiment studies that inform food policy are reviewed in the following section. This is followed by the review of choice experiment studies that value water resources and forest resources, respectively. The final review section summarises various choice experiment studies on renewable energy, noise and air pollution, as well as waste management. The appendix to this chapter provides a table summarizing the choice experiment studies reviewed by reporting the authors, year of study, environmental good valued, country, attributes, sample size, survey mode, econometric specification, and the value estimates of each study.

Agri-Environmental, Wildlife and Nature Conservation Schemes

The EU reformed Common Agricultural Policy (CAP) advocates conservation of the several values generated by agricultural landscapes (e.g. cultural, environmental, assimilative and historical). The EU, therefore, embraces the concept of multifunctional agriculture as it is explicitly spelled out in its EC No. 2078/92 agri-environmental regulation, which states that all EU countries should “support agricultural production methods that are environmentally friendly and aim conservation of the rural areas”.

Agri-environmental schemes stemming from this regulation aim to encourage production of environmental, social and cultural “goods” in the countryside, by providing the farmers with the necessary monetary incentives for provision of these goods. Public spending on agri-environmental schemes is an increasingly important component of agricultural policy, hence policy makers in EU countries are in need of information on how agri-environmental schemes can be best designed, to maximise the economic benefits provided by these schemes.

In addition to the agri-environmental schemes, there is also the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. An ecological network of special protected areas, known as "Natura 2000", is specifically set up to co-ordinate the nature conservation policy within the Member States. Furthermore, there are other EU level regulations, such as the EU Birds Directive (79/409/EEC) and the EU Habitats Directive (92/43/EEC), which aim to conserve several important ecological functions, services and species in the Member States.

The choice experiment method can inform efficient and effective design of these schemes and implementation of these regulations by providing the policy makers with information on public’s preferences for (i.e., valuation of in terms of their willingness to pay (WTP)) for various social, environmental, cultural features of the landscapes, natural habitats and species as well as information on farmers’ and other stakeholders’ preferences (or valuation of, in terms of their willingness to accept (WTA) compensation) for various agricultural production, landscape and natural resources management methods which provides these features.

Hanley et al. (1998a; 2003), Li et al. (2004), Christie et al. (2006) and Bennett and Willis (2007) are examples of choice experiment that aim to investigate the public's preferences to inform the design of efficient agri-environmental and wildlife schemes and nature conservation programmes. Hanley et al. (1998a) report the results of a choice experiment study on Environmentally Sensitive Areas (ESA) in Scotland, where such agri-environmental schemes are being implemented. For the Breadalbane ESA, Hanley et al. identify farm woodlands, archaeological features, heather moors, wet grasslands and drystone walls as important landscape features, which could be affected by the agri-environmental schemes. Their findings reveal that the public values agri-environmental schemes to improve farm woodlands the highest, followed by heather moors and wet grasslands, whereas their valuation of schemes that improve archaeological features are the lowest. Agri-environmental schemes in this ESA should therefore prioritise provision of woodlands on farms.

Christie et al. (2006) estimate the benefits the public derives from conservation of biodiversity and enhancement of farmland to inform the design efficient of agri-environment and wildlife management schemes in Cambridgeshire and Northumberland England. They estimate the public's valuation of various biodiversity attributes including protection of familiar, rare and unfamiliar species of wildlife; restoration and recreation of habitats, and restoration of ecosystem services. Their results reveal that the majority of the respondents are WTP for biodiversity enhancements, i.e., they do value biodiversity, although they are indifferent to how biodiversity protection was achieved. The public supports those biodiversity conservation policies, which target rare familiar species of wildlife; recover populations of rare unfamiliar species; protect and enhance habitats, and

restore ecosystem services that affect humans. These results provide support for policies such as Biodiversity Action Plans, which target rare, unfamiliar species, as well as for inclusion of biodiversity conservation, habitat protection and enhancement, and ecosystem restoration in agri-environment and wildlife management schemes

Another choice experiment study that focuses on nature conservation is that of Li et al. (2004). They investigate the preferences of the Finnish public for increasing the area under preservation to evaluate the welfare effects of the Natura 2000 Nature Conservation Programme. Analysis of the choice experiment data reveal that there is considerable heterogeneity within the public, however, overall Finnish public is more sensitive to a decrease in nature conservation, compared to an increase, as the mean WTA for a decrease is four times higher than mean WTP for an increase. Moreover, the marginal value of nature preservation becomes zero after a certain level (i.e., 3% increase in the size of the current preserved area). These results are expected to aid policy makers in their cost benefit analysis of alternative nature preservation programmes in Finland.

The choice experiment method can also be employed to generate information on benefits of conservation of a single species. Hanley et al. (2003), for example, investigate public preferences over the design of wild goose conservation policy in Islay, Scotland. Investigations of the preferences of various stakeholders, including general Scottish public, local residents and visitors to the wildlife area, reveal that on the whole, respondents are WTP for the conservation of the wild geese in Scotland. These stakeholders, however, exhibit very different preferences for how geese are conserved: general public and visitors are WTP significant amounts for a policy which stops the shooting of geese; both visitors and local residents prefer a strategy that targets endangered species rather than all goose

species, whereas the public did not differentiate between the two, and visitors prefer geese to be conserved throughout Scotland rather than at special sites. Moreover, there is evidence of utility losses for a population increase of 50%; utility gains from maintaining the current population levels, and the locals are WTP for 25% increase in geese numbers. These findings have implications for the design of conservation policy for wild geese in Islay, Scotland.

Recently, Bennett and Willis (2007) carry out a choice experiment in England and Wales to investigate the public's trade off between conservation of badgers and cattle production. They estimate the economic values that the public places on the changes in the size of the badger population; various means of managing the badger population, and controlling of the bovine tuberculosis (bTB) in cattle caused by badgers. They find that the public are concerned about the bTB in cattle and they are WTP considerable amounts through higher taxes in order to control this disease. Even though the estimated value for the changes in the size of the badger population is relatively low, the results reveal that the public places a very high value on not having a policy that intentionally kills a large number of badgers. These results have useful policy implications for the management of badger population to control bTB in cattle in England and Wales.

A few choice experiments also study the preferences for the design of agri-environmental, rural and nature conservation policies from the farmers' and other landowners' point of view. Horne and Petajisto (2003) estimate the landowners' preferences for the management of moose, which used to be an endangered species in Finland. Under a strict control of usufruct rights moose populations have been restored, however, there are large fluctuations in population levels. Preferences for moose

population level are investigated for four types of landowners', divided according to their participation in moose hunting and if they had noticed considerable browsing damage in the forest. Findings reveal that even though there is considerable heterogeneity across the types of users, majority of users, including those who benefit from hunting, would prefer a lower level of moose population, especially in the regions adjacent to the landowners' property.

Toma and Mathijs (2004) implement a choice experiment study in the Cazanesti agricultural region of Romania to investigate farmers' trade-offs between environmental quality, i.e, water pollution from agricultural sources (mainly from farm animals), and environmental efforts. The results reveal that although farmers preferences are heterogeneous, overall they prefer the status quo, i.e., low environmental quality in the form of polluted water and no investment in environmental efforts. The agri-environmental schemes in Romania would therefore need to be designed to provide these farmers with the necessary monetary incentives to encourage them to undertake those agricultural practices that maximize environmental quality, i.e. water quality in this case.

Another choice experiment study, which studies the preferences of farm families for those agricultural production methods that generate multifunctional agricultural, is by Birol et al. (2006a). This study investigates Hungarian farmers preferences for undertaking traditional farming methods on their small family farms termed home gardens. The study investigates farmers valuation of those agricultural practices which generate several agrobiodiversity components, including crop variety diversity, landraces, agro-diversity, and organic production, which generates soil micro-organism diversity. Choice experiment data are collected from farmers located across 22 communities in three regions of Hungary.

The results reveal that farmers located in the most isolated communities derive the highest values from crop variety diversity, and among those, elderly derive the highest values from landraces. Moreover, across the regions farm families that are wealthier and more educated value organic production method most highly, followed by those who are poorer, older and located in the most isolated communities. Agro-diversity is valued highly across the country, but most highly by those farm households who manage large fields alongside home gardens, due to the complementarity between feed production in the field and livestock production in the home gardens. Overall, these results reveal that with the environmental, cultural and historical benefits they generate, home gardens should be included in the Hungarian agri-environmental schemes, and those households that value the benefits they generate the most would be the least cost options to target for these schemes.

Chapters three, four, five and six in this volume present further examples of how choice experiment method can be applied to value various attributes of the countryside and landscape, in order to inform agri-environmental policies in Ireland, England, France and Spain, respectively.

Genetically Modified Food and Food Labelling

Safety, security and origin of food are important issues in the EU, and the choice experiment method can help inform implementation, adaptation and formation of food policy. EU regulations on the Genetically Modified Organisms (GMOs) aim to protect human health and the environment whilst ensuring the free movement of safe genetically modified (GM) products in the EU. Only GMOs and GM food or feed products that have

been assessed as safe to health and the environment are authorised for use in the EU. The EU legislative framework on GMOs is considered to be one of the strictest in the world, and includes various Directives and Regulations, such as the Directive 2001/18/EC on the deliberate release into the environment of GMOs applying to the intentional introduction of GMOs; Regulation EC No 1829/2003 on GM food and feed; Regulation EC No 1946/2003 on transboundary movements of GMOs; Directive 98/81/EC, on the contained use of genetically modified microorganisms, and Regulation EC No 1830/2003 concerning the traceability and labelling of GMOs and the traceability of food and feed products produced from GMOs

In addition, with the Council Regulations EC No 2081/92 and EC No 2082/92, the EU created labels known as PDO (Protected Designation of Origin), PGI (Protected Geographical Indication) and TSG (Traditional Speciality Guaranteed) to promote and protect agricultural products. These labels are expected to encourage diverse agricultural production in a rural development context; protect product names from misuse and imitation, and help provide product information to consumers.

Burton et al. (2001) study consumer attitudes towards GMOs in food and the extent to which these attitudes translate into WTP to avoid these products. The choice experiment method is suitable for investigation of this issue, since it allows for GMOs to be presented alongside a number of other potential consumer concerns (e.g., on farm chemical use, food health risk and locally vs. globally produced food), allowing for investigation of the trade-offs that food consumers make in real decision-making. They find that GM food is an important food concern. Consumers are WTP significant increases in their food bills to avoid GM food, and their attitudes towards organic food are useful indicators of their

attitudes towards GM food. There is, however, significant differences in consumer preferences between GM technologies in which plants are modified by the introduction of genes from other plants and those GM technologies in which plants are modified by the introduction of genes from animals and plants. Their results also disclose that consumers are WTP higher food bills for a reduction in chemical use; safer food, and locally produced food, where consumers' WTP for these attributes increase in the frequency of their purchase of organic food. A follow up study by Rigby and Burton (2005) investigate the heterogeneity in consumer preferences further and reveal that even though the average WTP measures are not significantly different in the two studies, there is considerable heterogeneity in WTP for all but one of the attributes, which was not captured by Burton et al. (2001). Inclusion of the status quo in the analysis reveals that the consumers are WTP to preserve the current system, i.e., non- GM food market.

EU regulations on foodstuff, such as restrictions on GM food and hormone treated meat, also have implications on EU's trade with other countries. Lusk et al. (2003) employ a choice experiment to compare EU (French, German and British) and US consumers' preferences for beef from hormone treated and/or GM fed cattle, and analyse the implications of various trade policies given the differences in consumer preferences across these countries. Their results disclose that compared to the US consumers, French consumers derive higher values from beef from cattle that have not been administered added growth hormones. There are, however, no statistically significant differences across the US, German and British consumers' WTP for non-hormone treated beef. Overall, EU consumers derive significantly higher values from beef from cattle that have not been fed GM feed compared to their US counterparts. There is considerable heterogeneity for steak

attributes among US and British consumers, whereas French and German consumers were relatively more homogenous in their preferences. These results have implications for trade policies between US and the EU: First, the lack of differences in consumer preferences for hormone treated beef does not justify the EU import ban on hormone treated beef from the US; and second, EU consumers' high WTP for non-GM fed beef suggest that US exporters of GM foodstuff will encounter strong resistance in the EU markets.

Carlsson et al. (2007) conduct a choice experiment to estimate Swedish consumers' WTP for two GM-free meat products, namely chicken and beef, under a labelling regime and under a ban. Their results disclose that, similarly to Lusk et al (2003), consumers are WTP a high price premium for livestock fed with GM free fodder. Hence they conclude that a mandatory labelling scheme can be welfare enhancing. Moreover Carlsson et al. find that the difference between consumer WTP for a ban and WTP for a labelling scheme is not statistically significant. Consequently, they argue that a ban cannot be welfare enhancing if a labelling scheme is in place. These results have implications for whether or not to ban GM food or to have a labelling scheme in place.

Choice experiment method has also been employed to investigate animal welfare vs. biotechnology (GM food) issues. Lagerkvist et al. (2006) estimate Swedish consumers' trade-offs for several pork production attributes related to animal welfare, including type of housing system, tail docking, fixation and castration, the latter including the three levels of surgical castration, no castration and immunocastration, which implicates tradeoffs between animal welfare concerns, food safety risks due to the use of biotechnology, as well as food (e.g., taste) quality. Findings reveal that when taste quality is controlled for, consumers accept potential food safety risks associated with biotechnology to alleviate animal welfare

problems related to surgical castration. However, consumers prefer pork from surgically castrated boars over pork from not castrated boars, suggesting that taste quality dominates animal welfare concerns. Lagerkvist et al. conclude that immunocastration is a socially viable alternative and abolition of surgical castration of pigs should be supported since immunocastration provides several potential public and agribusiness advantages over surgical castration, including potential cost savings in procedures, gains from higher growth rates for pigs as well as animal welfare improvements.

Several choice experiment studies explore consumers' WTP for various labelling and certification systems, which signal the origin, safety or method of production of the foodstuff. Scarpa and Del Giudice (2004) investigate urban consumers' preferences for various attributes of extra-virgin olive oil in three Italian cities, namely Naples, Rome and Milan. Certification (whether PDO/PGI, Organic or no certification) and geographic origin (North-Centre or South of Italy, or unknown origin) are among the extra-virgin olive oil attributes studied. The results disclose that consumers prefer olive oil from their own region, revealing a home-bias. Moreover, there is considerable heterogeneity in consumer preferences for various certification programmes in the olive oil market. Consumer preferences for olive oil with organic certification decrease from North to South. Even though consumers' valuation of PDO/PGI dominates the organic certification in each one of the three cities, the degree of dominance increases from North to South.

Another certificate of quality indication and EU recognition of territorial specify in food products is the Region of Origin (ROO). Scarpa et al. (2005) investigate the importance of regional (both national and territorial) identity in consumer perceptions for specific food product categories. Employing data from Italian consumers the significance

of the ROO attribute is explored for grapes, oil and oranges. The results disclose that similarly to Scarpa and Del Giudice (2004) there is home-bias for all three food products, although at varying degrees. For olive oil, domestic origin attribute is an important determinant of choice. For oranges and grapes, ROO is influential on consumer choice, however not quiet as dominant, compared to organic growing techniques for oranges and ripeness for grapes. Moreover, there is significant preference heterogeneity for grapes and oil but not for oranges, disclosing agribusinesses information on both the strength of market demand, and taste variation. Overall, results of this study disclose valuable information for labelling of food (e.g., PDO food marking, organic certification) and product marketing strategies for the agribusiness industry.

Enneking (2004) studies German consumers' WTP for quality assurance schemes, which aim to improve food safety in the meat sector. Consumers are presented with six different sausage brands, including a national premium brand, with and without the 'quality and safety' (Q&S) label; a national brand which exhibits low degree of brand awareness, with and without the Q&S label; two organically produced brands; a reduced fat brand and a low price brand, all without the Q&S label. Findings reveal that quality labelling significantly influences consumer choice, i.e., consumers are WTP higher prices for food safety improvements. Sausage suppliers that indicate food safety with a Q&S label can charge up to 20 per cent more than those suppliers that forego this type of signalling. This result supports the recent literature that certificates that aim to reduce information asymmetries in the food market are influential on product choice. Enneking concludes that the results of this study provide case for public support of third party certification and hence for the Q&S system.

Another study that investigates food product quality attributes is that of Carlsson et al. (2005). In this study consumer WTP for existing, as well as currently non-existent, private and public attributes of Swedish agriculture are estimated. Six agricultural products are studied in a combination of two products per survey: chicken and ground beef; pork chop and egg; and milk and grain. Attributes included in the choice experiment vary depending on the food product, however, issues explored include, among others, labelling of farm origin and choice of husbandry; ban on GM fodder; labelling if GM fodder is used; nutritional information (e.g., omega 3 enriched eggs); free range production and transport of animals. Findings reveal that consumers do not value animal welfare attributes similarly across livestock types studied. Moreover, the results disclose consumers' WTP to ensure a total ban on the use of GM fodder is higher than their WTP for labelled GM food, indicating that there might be a market failure even if GM food is labelled. Surprisingly, for egg production, consumer WTP for the use of battery cages is not significantly different than their WTP for free-range eggs. In addition consumers are WTP high premiums for some animal welfare attributes including slower growth chicken, outdoor production of pigs and free-range barn in milk production. Consumers also prefer no or restrictive use of spraying and analysis of soil and grain for cadmium content in grain production. Overall, the data exhibit significant heterogeneity in consumer preferences, revealing important information for agribusinesses, such as the identification of market shares and niche markets. The results are also informative for food policy formulation on an array of agricultural and food issues.

Chapter seven in this volume reports the results of a state-of-the art choice experiment on consumers' preferences for GM food and other production methods (e.g.,

organic and free range) in the UK, and presents a thorough discussion of the policy implications of the results for GM food regulations in the EU.

Water Resources Management

The importance of efficient, effective, equitable and sustainable allocation of water resources in the EU, and the need for an integrated management approach to solve water quantity and quality related problems have been recognized by the EU policy makers, and reflected in the EU's recent Water Framework Directive (WFD, 2000/60/EC). WFD aims to protect and achieve a "good status" for all water resources by 2015, where water resources include surface water, groundwater, inland water, rivers, lakes, transitional waters, coastal waters, wetlands and aquifers. This "good status" is set to be achieved with a combined approach of emission limit values, quality standards, and the introduction of more efficient water prices. Choice experiment studies can provide valuable information for efficient and effective establishment and implementation of several of these measures. Several noteworthy choice experiment studies have been implemented throughout the EU to value various aspects of water resources, including their quality and quantity; ecological and recreational functions, as well as commercial uses.

A number of choice experiment studies have focused on wetland management. Willis et al. (2002) investigate water company consumers' trade-offs between increased security of water supply and potential environmental impacts on local wetland sites and flows of Amberley and Pulborough brooks in south-east England. The results of this study suggest that environmental services from natural river flows (i.e., river levels and bird and

plant numbers and diversity on wetlands) generate substantial benefits, given that the water supply to customers was reasonably secure at the time of this study. Customers were WTP increased water charges to secure the preservation of wetland habitats. These findings highlight that the relevant authorities should recognise environmental impacts when reviewing water company prices and service standards.

Carlsson et al. (2003) apply a choice experiment in southern Sweden to generate information on how best to design wetlands to maximise social benefits. Investigating public's valuation of several wetland attributes, they find that the public derives the highest benefits from higher levels of biodiversity and improved walking facilities, whereas they derive losses from surrounding vegetation, crayfish, and fenced waterline attributes.

Similarly, Birol et al. (2006) investigate the public's preferences for attributes of the Cheimaditida wetland in Greece, in order to recommend sustainable management options. Results of the econometric analyses disclosed that there is considerable heterogeneity in the preferences of Greek public for wetland attributes. Overall they derive significant and high values from both use and non-use values generated by the wetland, including biodiversity, open water surface area, research and education activities in the wetland and retraining of farmers to environmentally friendly farming practices. A cost benefit analysis of alternative management options revealed that the highest total net economic benefits are reached when all attributes are managed in their high levels and 150 local farmers are re-trained.

More recently, Birol and Cox (2007) estimate the local public's WTP for conservation of the Severn Estuary wetland located in England. Values of various wetland management attributes are elicited, including wetland area, creation of habitats for otters, which are threatened mammal species, number of protected bird species and number of

locals employed in agriculture from irrigation water supplied by the wetland. The results reveal that there is considerable heterogeneity in the sample, though both environmental and social and economics wetland attributes generate positive and significant values. The public, however derives significantly lower values from irrigation related employment compared to environmental attributes. This information could help policy makers and managers of the wetland in formulating water allocation decisions that maximise social welfare.

Nunes et al. (2004) investigate fishermen's preferences for commercial activities, namely clam fishing, in a natural wetland, Venice lagoon in Italy. The attributes considered in this choice experiment are fishing area, fishing system employed and price of the annual permit. All of these attributes are found to be significant determinants of fishermen's wetland management choice. It is also found that adopting the most environmentally friendly and traditional fishing system will amount to significant welfare losses for the respondents and the population they are drawn from.

Willis et al. (2005) employ the choice experiment method to estimate water company customers' WTP for improvements in several services they provide in Yorkshire, England. Specifically they estimate customers' (both residential and business) WTP for improvements in the levels of 14 services, including security of supply; interruption to supply; drinking water (biological & chemical/ discoloration); sewage escape into property/ land; odour & flies; pollution incidents; ecological quality of rivers; use of inland waters for recreation, and bathing beaches water quality, among others. They analysis reveal that customers place the highest value on maintaining a good water supply, in terms of ensuring that temporary interruptions to water supply to properties was minimised. Moreover,

customers also placed considerable value on drinking water quality, improving the ecological quality of river water, reducing the number of properties affected by odour and flies from sewage treatment works, and finally, increase in the number of areas for recreation. Improvements to bathing water above the exiting EU standard, however, have a very low value, since bathing activities are not common in the area. Findings of this study are directly relevant to water industry regulation policy in the UK, among other relevant EU level policies.

Several choice experiment studies are applied to estimate the value of surface water quality and quantity. Hanley et al. (2005; 2006a) examine the public's WTP for improvements in water resources quality in Rivers Wear and Clyde in Scotland. Their results reveal that the public derives the highest benefits from good level of bankside condition followed very closely by good levels of ecology attribute, where the definition of good level was compatible with the conditions set by the WFD for good ecological quality status of rivers. Similarly, Hanley et al. (2006b) value improvements in river ecology in the Motray and Brothock catchments in Scotland. They investigate the public's WTP for ecological improvement, flow rate and employment. The highest WTP is estimated for improvement in the ecology of the rivers, whereas WTP for improvements in river flow conditions and employment in local farms are found to be lower, however significant.

Alvarez-Farizo et al. (2007) evaluate the public's valuation of attaining good ecological status river Cidacos, Spain, according to the requirements of the WFD. Various river management attributes, including aesthetic and environmental aspects of the river's ecology as well as urban water supplies' quantity and quality, are valued in this choice experiment. The results of the analysis reveal that all of these attributes are significant

factors in affecting individual choice. Furthermore the members of the public interviewed did not reveal a difference in behaviour when acting towards their self interest, compared to when acting for the collective interest.

Hasler et al. (2005) employ the choice experiment method to value groundwater protection in Denmark. Specifically, the values of two qualitative attributes related to drinking water quality and aquatic environment quality, are investigated. Findings reveal that both of these attributes significantly affect public utility. The Danish public therefore reveals strong preferences for naturally clean groundwater as well as good ecological conditions and purified water. Tests of dominance of one attribute over the rest disclosed that there is no dominant attribute and respondents are willing to trade among the levels of the attributes.

Choice experiment method is also applied in the context of angling, a recreational activity dependent on water resources. Paulrud and Laitila (2004) value management policies for recreational angling in the Kaitum River in Sweden using catches of different species at different sizes as attributes. Their analysis points to the conclusion that although the size and the number of the catch is an important determinant in individual decision making, there is no significant difference in the valuations of different species of fish. Furthermore, the impacts on individual welfare form alternative policies vary from negative to positive depending on the size of the permitted catch number.

Several choice experiment studies included characteristics of water resources as attributes in the context of valuation exercises of wider environmental goods. Colombo et al. (2005; 2006; 2007), for example, estimate the value of reducing soil erosion in Spain. Among the attributes used in this study surface and ground water quality are included

alongside other attributes such as landscape change and flora and fauna quality. Their results indicate that water quality is a significant factor affecting publics' choice of policy alternatives for soil conservation. Furthermore, the public is WTP the most for high levels of water quality, followed by improvement in landscape desertification.

Travisi and Nijkamp (2004) include groundwater contamination from fertilizers and pesticides as an attribute in a choice experiment which investigates Milanese residents' WTP for agricultural environmental safety. Results disclose that impact of groundwater contamination attribute on utility is highly significant, where reducing groundwater contamination by 50% raises the probability of choosing the agricultural scenario by 2%. Milanese residents are also found to value improvements in biodiversity levels and reductions in impacts on human health significantly and highly.

Applications of the choice experiment method to water resources management issues are also included in this volume. Chapter 11 estimates the Greek public's valuation of the sustainable management of the Cheimaditida wetland in Greece, whereas chapter 12 investigates the residents' trade-offs between flood risk reduction and recreational and biodiversity attributes of rivers in Upper Silesia Region in Poland, whereas. These chapters also discuss implications of their results for informing EU WFD.

Forest Management

The Forestry Strategy of the EU establishes a framework for forest-related actions in support of sustainable forest management based on the co-ordination of the forest policies of the Member States and Community policies, and initiatives relevant to forests and

forestry. The Strategy emphasises the importance of the multifunctional role of forests and sustainable forest management for the development of society. The EU Habitats Directive and Natura 2000 are also legislations relevant to the management of European forests.

Hanley et al (1998b) investigate the UK public's preferences for various forest attributes to inform forest management policies that maximise the social value of forestry. Forest landscape management attributes valued in this choice experiment include species diversity, how the forest was felled and the shape of plantations when seen at a distance. Their results disclose that the public prefers improvements in all of these attributes, where the improvements to forest shape to an organic shape was most highly valued, followed by small scale felling regime and high species diversity.

Lehtonen et al (2003) employ the choice experiment method to estimate the non-market benefits of forest conservation in Finland. Among the attributes they use are information and education, number of endangered species, conservation contracts and conservation areas. All of these attributes except information and education effect individual utility. Regarding the policy implications, the authors state that the estimated benefits of the conservation plans are in excess of their costs of implementation, even if the forest in question is at an age close to commercial maturity.

Horne et al. (2005) estimate visitors' valuation of five forest municipal recreation sites around Helsinki. Alternative models specific to each recreational site are estimated. Findings of this study disclose that the public values species richness significantly across all the sites studied. In another study on forestry in Finland, Horne (2006) investigates the private forest owners' preferences for various characteristics of voluntary contracts for forest biodiversity conversation. Forest owners were asked to state their WTA

compensation for applying conservation measures that would impose restrictions on forest use for given time horizons. The results point out the sensitivity of welfare to changes in the contractual characteristics of forest management.

Chapters eight, nine and ten in this volume estimate various stakeholders' valuations of use (recreational) and non-use (biodiversity) attributes of forests in Finland, Spain and UK, respectively, and discuss implications for EU Forest Action Plan as well as for those EU regulations and directives related to biodiversity conservation.

Green Energy, Environmental Pollution and Waste Management

The EU is at the forefront of international efforts to combat Climate Change and has played a key role in the development of the Kyoto Protocol. As a signatory to Kyoto Protocol the EU has agreed to cut its greenhouse gas emissions to 8% below 1990 levels by 2008-2012. As one of the initiatives to reach this target the EU aims to increase the fraction of electricity consumption from renewable sources to 12% by 2010 according to the Directive 2001/77/EC. All Member States have adopted national targets for the share of electricity production from renewable energy sources. Information on various social and environmental costs and benefits of alternative renewable energy sources are needed, and a few noteworthy choice experiment studies are conducted to evaluate the costs and benefits of various renewable energy sources.

Among renewable energy sources, utilization of wind power by means of wind farm construction has received considerable attention, mainly due to these farms' highly visible effects on local landscapes. Álvarez-Farizo and Hanley (2002) examine the social costs of

constructing wind farms in La Plana of Zaragoza, Spain. Impacts of wind farms construction on protection of cliffs, fauna and flora and landscape are investigated. The main findings reveal that adverse environmental impacts associated with the construction of wind farms generate significant social costs, and the public values impacts on flora and fauna more highly than impacts on cliffs and landscape.

In two papers Sundqvist (2002a, 2002b) examines residential and non-residential users' valuation of the environmental impacts of hydropower in Sweden. In both surveys, a measure of water quantity, namely the downstream water level, is included. Neither group is found to derive significant benefits from water quantity, implying that the downstream water level does not affect individuals or businesses choice of hydropower production arrangements.

Bergmann et al. (2006) investigate the environmental and social costs and benefits of renewable energy investments in Scotland. Renewable technologies considered in this study include hydro, on-shore and off-shore wind power and biomass. Magnitude and significance of several external costs and benefits of renewable energy investments are estimated, including those pertaining to landscape quality, wildlife and air quality, as well as creation of long-term employment. Findings disclose that the public derive considerable benefits from those renewable energy investments that avoid impacts on landscapes and wildlife, as well as those that do not create additional air pollution. Even though these preferences do not vary by income level, there is considerable heterogeneity between urban and rural households, the latter deriving higher values from wildlife benefits, reductions in air pollution and employment creation. The value estimates of this choice experiment are employed to calculate and compare the benefits generated by alternative renewable energy

investments. Findings suggest that Scottish public derives the highest benefits from off-shore wind farms, followed by biomass power plant, whereas they derive large costs from on-shore wind farms.

The EC Landfill Directive (1999/31/EC) aims to aims to improve standards of landfilling across Europe, and sets out successive targets for reducing biodegradable municipal waste to 75% of the 1995 baseline by 2010, 50% by 2013 and 35% by 2020. Choice experiment studies are also employed to inform the management of municipal solid waste (MSW) in EU countries.

Garrod and Willis (1998) estimate the impact on local residents of a well established landfill waste disposal facility in England. Residents' WTP to reduce the levels of several types of disamenities (e.g., dust, litter, noise, smell) arising from the site are estimated. The results disclose that the cost of the landfill in terms of lost amenity value to local residents is relatively low. Disamenity caused by dust and litter is higher than that caused by odour, although there is no significant difference. Disamenity caused by noise, however, was not statistically significant. The authors conclude that the residents are not WTP higher taxes to reduce the disamenity levels because they have become used to the disamenity levels and learnt to accept them. The relatively small impact of externalities from the landfill site is not surprising because in the UK planning permission is only given to those landfills whose adverse effect on the environment and amenity is less than any environmental gains arising from the landfill site. Garrod and Willis suggest that an ex post choice experiment shortly after the opening of a landfill site would give a more realistic measure of the cost of disamenities of a landfill site.

The UK has one of the poorest records in the EU with regard to the proportion of MSW that is sent to landfills. Failure to meet the targets of the Landfill Directive would mean that the UK could face a very high non-compliance fine to be paid by the local authorities, which are deemed responsible for the UK's failure to meet its targets. Local authorities therefore need information on how to prioritise recycling services and facilities they offer to their residents. Karousakis and Birol (forthcoming) employ a choice experiment in several London boroughs to examine the determinants of household recycling behaviour and to estimate the recycling service attributes that are valued most highly by the public. Their results disclose that households across London are WTP significantly higher monthly council taxes for an increase in the number of dry materials collected. Moreover, they are WTP higher taxes for compost collection, a service not available in most of the London boroughs.

There are also several choice experiment studies from transport literature, which have direct implications for improving local environmental quality (e.g., noise pollution, regulated by the Directive 2002/49/EC on assessment and management of environmental noise, and air pollution, regulated by the Directive 96/62/EC on ambient air quality assessment and management) as well as indirect implications for wider environmental problems, such as Climate Change. Some of the most notable studies carried out in EU countries include Wardman et al. (1997), Carlsson et al (2004), Wardman and Bristow (2004), Hiselius (2005), Arsenio et al. (2006)

Wardman et al. (1997) evaluate the impacts and benefits of improved cycling facilities in Leeds, England. Value estimates of the benefits of unsegregated cycle lanes and segregated cycle paths reveal that it is important to improve the safety of cycling and

distancing cyclists from the noise and pollution of urban traffic. Authors conclude that investment in cycling facilities could lead to significant increases in cycle demand, such that even costly investments may prove to be worthwhile in an economic evaluation of user benefits. The results, however, do not suggest that such investments could on their own achieve target levels of increased cycle use. Wardman et al. argue that other traffic management and restraint measures are needed in order to achieve target levels of increased cycle use. The results of this study are expected inform the UK policy makers in devising policies and projects to meet the National Cycling Strategy targets, which are put in place to alleviate traffic congestion and environmental pollution.

Wardman and Bristow (2004) estimate households' valuation of traffic related noise levels and air quality in Edinburgh, Scotland. Their findings disclose that variations in air quality are valued more highly than variations in noise, where households' valuation varies according to their size, income level and whether or not they have children. Overall, it was found that relatively large proportions of residents experience a noisy environment and poor air quality, and improvements in noise and air quality are quality of life priorities.

Carlsson et al. (2004) estimate the value of noise disturbance from air traffic in Stockholm, Sweden. They employ two surveys to estimate the value of increase and decrease in the number of flights per day. In particular, they investigate the time of the day and day of the week the air traffic takes place. The results disclose that a significant proportion of respondents prefer the current situation. Moreover, a larger number of non-traders and lower WTP levels were found in the "decrease" version of the survey. This finding indicates the existence of endowment effects according to which individuals are reluctant to pay for improvements compared to the status quo.

Hiselius (2005) investigates the public's preferences for transportation of hazardous materials by railway in two Swedish cities. Public's valuations of quantity of hazardous material transferred, the timing of the transport and the classification of the hazardous material are estimated. The results disclose that all attributes are significant factors affecting individual scenario choice.

Arsenio et al. (2006) examine the preferences for inner city road traffic noise reductions in Portugal. Their results reveal self-selectivity, where those with higher marginal values of noise tend to live in quieter apartments. The authors conclude that this finding suggests that the common use of a cut-off level of noise below which no annoyance or cost is deemed to occur may be inappropriate as it will undervalue the preferences of those in quiet areas who are WTP relatively large amounts to preserve that quiet.

In this volume, residents' preferences for local environmental quality, namely their valuation of rail noise abatement, are investigated in chapter 13. That chapter reports the results of a case study from Italy and discusses the implications of the results for EU and national level noise pollution management regulations.

Conclusions

This chapter has reviewed some of the most noteworthy examples of choice experiment applications carried out in the EU countries to date. This review is by no means exhaustive, however merely serves to highlight how this method can be applied to tackle various environmental, agricultural, food and natural resource management issues. Furthermore, the chapter draws attention to how this method can inform implementation, adaptation and

development of various EU Policies, Regulations and Directives. A summary of all the studies reviewed above can be found in the appendix to this chapter.

Next chapters of this book present state of the art applications of the choice experiment method to various environmental, agricultural, food and natural resource management, and discusses in detail how their results could inform EU policies, Regulations and Directives on various environmental, agricultural, food and natural resource management issues.

Appendix

Table A1: Summary of Choice Experiment Studies Carried out in the EU to inform Environmental, Agricultural, Food and Natural Resources Management Policies

Authors (year)	Environmental Good Valued	Site, Country	Attributes	Sample Size and Survey Mode	Econometric Specification	WTP/WTA Estimates
Choice Experiment Studies on Agri-Environmental Schemes, Wildlife and Nature Conservation						
Hanley, MacMillan, Wright, Bullock, Simpson, Parsisson and Crabtree (1998)	Environmentally Sensitive Areas	Scotland	Farm woodlands; archaeological features; heather moors; wet grasslands; drystone walls; annual tax	256 face to face interviews with members of the public	Conditional Logit	WTP in £/households/year: 50.46 for farm woodlands; 6.65 for archaeological features; 22.95 for heather moors; 20.85 for wet grasslands; 11.30 for drystone walls.
Hanley, MacMillan, Patterson and Wright (2003)	Wild goose conservation	Islay, Scotland	Species; means of control; location; population change; tax	Face to face interviews 426 members of the public; 205 local residents and 212 visitors	Conditional Logit	WTP in £/ households/year Scottish public (visitors): 9.23 (6.74) to stop shooting; Visitors (residents) WTP 16.5 (12.26) for conserving endangered species only; Visitors WTP 6.73 for conservation in all sites of Scotland; 6.73 for 25% rise in population; Residents – 29.67 if goose population rose by 50%; 24.98 to avoid 10% fall in population
Horne and Petäjistö (2003)	Moose management	Finland	Moose population in Finland; moose population in the area adjacent to the farm; rent from the hunting club; deductibles covered by the landowner; % of compensation	Mail survey of 765 landowners	Conditional Logit	WTA in € for 40% reduction in the moose population level in Finland and 40% reduction in moose population in the region adjacent to the property: 204 for those for those who noticed browsing damage and did not hunt; 137 for those who did not notice browsing damage and did not hunt: f84 or those who noticed browsing damage and hunt

Li, Kuuluvainen, Pouta, Rekola, Tahvonen (2004)	Nature conservation	Finland	Nature conservation area, types of nature conserved (swamps, shores, wetlands, forests); income tax	Mail survey of 562 members of the public	Nested Logit with interactions	WTP in FIM/households/year: 782 for 3% increase in nature preservation, and –3422 for 3% reduction.
Toma and Mathijs (2004)	Water pollution from agriculture	Romania	Environmental (water) quality; environmental effort	99 Face to face surveys farm households	Binary Logit with interactions	57% chose option with polluted environmental (water) quality and no environmental effort
Birol, Smale, Gyovai (2006)	Agrobiodiversity conservation	Devevanya, Orseg-Vend and Szatmar Bereg Environmentally Sensitive Areas (ESAs), Hungary	Crop variety diversity; landrace cultivation; agro-diversity; organic production; % of household food consumption obtained from the home garden	Face to face interviews with 104 in farmers Devevanya, 109 farmers in Orseg-Vend and 110 farmers in Szatmar Bereg.	Conditional Logit with interactions	WTA in €/households/year: Devevanya ESA: 404 for agro-diversity; 235for organic production; Orseg-Vend ESA: 111 per crop variety; 95 for landrace cultivation; 100 for agro-diversity; Szatmar Bereg ESA: 141 per crop variety; 83 for landrace cultivation; 198 for agro-diversity; 76 for organic production.
Christie, Hanley, Warren, Murphy, Wright and Hyde (2006)	Biodiversity conservation	Cambridgeshire and Northumberland, England	Familiar species of wildlife; rare, unfamiliar species of wildlife; Habitat quality, ecosystem process; annual tax	Face to face interview with 343 members of the public in Cambridgeshire and 391 members of the public in Northumberland	Conditional Logit	WTP in £/households/year: Cambridgeshire (Northumberland): 35.65 (90.59) for protecting rare familiar species; 93.49 (97.71) for protecting both rare and common species; 34.4 (71.15) for habitat restoration and 61.36 (74) for habitat recreation; 53.62 for recovery of ecosystem services relevant for humans; 42.21 for recovery of all ecosystems (105.55 for recovery of ecosystem services relevant for humans); 115.15 (189.05) for ensuring recovery of, and –46.68 for slowing down decline of rare unfamiliar species.

Bennett and Willis (2007)	Badger conservation vs. control of bovine tuberculosis (Btb) in cattle	England and Wales	Badger populations; management strategy; cattle with Btb slaughtered per year; increase in tax	Telephone interviews with 402 members of the public	Conditional Logit	WTP in £/households/year: 0.10 for every additional 100000 badgers; 1.52 for every 10000 reduction in cattle slaughtered; 68.31 not to have badger culling; 13.58 to have badger contraception an 22.40 to have badger tunnels; Aggregating over the populations of England and Wales in£: 22/badger; 3298/animal for reduction in cattle slaughtered due to Btb; 1,480 m total to avoid badger culling.
Choice Experiment Studies Genetically Modified Food and Food Labelling						
Burton, Rigby, Young and James (2001)	Food production system	Manchester, England	Weekly food bill; production technology; on farm chemical use; food miles; food health risk	Drop off and collect surveys with 228 members of the public	Conditional Logit with interactions	WTP in % change in food bill: 26.25-471.95 for GM free diet, depending on gender; 13-103.2 for a 10% reduction in chemical use; 5.2-27.10 for a10% reduction in food miles; 21.35-41.6 for a reduction in food risk from 1/10000 to1/15000, all estimates vary depending on whether infrequent, occasional or committed purchasers of organic food
Lusk, Roosen and Fox (2003)	Beef production	France, Germany, UK and USA	Marbling; tenderness; animal administered growth hormones; animal fed GM corn; price	Mail survey of 93 members of the public in France, 45 in Germany, 109 in UK and 566 in USA	Conditional Logit and Random Parameter Logit	WTP in $ for beef from cattle not administered growth hormones: France: 9.94; Germany: 7.29; UK: 7.39; USA: 8.12; WTP in $ for beef from cattle not fed GM: France: 9.32; Germany: 7.67; UK: 6.31; USA: 3.31
Enneking (2004)	Labelling of packaged liver sausages	Four cities in Northern Germany	Six different brands of sausage with organic, low fat and low degree of brand awareness attributes; Q&S label	Computer assisted face to face interviews with 321 consumers of packaged liver sausages	Conditional Logit	WTP $0.34 for Q&S label attached to a national premium brand, and WTP $0.11 for Q&S label attached to a national brand with low degree of brand awareness

Scarpa and Del Giudica (2004)	Extra-virgin olive oil	Milan, Rome and Naples, Italy	Appearance; Geographic origin; Certification; price	Face to face interviews with 300 consumers of olive oil	Random Parameter Logit	Predicted % of consumers with negative preferences: Milan: 21.36 for oil from South; 0 for oil from North/Centre; 18.68 for organic oil; 18.1 for PDO/PGI label; Rome: 15.23 for oil from South; 7.09 for oil from North/Centre; 18.25 for organic oil; 11.63 for PDO/PGI label; Naples: 12.81 for oil from South; 5.68 for oil from North/Centre; 34.56 for organic oil; 22.95 for PDO/PGI label.

Carlsson, Frykblom and Lagerkvist (2005)	Production of six agricultural products: chicken and ground beef; pork chop and egg; and milk and grain	Sweden	Label; fodder; outdoor production; transport; growth; cages; Omega 3; barn system; cow-calf; spraying; cadmium; cost	Mail survey of 710 members of the public	Random Parameter Logit	WTP in SEK/kg for chicken: 7.92 for label if GM fodder used; 15.73 for ban of GM fodder; 6.74 for herd kept outdoors; -3.31 for mobile slaughter house; 11.28 for slower growth chicken; WTP in SEK/kg for beef: 7.31 for labelling of farm origin and choice of husbandry; 6.17 for label if GM fodder used; 18.74 for ban of GM fodder; 1.82 for herd kept outdoors; 3.77 for mobile slaughter house; WTP in SEK/kg for pig: 3.54 for labelling of farm origin and choice of husbandry; 3.45 for label if GM fodder used; 21.69 for ban of GM fodder; 27.5 for herd kept outdoors; 3.17 for mobile slaughter house; WTP in SEK/dozen for eggs: 4.94 for label if GM fodder used; 13.39 battery cages and free-range coexist; 21.11 battery cages banned; 2.12 omega 3 enriched; WTP in SEK/litres for milk: 3.46 for label if GM fodder used; 6.52 for ban of GM fodder; 2.67 for free range indoor; 1.43 for cow-calf together 8-12 weeks; WTP in SEK/2kg for grain: 4.16 for labelling of farm origin and choice of husbandry; 6.8 for restrictive use of spraying; 5.5 for soil and grain analysed for cadmium

Rigby and Burton (2005)	Food production system	Manchester, England	Weekly food bill; production technology; on farm chemical use; food miles; food health risk	Drop off and collect surveys with 228 members of the public	Random Parameter Logit with interactions	WTP in % change in food bill: 41.7-462.3 for GM free diet, depending on gender; 11.7-60.2 for a 10% reduction in chemical use; 4.6-22.4 for a10% reduction in food miles; 21.9-36.3 for a reduction in food risk from 1/10000 to1/15000, all estimates vary depending on whether infrequent, occasional or committed purchasers of organic food
Scarpa, Philippidis and Spalatro (2005)	Production and labelling of grapes, oil, oranges	Italy	Packaging attributes; Production attributes (integrated pest management; organic production; national product; regional origin; quality certified); price	Computer administered surveys with 2000 members of the public	Conditional Logit, Random Parameter Logit and Random Parameter Logit with interactions	66.33% of households prefer domestic table grapes, and 77.56% of households prefer territorial certification of origin for olive-oil, supporting the notion of home-bias.
Lagerkvist, Carlsson and Viske (2006)	Pork production	Sweden	Type of housing system; tail docking; fixation; castration; price	Mail survey of 286 members of the public	Binary Heteroskedastic Logit	WTP in SEK/kg: for indoors (plenty of straw): 34.4; outdoors: 47.9; No castration: -15.9; Immunocastration: 15.7; No tail docking (tail biting can occur): -10.6; No tail docking (tail biting prevented): 7.9; Fixation at delivery: 48.6; Fixation banned: 54.3.
Carlsson, Frykblom and Lagerkvist (2007)	Chicken and beef production	Sweden	Label; fodder; outdoor, transport; growth; price	Mail survey of 395 members of the public with an opt-out option and 362 without opt-out option	Random Parameter Logit	WTP in SEK/kg for Chicken (beef): Without Opt-out: GM fodder not used but allowed: 30.13 (32.54); Use of GM fodder banned: 30.59 (30.12); With Opt-out: GM fodder not used but allowed: 26.75 (38.95); Use of GM fodder banned: 24.31 (34.69).
Choice Experiment Studies on Water Resources Management						
Sundqvist (2002a)	Alternative Hydroproduction Effects	Sweden	Downstream water level; erosion and vegetation; fish; electricity price/kWh	Mail Survey of 479 residential users	Random Effects Probit	WTP in SEK/kWh: Water Level increase by 25%: 0.54; Water Level increase by 50%: -0.56

Sundqvist (2002b)	Alternative Hydroproduction Effects	Sweden	Downstream water level; erosion and vegetation; fish; electricity price/kWh	Mail Survey of 479 non-residential users	Random Effects Probit	WTP in SEK/kWh: Water Level increase by 25%: 0.77; Water Level increase by 50%: 0.71
Willis, McMohan, Garrod and Powe (2002)	Water services vs. environment	Amberley and Pulborough brooks, England	Frequency of hosepipe bans; risk of water supply interruptions; bird and plant diversity; river levels	412 face to face survey with members of the public	Conditional Logit	WTP in £: 1.42 for 1% change in number of birds and plant diversity; 4.27 for change in river flows
Carlsson, Frykblom and Liljenstolpe, (2003)	Wetland management	Staffanstorp wetland, Sweden	Surrounding vegetation; fish; biodiversity; fenced waterline; crayfish; walking facilities; cost	Mail survey of 468 members of the public	Random Parameter Logit	WTP in SEK: High biodiversity: 719.75; medium biodiversity: 493.76; fish: 292.49; fenced waterline: -183.55; crayfish: -56.30; walking facilities: 601.41
Nunes, Rossetto and Blaeij (2004)	Clam fishing management	Venice Lagoon, Italy	Fishing Area; fishing System; annual Permit	114 face to face interviews with members of the public	Conditional Logit	WTP €/year model without interactions €/year: Fishing area: 568 (811); fishing system: 1005 (2546)
Paulrud and Laitila (2004)	Sport Fishing management	Kaitum River, Sweden	Catch/ day of grayling; catch/ day of brown trout; bag limit/day-grayling; Bag limit/day-brown trout; fee/day	Mail survey with 569 completed responses over three years	Conditional Logit	In SEK/day: 16.81 for Grayling and Brown Trout <30cm; 109.39 for Grayling and Brown Trout 30-40cm; 333.36 for Grayling and Brown Trout >40cm; 43.50 for Bag limit Grayling and Brown Trout
Travisi and Nijkamp (2004)	Agricultural environmental safety	Milan, Italy	Biodiversity; human health; groundwater contamination; food expenditure households/ month	302 drop off and collect surveys of members of the public	Conditional Logit	WTP in €/households/month: Biodiversity: 23.01-24.57; human health: 2.5-3.14; groundwater contamination: 12.28-16.21

Colombo, Calatrava-Requena and Hanley (2005)	Soil conservation	Andalusia, Spain	Landscape change; water quality; flora and fauna quality; jobs created; area; tax	310 face to face interviews with members of the public	Conditional Logit and Random Parameter Logit	WTP in €: 21.865 for improvement of water quality to medium level; 29.352 for improvement of water quality to high level; 17.428 for small improvement in landscape desertification; 22.88 for moderate improvement in landscape desertification; 14.922 for medium flora and fauna quality; 17.765 for high flora and fauna quality.
Hanley, Adamowicz, and Wright (2005)	Water quality improvements	River Wear, England	Ecology; aesthetics; bankside condition; water rates	340 face to face interviews with members of the public	Random Parameter Logit	WTP in £ for improvements: 11.12 for ecology; 11.10 for aesthetics; 11.94 for bankside condition.
Hasler, Lundhede, Martinsen, Neye and Schoi (2005)	Groundwater protection	Denmark	Drinking water quality; aquatic environment quality; cost	Mail survey with 584 members of the public	Conditional Logit	WTP in DKK for model with (without) ASC: 1899 (2855) for naturally clean groundwater; 912 (1777) for purified groundwater; 1204 (1818) for very good condition; -1759 (-1627) for bad conditions

Willis, Scarpa and Acutt (2005)	Water company service improvements	Yorkshire, England	Security of supply; interruption to supply; drinking water (biological & chemical); drinking water (discoloration); leakage; inadequate pressure; lead sewage escape into property; sewage escape to land; odour & flies; pollution incidents; ecological quality of rivers; use of inland waters for recreation; bathing beaches water quality; cost	1000 residential customers and 500 businesses	Conditional Logit (quadratic), Nested Logit (quadratic); Random Parameter Logit	WTP in £/household for the Conditional Logit Model: 0.317 for security of supply; 1.536 for interruption to supply for 100 properties; 2.275 for interruption to supply for 1000 properties;0.025 for drinking water (biological & chemical); 0.783 for drinking water (discoloration); 0.697 for leakage; inadequate pressure; 0.148 for lead; 0.025 for sewage escape into property; 0.106 sewage escape to land; 0.935 for odour & flies; 0.03 for pollution incidents; 0.637 for ecological quality of rivers; 0.415 for use of inland waters for recreation; 0.081 for bathing beaches water quality
Birol, Karousakis and Koundouri (2006)	Wetland management	Cheimaditida Wetland, Greece	Biodiversity; open water surface area; research & education; retraining of farmers; one-off tax	407 face to face interviews with members of the public	Conditional Logit, Random Parameter Logit, Random Parameter Logit with interactions and Latent Class	WTP €/respondent: Biodiversity: 7.7; open water surface area: 8.45; research & education: 3.93; retraining of farmers: 0.127/farmer
Hanley, Wright and Alvarez-Farizo (2006)	Water quality improvements	River Clyde and River Wear, Scotland	Ecology; aesthetics; bankside condition; water rates	210 face to face interviews with members of the public	Random Parameter Logit	WTP in £ for improvements: For River Clyde (Wear) 38.70 (12.19) for ecology; 28.57 (12.07) for aesthetics; 42.99 (12.67) for bankside condition; Pooled Sample: 18.19 for ecology; 15.68 for aesthetics; 19.57 for bankside condition.
Hanley, Colombo, Tinch, Black, and Aftab (2006)	Water Quality Improvements	Motray and Brothock Catchments, Scotland	Ecological improvement; flow rate; employment; water rates	348 mail survey for Motray Catchment and 344 mail survey for Brothock Catchment	Random Parameter Logit	WTP in £: 10.11 for slight ecological improvement; 25.65 big ecological improvement; 3.40 for employment; 3.50 for flow rate.

Alvarez-Farizo, Hanley, Barberan and Lazaro (2007)	Water Quality Improvements	Cidacos River, Spain	Habitat; river surroundings; water supplies for urban and agricultural services; monthly shopping bill	24 face to face interviews with experts	Conditional logit with interactions	WTP in €/households/month: 4.6-7.8 for habitat; 3.7- 5.2 for river surroundings; 3.2- 6.1 for water supplies for urban and agricultural services.
Birol and Cox (2007)	Wetland management	Severn Estuary, England	Wetland area; otter holt creation; no. of protected bird species; irrigation related employment; water rates	100 face to face surveys with members of the public	Conditional Logit with interaction	WTP in £/person on average: 13.8 for wetland area/ha; 31.6 for otter holt creation; 1.2 for one more protected bird species; 0.06 per person in irrigation related employment
Choice Experiment Studies on Forest Resources Management						
Hanley, Wright and Adamowicz (1998)	Forest landscape management	UK	Felling regime; Shape; Species diversity; Tax	181 face to face interviews with members of the public	Conditional Logit	WTP for improvements in £/hh/year: 12.89 for felling regime; 13.90 for shape; 11.36 for species diversity
Lehtonen, Kuuluvainen, Pouta, Rekola and Li (2003)	Forest conservation	Southern Finland	Information & education; conservation contracts; conservation areas; biotopes at favourable levels of conservation; No of endangered species; annual income tax	1500 mail survey of members of the public	Nested Logit	WTP in €/year: Information & Education: 0.3; conservation contracts: 5.5; conservation areas: 4.15; No of Endangered Species: -0.3
Horne, Boxall, and Adamowicz (2005)	Forest management	Helsinki, Finland	Species Richness in site; Average species richness; variance of species richness; scenery at each site; change in municipal taxes	431 face to face interviews with visitors	Conditional Logit	Welfare impact of new management scenario with changes in scenery and species richness is a loss of - €10.36, however this value varies from €34.27 to - €50.11 depending on the sub group and their preferences for different scenery.
Horne (2006)	Forest biodiversity conservation	Southern Finland	Initiator of the contract; restrictions on forest use; duration of the	Mail survey 1181 usable responses collected	Conditional Logit	Average compensation for forest conservation estimated at €224/ha/year.

			contract; cancellation policy; compensation ha/year			
Choice Experiment Studies on Green Energy, Environmental Pollution and Waste Management						
Wardman, Hatfield and Page (1997)	Transport mode and cycling facilities	Leeds, England	Car/bus time; car/bus cost; cycle time; cycle facilities en route; weather; facilities at destination	221 face to face interviews and drop off and collect surveys with members of the public	Conditional Logit	Estimated values of time for cycling pence/min: 9.58-21.28 for no facilities; 7.53-19.24 for unsegregated facilities; 2.85-14.58 for segregated facilities, depending on the weather conditions; Estimated value of time for car/bus pence/min: 1.54
Garrod and Willis (1998)	Landfill waste disposal	Crawcrook Quarry and Landfill Site, England	Reduction in number of days per year with noise disturbance; smell; dust and litter; council tax/hh/year	73 face to face surveys with local residents	Conditional Logit	WTP £/hh/day: 0.11-0.18 (depending on the model specification) to reduce number days when respondent suffers from dust and windblown litter from the site; 0.09-0.14 (depending on the model specification) to reduce number days when respondent can smell the site from her home
Alvarez-Farizo and Hanley (2002)	Environmental impacts from wind farm construction	La Plana of Zaragoza, Spain	Protection of cliffs; protection of flora and fauna; protection of landscape; increase in taxes	488 face to face interviews	Conditional Logit	WTP Pta/year: 3580 for cliff protection; 6290 for fauna and flora protection; 6161 for landscape protection.
Carlsson, Lampi and Martinson (2004)	Air traffic noise reduction	Stockholm, Sweden	Decreases in: early morning flights; morning flights; afternoon flights; evening flights during weekdays and weekends	717 mail surveys	Mixed Logit	WTP SEK/month for Increase (Decrease): WEEKDAYS: Early morning: 2.21-4.48 (4.62-1.18); morning: 7.85-28.60 (-11.11- -4.44); afternoon: -15.12–0.20 (-13.65–2.64); evening: 3.15–8.86 (8.48–19.96) WEEKENDS: morning: 0.52–7.81 (10.27–29.93); afternoon: -2.08–8.33 (-5.32–16.18); evening: 3.82–8.68 (14.81–35.66)
Wardman and Bristow (2004)	Traffic related noise and air quality	Edinburgh, Scotland	Air quality; noise; car times; bus times; cost	398 face to face interviews with members of the	Conditional Logit with interactions	WTP/hh/pence/week in £: 6.9-42.4 for 1% increase in air quality; 0-24.2 for 1% improvement in noise level,

				public		depending on the household income level, size and composition.
Hiselius (2005)	Transportation of hazardous materials by railway	Lund and Borlänge, Sweden	Number of wagons with hazardous material; time of transport; classification of hazardous material; altered housing cost per month		Random Parameter Logit	SEK/month for Low income (Medium-High Income) households: Number of wagons: Twice: WTA 246 (278); Half: WTP 75 (85); None: WTP: 167 (190). Classification: Class 1: WTP: 61 (70); Class 3: WTA: 383(434); Time of transport: WTP: 46 (53); Night time: WTP: 12 (13)
Arsenio, Bristow and Wardman (2006)	Noise reduction	Portugal	Various Definitions of inner city noise	412 face to face in house interviews	Random Parameter Logit	WTP in €(income group): for a house in lower floor 0.80 (10^{th} percentile), 1.42(50^{th} percentile), 3.04(90^{th} percentile); for a house in upper floor 1.21 (10^{th} percentile), 2.16(50^{th} percentile), 4.61(90^{th} percentile);
Bergman, Hanley and Wright (2006)	Renewable energy investments	Scotland	Landscape quality; wildlife; air quality; jobs; electricity price	211 mail survey of the public	Conditional Logit with interactions	WTP in £/hh/year: 8.1 for no landscape impact; 11.98 for improvement in wildlife; 14.13 for no increase in air pollution
Karousakis and Birol (forthcoming)	Kerbside recycling services	London, England	Materials collected (paper, glass, aluminium); collection of compost; collection of textiles; frequency of collection; monthly council tax	188 face to face interviews with members of the public	Conditional Logit with interactions	WTP in £/hh/month: Sample average: 2.678 for one more material; 1.19 for compost; Kensington and Chelsea: 2.763 for one more material; 1.228 for compost; Richmond-upon-Thames: 2.864 for one more material; 1.272 for compost; Westminster: 2.604 for one more material; 1.158 for compost

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