Valuing landscape preferences with perceptive and monetary approaches: two case studies in Italy

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PhD

February 2012

Dedicated to Margherita, Francesca
and my parents Laura and Tiziano

keep reaching for that rainbow!

Abstract

This thesis presents two distinct participative approaches, qualitative the first and monetary the second to analyse people preferences for landscape management. The first approach analyses people opinions about the impact of some specific landscape elements on the landscape of a protected wetland area in northern Italy, while the second applies a stated preference technique, choice experiments, for the valuation of the benefits of different potential landscape settings of a urban forest near Venice.

Embracing the definition of landscape provided by the European Landscape Convention that defines landscape as "perceived by people" suggesting to apply participative approaches in the development of landscape policies, the objectives of this thesis are:

1. verify if the preferences expressed by means of opinions in the absence of visual stimuli are similar to those expressed by scoring images;

2. analyse the effect of the presence/absence of some elements on the preferences of the two groups of respondents;

3. to understand whether choice experiments can be structured (designed) to value landscape providing both welfare estimates and planning support, objectives that are usually achieved applying two distinct approaches: a stated preference valuation (either contingent valuation or choice experiments) and a perceptive study

The thesis consists of two main parts: the first part (chapters 1, 2 and 3) presents the theoretical framework for understanding the need to value landscape, its contextualisation in economic theory and the main valuation methodologies that can be applied to its valuation with particular focus on choice experiments. The sec-

ond part of this work (chapters 4 and 5) is devoted to the presentation of the results obtained from the application of the two valuation approaches to the two case study.

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Acknowledgements

Professor Tiziano Tempesta and Professor Riccardo Scarpa have provided important feedbacks with regard to the study presented in chapter 5 “Monetary valuation: the Wood of Mestre case study”.
My sincere thanks go to Professor Piran White and Dr. Murray Rudd for their friendly support and precious supervision.

Declaration

The thesis is my own work.

The current version of chapter 4 has been submitted to the ISI journal Land Use Policy for evaluation while an early version has been published in the book:

> Tempesta, T. and Vecchiato, D. (2010), "A perceptive web-based landscape evaluation of the Delta del Po Natural Park (Italy): testing the difference between experts and lay people priorities", in "LIVING LANDSCAPE - The European Landscape Convention in research perspective", vol.1, pp. 128–144, Bandecchi e Vivaldi, ISBN: 978-88-8341-458-9.

Chapter 5 has been published on the ISI journal Forest Policy and Economics and can be quoted as:

> Vecchiato, D. and Tempesta, T. (2013) "Valuing the benefits of an afforestation project in a peri-urban area with choice experiments", Forest Policy and Economics, Volume 26, 111-120, doi: 10.1016/j.forpol.2012.10.001

CHAPTER 1

Introduction

1.1 Introduction

Landscape is assuming nowadays an increasingly important role in environmental planning given that it has been recognised as a resource and it is therefore a variable that needs to be considered in land use decisions. In fact landscape values go far beyond aesthetics and changes in landscape are the source of many consequences for society, nature and human well-being. Landscape values are source of migrations (Waltert and Schläpfer, 2010), tourism/recreation and restoration (Ulrich et al., 1991; Ulrich, 1986) and ecosystem services in the form of indirect use benefits.

Landscape valuation aims to support decision makers in satisfying people aspirations toward the planning and preservation of landscapes. This thesis focuses on the presentation of the methodologies that can be applied to perform qualitative and quantitative valuations of landscape as a support for policy decisions. Perceptive techniques are applied to assess landscape quality, while monetary approaches are applied to quantify in monetary terms the benefits or costs of a policy that impacts on landscape.

An important aspect that will be considered in my work concerns the answers that these different approaches can provide to the challenges posed by the European

Landscape Convention (2000) (ELC) that defines landscape as an

> "area perceived by people, whose character is the result of the action and interaction of natural and/or human factors".
>
> (European Landscape Convention, Article 1, point a)

This thesis presents two applications of landscape valuation: perceptive the first and monetary the second. Both case study are located in Italy.

The first case study (chapter 4) concerns a protected wetland area and applies a perceptive approach to understand whether experts' landscape preferences can be considered representative of those of lay people. The comparison of experts and lay people perception of landscape is particularly important if we consider the geographical location of the case study, Italy, where the current legislation that considers landscape preservation relies uniquely on the judgements provided by experts (see section 2.3.4 for a detailed discussion). An online survey was developed where experts and lay people evaluated 63 images of the Po River Delta. The images were partly obtained through photomontages; this made it possible to assess the direct impact of some elements on landscape quality and to gain an insight into how differently they are perceived by experts and lay people.

The second case study (chapter 5 applies a stated preference technique, choice experiments, to value the benefits of a forest landscape. The forest under valuation (the Wood of Mestre) was hypothetical due to the fact that it was not realised yet. Therefore the choice experiment has been designed to derive both an estimate of the future benefits and to understand which forest land management will maximise residents benefits.

The perceptive study presented in chapter 4 is the first application in Italy that tries to understand whether experts opinions can be considered representative of lay people preferences. A further aspect of originality lies in the landscape type chosen:

among the studies that compared experts and lay people opinions, only two were on wetlands.

An interesting and original characteristic of the monetary case study is the type of environmental good under consideration. In fact the outcome of the project is the creation of a woodland with unique and distinctive characteristics in between an urban park and a forest. Indeed the future forest will share some characteristics with an urban park in terms of location and recreational benefits and others with a typical forest as concerns composition, extension (size) and environmental benefits. While it is possible to find willingness to pay estimates with regard to the two distinct types of good (forest and urban park), as far I know there are no studies focusing on goods that share the same characteristics as the Wood of Mestre.

1.2 Literature background

1.2.1 Experts vs lay people preference comparison

Several researches have highlighted how landscape perception and therefore landscape values differ among people (Howley et al., 2012). The results of these studies as well as the definition of landscape given by the European Landscape Convention make the development of participatory valuation instrument a necessary requirement in order to provide a suitable assessment of landscape.

Usually landscape policies are implemented exclusively by experts who have assigned the task of identifying landscapes to protect and the transformations compatible with preservation of the landscape quality. This practice can be considered correct only if the experts have preferences similar to those of lay people.

Several studies in the past compared the visual preferences of lay people and experts (Coeterier, 2002; Dandy and Van Der Wal, 2011; Daniel and Boster, 1976; Dear-

den, 1981; Hunziker et al., 2008; Kaplan and Kaplan, 1989; Rogge et al., 2007; Ryan, 2006; Strumse, 1996; Vouligny et al., 2009). However, the results obtained are not unique. While for some authors there seems to be a significant difference (Hunziker et al., 2008; Kaplan, 1973; Rogge et al., 2007; Vouligny et al., 2009), other studies did not find any difference and in yet others the differences pertained only to some landscapes or to some categories of respondents (Anderson, 1978; Dandy and Van Der Wal, 2011; Daniel and Boster, 1976; Dearden, 1981; Hudspeth, 1986; Ryan, 2006; Strumse, 1996).

The disparity of results might be ascribed to the landscape types under investigation, the method used to elicit and analyse the preferences, and the definition of expert.

With reference to landscape types the previous studies have analysed woods (Anderson, 1978; Dandy and Van Der Wal, 2011; Daniel and Boster, 1976), rural landscapes (Rogge et al., 2007; Strumse, 1996; Vouligny et al., 2009) and wetlands (Hudspeth, 1986; Miller, 1984). Considering the possibility that the differences depend, among the other things, on the landscape types, it seems not possible to draw general conclusions from past studies. The most widely used methods of elicitation of the preferences have been images scoring (Anderson, 1978; Daniel and Boster, 1976; Hudspeth, 1986; Kaplan, 1973; Miller, 1984) or interviews in which the opinions of different groups of people were recorded on the factors that affect the aesthetic value of the landscape and on the reasons underlying their preferences (Coeterier, 2002; Rogge et al., 2007; Vouligny et al., 2009). Since these are methods involving cognitive processes that are at least in part different it can be assumed that the results obtained are not entirely comparable. From the statistical point of view, the method usually utilised to verify the score or opinion differences between experts and lay people has been the analysis of variance. As pointed out by Nakagawa and Cuthill (2007), the null hypotheses significance testing by means of the ANOVA can be misleading in some cases and have some not negligible drawbacks. Moreover,

from the point of view of the policy maker what is important is the magnitude of the differences and their rank, and not only its significance per se. Finally, in the past researches have been considered as experts: students of disciplines connected to landscape management (Strumse, 1996), land planners (Dearden, 1981; Miller, 1984; Ryan, 2006), foresters (Anderson, 1978; Dandy and Van Der Wal, 2011; Daniel and Boster, 1976), landscape experts and architects (Rogge et al., 2007). The categories of expertise are therefore very diverse, making the research results little comparable. There are two further elements that make the results of the previous research only partially useful for the implementation of landscape policies: in a few cases the effect on the landscape of the visibility of a single element has been analysed, the correspondence of individual expert assessments with that of lay people has never been analysed. Regarding the first aspect, it can be noted that the studies done in the past have not always tried to understand if the experts and lay people evaluate the various landscape elements differently. This limitation is particularly evident when one considers that landscape planning is generally divided into two distinct phases. In the first, the landscapes are divided into different classes of quality (landscape quality assessment). In the second phase, to preserve the landscape quality, it is necessary to assess the impact of any land use transformation (such as the construction of new homes or other buildings, power lines, roads, etc.). It can be assumed that the role of the experts is to a certain extent more important in the second phase than in the first. With regard to the second aspect, researches in the past usually compared the average value of the experts with the average value of the lay people. This approach does not take into account the fact that generally in both the first and second phase of the landscape planning only a few experts are involved (sometimes just one). The problem is thus not to verify if the average value is statistically equal but to understand how many experts are able to correctly interpret the preferences of the population. It can therefore be said that currently there is no experimental evidence that unambiguously supports the hypothesis that experts

evaluate the landscape in a different way from lay people. In an attempt to improve the knowledge in this field the research presented in chapter 4 aims to:

1. verify if the preferences expressed by means of opinions in the absence of visual stimuli are similar to those expressed by scoring images;
2. analyse the effect of the presence/absence of some elements on the preferences of the two groups of respondents.

With this aim a perceptive study was conducted on the Po River Delta in Italy, an area that is entirely under landscape protection.

1.2.2 Urban forest landscape valuation

In the last twenty years, many surveys have been conducted in order to determine the monetary value of goods and services derived from forest ecosystems (Willis et al., 2000; Krieger, 2001; SCBD, 2001; Jones et al., 2003; Merlo and Croitoru, 2005; Lindhjem, 2007; Barrio and Loureiro, 2010).

The common aim of these studies was to quantify the monetary value of the environmental services provided by existing forests. The studies highlighted that the total economic value (TEV) can vary widely across different areas and countries. The relative magnitude of the services is also very varied. In some cases, the recreational value prevails over the other components of TEV, while in others the biological value can be the most important. However, especially in the Mediterranean area, the recreational value accounts for more than half of the forest values (Croitoru and Merlo, 2005), excluding marketable products. Most of the Italian studies were concerned with the recreational value of forests located in mountain areas. Only a few estimated the TEV (Marangon and Tempesta, 2001; Goio et al., 2008; Tempesta and Marangon, 2008). Despite the large number of studies, not many of them (Bullock et al., 1998; Hanley et al., 1998, 2002; Lehtonen et al., 2003; Mogas et al., 2005;

Campbell et al., 2006; Christie et al., 2006, 2007; Rambonilaza and Dachary-Bernard, 2007; Meyerhoff and Liebe, 2009) analysed the intrinsic characteristics affecting the value of forests.

There are also several studies that analysed the value of urban parks and urban forests, both in Italy (Willis, 2003; Fratini et al., 2009; Tempesta, 2010) and abroad (Lockwood and Tracy, 1995; Tyrväinen and Väänänen, 1998; Tyrväinen, 2001; Jim and Chen, 2006; del Saz Salazar and García Menéndez, 2007; Bernath and Roschewitz, 2008; Brander and Koetse, 2011; López-Mosquera and Sánchez, 2011; Chen and Jim, 2012; Lo and Jim, 2012). However the benefits of an afforestation programme have only been analysed in two cases (del Saz Salazar and García Menéndez, 2007; Chen and Jim, 2012). Moreover, with few exceptions, the area of the parks is very small and not comparable to that of the Wood of Mestre. In an attempt to know whether the benefits of the Wood of Mestre outweigh the costs, a contingent valuation study was undertaken in 2004 by Tempesta (2006). The study looked at the benefits accruing from a single scenario consisting of devoting the entire area to afforestation (100% forest). Unfortunately it did not include 'mixed' afforestation scenarios.

The aim of the study presented in chapter 5 is:

- first, to estimate the monetary benefits arising from different land use scenarios;
- second, to find the land use scenario that maximises residents' utility

Given these objectives, the choice experiment methodology was selected, as it permits us to analyse the monetary value, both of use and non-use, of different afforestation scenarios while dealing with a non-existent good and to analyse different landscape configurations of the forest.

1.3 Thesis structure

The thesis consists of two main parts: the first part (chapters 2 and 3) presents the theoretical framework for understanding the need to value landscape, its contextualisation in economic theory and the main valuation methodologies that can be applied to its valuation with particular focus on choice experiments. The second part of this work (chapters 4 and 5) is devoted to the presentation of the results obtained from the application of the two valuation approaches to the two case study.

Chapter 2 introduces the main frame in order to understand the characteristics of landscape as a good. Public goods will be described as well as the market failures that characterise public goods. Cost-benefit Analysis (CBA) will then be described given that it is the analytical tool used to evaluate public policies in the presence of externalities. A definition of landscape will be provided as well as its framing in the theory of public goods. The motivations that make landscape valuation a necessary tool will be discussed along with the Italian legislative framework concerning landscape.

Chapter 3 is dedicated to the presentation of the tools developed by economists to value non-market goods. These instruments are divided in two main categories: stated preference techniques and revealed preference techniques. The focus will then be on the description of the main stated preference techniques, contingent valuation and choice experiments, and on the main biases that can be faced in their application. Random Utility theory will be introduced along with the econometric aspects that characterise logit and multinomial logit models. The latter are the base for the estimation of choice experiments and their formal introduction is needed in order to properly interpret choice experiments estimates.

The case study of this research will be presented in chapter 4 and 5. The first case study concerns the application of a perceptive valuation on a wetland area in Northern Italy: the Po Delta. This case study, beside being applied in an area (wetlands)

that did not have many applications in the literature, analyses whether differences exist among two groups of people: experts and lay-people. The second research applied choice experiments to the case study of the Wood of Mestre. This chapter presents a quite unique application of choice experiments driven by the fact that the design of the experiment was designed in order to provide indications to the policy makers about the preferred landscape setting. This is particularly important given that this case study aims to test whether choice experiments can be applied as a comprehensive instrument capable of deriving both welfare measures as long as landscape planning indications in order to maximise the benefits of the residents.

The final chapter, 6, summarises the main findings of this research and provides a final discussion on their implications.

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CHAPTER 2

Why should we value landscape? Key concepts and problem framing

2.1 Introduction

The first objective of this chapter is to introduce the main issues behind the need of environmental valuation and in particular that motivate the application of non-market valuation techniques to landscape valuation. The second objective is to frame landscape in the economic concept and present different valuation approaches that can be applied to its qualitative assessment and monetary valuation. The first objective is accomplished in the first part of the chapter where a definition of externalities, public goods and market failure will be provided along with a presentation of the concept of Total economic value (TEV) and its central role in cost benefit analysis (CBA) when valuing natural resources. The characteristics of landscape as a public good will be discussed and the total economic value of landscape analysed in the second part of this chapter.

2.2 Key concepts at the basis of landscape valuation

2.2.1 Public goods and market failure

Public goods are defined as "non-excludable" and "non-rival" in consumption. The first characteristic refers to the impossibility of exclude a person from consuming a good, while the second characteristic refers to the the impossibility to limit consumption of a good to another person while one consumes it. Making an example if we watch a landscape we do not affect the capacity of others of watching it, while if we have one litre of water and we drink half a litre, the remaining people can only enjoy the water left.

Some common examples of public goods are fresh air, national defence and lighthouses. Samuelson (1954) is usually credited as the first that provided a definition of public goods.

It is often difficult in reality to find perfectly non-excludable or perfectly non-rival goods, and it should be remembered that these characteristics are often relative in the real world. Therefore goods that are "perfectly" non-excludable and "perfectly" non-rival are referred as "pure" public goods, while goods for whom it is theoretically possible but in practice really difficult or incredibly expensive to exclude agents from consumption are considered public goods making a realistic approximation. The same relativism applies for the rivalry property.

Given that different degrees of excludability and rivalry are usually present in reality, it is possible to categorise different goods according to the matrix presented in Table 2.1.

Common goods are rival but not excludable like for example example is deep-sea fish stock. A typical problem of common goods is "the tragedy of the commons" (Hardin, 1968): the difficulty to exclude agents from using a depletable rival resource causes its depletion

	Excludable	**Non Excludable**
Rival	Private Goods	Common Goods
Non Rival	Club Goods	Public Goods

Table 2.1: Classification of goods according to different degrees of excludability and rivalry.

Club goods (Buchanan, 1965) at the opposite are not rival but excludable as for example a golf field. One of the main problems of club goods is congestion, and therefore a solution for properly allocating their benefits is to enforce excludability managing them as a "club" where a proper club membership fee is introduced in order to exclude some agents from the use of the resource. In this way only the agents whose expected value of benefits is greater than the cost of membership will pay for the good and gain access to its services.

The properties that characterise public goods highlight some market failures: markets fail to provide an efficient allocation of these goods. Non excludability generates a sub-optimal provision of a good due to the free-riding problem (Isaac et al., 1984), because the supplier of such good fails to fully internalise the benefits of such provision given that only a small part of those that enjoy the good pay for it.

The demand for public goods is derived in microeconomics as the vertical sum of the subjective demand curves rather than as the horizontal sum like in private goods. This is due a direct consequence of non-excludability and non-rivalry. In fact given that the extra benefit derived from the consumption of the good by one person does not preclude others from consuming it (non-excludability) and it does not reduce the benefits of others from consuming it (non-rivalry), the aggregate benefit derived from consumption is the sum of the extra benefit obtained by each consumer, namely the sum of the price each is willing to pay.

Considering a perfect market where the Pareto-optimal allocation of a scarce good

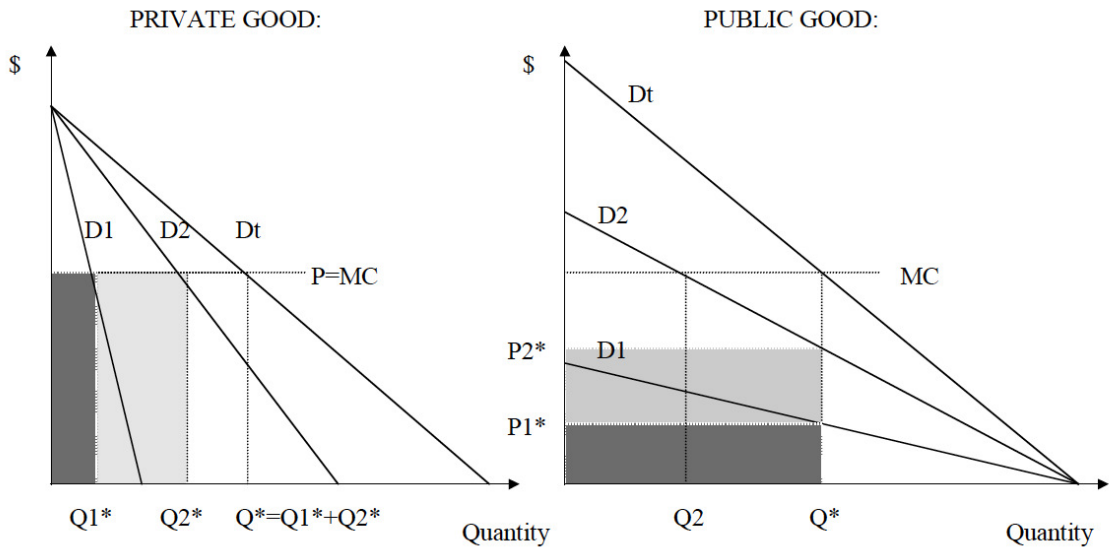

Figure 2.1: Market failure in allocating public goods

reaches its equilibrium when the marginal cost of production equal its marginal benefits in consumption, when the good is non-excludable and non-rival (namely a pure public good) this condition is not satisfied and market fails to provide an optimal quantity of the good in the Pareto sense. One thing should be noted: market equilibrium is socially optimal only when marginal private benefits equal marginal social benefits and marginal private costs equal marginal social costs. When this condition is not satisfied markets maximise net private benefits but fail to maximise net social benefits.

There are four sources of market failures:

1. imperfect competition
2. imperfect information
3. public goods
4. externalities

An extreme case of **imperfect competition** is a monopoly situation, where there is only one supplier of a good that has the power to act on the quantity of the good

supplied in order to maximise its profits. Usually the level of the output supplied by a monopolist is lower than that of a competitive market.

Imperfect information implies that the true costs or benefits associated with a given activity or good are not know by the economic agents. Therefore it is impossible to achieve an optimal allocation of a good based on equating marginal costs with marginal benefits. An example of **imperfect information** (Akerlof, 1970) in environmental goods is the not well known relationship on the emission of green house gasses and global warming. In this condition of imperfect information it is really difficult to develop public policies that reach optimality in correcting market failures.

Examples of market failures concerning **public goods** were just mentioned above while an example for **externalities** were provided in the previous paragraph (2.2.2).

Kahn (1995) includes among the causes of market failure a fifth source: **inappropriate government intervention**. In fact despite not being a direct action of the economic agents themselves, a wrong government intervention might generate a market failure introducing a disparity between social costs/benefits and private costs/benefits. An example quoted by the author is the management of the US Forest Service of the leasing of wood harvesting rights in national forests. The leasing itself is not a cause of failure, but the provision of free roads in the forests for the harvesting companies introduces a distortion lowering the true social costs of harvesting.

Often environmental goods are public goods, and therefore it is very likely that the quantity of a public good supplied by a free market differs from the social optimal quantity. In this case a market failure arises and some intervention is needed in order to achieve the right provision of that good.

Common solutions to the market failures in the case of public goods and externalities often require public intervention in the form of moral suasion, direct production

of environmental quality, command and control regulations, economic incentives to increase the supply of public goods, enforcement of property rights (Coase, 1974) and markets creation (Smale et al., 2006) in order to correct market inefficiencies.

2.2.2 Externalities

Externalities are defined as costs or benefits that are not 'directly' internalised by economic agents in economic transactions. An externality can be formally defined as a situation where the well being of a consumer or the production possibilities of a firm are directly affected by the actions of another agent in economy and this interaction is not mediated by market prices. Externalities can be negative or positive, depending on the type of effect the action produces on the well-being of the affected agent, either negative or positive. An example of negative externality can be the air pollution of a paper factory on the surrounding houses, when no monetary compensation is contemplated to the local residents to outweigh the damage.

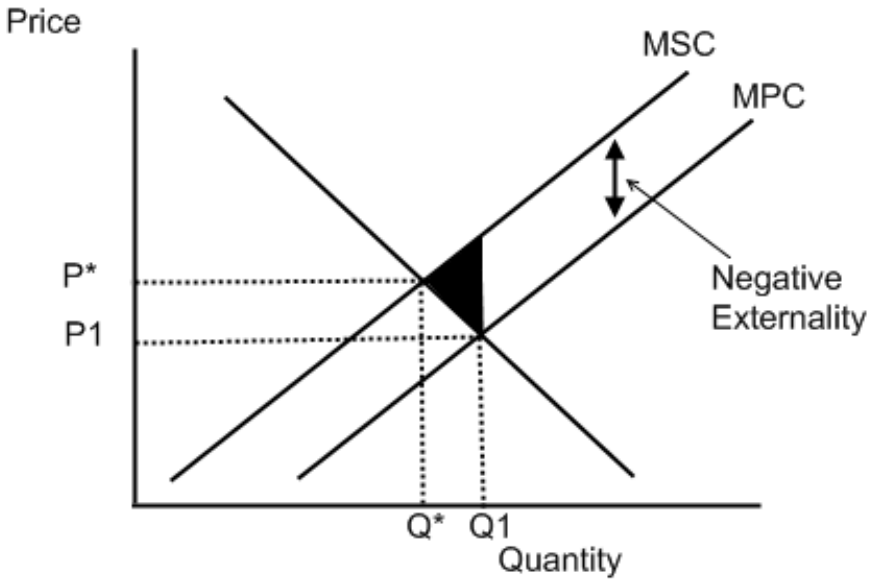

Figure 2.2: Externalities: social and private market equilibrium

Figure 2.2 illustrates how externalities influence market equilibrium. As it is illustrated, when negative externalities are present, the marginal social costs (*MCS*) dif-

fer from marginal private costs (*MPC*) and therefore the good that causes externalities is overproduced at quantity $Q1$ with respect to the social optimum Q^* that corresponds to the price $P^* = P1 + COST_{externality}$. In this case a tax could be imposed to firm in order to increase production costs and achieve a social optimal level of production, or alternatively a socially optimal level of air or environmental quality.

At the opposite goods or services whose production implies positive externalities often need to be supported with subsidies, in order to achieve the socially optimal production. An example related to landscape could be pasture mowing in mountain areas: farmers get subsidies to perform their work that besides providing food for cows has positive externalities on landscape and therefore on tourism. In this sense the positive externalities of pasture mowing justify an external intervention in form of subsidies to farmers to guarantee a socially optimal level of landscape quality in mountain areas that without intervention would be left wild. This policy is enforced in northern Italy and is part of European common agricultural policy (CAP).

Negative externalities are often referred to as external costs, while positive externalities are often called external benefits.

2.2.3 Cost benefit analysis

Cost benefits analysis (CBA) is a technique applied for the valuation of public policies. While it is possible to make a parallelism with profit-and-loss for private companies, CBA differs for the fact that it tries to incorporate the "true" social benefits and costs of a policy or project considering its positive and negative externalities. CBA was first used in the USA in conjunction with the *United States Flood Control Act* of 1936. In 1981 US president Ronald Regan introduced CBA as a requirement for all major government regulations. In 2000 the US *Regulatory Right to Know Act* required to extend CBA to all programs and regulations of US public agencies.

The main phases of CBA require (Field and Field, 2009):

1. a clear specification of the project or policy
2. a quantitative description of the inputs and outputs of the program
3. an estimation of the social costs and benefits of these inputs and outputs
4. a comparison of the estimated social costs and benefits

Once the comparison of the costs and benefits of a project or regulation have been made, a decision on whether to adopt it or not is taken considering if its benefits justify its costs (Pierce et al., 2006).

Cost benefit analysis is simple in conceptual terms, but in practice poses several challenges. Among these:

1. the definition of the perspective of the project (local, regional, national, global) and therefore of the scale of its impacts
2. the definition of the time horizon of the project impacts and the choice of a proper discount rate
3. the choice of the values that should be included (ie. jobs opportunities: are they a simple shift from a sector to another and therefore should not be included among the benefits or are they real "new" opportunities?)

At a first glance CBA might seem a simple accounting exercise, but given the several challenges it implies, many assumptions should be made by those that apply this instrument. Therefore the results of a CBA should be analysed with caution and a critical eye taking into consideration the assumption made and the degree of subjectivity that they imply. Hansjürgens (2004) provides a detailed analysis of the the problems that characterise CBA providing important informations for the interpretation of CBA results.

2.2.4 The Total Economic Value of environmental resources

As Costanza et al. (1997) pointed out in their attempt to value the ecosystem services of Earth, natural resources provide a huge variety of important ecosystem services that in economic terms should be considered as positive externalities and taken into consideration in CBA. These services can be classified in 17 groups (Costanza et al., 1997, Table 1): gas regulation, climate regulation, disturbance regulation, water regulation, water supply, erosion control and sediment retention, soil formation, nutrient cycling, waste treatment, pollination, biological control, refugia, food production, raw materials, genetic resources, recreation and cultural.

To consider the value of a natural resource limiting its value to the value of its products traded on markets is a great underestimation. Therefore, while considering natural resources an important concept in economics is that of their Total Economic Value (TEV). The concept of TEV goes beyond the market economic value of the resource products traded on market and defines the value of a resources considering all its composite values dividing them into use values and non-use values.

Use values include:

- Direct use value
- Indirect use value
- Option use value

Non-use values include:

- Existence value
- Bequest value

To better clarify the concept of TEV it is useful to make an example taking a small lake. Use values might include swimming or fishing in the lake (**direct use**), enjoying a better climate due to the climate mitigation function of the lake living close by

the lake, biodiversity conservation (**indirect use value**) and finally not going swimming but having the possibility to go and swim or fish one day (**option use value**). Non-use values might be represented by the willingness to preserve the ecosystem provided by the lake even if not visiting the lake (**existence value**) and the willingness to preserve the lake for allowing future generations to enjoy the benefits of the lake either directly or indirectly (**bequest value**).

Figure 2.3 presents a graphical representation of the linkage between TEV and some common ecosystem services.

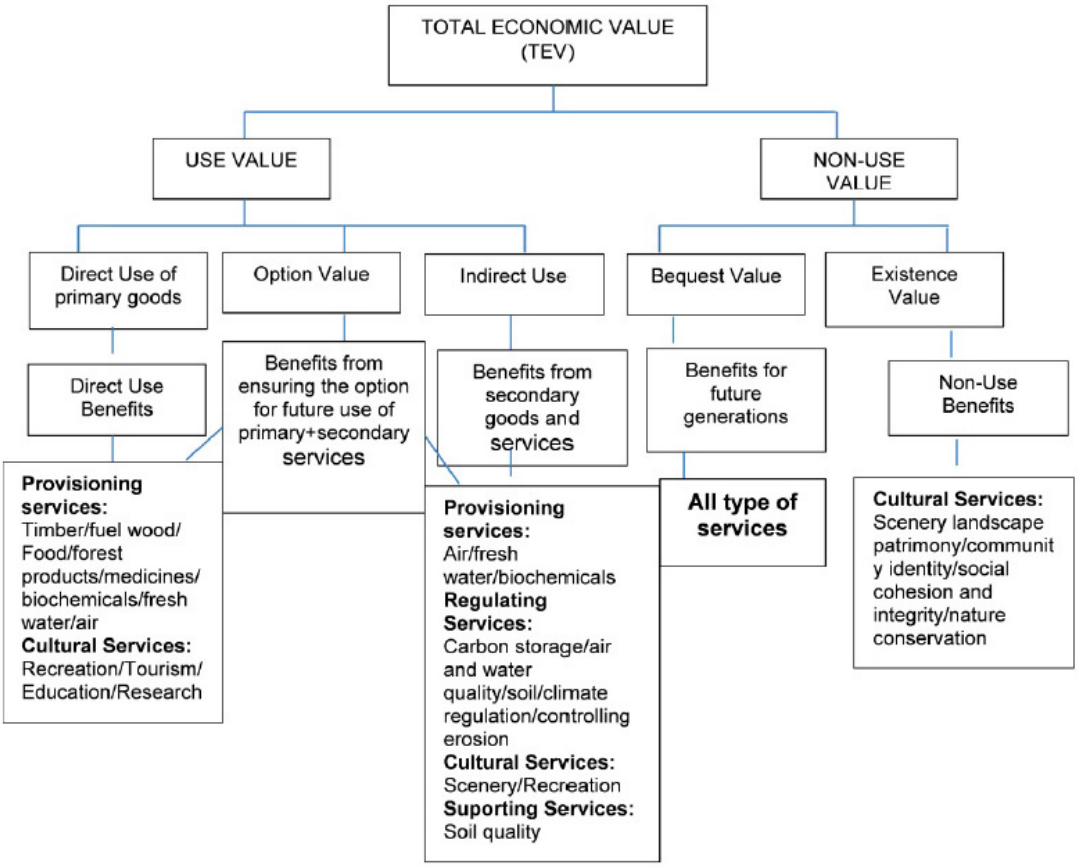

Figure 2.3: Total Economic Value: how different ecosystem values can be framed in the TEV scheme (source Mendes, 2012)

TEV reppresent the sum of values that each individual puts on a specific good, and can be represented as:

$$TEV = \sum_{i=1}^{i=n} WTP_i \tag{2.2.1}$$

where i is the *i-th* individual and WTP the willingness to pay of each individual for the good. Considering that in a Cost-Benefit analysis we should take into consideration the present value (PV) of the cash flow of the present and future benefits of the good, this can be calculated as:

$$PV(TEV) = \sum_{i=1}^{i=n} \frac{WTP_i}{\rho} \tag{2.2.2}$$

where ρ is the discount factor:

$$\rho = (1+r)^t \tag{2.2.3}$$

where r is the social discount rate chosen and t the time interval considered (usually years if using an annual discount rate).

From the complexity of the components of value in a TEV framework follow the problem of developing a set of instruments that can be suitable in providing an economic estimate of their value trying to price what can seem at a first glance "unpriceble". In fact a proper Cost-Benefit analysis should take into consideration all components of TEV. Economists have developed a set of valuation techniques that can cope with the various component of TEV. Figure 2.4 presents an graphical overview of the various techniques that can be applied to measure the TEV components of a natural resource.

2.2.5 Environmental valuation techniques: an introduction

Economists developed a set of techniques to cope with the valuation of non-market goods like landscape. These techniques have been grouped into two categories: re-

vealed preference (RP) and stated preference (SP) methods. **Revealed preference** techniques look at people real behaviour with regard to activities related to an environmental good to infer the value of that good while **stated preference** techniques elicit the value of the good asking it directly to people by means of questionnaires. While in the first case the value of environmental amenities is derived indirectly, in the second people declare their willingness to pay (WTP) for a given environmental good or the willingness to accept (WTA) a compensation for enjoying less benefits for that good. Revealed preference techniques include hedonic pricing (HPM), the travel cost model (TCM) and averting behaviour (ABM) while stated preference techniques include contingent valuation (CV) and choice experiments (CE).

One important difference between RP and SP methods is that the first are limited to the elicitation of use values, while the latter are suitable for valuing both use an non-use values. When non-use values are important, SP techniques should therefore be preferred because they allow to better estimate the TEV of a resource. The estimates of the methodologies presented above are instrumental to Cost-Benefit analysis for policies/projects assessment.

The characteristics of each valuation technique will be presented more in detail in next chapter (section 3.2).

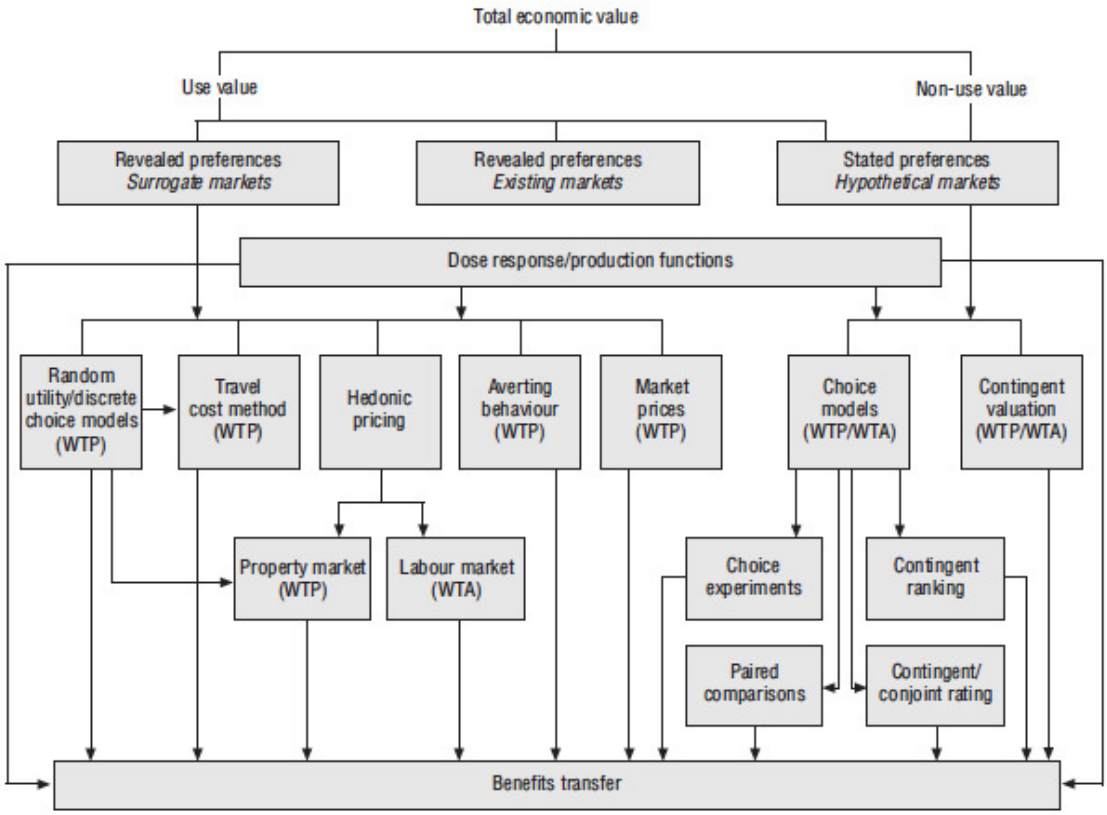

Figure 2.4: Total Economic Value: valuation approaches

2.3 Landscape

2.3.1 Introduction

Landscape resources (water quality, beauty, nature) and their improvements are considered a public good by economists. An efficient resource allocation in landscape planning and management therefore requires the consideration of the effects and the values that individuals and society place on the non-market aspects of landscape and landscape structures (Franco et al., 2001). In order to better understand the meaning of landscape for individuals and society, this section will present an introduction to the concept of landscape and its importance in social, economics and environmental terms. Landscape will then be framed into economic theory and the components of its value will be analysed. The contextualisation of landscape in economic theory will help to better understand the motivation of its valuation

in economic terms and this constitutes the background for a better understanding of the case study presented in chapter 5 while the presentation of non monetary approaches will drive the reader into the case study presented in chapter 4.

2.3.2 What is landscape?

2.3.2.1 Landscape value: an analysis of its TEV components

According to Daniel and Vining (1983) and Amir and Gidalizon (1990), the term landscape clearly focuses upon the visual properties or characteristics of the environment. These include natural and man-made elements and physical and biological resources which could be identified visually: thus non-visual biological functions, cultural/historical values, wildlife and endangered species, wilderness value, opportunities for recreation activities and a large array of tastes and feelings are not included. Nevertheless, the European Landscape Convention (ELC) (Council of Europe, 2000) provides a more comprehensive definition of landscape. It defines landscape as an

> *"area perceived by people, whose character is the result of the action and interaction of natural and/or human factors"*.
>
> (European Landscape Convention, Article 1, point a)

The ELC gives immediate relevance to the fact that the concept of landscape is permeated by a high degree of subjectivity. In fact landscape is defined as a people perception, that means that it is a subjective construction or composition of physical and emotional aspect related to a particular area. This is the reason that justifies the investigation of people's preferences with regard to landscape and the source of

difficulties in decomposing landscape[1] into general attributes[2].

The definition of the term landscape immediately highlights how the landscape embeds a series of objective and subjective components strictly interrelated. A great debate has grown in the 20th century on which of these two components should have been considered more important in landscape assessment, and two main approaches raised from this debate: the expert approach and the perception-based approach.

The two approaches differ in the conceptualization of the landscape and the human viewer and in the relative importance that is given to them. This has been at the base of a long-standing debate in philosophy and aesthetics. The different approaches will be analysed more in detail in section 2.3.3 .

The components of landscape value can be analysed in the TEV framework (Figure 2.5). Use values of landscape include tourism and recreation (direct use), biodiversity conservation, provision of ecosystem services (indirect use) and the option to enjoy and visit a particular landscape in the future. Non use values include the cultural, affective/emotional and historical components of landscape value.

It is possible to classify landscape into two broad categories: natural landscape and cultural (man-made) landscape (Figure 2.6). Cultural landscape includes agricultural/rural landscapes and urban landscapes. These different types of landscapes share some of the values mentioned above like tourism/recreation, cultural, affective/emotional and historical, but indirect use values are usually greater in natural landscapes and agricultural/rural landscapes than in urban landscapes.

According to Jacques (1980) the distinction between value and quality is meaningless with reference to landscape, since both terms refer to the comparison of the

[1]One of the biggest problems in developing quantitative assessment methods for scenic impacts is that of measuring the contributions of specific landscape elements to overall preference (Buhyoff and Riesenman, 1979).

[2]Ecological and formal aesthetic models relay on this kind of decomposition, starting from the assumption that scenic quality of the whole landscape can be explained in terms of aggregation of the values of the landscape components (Daniel and Vining, 1983).

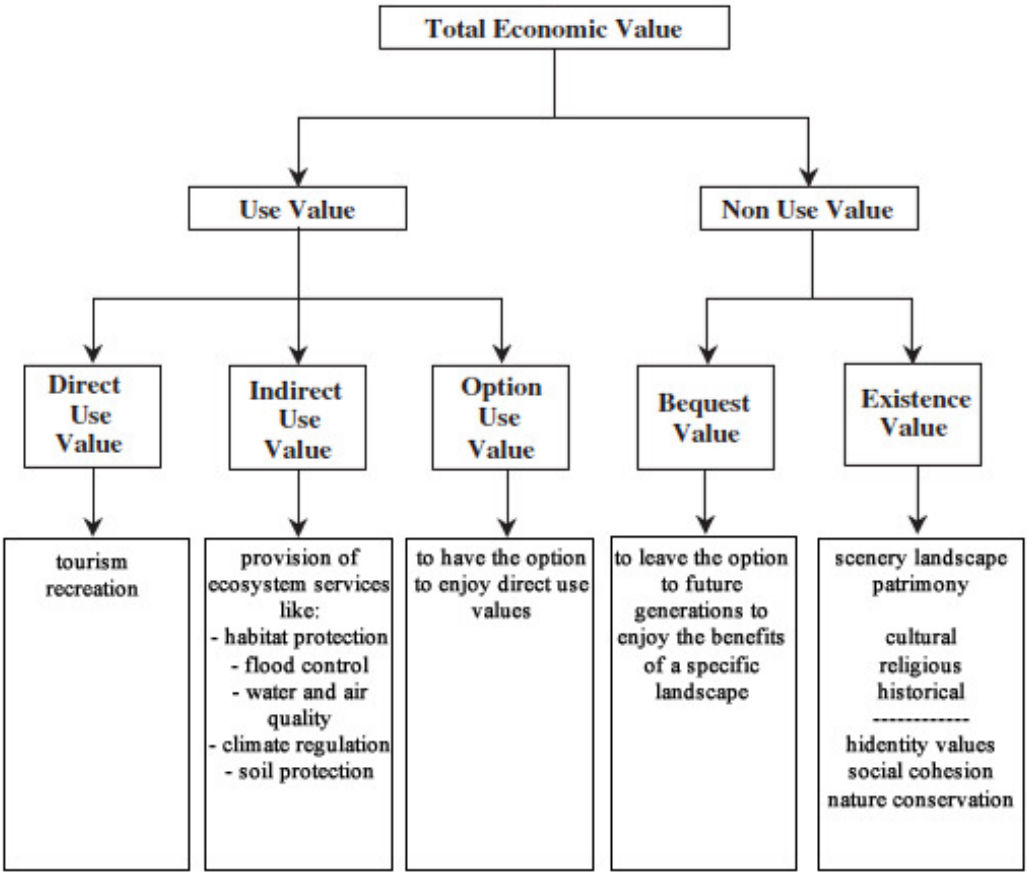

Figure 2.5: TEV components of landscape

landscape in front of your eyes to an idealised landscape in one's mind. Therefore the terms quality and value will be considered as synonymous in this dissertation. The fact that landscape value is subjective is particularly important in determining the right evaluation methodology. The right methodology should therefore assess people preferences as emotional perceptions of the objective elements of a certain landscape and not just an economic inventory of its elements. From the perspective of the single, the value of a certain landscape is subjective, while from a social viewpoint, the value of a certain landscape can be derived aggregating the perceptions of the stakeholders considered by the scope of the investigation.

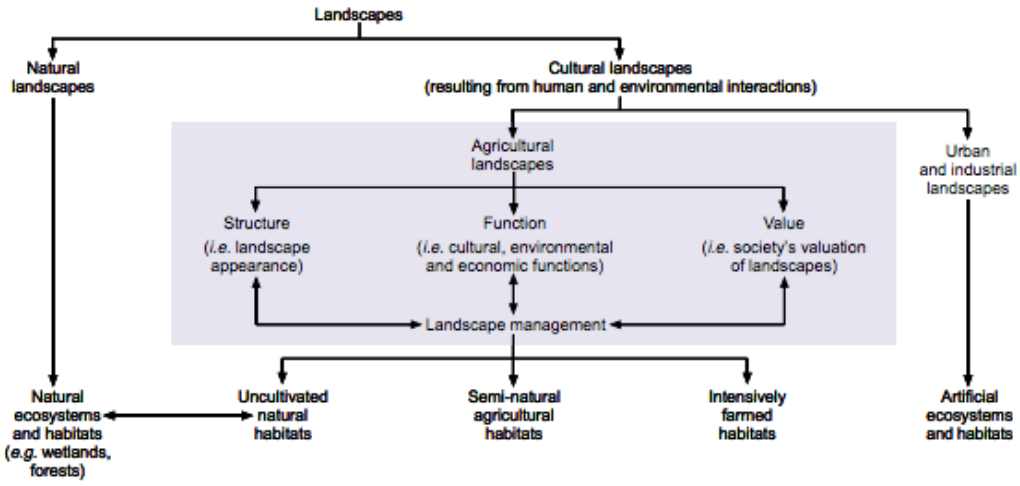

Figure 2.6: Natural and cultural landscapes in the agricultural context (source OECD, 2001a)

2.3.2.2 Landscape as an economic good

The complex components of landscape value and services make it difficult to categorise landscape as an economic good as described in paragraph 2.2.1. In economic terms, landscape can be considered a public good in some circumstances (natural landscape) and an externality in others (cultural landscape resulting as a consequence of other human activities). It is debatable whether landscape is a pure public good and therefore completely non-excludable and non-rival. In fact in some circumstances it can be excludable or rival. If we consider for example the landscape of a waterfall reachable from a narrow valley, it would be possible to exclude visitors closing the road at the beginning of the valley in order to control its access by car imposing an entrance fee and a standard fixing the maximum number of visitors per day in order to avoid possible congestion. If the viewpoint is restricted, visitors that reach the place walking might be excludable putting fences just before the viewpoint, asking them to pay and entrance fee. If the viewpoint is not restricted and the waterfall can be watched from many perspectives, it can be unrealistic or too expensive to put fences around the all valley. In this case the specific landscape would be excludable but with unbearable costs. Another example of great costs of exclud-

ability is the Grand Canyon landscape: try to imagine putting fences all around it! As it can be understood while excludability is theoretically and sometime even practically possible in most of the cases it is too expensive to enforce.

Congestion might affect the quality of a landscape, or better the experience of enjoying its view. Nevertheless congestion is again a relative concept and, in most of the cases it is difficult that landscape consumption is rival.

Given the practical difficulties in enforcing excludability and the fact that in most of the cases landscape is not rival in consumption, there seems to be consensus in the economic literature to treat landscape as a public good (see for example Drake, 1992; Pruckner, 1995; Brunstad et al., 1999; Fleischer and Tsur, 2000; Schläpfer and Hanley, 2003; McVittie et al., 2009; Agnoletti, 2013).

Landscape can be also considered an externality (positive or negative) of human activities. When landscape is an externality like in the case of agricultural landscape, "its quality does not depend on an intentional action by a farmer who is working only to make a profit, but is instead an external and unplanned effect of his activity" (Agnoletti, 2013, p. 7).

2.3.3 Why should we evaluate landscape?

The analysis of landscape in economic terms provided in previous chapter highlighted as landscape can be considered a public good and in some circumstances as an externality with public good characteristics. Therefore in both circumstances, either considering landscape as a public good, or as an externality, a free market will fail to provide an optimal quantity of landscape quality and its provision requires public intervention in order to ensure its services. From this derives the need to apply valuation methodologies to assess the value of landscape and its services and determine the optimal level of landscape quality for society. Valuation methodologies should therefore be applied as a support for the planning and valuation of

policies that affect landscape (consider for example the European Agricultural Policy) or are directly focusing on ensuring an optimal provision of landscape quality (de Groot et al., 2010).

Landscape is assuming nowadays an increasingly important role in environmental planning given that it has been recognised[3] as a resource and it is therefore a variable that needs to be considered in land use decisions[4]. In fact every action that modifies a land setting has an effect on its visual or perceptive counterpart: its landscape. Therefore landscape issues range from farmland reconversion in a multifunctional[5] fashion to the valuation of the impact of new energetic sustainable technologies, that in some cases[6], have big impacts on landscape. A structured method of landscape assessment should include several phases combining its linking description, classification, analysis and evaluation in order to provide an integrated framework within which decisions on land use management and advice can be debated (Cooper and Murray, 1992). According to Unwin (1975) landscape evaluation should follow three main phases:

- Landscape measurement: an inventory of what actually exists in the landscape;
- Landscape value: an investigation and measurement of value judgements or preferences in the visual landscape;
- Landscape evaluation: an assessment of the quality of the objective visual landscape in terms of individual or societal preferences for different landscape types.

[3]Landscape has been formally recognised in Europe as a resource by itself by the European Landscape Convention (Council of Europe, 2000).

[4]See section 2.3.2, for a more detailed analysis of the recommendations given by the European Landscape Convention (Council of Europe, 2000) with regard to the role of landscape in different governance topics.

[5]See OECD (2001b).

[6]Consider for example the visual impact of wind or solar power plants. Some example of landscape valuation in these fields are Álvarez-Farizo and Hanley (2002); Krueger et al. (2011); Ladenburg and Dubgaard (2007).

Several methodologies are mentioned in the geography, economic, psychology and environmental planning literature and can be applied to evaluate landscape. A first macro-classification can be done dividing them in two big categories: monetary and non-monetary methodologies. It is possible to find some fundamental assumption or paradigms on which different valuation methods relay: the cognitive paradigm, the psychophysical paradigm and the interactionist paradigm.

The central concept underlying the **cognitive paradigm** is that environmental perception is subjective, where people as thinkers value environments from the way information is given meaning in the mind through special thought processes. Appreciation and environmental perception are therefore considered a function of the observer.

The **psychophysical paradigm** views physical characteristics of landscapes as an important determinant of aesthetic appreciation. The most important assumption is that the landscape or elements of the landscape act as stimuli to which the human observer responds. Humans are regarded as passive observers and the value of the landscape is assumed to be its stimulus property, whereas this property is outside the observer, does not vary and can be perceived without thinking (Taylor et al., 1987).

According to the **interactionist paradigm**, the human observer and the environment cannot be separated in the understanding of aesthetic appreciation and environmental perception: scenic beauty is inferred from a judgement made by a human observer in response to his perception of a landscape. An observer's judgements of scenic quality are assumed to be affected by both the perceived characteristics of the landscape and by the observer's own aesthetic standards of judgement criteria. Table 2.2 summarises the characteristics of the above methodologies with particular concern on their central assumptions/paradigm.

Environmental economics provides a set of methodologies referred to as revealed

Category	Central assumptions	Models
Descriptive inventories	psychophysical paradigm	Formal aesthetic models Ecological models
Public preference models	cognitive paradigm	Psychological models Phenomenological models
Quantitative holistic techniques	interactionist paradigm	Psychophysical models Surrogate components models Visual management systems

Table 2.2: A comparative overview of the main landscape evaluation techniques grouped by category

and stated preference methods in order to provide a monetary evaluation of landscape. Revealed preference methods include hedonic pricing techniques, travel cost methods and averting behaviour while stated preference methods include contingent valuation and choice experiments. An important advantage of CV and CE compared with HPM, TCM and ABM is that they allow to value hypothetical goods (non existent at present but planned in the future) and therefore they can both assist in valuing today's landscapes as well as the benefits which residents and visitors might derive from alternative landscapes which could arise at some time in the future (Willis and Garrod, 1993).

Considering the landscape evaluation paradigms, CV and CE endorse the interactionist paradigm, and therefore, in the context of a broader landscape evaluation scheme, they might be classified among quantitative holistic techniques. Nevertheless, they distinguish themselves from other methodologies because they provide a monetary assessment of landscape attributes and therefore, even if they share the same paradigm, they can constitute a specific subcategory of quantitative holistic techniques: that of economic quantitative holistic techniques.

Both techniques, CV and CE, enable the researcher to evaluate the sum of money that a person is willing to pay in order to enjoy the benefits of the commodity provided by the policy described. In other terms, the WTP expressed by the interviewee

is theoretically equivalent to the benefits provided by the good under consideration, and therefore provides an economic measure of these benefits. While CV enables the researcher to evaluate a specific public project asking the respondents to indicate their WTP when facing two alternatives (often the status-quo and a policy that provides a certain amount of the public good), CE performs the same task asking respondents to choose between a wider range of consumption bundles, systematically described in terms of combinations of attribute levels and specific cost level (Lehtonen et al., 2003, p 198). The wider range of possible policy combinations that CE can offer to the respondents, should provide more information[7] about the marginal level placed on different policy measures. In this sense, CE should be preferred as an informative tool in order to provide policy advice for governance.

2.3.4 Landscape policies in Italy: does participation matter?

The first Italian Act passed regarding landscape preservation was the Protection of Natural Beauties Act in 1939. The aim of the Act was to protect areas (natural and anthropogenic) of particular aesthetic beauty, historical villas, gardens and parks, vernacular landscapes, and panoramas and panoramic viewpoints. A commission of experts appointed by the Ministry of Culture was in charge of identifying in which areas to protect the landscape and control development. Any changes to these areas were submitted for approval to another commission of experts belonging to the Superintendence of the Artistic and Historical Monuments. The Act also dictates the necessity to create landscape master plans to define the characteristics of

[7] According to Hanley et al. (1998), "by repeating choices between the bundles, and varying attribute levels, the researcher can infer four pieces of information:

(i) which attributes significantly influence choice

(ii) the implied ranking of these attributes

(iii) the marginal WTP for an increase or decrease in any significant attribute

(iv) implied WTP for a programme which changes more than one attribute simultaneously."

the land development by giving indications about, for instance, the number and appearance of new buildings, the planting of trees, the implementation of new routes, the area to be preserved and not developed.

For a long time Act n.1497 of 1939 was not enforced. In 1977 landscape policies were partially entrusted to the Regions; this change in landscape protection procedures did not have marked effects. Only a few areas were identified as requiring landscape protection. Furthermore, land changes were rarely controlled. No general rules were followed to govern the impact of land uses, and the granting of development permits was highly subjective. Numerous buildings were built without any authorisation. Finally, no landscape master plans were drawn up. From the end of the Second World War to the end of the 1970s there was a dramatic transformation of the Italian landscape. This led to a critical change in Italian landscape policies. The Act n.431 of 1985 widely extended the areas where landscape must be protected, including forests, coasts, mountains above 1,300 m (Apennines) or 1,600 m (Alps), national and regional parks, volcanoes and archaeological areas. As a consequence, about 47% of the country was designated as protected landscape. In addition, all the Regions were forced to draw up landscape master plans; a master plan details the goals of landscape policies in order to accomplish conservation and development strategies.

Despite this important legislative effort, some problems were not solved (Settis, 2010). Most strangely, despite the fact that the 1948 Italian Constitution recognised that "the Republic promotes the [...] conservation of the landscape and the cultural heritage", the Italian legislation did not provide any definition of "landscape". It is clear that without specifying the object of a policy the subsequent normative efforts were ambiguous and poorly targeted. This lack of Italian legislation was partially resolved by law decree n.42 of 2004, the "Codex of cultural heritage and landscape" (amended by the law decrees 157 of 2006, 62 and 63 of 2008). During the same period the European Landscape Convention was ratified (Act n.14 of 2006). Law de-

cree n.42 of 2004 re-assigned the safeguarding of the landscape to state authorities (which act in cooperation with regional and local authorities). The issuance of permits to develop the territory was re-entrusted to the Superintendence of the Artistic and Historical Monuments. The impact of any land-use change on landscape was to be analysed and valued by the experts commissioned by the Ministry of Cultural Heritage. In this respect, law decree 42 of 2004 does not clearly demarcate a set of objective parameters but only lists the factors to be considered for a transformation to be compatible with the landscape preservation.

This approach contradicts some stated principles of the European Landscape Convention. The first two articles of the European Landscape Convention state that "landscape means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors". Landscape policy must allow "specific measures aimed at the protection, management and planning of landscapes" to be adopted to satisfy the "aspirations of the public with regard to the landscape elements of their surroundings". From this definition, one understands that landscape visual quality has to be judged by the general public and not only by experts. Previous studies reveal that, often, the judgement of experts on the aesthetic quality of the landscape diverges from that of the users (residents and tourists) (Daniel, 2001; Daniel and Boster, 1976; Kaplan, 1985).

The study presented in chapter 4 is the first that tries to test whether the opinions of experts can be considered representative of the aspirations of people in Italy. The case study considered is the Po River Delta in Italy, an area that is entirely under landscape protection. The Po River Delta is the only Italian delta and one of the most important wetlands of the Adriatic coast. To date, this is one of the few perceptive studies that focuses on the landscape perception of wetlands.

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CHAPTER 3

Valuation methodologies

3.1 Introduction

The objective of this chapter is to present more in detail the valuation methodologies introduced in chapter 2 with particular focus on stated preference methods. This chapter will also provide an in depth overview of choice experiments. The in depth treatment of choice experiments will provide the basis for understanding why choice experiments have been preferred to contingent valuation for the case study presented in chapter 5. The main biases associated with stated preference methods will also be discussed.

3.2 Stated preferences and Revealed preferences techniques

As previously discussed in section 2.2.5, environmental economics answered the need to assess the TEV of complex goods like natural resources and landscape developing revealed (HPM, TCM, ABM) and stated preference (CV and CE) methodologies. The first look at the real behaviour of consumers and their expenditures

in order to derive WTP estimates, while the second ask them to stated their WTP for the good/service under valuation by means of questionnaires. Among revealed preference methods, HPM is mainly used in the landscape context to assess the values of urban landscape, TCM is particularly suitable for valuing direct use values of recreational demand while ABM is commonly used to value the effects of indirect benefits like water quality, wildfire protection etc. offerend by landscape. Stated preference methods are applied to landscape valuation when non-use values and indirect use values play an important role. Therefore they saw several applications in the literature for the valuation of natural landscapes and rural landscapes including agricultural ones. CV has been the predecessor of CE and therefore saw numerous applications from 1980 to 2005 while in last decade the frequency of adoption of CE saw a fast increase (Hoyos, 2010). This does not mean that CV is obsolete but simply reflects a quantitative trend in the studies published.

3.2.1 Revealed preference methods

3.2.1.1 Hedonic pricing

The HPM is base on the assumption that people value the characteristics of a good rather than the good itself and that therefore the prices of goods reflect people appreciation for their characteristics. For example houses in areas close by urban parks might be more expensive reflecting people preferences for a higher environmental quality in their neighbourhood. Therefore the price of an house does not only reflect the characteristics of the house itself (number of rooms, age of the house, presence of a garage and so on) but also of the quality of the services it offers (easy access to public transport, quiet, environmental quality). WTP is estimated applying regressions analysis to the attributes that influence the price of the good under investigation. See Nelson (1978) for an application of the HPM to the valuation of urban air quality in Washington DC (USA).

3.2.1.2 Travel cost

The TCM is mostly applied for the valuation of environmental resources associated with recreational activities. The key assumption made applying this methodology is that the travel cost to reach a specific site represent the price to enjoy its benefits and that the the frequency of visits depends on the travel cost. Usually visitors are interviewed and are asked to provide informations about their travel expenses, the number of trips they do in a given range of time to a specific site and their origin. The informations about the number of trips of each visitor and the travel costs are then used to run a regression analysis to derive the demand curve for the site for each individual for each zone of origin. The value of the site is then determined finding the average consumer surplus for each visitor and multiplying it for the number of visitors. See Willis and Garrod (1991) for an application of TCM for the valuation of forest recreation or Fleischer and Tsur (2000) for an application in valuing Israel agricultural landscape.

3.2.1.3 Averting behavihour

The ABM method is applied to study people expenditures to avoid unwanted effects like for example the expenditure on double glass windows for reducing noise pollution Starkie and Johnson (1975). The estimation of the expenditures of private agents to avoid some environmental risks represent the economic benefits of an environmental policy that reduces that risk. See Blomquist (2004) for an application related to the study of the value of statistical life based on averting behaviours.

3.2.2 Stated preference methods

3.2.2.1 Contingent valuation

The CV method has been widely applied by researchers because it allows to determine both use and non-use values. Furthermore, given that it relies on a hypothetical market, it can be the right choice to understand future benefits of goods that do not yet exist (ie. a future forest). CV relies on questionnaires and respondents are required to declared their WTP for the policy/good. WTP questions are usually presented using one of the following formats:

1. "**Bidding game**": respondents are first asked if they are willing to pay a given amount. Respondents are then offered lower or higher bids depending until the maximum WTP is found. The main problems are the lack of incentive compatibility and the so called starting point bias, furthermore it is subject to fatigue effects.

2. **Payment card**: a card with a range of possible values is presented, one of which is pointed out by interviewee. May have problems referred as "starting point" bias;

3. **Open-ended question**: respondents are required to declare their WTP without any suggestion, this often implies a high degree of individual impreciseness, and sometimes systematic bias, may be a problem;

4. **Closed-ended single-bounded referendum**: a single bid value is proposed to the respondent;

5. **Double-bounded referendum** (same as closed-ended, but with an additional follow-up question of maximum WTP);

The extensive application of CV raised several critics (Hausman, 1993; Carson et al., 2001) and several studies (see for example Schulze et al., 1996; Morrison et al., 2000;

Lusk, 2003; Cummings et al., 1986; Carson and Mitchell, 1993; Boyle et al., 1993, 1985; Blamey et al., 1999, just to quote some) further investigated the degree of reliability of the estimates provided by this methodology and their limits as well as possible solutions.

CV received several critics due to the many biases[1] its estimates might be subject to. These include:

1. the **payment bias** (Morrison et al., 2000): WTP is influenced by the payment vehicle chosen (ie. donation vs tax);

2. the **information bias** (Whitehead and Blomquist, 1991): occurs when the WTP declared is influenced by the informations provided in the hypothetical market scenario;

3. the anchoring bias (Boyle et al., 1985): when respondents are not familiar with the good under valuation they might tend to interpret the first bid presented as a signal of the real value of the good;

4. the **operating bias** (Cummings et al., 1986): in this case respondents have different understanding of the good valued with respect to the meaning given to it by researchers;

5. the interviewer bias (Boyle and Bishop, 1988): responses are conditioned/influenced by the way are conducted by the interviewer;

6. the **hypothetical bias** (Blumenschein et al., 1998; Lusk, 2003): this implies that the hypothetical scenarios is not belived to be "realistic" by the respondent and therefore respondents do not belive they have to pay. This bias is strictly related to 'incentive incompatibility', where an incentive compatible contingent

[1] Schulze et al. (1996) define a bias as "the difference between the distributions of hypothetical bids obtained from a survey and the distribution of bids that would be obtained in an actual demand revealing market setting".

valuation survey design implies that respondents provide truthful and accurate responses to the contingent valuation question;

7. the **embedding bias**[2] (Carson and Mitchell, 1993): in this situation the respondent fails to properly value the scenario provided, giving a personal interpretation that leads to the confounding of the specific good investigated (ie. preservation of a specific specie) with a more general concept (ie. preservation of all threatened species in the area). Therefore the WTP declared is not truly associated to the good it is asked for but refers to a more general set of related goods. The implication is that if the researcher does a survey focusing on one specific specie and then on for all species he might result obtaining the same WTP estimates;

8. the **strategic bias** (Mitchell and Carson, 1989): in this situation the respondent acts strategically trying to influence the future policy with the provided WTP. Therefore he will provide an higher WTP conscious that he will not be subject to the payment vehicle and that other will pay for the policy;

9. **yea-saying bias** (warm-glow effect) (Blamey et al., 1999; Nunes and Schokkaert, 2003): when people answer that they will be willing to pay because it makes them feel better but in reality they will not pay the declared amount.

In occasion of the Exxon Valdez oil spill (an environmental disaster occurred in Prince William Sound, Alaska, on March 24, 1989) (Carson et al., 2003), the National Oceanic and Atmospheric Administration (NOAA) appointed a commission of high qualified experts chaired by the Nobel Laureates Kenneth Arrow and Robert Solow to establish procedures for assessing damages to or destruction of natural resources. The commission concluded that:

[2] In the literature different authors refer to this bias using different terminologies like *part-whole* bias or *scope effect* (Venkatachalam, 2004).

> *"CV studies can produce estimates reliable enough to be the starting point for a judicial or administrative determination of natural resource damages-including passive use values. To be acceptable for this purpose, such studies should follow the guidelines described in Section IV above. The phrase 'be the starting point' is meant to emphasize that the Panel does not suggest that CV estimates can be taken as automatically defining the range of compensable damages within narrow limits. Rather, we have in mind the following considerations.""*
>
> (Arrow et al., 1993)

The NOAA panel provided a set of guidelines (Arrow et al., 1993, p. 46) that should be applied to avoid the most common biases of contingent valuation[3] as well as declaring that further research is needed to investigate some problems (embedding bias, warm-glow effect) connected to CV.

This guideline suggest to:

- choose a proper **sample size** to limit sampling errors
- **minimize non-responses** (protest-votes) both in terms of sample non-response and item non-response to increase reliability of relsults
- prefer **personal interviews**: the panel discourage mail surveys but this position has been critiqued by for example Hanley et al. (1998a), telephone interviews are accepted
- included **tests for assessing interviewer bias**
- provide a complete **reporting** about the study that includes: sample size, the sampling frame used, sample non-response rate, the hypothetical market proposed to respondents

[3]The panle recognised that part of the critiques to CV are common to other valuation studies like for example the interviewer bias.

- carefully **pretest** the questionnaires with focus groups
- **prefer conservative estimates** (design) eliminating extreme responses
- **measure WTP** rather than WTA: WTP should in fact be subject to the budget constrain of the respondent at the opposite of WTAand therefore is expected to be a more conservative measure
- use the **dichotomous choice format** (referendum format) because this formulation is 'incentive compatible'. If using a double-bounded design, potential biases should be investigated
- use an **accurate description of the program** or policy (hypothetical scenario)
- **pretest photographs** if used in order to avoid 'emotional' biases
- remind of undamaged **substitute commodities**
- consider an **adequate time lapse** when valuing WTP for environmental damage restoration to avoid emotional answers and to make the restoration scenario plausible
- include a **no-aswer option** to make the contingent market more plausible and ask motivations for choosing the no-asnwer option
- use **"yes/no" follows-ups** to understand motivations of choice (either positive or negative)
- use **cross-tabulation** about socio-economic characteristics, knowledge of the event/are etc. to better interpret results

An alternative approach, not limited to CV, for valuing the quality and reliability of valuation studies was proposed by the Swedish Environmental Protection Agency and called quality assessment instrument (QAI) (Söderqvist and Soutukorva, 2009).

3.2.2.2 Choice experiments

This paragraph will provide an intuitive introduction to choice experiments given that a detailed treatment is provided in paragraph 3.3. Choice experiments, like CV, ask respondents to state their WTP for a good, service or policy directly by means of questionnaires. After a clear specification of the hypothetical market, respondents are usually presented a choice card (*choice set*) containing a number of potential configurations (*choice options*) of the good under investigation. In each choice set respondents choose their favourite choice options among the proposed ones, according to the characteristics of the option. Each option is built following a procedure called *experimental design* (Ferrini and Scarpa, 2007) that has the purpose of mixing the levels (namely the values that an attribute can assume, i.e. present/absent, quantitative like the cost attribute or qualitative) of it attributes following certain criteria (usually orthogonality or optimality). In order to derive welfare measures (WTP or WTA) one of the presented attributes must be monetary, and represents the cost of choosing that option. While choosing respondents made trade-offs weighting the different characteristics of the goods represented by each option. Data are analysed with different statistical techniques and among them the most applied in the literature are multinomial logit models, latent class models, nested logit models and mixed logit models. From the analysis of the data collected it is then possible to derive welfare measures both with respect to each level of the attributes proposed and for comparing a set of attribute combinations with another (often the status quo option in environmental valuation) changing more than one attribute level simultaneously.

CE offers several advantages with respect to CV and they include Hanley et al. (1998a):

- the presentation of a choice format that better mimics situations respondents are used to in the real market and therefore is incentive compatible

- the capacity to infer the marginal WTP for an increase or decrease in the level of each characteristic (attribute) of the good
- the avoidance of the "yea-saying" bias of dichotomous choice CV

One interesting advantage in applications concerned with landscape is that CE, if properly structured, can offer planning informations as long as monetary values suitable for CBA. **This is the main reason that has led to the choice of CE in the case study presented in chapter 5.**

3.3 Choice experiments: a detailed overview

3.3.1 Overview

The CE methodology (Batsell and Louviere, 1991; Hensher, 1994; Louviere, 1988a,b, 1991; Louviere and Hensher, 1982) has been widely applied in the last decade for valuation purposes like transport studies, environmental valuation, marketing, agribusiness and health. Among non-market valuation techniques CE is part, along with Contingent Valuation (CV), of the stated preference methods. With respect to CV, CE allows not only a welfare measure to be derived for the good/service as a whole, but also provides further insights to understand to what measure the single characteristics of the good/service influence the probability of choosing it. In fact CE is based on Random Utility Models (RUMs) (Luce, 1959; Manski, 1977; McFadden, 1974; Thurstone, 1927; Yellott, 1977), which assume that utility is derived from the properties/characteristics of goods/services rather than directly from the goods themselves. The good/service characteristics (referred to as “attributes” in CE) are therefore the determinants of the good/service utility.

In practice, the good/service examined is split into its key characteristics, or "attributes". Each attribute can assume different "levels". To make things clearer it is

useful to give an example. If the good being investigated is a smartphone, its attributes might be the size of display (SOD), the type of connectivity and price. The levels of the attribute SOD could be 3", 4", 5"; those of the attribute connectivity 3G, 4G and those of price 100€, 200€ and 400€. As can be seen attribute levels can be qualitative or quantitative. With a procedure called experimental design, the number of all possible combinations of attributes and levels are reduced. In this way the researcher is able to present a reasonable number of treatment combinations (or choice profiles) to the respondents. Treatment combinations are usually grouped into "choice sets" so that the respondents choose between a minimum of 2 treatments combinations. To make the choice task more realistic, a further choice option is often added to the choice set: the *status quo* - in the case of policy - or "none of these" - in the case of goods - option.

In this way the researcher derives the probability of a person n choosing alternative i (where *alternative* is synonymous of *choice option*) among a set of possible alternatives in a choice set.

3.3.2 Roots in economic theory

CE is grounded in neoclassic welfare theory, Lancaster (1966) consumer theory and Random Utility Theory (McFadden, 1974; Manski, 1977).

The basic assumption derived from neoclassical welfare theory implies that economic agents behave rationally[4] in order to maximise their utility. Rationality implies that people preferences satisfy the five axioms of completeness, transitivity, reflexivity, non-satiation and continuity (Gravelle and Rees, 2004).

The second assumption is grounded in Lancastrian consumer theory. According to Lancaster (1966) the utility of a good is the sum of the utilities derived from its

[4]This assumption received several criticism: see Gowdy and Mayumi (2001) for a discussion with regard to environmental valuation and stated preference methods.

characteristics. This condition can be formally expressed in mathematical terms as:

$$U_{ni} = U(x_{ni}, S_n) \tag{3.3.1}$$

where the utility derived from a person n from the good i depends on a vector of characteristics of the good x and on the socio-economic characteristics S of the person.

When a person makes a choice between two goods i and j, assuming that this choice is made respecting rationality and a budget constrain, the person will choose the good that maximises his utility. Therefore good i is chosen if the utility derived from it is greater than utility derived from good j:

$$U_i > U_j, \forall i \neq j \tag{3.3.2}$$

The analysis of utility as an expression of people preferences poses some difficulties and the analyst can only infer what is referred to as the visible portion" of utility. These difficulties include the impossibility to consider all characteristics of a good, measurement errors and differences in how people value the attributes of the good. To overcome these problems and take into account uncertainty in the estimation of utility, Random Utility Models are applied. According to Thurstone (1927), individuals choices are the result of the value of the attributes chosen and some degree of randomness (Luce, 1959; Manski, 1977; McFadden, 1974)

It is therefore possible to represent utility U as formulated in equation 3.3.1 as a random variable:

$$U_{ni} = V(x_{ni}, S_n) + \varepsilon(x_{ni}, S_n) \tag{3.3.3}$$

where $V(\cdot)$ is the observable part of utility and $\varepsilon(\cdot)$ the unobservable or random

component.The random component of utility represents the uncertainty of the analyst about the factors that determined a specific choice. due to the presence of a stochastic part in the utility function presented in equation 3.3.3, it is only possible to predict choices in terms of probabilities. It is then possible to specify the probability of choosing alternative i over another alternative j by an individual n as (Train, 2009):

$$\begin{aligned} P_{ni} &= Prob(U_{ni} > U_{nj} \forall j \neq i) && (3.3.4) \\ &= Prob(\varepsilon_{ni} - \varepsilon_{nj} > V_{nj} - V_{ni} \forall j \neq i) && (3.3.5) \\ &= \int_{\varepsilon} I(\varepsilon_{ni} - \varepsilon_{nj} > V_{nj} - V_{ni} \forall j \neq i)\, \mathrm{f}(\varepsilon_n) \mathrm{d}\varepsilon_n && (3.3.6) \end{aligned}$$

Where $\mathrm{f}(\varepsilon_n)$ is the density of the unobserved portion of utility and the indicator function $I(\cdot)$ assumes the following values:

$$I(\cdot) = \begin{cases} 1 & \text{if } i \text{ is chosen} \\ 0 & \text{if } i \text{ is not chosen} \end{cases} \quad (3.3.7)$$

Equation 3.3.6 is a multidimensional integral and its solution depends on the assumption about the distribution of the density function $f(\varepsilon_n)$.

When error terms are independent and identically distributed (IID) Gambel the density function takes a closed form and Multinomial Logit Model (see section 3.3.4.2) can be applied. MNL models rely on the following assumptions:

- error terms are Independent and Identically Distributed (IID)
- Independence from Irrelevant Alternative assumption (IIA)

The second assumption (Luce, 1959, 1977) implies that the odds ration of the probabilities of choosing one alternative should be independent from the alternatives con-

sidered. In other words, considering a situation in which 4 possible outcomes/choices are possible (A, B, C, D), the odds of $Pr(A)/Pr(B)$ should remain unchanged if we exclude one of the possible choices (let us say D). It is possible to test if a particular model respects this assumption using the *ias()* function of the *mlogit* R package (Croissant, 2011).

When the IIA assumption is not satisfied, the analyst is requested to apply alternative models like latent class models, nested logit models or mixed logit models[5] (Train, 2009). Mixed logit models (RPL) (Train, 2009; Greene, 2003) and latent class models (LCM) are suitable for investigating respondents taste heterogeneity but differ in the way individual characteristics are handled in determining choice probability. RPL models take into account taste heterogeneity in a continuous fashion, considering it random with a specific density function. It is up to the researcher to identify which parameters of the utility function should be treated as random and to impose the distribution of their density function (normal, lognormal, triangular, uniform). Latent class models can be considered a semiparametric variant of MNL models (Greene, 2003), in which the probability of choosing a specific option is conditional on both the attribute bundle and the individual belonging to a specific group of people with common taste characteristics.

Data analysis can be performed with both commercial (NLogit®[6], Stata®[7]) or open source (R Core Team, 2012; Croissant, 2011; Bierlaire, 2003) software. More details on the econometric specifications of the different CE models can be found in Hensher et al. (2005) and Train (2009).

[5] Also known as Random Parameter Logit (RPL).
[6] http://www.limdep.com/
[7] http://www.stata.com/

3.3.3 Welfare measures

Usually the utility of a choice option i in a choice set assumes the following linear specification:

$$V_i = ASC_i + \sum_{i=1,n} \beta_{in} x_{in} \tag{3.3.8}$$

where ASC is the alternative specific constant for the option i and β the coefficient for the n-th attribute level x. When dealing with unlabelled[8] choice experiments alternative specific constants for each choice option in a choice set does not make sense and therefore are usually omitted. When a status quo option or "no-choice" option is present a dummy variable is usually included to detect its effect, especially if the levels of its attributes are not included in the experimental design generation.

Welfare measures are derived by looking at the marginal rate of substitution between non-monetary attributes and the monetary attribute included in the indirect utility function described by equation 3.3.8. Therefore, the consumer surplus can be calculated within the context of discrete choice models such as the relative Hicksian compensating variation (Hoyos, 2010). When dealing with additive IUFs, the formula for calculating WTP becomes:

$$WTP_j = -\frac{\partial V / \partial x_j}{\partial V / \partial p} = -\frac{\partial \beta_j}{\partial \beta_p} \tag{3.3.9}$$

Where j is the *j-th* attribute, U is the indirect utility function and p is the price attribute. The application of equation 3.3.9 should take into consideration whether the attributes are dummy or effect coded in the IUF formula and in the case they are effect coded apply the needed corrections to take into account the introduced gap from the base level (see Bech and Gyrd-Hansen, 2005, for further details).

[8] "Experiments that use generic titles for the alternatives [choice options] are called unlabeled experiments" – (**?**). See also **?** Chapter 5.3 (page 150) "A note on unlabeled experimental design", and Appendix 10A (page 371) "Handling unlabeled experiments".

Equation 3.3.9 allows to elicit the marginal WTP of an attribute level with respect to its base level *ceteris paribus*. To derive the consumer surplus from a simultaneous change in more than one attribute level it is necessary to calculate the indirect utility difference between the two choice option considered and to divide it from the negative of the monetary coefficient (Bennet and Adamowicz, 2001):

$$Economic\ surplus = -\frac{1}{\beta_p}(V_1 - V_0) \tag{3.3.10}$$

where V_0 represent the IUF of the base option (usually the status quo option) and V_1 the IUF of the 'change' option considered. A negative value of the consumer surplus indicates a positive welfare change for the change from the base option to the 'chabge' scenario considered. The consumer surplus calculated with equation 3.3.10 is the welfare measure that should be used in CBA for policies assessment.

3.3.4 Econometric modelling

This section presents logit an multinomial logit models in detail taking inspiration from the following author: Wooldrige (2013). Both models deal with discrete dependent variables but while logit models are suitable for the analysis of binary response data, multinomial logit models allow to deal with multinomial discrete response dependent variables. In other words, while logit models look at the probability of n random variables to take 1 of two possible outcomes (ie. imaging choosing between two options), multinomial logit models are a generalisation of the binomial distribution and can be used where the dependent variable can assume more than two outcomes (ie image choosing between 3 options, where each choice has a probability of $1/3$ of being chosen).

3.3.4.1 Logit models

Logit models have been developed in order to deal with binary dependent variables. Binary dependent variables can be considered a special case of limited dependent variables (LDV)[9] because they assume only two values. For convenience these values will be treated as one and zero in the rest of this paragraph. Both Logit and Probit models can be applied in binary response contexts. The main difference between Logit and Probit models lays on the assumption about the distribution of the error terms. If they are assumed to have a standard logistic distribution (Figure 3.1) logit models are applied, while if they are assumed to have a standard normal distribution probit models are the right choice. Among the models suitable for the analysis of LDV Poisson regression models are suitable for dealing with count variables while Tobit models are specifically designed for dealing with corner solutions.

Assuming that the dependent variable under analysis has the following behaviour:

$$y_i = \begin{cases} 1 & \text{if } y_i \text{ is chosen} \\ 0 & \text{if } y_i \text{ is not chosen} \end{cases} \tag{3.3.11}$$

it is possible to treat y_i as a random variable Y_i taking values 1 and 0 with probability π_i and $1 - \pi_i$ respectively. Therefore Y_i assumes a *Bernoulli* distribution with parameter π_i and can be written as:

$$Pr\{Y_i = y_i\} = \pi_i^{y_i}(1 - \pi_i)^{1-y_i}, \tag{3.3.12}$$

where when y_i assumes value 1 the probability of Yi is π_i and when y_i assumes value 0, equation (3.3.12) drops to $1 - \pi_i$.

It should be remembered that a variable that takes a Bernoulli distribution is characterised by the fact that both its expected value $E(\cdot)$ and variance $var(Y_i)$ depend

[9] A limited dependent variables is a variable whose value is restricted in a range (Wooldrige, 2013).

by the probability π_i.

$$E(Y_i) = \mu_i = \pi_i, \tag{3.3.13}$$

$$var(Y_i) = \sigma_i^2 = \pi_i(1 - \pi_i) \tag{3.3.14}$$

It is possible to define a basic logit model as:

$$\pi_i = \beta_i x \tag{3.3.15}$$

where β_i is a vector of coefficients and x_i a vector of predictors. We expect the probability π to depend from the regression coefficients β associated with some observable predictors x. Given that we are working with binary variables, it is necessary to have the binary response variable π_i in the [0,1] interval while the right hand side of equation (3.3.15) is not necessarily constrained to the binary range of values we would expect. Therefore we need to bind our dependent variable to the expected range [0,1]. To achieve this purpose a convenient approach is to use an indicator function that applies a *logit* transformation of the probabilities. This can be obtained in two steps. Considering the odds of the probability of success and non success ensures that π_i will be always positive, while taking its $log(\cdot)$ will bind it to 1 as superior limit.

$$odds_y = \frac{\pi_i}{1 - \pi_i} \tag{3.3.16}$$

Equation (3.3.16) reppresents the ratio of the probability of an event occurring versus the probability of its non occurrence. Taking the odds of the probability has the advantage that they are positive, and therefore there is no need for imposing ceiling restrictions to the equation. Furthermore odds can be easily translated into real

probabilities.

In order to remove the floor restriction (namely to constrain the odds to a maximum of 1), it is convenient to take the log of (3.3.16) that becomes:

$$\eta_i = logit(\pi_i) = log\left(\frac{\pi_i}{1-\pi_i}\right) \tag{3.3.17}$$

Equation (3.3.17) basically models the transformation as a linear function of the covariates binding them to the $[0, 1]$ interval, suitable for probability analysis. It can be noticed that a one-to-one linear relation is built and the logit probabilities can be easilly remapped to real probabilities. In fact from the logit transformation it is possible to derive the probability of a binomial event applying the *antilogit* transformation as follows:

$$\pi_i = logit^{-1}(\eta_i) = \frac{e^{\eta_i}}{1+e^{\eta_i}} \tag{3.3.18}$$

Let us suppose that 300 people choose a red car out of 1200, the probability of choosing a red car in our population is therefore $200/1200 = 1.666$. The odds are $200/1000 = 0.2$ and the $logit()$ is log(0.2) = -1.609. Applying (3.3.18), exp(-1.609) = 0.2 represents the odds and therefore, applying the *antilogit* transformation in (3.3.18) we derive $0.2/(1 + 0.2) = 1.666$ that are the probabilities of one person choosing a red car in our population.

It is possible to write a *logit* model with the following notation:

$$P(y \mid \mathbf{x}) = P(y = 1 \mid x_1, x_2, \ldots, x_k) \tag{3.3.19}$$

$$P(y \mid \mathbf{x}) = G\left(\beta_0 + \sum_{n=1}^{n=k} \beta_n x_n\right) = G(\beta_0 + \mathbf{x}\boldsymbol{\beta}) \tag{3.3.20}$$

When $G(\cdot)$ is a logistic function (3.3.15) becomes:

$$z = \beta_0 + \sum_{n=1}^{n=k} \beta_n x_n \tag{3.3.21}$$

$$G(z) = \frac{exp(z)}{1 + exp(z)} = \frac{e^z}{1 + e^z} = \Lambda(z) \tag{3.3.22}$$

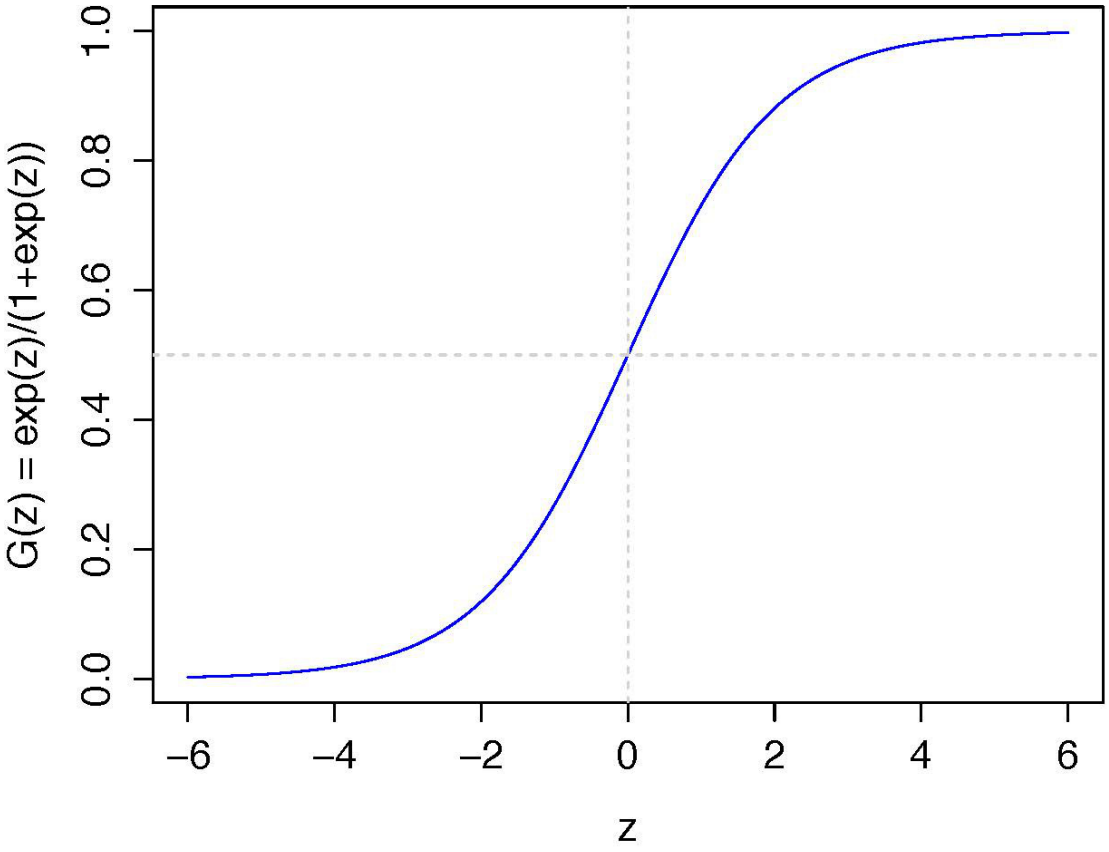

Figure 3.1: Logistic function

Summarising, a logit model is a generalised linear model (Nelder and Wedderburn, 1972) with binomial response and link *logit*.

Logit model parameters β can be estimated with Maximum Likelihood. The log-likelihood function for a logit model considering n independent binomial observa-

tions is:

$$logL(\beta) = \sum \{y_i \, log(\pi_i) + (n_i - y_i) \, log(1 - \pi_i)\} \tag{3.3.23}$$

The estimated regression coefficient β_j should be interpreted as a 1% change in the *logit* probability given a unit change in the x_j predictor *ceteris paribus*. It is possible to understand the effects of the coefficients on the odds of the probabilities exponentiating (3.3.17):

$$\frac{\pi_i}{1 - \pi_i} = \exp\{x_i' \beta\} \tag{3.3.24}$$

therefore, holding all predictors constant but j, the effect β_j on the odds can be summarised as:

$$exp\{\beta_j\} = \frac{\partial odds}{\partial x_j} \tag{3.3.25}$$

3.3.4.2 Multinomial logit models

Multinomial logit (MNL) models generalise logit models allowing the dependent variable to assume more that 2 discrete values. These models are therefore suitable for predicting categorical outcomes, like for example in the choice experiment context where a respondent faces more that 2 choice options (let us say K options) per choice set and therefore our dependent variable Y_i can assume K values rather than 2 like in a logit model. If $K = 2$ the multinomial logit model reduces to the usual logistic regression model.

In introducing MNL models we assume to have N different data points, and each observations i, where $i \in (1, \ldots, N)$ consists in M predictors variables x_{im}, where $m \in (1, \ldots, M)$, and one dependent variable Y_i that can assume K categorical out-

comes. The objective of a MNL model is to understand the probability of a data point to belong to a specific category k given its observed characteristics x_{im}. In order to derive the probabilities of the the Y_k its is sufficient to keep the probability of the Y_k outcome as reference point and to calculate the log-odds of the other $K-1$ outcomes, considering them as a linear function of the M predictors $x_i m$.

The linear predictor function of a MNL model to predict the probability that observation i has outcome k can be written as:

$$f(k,i) = \beta_{0,k} + \beta_{1,k} x_{1,i} + \ldots + \beta_{M,k} x_{M,i} \tag{3.3.26}$$

(3.3.26) can be written as:

$$f(k,i) = \beta_k \cdot x_i \tag{3.3.27}$$

where β_k is a vector of coefficients for the outcome k and x_i a vector of explanatory variables associated with observation i.

It is possible to consider a MNL model[10] as a set of independent binary regressions[11]. Starting from this viewpoint, it is possible to set K_1 independent logistic regression models.

[10] In multinomial logit models (MNL) the error term assumes a multinomial distribution:

$$Pr\{Y_{i1} = y_{i1}, ..., Y_{iK} = y_{iK}\} = \binom{n_i}{y_{i1}, ..., y_{iK}} \pi_{i1}^{y_{i1}} \cdots \pi_{iJ}^{y_{iJ}}$$

where Y_i is a dummy variable that take value 1 if the response variable for individual i belongs to a certain category K and zero otherwise.

[11] Alternative and equivalent approaches can present MNL models as a log-linear model or as a latent-variable model.

$$
\begin{aligned}
ln\frac{Pr(Y_i = 1)}{Pr(Y_i = K)} &= \beta_1 \cdot x_i \\
ln\frac{Pr(Y_i = 2)}{Pr(Y_i = K)} &= \beta_2 \cdot x_i \\
&\dots \\
ln\frac{Pr(Y_i = K-1)}{Pr(Y_i = K)} &= \beta_{K-1} \cdot x_i
\end{aligned}
\tag{3.3.28}
$$

Exponentiating both sides of (3.3.28) we obtain:

$$
\begin{aligned}
Pr(Y_i = 1) &= Pr(Y_i = K)e^{\beta_1 \cdot x_i} \\
Pr(Y_i = 2) &= Pr(Y_i = K)e^{\beta_2 \cdot x_i} \\
&\dots \\
Pr(Y_i = K-1) &= Pr(Y_i = K)e^{\beta_{K-1} \cdot x_i}
\end{aligned}
\tag{3.3.29}
$$

Considering that all probabilities $Pr(Y_i = k, \forall k \in \{i, K\}$ should sum to 1, it is therefore possible to derive the probability of $Y_i = K$ as:

$$
Pr(Y_i = K) = \frac{1}{1 + \sum_{k=1}^{K-1} e^{\beta_K \cdot x_i}} \tag{3.3.30}
$$

Substituting (3.3.30) into (3.3.29) it is then possible to derive the probabilities for each category k :

$$
\begin{aligned}
Pr(Y_i = 1) &= \frac{e^{\beta_1 \cdot x_i}}{1 + \sum_{k=1}^{K-1} e^{\beta_{K-1} \cdot x_i}}, \\
Pr(Y_i = 2) &= \frac{e^{\beta_2 \cdot x_i}}{1 + \sum_{k=1}^{K-1} e^{\beta_{K-1} \cdot x_i}}, \\
&\dots \\
Pr(Y_i = K-1) &= \frac{e^{\beta_{K-1} \cdot x_i}}{1 + \sum_{k=1}^{K-1} e^{\beta_{K-1} \cdot x_i}}
\end{aligned}
\tag{3.3.31}
$$

McFadden (1974) formulated what is referred to as *conditional logit model*. Condi-

tional logit models differ from MNL models because the expected utilities derived are represented by the characteristics of the good/service chosen rather than by the characteristics of the individual choosing it. Therefore the probability of the studied outcome (namely the probability of choosing a specific good out of a bundle) depends on the characteristics of the good itself. While in fact in the discrete choice literature discrete choice models are applied, they are often referred to as multinomial logit models.

3.3.5 Potential biases

With the increasing application of choice experiments some problems emerged and have been analysed in the literature. Many of the biases that characterise CV were found to influence CE estimates. In most of the cases the magnitude of the biases associated with choice experiments can be limited applying good questionnaire pretesting and choosing realistic attribute levels. The most common biases of choice experiments are:

- the status quo bias (Scarpa et al., 2005; Meyerhoff and Liebe, 2009; Bonnichsena and Ladenburgb, 2010)
- the hypothetical bias (Samuelson and Zeckhauser, 1988; Carlsson et al., 2005; Hensher, 2010)
- the bidding vector bias (Mørkbak et al., 2010; Kragt, 2013)
- the ordering bias (Bateman et al., 2008; Day et al., 2012; Scheufele and Bennett, 2013)

3.3.5.1 The status quo bias

The status quo bias can be framed in the context of choice experiments as a situation in which the probability of choosing the status quo option in a contingent market is greater than in a real market. This has two consequences on CE estimates: first it tends to underestimate welfare measures; second it affects the effectiveness in identifying the preferences for alternative attribute levels not present in the status quo (Bonnichsena and Ladenburgb, 2010). The source of the status quo bias can be implied to experimental design choices and their effect on choice complexity (Meyerhoff and Liebe, 2009), like for example the number of choice tasks submitted to each respondent, the number of attributes considered and the vector of prices chosen.

Hanley et al. (2006) provided three possible interpretations for describing a systematic trend in favour of the status quo. First people might choose the status quo option because they are not willing to pay at all because they do not place any value on the good proposed. The second reason is due to protest: people value the good but think that they should not have to pay for its provision. In the third circumstance people might opt for the status quo because they do not know what they are willing to pay.

Bonnichsena and Ladenburgb (2010) found that the introduction of a "Protest Reduction Entreaty" (PRE), namely a statement in the hypothetical scenario that describes the price attribute as hypothetical (therefore not to by paid in reality) and invites the respondent to take it carefully into consideration as it was to be paid. They tested the effect of PRE under different modelling assumptions and found that PRE has a positive effect in reducing the status quo bias.

In two studies (Scarpa et al., 2005, 2007) error components models were found to perform better in circumstances were the status quo bias affects estimates.

Meyerhoff and Liebe (2009) investigated the effect of the socio-economic characteristics of respondents in choosing the status quo option interacting it with various

socio-economic variables. The authors make some interesting consideration on the opportunity to include or not the status quo dummy effect in the indirect utility function for the calculation of the consumer surplus. The problem raised by the authors is on the meaning of the status quo dummy coefficient: does it indicate a preference for the status quo or is it an indication of protest? The solution of the enigma is difficult when the status quo dummy represents both when status quo biases are present. The authors therefore suggest to focus further research on the effect of including debriefing questions that investigate respondents attitudes toward the good analysed. The inclusion of people attitudes in the analytical model in fact might help in interpreting the reasons behind the choice of the status quo.

When the researcher detects that choice complexity might be the source of the status quo bias, it is strongly suggested to take this aspect into consideration while pretesting the questionnaire. This implies asking respondents whether they consider the number of attributes excessive and their levels plausible and clear to understand. A further thing that should be taken into account is the number of the choice tasks and whether they create fatigue effects. If the number of choice tasks is found to be a critical aspect for the respondents, the analyst might opt for a design blocking strategy. This implies presenting only a given number of the total choice tasks of the experimental design to each respondent. The advantage of blocking the design is to reduce the choice task complexity but at the same time it increase the number of respondents needed to achieve the same number of choice observations.

3.3.5.2 The hypothetical bias

The literature refers to hypothetical biases in SP valuation studies as "deviations from real market evidence" Hensher (2010). In choice experiments this might result more evident in studies the applied the methodology to market goods (see for example Alfnes et al., 2006; Carlsson et al., 2005; Tempesta and Vecchiato, 2013; Mau-

racher et al., 2013) and only few studies investigated this problem systematically (some of them include Alfnes et al., 2006; Lusk, 2003; Murphy et al., 2005; Carlsson et al., 2005).

Carlsson et al. (2005) tested the influence of a "cheap-talk script" asking the respondent to behave like in a real market and to try to explain why in surveys people tend to show higher WTP than in real circumstances. The authors found that the questionnaire version presenting the cheap-talk script was effective in decreasing the degree of inflated values. The authors suggest further research in trying to see if the effectiveness of cheap talk scripts might be enforced by interviewing respondents in an environment that resembles an actual shopping situation.

Examples of "real" market scenarios in choice experiments were respondents had to buy the chosen option include Alfnes et al. (2006) and .Lusk and Schroeder (2004).

Hensher (2010) makes a summary of the main strategies suggested in the literature to avoid the hypothetical bias. They include the use of cheap-talk, the inclusion of the opt-out option and the use of questions to try to understand which alternatives have been treated seriously.

A real important suggestion made by Hensher (2010) is to to keep in mind the credibility of the choice scenario without and real behaviour of economic agents without letting it be undermined by statistical issues. To quote the author's words:

> "Despite the importance of good experimental design, the disproportionate amount of focus in recent years on the actual design of the choice experiment, in terms of its statistical properties, may be at the expense of substantially placing less focus on real behavioural influences on outcomes that require a more considered assessment of process (see Hensher, 2008), especially referencing that is grounded in reality."
>
> (Hensher, 2010, p 747)

3.3.5.3 The bidding vector bias

According to economic theory changes in price vectors used to set the levels of the cost attribute in a choice experiment should not influence consumer behaviour assuming that an agent acts rationally under a budget constraint in order to maximise his utility (Braga and Starmer, 2005).

Respondents might interpret the levels of the cost attribute as signals and consider them as the true values for the good presented: in this circumstance the preferences expressed might not reflect the value assigned to the good by the person according to his budget constrain because the WTP declared is built/influenced by the prices presented. Usually the less people is familiar with the good valued the most probable that the presented prices will act as signals.

Some studies investigated the effects of changing price vectors on people preferences in choice experiments and reached different conclusions. Some studies found that using higher price levels resulted in higher WTP estimates (Carlsson and Martinsson, 2008; Ladenburg and Olsen, 2008), while others found that preferences were "neutral" to price changes (Hanley et al., 2005).

Hanley et al. (2005) found that other effects might be caused by price vectors increases like for example a major propensity to opt for the status quo or no-choice option when prices grow.

It should be noted that while Hanley et al. (2005) included in their design the opt-out alternative, Carlsson and Martinsson (2008) did not.

Mørkbak et al. (2010) found a quote substantial effect in changing only the maximum level of the price vector with increases in WTP estimates by 32–68% even including the opt-out option in their design. The same positive effect was detected by Slothuus Skjoldborg and Gyrd-Hansen (2003).

According to Mørkbak et al. (2010) effects of the price vector on WTP estimates

might be due to two irrational behaviours: yea-saying and anchoring. They concluded that great attention in finding respondents choke price should be given in the pretesting phase of the CE questionnaire. In fact there is a great probability of choice insensitivity to changes in prices if the vector of prices does not include the maximum WTP (choke price) of respondents.

Kragt (2013) points out that another important factor in the experimental design is to set credible prices given that implausibly high cost levels may be the cause of hypothetical survey bias or result in a high rate of protest responses.

3.3.5.4 The ordering bias

The ordering bias implies that the choice experiments results are in some way dependent on the order in which the choice tasks are presented. It is possible to detect two main types of order effects (Day et al., 2012): position-dependent effects and precedent-dependent order effects. The first category of effects refers to effects strictly connected with the ordering of the choice tasks (credibility, fatigue, preference learning, increasing randomness, increasingly opting for the status quo) while the second refers to effects due to considerations of the respondent about previous options like waiting for the "best deal" compared to previous options or comparing the most convenient attribute levels not between the choice options offered in a choice task but between all choice options presented. Day et al. (2012) assumed that part of the responsibility of the ordering biases was due to the choice task elicitation format. Therefore they tested whether showing all choice tasks to the respondents before answering (advanced disclosure format - ADV) has any effect in reducing ordering biases rather than adopting the common stepwise disclosure (STP) format where respondents are showed one task at a time without prior information about the composition of subsequent choice tasks. The effects of the two presentation formats were tested submitting the same questionnaire with the STP format to one

group and with the ADV format to another. The authors found that the ADV format helps in mitigating position-dependent effects increasing the credibility of the choice exercise and therefore reducing the tendency to converge on the status quo option and limiting learning effects on choices. They also found that the options of the first task proposed is important with both presentation format, while with the STP format the worst deal is more influential on the formation of preferences and the best deal has a major impact in the ADV format.

A different approach for testing the presence of ordering effects has was by Scheufele and Bennett (2013). The authors compared the results obtained presenting two questionnaires differentiated by the number of choice tasks: while the first group was presented a single choice task (single-binary format) the second group was presented 4 choice tasks (repeated-binary format). In other words, the same design containing 16 choice tasks was divided in 16 blocks in the first case and in four in the second. Each choice task presented two choice options. The authors found that the single-binary elicitation format, while being a possible solution for limiting ordering biases provided higher WTP estimates than the repeated-binary format. The possible explanations provide for this result are the presence of preference learning effects (preferences tend to stabilise acquiring informations) and strategic misrepresentation of preferences (the process of finding the good deal with respect to previously built knowledge). One thing that should be taken into consideration when adopting blocking strategies to limit ordering effects is the positive correlation between the number of choice options per person and the stability of WTP estimates in mixed logit models found by Rose et al. (2009). This means that the practice of blocking an experimental design should be used with caution and balance[12] when applying mixed logit models: trying to avoid ordering effects limiting presenting a single choice task to each respondents might have side effects on the stability of

[12] An excessive number of choice tasks is expected to affect the credibility of the choice experiment undermining its incentive compatibility.

results.

When the researcher wants to limit ordering effects without reducing the number of choice observations per respondent, a possible solution is the randomisation of the presentation order of the choice tasks. A full randomisation is easily achievable in practice with internet surveys, while a partial randomisation is practically possible for the other formats (mail, in person interviews, phone interviews). The choice experiment presented in chapter 5 adopted a partial randomisation, creating four versions of the questionnaire, where the only difference was the ordering of presentation of the choice tasks. The analyst should keep track of the ordering of the choice tasks in order to perform a proper data analysis if the randomisation strategy is adopted.

3.4 Appendix A: logit models in R

3.4.1 Logit function plotting

The R (R Core Team, 2012) code used to plot the function in figure 3.1 is:

```
x<-seq(-6, 6, 0.001)

plot(exp(x)/(1+exp(x))~x, type="l", col="blue",
     xlab = "z", ylab = "G(z) = exp(z)/(1+exp(z))")

abline(h = 0.5, v = 0, col = "lightgray", lty= "dashed")
```

3.4.2 Logit models estimation in R

Source: http://goo.gl/eq3Ic

```
x <- 1 + rnorm(1000,1)
xbeta <- -1  + (x* 1)
proba <- exp(xbeta)/(1 + exp(xbeta))
y <- ifelse(runif(1000,0,1) < proba,1,0)
table(y)
df <- data.frame(y,x)

res <- glm(y ~ x , family  = binomial(link=logit))
# results
summary(res)
# confindence intervals
confint(res)
# odds ratio
exp(res$coefficients)
# Confidence intervals for odds ratio (delta method)
exp(confint(res))
# prediction on a linear scale
predict(res)
# predicted probabilities
predict(res, type = "response")
# plot the predicted probabilities
plot(x, predict(res, type = "response"))
```

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CHAPTER 4

Testing the difference between experts' and lay people's landscape preferences

Abstract

Numerous studies have demonstrated that landscape can produce multiple benefits for people. For this reason many countries have implemented policies for landscape conservation and improvement. The European Landscape Convention, ratified by 40 nations, has placed emphasis on the necessity that the value of the landscape is assessed by the population. However it is standard practice that a few experts decide which areas are of landscape interest and the transformations that are compatible with their conservation. This procedure can be considered acceptable if the preferences of the experts are similar to those of lay people. However, the few researches conducted on this topic so far have not provided uniform results. To compare the landscape preferences of experts and lay people a study was done on the Po Delta Natural Park (Italy) using a psychophysical approach. The survey was conducted via web and involved 50 experts and 178 lay people. The images were in part obtained through photomontages. In our case study the average scores of experts and lay people are not very different. However it was also ascertained that the experts evaluate the presence of some elements in a way that differs from lay people, in particular rural buildings and wild animals. The preferences of the experts are more influenced by the context in which the element is inserted. This makes them more tolerant to the presence of elements of degradation like some types of buildings. At individual level the capacity of the experts to correctly interpret the preferences of lay people is very limited. As the responsibility for landscape policies is normally devolved to a few experts it would appear necessary that the preferences and opin-

ions of lay people should always be carefully analysed.

4.1 Introduction

Many researches in the last decades highlighted that landscape quality affects people's wellbeing. It has been seen that the quality of the landscape interacts with numerous physiological parameters of an individual and that more pleasant landscapes tend to improve personal health (Berto, 2005; Hartig et al., 2003; Muñoz, 2009; Ulrich, 1984; Ulrich et al., 1991; Velarde et al., 2007; Wells, 2000). As stated by the Sustainable Development Commission (2008)

> "The knowledge base shows that exposure to natural spaces – everything from parks and countryside to gardens and other green spaces – is good for health",

Some researches pointed out that the more pleasant landscapes tend to have a restorative effect on people (Kaplan, 1995; van den Berg et al., 2003). It can be argued that man prefers landscapes where he feels better, and, in general, he tries to pass as much time as possible in such landscapes. For this reason, in recent decades, laws have been passed in many countries to protect the quality of the landscape. In Europe, the European Landscape Convention, which was ratified by 40 countries, has introduced important innovations in landscape policy. The first two articles of the European Landscape Convention state that

> "landscape means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors".

Landscape policy must allow "specific measures aimed at the protection, management and planning of landscapes" to be adopted to satisfy the "aspirations of the public with regard to the landscape elements of their surroundings". From this definition, one understands that landscape visual quality has to be judged by the general public and not only by experts.

Usually landscape policies are implemented exclusively by experts, but this practice can be considered correct only if the experts have preferences similar to those of lay people.

Several studies in the past compared the visual preferences of lay people and experts (Coeterier, 2002; Dandy and Van Der Wal, 2011; Daniel and Boster, 1976; Dearden, 1981; Hunziker et al., 2008; Kaplan and Kaplan, 1989; Rogge et al., 2007; Ryan, 2006; Strumse, 1996; Vouligny et al., 2009). However, the results obtained are not univocal. While for some authors there seems to be a significant difference (Hunziker et al., 2008; Kaplan, 1973; Rogge et al., 2007; Vouligny et al., 2009), other studies did not find any difference and in yet others the differences pertained only to some landscapes or to some categories of respondents (Anderson, 1978; Dandy and Van Der Wal, 2011; Daniel and Boster, 1976; Dearden, 1981; Hudspeth, 1986; Ryan, 2006; Strumse, 1996).

The disparity of results might be ascribed to the landscape types under investigation, the method used to elicit and analyse the preferences, and the definition of expert.

With reference to landscape types the previous studies have analysed woods (Anderson, 1978; Dandy and Van Der Wal, 2011; Daniel and Boster, 1976), rural landscapes (Rogge et al., 2007; Strumse, 1996; Vouligny et al., 2009) and wetlands (Hudspeth, 1986; Miller, 1984). Considering the possibility that the differences depend, among the other things, on the landscape types, it seems not possible to draw general conclusions from past studies.

The most widely used methods of elicitation of the preferences have been images scoring (Anderson, 1978; Daniel and Boster, 1976; Hudspeth, 1986; Kaplan, 1973; Miller, 1984) or interviews in which the opinions of different groups of people were recorded on the factors that affect the aesthetic value of the landscape and on the reasons underlying their preferences (Coeterier, 2002; Rogge et al., 2007; Vouligny

et al., 2009). Since these are methods involving cognitive processes that are at least in part different it can be assumed that the results obtained are not entirely comparable. From the statistical point of view, the method usually utilised to verify the score or opinion differences between experts and lay people has been the analysis of variance.

As pointed out by Nakagawa and Cuthill (2007), the null hypotheses significance testing by means of the ANOVA can be misleading in some cases and have some not negligible drawbacks. Moreover, from the point of view of the policy maker what is important is the magnitude of the differences and their rank, and not only its significance per se. Finally, in the past researches have been considered as experts: students of disciplines connected to landscape management (Strumse, 1996), land planners (Dearden, 1981; Miller, 1984; Ryan, 2006), foresters (Anderson, 1978; Dandy and Van Der Wal, 2011; Daniel and Boster, 1976), landscape experts and architects (Rogge et al., 2007). The categories of expertise are therefore very diverse, making the research results little comparable. There are two further elements that make the results of the previous research only partially useful for the implementation of landscape policies: in a few cases the effect on the landscape of the visibility of a single element has been analysed, the correspondence of individual expert assessments with that of lay people has never been analysed

Regarding the first aspect, it can be noted that the studies done in the past have not always tried to understand if the experts and lay people evaluate the various landscape elements differently. This limitation is particularly evident when one considers that landscape planning is generally divided into two distinct phases.

In the first, the landscapes are divided into different classes of quality (landscape quality assessment). In the second phase, to preserve the landscape quality, it is necessary to assess the impact of any land use transformation (such as the construction of new homes or other buildings, power lines, roads, etc.). It can be assumed

that the role of the experts is to a certain extent more important in the second phase than in the first. With regard to the second aspect, researches in the past usually compared the average value of the experts with the average value of the lay people.

This approach does not take into account the fact that generally in the implementation of landscape policies only a few experts are involved (sometimes just one). The problem is thus not to verify if the average value is statistically equal but to understand how many experts are able to correctly interpret the preferences of the population.

It can therefore be said that currently there is no experimental evidence that unambiguously supports the hypothesis that experts evaluate the landscape in a different way from lay people. In an attempt to improve the knowledge in this field the present research aims to:

1. verify if the preferences expressed by means of opinions in the absence of visual stimuli are similar to those expressed by scoring images;

2. compare the landscape visual preferences of lay people with those of the experts for different types of landscape;

3. analyse the effect of the presence/absence of some elements on the preferences of the two groups of respondents;

4. analyse individually the ability of experts to correctly interpret the preferences of lay people.

With this aim this paper presents the results of a perceptive study conducted on the Po River Delta in Italy, an area that is entirely under landscape protection.

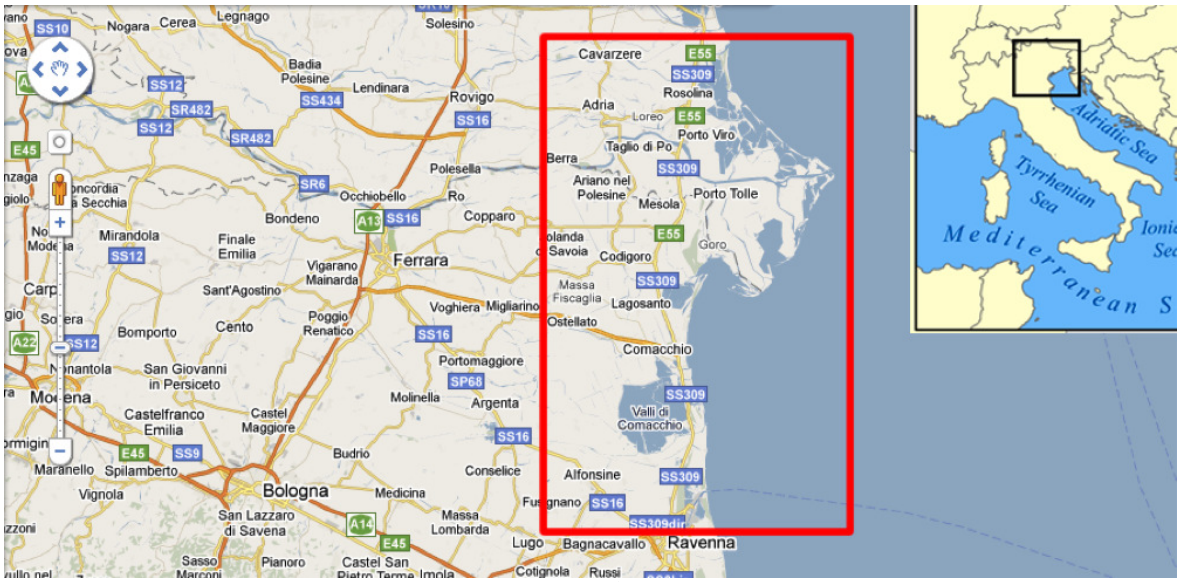


Figure 4.1: Study area map

4.2 Methods

The study area is the Po River Delta Regional Park located in north-eastern Italy between two Regions (Figure 4.1): Veneto and Emilia Romagna. The park has a surface of about 65,000 ha and is protected by national laws and international conventions like the Ramsar Convention, Conservation of Wild Birds Directive (79/409/EEC) and Habitat Directive (92/43/EEC). The Po River Delta is the only Italian delta and one of the most important wetlands of the Adriatic Sea coast. To analyse the landscape preferences we used a psychophysical approach (Daniel, 2001; Daniel and Vining, 1983). Five landscape types were initially identified: agrarian, salt marshes, woods, fishing lagoons and rivers (Figure 4.2). Five elements that could theoretically affect the landscape aesthetic quality were then selected: traditional buildings, modern buildings, ruins, factories, presence of wild birds (seagulls, flamingos and cormorants)[1].

We considered these elements because the findings of previous researches (Arriaza

[1]While several species of birds could have been chosen, we opted for the three mentioned species for the following reasons: 1) they are present in the study area; 2) they can be easily distinguished by both experts and laypeople in pictures even if not covering the main portion of the picture (close focus); 3) these species are diversified by their rarity moving from seagulls (most common), cormorants, flamingos (most rare).

Scene		No.	%
Landscape type	Element		
agrarian	*	6	9.5
	with traditional buildings	5	7.9
	with ruins	2	3.2
	with modern buildings	3	4.8
	with factories	5	7.9
	total agrarian	21	33.3
fishing lagoon	*	7	11.1
	with wildlife	3	4.8
	with ruins	2	3.2
	with modern buildings	2	3.2
	total fishing lagoon	14	22.2
river	*	6	9.5
	with traditional buildings	1	1.6
	with modern buildings	2	3.2
	with ruin	2	3.2
	total river	11	17.5
salt marsh	*	6	9.5
	with wildlife	4	6.3
	with ruins	1	1.6
	with factories	1	1.6
	total salt marsh	12	19.0
woods	*	5	7.9
	total woods	5	7.9
Total	Total	63	100.0

Table 4.1: Number of images selected for each landscape type and scene considered.

et al., 2004; Kaplan et al., 2006; Rogge et al., 2007; Tempesta, 2010; Tempesta and Thiene, 2007) highlighted that they can influence the landscape appreciation in territorial contexts similar to the area under analysis. Crossing the 5 landscape types and the 5 elements, 18 scenes were identified (Table 4.1). Each scene has been obtained from the combination of a landscape type and an element. A variable number of images belong to each scene. Note that some scenes were not considered because they were not present or plausible in the study area. This is especially true in the case of woods where, due to reasons of visibility, it is not possible to see the impacting elements (i.e. a factory in a wood).

(a) Picture 17 – river

(b) Picture 3 - wood

(c) Picture 19 - agrarian

(d) Picture 33 – fishing lagoon

(e) Picture 44 – salt marsh

Figure 4.2: Landscape types: five examples

All images presented in the questionnaire (see Appendix B on page 167) were selected from a set of 140 pictures of the Po River Delta area. The images were then categorised according to the landscape type and to the presence or absence of the chosen landscape elements. We then choose 38 base images and modified a selection with Gimp® software. These modifications follow Stamps (1992, 1993), who found that the use of photomontages (see Appendix A on page 166) does not modify the appreciation of the landscape. Only a few people are able to identify photographic alteration, and the effect on mean scoring is negligible (Stamps, 1993). Using photomontages it is possible to directly verify the effect of an element on the landscape appreciation and this makes the interpretation of the preferences straightforward. We also tried to analyse the effect of the distance and visibility of certain elements (ruins and factories) on a given scene by modifying the shooting distance from the subject while keeping the same perspective. In some cases the effect of different elements have been analysed with reference to the same view.

This process led to a final set of 63 images (38 original, 25 modified) that focus on a balanced representation of key landscape scenes. We took care that the images obtained from photomontages or belonging to the same landscape type were separated by at least three photos of other landscapes scenes.

The questionnaire was delivered by means of a web application designed and built specifically for this study using PHP, JavaScript, HTML and CSS programming languages. The web survey (WBS) utilised a MySQL database to store data and provide real time statistics. We used JavaScript to create the images fading effect, making them disappear after 8 seconds, and PHP to build the engine of the application. We opted for an open survey format: no credentials were required from the respondents to complete the survey. We optimised the survey to be listed on search engines. Furthermore, we invited people to answer using mailing lists and, taking advantage of web 2.0, we promoted the WBS on social networks like Facebook® and Twitter®. In order to involve experts in the study we advertised the online questionnaire at two

international conferences related to landscape, while some Italian experts have been contacted directly by the authors. Given the 'open nature' of the survey, some measures were adopted to check for data validity. First, the survey completion time was recorded for each respondent. All questionnaires completed in less than 10 minutes were ignored due to potentially random responses. Data integrity was ensured through server-side validation.

The questionnaire was divided in four sections. The first introduces the reader to the questionnaire. The second asks questions concerning socio-economic data and opinions about the elements that may affect landscape visual quality. The third shows the respondent some demonstration landscapes that will be rated in section four. The final section focuses on the landscape rating task.

Among the questions in section two, the interviewees were asked to express their opinion about the importance of some landscape elements in order to improve the visual quality using a five point rating scale without seeing any image. The elements considered were: woods, water bodies (rivers, streams, bays, sea etc.), meadows, hedges and tree rows, traditional rural buildings, poplars plantations, unpaved roads, uncultivated fields, urban settlements, paved roads, modern buildings, shopping malls, factories, power lines, paved roads and antennas. The ratings lie in an integer range from -2 (very negative impact) to +2 (very positive impact).

People were then asked to rate the images portraying various scenes of the area using a 1 to 5 point scale (section four of the questionnaire), and their attention was drawn to the need to utilise the entire scale. Following a well-established methodology (Daniel and Boster, 1976), the interviewees were first shown eight photos (section three of the questionnaire) to allow them to adjust their evaluation scale. Each image was displayed for 8 seconds to obtain the respondent's first impression.

Image rating is widely used in this field of research. Empirical findings suggest that there is a close relationship between on site landscape appreciation and appreciation

of a photo (Palmer and Hoffman, 2001; Stamps, 2000). We considered as experts all the respondents who declared that they work in the field of landscape planning, management, analysis and evaluation. Following this heuristic, from our dataset we classified 50 (21.9%) respondents as experts and 178 (78.1%) as lay people.

To compare the lay people and experts scores as recommended by the American Psychological Association (2009), we carried out both analysis of variance and analysis of the effect-size using Cohen's *d* statistics (Cohen, 1988). Comparing the landscape appreciation of two different groups it is important not only to know if the mean scores can be considered statistically different but also the magnitude of such a difference. In order to take into account the difference in size of the experimental (experts) and control group (lay people) we used a "pooled" estimate of standard deviation to calculate Cohen's effect-size (S_{pooled}):

$$S_{pooled} = \sqrt{\frac{(n_E - 1)S_E^2 + (n_L - 1)S_L^2}{n_E + n_L - 2}} \tag{4.2.1}$$

Where n_E and n_L are the sizes of experts and lay people groups respectively, and S_E and S_L their standard deviations.

Cohen's effect-size has therefore been calculated[2] as:

$$d = \frac{\bar{x}_E - \bar{x}_L}{S_{pooled}} \tag{4.2.2}$$

Where $\bar{x}_E$ and $\bar{x}_L$ are the means of experts and lay people respectively.

To interpret the effect size value, following Cohen (1988), it is possible to consider that it is high when $d > 0.80$, medium when $0.5 < d < 0.80$ and small when $d < 0.5$.

To verify the capacity of each expert to correctly represent the preferences of the public two indexes were defined.

[2]The Cohen's *d* reported in this paper were calculate using the R software (R Core Team, 2013) and in particular the *cohensD()* function of the *lsr* package (Navarro, 2013).

The Mean Interval of Confidence Index (MICI): is constituted by the number of images for which each expert has given a score that falls within the interval of confidence of the average scores of the lay people.

This index can provide a measure of the capacity of the experts to represent the average behaviour of the population. The Half Lay People Index (HLPI): is constituted by the number of images for which each expert has given a score that falls within the interval around the mean comprising 50% of the scores given by lay people. It is therefore a less restrictive index as it regards the capacity to approximate the preferences of half of the population.

In the first case the interval was calculated as:

$$\bar{x}_{Li} - t \cdot S_{\bar{x}Li} \leq x_{ij} \leq \bar{x}_{Li} + t \cdot S_{\bar{x}Li} \tag{4.2.3}$$

In the second case as:

$$\bar{x}_{Li} - t \cdot S_{Li} \leq x_{ij} \leq \bar{x}_{Li} + t \cdot S_{Li} \tag{4.2.4}$$

Where: $\bar{x}_{Li}$= the average lay people's score for the i-th image; $S_{\bar{x}Li}$ is the standard deviation of the lay people's average score for the i-th image; S_{Li} is the standard deviation of the lay people's score for the i-th image; x_{ij} is the score of the j-th expert for the i-th image.

	Experts (%)	Lay people (%)
Educational level		
primary	0	0.60
lower secondary	0	7.90
secondary	2	34.30
graduate	98	57.30
Total	100	100.00
Father's sector of activity		
agriculture	12	8.40
industry	30	40.40
services	58	51.10
Total	100	100.00
Sector of activity		
agriculture	6	2.20
industry	2	10.10
services	22	44.90
university	64	32.00
retired, students or housewives	6	10.70
Total	100	100.00
Gender		
male	72	49.40
female	28	50.60
Total	100	100.00
Country of residence		
Italy	46	93.30
Europe	50	4.50
other	4	2.20
Total	100	100.00
Place of residence during childhood		
urban area - centre	36	27.50
urban area - suburbs	18	24.20
rural area - village	38	28.10
rural area - scattered housing	8	20.20
Total	100	100.00
Current place of residence		
urban area - centre	58	41.00
urban area - suburbs	6	30.90
rural area - village	24	16.30
rural area - scattered housing	12	11.80
Total	100	100.00

Table 4.2: Interviewees' socio-economic characteristics

4.3 Results

4.3.1 Interviewees' Characteristics

From July to November 2009, 228 questionnaires have been collected. The mean interviewee age is 40 years and is not statistically different between experts and lay people (Table 4.2). Nearly half of the interviewees from both groups spent

their childhood in rural areas but only 10% of them declared that their father was a farmer.

There are some important differences between the two groups. Experts have a higher educational level and are, with few exceptions, all university graduates. The majority of experts work at a university (64%), while lay people exhibit more occupational heterogeneity. Among the experts, 28% are female, whereas the lay people's group had a female participation rate of 51%. Less than 50% of experts are Italian, whereas almost all lay people are from Italy. With reference to the sector of expertise, 44% of experts are architects or landscape planners, 28% are landscape ecologists, and 28% landscape economists.

Landscape elements	Experts		Lay people		Mean Difference[a]	$\|d\|$	sign.[b]
	mean	sd	mean	sd			
Water bodies	1.40	0.53	1.44	0.52	-0.04	0.08	
Woods	1.18	0.52	1.53	0.52	-0.35	0.68	***
Traditional rural buildings	1.16	0.65	1.03	0.69	0.13	0.19	
Hedges and tree rows	1.14	0.64	1.17	0.61	-0.03	0.05	
Meadows	1.06	0.51	1.33	0.60	-0.27	0.47	***
Unpaved roads	0.86	0.61	0.82	0.80	0.04	0.05	
Poplar plantations	0.30	0.81	0.83	0.77	-0.53	0.68	***
Uncultivated fields	0.14	0.83	-0.28	0.94	0.42	0.46	***
Urban settlements	-0.28	0.83	-0.62	0.77	0.34	0.44	***
Modern buildings	-0.30	0.95	-1.15	0.85	0.85	0.97	***
Paved roads	-0.62	0.78	-0.79	0.87	0.17	0.20	
Factories	-1.28	0.81	-1.57	0.62	0.29	0.43	***
Shopping Malls	-1.30	0.86	-1.56	0.68	0.26	0.35	
Antennas	-1.32	0.74	-1.62	0.56	0.30	0.50	***
Paved roads (high traffic)	-1.38	0.75	-1.58	0.67	0.20	0.30	
Power lines	-1.42	0.78	-1.58	0.61	0.16	0.24	

a: $m_{experts} - m_{laypeople}$
b: Mean difference significance (t-test) of $H_0 : m_{experts} \neq m_{laypeople}$ with p<0.05

Table 4.3: Experts and lay people opinion about the elements that affect the landscape visual quality. Data ordered from the less impacting element to the most impacting one.

4.3.2 Opinions

As mentioned in section 4.2 the interviewees were preliminarily asked to express their opinion about 16 elements that could have a negative or positive impact on landscape by using a five point scale without seeing any image. The results are reported in Table 4.3.

For the experts the four elements that increase the landscape quality are in order of importance: water bodies (rivers, streams, bays, sea etc.), woods, traditional rural buildings and hedges and tree rows. The opinion of the lay people is not very different, even if the presence of meadows is more important to them than that of traditional rural buildings. The elements that reduce the visual quality of the landscape for the experts are in the order: power lines, paved roads, antennas, shopping malls, factories. These are also the five elements that chiefly reduce the quality of the landscape for lay people, although their order of importance differs (Table 4.3).

The analysis of variance shows that the scoring of the experts differs from that of the lay people ($p<0.05$) in 8 cases out of 16 (50%). Considering Cohen's d test, in one case the difference can be considered big (modern buildings) and in three cases medium (antennas, woods and poplar plantations).

Compared with experts, on average lay people assigns a more positive score to the impact of natural elements (hedge, woods, water bodies and meadows) and a more negative score to man-made elements (modern buildings).

4.3.3 Images and scenes preferences

The average score for each image by experts and lay people differed ($p<0.05$) in 15 cases (24%) (Table 4.4). This difference occurs especially in the cases of images portraying rivers (alone or with ruins), woods, agrarian scenes and fishing lagoons. However the Cohen's d value is greater than 0.5 in only 7 cases out of 63. We can

therefore conclude that the means' difference is generally moderate and can be considered small in 56 scenes out of 63. Considering the scenes (Table 4.5), the ranking of the preferences differs only slightly between the two groups. The three most and least appreciated scenes are exactly the same (least appreciated: salt marshes and factories, agrarian and factories, agrarian and modern buildings; most appreciated: salt marshes and wildlife, fishing lagoons and wildlife, woods). In general, the presence of buildings tends to reduce visual quality. This is particularly evident in the case of factories and modern buildings. Ruins have a negative impact while the effect of traditional buildings is unclear. It is also interesting to observe how the presence of wildlife is without fail positively correlated with landscape appreciation. The scores are statistically different ($p<0.05$) in the case of agrarian scenes, woods, fishing lagoons, fishing lagoons and wildlife, rivers, rivers and ruins (Table 4.5). However the d statistics shows that the difference is small in all cases (d in absolute value is never higher than 0.50).

Scene		n. images	ANOVA($p<0.05$)		$\lvert d\rvert < 0.50$		$0.50 \leq \lvert d\rvert \leq 0.80$		$0.80 < \lvert d\rvert$	
Landscape type	Element		n.	%	n.	%	n.	%	n.	%
agrarian		6	1	17	5	83	1	17	0	0
	factory	5	0	0	5	100	0	0	0	0
	modern building	3	0	0	3	100	0	0	0	0
	ruins	2	0	0	2	100	0	0	0	0
	traditional building	5	0	0	5	100	0	0	0	0
fishing lagoon		7	2	29	6	86	1	14	0	0
	modern building	2	0	0	2	100	0	0	0	0
	ruins	2	0	0	2	100	0	0	0	0
	wildlife	3	1	33	3	100	0	0	0	0
river		6	4	67	3	50	3	50	0	0
	modern building	2	1	50	2	100	0	0	0	0
	ruins	2	2	100	2	100	0	0	0	0
	traditional building	1	0	0	1	100	0	0	0	0
saltmarsh		6	0	0	6	100	0	0	0	0
	factories	1	0	0	1	100	0	0	0	0
	ruins	1	0	0	1	100	0	0	0	0
	wildlife	4	1	25	4	100	0	0	0	0
wood		5	3	60	3	60	2	40	0	0
total		63	15	24	56	89	7	11	0	0

Table 4.4: Percentage of cases for which the difference between experts and lay people score is statistically significant ($p < 0.05$) and percentage of cases by effect-size value

Scene		Experts		Lay people		Mean difference[a]	$\|d\|$	sign.[b]
Landscape type	Element	mean	sd	mean	sd			
agrarian		2.78	1.04	3.01	1.08	-0.23	0.22	***
	factory	1.99	0.90	1.94	0.88	0.05	0.06	
	modern building	2.41	1.07	2.54	1.08	-0.13	0.12	
	ruins	2.78	1.03	2.78	0.97	-0.00	0.00	
	traditional building	2.99	0.97	3.09	1.05	-0.10	0.09	
fishing lagoon		3.60	1.01	3.76	1.02	-0.17	0.16	***
	modern building	3.17	0.88	3.03	1.00	0.14	0.15	
	ruins	3.03	1.15	3.08	1.08	-0.05	0.04	
	wildlife	3.68	0.91	3.93	0.94	-0.25	0.27	***
river		3.46	0.97	3.79	1.05	-0.34	0.33	***
	modern building	2.88	1.09	3.06	1.12	-0.18	0.16	
	ruins	2.82	0.88	3.19	1.00	-0.36	0.38	***
	traditional building	3.62	0.75	3.84	0.88	-0.22	0.26	
saltmarsh		3.65	0.96	3.64	1.04	0.01	0.01	
	factories	1.78	0.82	1.65	0.80	0.13	0.17	
	ruins	2.92	1.12	3.02	0.96	-0.10	0.10	
	wildlife	3.80	0.91	3.84	0.98	-0.04	0.05	
wood		3.69	1.00	4.06	0.94	-0.37	0.39	***

a: $m_{experts} - m_{laypeople}$
b: Mean difference significance (t-test) of $H_0 : m_{experts} \neq m_{laypeople}$ with p<0.05

Table 4.5: Mean rating by landscape types and scenes: t-test and d statistic

4.3.4 Landscape elements: photomontages

As described in the Methods section, to isolate the effect of individual landscape elements, some images were obtained using photomontage (Table 4.6 and *Appendix A* for the full list of photomontages). The presence of wild birds significantly increases the landscape aesthetic value for experts and lay people in 3 cases out of 4. The only exception is couple 2 where a flock of flamingos occupy a small part of the view. Considering the Cohen's d statistic it is possible to observe that the appreciation of the wild birds seems also to be driven by the rarity of the species for experts while lay people seem to consider their visibility more. For experts Cohen's d is highest for the flamingos while for lay people it is highest for the seagulls, which are very common.

The preferences of the two groups are also similar in the case of factories. They

generally have a strong negative impact regardless of the landscape type. However the *d* value is higher for salt marshes than for agrarian landscapes, suggesting that the negative effect of some modern buildings is particularly strong in natural areas.

For lay people the negative effect of the factories tends to diminish if the distance increases and their visibility is reduced (couple 19) but this does not happen in the case of experts who probably tend to judge a view more in terms of presence/absence of an element than in terms of its visibility.

For the other categories of buildings analysed through the photomontages the perception seems to differ more between the two groups. A traditional building along a river has a negative effect for lay people but it does not influence experts' appreciation (couple 7). Experts probably tend to evaluate, at least to certain extent, the importance of the ecosystem underlying the landscape instead of the aesthetic quality of a view. This emerges clearly considering the presence or absence of modern buildings. The latter reduce the appreciation of experts only in the case of agrarian landscapes but they do not reduce the value for fishing lagoons and rivers (couples 8 and 9), while for lay people the negative impact is almost the same in the three settings. It is possible to observe the same phenomenon in the case of the presence of ruins along the rivers (couples 17 and 18).

It is interesting to note that the tendency to give more importance to the ecosystem rather than to the aesthetic quality is common to all three categories of expertise considered.

4.3.5 Individual preferences of the experts and preferences of the lay people

It is normal practice that landscape policies are implemented by one or a few experts who decide both the value of the landscape and the type of actions that are compat-

Picture couple	Base scene	Modified scene	Experts			Lay people		
			mean diff.	sign.[a]	Cohen's *d*	mean diff.	sign.[a]	Cohen's *d*
1	P14: salt marsh and reeds	P9: salt marsh and reeds + wildlife (seagulls)	0.54	0	0.56	0.79	0	0.83
2	P36: fishing lagoon	P47: fishing lagoon + wildlife (flamingos)	-0.08	0.49	-0.08	0.05	0.33	0.05
3	P50: fishing lagoon	P23: fishing lagoon + wildlife (flamingos)	0.72	0	0.83	0.61	0	0.61
4	P18: fishing lagoon	P42: fishing lagoon + wildlife (cormorants)	0.44	0	0.46	0.37	0	0.35
5	P31: agrarian	P19: agrarian + traditional building	0.38	0	0.39	0.22	0	0.23
6	P43: agrarian	P46: agrarian + traditional building	0.2	0.08	0.22	0.17	0.04	0.17
7	P59: river	P32: river + traditional building	-0.06	0.61	-0.08	-0.29	0	-0.33
8	P52: agrarian	P10: agrarian + modern building	-0.5	0	-0.53	-0.45	0	-0.46
9	P62: fishing lagoon	P33: fishing lagoon + modern building	0.06	0.5	0.07	-0.43	0	-0.41
10	P5: river	P21: river + modern building	-0.08	0.65	-0.11	-0.43	0	-0.49
11	P7: agrarian + ruin (close focus)	P22: agrarian + ruin (distant focus)	-0.28	0.03	-0.4	-0.03	0.63	-0.05
12	P58: agrarian	P7: agrarian + ruin (close focus)	0.34	0.05	0.32	0.01	0.95	0.01
13	P58: agrarian	P22: agrarian + ruin (distant focus)	0.06	0.74	0.06	-0.03	0.67	-0.03
14	P44: salt marsh and reeds	P20: salt marsh and reeds + ruin	-0.26	0.11	-0.27	-0.08	0.31	-0.08
15	P26: fishing lagoon	P12: fishing lagoon + ruin	-0.64	0	-0.52	-0.75	0	-0.69
16	P8: fishing lagoon	P54: fishing lagoon + ruin	-0.94	0	-1.11	-0.94	0	-0.98
17	P38: river	P11: river + ruin	-0.08	0.44	-0.09	-0.27	0	-0.28
18	P17: river	P45: river + ruin	-0.12	0.32	-0.15	-0.17	0.01	-0.18
19	P40: agrarian + factory (close focus)	P49: agrarian + factory (distant focus)	0.1	0.39	0.12	0.33	0	0.41
20	P1: agrarian	P13: agrarian + factory	-1.52	0	-1.46	-2.12	0	-2.08
21	P16: agrarian	P4: agrarian + factory	-0.6	0	-0.65	-0.87	0	-0.88
22	P4: agrarian + factory (close focus)	P28: agrarian + factory (distant focus - changed factory)	0.06	0.62	0.08	-0.22	0	-0.31
23	P16: agrarian	P28: agrarian + factory	-0.54	0	-0.58	-1.09	0	-1.1
24	P20: salt marsh and reeds + ruin	P57: salt marsh and reeds + factory	-1.14	0	-1.02	-1.37	0	-1.43
25	P44: salt marsh and reeds	P57: salt marsh and reeds + factory	-1.4	0	-1.43	-1.45	0	-1.41

a: Means difference significance (t-test) of $H_0 : m_{experts} \neq m_{laypeople}$.

Table 4.6: Analysis of perceived difference in photomontages. Means difference significance (t-test) and Cohen's d statistic

ible with its transformations. However, an analysis of the average preferences of experts may lead to mistaken conclusions about their real capacity to correctly interpret the expectations and needs of the lay people. In order to verify the ability of each individual expert to correctly interpret the preferences of the population the two indexes described in section 2 were used.

The Mean Interval of Confidence Index (MICI) assumes values that vary widely among the experts interviewed. They go from a minimum of 1 (1.5% of the images) to a maximum of 18 (28.5% of the images). The average value is 10.57 and the standard deviation 4.34. The median is 11. Therefore 50% of the experts have given a score that falls within the interval of confidence of the scores of the lay people in less than 17.4% of the images. The Half Lay People Index (HLPI) is less restrictive because it considers the number of scores that fall within the interval around the mean that covers 50% of the scores given by lay people. The value of HLPI is therefore higher than that of MICI and goes from a minimum of 2 to a maximum of 46. The average value is 28.22 and the standard deviation is 9.37. The median value is 29 (46.0%). Half of the experts have not provided an evaluation even approaching that

of the lay people.

4.4 Discussion and Conclusions

The aim of the research was to verify if the landscape preferences of experts differ from those of lay people. In the several studies conducted on this subject in the past the results obtained were not uniform. Especially in Europe, where 40 nations have ratified the European Landscape Convention, it has become particularly important to understand if and to what extent the judgement of experts reflects that of the population as a whole. In fact, under the Convention, landscape policy must to be aimed at satisfying the aspirations of the general public with regard to the landscape where they live.

In our study in many cases the experts have evaluated the landscape in a similar way to the population as a whole. This finding is particularly evident if we consider the magnitude of the differences and not simply their statistical significance. Both groups tend to prefer the more natural landscapes, in particular woods and wetlands. Whereas the least appreciated landscapes are those with modern buildings and factories. In this respect the preferences of our sample are similar to those of other studies (Arriaza et al., 2004; Cook and Cable, 1995; Eleftheriadis and Tsalikidis, 1990; Kaplan et al., 2006; Kaplan and Kaplan, 1989; Palmer, 2008; Rogge et al., 2007; Schroeder, 1988; Tempesta, 2006; Ulrich, 1986). These findings are supported both by the opinions expressed by the interviewees and by their evaluation of the images. However, it is interesting to note that the difference between experts and non-experts is more accentuated in the case of the opinions than that of the scores attributed to the images. In the case of the opinions, ANOVA showed that in 50% of the landscape elements considered the difference in scoring is statistically significant ($p<0.05$). Cohen's d test resulted as large in one case (6.2%) and medium in three cases (18.7%). In the case of the preferences for the images difference in scores

is only statistically significant in 24% of the photos, and in seven cases (11%) Cohen's *d* test has a value between 0.5 and 0.8 (medium). This would seem to suggest that the results obtained comparing opinions and those obtained evaluating images are not entirely comparable.

The use of photomontages has evidenced some important differences between experts and lay people. This approach made it possible to analyse more specifically what effect the presence/absence of an element might have on the preferences of the two groups of interviewees.

In our study, experts tend to make a less critical assessment of the decay of buildings. Moreover, contrary to our expectations, experts exhibit a higher tolerance to possible interventions of landscape transformation. The presence of modern buildings, with the exception of factories, seems to have a lower negative effect for experts than for lay people. It seems that experts have judged the effect of buildings with regard to the context of where they are built. In particular experts tend to evaluate the importance of the ecosystem more than the aesthetic quality so they are more tolerant of the presence of some anthropogenic elements that can have only a moderate impact on the ecosystem. This result is in agreement with the results found by Coeterier (2002): experts tend to pay more attention to the context while lay people are more focused on evaluating the quality of the artefacts.

With reference to wildlife, it emerged that lay people valued the presence of very common birds (seagulls) with high visibility more than that of rare birds (flamingos) that occupy a small part of the view. Experts rated the images valuing the rarity of the species more than their visibility. It is possible to suppose that the evaluation of experts has a more relevant cognitive basis, so they are less affected by the visibility of an element than lay people and tend to attribute more importance to the landscape type or to the element itself.

The results of our research seem to suggest that when analysing the impact of new

buildings and applications for the restoration of existing ones the public authorities should carefully consider the preferences of the general public since the opinion of experts might be misleading. This is particularly important if it is considered that only a few experts are normally involved in the implementation of the landscape policies in a given territory.

The fact that on average the preferences of the experts do not differ greatly from those of the population does not exclude that within the ambit of a specific landscape plan or in the evaluation of the impact of a particular element the opinions of just one expert may differ markedly from those of the population as a whole. From this point of view the research has demonstrated that the individual experts tend to make evaluations that may diverge notably from those of lay people. Given this knowledge, it would appear opportune that in every case the preferences of the lay people are taken carefully into consideration regarding landscape policies as there may be many factors that render the opinions of experts alone unreliable.

4.5 Appendix A

Table 4.7: Landscape images

Couple 1	
	
picture 14	picture 9

Continued on next page

Table 4.7 – *Continued from previous page*

Couple 2

picture 36

picture 47

Couple 3

picture 50

picture 23

Couple 4

picture 18

picture 42

Continued on next page

Table 4.7 – *Continued from previous page*

Couple 5

picture 31

picture 19

Couple 6

picture 43

picture 46

Couple 7

picture 59

picture 32

Continued on next page

Table 4.7 – *Continued from previous page*

Couple 8

picture 52

picture 10

Couple 9

picture 62

picture 33

Couple 10

picture 5

picture 21

Continued on next page

Table 4.7 – *Continued from previous page*

Couple 11

picture 7

picture 22

Couple 12

picture 58

picture 7

Couple 13

picture 58

picture 22

Continued on next page

Table 4.7 – *Continued from previous page*

Couple 14

picture 44

picture 20

Couple 15

picture 26

picture 12

Couple 16

picture 8

picture 54

Continued on next page

Table 4.7 – *Continued from previous page*

Couple 17

picture 38

picture 11

Couple 18

picture 17

picture 45

Couple 19

picture 40

picture 49

Continued on next page

Table 4.7 – *Continued from previous page*

Couple 20

picture 1

picture 13

Couple 21

picture 16

picture 4

Continued on next page

Table 4.7 – *Continued from previous page*

Couple 22

picture 4

picture 28

Couple 23

picture 16

picture 28

Couple 24

picture 20

picture 57

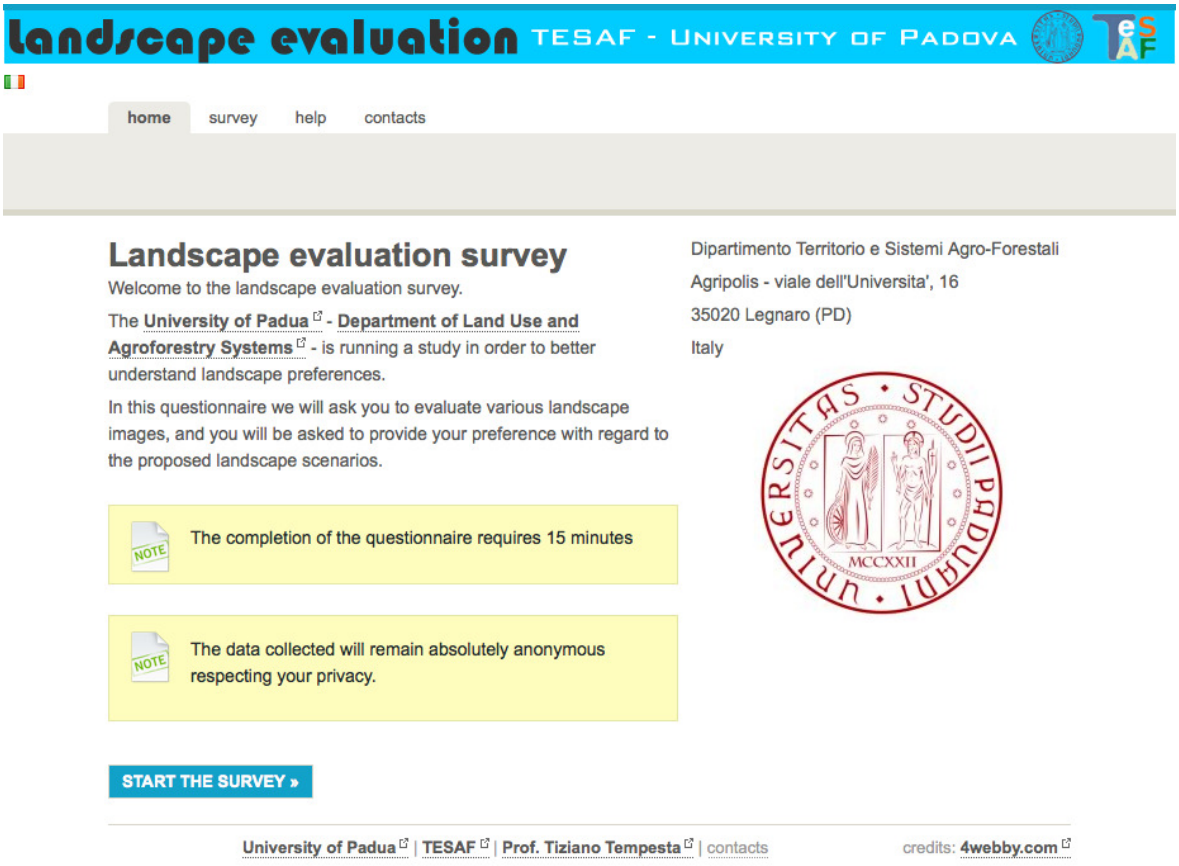
Continued on next page

Table 4.7 – *Continued from previous page*

Couple 25	
	
picture 44	picture 57

4.6 Appendix B

For editing purposes some pages of the questionnaire have been cropped in order to make them fit the page size and therefore the rate of completion indicator and other details are missing in the version reported here. Only the first landscape rating task (see page 128) is reported for brevity out of the 63 proposed.


landscape evaluation
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Landscape evaluation survey
Welcome to the landscape evaluation survey.
The University of Padua - Department of Land Use and Agroforestry Systems - is running a study in order to better understand landscape preferences.
In this questionnaire we will ask you to evaluate various landscape images, and you will be asked to provide your preference with regard to the proposed landscape scenarios.
NOTE
The completion of the questionnaire requires 15 minutes
NOTE
The data collected will remain absolutely anonymous respecting your privacy.
START THE SURVEY »
Dipartimento Territorio e Sistemi Agro-Forestali
Agripolis - viale dell'Universita', 16
35020 Legnaro (PD)
Italy
UNIVERSITAS STUDII PADUANI
MCCXXII
University of Padua | TESAF | Prof. Tiziano Tempesta | contacts
credits: 4webby.com

NOTE The completion of the questionnaire will take approximatively 15 minutes

The questionnaire is subdivided in **4 sections**.

You are at Section 1.

Section 1

The first section, where you actually are, introduces the respondent to the questionnaire.

Section 2

Section 2 is constituted by 2 pages where you will face socio-economic and attitudinal questions.

Section 3

Section 3 will introduce the respondent to the effective landscape evaluation task.

Some landscape preview images will be presented.

In this way you will be able to understand their beauty in order to evaluate them properly on a scale range from 1 (low liking) to 5 (high liking).

Section 4

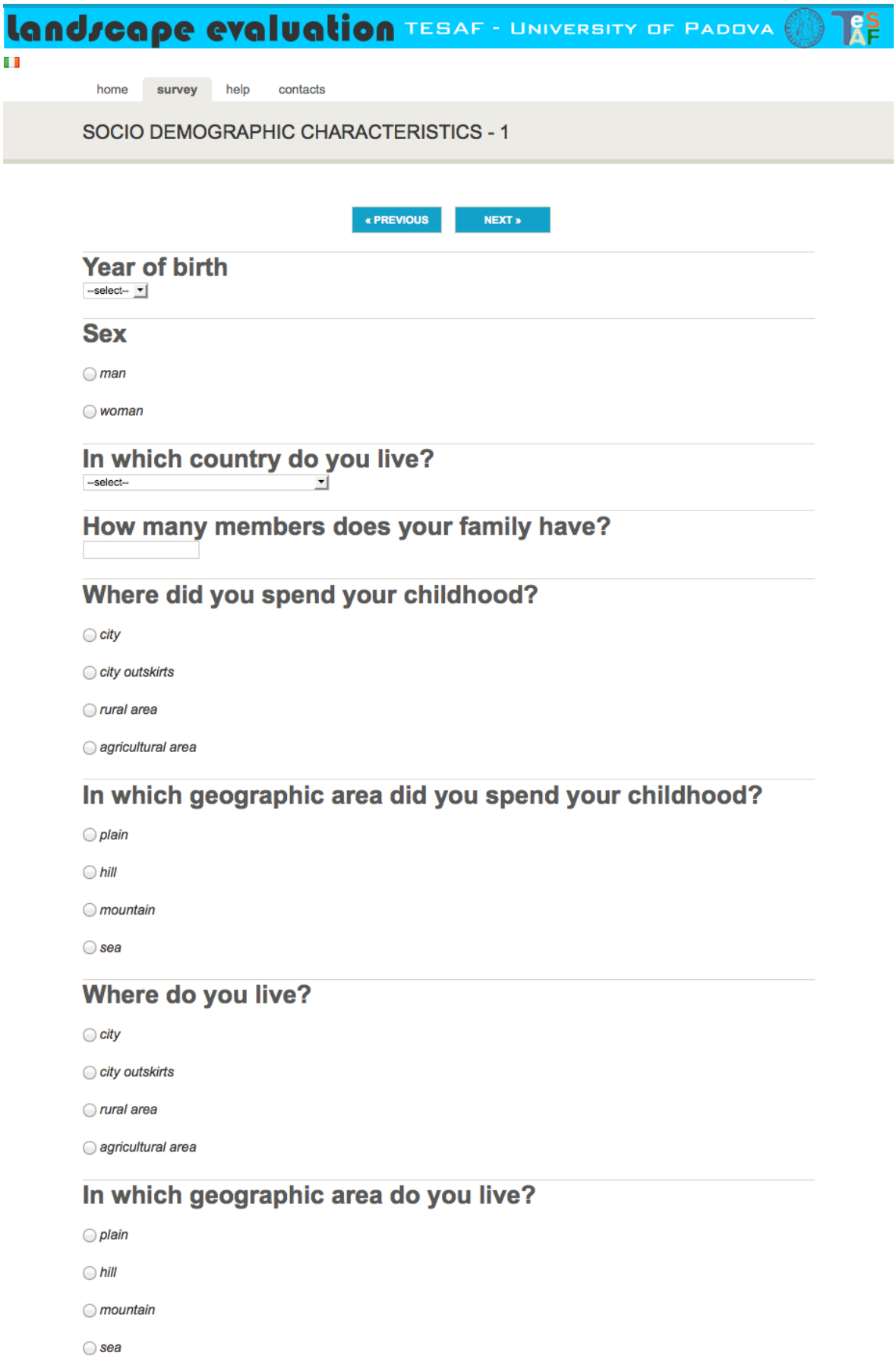
Section 4 presents 63 landscape scenarios.

Each scenario/photo will be displayed for **8 seconds**. When you have lloked at the displaied scenario you will be asked to provide your preference for it on a rating scale from **1 (low liking)** to **5 (high liking)**.

It is important that you provide your preference thinking at the first impression you got looking at the displaied landscape.

Privacy

NOTE The data collected will be use exclusively for research purpuses and will remain absolutely anonymous respecting your privacy.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home
survey
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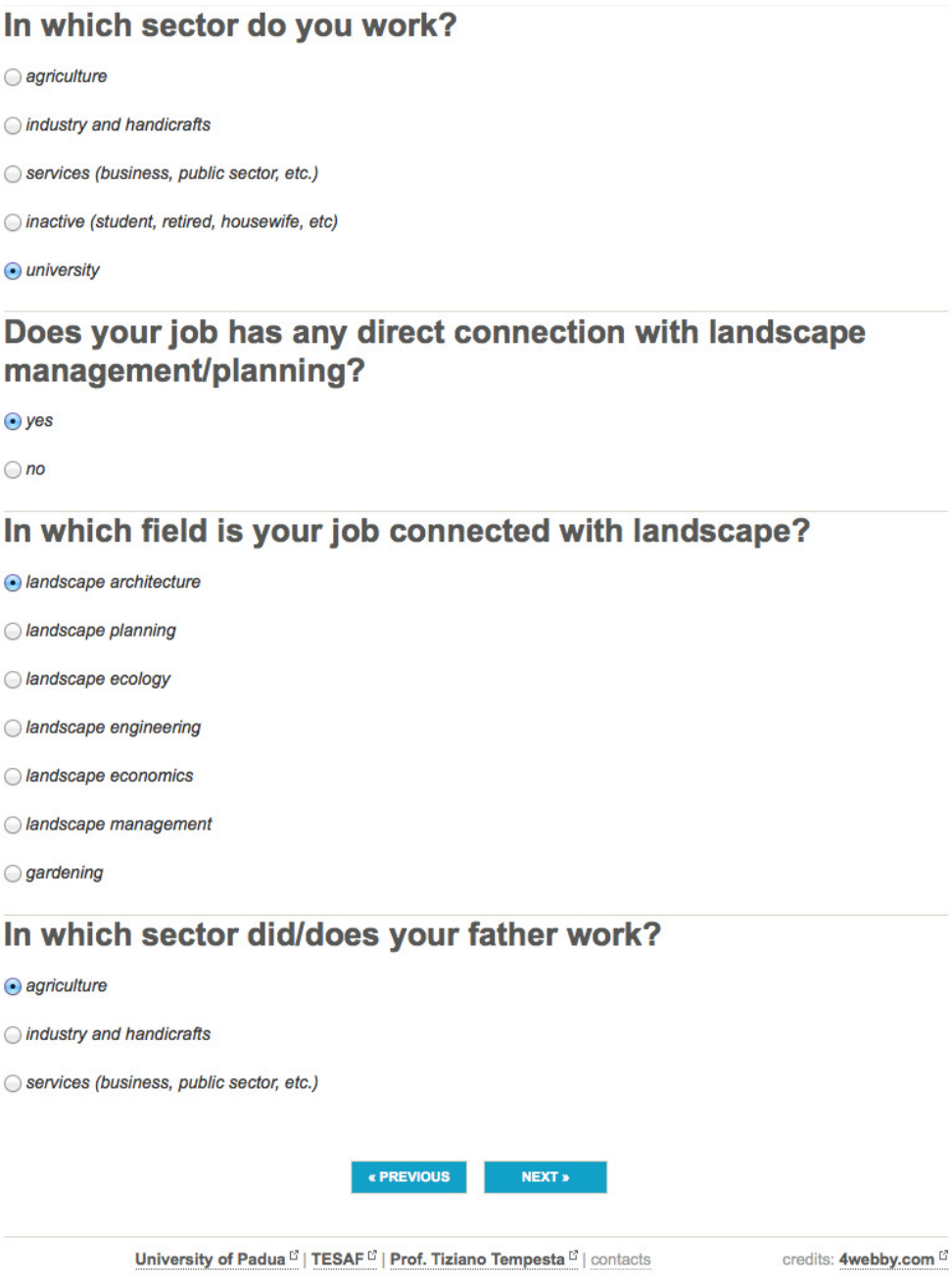
contacts
SOCIO DEMOGRAPHIC CHARACTERISTICS - 1
« PREVIOUS
NEXT »
Year of birth
--select--
Sex
man
woman
In which country do you live?
--select--
How many members does your family have?
Where did you spend your childhood?
city
city outskirts
rural area
agricultural area
In which geographic area did you spend your childhood?
plain
hill
mountain
sea
Where do you live?
city
city outskirts
rural area
agricultural area
In which geographic area do you live?
plain
hill
mountain
sea

Education

- ○ primary school
- ○ secondary school
- ○ high Diploma
- ◉ university degree

Specify your university degree MAIN area of study

- ◉ multidisciplinary
- ○ agricultural and biological sciences
- ○ arts and humanities
- ○ architecture
- ○ biochemistry, genetics and molecular biology
- ○ business, management and accounting
- ○ chemical engineering
- ○ chemistry
- ○ computer science
- ○ decision sciences
- ○ earth and planetary sciences
- ○ economics, econometrics and finance
- ○ energy
- ○ engineering
- ○ environmental science
- ○ immunology and microbiology
- ○ materials science
- ○ mathematics
- ○ medicine
- ○ neuroscience
- ○ pharmacology, toxicology and pharmaceutics
- ○ physics and astronomy
- ○ psychology
- ○ social sciences
- ○ veterinary science
- ○ other



In which sector do you work?

- ○ agriculture
- ○ industry and handicrafts
- ○ services (business, public sector, etc.)
- ○ inactive (student, retired, housewife, etc)
- ◉ university

Does your job has any direct connection with landscape management/planning?

- ◉ yes
- ○ no

In which field is your job connected with landscape?

- ◉ landscape architecture
- ○ landscape planning
- ○ landscape ecology
- ○ landscape engineering
- ○ landscape economics
- ○ landscape management
- ○ gardening

In which sector did/does your father work?

- ◉ agriculture
- ○ industry and handicrafts
- ○ services (business, public sector, etc.)

« PREVIOUS NEXT »

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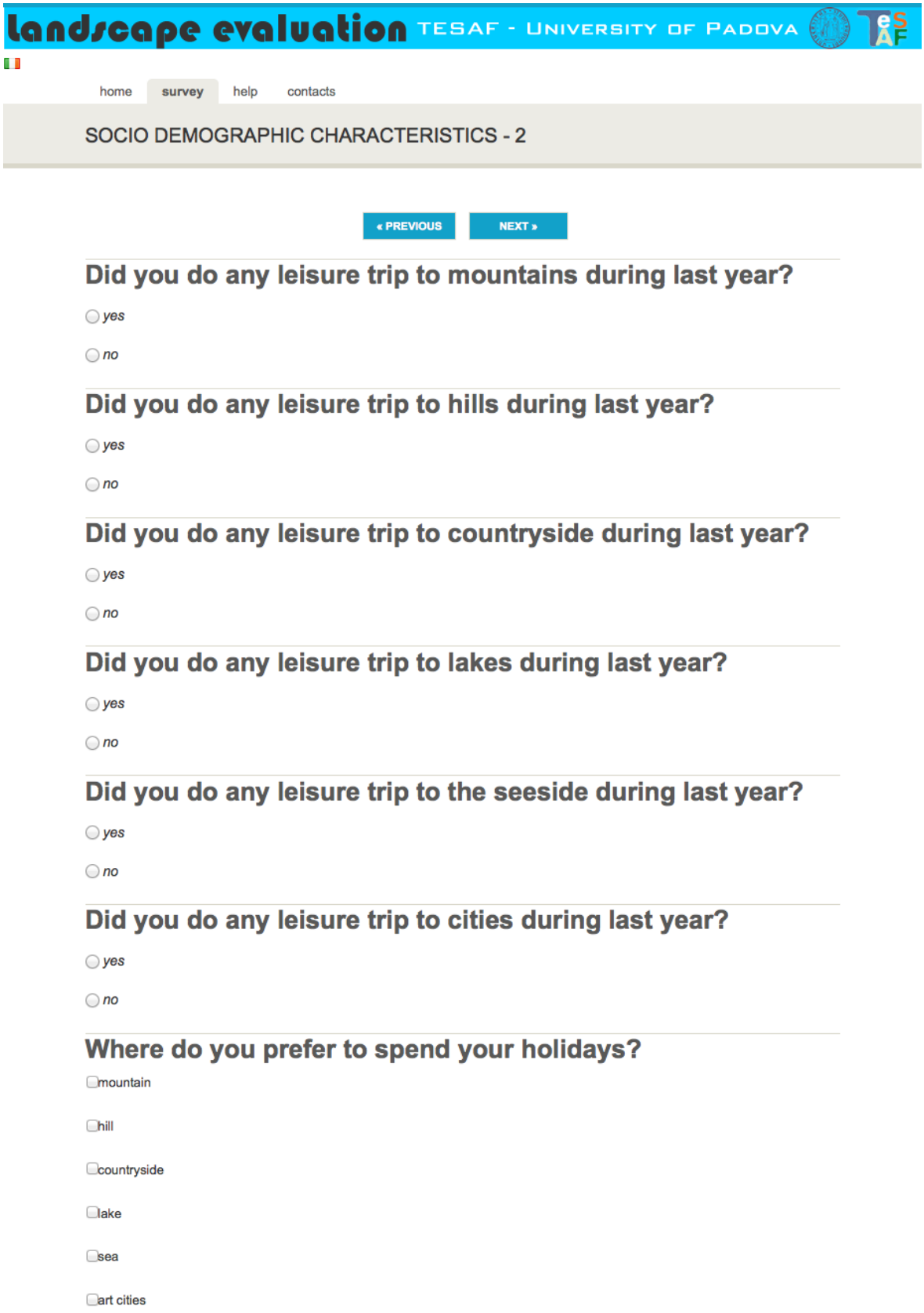
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SOCIO DEMOGRAPHIC CHARACTERISTICS - 2
« PREVIOUS
NEXT »
Did you do any leisure trip to mountains during last year?
yes
no
Did you do any leisure trip to hills during last year?
yes
no
Did you do any leisure trip to countryside during last year?
yes
no
Did you do any leisure trip to lakes during last year?
yes
no
Did you do any leisure trip to the seeside during last year?
yes
no
Did you do any leisure trip to cities during last year?
yes
no
Where do you prefer to spend your holidays?
mountain
hill
countryside
lake
sea
art cities

Are you member of environmental associations?

- ○ *yes*
- ○ *no*

How much do you care for the conservation of the tipical landscape of a certain area?

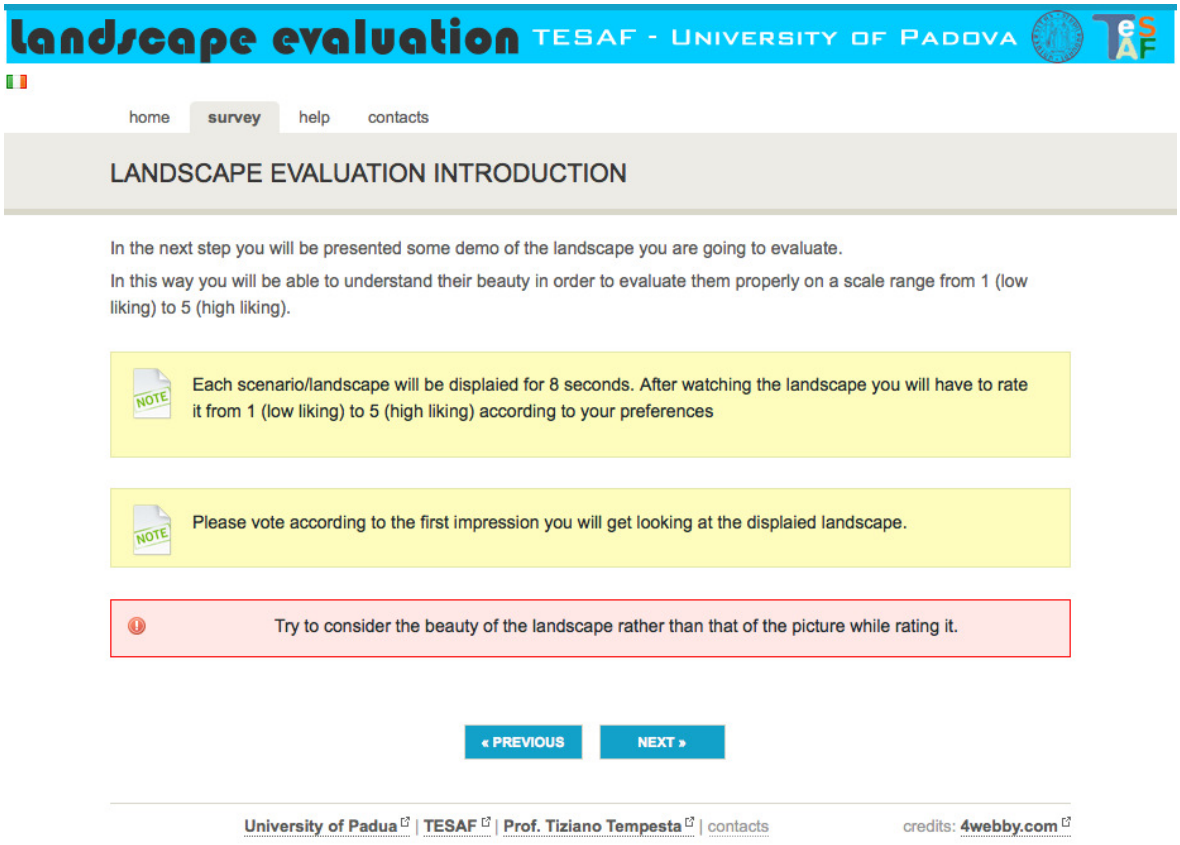
- ○ *very much*
- ○ *much*
- ○ *enough*
- ○ *little*
- ○ *very little*

When do you plan a daily recreational journey which elements do you take into account?

	very little	little	enough	much	very much
quiet of the place	○	○	○	○	○
leisure facilities	○	○	○	○	○
sport facilities	○	○	○	○	○
landscape beauty	○	○	○	○	○
travel cost	○	○	○	○	○
distance from home	○	○	○	○	○
familiarity (you have already been there in the past)	○	○	○	○	○

How do you consider the effect on landscape quality of the presence of the following elements?

	effect on landscape quality				
	very negative	negative	indifferent	positive	very positive
hedges and tree lines	○	○	○	○	○
woods	○	○	○	○	○
poplars	○	○	○	○	○
water bodies (rivers, streams, gulfs, seas etc.)	○	○	○	○	○
meadows	○	○	○	○	○
unpaved roads	○	○	○	○	○
typical rural buildings	○	○	○	○	○
urban settlements	○	○	○	○	○
antennas	○	○	○	○	○
power lines	○	○	○	○	○
traffic routes	○	○	○	○	○
paved roads	○	○	○	○	○
factories	○	○	○	○	○
malls	○	○	○	○	○
modern buildings	○	○	○	○	○
uncultivated fields	○	○	○	○	○


landscape evaluation TESAF - UNIVERSITY OF PADOVA
home
survey
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contacts
LANDSCAPE EVALUATION INTRODUCTION
In the next step you will be presented some demo of the landscape you are going to evaluate.
In this way you will be able to understand their beauty in order to evaluate them properly on a scale range from 1 (low liking) to 5 (high liking).
NOTE
Each scenario/landscape will be displaied for 8 seconds. After watching the landscape you will have to rate it from 1 (low liking) to 5 (high liking) according to your preferences
NOTE
Please vote according to the first impression you will get looking at the displaied landscape.
Try to consider the beauty of the landscape rather than that of the picture while rating it.
« PREVIOUS
NEXT »
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credits: 4webby.com

Watch carefully the 8 previews of the 63 landscapes that you will rate in next pages.

It is really important that you will make use of the full range of the rating scale from 1 to 5

hugly ○ ○ ○ ○ ○ *beautiful*
1 2 3 4 5

Therefore we ask you to watch carefully the images below and to rate with score 1 that you like the less, and with score 5 that you like the most.

ugly ○ ○ ○ ○ ○ beautiful
1 2 3 4 5

ugly ○ ○ ○ ○ ○ beautiful
1 2 3 4 5

ugly ○ ○ ○ ○ ○ beautiful
1 2 3 4 5

ugly ○ ○ ○ ○ ○ beautiful
1 2 3 4 5

ugly ○ ○ ○ ○ ○ beautiful
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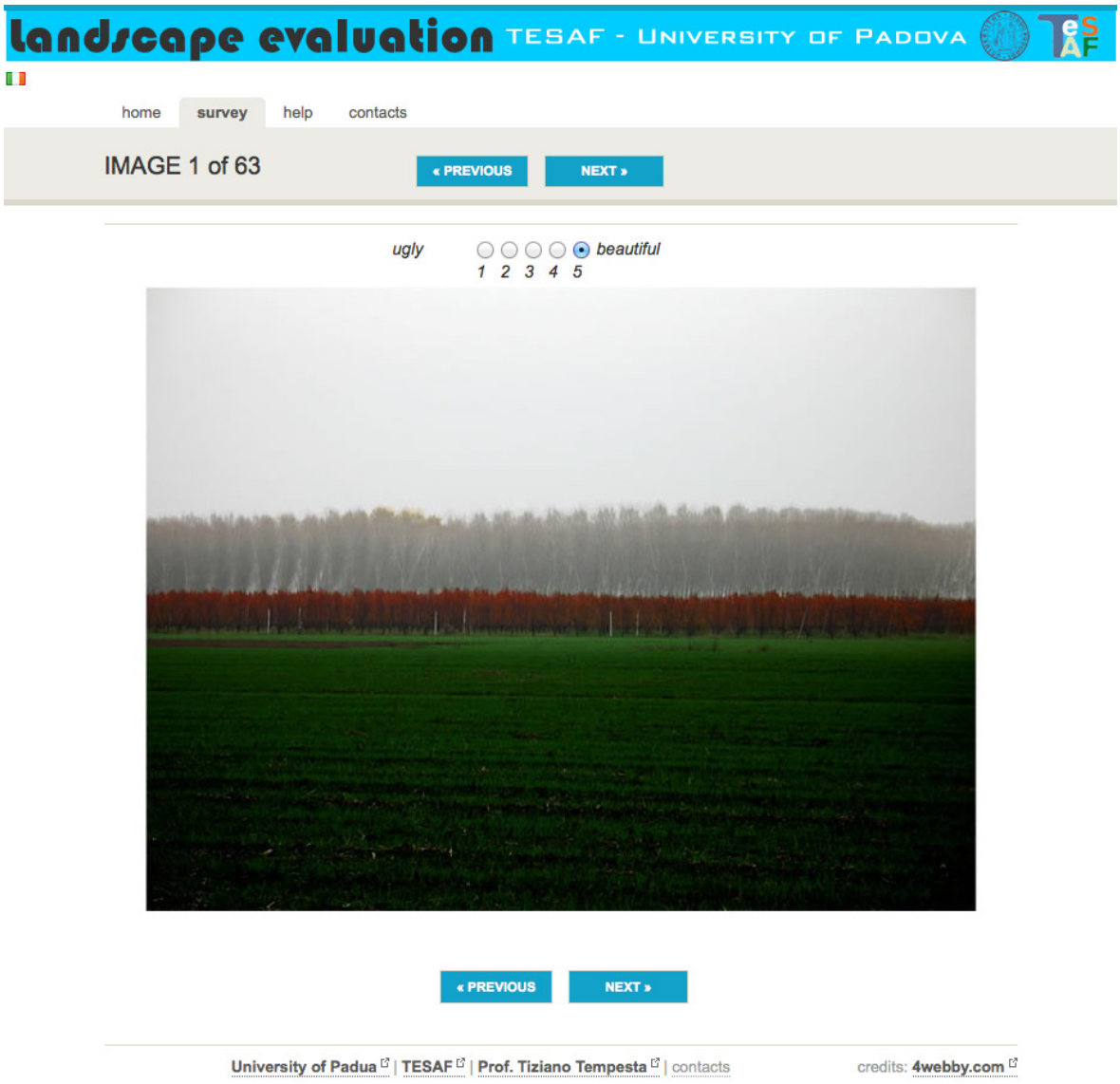
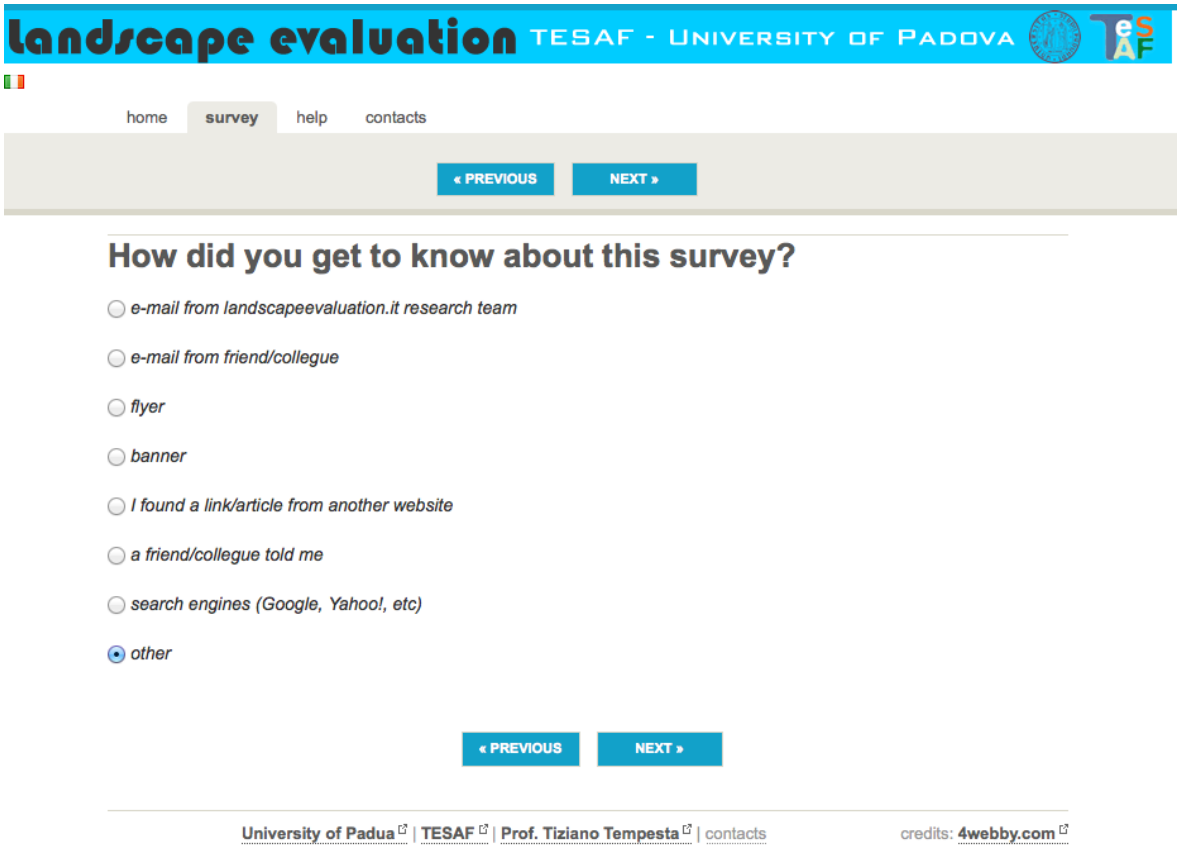


Figure 4.3: Questionnaire: image rating task.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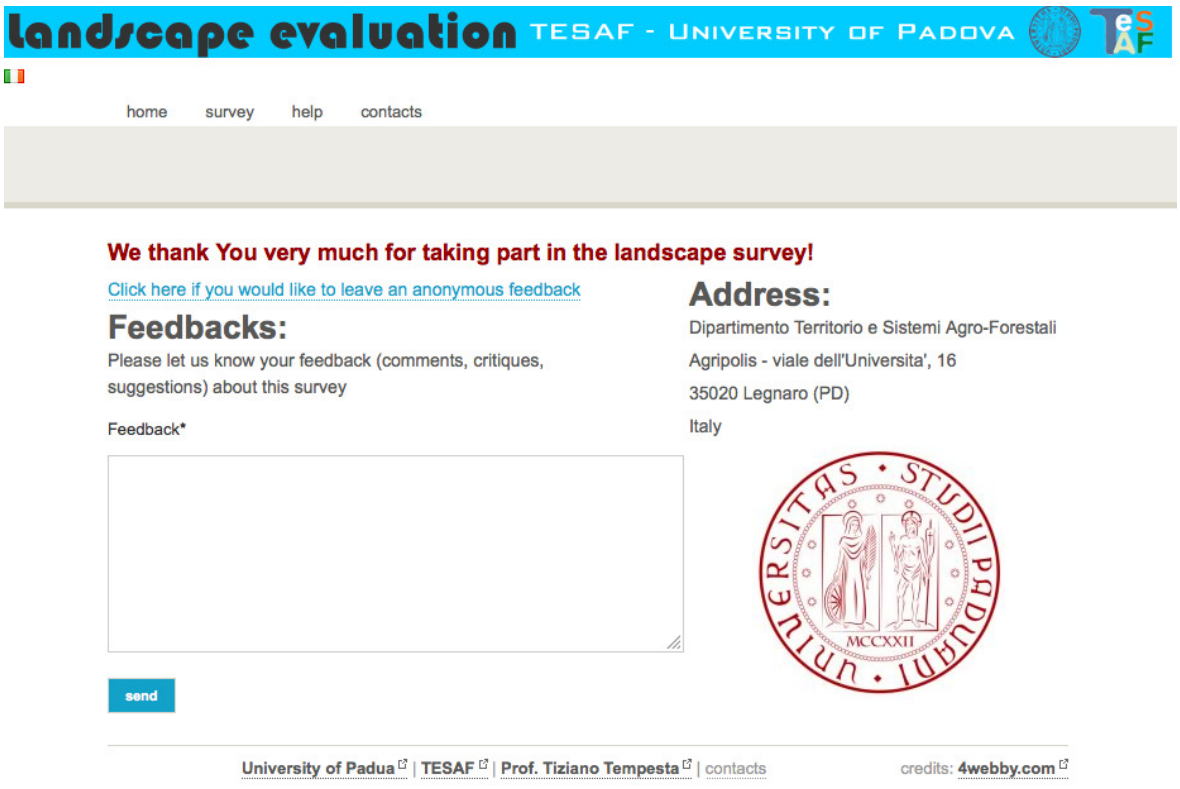
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Click here if you would like to leave an anonymous feedback
Feedbacks:
Please let us know your feedback (comments, critiques, suggestions) about this survey
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Address:
Dipartimento Territorio e Sistemi Agro-Forestali
Agripolis - viale dell'Universita', 16
35020 Legnaro (PD)
Italy
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MCCXXII
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Help/Faqs

NOTE The completion of the questionnaire will take approximatively 15 minutes

The questionnaire is subdivided in **4 sections**.

Section 1

The first section introduces the respondent to the questionnaire, presenting the same information you are reading in this page.

Section 2

Section 2 is constituted by 2 pages where you will face socio-economic and attitudinal questions.

Section 3

Section 3 will introduce the respondent to the effective landscape evaluation task.

Some landscape preview images will be presented.

In this way you will be able to understand their beauty in order to evaluate them properly on a scale range from 1 (low liking) to 5 (high liking).

Section 4

Section 4 presents 63 landscape scenarios.

Each scenario/photo will be displayed for **8 seconds**. When you have lloked at the displaied scenario you will be asked to provide your preference for it on a rating scale from **1 (low liking)** to **5 (high liking)**.

It is important that you provide your preference thinking at the first impression you got looking at the displaied landscape.

Privacy

NOTE The data collected will be use exclusively for research purpuses and will remain absolutely anonymous respecting your privacy.

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CHAPTER 5

Monetary valuation: the Wood of Mestre case study

Abstract

Woodlands on the Veneto region plain have progressively disappeared since the 19th century. This has led to a decrease in environmental and landscape quality with fewer social benefits accruing from the rural land. The demand for environmental conservation and recreational areas has increased in recent years, especially in the urban context. In order to meet these needs the Venice City Council decided to establish an extensive woodland on the Venice hinterland. Due to the high costs of the project it was important to evaluate its benefits in monetary terms and whether a mixed landscape might produce a higher benefits flow than a dense woodland. The objectives of our study are to estimate the willingness to pay (WTP) for different surface allocations of the future Wood of Mestre and to better understand the influence on WTP of the delay in the benefits due to the time needed for tree growth. Our first finding was that people prefer a mixed solution in terms of surface allocation: the wood–meadow mix (75% woodland, 25% meadow) is at the top of the sample preferences. Second, the WTP of the preferred afforestation programme is €51 year/family. The research highlighted how WTP has an inverse correlation with age. Nonetheless the WTP of older people is not negligible and this appears to support the hypothesis that the woodland will also have a bequest value. The WTP also tends to decline with the distance of the district where the interviewees live. Finally, CE proves to be a consistent and robust methodology for forest benefits evaluation that can provide both land management and quantitative information to policymakers.

5.1 Introduction

During the 1990s, the Venice City Council (Italy) decided to establish a natural woodland on the city hinterland (Figure 5.1). The aim was to improve the quality of life for the densely populated districts of Mestre and Marghera. The master plan designated an area of about 1,200 ha located in the northern part of the municipality near Mestre to be afforested in about ten years. It was an ambitious plan given that only 3% of the land was publicly owned. The only possibility of succeeding therefore relied on either buying or renting the land. In 2003, the Council rented 200 ha from a charitable foundation and made a start to the project. At that point, it was clear that completion of the project would be very expensive. Today, the average land value is about €80,000 – 100,000/ha, while the land rent amounts to €600/ha per year. Tree planting costs are about €7,200/ha. Furthermore, a natural woodland will not provide any income, whereas other land uses that can improve the environment and the landscape (e.g., pasture, meadows, etc.) would offer not negligible profits. Note that the Council had no precise idea about the monetary value of the social benefits of the woodland. The original Wood of Mestre project aimed at a full afforestation of the available surface. Nevertheless, from the results of an aesthetic visual analysis on the Wood of Mestre, Tempesta (2006a) found that, from an aesthetic point of view, the most preferred landscape involved a mixed land use (woods, hedges, meadows and pastures) rather than just a dense woodland. The total costs to convert the area with meadows, besides avoiding planting expenditures, are much lower due to the fact that this policy could be implemented with a subsidy scheme that compensates farmers for the revenue losses incurred by giving up crop production[1].

[1]Such a policy should guarantee the same results in terms of land conversion to meadows instead of buying/renting the land. The subsidy scheme could be successful for converting crops to meadows but not to woodland given that the Italian law prevents woodland being substituted by crops after it has existed for 30 years. Therefore farmers would be unlikely to accept this kind of policy for a time horizon longer than 30 years and this would undermine the sustainability of the project in the long term.

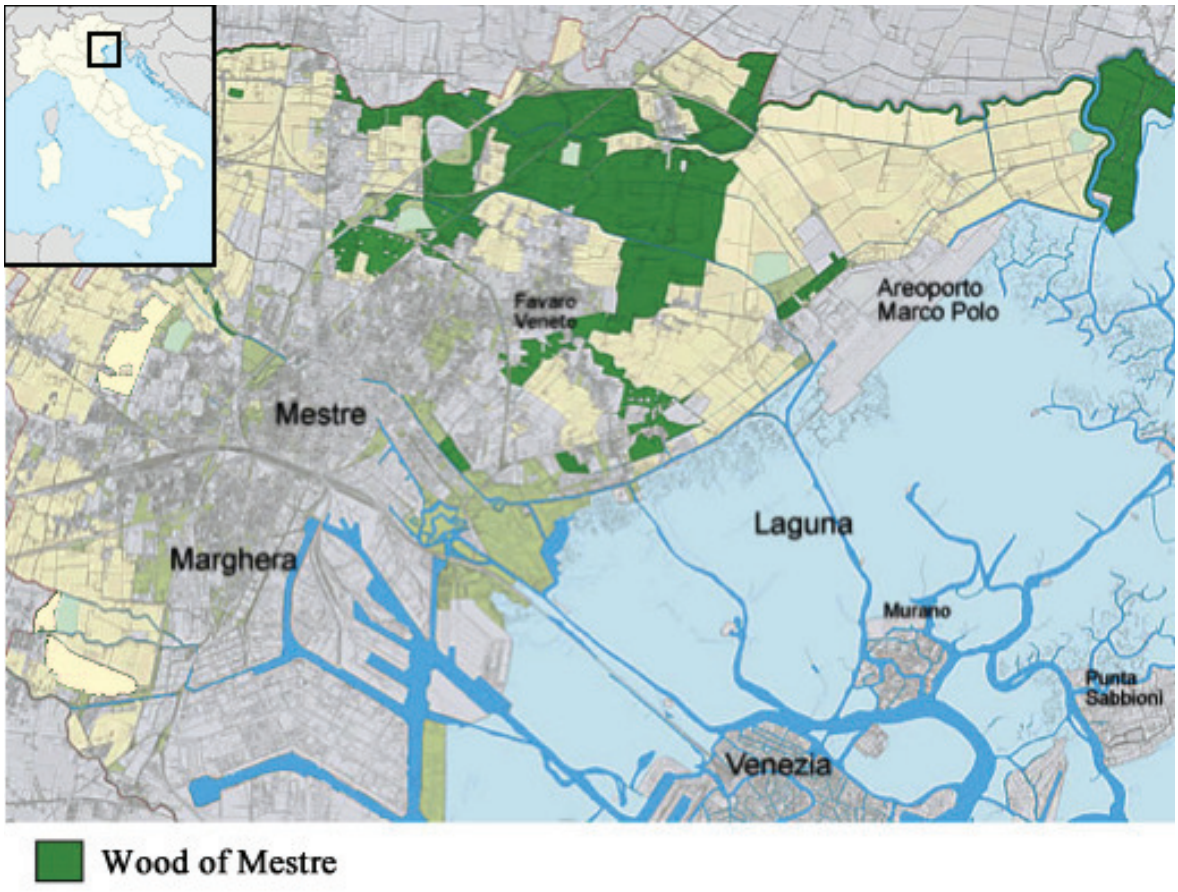


Figure 5.1: The Wood of Mestre case study map

Policymakers need to deal with two different but related problems: estimating the social benefits of the wood and finding the land use scenarios that satisfy residents' expectations, comparing the social benefits of the best territory arrangement with its costs. It is therefore necessary to apply an evaluation methodology capable of eliciting the value of alternative land use scenarios of a non-existent good.

An interesting and original characteristic of the Wood of Mestre case study is the type of environmental good under consideration. In fact the outcome of the project is the creation of a woodland with unique and distinctive characteristics in between an urban park and a forest. Indeed the future Wood of Mestre will share some characteristics with an urban park in terms of location and recreational benefits and others with a typical forest as concerns composition, extension (size) and environmental benefits. While it is possible to find WTP estimates with regard to the two

distinct types of good (forest and urban park), as far as we know there are no studies focusing on goods that share the same characteristics as the Wood of Mestre.

In the last twenty years, many surveys have been conducted in order to determine the monetary value of goods and services derived from forest ecosystems (Willis et al., 2000; Krieger, 2001; SCBD, 2001; Jones et al., 2003; Merlo and Croitoru, 2005; Lindhjem, 2007; Barrio and Loureiro, 2010).

The common aim of these studies was to quantify the monetary value of the environmental services provided by existing forests. The studies highlighted that the total economic value (TEV) can vary widely across different areas and countries. The relative magnitude of the services is also very varied. In some cases, the recreational value prevails over the other components of TEV, while in others the biological value can be the most important. However, especially in the Mediterranean area, the recreational value accounts for more than half of the forest values (Croitoru and Merlo, 2005), excluding marketable products. Most of the Italian studies were concerned with the recreational value of forests located in mountain areas. Only a few estimated the TEV (Marangon and Tempesta, 2001; Goio et al., 2008; Tempesta and Marangon, 2008). Despite the large number of studies, not many of them (Bullock et al., 1998; Hanley et al., 1998a, 2002; Lehtonen et al., 2003; Mogas et al., 2005; Campbell et al., 2006; Christie et al., 2006, 2007; Rambonilaza and Dachary-Bernard, 2007; Meyerhoff and Liebe, 2009) analysed the intrinsic characteristics affecting the value of forests.

There are also several studies that analysed the value of urban parks and urban forests, both in Italy (Willis, 2003; Fratini et al., 2009; Tempesta, 2010) and abroad (Lockwood and Tracy, 1995; Tyrväinen and Väänänen, 1998; Tyrväinen, 2001; Jim and Chen, 2006; del Saz Salazar and García Menéndez, 2007; Bernath and Roschewitz, 2008; Brander and Koetse, 2011; López-Mosquera and Sánchez, 2011; Chen and Jim, 2012; Lo and Jim, 2012). However the benefits of an afforestation programme

have only been analysed in two cases (del Saz Salazar and García Menéndez, 2007; Chen and Jim, 2012). Moreover, with few exceptions, the area of the parks is very small and not comparable to that of the Wood of Mestre. In an attempt to know whether the benefits of the Wood of Mestre outweigh the costs, a contingent valuation study was undertaken in 2004 by Tempesta (2006a). The study looked at the benefits accruing from a single scenario consisting of devoting the entire area to afforestation (100% forest). Unfortunately it did not include 'mixed' afforestation scenarios. The aim of our study is, first, to estimate the monetary benefits arising from different land use scenarios; second, to find the land use scenario that maximises residents' utility and finally to understand whether the long delays prior to enjoying the woodland at a mature stage have any impact on people's WTP. Given our objectives, the choice experiment methodology was selected, as it permits us to analyse the monetary value, both of use and non-use, of different afforestation scenarios while dealing with a non-existent good.

The paper is organised as follows. Section 5.2 focuses on the presentation of the CE methodology, experiment design, questionnaire design, data collection and model specification. Results are described in Section 5.3. Section 5.4 presents a discussion of the results and conclusions.

5.2 Material and methods

5.2.1 Choice experiment methodology

Because most of the outputs, functions and services of the Wood of Mestre are not traded on markets, non-market valuation methods must be used to determine the value of its benefits. These benefits primarily accrue to the residents in the areas surrounding the woodland in the form of non-market use values, or utility. Among non-market valuation approaches, CE is appropriate for valuating landscape poli-

cies because it allows for estimation not only of the value of the environmental asset as a whole, but also of the implicit value of its attributes[2] (Hanley et al., 1998b; Bateman et al., 2002).

CE can be considered a multi-attribute extension of dichotomous choice contingent valuation (CV) (Bateman et al., 2002). Valuation techniques are grouped into stated preferences and revealed preferences. Both CE and CV are part of stated preference (SP) techniques, while revealed preferences (RP) include hedonic pricing, the travel cost method and averting behaviour. SP techniques should be preferred to RP when dealing with ex-ante valuations and when non-use values are assumed to play an important role. In fact, stated preference techniques allow the valuation of both existent and not existent goods and services. A further advantage of SP is that it permits both use and non-use values to be estimated.

CE data are collected by means of a questionnaire in which respondents are asked to choose from among a set of options presenting the product/policy under valuation in different configurations. Each set of options is called a *choice set* and each option a *choice profile*. The product service characteristics are technically called *attributes* and the values that they assume *attribute levels*.

The founding pillars of CE theory are the Lancastrian consumer theory (Lancaster, 1966) and random utility theory (McFadden, 1974; Manski, 1977; Yellott, 1977). The central assumption of CE methodology is the postulate that utility is derived from the properties/characteristics of goods, rather than the goods per se.

The fields of application of CE include travel demand (Louviere and Hensher, 1982; Louviere, 1988a,b; Batsell and Louviere, 1991; Louviere, 1991; Hensher, 1994), forests and recreation (Hanley et al., 1998a, 2002; Mogas et al., 2006; Christie et al., 2007), biodiversity (Christie et al., 2006; Meyerhoff and Liebe, 2009), landscape (Bullock

[2]Compared to contingent valuation, CE is more suitable when a research focuses on estimating the relative importance and partial contribution of the attributes of a good/policy to its total value. In fact, while CV allows a good/policy to be evaluated as a whole, in CE, the goods valued are split into their key attributes.

et al., 1998; Campbell et al., 2006; Rambonilaza and Dachary-Bernard, 2007), agribusiness (Tempesta and Vecchiato, 2013) and health (De Bekker-Grob et al., 2012).

Different models[3] can be used in discrete choice studies. Multinomial logit (MNL) models have been widely applied and are mostly suitable for exploratory data analysis due to the fact that often they do not satisfy some assumptions[4]. Random parameter models (RPL) (McFadden and Train, 2000; Greene and Hensher, 2003) and latent class models (LCM) are more flexible and not subject to the IIA assumption. Both models are suitable for investigating respondents taste heterogeneity but differ in the way individual characteristics are handled in determining choice probability. RPL models take into account taste heterogeneity in a continuous fashion, considering it random with a specific density function. It is up to the researcher to identify which parameters of the utility function should be treated as random and to impose the distribution of their density function (normal, lognormal, triangular, uniform). Latent class models can be considered a semiparametric variant of MNL models (Greene and Hensher, 2003), in which the probability of choosing a specific option is conditional on both the attribute bundle and the individual belonging to a specific group of people with common taste characteristics.

Welfare measures are derived by looking at the marginal rate of substitution between non-monetary attributes and the monetary attribute included in the indirect utility function (IUF). Therefore, the consumer surplus can be calculated within the context of discrete choice models such as the relative Hicksian compensating variation (Hoyos, 2010). When dealing with additive IUFs, the formula for calculating WTP becomes:

[3]The interested reader can find more details on the mathematical specifications of the different CE models in Hensher et al. (2005) and Train (2009).

[4]In particular the Independence from Irrelevant Alternatives (IIA) assumption, namely that the ratio of the probabilities of choosing one alternative over another (given that both alternatives have a non-zero probability of choice) is unaffected by the presence or absence of any additional alternative in the choice set (Louviere et al., 2000).

$$WTP_j = -\frac{\partial U/\partial x_j}{\partial U/\partial p} = -\frac{\partial \beta_j}{\partial \beta_p} \tag{5.2.1}$$

Where j is the jth attribute, U is the indirect utility function and p is the price attribute.

5.2.2 Experimental design

According to the objectives of the study, three main categories of attributes were defined: surface attributes, landscape elements and an array of prices reflecting the cost of the landscape scenario.

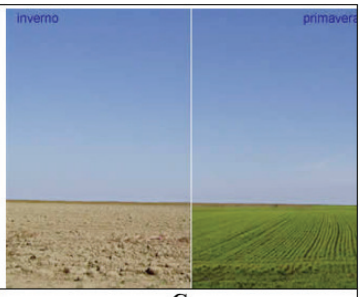
			
	A	**B**	**C**
Woodland	100%	75%	-
Arable crops	-	-	100%
Meadows	-	25%	-
Hedges	no	no	no
Animals	no	yes	no
Lakes	no	no	no
Cost/year	€15	€7	€0
	❑	❑	❑

Figure 5.2: Example of a choice set

The first category (surface attributes) refers to different options for allocating the total surface planned for the project. The attributes chosen for this purpose are the total surface (expressed as a percentage) devoted to woodland, meadows and arable crops. The second category of attributes includes three relating to the presence or absence of possible additional landscape elements in the project: small lakes, domestic animals (grazing cattle) and hedges. These are all dichotomous attributes. The third category is dedicated to the cost of the project. The vehicle of payment considered is a lump sum tax that needs to be paid by the respondent's family on an annual

basis, for ten years. A tax as payment vehicle, instead of an entrance fee, makes it is possible to suppose that the WTP will comprehend both use and non-use values and will therefore approximate the total economic value (TEV) of the woodland. The TEV of the Wood of Mestre includes, among others, values due to the following functions: recreational, cultural (educational), bequest and environmental preservation/improvement (carbon sequestration, phytodepurative capacity, biodiversity conservation and improvement of the microclimate). The array of prices ranges from €7/year to €40/year. The attribute levels used in the choice experiment are reported in Table 5.1. To verify the presence of a non-use value we limited the period of payment to ten years and specified that during the same period it will not be possible to use the woodland for recreational purposes. Note however that to limit the length of the payment we made the hypothetical market more plausible since people will have to pay for an investment that will be made in the immediate future and that will involve no other costs after planting (e.g. pruning and tree cutting, etc.).

Table 5.1: Attributes and levels of the choice experiment design.

Attributes	Levels
Woodland (%)	100, 75, 50, 25, 0
Remaining surface	Arable crops, meadow, 1/2 meadow - 1/2 arable crops
Hedges	Present, absent
Animals	Present, absent
Lakes	Present, absent
Cost (€/year) for 10 years	0, 7, 10, 15, 30, 40

A fractional factorial orthogonal design[5] was then generated with SPSS® software, and a final set of 32 treatment combinations plus one, the status quo alternative, derived. The status quo alternative provides a scenario at zero cost where the proposed policy will not be undertaken; the land will be left to the respective landowners and

[5]See Ferrini and Scarpa (2007) and Rose and Bliemer (2004) for a complete treatise on design optimisation practices and performances.

arable crops without any additional hedges, lakes or domestic animals.

The 32 treatment combinations were grouped in pairs, resulting in 16 scenarios with three options each: option A, option B and option C. Option C represents the status quo. Figure 5.2 presents one of the 16 choice sets submitted to interviewees.

Particular attention was paid to avoiding possible biases given by the order of the scenarios supplied to the respondent. It is in fact recognised that the respondent might undergo a learning process while answering the first questions and be tired when facing the last ones. In order to avoid such biases, the order of the presentation of the scenarios was randomised. Four versions of the questionnaire, each with a different presentation order of the scenarios, were submitted to the respondents. We decided not to block the design and to submit all 16 profiles, given that from a cognitive point of view, the decision task was quite simple due to the low number of attributes and their homogeneity of unit of measure (surface percentages or dichotomous).

In this respect it has to be considered that there is no univocal evidence about the optimal number of choice tasks to be submitted to interviewees. Both Stopher and Hensher (2000) and Hensher et al. (2001) found that the number of choice sets has a marginal effect on the consistency of the results. Caussade et al. (2005) found that there is an inverse U-shaped relationship between the number of choice situations and the error variance. The optimal number of choice sets seems to be around 9 or 10. These authors also point out that the effects of the number of choice situations are anyway less important than the number of alternatives per choice situation, the number of attributes per alternative and the number of levels per attribute. In a recent study on fatigue and boredom effects, Hess et al. (2012) found no relationship between survey length and decreasing response quality. In any case to simplify the interviewees' task every option was accompanied by a photographic representation. Moreover, the submission of 16 choice tasks was not criticised during the focus

groups used to test the questionnaire, so we decided not to block the design.

5.2.3 Questionnaire design and data collection

The questionnaire is divided into an introduction, three main sections and an appendix. The introductory page presents the survey and the institution conducting it and then emphasises the importance of taking part in the survey and the fact that the respondent will remain anonymous. The first section introduces the policy scenario (Appendix A) and locates the project area with a map of Mestre and Venice. It also illustrates the Wood of Mestre project, its benefits, progress and the need for further resources in order to complete it. The respondent is then advised that due to Council budget constraints the needed resources will be collected through a Council lump sum tax per family, per annum for a period of ten years. It is then stressed that the completion of the project will depend on the results of the survey regarding the respondents' willingness to pay.

The second section is dedicated to the choice tasks. The respondent, assisted by the interviewer, tackles 16 choice tasks. Each task consists of three options, A, B, and C. Option C is repeated in every choice task and represents the status quo. According to their preferences and budget constraints, the respondents have to choose one option for every choice task.

The third and final section investigates the respondents' socioeconomic characteristics, recreational behaviour, previous knowledge about the project and relative sources of information, whether they are in favour of the project and their attitude towards the environment in general.

As can be seen in Figure 5.2, we provided both numerical and visual information. In particular, we tried to represent through a realistic photomontage the landscape that would result from any scenario. Mixing images and numbers in this case is of importance because the project will have a strong impact on the landscape charac-

teristics of the territory. This also helps to specify that in any case the landscape will be mixed, excluding the possibility that the woodland and other land uses will be on separated parts of the territory. Three focus groups were conducted in order to test the comprehensibility of the questionnaire structure, its jargon and the extent to which the choice task was clear to the respondents. The main purpose of the first two focus groups was to check whether the structure of the questionnaire was clear, identify typing errors, verify the acceptability of the hypothetical market and payment vehicle, and test the choice task comprehension. The information provided about the policy scenario was considered sufficient by 82% of the participants. The jargon was judged understandable by 72%, while the photo-realistic simulations were judged representative by 11.5% of the participants, fairly representative by 70.5% and not very representative by 12%. The choice task presentation and logic resulted as being clear and they made just some minor comments about the jargon and the map locating the project. The purpose of the third focus group was to test an improved version of the questionnaire on a more "realistic" sample: namely residents of Mestre and Venice. The focus group meeting was therefore held in Marghera, a suburb of Mestre with 8 participants from Mestre and Venice. Compared with the previous focus groups, the participants of this one had a better comprehension of the information provided, considered complete by 50% of them, and fairly complete by 38%. With regard to the jargon, 88% of them found it understandable and 13% fairly understandable. They reacted positively to the photo-realistic simulations, which were considered fairly representative by 75% of the group. After each focus group, we asked them whether they felt the 16 choice tasks were too tiring, but no one complained about this. The questionnaire was finally revised to take into account the group members' suggestions.

From May to October 2006, 152 one-on-one interviews were held. The interviews were conducted by the same interviewer with residents of Venice, Mestre, Favaro-Dese and Marghera-Malcontenta. Given the non-blocked structure of the design,

each respondent tackled the entire choice set. The interviewees were chosen at random from the phone book so that the sample was stratified by area of residence (Figure 5.3). This latter aspect is quite important, given that we expected an inverse relationship between the distance of the area of residence of the interviewee from the Wood of Mestre and his WTP for the realisation of the project. We then contacted the chosen targets by phone and visited those who agreed to the interview. About 70% of the people contacted by phone were available for the in person interview. We did an ex-post check of the correspondence of our sample with the characteristics of the residents of the area in terms of age and sex, which showed that the data collected are quite representative of the real population.

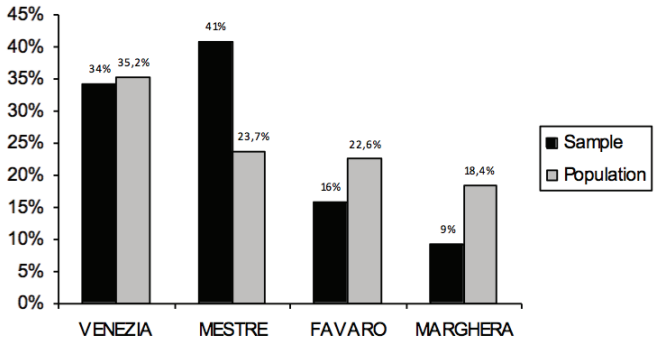


Figure 5.3: Households by location: sample versus real population

All 152 questionnaires were successfully completed and deemed suitable for the data analysis. Only 5 respondents (3.29% of the full sample) declared themselves to not be in favour of the Wood of Mestre initiative. The completion of the Wood of Mestre was therefore judged positively by the majority of respondents (96.7% of the sample, 147 respondents).

5.2.4 Model specification

We opted for an unlabelled[6] and unblocked[7] CE. The decision to rely on an unlabelled CE is justified by the need to examine different (potential) configurations of a single alternative, namely, the future management of the project area.

We applied different models for the analysis of different aspects of our research. The analysis of the best allocation of the area of the project was performed with an RPL model using sample mean WTP values. In order to investigate the implication of socioeconomic characteristics on the preferences for the delayed benefits accruing from the afforestation project we analysed the individual-specific WTPs resulting from an RPL model for interactions with socioeconomic characteristics.

5.2.4.1 MNL model

The data analysis followed different steps according to the objectives of our study. We first analysed the data using an MNL model. One of the main limitations of the MNL model lies in the IIA assumption. We then ran the Hausman test using the R mlogit package (Croissant, 2011) and the IIA hypothesis was rejected. Finally we applied an RPL model (Greene and Hensher, 2003; Train, 2009) given that these are not subject to the IIA assumption.

The implicit assumption of the utility function specification is that people evaluate any attribute per se regardless of the presence of interactions between the elements that constitute the forest ecosystem. Given this assumption we did not take into consideration any correlation between the attributes. We estimated the social benefits of the woodland under the hypothesis that people essentially have an additive

[6] "Experiments that use generic titles for the alternatives [choice options] are called unlabeled experiments" – (Hensher et al., 2005). See also Hensher et al. (2005) Chapter 5.3 (page 150) "A note on unlabeled experimental design", and Appendix 10A (page 371) "Handling unlabeled experiments".

[7] Blocking, in CE design terms, implies the segmentation of the design in multiple parts. Let's say that a design has 16 choice profiles; to block the design by 4 blocks requires the analyst to subdivide the design in 4 choice sets. Each block is then given to a different respondent, the result of which is that 4 different decision makers are required to complete the full design (Hensher et al., 2005).

approach. The utility function considered is illustrated as follows:

$$\begin{aligned} U(x_i) &= ASC_i + b\_wood * L\_W_i + \\ &+ b\_meadow * L\_M_i + b\_hed * HEDGES_i + \\ &+ b\_anim * ANIM_i + b\_lake * LAKE_i + \\ &+ b\_tax * COST_i \end{aligned} \tag{5.2.2}$$

where i = the *i*th choice option; ASC = alternative specific constant assuming value 1 if status quo option and 0 otherwise; L_W = log % surface of woodland +1; L_M = log % surface of meadows +1; ANIM = dummy variable presence of grazing cattle; HEDGES = dummy variable presence of hedges; LAKE = dummy variable presence of small lakes; COST = tax per year per family.

We used the log transformation of the percentage of the surface occupied by woodland, meadows and arable crops assuming that the marginal utility cannot be constant (Horne et al., 2005). Obviously, the log assumption can have a profound impact on the estimated values. From this point of view, other models were estimated (linear and quadratic), but were not chosen because of a higher log likelihood.

5.2.4.2 RPL with socioeconomic interactions and individual WTP

Considering the RPL model, we chose the random parameters looking at the significance of the derived standard deviation after running several RPL models with different random parameters as suggested by Hensher et al. (2005). We finally chose to set as random the parameters of the attribute woodland (L_W), meadows (L_M) and LAKE. When using the RPL model, the scientist has to make strong distributional assumptions about the chosen random parameters. We opted for a normal distribution for the continuous variables (L_W and L_M) and for a triangular distri-

bution for the dummy variable LAKE. Neither type of distribution was constrained, allowing the random parameters to assume negative values. We introduced in equation (2) the interaction terms of the random parameters with the following socioeconomic characteristics: age, education (whether the respondent has a degree or not), place of residence and family income. This allowed us to investigate the sample heterogeneity around the means of the estimated parameters.

$$U(x_i) = ASC_i + \sum \beta_{Z_i} Z_i + \sum \beta_{N_i} N_i + \sum \sum \beta_{ZS_i} Z_i S_i \tag{5.2.3}$$

Where Z represents the parameters of (2) that will be interacted with socioeconomic characteristics (L_W and L_M); N the parameters of (2) that will not be interacted with socioeconomic characteristics (HEDGES; ANIM; LAKE; COST); S the socioeconomic characteristics that are interacted with the Z attributes (AGE; MARGHERA; FAVARO; DEGREE and FINCOME), where MARGHERA is a dummy variable for the residents of Marghera, FAVARO is a dummy variable for the residents of Favaro, DEGREE a dummy variable assuming value 1 if the respondent holds a degree and FINCOME is a continuous variable for the family income.

AGE was chosen in order to see whether the long delay in benefits has any effect on WTP. If use values prevail, we would expect younger people, other things being equal, to have a higher WTP for the afforestation project. Older people might be willing to pay if in their perception some non-use components of value (existence and bequest) are strong enough to outweigh the potential low use values. At the same time a considerable role could be played by the family income (FINCOME): according to economic theory there could be a positive relationship between WTP and family income especially if non-use values are involved. Finally the two residential dummies (MARGHERA and FAVARO) were chosen in order to test the effect of distance (del Saz Salazar and García Menéndez, 2007) and therefore the ease of access to the woodland benefits. One would expect that the closer the respondent

lives to the woodland the higher is his WTP.

In order to obtain more precise insights into respondents' heterogeneity around the mean parameters we derived individual-specific WTP measures (Greene et al., 2005; Sillano and de Ortúzar, 2005; Train, 2009). Individual-specific WTP measures are calculated using simulated values from the chosen distributions for the parameters specified as random in the RPL model. Estimates were derived using the WTP command in the NLOGIT 4.0 model specification (Hilbe, 2006). This approach was applied by, among others, Greene et al. (2005), Hilbe (2006) and Beharry-Borg and Scarpa (2010).

5.3 Results

Data were analysed using NLOGIT® software version 4.0. The results obtained from the two models (MNL and RPL) are summarised in Table 5.2. MNL estimates are presented only for completeness, given that they do not satisfy the IIA assumption and are therefore not reliable. According to Hensher et al. (2005) it is possible to state that the RPL model has a good fit (McFadden pseudo-R^2 of 0.51; Table 5.2 and Table 5.3).

Table 5.2: Model comparison.

	MNL	RPL
LL	-2140.06	-1314.36
AIC	1.77	1.09
BIC	1.78	1.09
HQIC	1.77	1.13
McFadden pseudo R^2	0.20	0.51

The statistical non-significance of the attribute hedges in both models may be due to the attribute's poor photographic representation in the questionnaire. Especially when the hedges were placed in front of woodland, it was difficult to distinguish

them. Moreover, the idea of a hedge that people usually have in mind is not univocal and probably led to confusion. Without a clear visual representation, people may underestimate the aesthetic and ecological importance of hedges. Perhaps the aim of the choice experiment could also have influenced the answers of the interviewees. In fact, people were asked to state their opinion about the creation of a woodland. The RPL model results suggest that on average the interviewees reacted positively to the idea of the project. All parameter estimates (Table 5.3) are significant at a 95% confidence level apart from hedges and animals. The attribute cost is negative as expected. The mean WTP for covering the remaining area (1000 ha) with woodland is €42.7 year/family (Table 5.4).

With regard to the completion of the project, it is interesting to note that people preferred a mixed solution in terms of surface allocation. The woodland–meadow mix is at the top of the sample preferences. In particular, among the proposed scenarios the mix 75% woodland, 25% meadow maximises respondents WTP (€51.2 year/family). It should be noted that the monetary amount of the benefits provided by the mix 25% woodland, 75% meadow, while being sub-optimal in terms of benefits, is equivalent to covering the full surface with woodland. This result could have important consequences if the policy maker should opt for a second best solution looking to minimise the project costs. The lakes have a high WTP (€11.7 family/year).

The terms interacted with the random parameter L_W are statistically significant at a 95% confidence level and have the expected sign. In the case of the terms interacted with the random parameter L_M only the family income is statistically significant at a 90% confidence level, while no individual characteristics are significant for lakes.

According to the RPL results every income increase of €1,000 implies a mean WTP increase of €0.16 for the realisation of the woodland. It is interesting to observe that

the same does not apply for the surface covered by meadows, where the correlation with family income is negative. A possible interpretation of the latter result could be that with the increase in the family income the non-use value component of WTP rises, which is much more important for the woodland than the meadows.

The residents in the neighbourhood of Favaro Veneto have a WTP that is €30 family/year higher on average than those of Marghera, the furthest away neighbourhood from the woodland. The distance and accessibility effect is quite substantial, involving a reduction of up to 37% in the WTP.

The educational effect has a lower impact. Respondents who hold a degree have a WTP for the woodland €6 higher than those with a lower education.

With regard to the effect of age it is possible to observe that elderly people have a lower WTP compared to younger people. The reduction of WTP for the woodland is on average €0.19 year/family for every increase in age of one year. Nevertheless WTP is quite high even for elderly people who will have fewer chances to enjoy the benefits of the woodland at maturity. The life expectancy in northern Italy is less than 10 years for men over 76 and women over 79. This means that elderly people will be less likely to enjoy the recreational benefits of the woodland, which as explained in the introductory scenario (Appendix A) will be exploitable after 10 years. It should also be considered that with advancing age the mobility of elderly people reduces and therefore it is unlikely that this category of people would effectively enjoy recreational activities in the woodland. The RPL model provided a mean estimate of €43 family/year for the WTP of the respondents over 70. The non-use values attached to the woodland therefore seem to play an important role in the aggregate value stated for the enjoyment of its benefits by the residents of the Venice Municipality.

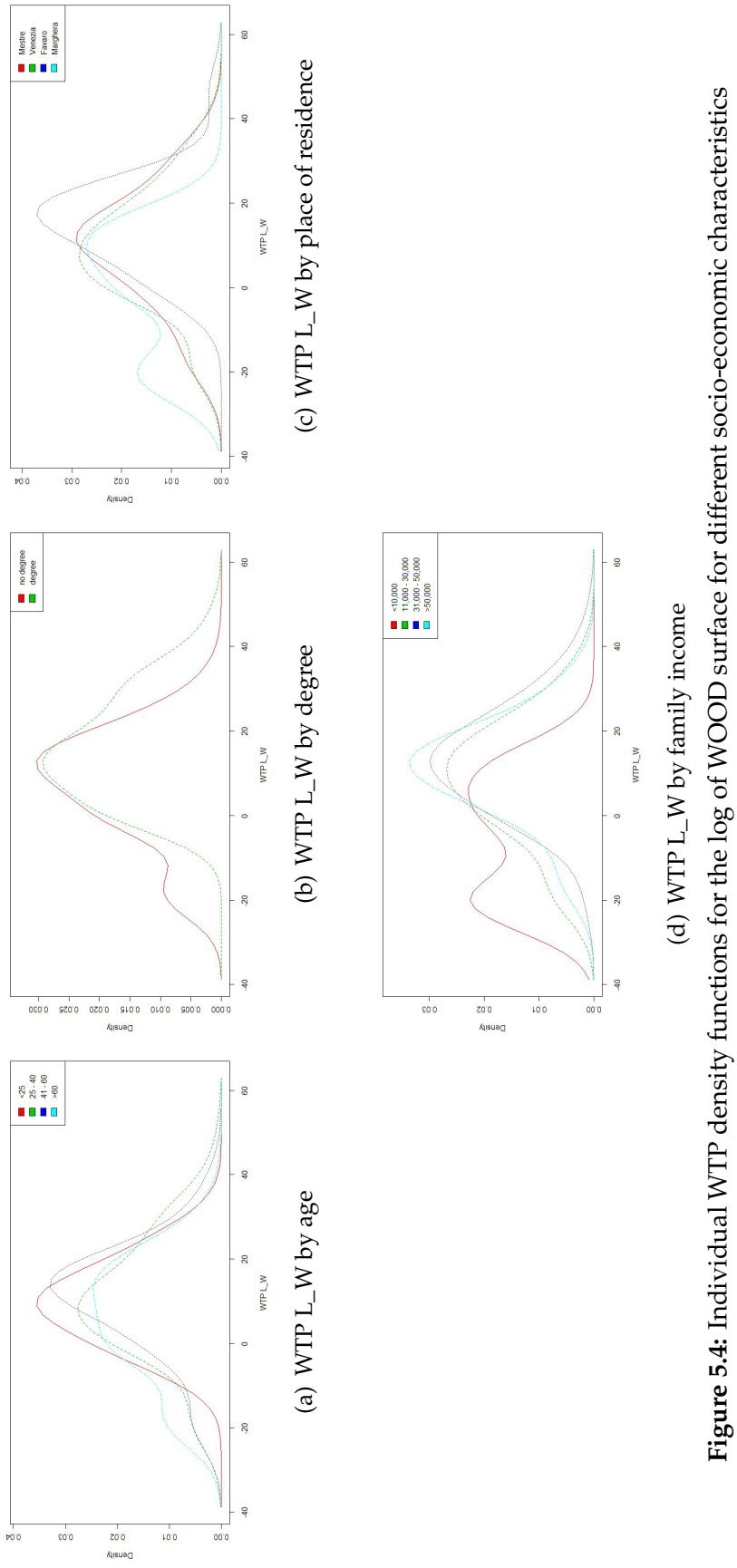
Table 5.3: Parameter estimates for the MNL and RPL.

	MNL			RPL		
	β	Std. error	t-Value	β	Std. error	t-Value
Non random parameters						
ASC	1.627	0.366	4.443***	-1.062	0.591	-1.797**
L_W	0.568	0.092	6.192***			
L_M	0.254	0.025	10.260***			
HEDGES	0.077	0.085	0.903	-0.075	0.111	-0.676
ANIM	0.379	0.087	4.337***	0.169	0.127	1.334
LAKE	0.624	0.077	8.134***			
COST	-0.050	0.004	-12.849***	-0.116	0.008	-14.712***
Random parameters (latent heterogeneity)						
L_W				1.302	0.375	3.472***
L_M				0.516	0.098	5.286***
LAKE				1.323	0.158	8.357***
Standard deviations of random parameters distributions						
L_W_SD				1.5789	0.1478	10.6800***
L_M_SD				0.3788	0.0441	8.5850***
LAKE_SD				3.0930	0.3535	8.7500***
Interaction (observed heterogeneity)						
L_W:AGE				-0.022	0.006	-3.799***
L_W:MARGHERA				-1.493	0.235	-6.363***
L_W:FAVARO				0.908	0.166	5.468***
L_W:DEGREE				0.739	0.168	4.396***
L_W:FINCOME				0	0	3.557***
L_M:FINCOME				0	0	-1.842**

*** p-value<0.05
** p-value<0.1

Table 5.4: WTP estimates by surface proportion.

Other elements	Territory percentage			WTP per year (€) mean per family	
	Woods	Meadows	Crops	MNL	RPL
	100			52.43	42.7
		100		23.44	15
	75		25	49.2	40.6
	50		50	44.67	36.3
	25		75	37.01	30.1
	75	25		65.75	51.2
	50	50		64.64	49.1
	25	75		59.01	44.2
Hedges				1.54	-0.7
Grazing cattle				7.58	1.5
Small lakes				12.48	11.7



(a) WTP L_W by age

(b) WTP L_W by degree

(c) WTP L_W by place of residence

(d) WTP L_W by family income

Figure 5.4: Individual WTP density functions for the log of WOOD surface for different socio-economic characteristics

5.4 Discussion and conclusions

The realisation of a plain afforestation project such as that foreseen by the Venice City Council on the outskirts of Mestre implies high costs as it is not without side effects on the local economy. First of all, it would cause a considerable reduction in the income of local farmers. This consequence is enforced by the Italian law that prevents woodland being cleared for crops after it has existed for 30 years. It is therefore necessary to carefully consider the benefits that the local population will enjoy from such a policy intervention.

As far as we know there are very few studies (Chen and Jim, 2008, 2012) that focused on the valuation of the benefits of re-forestation projects in peri-urban areas on the plain. The studies conducted so far estimated the value of woods or urban parks and in some cases of woods located near cities. In this regard it should be remembered that the Wood of Mestre has quite unique characteristics in between an urban park and a natural forest in terms of location and size. The fact that it is situated near a densely populated area highlights its recreational purposes. It is easily reached by bicycle from the most populated neighbourhoods and will be crossed by many paths that enable hiking or cycling in the woodland. On the other hand its size and the choice to create a natural woodland determine its potential in terms of both direct use and non-use environmental functions.

Given the structure of the hypothetical market of our CE with a ten year payment it is quite complex to compare the results obtained with those of other Italian and international studies. In fact the results obtained in other studies on parks and urban woods asked the WTP in the form of a perpetuity or an entrance fee. Their results are therefore not directly comparable. Nevertheless in order to perform a comparison we can adopt the following: we could take the value per hectare and calculate the present value of the expected future benefits or alternatively find the perpetuity equivalent to the present value of our ten year annuity. In both cases it

is important to choose a proper discount rate (Hepburn and Koundouri, 2007): this choice can have a not negligible effect on the comparability of results with those obtained by other scholars. Using a discount rate of 3.5% (del Saz Salazar and García Menéndez, 2007) and the WTP of the 100% woodland solution obtained with the RPL model (€42.70 per family/year), the present value (PV) of the benefits per family is €354.7[8], which corresponds to a perpetuity of €12.40 year/family[9]. If we calculate the total economic value (TEV) of the woodland per hectare considering the targeted tax payers we should multiply the PV per family by the number of families in the municipality of Mestre[10] and divide the result by 1,000 ha: in this case the TEV is €41,605/ha. The equivalent measure for the preferred scenario (75% woodland, 25% meadow) derived on a 10-year basis considering the presence of animals and lakes is €62,755/ha.

Looking at Italian studies on forest values, the average TEV of the forests in Trentino Province equals €11,000/ha[11] (Goio et al., 2008). In another Italian study undertaken in the Friuli Venezia Giulia Region, the TEV is €9,300/ha (Marangon and Gottardo, 2001). Croitoru and Merlo (2005) found a TEV of €6,530/ha for Italian woodlands as a whole. Tempesta and Marangon (2008) found a willingness to accept (WTA) of €202 year/family with a CV study concerning renouncing fire protection policies, obtaining a TEV of €19,000/ha.

From the international literature a great variability emerges of the estimated WTP for the conservation of forests. Barrio and Loureiro (2010) analysed 35 studies that report the values for 101 forests: the mean WTP per family or per person varies from a few dollars to $1,000. This variability depends on the purpose of the valu-

[8] We used the following formula: $PV = WTP_{ANNUITY} \frac{(1+i)^n - 1}{i \cdot (1+i)^n}$
where: WTP = mean annual willingness to pay; i = discount rate;
n = number of years.

[9] This figure has been calculated considering the tax payments as annuity-due (payments at the beginning of each period) using the formula: $WTP_{PERPETUITY} = PV \cdot i$.

[10] 117,267 families (Comune di Venezia, 2001).

[11] This figure has been calculated considering a discount rate of 3.5%.

ation and on the kind of value estimated. Scandinavian countries are also characterised by a high variability (Lindhjem, 2007). With regard to urban parks, studies have been done both in Italy (Willis, 2003; Marone et al., 2010; Tempesta, 2010) and abroad (Tyrväinen and Väänänen, 1998; Tyrväinen, 2001; del Saz Salazar and García Menéndez, 2007; Brander and Koetse, 2011; Chen and Jim, 2011, 2012). Tempesta (2010) analysed the recreational value of 7 urban parks in the Veneto region in municipalities with a diversified residential density. The estimated value varies from €4,400ha/year to €79,000/ha, with the values for the most densely populated towns being greater than €50,000/ha.

Marone et al. (2010) looked at the recreational value of 6 urban parks in Florence obtaining values much higher than Tempesta (2010), ranging from €65,000/ha to €666,000/ha. The authors found an inverse relation between the values found and the green parks endowment per resident. It should anyway be considered that the values proposed depend on the number of citizens in the area considered. Florence has a much bigger population than that analysed by Tempesta (2010) in Veneto and therefore the demand for urban green spaces should be greater. Looking at other studies abroad on urban parks, del Saz Salazar and García Menéndez (2007) applied CV for the ex-ante valuation of the WTP for the reconversion of a train station area into an urban park in the city centre of Valencia (Spain). They found a mean WTP per household of €53.61[12] and an aggregate value on a 5 year tax payment of €2,255,832.28/ha using a 3.5% discount rate and a yearly cash flow of €499,624,83/ha.

Bernath and Roschewitz (2008) applied CV to estimate the recreational benefits of the forest areas surrounding Zurich (Switzerland). The total surface of the forests considered is 2250 ha. The authors found a yearly mean WTP for an entrance fee of

[12]Data were collected in 2001 before the introduction of the Euro. Bid amounts were therefore in Spanish Pesetas and we converted the data using the initial exchange rate 1€ = 166.386 Pesetas (without adjusting to keep purchasing power parity).

€59.15[13] per person.

Chen and Jim (2012) applied CV and found a mean WTP of HK$101 (about €10.46) per person for the development of Hong Kong's country parks.

In a CV study, Chen and Jim (2011) measured the WTP for an urban greening project in Zhuhai (China). The WTP for leisure use of green spaces ranged between US$29 and US$20/household/year.

Tyrväinen (2001) studied the benefits for recreation and existence value of two urban contexts in Finland: Joensuu and Salo. The CV methodology was applied and the survey was conducted in 1995 and 1996. For the forests of the two cities (631 ha - Repokallio, Linnunlahti, Lykynlampi, Tupuri, Maalu and Kankare) they found an aggregate estimate of the yearly recreational benefits of 25.53 million FIM (€4.34 million[14]), which is equivalent to an average value of €6,878.13/ha.

Brander and Koetse (2011) did a meta-analysis of 20 CV studies on the value of urban parks and peri-urban open spaces. In their analysis the dependent variable was the value per hectare/year. In the estimated model it results that the value depends on the land use, the functions provided by the area of the urban park, its size and on the population density. Applying the same regression model to our case study the value of the Wood of Mestre is €57,598/ha, a result comparable to that found in our study with CE.

Looking at the above studies related to urban parks the WTP per family for the Wood of Mestre is in line with the results obtained by other scholars: the WTP for an urban park is on average higher than that for a forest. From the comparison with national and international studies on forests and urban parks we can say that in terms of WTP the Wood of Mestre is perceived more as an urban park than as a forest.

[13]This is the most conservative measure that includes protest votes. The amount is 91CHF, converted with an exchange rate of 1 CHF≈0.65 € (September 2004).

[14]The exchange rate reported by the authors is 1 FIM = 0.17€.

Nevertheless it should be admitted that some limits of our research could have affected our results. First it is possible to assume that some benefits of the Wood of Mestre could be of interest to the residents of other municipalities. Second it has not been easy to photographically represent the delay in reaching maturity of the woodland: the photomontages showed a mature woodland while in the questionnaire preamble the respondents were advised about the delay of at least ten years for the benefits. With regard to the first issue, our study highlighted how the existence and bequest values play an important role in the TEV of an afforestation project of considerable dimensions. In fact the residents of the most distant neighbourhood declared a positive and considerable WTP. It is therefore plausible to assume that the residents of the municipalities to the north of the considered area could receive substantial benefits from the project. The second issue could have influenced the WTP declared by older people. Looking at the photomontages it is possible that they have been induced to suppose that they will have the possibility of enjoying a mature woodland in a few years. The non-appreciation of the attribute hedges could also be related to representation problems. In fact in other studies that applied a perceptive approach it resulted that hedges tend to improve landscape quality (Tempesta, 2006b). In our study the representation of hedges with photomontages could have influenced the results obtained in terms of the relation between hedges and landscape. Nevertheless the concept of hedge is subject to misinterpretation given that in the local idiom it is often used as synonymous of fencing for houses. All these findings suggest that the use of photomontages or other images should be carefully checked during this kind of experiment.

Despite the aforementioned limits, the RPL model provided important insights on the structure of the preferences of the interviewees. A notable result is related to the finding that the non-use components and in particular the bequest value probably play an important role in the Wood of Mestre value. On the one hand we found a negative relation between the WTP and respondent's age, indicating that the wood-

land value is proportional to the number of years remaining for the interviewee to enjoy its benefits. Nevertheless we also found a high WTP for people over 70. It should be remembered that the hypothetical market proposed to the interviewees implies that they should pay a tax for ten years and that only after the payment of the tax would they start enjoying the benefits of the woodland. Considering the life expectancy of the residents, a not negligible fraction of the respondents has less probability of enjoying the benefits of the woodland for recreational purposes. In conclusion, the study seems to highlight that the benefits of the Wood of Mestre will be higher than that provided by other forests but, given the necessity to rent or buy the land, lower than the afforestation costs.

In this respect our findings could be useful since they show that the best landscape is less expensive than a dense forest. CE results show that it is possible to improve the landscape quality while saving money with respect to the 100% woodland plan. The opportunity cost (namely, the farmers' income reduction) of allocating the project surface to meadows is much lower than the opportunity cost of devoting it entirely to woodland. It is therefore possible to suppose that a cheaper solution than the 100% woodland scenario exists: allocating part of the area to meadows. The meadow–woodland landscape setting provides a win-win situation that simultaneously maximises the social benefits and reduces the afforestation costs for the municipality of Venice. It is thus highly recommended that the latter should be pursued. In fact the allocation of the surface to woodland implies greater realisation costs, while meadows do not necessarily require the acquisition of the land but can be guaranteed by subsidising the farmers to compensate them for the losses of income from agricultural production. Subsidies are expected to be cheaper than land acquisition therefore reducing the realisation costs. The best solution in terms of WTP maximisation (75% woodland, 25% meadow) provides a saving of 25%[15] in terms of land acquisition with respect to the 100% woodland scenario. While look-

[15]Excluding the costs of subsidies.

ing at costs minimisation the scenario 25% woodland, 75% meadows, equivalent in terms of WTP to the 100% woodland scenario, guarantees a 75% saving.[1]

There are also some interventions that are not very expensive (e.g. the creation of some small lakes and cattle grazing), but are able to greatly improve the social benefits of the whole project. As noted above, the best land use arrangement (Table 5.4) emerging from our CE RPL estimates is very similar to the findings of a visual-aesthetic research (60% woodland and 40% meadows) (Tempesta, 2006b). This suggests that the visual characteristics play a central role in defining the social benefits of an afforestation programme. In this respect, an in-depth analysis of the factors affecting the aesthetic quality of the landscape will probably make it possible to refine some details of the project, further increasing the social benefits.

According to the results of our study, it may be concluded that CE appears to be a reliable approach in the evaluation of the benefits of afforestation programmes. This method permits different land use arrangements to be evaluated simultaneously and it could provide more information for the policymaker than other approaches.

Acknowledgements

The authors are grateful to Robert Olschewski, the journal editor-in-chief, and to two anonymous reviewers for their constructive comments and suggestions. All errors and omissions are the responsibility of the authors alone.

5.5 Appendix A

5.5.1 Questionnaire scenario introduction

The Venice City Council decided (Master Plan modification 25/01/1999) to establish a 1200 ha woodland between Favaro and the motorway to Venice international airport.

After 10 years from the beginning of the project the woodland will be suitable for recreational purposes and will be an important environmental heritage for future generations.

Once completed, the "Wood of Mestre" will be one of the biggest woodlands of the "Pianura Padana" bringing to the residents of Venezia/Mestre and areas close by several benefits in terms of both environmental quality and recreation:

- Areas for sport and recreational activities;
- Improvement of air quality;
- Improvement of the quality of water flowing into the lagoon;
- A habitat for the reintroduction of species historically typical of plain forests;
- Re-naturalisation of the area with an improvement in biodiversity;
- Protection of the neighbouring populated areas in case of floods;
- The presence of a "living laboratory" and a reference point for environmental education.

Given that the areas designated for the project by the Master Plan are on private land, in order to complete the project the Municipality of Venice will have to rent or buy those lands, with the consequent expenses for the realisation of the project and its management.

The Venice City Council has already created 200 ha of the planned 1200 ha of woodland in the fort Cosenz area, renting the land from the Fondazione Querini Stampalia.

Due to the increasing cuts in government spending, the costs for the remaining 1000 ha of woodland will need to be borne by the local Venice City Council. This means that local taxation will be increased for a period of 10 years to finance the completion of the Wood of Mestre. The tax increase will be applied equally on all families living in the area affected by the project.

The Venice City Council is considering whether and to what level the project of the Wood of Mestre is shared and appreciated by the local population. For this purpose, in cooperation with the University of Padova, it was decided to conduct this survey to learn the opinions of the citizens both with regard to their willingness to complete the project and their preferences for the landscape characteristics of the remaining 1000 ha.

5.6 Appendix B

5.6.1 The questionnaire

Appendix B: Questionnaire

Università degli Studi di Padova

Te.S.A.F.

Dipartimento Territorio e Sistemi Agro Forestali

Indagine sui benefici ambientali e paesaggistici della realizzazione del Bosco di Mestre

Questa indagine è condotta dal Dipartimento Territorio e Sistemi Agro Forestali dell'Università degli Studi di Padova esclusivamente per fini di ricerca. Tutte le informazioni raccolte saranno trattate nel rispetto della privacy, non sarà quindi possibile in alcun modo identificare le generalità del rispondente. I dati del rispondente non saranno in alcun modo divulgati.

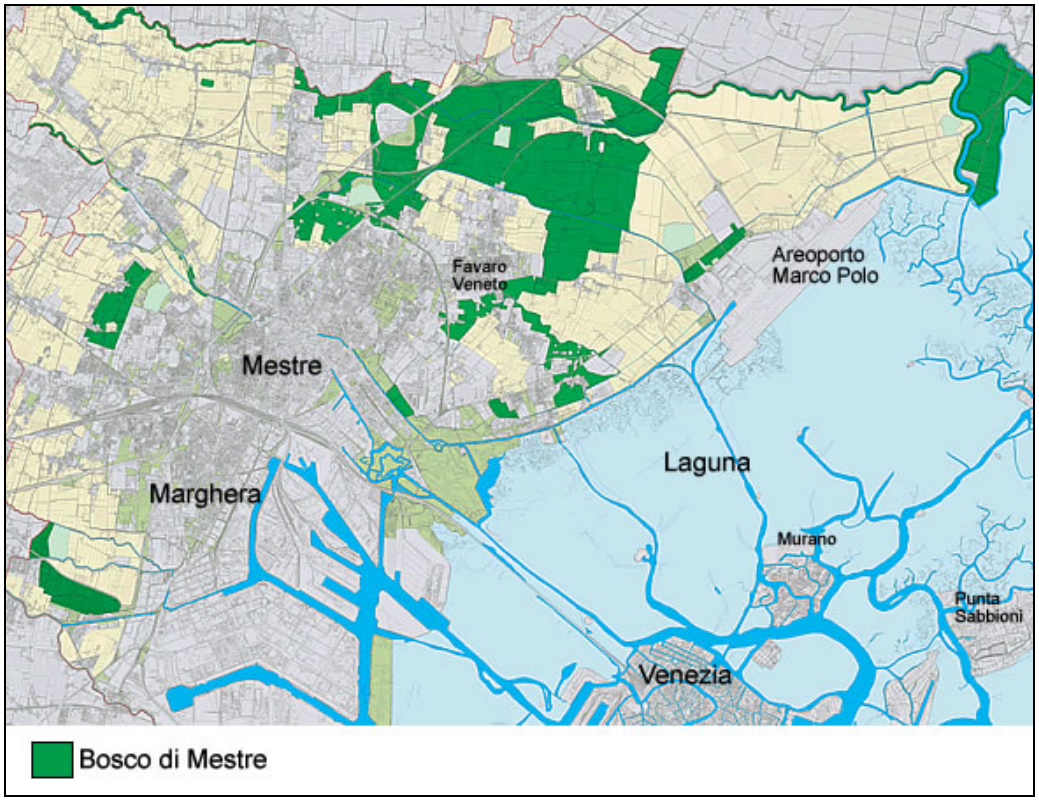
Non ci sono risposte giuste o sbagliate. Siamo interessati solo alle Sue opinioni, idee ed esperienze.

La Sua partecipazione a questo studio è molto importante, Le chiediamo quindi di rispondere alle domande del questionario con la massima serietà. La ringraziamo fin d'ora per il contributo apportato a questa ricerca.

Università di Padova – TESAF – Agripolis - Viale dell'Università, 16 - 35020 Legnaro (PD)

A. Informazioni introduttive

Il comune di Venezia con una variante al Piano Regolatore Generale adottata il 25/01/1999 ha deciso di realizzare un bosco di superficie pari a 1.200 ettari tra Favaro e la bretella autostradale per l'aeroporto. Una volta passati dieci anni dall'impianto, il bosco potrà essere utilizzato a fini ricreativi e costituirà un importante patrimonio ambientale per le future generazioni.



Il Bosco di Mestre ricoprirà una superficie di 1200 ettari (evidenziata in verde nella cartina).

Giunto a completamento il "Bosco di Mestre" diventerebbe il bosco planiziale più esteso della Pianura Padana e porterebbe innumerevoli **benefici** di carattere ambientale e ricreativo ai residenti di Venezia/Mestre e delle aree limitrofe, garantendo:

- aree per lo svolgimento di attività ricreative e sportive;
- il miglioramento della qualità dell'aria;
- il miglioramento della qualità delle acque che sfociano in laguna;
- un habitat idoneo al ripopolamento di specie animali un tempo autoctone dei boschi planiziali;
- la rinaturalizzazione dell'area da esso interessata ed un incremento della biodiversità;
- la protezione dei centri abitati limitrofi in caso di alluvioni;
- la presenza di un "laboratorio vivente naturale" e di un punto di riferimento per l'educazione ambientale.

Maggiori delucidazioni sui termini specifici usati sono consultabili nel glossario in **appendice** (pagina 146 di questo questionario).
E' inoltre possibile ottenere ulteriori informazioni sul bosco via web all'indirizzo http://www.comune.venezia.it/boscodimestre

Poiché i terreni che il Piano Regolatore Generale ha destinato alla realizzazione del Bosco di Mestre giacciono su suoli privati, per completarne il progetto la Regione Veneto dovrà provvedere al loro acquisto o affitto, facendosi carico delle relative spese di realizzazione e gestione.

Il Comune ha già provveduto alla realizzazione di 200 ettari di bosco nell'area di proprietà della Fondazione Querini Stampalia nei pressi del forte Cosenz.

In seguito ai crescenti tagli alla spesa pubblica, **la realizzazione dei restanti 1.000 ettari del Bosco dovrà essere finanziata quasi interamente dalle casse della Regione Veneto**. Ciò comporterebbe un aumento delle tasse per un periodo di 10 anni. Tale aumento andrebbe a gravare uniformemente su tutte le famiglie che risiedono nel territorio comunale.

Il Comune di Venezia sta valutando se ed in quale misura questa iniziativa possa essere condivisa ed apprezzata dalla popolazione. A tal fine il Comune, in collaborazione con l'Università di Padova, ha deciso di avviare questa indagine preventiva per conoscere l'opinione dei cittadini sia in merito alla loro volontà di completare il progetto, sia in merito alle caratteristiche paesaggistiche che questi restanti 1.000 ettari andrebbero ad assumere.

La Sua partecipazione a questo studio è molto importante, Le chiediamo quindi di rispondere alle domande del questionario in piena libertà.

Non ci sono risposte giuste o sbagliate. Siamo interessati solo alle Sue opinioni, idee ed esperienze.

B. SCENARIO 1

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	75%	100%	-
seminativo	25%	-	100%
prato	-	-	-
siepi	si	no	no
animali	si	no	no
laghetti	si	no	no
costo\anno*	€ 7	€ 10	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

C. SCENARIO 2

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	25%	50%	-
seminativo	-	50%	100%
prato	75%	-	-
siepi	si	si	no
animali	si	si	no
laghetti	no	no	no
costo\anno*	€ 7	€ 15	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

D. SCENARIO 3

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	75%	50%	-
seminativo	-	-	100%
prato	25%	50%	-
siepi	si	no	no
animali	si	si	no
laghetti	no	no	no
costo\anno*	€ 10	€ 7	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

E. SCENARIO 4

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	50%	50%	-
seminativo	25%	50%	100%
prato	25%	-	-
siepi	no	no	no
animali	si	no	no
laghetti	no	si	no
costo\anno*	€ 10	€ 30	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

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F. SCENARIO 5

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	100%	75%	-
seminativo	-	-	100%
prato	-	25%	-
siepi	no	no	no
animali	no	si	no
laghetti	no	no	no
costo\anno*	€ 15	€ 7	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

G. SCENARIO 6

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	25%	100%	-
seminativo	37,5%	-	100%
prato	37,5%	-	-
siepi	si	no	no
animali	no	no	no
laghetti	no	no	no
costo\anno*	€ 15	€ 30	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

H. SCENARIO 7

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	25%	100%	-
seminativo	-	-	100%
prato	75%	-	-
siepi	si	no	no
animali	no	no	no
laghetti	si	no	no
costo\anno*	€ 15	€ 40	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

I. SCENARIO 8

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	75%	25%	-
seminativo	12,5%	-	100%
prato	12,5%	75%	-
siepi	no	no	no
animali	no	si	no
laghetti	no	no	no
costo\anno*	€ 40	€ 10	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

J. SCENARIO 9

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	50%	25%	-
seminativo	25%	75%	100%
prato	25%	-	-
siepi	si	si	no
animali	si	no	no
laghetti	no	si	no
costo\anno*	€ 30	€ 40	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

K. SCENARIO 10

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	100%	100%	-
seminativo	-	-	100%
prato	-	-	-
siepi	no	no	no
animali	no	no	no
laghetti	no	si	no
costo\anno*	€ 10	€ 15	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

L. SCENARIO 11

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	25%	100%	-
seminativo	37,5%	-	100%
prato	37,5%	-	-
siepi	si	no	no
animali	no	no	no
laghetti	si	no	no
costo\anno*	€ 10	€ 30	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

M. SCENARIO 12

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	50%	75%	-
seminativo	-	25%	100%
prato	50%	-	-
siepi	si	no	no
animali	si	no	no
laghetti	no	no	no
costo\anno*	€ 7	€ 40	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

N. SCENARIO 13

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	75%	25%	-
seminativo	-	75%	100%
prato	25%	-	-
siepi	si	no	no
animali	si	si	no
laghetti	si	no	no
costo\anno*	€ 40	€ 15	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

O. SCENARIO 14

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	100%	75%	-
seminativo	-	12,5%	100%
prato	-	12,5%	-
siepi	no	no	no
animali	no	no	no
laghetti	no	si	no
costo\anno*	€ 7	€ 15	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

P. SCENARIO 15

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	50%	50%	-
seminativo	-	25%	100%
prato	50%	25%	-
siepi	no	no	no
animali	no	no	no
laghetti	si	si	no
costo\anno*	€ 15	€ 40	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

Q. SCENARIO 16

Quale delle seguenti opzioni paesaggistiche preferisce?
Scelga **una** delle tre opzioni proposte ed indichi con una crocetta l'opzione scelta.

			
	A	**B**	**C**
bosco	75%	75%	-
seminativo	25%	12,5%	100%
prato	-	12,5%	-
siepi	no	si	no
animali	no	si	no
laghetti	no	si	no
costo\anno*	€ 30	€ 30	€ 0
	❑	❑	❑

* aumento annuo delle tasse comunali, per famiglia, per anno, per un periodo di 10 anni.

R. Informazioni personali

Di seguito Le verrà chiesto di fornire alcune informazioni di natura socio-economica.
Le garantiamo che ogni informazione verrà trattata in forma strettamente riservata e solo ai fini dell'indagine.

Sesso M ❑ F ❑

Anno di nascita _____

Comune di residenza _____

Area di residenza:

1	Mestre	❑
2	Venezia centro storico - Lido	❑
3	Favaro - Dese	❑
4	Marghera - Malcontenta	❑

Stato civile:

Celibe/nubile	❑
Coniugato/a	❑
Convivente	❑
Vedovo/a	❑

	SI	NO
Ha figli?	❑	❑

Informazioni relative allo stato occupazionale, titolo di studio e reddito dei membri del nucleo famigliare:

	Età	**SETTORE OCCUPAZIONALE**						**TITOLO DI STUDIO**				**REDDITO**								
		Non Attivo (studente, pensionato, casalinga/o)	Agricoltura	Industria / Artigianato	Servizi	Disoccupato	Elementari	Medie	Superiori	Laurea	**Fino a 10.000 €**	**Da 10.001 a 20.000 €**	**Da 20.001 a 30.000 €**	**Da 30.001 a 40.000 €**	**Da 40.001 a 50.000 €**	**Da 50.001 a 75.000 €**	**Da 75.001 a 100.000 €**	**Oltre 100.000 €**
Intervistato																				
Coniuge																				
Figlio 1																				
Figlio 2																				
Figlio 3																				
Figlio 4																				
Altro 1																				
Altro 2																				
Totale reddito																				
Totale attivi	n°_____																			

S. Informazioni aggiuntive

E' POSSIBILE INDICARE RISPOSTE MULTIPLE

Nell'ultimo anno ha mai frequentato un bosco (escluse pinete al mare)	SI	NO
	❑	❑

Se SI:

1	Durante una gita in giornata	❑
2	Durante una vacanza	❑

Dove ha frequentato i boschi:

1	Collina	❑
2	Montagna	❑
3	Pianura	❑

Quali attività ricreative all'aria aperta pratica abitualmente?

1	Gite in bicicletta	❑
2	Corsa a piedi/jogging	❑
3	Passeggiate	❑
4	Pesca	❑
5	Caccia	❑
6	Raccolta funghi/piccoli frutti ecc.	❑
7	Altro (specificare)	_____
		_____

Fa parte di associazioni ambientaliste?	SI	NO
	❑	❑

Quanto considera importante la conservazione dell'ambiente naturale?

Moltissimo	❑
Molto	❑
Abbastanza	❑
Poco	❑
Molto poco	❑

Ritiene corretto che le amministrazioni pubbliche spendano una parte dei soldi ottenuti con le tasse per conservare o migliorare l'ambiente?

Moltissimo	❑
Molto	❑
Abbastanza	❑
Poco	❑
Molto poco	❑

Quale delle seguenti istituzioni sta, a Suo giudizio, facendo di più per migliorare l'ambiente nell'entroterra veneziano?

1	Lo Stato	❑
2	La Regione	❑
3	La Provincia	❑
4	Il Comune	❑
5	Il Consorzio Venezia Nuova	❑
6	Le associazioni ambientaliste	❑
7	Altro (specificare)	_____
		_____

Ha mai sentito parlare del Bosco di Mestre	SI	NO
	❑	❑

Se SI, da chi ha ricevuto informazioni/notizie relative al Bosco di Mestre?

1	Amici	❑
2	Consiglio di quartiere/Comune	❑
3	Quotidiani	❑
4	Materiale divulgativo del Comune	❑
5	Televisione	❑
6	Radio	❑
7	Altro (specificare)	_____
		_____

Pensa che l'iniziativa del Bosco di Mestre sia positiva?	SI	NO
	❑	❑

Appendice

Glossario

A

Autoctono: specie animale o vegetale che si perpetua rinnovandosi per via naturale nel luogo in cui si è originata o dove è stata anticamente introdotta.

B

Biodiversità: è sinonimo di "diversità biologica". In particolare per biodiversità di un particolare ambiente si intende la varietà di organismi viventi presenti in esso. La biodiversità è attualmente minacciata dal progressivo aumento dei fattori inquinanti e dalla riduzione degli habitat. La biodiversità si può misurare in termini di geni, specie o ecosistemi.

Bosco planiziale: bosco che ricopre aree di pianura. Nella pianura Padana è costituito dall'associazione vegetale querco-carpineto.

F

Fitodepurazione: depurazione ad opera delle piante. Viene sfruttata la capacità delle piante di filtrare assorbire ed assimilare l'azoto, il fosforo ed altre sostanze contenute nell'acqua dei canali e in quella che scorre nel terreno.

H

Habitat: insieme dei fattori ambientali che determinano l'esistenza di una comunità in un determinato luogo. L'habitat è il risultato dell'interazione dei fattori del suolo, climatici, antropici e biologici.

P

Paesaggio: è la forma dell'ambiente, l'aspetto formale di tutti gli elementi che lo compongono: aspetti fisici, naturali, biologici o storici.

Q

Querco-carpineto planiziale: tipo di bosco caratteristico della pianura padana. La struttura portante di tale associazione forestale è costituita dalla farnia (Quercus robur) e dal carpino (Carpinus betulus), dai quali deriva il termine querco-carpineto. Sono presenti anche altre specie arboree secondarie come l'acero campestre (Acer campestre), il frassino (Fraxinus oxycarpa), il tiglio (Tilia cordata) e l'ontano nero (Alnus glutinosa). Tra le varie specie arbustive si possono annoverare il biancospino (Crataegus monogyna), il ligustro (Ligustrum volgare), il prugnolo (Prunus spinosa), e la sanguinella (Cornus sanguinea).

R

Rinaturalizzazione: intervento volto ad inserire elementi naturali all'interno di un ambiente artificiale con lo scopo di migliorare l'ambiente stesso senza compromettere equilibri già strutturati.

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CHAPTER 6

Conclusions

6.1 Conclusions

This chapter discusses the results obtained wit reference to the objectives of this research.

6.1.1 Landscape preferences: experts vs lay people

6.1.1.1 Objective 1

The first objective was to **verify if the preferences expressed by means of opinions in the absence of visual stimuli are similar to those expressed by scoring images**.

In this study in many cases the experts have evaluated the landscape in a similar way to the population as a whole. This finding is particularly evident if we consider the magnitude of the differences and not simply their statistical significance. Both groups tend to prefer the more natural landscapes, in particular woods and wetlands. Whereas the least appreciated landscapes are those with modern buildings and factories. In this respect the preferences of our sample are similar to those of other studies (Arriaza et al., 2004; Cook and Cable, 1995; Eleftheriadis and Tsalikidis, 1990; Kaplan et al., 2006; Kaplan and Kaplan, 1989; Palmer, 2008; Rogge et al.,

2007; Schroeder, 1988; Tempesta, 2006a; Ulrich, 1986).

These findings are supported both by the opinions expressed by the interviewees and by their evaluation of the images.

However, it is interesting to note that **the difference between experts and non-experts is more accentuated in the case of the opinions than that of the scores attributed to the images**. In the case of the opinions, ANOVA showed that in 56.2% of the landscape elements considered the difference in scoring is statistically significant ($p<0.05$). Cohen's d test resulted as large in one case (6.2%) and medium in three cases (18.7%). In the case of the preferences for the images difference in scores is only statistically significant in 25.4% of the photos, and in one case (1.6%) Cohen's d test has a value between 0.5 and 0.8 (medium). This would seem to suggest that the results obtained comparing opinions and those obtained evaluating images are not entirely comparable.

6.1.1.2 Objective 2

The second objective was to **analyse the effect of the presence/absence of some elements on the preferences of the two groups of respondents**.

The use of photomontages has evidenced some important differences between experts and lay people. This approach made it possible to analyse more specifically what effect the presence/absence of an element might have on the preferences of the two groups of interviewees.

In this study, experts tend to make a less critical assessment of the decay of the built heritage. Moreover, contrary to our expectations, experts exhibit a higher tolerance to possible interventions of landscape transformation. The presence of modern buildings, with the exception of factories, seems to have a lower negative effect for experts than for lay people. It seems that experts have judged the effect of buildings with regard to the context of where they are built.

In particular experts tend to evaluate the importance of the ecosystem more than the aesthetic quality so they are more tolerant of the presence of some anthropogenic elements that can have only a moderate impact on the ecosystem. This result is in agreement with the results found by Coeterier (2002): experts tend to pay more attention to the context while lay people are more focused on evaluating the quality of the artefacts.

With reference to wildlife, it emerged that lay people valued the presence of very common birds (seagulls) with high visibility more than that of rare birds (flamingos) that occupy a small part of the view. Experts rated the images valuing the rarity of the species more than their visibility. It is possible to suppose that the evaluation of experts has a more relevant cognitive basis, so they are less affected by the visibility of an element than lay people and tend to attribute more importance to the landscape type or to the element itself.

6.1.1.3 Final remarks about experts and lay people

The results of our research seem to suggest that when analysing the impact of new buildings and applications for the restoration of existing ones the public authorities should take into consideration the preferences of the general public since the opinion of experts might be misleading. This is particularly important if it is considered that only a few experts are normally involved in the implementation of the landscape policies in a given territory. The fact that on average the preferences of the experts do not differ greatly from those of the population does not exclude that within the ambit of a specific landscape plan or in the evaluation of the impact of a particular element the opinions of just one expert may differ markedly from those of the population as a whole. From this point of view the research has demonstrated that the individual experts tend to make evaluations that may diverge notably from those of lay people. Given this knowledge, it would appear opportune that in every

case the preferences of the lay people are taken into consideration regarding landscape policies as there may be many factors that render the opinions of experts alone unreliable.

6.1.2 Choice experiments and landscape

6.1.2.1 Objective 3

The third objective was **to understand whether choice experiments can be structured (designed) to value landscape providing both welfare estimates and planning support, objectives that are usually achieved applying two distinct approaches: a stated preference valuation (either contingent valuation or choice experiments) and a perceptive study**.

The realisation of a plain afforestation project such as that foreseen by the Venice City Council on the outskirts of Mestre implies high costs as it is not without side effects on the local economy. First of all, it would cause a considerable reduction in the income of local farmers. This consequence is enforced by the Italian law that prevents woodland being cleared for crops after it has existed for 30 years. It is therefore necessary to carefully consider the benefits that the local population will enjoy from such a policy intervention.

This study as highlighted how the application of choice experiments can provide both a benefit estimate and policy suggestion with regard to landscape planning.

In this respect our findings could be useful since they show that the best landscape is less expensive than a dense forest. CE results show that it is possible to improve the landscape quality while saving money with respect to the 100% woodland plan. The opportunity cost (namely, the farmers' income reduction) of allocating the project surface to meadows is much lower than the opportunity cost of devoting it entirely to woodland. It is therefore possible to suppose that a cheaper solution

than the 100% woodland scenario exists: allocating part of the area to meadows. The meadow–woodland landscape setting provides a win-win situation that simultaneously maximises the social benefits and reduces the afforestation costs for the municipality of Venice.

It is thus highly recommended that the latter should be pursued. In fact the allocation of the surface to woodland implies greater realisation costs, while meadows do not necessarily require the acquisition of the land but can be guaranteed by subsidising the farmers to compensate them for the losses of income from agricultural production. Subsidies are expected to be cheaper than land acquisition therefore reducing the realisation costs. The best solution in terms of WTP maximisation (75% woodland, 25% meadow) provides a saving of 25%[1] in terms of land acquisition with respect to the 100% woodland scenario. While looking at costs minimisation the scenario 25% woodland, 75% meadows, equivalent in terms of WTP to the 100% woodland scenario, guarantees a 75% saving.[1]

There are also some interventions that are not very expensive (e.g. the creation of some small lakes and cattle grazing), but are able to greatly improve the social benefits of the whole project. As noted above, the best land use arrangement (Table 5.4) emerging from our CE RPL estimates is very similar to the findings of a visual-aesthetic research (60% woodland and 40% meadows) (Tempesta, 2006b). This suggests that the visual characteristics play a central role in defining the social benefits of an afforestation programme. In this respect, an in-depth analysis of the factors affecting the aesthetic quality of the landscape will probably make it possible to refine some details of the project, further increasing the social benefits.

As clearly stated by Hanley et al. (1998) and Birol et al. (2008) CE allows inference of three main sets of information: i) the contribution to the respondents' utility derived from the variation of a single attribute level; ii) the relative ranking among attributes and their levels in terms of importance/priority for policy development;

[1] Excluding the costs of subsidies.

and iii) the utility derived from varying more attribute levels simultaneously, an aspect that allows comparison of the benefits of different scenarios, including the status quo, in policy design and valuation. The information provided by CE makes them particularly suitable for the valuation of complex goods like landscape benefits and agricultural policies (Birol et al., 2008), where different policy options need to be considered. On the contrary, CV compares two scenarios, the status quo and a single policy that introduces some fixed changes with respect to the actual situation. Therefore, while being a valid valuation method, CV provides less information than CE (namely the third described above). Despite its advantages compared to CV in terms of information provided, CE studies started to highlight how this methodology is subject, like CV, to some biases that were presented in the thesis. In order to achieve trustful estimates, the researcher should therefore be aware of the possible pitfalls of the CE methodology, and structure the questionnaires properly to avoid potential biases. Further research will be focused on the investigation of CE biases and its results will help in improving the reliability of this methodology in the near future.

6.2 References

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