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Re-evaluating the Contingent Valuation Method as a Standard Method for Monetary Valuation of Ecosystem Services

– A Case Study of the Vitberget Forest Region in Skellefteå in Sweden

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Content

Abstract
Ecosystems and their services are key to humans. One if not the main methods to obtain a monetary value of cultural ecosystem services is the contingent valuation method. This thesis sets out to contest predominant assumptions of how to design contingent valuation study surveys intended for monetary valuation of non-good values by using the Vitberget forest region in Skellefteå in Sweden as a case study. Specifically, I tested the assumption that survey design and length is influencing the outcome of the estimated monetary value of the ecosystem services. The thesis is presented in six chapters: the first chapter introduces relevant concepts and methods. The focus is placed upon the concept of ecosystem services and the contingent valuation method. The second chapter presents the applied methodology used in the case study as well as it focuses on the experiment design and data analysis – person to person interviews in the field were held in order to execute the contingent valuation exercise. The third chapter presents the results, which show that there is no linear relationship between survey design and monetary evaluations. Longer or more complex survey versions don't produce better results than shorter, less complex survey versions. The total estimated value for cultural ecosystem services of the study region is 21.969.738 SEK per year. The fourth chapter forms the discussion, which lead to the conclusion that predominant opinions about survey design regarding contingent valuation studies can be contested. In the last chapter an outlook for future research is presented as well as recommendations for practitioners are made. Future research should build on the good base of this study regarding survey design and contingent valuation. Practitioners should aim for simplified surveys with maximized sample size to improve value for money.

***Keywords**: Contingent Valuation Method, Cultural Ecosystem Services, Valuing Ecosystem Services, Stated Preference, Sweden, Methodological Assessment*

Abbreviations
WTP - Willingness to pay
MA – Millennium Ecosystem Assessment

Summary
Humanity depends in multiple ways on ecosystems and the services they provide to us – without them, life on earth wouldn't be possible. Services like the provisioning of clean drinking water, food , crop pollination, spiritual and cultural identity and many more are commonly referred as ecosystem services (MA, 2005, p.57). They are defined as: "*[...] the benefits people obtain from ecosystems."* (MA, 2005, p.53). In 2005 the Millennium Ecosystem Assessment was published, a collaborative scientific study that was aiming to assess the state of ecosystem services globally. They found that 15 of the 24 global ecosystem services are in decline and that negative impact on human welfare is likely to be expected in the future (Fisher et al., 2009, p.643; MA, 2005, p.27).

The ecosystem service concept is intended to highlight the importance of ecosystem services to humanity. One aspect is the attempt to quantify the value of ecosystem services in monetary terms, in order to strengthen the position of nature in political debates (Gómez-Baggethun & Pérez, 2011, p.1). There are various techniques for different types of services to do so. This thesis focuses on the so called contingent valuation method in relation to cultural ecosystem services. The aim of this thesis is to contest predominant assumptions of the scientific literature about how to design and conduct contingent valuation studies. It is generally being assumed that the design of a survey intended for contingent valuation is of great importance (Bergstrom et al., 1985, p.140).

As a case study the Vitberget forest region in Skellefteå in Sweden was being used. The area is highly suited and a interesting case. The forest is popular amongst the locals as a recreational side, but at the same time experiences external pressure from the housing sector due to lack of housing in Skellefteå. Specifically it was tested if the survey design and length is influencing the outcome of the estimated monetary value of the cultural ecosystem services of the forest region. To do so three different survey versions were developed with different levels of complexity. This way the results can be compared to each other. In April 2016 I went for two weeks to Skellefteå and conducted 60 interviews per survey version. Core of each survey is a question that asks how much people would be willing to pay, in order to maintain the study side, the Vitberget forest region, as it is. A regression analysis was then conducted in order to assess the relationship between a specific survey version and the target variable, that is the monetary estimate that was stated by each participant.

The results show that predominant assumptions of the literature can be contested. Survey design in this case study is not influencing the quality of the monetary estimate. In other words, more complex versions don't produce any better estimates than less complex versions. The total estimated value for the cultural ecosystem services of the study region is about 22 million SEK per year. This estimate might serve as a potential argument in favour for future conservation projects of the forest region. Further, this study serves as a good base for future research regarding survey design and contingent valuation. The results can help practitioners to design contingent valuation studies in a more time efficient way. Time can be saved during the design process of a contingent valuation study as well as during the conduction in the field.

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1. Introduction

Humanity depends in multiple ways on ecosystems and the services they provide. The concept of ecosystem services intends to highlight this dependence and raise awareness towards ecosystems. Since mentioned for the first time in the beginning of the 1980's, the concept has experienced a tremendous success story (Carson & Hanemann, 2005, p.842). Through the famous Millennium Ecosystem Assessment (MA) in 2005 the concept made a leap to the international arena of politics (Mellmann, 2015, p.9). The strength of ecosystem service arguments is the valuation of ecosystem services, which is intended to strengthen the position of nature in political debates. Before the popularity of the ecosystem service concept, the scholars of conservation relied on biocentric reasoning that highlights the intrinsic values of nature (Schröter et al., 2014, p.515). However, many see numerous dangers associated with the valuation of ecosystem services and anthropocentric reasoning, due to the fear of a 'selling out' of nature and an underestimation of its values (Schröter et al., 2014, p.515). Consequently, the concept of ecosystem services is still a much debated issue with many advocates as well as many who remain sceptical towards it. A solution to this debate would be an evaluation of commonly used ecosystem service evaluation methods to better understand the error associated with monetary evaluations.

The thesis is structured as follows – subsequent to this chapter, the concept of ecosystems and ecosystem services shall be introduced. A special focus shall be given to the debate around the valuation of ecosystem services that was previously mentioned. Then the method of contingent valuation will be presented and the critique the concept faces. A special focus shall be given to the shortcomings of the literature when it comes to precise practical advice. This will be followed by the methodology chapter, in which the case study, the survey instrument and the statistical analysis will be presented. This is followed by the results of the case study and the statistical analysis. In the results chapter, there will be no further discussion or interpretation of the results as this will be done in the next chapter. There the results will also be brought into context to the ongoing debate regarding ecosystem services and contingent valuation method. Lastly, a short outlook for further studies will be given as well as recommendations for practitioners.

1.1 Problem Statement and Aims of the Thesis

In this thesis, I use the Vitberget forest region in Skellefteå in Sweden as a case study to test the robustness of the commonly used contingent valuation method for cultural ecosystem service evaluation. In commonly applied contingent valuation method, a hypothetical scenario is first described to the participants; they are then asked what they would be willing to pay to either to enable or prevent this scenario from taking place – depending on whether the scenario is formulated positively or negatively. The statements are then used to derive a value for non-use goods, such as cultural ecosystem services (Bishop et al., 1995, p.629). There are numerous scientific publications regarding contingent valuation method, but there seems to be only little advice for practitioners outside of the scientific community on how to conduct contingent valuation studies and how to omit flaws (Carson & Hanemann, 2005, p.842).

As the contingent valuation method is intended to influence political decision making, it misses its purpose if the science doesn't enable practitioners to conduct robust contingent valuation studies.

While guidance on how to conduct a contingent valuation study is readily available, it is vague on which factors in the process of designing a contingent valuation study affect its robustness. Factors of importance are the level of detail provided on the subject matter before starting the survey, the length of the survey and the necessity to "warm up" the participants before describing the hypothetical scenario and asking the willingness to pay (WTP) question (Bergstrom et al., 1985, p.141). Warming up in this context means to get the participants in a mood to answer questions and in the right mind set (Bergstrom et al., 1985, p.140). However, there is yet to be a study that specifically examines how the survey design based on level of detail, participant engagement, and length influences the quality of its outcome. From a practical point of view, the length and complexity of the survey design is important, because a shorter version takes less time, and hence, resources to be designed and conducted.

The aim of the thesis is to broadly understand how survey design of contingent valuation studies affects the outcome to use robust science to give advice for practitioners. The case study in Vitberget forest region in Skellefteå is a suitable case study to use the contingent valuation method to assess the cultural ecosystem services of the forest region to the local community. The region might face increased pressure from the housing market in the future and arguments for its conservation are useful for future developments. To test if the length of the survey has an influence on the outcome and WTP of the participants, three different survey versions were designed with subsequent differing levels of complexity. The outcomes are being compared to each other and an investigation whether the design has an influence on the quality of the outcome takes place in this thesis.
The following questions were formulated to guide the course of this study:

- How does the complexity of the survey instrument influence the quality of the outcome?
- How does the survey design influence the outcome of the contingent valuation study of this thesis?
- What is the estimated value of cultural ecosystem services in the Vitberget region per year according to this study?
- How meaningful is that estimate?

1.2 The Ecosystem Concept

The term ecosystem is so frequently applied, that one easily forgets that it itself is a concept. It's a product of the 20th century – although the roots of the concept can be traced as far back as to 1864 when George P. Marsh describes the stability of nature in his book 'Man and Nature'. The meaning of the term ecosystem changed over the course of the years. Today there are numerous definitions, but most of them define three common properties – the presence of biotic and abiotic components and their interactions (Christian, 2002).
Ecosystems are generally perceived as disequilibria, open, hierarchical, spatially patterned and scaled (O'Neill, 2001, p.3276). Scaled meaning that an ecosystem can be of any size, as

long as biotic, abiotic and interactions exist – for example, the smallest pond can be understood as an ecosystem.

1.3 Ecosystem Services - A Scientific Concept on the Rise

First, definitions of the concept of ecosystem services and the categorization of it will be presented. Then, a closer look will be taken at the history and the initial ideas that gave rise to the concept. Lastly, the opinions of advocates and critics of the concept will be examined.

1.3.1 Definition and Categorization

The most concise and currently most widely cited definition of ecosystem services is given by the MA. They define ecosystem services as: "*[…]the benefits people obtain from ecosystems."* (MA, 2005, p.53). According to the MA, this definition was derived from several previous authors that were writing about ecosystem services. Costanza et al. (1997) wrote the following: *"Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions".* Another popular and a little more elaborate definition was phrased by Daily in 1997, the same year Costanza et al. published their definition, and it states that: "*Ecosystem services are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life. They maintain biodiversity and the production of ecosystem goods, such as seafood, forage, timber, biomass fuels, natural fiber, and many pharmaceuticals, industrial products, and their precursors. The harvest and trade of these goods represent an important and familiar part of the human economy. In addition to the production of goods, ecosystem services are the actual life-support functions, such as cleansing, recycling, and renewal, and they confer many intangible aesthetic and cultural benefits as well."* (Daily, 1997, p.3). Inspired by the definition of the MA, a report by the Economics of Ecosystems and Biodiversity (TEEB) defined ecosystem services as *"the direct and indirect contributions of ecosystems to human well-being."* (TEEB, 2010, Ch.1, p.19). In addition to the MA definition, it acknowledges direct as well as indirect services. For the purpose of this study, the definition of the MA shall be adopted when referring to ecosystem services as it is the most popular and concise definition that includes all of the other definitions.

The following table from the MA report provides a good overview of Ecosystem Services (See Figure 1 below). The MA divides the services into four different categories: provisioning services, regulating services, cultural services and supporting services (MA, 2005, p.57). Some studies have slightly different categorization of the services, but overall the classification of the MA is widely acknowledged.

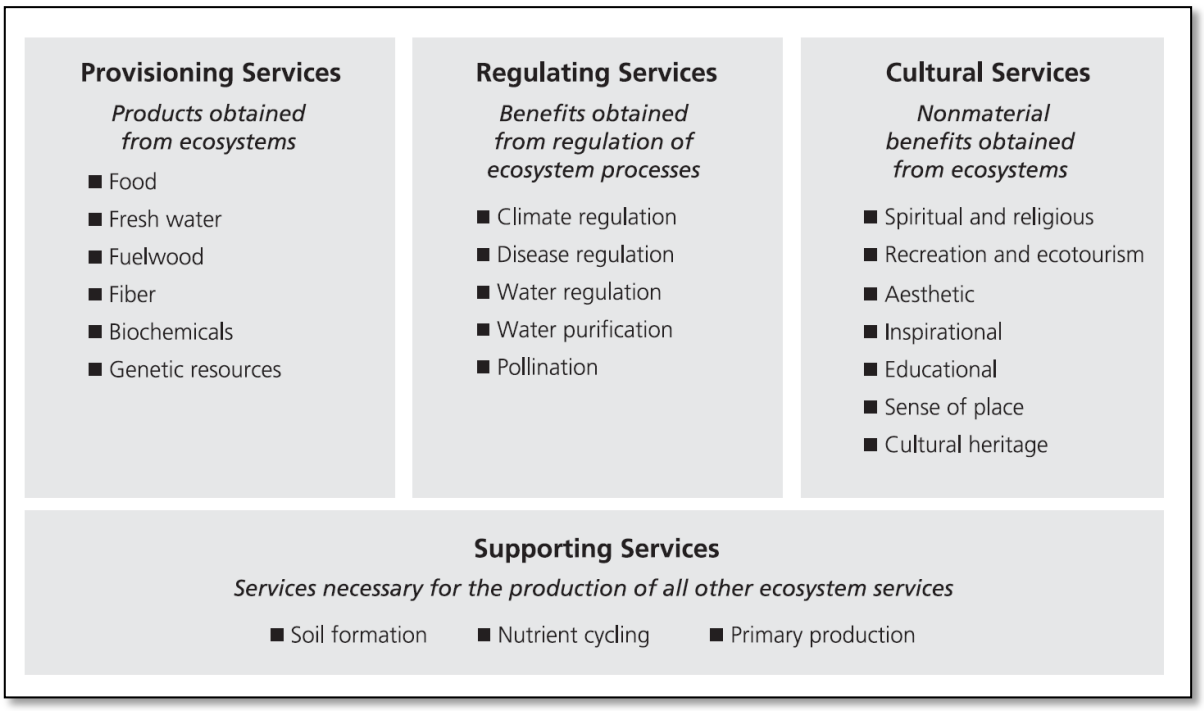

Figure 1: Ecosystem Services
Source: MILLENNIUM ECOSYSTEM ASSESSMENT, 2005, p. 57

The MA understands provisioning services as the products obtained from ecosystems, such as food and fibre as well as fuels of any sort. It also includes genetic resources, genes and genetic information used for animal and plant breeding and biotechnology – also biochemicals, natural medicines and pharmaceuticals – ornamental resources such as animal skins, shells or flowers and last but not least fresh water. Fresh water is an example that shows many linkages to other services, e.g. to regulating services such as climate regulation (MA, 2005, p.57).

Regulating services are understood as the benefits obtained from the regulation of ecosystem processes. This includes a wide range of services such as air quality maintenance - ecosystems contribute and extract substances to and from the atmosphere. They play an important role in climate regulation and influence the climate locally as well as globally, e.g. changes in land cover can affect precipitation and temperature, on a global scale ecosystems are a source and at the same time a sink of greenhouse gases and thus play an important role in the global gas budget. Water regulation as in flood control is an example of another service, as is water purification and waste treatment, erosion control, storm protection, biological control such as pest and disease control. Pollination is another very important service for our food production that is often overlooked as a crucial service for us humans and the regulation of human diseases (MA, 2005, p.58).

The MA recognizes cultural services as the nonmaterial benefits that people obtain from ecosystems, which include spiritual enrichment, recreation, reflection, cognitive development, and aesthetic experiences. The MA identified the following cultural services – cultural diversity, ecosystems influence the diversity of cultures - spiritual and religious values - knowledge systems, ecosystems influence the knowledge system development of different cultures – educational values – inspiration – aesthetic values – social relations – recreation – sense of place – cultural heritage values and recreation and ecotourism (MA, 2005, p.59).

The fourth category consists of supporting services, which are those that are necessary for all of the other ecosystems services (also see Figure 1) (MA, 2005, p.59). They differ in that sense from the other services, as their impact on people is either indirect or occurs over a long period of time, whereas the other three categories have a relatively direct impact on people (MA, 2005, p.59). An example would be soil formation as a service, which takes place in comparison to the lifespan of people over a long period of time. Examples of supporting services are nutrient cycling, water cycling, soil formation and retention, production of atmospheric oxygen and provisioning of habitat.

The mentioned processes are generated by a complex of natural cycles, driven by the solar energy. This energy constitutes to the working of the biosphere, the thin layer of the earth that contains all known life. The cycles operate on very different scales, spatial as well as time wise. All of these cycles are ancient and the result of millions of years of evolution (Daily, 1997, p.5).

1.3.2 History of the Concept

In conclusion to the previous chapter, humankind depends in multiple ways on ecosystems and on their services and benefits they provide. As a species, we humans have an understanding like no other to make use of the products and the services nature offers. This is part of our enormous success story and one reason why homo sapiens can be found in every corner of the planet. For thousands of years, humanity has drawn benefits from these services without causing much of a global disruption. Many of the services go unnoticed and often it takes the depletion of a service for it to be acknowledged. Metaphorically, this can be represented in a healthy person that starts to appreciate health as soon as an injury or something comparable occurs. For example, deforestation and its consequences have revealed the enormous importance of forest for the hydrological cycle – in particular mitigating floods, drought and the forces of wind and rain that cause erosion (Daily, 1997, p.5). Another example of a service that mostly goes unnoticed by common people but plays a tremendous role in the global carbon cycle, is the absorption of carbon of terrestrial and ocean ecosystems that absorb about 60% of the carbon that is emitted to the atmosphere from human activities (MA, 2005, p.28).

It took until the mid of the 20th century that more voices started to frame concern about the finiteness of the resources we so heavily depend on and the consequences that inconsiderate usage of them may bring with it. The same goes for the depletion of ecosystem services. Considerations for the human-environment interactions and their consequences goes a long way back; this can already be found in writings from Roman times that deal with the increase in population and the decline of what is today called ecosystem services (Johnson, 2000, p.1, TEEB, 2010, p.7). According to TEEB (2010), early writers on the subject include Marsh (1874), Leopold 1949), Carson (1962) and Krutilla & Fisher (1975). A milestone in the history of the ecosystem services concept was the article by Westman entitled "*How Much Are Nature's Services Worth?*", in which he examines the link between ecological processes and the economic system (Westman, 1977, p.1; TEEB, 2010, Ch.1, p.7). In 1981, Ehrlich & Ehrlich were the first to coin the term "*Ecosystem Service*" (TEEB, 2010, Ch.1, p.7). In 1983,

the same Paul R. Ehrlich, who together with his wife were the first to coin the term, published together with Harold R. Mooney a paper called "*Extinction, Substitution, and Ecosystem Services*" in which they discuss the role of extinction in relation to the degradation of ecosystems and their services (Ehrlich & Mooney, 1983). Their understanding of ecosystem services and the way they use the word in the context of their paper reveals that it doesn't differ much from today's understanding of ecosystem services. For example, they state, "*Deforestation cancels numerous [ecosystem] services, such as flood control, erosion prevention, filtration of atmospheric pollutants, and the continuous supplying of firewood and timber*" (Ehrlich & Mooney, 1983, p.249). In the following decade, ecologists as well as economists further elaborated the notion of the concept of ecosystem services. de Groot (1987) for instance describes that some of the reasons for the continued abuse of natural environment are the short-term nature of the economic planning process. This short-term thinking ignores the long-term effects of economic production of the environment. Additionally, the pricing system mainly concentrates on man-made goods and services while considering most natural resources to be free goods. He argues that the environmental functions are at least as important as man-made goods and services (de Groot, 1987, p.105). This line of thought matches the notion of sustainable development. One can see overlapping ideas and a similar view of the role of the environment in the uprising of both concepts ecosystem services and sustainable development. Nevertheless, it was not until the late 1990's that the concept of ecosystem services gained wide attention with the publications of Costanza et al (1997) and Daily (1997) (TEEB, 2010, Ch.1, p.7). In the same decade, the interdisciplinary field of ecological economics developed the concept of natural capital, which includes renewable resources, non-renewable resources and ecosystem services to show the importance of ecosystems as providing the foundation for societal development and all human economies (TEEB, 2010, Ch.1, p.7). Then in 2005, the concept of ecosystem services was introduced to the global agenda by the work of the MA and subsequently gained most of its popularity (Mellmann, 2015, p.9). Established in 2001 by a partnership of international institutions, and with support from governments, about 1300 scientists investigated the status of ecosystems and their services in a monumental scientific study (Fisher et al., 2009, p.643; MA, 2005, p.27). The goal of the study was to enhance the scientific basis for the management of the relationship between humans and ecosystem services. It was seen as necessary in order to be able to ensure human well-being without affecting the long-term capacity of ecosystems to provide services. One of the key results of the MA's investigation was that 15 of the 24 global ecosystem services are in decline and that negative impact on human welfare is likely to be expected in the future. The assessment called for increased research in measuring, modelling and mapping of ecosystem services (Mellmann, 2015, p.9). The MA moved the science surrounding the concept of ecosystem services considerably forward and sparked the hope that this framework might provide a new and generous source of conservation funding. The report led to an impressive volume of work being conducted in the field (Simpson, 2011, p.4). Fisher et al. (2008) looked in their study at the appearance of the word "ecosystem services" in the scientific literature. They showed an exponential growth-like curve with only a few mentions of the concept in the early 1980's to several hundred in the late 2010's (Fisher et al., 2008, p.644). Gómez-Baggethun et al. (2010) noted

as well that the concept of ecosystem services is gaining increased attention as a way to communicate the dependence of humanity on nature.

1.3.3 Critique

With the uprising of the concept and its increased popularity, more critical voices started to enter the debate as well. Until today, the concept is still debated with much controversy. In this chapter, a closer look at the critique towards the concept shall be taken. To many, the concept is a promising approach to be able to view nature from a different kind of perspective. One of the core ideas of the concept is to reveal the value of ecosystems to humans (Gómez-Baggethun & Pérez, 2011, p.1). By doing so, many hope that this would strengthen the "position" or the "voice" of nature within the political arena. By highlighting the services, at least that is the idea, it would raise awareness towards our dependence on nature and its value of it for us humans. At the same time, critics frame the concern of a sell out of nature and a cruel underestimation of its value by valuing it with the help of the ecosystem service framework. Both positions shall be given consideration in this paper.

In the following, the recurring pro and contra arguments in relation to ecosystem services shall be looked at one by one – Schröter et al. (2014) and Gómez-Baggethun & Pérez (2011) will serve as main sources in this context. In their paper "*Ecosystem Services as a Contested Concept: A Synthesis of Critique and Counter-Arguments*", Schröter et al. (2014) collected different aspects of critique towards the concept and present respective counter-arguments. They identified three types of critical arguments against the concept: the first one covers ethical considerations, the second type deals with strategies for nature conservation and sustainable use of ecosystems and the third one addresses the current state of ecosystem services as a scientific approach (Schröter et al., 2014, p.514 ff.). By ethical considerations, Schröter et al. (2014) simply mean the questions of how humans interact with nature. The concept of ecosystem services is criticized for having an anthropocentric focus while at the same time excluding the intrinsic value of different entities in nature (Schröter et al., 2014, p.515). This critique is right in the centre of the debate and one of the core arguments that is used against the framework of ecosystem services. It has its roots in a long-standing debate within the environmental ethics. This debate deals with the question whether the actions of humans in relation to nature should be based on an anthropocentric view that contributes to acknowledging instrumental values of nature most, or a more biocentric centred reasoning that accounts also for intrinsic values of nature (Schröter et al., 2014, p.515). At this point, the debate shall not be treated to full extend as one could dedicate an entire book to it – the standpoint of the critics is clear though, ecosystem services as a concept is too anthropocentric. The other side of the debate argues that the framework should not be understood as an attempt to replace biocentric reasoning in favour for nature conservation, but that it should be perceived as a tool providing additional arguments that can enforce biocentric reasoning in order to address the ongoing ecological crisis. A second argument in favour of the concept in this regard is that ecosystem services as a concept itself to some extent also accounts for intrinsic values. Especially within the cultural ecosystem service category, many overlaps are identified between pure anthropocentric and intrinsic values. Many people agree that nature has other purposes than just providing humans with their

needs. Many scientists dealing with ecosystem services are acknowledging that people are appreciating species and ecosystems simply because of their existence – appreciating an object or ecosystem for what it is in itself (Schröter et al., 2014, p.515). Thus, the concept might allow for an integration of intrinsic values. Another similar point of critique is the framed concern of many scholars that the ecosystem service concept could be seen as a economic production metaphor, which would promote an exploitive human nature relationship whereby ecosystems are seen as a good of consumption. The fear is that this would simply turn humans into consumers that are increasingly separated and alienated from nature. This might contradict other perceptions of human nature relationships – a drastic example would be holistic perspectives of indigenous or long-resident people (Schröter et al., 2014, p.515). However, a strong disconnection, especially in the western capitalistic world, can in fact already be observed to a frightening extent. One could even argue that the concept of ecosystem services could help to re-establish a connection with nature, by enabling people to become aware of the services nature provides. For example, many people are not aware of the value of soil formation through bio-physical processes and the meaning for humanity, the same goes for water purification, pollination of crops and the list goes on. Hence, this argument could be explored in both directions.

Leaving the ethical consideration aspect of the critique, we turn to the critique that involves strategies for nature conservation and sustainable use. One concern of a different kind is that ecosystem services could be used as a conservation goal at the expense of biodiversity-based conservation according to Schröter et al. (2014). Conservation projects that are focused on supporting ecosystem services might not necessarily be safeguarding biodiversity, but instead much rather divert attention and interest. For some, a win-win scenario in which both, ecosystem services and biodiversity profit is unlikely to occur and that the empirical evidence for such scenarios is rather rare. Moreover, it seems to be true that most ecosystem-based project don't monitor for biodiversity, so this critique is justified. At the same time, there seems to be an increase in empirical evidence that certain services of ecosystems are directly influenced by safeguarding biodiversity. Furthermore, Schröter et al. (2014) argue that comparable to the discussion around intrinsic values, there are overlaps between the ecosystem services concept and the concept of biodiversity. Aspects of biodiversity are included within some of the categories such as habitat, supporting and cultural services.
Lastly, the third type of critical argument that deals with the current state of ecosystem services as a scientific approach will be looked at: the valuation of ecosystem services. Subsequent to that, arguments around the vagueness of the concept and its supposedly general optimistic assumptions will be presented. The value of an ecosystem doesn't necessarily have to be one of a monetary kind. The MA defines value as "The contribution of an action or object to user-specified goals, objectives or conditions (MA, 2005, p.216). de Groot et al. (2002) state that the value of an ecosystem can be generally divided into three types – ecological, socio-cultural and economic value. The TEEB report comes to the same categorization (TEEB, 2010, Ch.1, p.22). One would think that all types of value should more or less receive the same recognition, as all of them seem equally important, however this is not necessarily the case. Economic valuation tends to receive most of the attention. According to Gómez-Baggethun & Pérez (2011), ecosystem services were originally conceived as a

metaphor to highlight the dependence of society on ecosystems. Nevertheless, over the last few decades environmental science and policy have made increasing efforts to value ecosystem services in monetary terms. Regardless whether or not this is desirable, there has been increasing interest within the scientific community and a growing number of publications on this topic can be observed. This growing field of economic valuation has led to a heated debate among environmental scientists (Gómez-Baggethun & Pérez, 2011, p.1). So far, ethic and aesthetic values have been the core of the rationale of modern environmentalism, however recently more incorporation of utilitarian arguments is taking place and this has been fuelling the debate (TEEB, 2010, Ch.5, p.8). Whereas ecologists and conservationists adopt a perspective based on ecological values and intrinsic values of nature, environmental economists advocate an anthropocentric perspective with a focus on instrumental valuation. One of the core issues in the debate is the question of complementarity or substitutability when deciding on the conservation of nature. Some see no problem in combining intrinsic and ecological value-based reasoning with the economical aspect of the ecosystem services concept, while others see danger in adopting a utilitarian perspective that may change our conception of human-nature interaction in a negative way (TEEB, 2010, Ch.5, p.7). In their paper "*Economic valuation and the commodification of ecosystem services"* Gómez-Baggethun & Pérez (2011) introduce some main lines of criticism in relation to monetary valuation and the commodification of ecosystem services. First of all, the most intuitive and general critique is that based on ethical reasons, some things ought not to be for sale. This touches upon ethical aspects as mentioned before in this chapter, but centres more around the question of what should be within the sphere of markets and trades and what should not (Gómez-Baggethun & Pérez, 2011, p.9). In fact, natural recourses have been sold since the existence of markets, only few criticise commodification in its totality, but the main issue in regards to ecosystems and wildlife is where to draw the line. Gómez-Baggethun & Pérez (2011) describe that in some contingent valuation studies, participants refused to bid for a hypothetical scenario, which was interpreted as an opposition to monetize ecological values and to frame ecosystem services as commodities. This is an interesting aspect that shall be picked up again in the discussion part of this thesis. A second line of criticism deals with a potential blinding effect the monetary valuation of ecosystem services might have. The assigned value to an ecosystem service could outshine the complexity that lies behind it, transforming it into the homogeneity of a monetary figure. Here, one is reminded of the missing holistic view that was mentioned earlier. Thirdly, it can be criticised that the concept tries to fit the complex nature of ecosystem functions into a mechanistic analytical framework. Ecosystem functions can be entangled in complex ways, making it difficult to single them out in order to assign a value to them (Gómez-Baggethun & Pérez, 2011, p.9). Schröter et al. (2014) state as a counter argument that monetary valuation helps to raise awareness about the relative importance of ecosystem services, compared to man-made services and highlights the undervaluation of positive and negative externalities. They argue that monetary valuation thus provides additional arguments for decision-making processes and does not replace ethical, ecological or other nonmonetary arguments. Additionally, except for methodological shortcomings, it enables one to form a sum of a value of several ecosystem services with the same unit of measurement. This, in turn, enables a comparison over larger scales and could help to highlight trade-offs between private benefits

and public costs as well as short- and long-term consequences. Another important aspect in relation to the valuation that neither Schröter et al. (2014) nor Gómez-Baggethun & Pérez (2011) mentioned is the methodological aspect. Depending on the type of service, the scientific community has developed all kinds of different valuation approaches. However, it becomes particularly difficult to assign a monetary value to something that is not related to a market in any form. For example, valuing a provisioning service of a forest in terms of timber value or the water purification function of a certain ecosystem under conservation is comparably simple, because it could be compared to the cost of alternative measures. But what about the assessment of a spiritual service, what about the value of the sense of home some ecosystems give to people? One could wonder if an assessment in such cases makes sense. It poses the question – how meaningful is the assessment regarding services that are not directly related to a market? The difficulties related to the assessment of monetary valuation of non-market goods will also be discussed in Chapter 1.4.2 "Contingent Valuation Method", it will also be picked up again in the discussion part where the conducted valuation exercise of this study will be reflected upon.

Schröter et al. (2014) describe that according to Nahlik et al. (2012) the concept is being criticised for being vague. Most definitions of ecosystems services, as mentioned in Chapter 1.3.1, are based on the MA report. There have been authors who have proposed ways to define ecosystem services more consistently, but these attempts have been criticised for being impractical, open to interpretation and inconsistent. Critics suggest this has caused the concept to become sort of a "catch-all" phrase that is used to represent ecosystem functions or properties, goods, contributions to human well-being or economic benefits (Schröter et al., 2014, p.517). Schröter et al. (2014) then present as a counter argument that vagueness can also have its benefits, as imprecision often spurs creativity and leads to refined or new ideas. In addition, it's a fairly young scientific approach which is gaining increased attention and thus being continuously improved and refined. They also present the argument that diffusing boundaries inspire transdisciplinarity – e.g. the concept has led to a dialogue and cooperation between economists and ecologists, between scientists and policy makers. One can perceive the described vagueness as both an limitation and an opportunity.

As a last critical argument against the concept of ecosystem services, Schröter et al. (2014) describe how several authors criticise the concept for having optimistic assumptions and normative aims. According to some authors, the concept implies that all outcomes of ecosystem processes are desirable or good, which can lead to narrative parables where the positive nature of the concept remains unquestioned or unchallenged. This could encourage the formulation of normative aims that go beyond a cognitive interest. The concept could then be based on an idea of how the world should be – that ecosystems are benevolent, thus they must be protected. Some authors frame the concern that disservices of ecosystems to humans might be disregarded, such as increased risk of diseases in some cases. Schröter et al. (2014) then argue that the positive aspect of the connection between humans and ecosystem is what spurs research interest. Even if some reject an issue-orientated, normative approach to science, others argue that total value freedom is impossible, as science is often embedded in socio-cultural contexts.

1.4 Valuation of Cultural Ecosystem Services

In the previous chapter, the valuation of ecosystem services was introduced and it was mentioned that different types of services require different valuation approaches. In this chapter, the valuation of cultural ecosystem services will be examined closer. What gets measured, gets managed is a familiar modern management mantra (Clough, 2013, p.330). However, as cultural ecosystem services are mostly non-market goods, they are often not measured. These services mostly occur informally and fall outside the system of market exchange, which makes it difficult to observe them. This becomes very apparent when sites that provide cultural ecosystem services are threatened by developments and there is no value of the current and future uses that could be compared against more concrete expected benefits of the development (Clough, 2013, p.330). In such situations, it might happen that the cultural ecosystem service value gets underweighted, which may in turn result in insufficient resource allocation and use. As mentioned before, the systems of ecosystem services are increasingly being used to address the problem of missing markets for the natural environment and provide a means of weighing the environment in economic terms (Clough, 2013, p.330). This way, the approach of ecosystem services enables an attempt to assign a value to cultural ecosystem services and ideally influences decision-making processes in a way that natural capital is not underweighted.

1.4.1 Revealed Preference and Stated Preference Techniques

For cases in which ecosystem services do not affect markets and market data is not available, methods have been developed to derive 'consumer' preferences. Literature on the economic value of cultural ecosystem services falls under two broad headings:

- Economic impact studies (Revealed preferences techniques)
- Economic welfare analysis (Stated preference techniques)

Revealed preferences techniques try to reveal preferences from actual, observed market based information that is indirectly linked to the ecosystem service in question. Ghermandi et al. (2009) describe that preferences for environmental goods are usually revealed indirectly when an individual purchases a market good to which the environmental good is related in some way. They are all indirect, because the service in question is not traded in itself. The techniques included in this group are the travel cost method (TCM), the hedonic pricing method (HP), wage techniques, averting behaviour, market prices and random utility/discrete choice models. These techniques only capture use values, leaving passive values out of consideration (Ghermandi et al., 2009, p.8). Figure 2 below gives an overview of the different methods.

Stated preference techniques are classified in contingent valuation methods and choice modelling **(**Figure 2**)**. Both are administered by asking hypothetical questions through a questionnaire to a sample of the affected population (Ghermandi et al., 2009, p.9; Pearse & Özdemiroglu, 2002, p.31). The contingent valuation method seeks to reveal WTP through direct questions addressed towards participants in a study such as "*Are you willing to pay X in order to prevent scenario Y from happening?*" or "*What are you willing to pay for good X?*".

Choice modelling tries to secure rankings and ratings of alternatives from which WTP can be inferred (Pearse & Özdemiroglu, 2002, p.31).

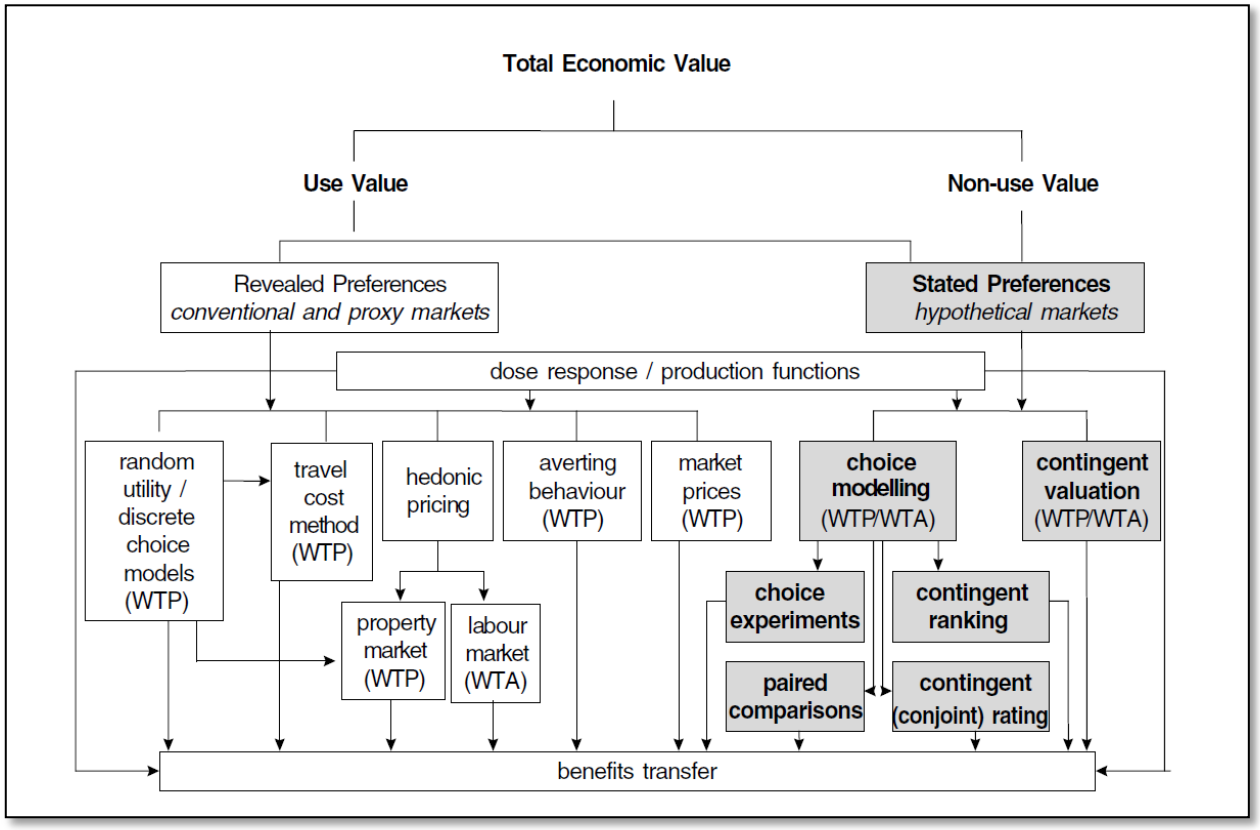

Figure 2: Revealed preference and stated preference techniques
Source: Pearse & Özdemiroglu (2002)

1.4.2 Contingent Valuation Method

This chapter will discuss the contingent valuation method, why it is the method of choice for this study, its limitations and the knowledge gap that has been identified during the literature review.

The contingent valuation method is generally used to estimate values for environmental amenities and other non-market goods and services. As mentioned in the previous chapter, surveys are used to ask participants about their monetary values for non-market goods, contingent upon the creation of a hypothetical market (Bishop et al., 1995, p.629). According to Hoyos & Mariel (2010), the history of the contingent valuation method can be broadly divided into three periods. The first period would be from 1943-1989 covering the inception of the method up to the Exxon Valdez oil spill in the Arctic. During that period, the contingent valuation method is recognized as an alternative to revealed preference methods, especially in the field of outdoor recreation. In the second period, from 1989-1992, the extensive debate following the Exxon Valdez oil spill led to increased research in the field. From 1992 onwards, the method has been consolidated as an evaluation technique of non-market goods, being accepted in the science as well as at the political level (Hoyos & Mariel,

2010, p.329 ff.). A graph showing the development of contingent valuation within the science can be found in Carson and Hanemann (2005):

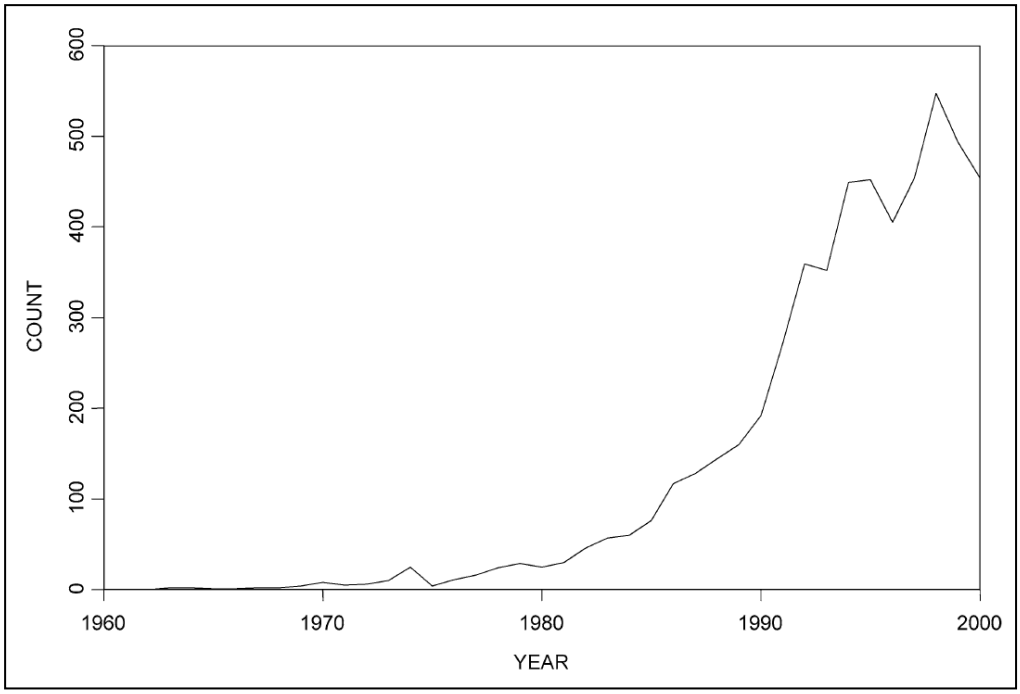

Figure 3: Literature contingent valuation method produced by year.
Source: Carson & Hanemann, 2005, p.842

The graph shows a steep increase of contingent valuation method publications towards the end of the 1980's (Figure 3). The Exxon Valdez oil spill was an outstanding case, in which the oil company was sued for the loss of passive-use values partly due to the findings of applied contingent valuation method. The oil industry immediately started a campaign aiming at questioning the results and the reliability of the contingent valuation method (Hoyos & Mariel, 2010, p.331). This is the most recurring critique towards the concept, the question of reliability. In relation to the Exxon Valdez case, the National Oceanic and Atmospheric Administration (NOAA) published a report in 1993, in which they examined the contingent valuation method. The panel concluded that […]: "*contingent valuation studies can produce estimates reliable enough to be the starting point of a judicial process of damage assessment, including lost passive-use values.*" (Arrow et al., 1993, p.43). Bishop et al. (1995) state that contingent valuation methods have been applied in hundreds of studies and as a result of this research, the method has received considerable acceptance internationally. Nevertheless, the accuracy of the contingent valuation method continues to be subject of debate (Bishop et al., 1995, p.629). Other valuation methods, including market valuations as well as non-market valuations, depend on evidence generated as economic actors reveal their preferences through transactions and other behaviour (Bishop et al., 1995, p.629). This includes the hedonic pricing method, in which the values of non-use goods are assessed through the analysis of property prices and the travel cost method, which, in order to deduct values for non-use goods, uses the costs people are willing to pay to travel to the place of interest. Such techniques in which preferences are revealed through actual behaviour enjoy great credibility in the economics, while other statements of economic actors on how they would act under

hypothetical circumstances continue to be viewed with great suspicion. The scientific issue here can be framed in terms of the concept of validity (Bishop et al., 1995, p.630). Mitchell & Carson 1989 (cited in Bishop et al., 1995, p.630) explain validity and apply it to contingent valuation as follows: "*The validity of a measure is the degree to which it measures the theoretical construct under investigation. This construct is, in the nature of things, unobservable; all we can do is to obtain imperfect measures of that entity. In the contingent valuation context the theoretical construct is the maximum amount of money the respondents would actually pay for the public good if the appropriate market of the public good existed.*" Bishop et al. (1995) elaborate on this perception of validity in the context of contingent valuation, that in order for the method to yield valid economic values, study participants must be both willing and able to reveal their values. They argue that even though participants might be willing to respond accurately, they might be unable to do so because chances are that participants have never before been in a situation where they had to express their WTP for environmental goods in monetary terms (Bishop et al., 1995, p.630). They also argue that from a psychological standpoint, it makes quite a difference if actors enter a real or a hypothetical market. Additionally, in all contingent valuation studies there is the potential for strategic bias, meaning that participants could willingly over- or understate their WTP with hopes to influence study outcomes in their favour. For example, participants could overstate their WTP in order to try and influence a City Council decision (Breffle et al., 1998, p.719). Carson & Hanemann (2005) bring forward another interesting thought in regards of the limitations of contingent valuation, they argue that often the estimated value of a study will inevitably be too high or too low for one of the parties with a vested interest. As a contingent valuation study involves expensive and time consuming original data collection, the method will tend to only be used when there is some sort of a conflict that needs to be resolved. For the mentioned reasons, contingent valuation is continued to be viewed critically by the scientific community (Bishop et al., 1995, p.630).

One might wonder that if there are so many critical aspects around contingent valuation, why was it chosen as a method for this study? Alternative methods for non-use value assessments are not manifold and they have their limitations too. An alternative approach would have been to choose a choice modelling method (See Figure 2). Contingent valuation was chosen over choice modelling techniques for two reasons. First of all, applying modelling choices would involve a substantial jump in the level of technical complexity involved in the design and the analysis process one would have to face in comparison to contingent valuation (Bennett & Blamey, 2011, p.239). They also require larger sample sizes (Bowker & Didychuk, 1994, p.219). With respect to the available resources - time and workforce mainly, contingent valuation was more appealing. Moreover, choice modelling involves a cognitive burden for the participants, as it requires them to undertake a number of tasks. In a contingent valuation study, the participants are required to consider one base case and one alternative scenario in order to state their WTP. Choice modelling techniques require the participants to understand multiple scenarios, the attributes of the different options and how the attributes vary across the options (Bennett & Blamey, 2011, p.235). One explicit goal of the study is the attempt to assess a monetary value of the non-use values of the Vitberget region. Choice modelling doesn't allow for such an assessment per se – but gives ordinal values as an output. This

argument clearly determines the choice of method. Lastly, there is one more important reason – it makes sense to investigate in contingent valuation. The role of contingent valuation as a method for non-use value valuation has been widely acknowledged in an international context, which makes it intriguing to investigate. Furthermore, this method is continued to be viewed critically - Bishop et al. stated that in their paper 1995 and until today that has yet to change. Due to the methodological nature of the concept, there will always remain doubt about its explanatory significance. It's thus worth to investigate in the method and contribute to refining it. The main motivation behind this thesis though, goes a step further. In the introduction chapter, the knowledge gap has already been mentioned. It has been mentioned how vague the literature stays when it comes to guidelines on how to conduct contingent valuation studies, especially in terms of quality assessment in relation to survey design. The link between the scientific world and the practice could be strengthened. In the following, this gap shall be more elaborated. A good example is Jim & Chen (2006) and their study about the valuation of urban green spaces in Guangzhou, China. They state: "*Questionnaire design is crucial to contingent valuation study.*" This seems to indicate the importance of putting great effort into the design of a contingent valuation questionnaire, to take time and consider every part of the content. They underline their argument by providing three different sources that seem to have come to this conclusion - Hoevenagel (1994), Jakobsson & Dragun (1996) and Bateman et al. (2002). It goes without doubt that the design of a questionnaire or survey is of great importance to the outcome. In this instance, it seems as if it's especially important in the case of conducting a contingent valuation study. Jim & Chen (2006) note that if inadequate information and clues are provided in the questionnaire, respondents may not be able to give reliable response. Bishop et al. (1995) also support this view. Lastly, they state that a questionnaire, when doing a contingent valuation study should not be too long, otherwise respondents would get bored, nor should it be too short. Hence, a medium version of a contingent valuation questionnaire, they say, is the best way to go and a choice has to be made between providing too much and too little information (Jim & Chen, 2006, p.84). This viewpoint seems legitimate at a first glance.

Before looking at the sources and examining why questionnaire design is crucial – the author would like to stop for a second and reflect on what actual practical advice is provided up to this point by Jim & Chen (2006) when it comes to questionnaire/survey design. First of all, the questionnaire/survey has to be very much thought through, because that is especially important when it comes to contingent valuation. Secondly, adequate information has to be provided. Thirdly, it shouldn't be too short or too long. Frankly, this seems to be vague and without any further explanation provided, extracting practical advice at this point seems rather difficult. One could ask – what would be adequate information? How short is too short and when would the questionnaire be too long? What would be a good compromise of length?
Let us take a look at the sources that are being mentioned by Jim & Chen (2006) – maybe they'll shed more light on the topic of questionnaire/survey design in contingent valuation studies in regards of length of the questionnaire/survey. Hoevenagel (1994) and Jakobsson & Dragun (1996) don't specifically make any remarks that lead to an answer concerning the question of when a questionnaire is either too short or too long. Bateman et al. (2002) are more specific in terms of how a questionnaire should be built up. Nevertheless, they lack an

explanation of why certain components are necessary in the questionnaire/survey (Bateman et al., (2002), p.47 ff.). Again, practical advice is hard to extract. In regards of the necessity to provide adequate information in a contingent valuation study, Jim & Chen (2006) cite Bishop et al. (1995). Indeed Bishop et al. (1995) is the most extensive source Jim & Chen (2006) used, which serves as a good handbook for contingent valuation. Bishop et al. discuss the amount of information needed and information overload (Bishop et al., 1995, p.633). However, their overall conclusion suggests that more research in the field of contingent valuation is needed (Bishop et al., 1995, p.649 pp). Jim & Chen (2006) is only one example that was chosen to exemplify the difficulty to extract practical advice from the scientific literature. Bergstrom et al. (1985) write that in the beginning of their survey, some preference/attitude questions that dealt with the respondent's qualitative beliefs in relation to the topic at hand were asked in order to warm them up as well as help focus their attention on topic of the study. Again, no further remarks were made on what insight this decision of designing the beginning of their questionnaire is based upon. To give another example – Bowker & Didychuk (1994) state the following: "*The respondent was then asked to answer several preference/attitude type questions to give a smooth transition to the contingent valuation method question.*" (Bowker & Didychuk, 1994, p.220). It must be assumed that the authors simply believe that this is the right thing to do, because they don't back up their decision scientifically. A similar course of action can be observed in Chen (2005), who conducted a contingent valuation study on the environmental services of agriculture in Taiwan. In the methodology part of the study, it's stated that the author began by describing the environmental functions and benefits of agriculture, in order to help the respondents to formulate a hypothetical market in their mind. No reference is made to a scientific study that suggests such an introduction. It could be assumed that again it's only the authors who believe that it's necessary to start the study in such a way, without basing the decision on any scientific literature (Chen, 2005, p.2).

The literature review revealed that some things seem to be generally accepted when it comes to contingent valuation studies and how to design the surveys in order to reveal the WTP of the participants. The literature seems to agree that it is important to brief the participants before describing the hypothetical market situation and asking the WTP question. It appears to be necessary to make a "smooth" transition from initial questions that ideally get the participants in the right mindset, before moving on to the actual WTP question that represents the core of the survey (Bowker & Didychuk, 1994, p.220). During the literature review, no study could be found that contests this assumption. No study has been identified either that deals with the length and the depth of a survey in relation to the outcome. To be fair, most of the papers about contingent valuation don't intend to function as a handbook of how to conduct a contingent valuation study. However at this point, a certain gap can be identified when it comes to the translation of science into practice. The scientific realm of contingent valuation studies seems to stay within the world of science, at least in most of the cases. It would be hard for practitioners to go out and do a contingent valuation study based on scientific recommendations. This represents a phenomenon that can be observed in many fields of science, the link into the world of practice could be stronger. After all, contingent valuation in relation to ecosystem services is not a purpose in itself, but much rather intended

to be practically applied in order to help in decision making processes. The science behind it simply falls short of its purpose if it doesn't enable practitioners to do so.

2. Methodology

In this chapter, I will first introduce the case study and the survey design, followed by the statistical analyses.

2.1 The Case Study – Skellefteå and the Vitberget Forest Region

The case study was conducted in Skellefteå, a city in northern Sweden, located 15 km from the Bothnian Bay (Figure 4). Skellefteå is a city in the Västerbotten County, it's also the seat of the Skellefteå Municipality. The city has approximately 32.775 inhabitants, while the entire municipality of Skellefteå had in 2013 approximately 72.000 inhabitants (Statistics Sweden, 2010). Skellefteå is the second largest city after Umeå in the Västerbotten County in terms of population size. The city covers a region of 21.74 km^2, with a population density of 1508 people per km^2 (Statistics Sweden, 2010).

Figure 4: Location of Skellefteå

Skellefteå is highly suitable for the planned study, because of the Vitberget forest region close to the city centre of Skellefteå. The Vitberget forest region is a famous local recreational site for example for cross country skiing in winter, fishing, hiking, biking, or enjoying the view, commonly referred to as cultural ecosystem services. Moreover, there exists an educational forest path in the region that is used by schools.

While of critical importance to the locals, Skellefteå is experiencing a lack of housing, similar to other cities in Sweden. This high pressure is also affecting the mostly privately owned Vitberget region, where residential houses have already been built. The municipality may want to consider protecting the forest in the future to keep the space available for the locals. Thus, to protect certain parts of Vitberget funds will be needed to pay off landowners. As such, a study about the value for cultural ecosystem service preservation may provide additional arguments in favour of its protection.

2.2 The Survey Instrument

The survey was developed to test if survey complexity has an effect on the outcome of the study. Three different survey versions were developed, ranging from short and simple to long and complex. First, the parts that were in all of the three versions shall be described and then each of the versions shall be described in detail. All of the versions started with the same entry question: "*How often do you spend time out in the green*?" and six different answer options were given. This question served the purpose of an entry question, warming up the participants. The next element that was present in all of the versions is the description of a hypothetical scenario:

"Imagine the following fictional scenario: the Vitberget region is facing a change. People are getting more interested in living in the Vitberget region and more and more houses are built in the area as well as more roads to access these houses. Hotels and holiday homes start to appear to accommodate tourists. Slowly the Vitberget region is changing over a period of the next twenty years– the landscape is changing. There is less nature, less trees, less walking paths but instead there are more houses, hotels, holiday homes and more cars. Industry becomes interested in the area and supermarkets and shops start to appear.

Imagine this change could be avoided by establishing a nature reserve for the Vitberget region. In order to be able to do that a trust fund would need to be arranged. Would you be willing to contribute to such a fund with a monthly payment if it would help to prevent those changes from happening?"

As mentioned in the beginning of the description, the scenario is fictional. However, the described scenario is inspired by events currently taking place in Skellefteå. Through prior research and discussions with people who are familiar with the city of Skellefteå, the author received information that there is a high demand in the housing market in Skellefteå. Some houses have been built at the borders of the Vitberget region and the pressure on the region is real high. Many people are aware of this situation and thus are able to imagine the fictional scenario well. If the question whether or not the participant would be willing to pay in order to prevent this hypothetical scenario from taking place was answered with "*Yes*", a bidding process was applied in order to access the maximum WTP of the participant. There are several ways to access the WTP of participants of a survey in nonmarket evaluation study. Amongst the most popular are simple open-ended questions, iterative bidding or also called the "bidding game" and payment card method (Tyrväinen, 2001, p.76). When using the open-ended question approach, the participant is asked a single question along the lines of "How much would you be willing to pay for this item/scenario?" It was found that this approach produces many "I don't know" answers and was therefore disregarded for this study (Carson & Hanemann, 2005, p.870).

In the bidding game, respondents are asked a series of questions such as "Would you be willing to pay X for this item/scenario?" If the respondent answers "*Yes*", the question is repeated with a higher amount, if the answer is "*No*" the question is then repeated with a lower amount. This process is continued until a value is isolated that represents the most that

the respondent is willing to pay (Carson & Hanemann, 2005, p.870). The payment card method is a variation of the open-ended question wherethe respondent is given a card or sheet with an array of potential WTP amounts on it, and is asked to identify his/her maximum WTP (Tyrväinen, 2001, p.76).

For this study, the bidding game approach to access the WTP of the participants of the study was chosen. Throughout the survey, the participants are asked about twenty questions – to the author it seemed most "natural" and in line with the interview to also access the WTP through a series of questions, rather than handing over a sheet with an array of values on it. In case this approach would have turned out inefficient during the pre-test, the option for using the payment card method was left open. Some say that for the bidding game, as well as for the payment card method, the starting bid utilized in the question has a sizeable effect of the outcome of the answer. According to Carson & Hanemann (2005), a study by Rowe et al. (1980) found that this was the case, whereas Thayer (1981) found no such effect. It was decided to use a starting point of 50 SEK as a monthly payment, with the option of changing this amount in case the pre-tests give indication that this value is too high or too low. It turned out during the pre-test that the amount of 50 SEK per month seemed a reasonable amount, as roughly a similar amount of people found it was too much, were willing to pay more or accepted 50 SEK per month as their WTP. In order to make the answers comparable, the exact same bidding scheme was applied in all of the interviews. Figure 5 shows the code for the bidding game process.

Ask if participant would be willing to pay **50 SEK per month**.

If answer is **no:**
Ask if 40, 30, 20, 10, 5, 2, 1.
If a person answers yes for 40, 30, 20 or 10 add +5
    If the answer is no, write down 40, 30, 20, 10.
    If the answer is yes, write down 45, 35, 25, 15.
If a person answers yes for 5, 2 or 1 just write it down.

If answer is **yes**:
Ask if 100, 150, 200, 400, 800.
If a person says no to 100, 150 or 200, go down in -10 steps until person agrees.
If person says no to 400, go down in -20 steps until person agrees.
If person says no to 800, go down in -50 steps until person agrees.
If person says yes to 800, ask how much and note down.

Figure 5: Bidding Scheme

If people weren't willing to pay, the reason why was assessed in order to determine if people refused paying as protest against payments for ecosystem services in general. Then, the survey continued with a sequence of questions concerning the use of the area such as if and how often the participants visit the study area, and questions concerning the demographics. The different survey versions are described in greater detail as follows.

1. The least complex survey, the short version, contained only the following elements:

- The entry question
- The hypothetical scenario + bidding game
- Questions concerning use of the area + demographics

2. The medium version has two additional sets of questions before the hypothetical scenario was described. In both of the additional blocks of questions, the participants had to answer how much they disagree or agree with certain statements on a scale from one to ten. The first block, consisting of eight statements, is about the relation of the participants towards nature, e.g. "*Nature is beautiful*" or "*Nature helps me to feel at home at one place*". In the second block, the topic is the relationship of people towards nature protection in general. The idea is that if people think about nature, what it means to them as well as nature protection, they would be put in the right mind set to think about valuing services provided by nature. In the literature, it's often recommended to get people in the right mindset by making them think about topics related to the hypothetical scenario and the valuation question, prior to the actual introduction of the scenario and the subsequent valuation question. Ideally, this would have a positive effect on the target variable, the WTP. Therefore, the second version consists of the following elements with the new ones highlighted in italic:

- The entry question
- *Two blocks of value statements*
- The hypothetical scenario + bidding game
- Questions concerning use of the area + demographics

3. The third version, the most complex and longest version, contains everything the two previous versions also contained, but in addition to the medium version, it had one more block of value statements plus one open question before the hypothetical scenario. The value statements involved consisted of the topic of nature conservation in Skellefteå. One example of an open question asked was: "*What are, to you, the most important services and benefits that nature provides?"* The intention behind adding more to the survey was to make it more complex. In theory, participants would think more about nature conservation within their city as well as they would have to think about what nature is providing them with, which theoretically would influence the way they think about the hypothetical scenario. The third version consists of the following elements, with the new ones highlighted in italic:

- The entry question
- Two blocks of value statements
- *One block about nature conservation in Skellefteå*
- *Open question about the most important services that nature provides*
- The hypothetical scenario + bidding game
- Questions concerning use of the area + demographics

The participants didn't know that these questions were solely serving the purpose of making the survey more complex. No participant was asked more than one survey version.

2.2.1 Conduction, Sampling Method and Area

I conducted 60 interviews for each of the three surveys. It is suggested to aim for a high number of participants, in order to increase robustness of the results (Carson & Hanemann, 2005, p.870 ff). This number was the maximum possible number of surveys that could be conducted within the resources of this study. As a sampling method, two-stage cluster sampling was used. In cluster sampling a selection of groups of study units takes place instead of the selection of study units individually. Visiting people scattered over a large area, the town of Skellefteå, would be too time consuming in order to gain a appropriate sample size (Hardon et al., 2004, p.61). More over the cluster sampling allows to understand the effects of distance to the area of interest. Thus two neighbourhoods in Skellefteå were selected as shown in Figure 6, one neighbourhood was located in the city centre that is about two kilometres away from the Vitberget region and the other one a little further outside, around ten kilometres away from Vitberget (See Figure 6). In a second stage, streets within the two areas were randomly selected for the conduction of interviews, in order to introduce randomness to the sampling process and because due to resource constrains not every street could have been included in the survey. After a pilot survey with 30 participants to identify areas that may potentially need fine tuning, the interviews were conducted by the author for two weeks in April 2016. Within the selected street, every second house was approached. The interviews took place on the doorsteps; many times the interviewer was also invited in to conduct the interview.

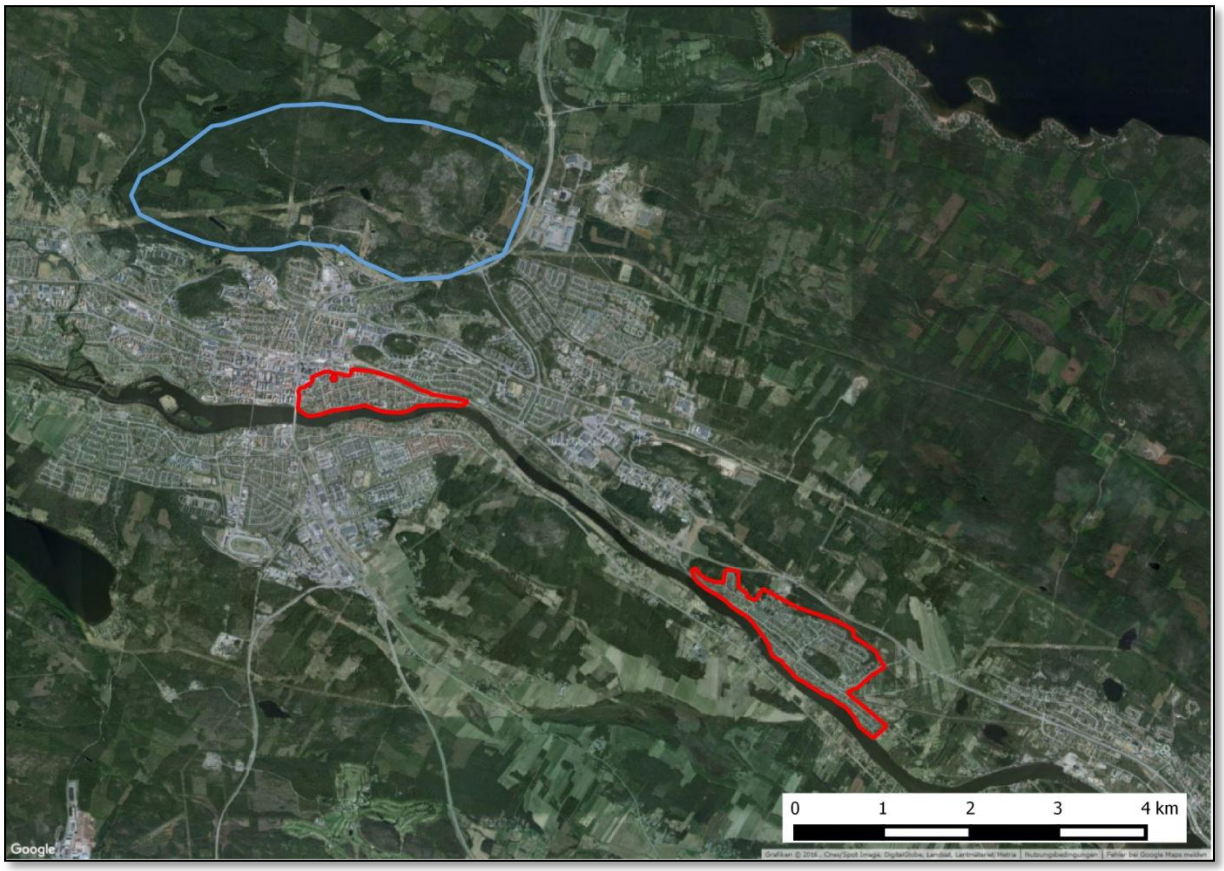

Figure 6: The Vitberget region and the two study sides – in blue the Vitberget region, in red the two study sides

2.3 Analysis

In this chapter, the variables and analyses are further described. The steps of choosing the right type of analysis shall be explained. It is the general belief in some scientific fields that one needs to formulate a hypothesis as well as specifying every step of the statistical analysis in advance. However, deciding on the statistical methods before seeing the data is a luxury that doesn't exist in most ecological and environmental studies (Zuur et al., 2007, p.3). Although the type of data that can be expected as a result from the survey was known before the actual survey was conducted, the author of this study decided to choose the appropriate type of analysis once the data was gathered. This has the advantage that the choice which analysis shall be conducted doesn't have to be made for a second time, due to eventualities that might occur during the data gathering process. Zuur et al. (2007) describe that, even though one is involved in the early stages of an ecological or environmental experiment or a survey, like the author in this study, it's highly likely that the generated data are so noisy, that pre-specified method is unsuitable and one has to look at alternatives.

2.3.1 The Variables

In total, there are eight variables: one target variable, six explanatory variables, and one control variable. The target variable "Money" is the people's maximum WTP in order to prevent the hypothetical scenario from happing. The values of the "Money" are non-negative integer values, thus requirements of the statistical data type count is met. The explanatory variables are called "Version", "Age", "Income", "Area", "Visit_h", "Gender", the control variable is called "Street". "Version" stands for the survey version, the variable is a factor and can take the values a, b or c – which represents the small, the medium and the long version. "Age" represents the age of the participants; this variable was chosen because several studies found positive correlation between age and environmental concern (Armocky & Stroink, 2010, p.5). "Income" represents the income of the participants. This variable was chosen simply because it's assumed that the amount of income most likely has an influence on the maximum WTP of the participants. "Area" stands for the two neighbourhoods in which the interviews took place, this variable is also a factor and can take either the values a or b. It was chosen as a variable because the type of place where the participant is living might influence the maximum WTP e.g. people in the city might value a near recreation side more than people that are living outside of the city, surrounded by more green areas. "Visit_h" stands for the amount of hours that the participants spend in the Vitberget region over the course of one year. It's assumed that visiting time has an influence on the maximum WTP. The last explanatory variable is "Gender" which stands for the gender of the participants. Gender is a factor variable that can take on the values a or b. This variable was not part of the survey, but was recorded by the interviewer. There was no case in which the gender seemed unclear. The variable was chosen to be included in the analysis, because several studies found that there are differences in environmental perception between males and females (Armocky & Stroink, 2010, p.7; Zelezny et al, 2000, p.451). The control variable is "Street" which stands for the street in which the interview was conducted; this variable is also a factor. It was chosen as a control variable to exclude effects between the sampling points.

2.3.2 Data Exploration

The first step in analysing data is graphical exploration (Zuur et al., 2007, p.23). This step is necessary before conducting any more in depth analysis, because follow up steps need to comply with several assumptions before any conclusions ban be considered valid (Zuur et al., 2007, p.23). In this chapter of data exploration, the following questions shall be asked and answered: Where is the data centred? How are they spread? Are there any outliers and are they normally distributed or not? These questions shall be answered by visual interpretation of the data and by using a range of exploratory tools suggested by Zuur et al. (2007). It's important to not only rely on the outcome of one technique, but much rather make decisions e.g. about outliners, normality or relationships based on several techniques (Zuur et al., 2007, p.23). As a first step, a box plot graph of the target variable "Money" shall be created and interpreted. Again, the variable "Money" is what people answered when asked what they would be willing to pay to prevent the described, fictional scenario from happening.

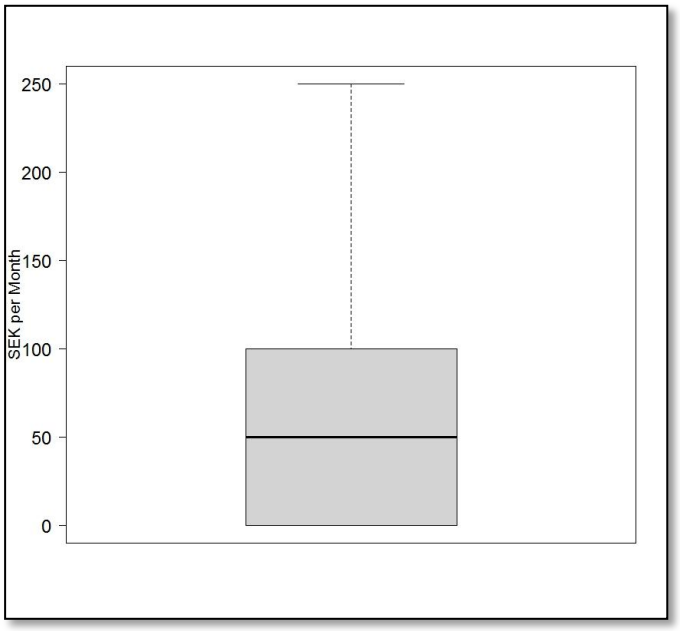

Figure 7: Box plot of the variable Money

The median value for Money is 50; the 25% and 75% quartiles are 0 and 100. The lines or whiskers are drawn from each hint to 1.5 times the spread of the data, which is in the case of the Money variable 250. At the same time, 250 is the highest observed value in the dataset. Figure 7 shows that no outliers are present, which indicates that there are no errors in the dataset and it means that no transformation of data is necessary (Zuur et al., 2007, p.25). The mean of the variable Money is 55.86 with a standard error (SE) of 4.33. In a next step, a histogram of the "Money" variable is generated (see figure 7). As one can see in the histogram, the data does not seem to be normally distributed. It is important to know for the follow up analysis whether or not the data is normally distributed. Figure 8 also shows that there is a lot of zero value in the data – meaning people that were not willing to pay anything to prevent the hypothetical scenario.

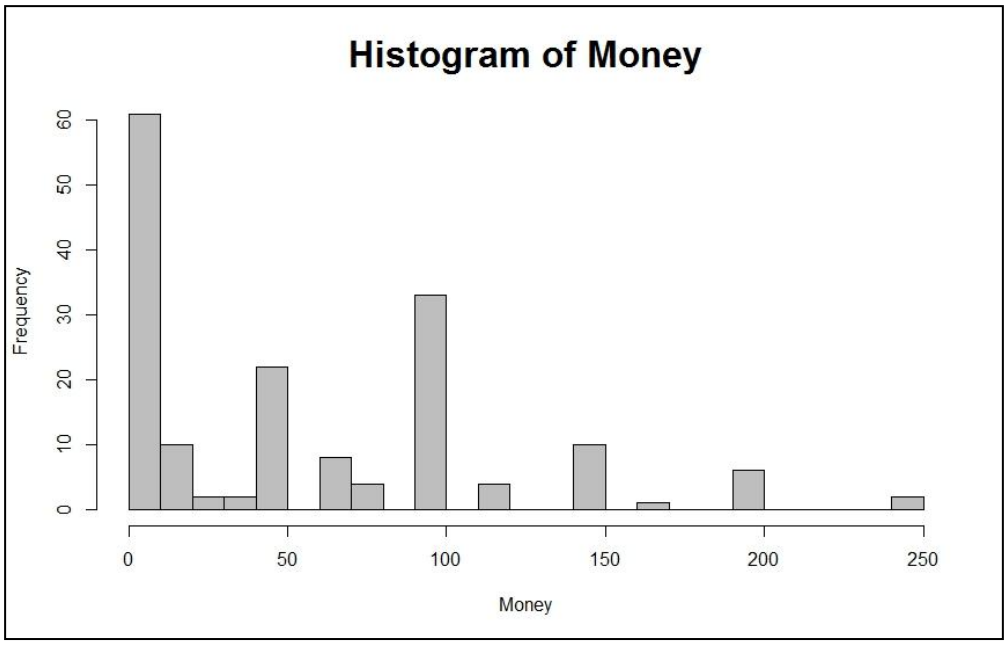

Figure 8: Histogram of the variable "Money"

In order to double check whether or not the data is normally distributed, a QQ plot is generated. The QQ plot for a normal distribution compares the distribution of a given variable, in this case the Money variable, to the Gaussian distribution. If the resulting points lay on a straight line, then the distribution of the data is considered the same as the normally distributed variable (Zuur et al., 2007, p.29). If that would be the case, a follow up test could be conducted to confirm if the data is normal distributed or not. However in the case of the "Money" variable, it's not necessary to further check for normality, as one can see in the QQ plot (Figure 9) the points don't lay on the straight line. With the histogram and with the QQ plot not normal distribution of the variable "Money" was identified.

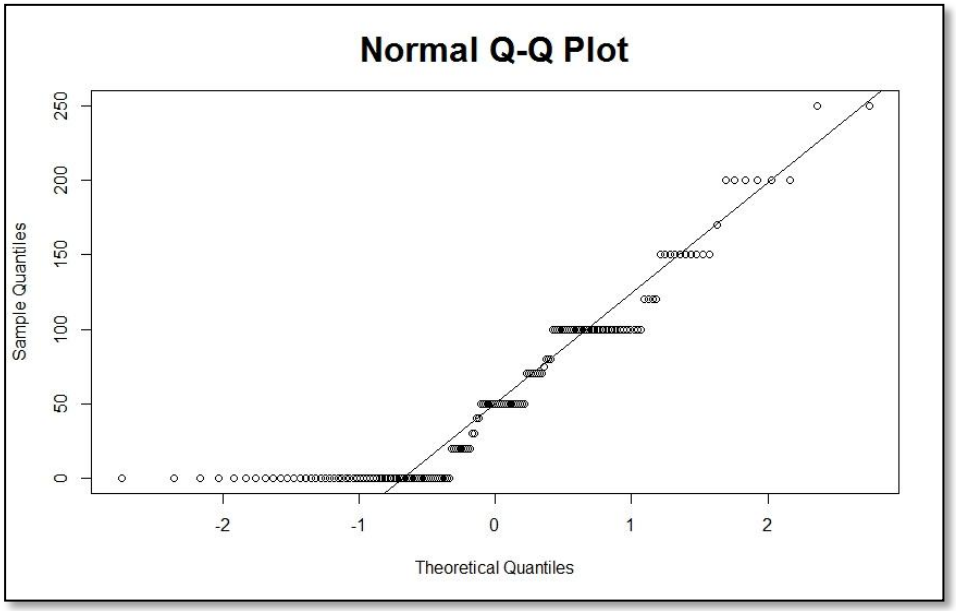

Figure 9: Normal Q-Q Plot

In order to get insight on correlation of the variables, a pair plot with the corresponding correlation values has been created in R. Figure 10 shows the results.

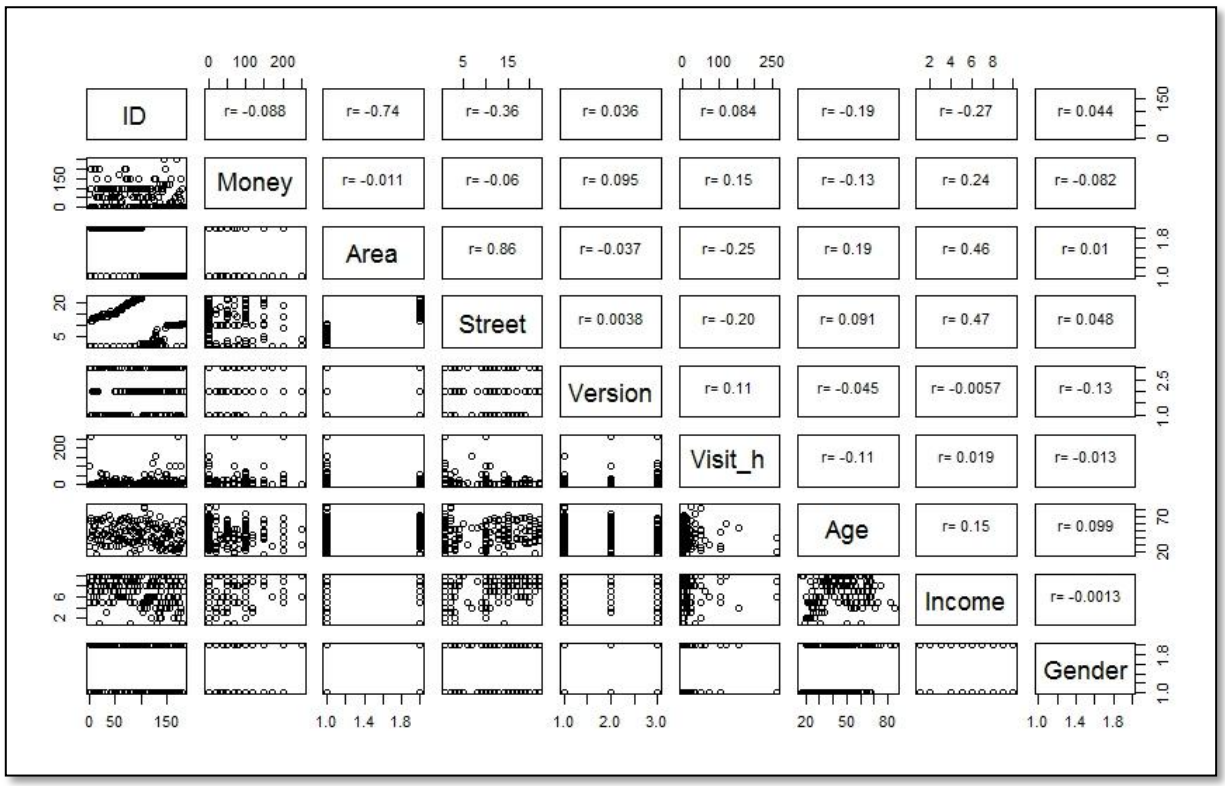

Figure 10: Pair plot with corresponding correlation values - the upper diagonal of the pairplot shows the (absolute) correlation coefficient. The lower diagonal part shows the scatterplots.

Figure 10 shows that there is no strong intercorrelation between the variables. No high r^2 values that would indicate an intercorrelation. "Area" and "Street" were found to have a high r^2 value, which was to be expected, but the fact that "Street" will be later on used, as random effect in the modelling structure, doesn't make it necessary to choose either one of the variables. The pair plot leads to the same conclusion; no clear intercorrelation patterns are visible. If a clear pattern and a high correlation value in the combination of two of the variables would occur, it would be better to choose either one, because they would have the same or similar explanatory character - following the idea to keep the models as simple as possible (Zuur et al., 2007, p.377). However, that is not the case in the dataset and therefore all the explanatory variables are kept.

2.3.3 Regression Analysis

In order to estimate the relationship between the variable "Version" and the target variable "Money", a regression analysis is conducted.

Linear regression is not suitable, as the scatter plot revealed no linear relationships between response variable and the explanatory variables (Zuur et al., 2007, p.48). Due to the experimental set up and the data type of the "Money" variable, a mixed effect Poisson model structure was chosen, with "Street" as the control variable – a Poisson GLMM. The full model looks like this:

Money ~ Income + Version + Age + Area + Gender + Visit_h + (1|Street)

The software R was then used to test the model for over dispersion. It turned out that there is high overdispersion. Moreover, the histogram of "Money" showed that there are many zeros amongst the values (see Figure 8). This suggests that the data is zero-inflated. In the following, two different model approaches shall be presented to continue the analysis.

2.3.3.1 Options 1

In the next step, a comparison is made between a Poisson GLMM, a negative binomial GLMM, a zero-inflated Poisson GLMM and a zero-inflated negative binomial GLMM. Even though the Poisson GLMM showed high overdispersion, it will be included in the comparison as a control model. The four different models were run with the "*glmmadmb*" function in R. In the next step, the AIC values of the four models were compared to each other using AICctab in order to determine the best fit. AIC compares multiple competing models all at once, asking "How certain are we that any given model is the best approximating model?" By doing so, model selection uncertainty can be quantified and accounted for (Symonds & Moussalli, 2011, p.14). It turned out that the simple negative binomial GLMM performed best as one can see in Table 1. As expected, the Poisson GLMM performed worst.

Table 1: Result of AICctab

	AIC	dAICc
Negative Binomial	1489.554	0.0
Zero-Inflated Negative Binomial	3821.56	2332.3
Zero-Inflated Poisson	3849.44	2359.9
Poisson	4728.22	3238.4

Different link functions were tested in the model and the logit link function performed best. It was tested if interactions between the variables might produce a better model fit, which was not the case. Now that the best model type has been identified, the effect of the variable "Version" on the target variable "Money" shall be assessed. In order to do that, in a next step a model selection was done using the "*dredge*" function in R to single out the best performing models out of all the variable combinations of the negative binomial GLMM.

2.3.3.2 Option 2

In order to differentiate better which variables influence if a participant is paying or not and which variables influence how much a participant is paying, if the decision for payment was made a zero-inflated model shall be performed. It offers the advantage of modelling both of the mentioned sides. The "*zeroinfl*" function of R is used to built a zero-inflated negative binomial model. First, the variable "Version" is modelled on both sides of the model. This

means that the model is looking at the binomial decision - is the participant paying "yes" or "no" and does "Version" have an effect on it - and then it models how much the participant is giving. The initial model structure looks like the following:

$$Money \sim Version + Age + Gender + Income + Area + Visit\_h \mid Version$$

One may notice that "Street" is not controlled for – in this model design, a random effect cannot be incorporated. The author decided to follow this approach, even if the results must be taken with a grain of salt, because "Street" cannot be controlled for. Different variables and variable combinations were tested on the binomial side of the model and the effect on the AIC was observed. The model with the variable "Age" on the binomial side performed best:

$$Money \sim Version + Age + Gender + Income + Area + Visit\_h \mid Age$$

Subsequent to this, a model selection was conducted using the "*dredge*" function in order to determine the best variables for the count part of the model (the left side).

3. Results

In total, the interviewer visited 887 apartments and houses in the two weeks of fieldwork. Out of those 887, 407 (46%) opened the door, 187 were willing to participate, which results in a response rate of 45.95%. 7 of the interviews could not be used for analysis because they were not properly answered by the interview partner. The target of 180 useful interviews was reached. People were able to understand the survey and the hypothetical scenario; only in rare cases further explanations were necessary. In less than ten cases, the interviewer was asked in relation to the hypothetical scenario about the time frame of the payments, this information was not included in the description of the scenario. The participants were putting great effort in answering the WTP question and took it seriously.

In the introduction, it was mentioned that the SE should serve as an indicator of quality. It is an indication of the reliability of the mean – a smaller SE indicates that the sample is a more accurate reflection of the actual population mean. If it is assumed for example, that complexity would have a positive effect on the quality of the survey, the outcome should then look similar to the following sketch in Figure 11.

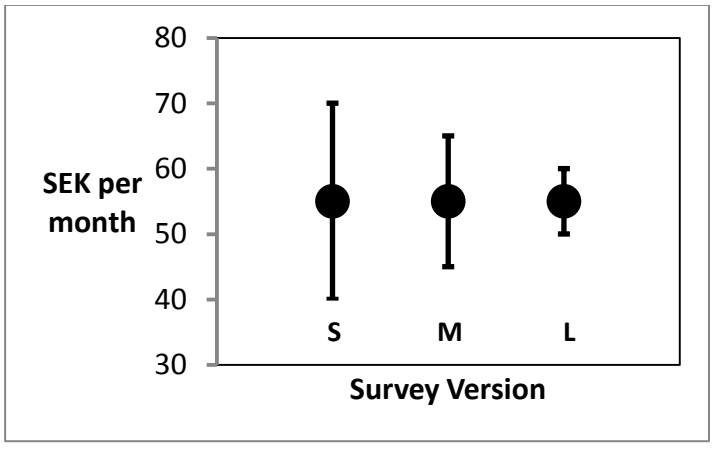

Figure 11: Sketch of "Money" a decreasing error with complexity

The error is decreasing with the complexity of the survey version and the average of the WTP should be similar in each version. The actual result can be seen in Figure 12. The error is not decreasing with the complexity of the survey. The SE of the short version is 6.96, the one of the medium version is 8.36 and the one of the long version is 6.96. The total error of all 180 surveys is 4.33. The average of the WTP differs from version to version.

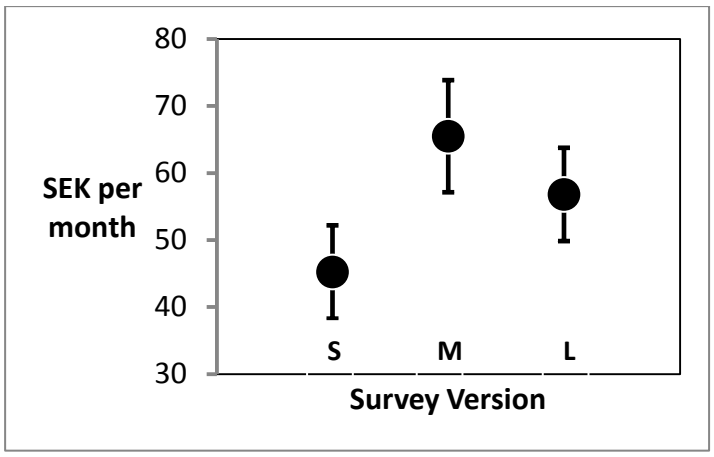

Figure 12: Result of "Money"

Figure 13 shows the average of the WTP of the participants per version and in total. On average, participants of the short version were willing to pay 45.25 SEK per month. Participants of the medium long version were willing to pay 65.50 SEK per month on average and lastly, participants of the long version were willing to pay 56.82 SEK per month on average. In total, participants were willing to pay 55.86 SEK on average with a SE of 4.33.

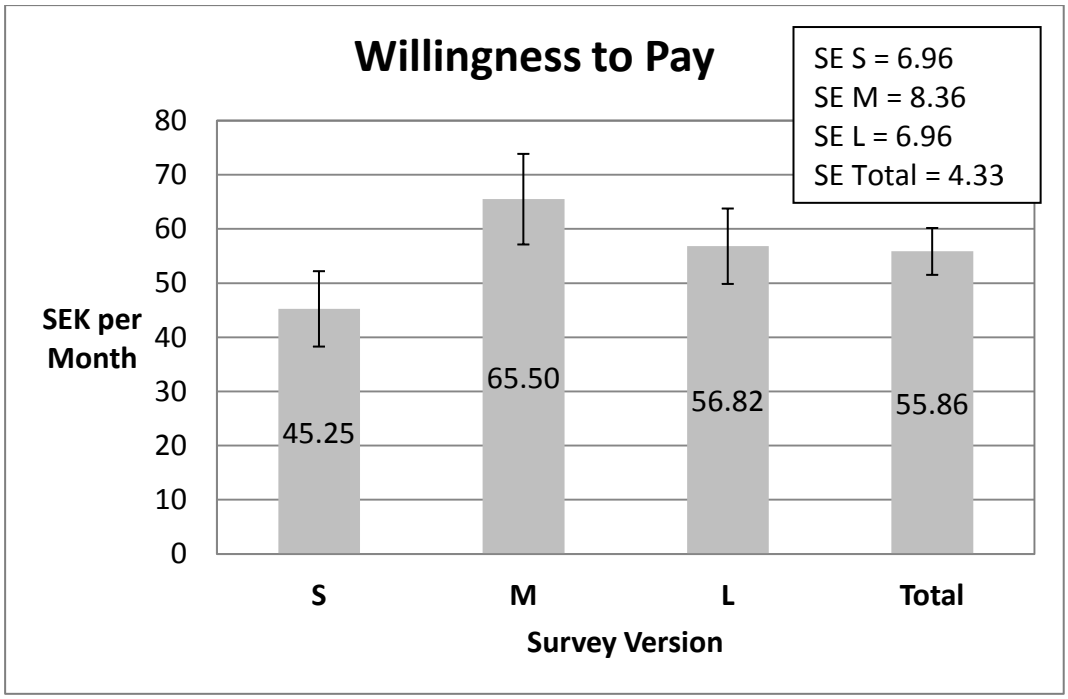

Figure 13: WTP – averages of the different versions and in total

In total, 62% of the participants were willing to pay in order to prevent the hypothetical scenario from happening, 38% weren't willing to pay (see appendix, Figure 17). The reasons why people didn't pay were recorded and it showed that no one didn't pay as an opposition to monetize ecological values and to frame ecosystem services as commodities. In most cases participants stated, that it's not their responsibility to pay. Figure 14 shows the distribution of the WTP. Most people were willing to either pay 50 SEK per month or 100 SEK per month, the maximum participants were willing to pay is 250 SEK per month.

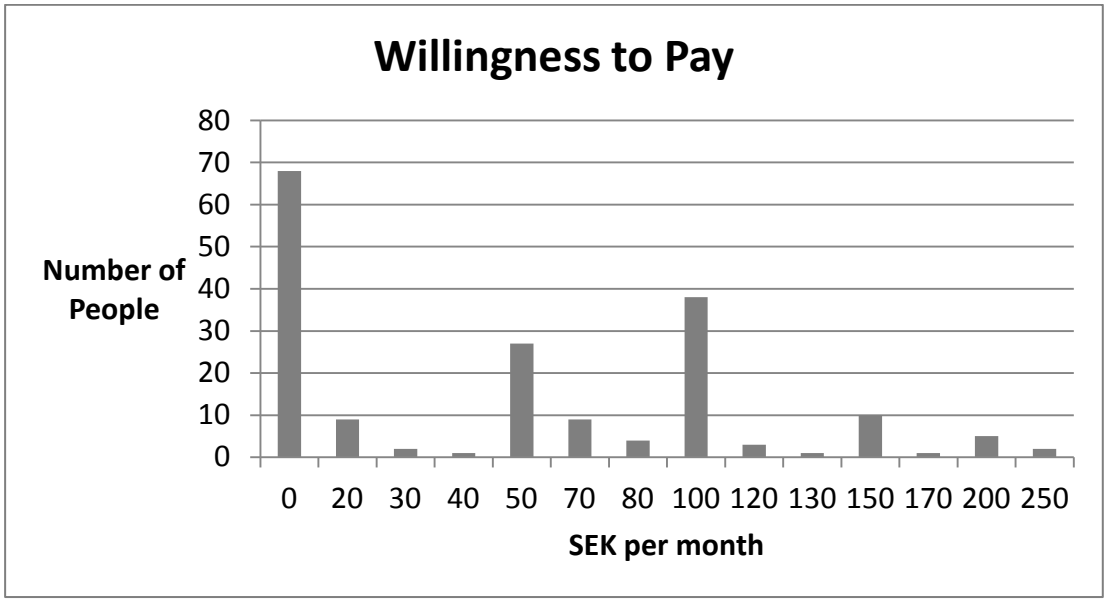

Figure 14: Number of people with the corresponding WTP

The overall interviews took 7.45 minutes on average, with a breakdown of 4.4 minutes for the short version, 8.31 minutes for the medium complex version and 11.31 minutes for the long version. The total interview time sums up to 24 hours – a full day. The total interview time for the different version sums up as the following – short version, 4,4 hours; medium complex version, 8,31 hours; long version 11,31 hours. This is net interview time only (see also appendix, Figure19). The mean age of participants is around 45 years, the age of the participants ranges from 15 to 85 years (for distribution graph, see appendix, Figure 20). In total, 46% of the participants were females and 54% were male.

3.1 Results of the Regression Analysis

Here, the results of the two analysis options presented in the methodology chapter will be summarized.

3.1.1 Option 1

In Table 2, one can see the results of the model selection.

Table 2: Result of model selection negative binomial GLMM

Canditate Models	df	logLik	AICc	delta	weight
Money ~ Income	4	-736.403	1481.1	0.00	0.186
Money ~ Age + Income	5	-735.499	1481.4	0.32	0.158
Null Model	3	-737.789	1481.7	0.67	0.133
Money ~ Area + Income	5	-735.975	1482.3	1.27	0.098
Money ~ Income + Visit_h	5	-736.071	1482.5	1.46	0.089
Money ~ Gender + Income	5	-736.306	1483.0	1.93	0.071
Money ~ Age	4	-737.386	1483.0	1.97	0.069
Money ~ Visit_h	4	-737.416	1483.1	2.03	0.067
Money ~ Age + Area + Income	6	-735.305	1483.1	2.09	0.065
Money ~ Age + Income + Visit_h	6	-735.345	1483.2	2.17	0.063

The AIC value of the best model is very close to that of several other models (compare in Table 2). It raises the question whether the variables included in the best model, which in this case is only the model with the "Income" variable, are really having a greater effect on "Money" than the others do. In such a case of model selection uncertainty, an approach called full-model averaging is recommended to determine the effects of the explanatory variables in relation to each other (Symonds & Moussalli, 2011, p.19). A full model averaging was performed with all models with deltaAIC < 2. In addition, a simple anova as well as a post-hoc comparison was performed in order to test the effect of "Version" on "Money".

The full-model average provides insights into the relative variable importance. The results are summarized in Figure 15. The analysis of the negative binomial GLMM revealed that the variable "Income" with a relative variable importance of 0.75 has the biggest influence on the target variable, followed by "Age" with a relative variable importance of 0.28, "Area" with a relative variable importance of 0.12, "Visit_h" with a relative variable importance of 0.11 and "Gender" with a relative variable importance of 0.09.

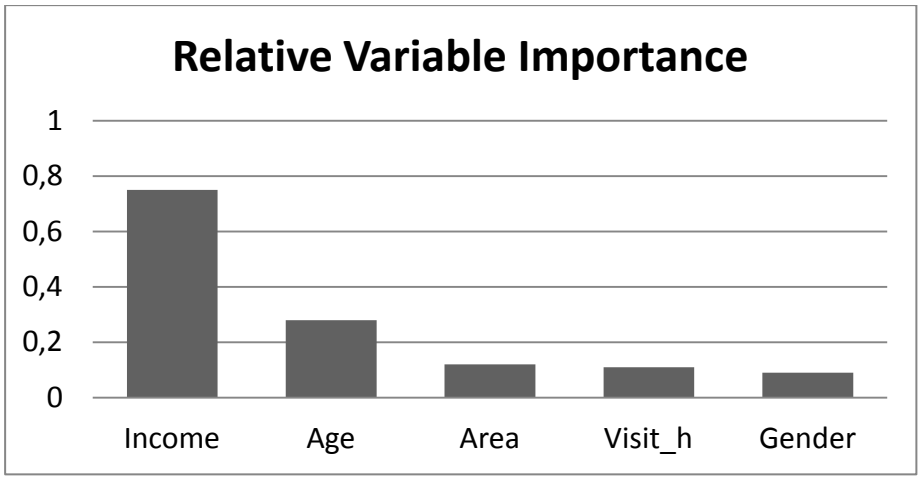

Figure 15: Relative variable importance negative binomial GLMM

Regarding the effect of "Version", it seems quite clear that it doesn't has any significant effect. The variable is far from the best models, it appears only after delta AICc > 3.45, and it's present in all the worst models. In addition, the simple anova as well as the post-hoc comparison that were performed with a 95% confidence level support this result by showing no significant effect of "Version" on "Money".

3.1.2 Option 2

Table 3 shows the result of the model selection. As in the previous analysis option, full-model averaging based on AIC was performed in order to account for model selection uncertainty and to reveal relative variable importance. Just like before, a simple anova as well as a post-hoc comparison was performed in order to test the effect of "Version" on "Money". Additionally a likelihood ratio test with a significance level of 0.05 was performed.

Table 3: Result of model selection zero-inflated negative binomial both sides modelled

Canditate Models	**df**	**logLik**	**AICc**	**delta**	**weight**
Money ~ Area + Income + Version	8	-641.075	1299.1	0.00	0.181
Money ~ Area + Income	6	-643.524	1299.6	0.51	0.141
Money ~ Income + Version	7	-642.608	1229.9	0.86	0.118
Money ~ Income + Version + Visti_h	8	-641.717	1300.4	1.28	0.095
Money ~ Area + Income + Visit_h	7	-642.827	1300.4	1.29	0.095
Money ~ Area + Income + Version + Visit_h	9	-640.622	1300.4	1.33	0.093
Money ~ Income + Visit	6	-644.129	1300.8	1.72	0.077
Money ~ Area + Gender + Income + Version	9	-640.909	1301.0	1.91	0.070
Money ~ Age + Area + Income + Version	9	-640.919	1301.0	1.93	0.069
Null Model	5	-652.908	1314.1	14.99	0.000

Figure 16 shows the overview of the outcome of the relative variable importance in the zero-inflated negative binomial model. The analysis of the zero-inflated negative binomial model strongly suggests that "Age" is important as to whether someone pays or not. It also strongly suggests that "Income" determines, how much the participant is willing to pay with a relative variable importance of 1. There is much weaker evidence that "Version" influences how much someone is willing to paying with a relative variable importance of 0.59. The effect of "Version" thus is probably weak, but it seems to be still positive. A simple anova as well as a post-hoc comparison was conducted as previously with a 95% confidence level, which showed that the effect of "Version" on "Money" is not significant. Additionally a likelihood ratio test with a significance level of 0.05 was performed. The null hypothesis - "Version" has no effect on "Money" – cannot be rejected. According to the test, "Version" is not significant.

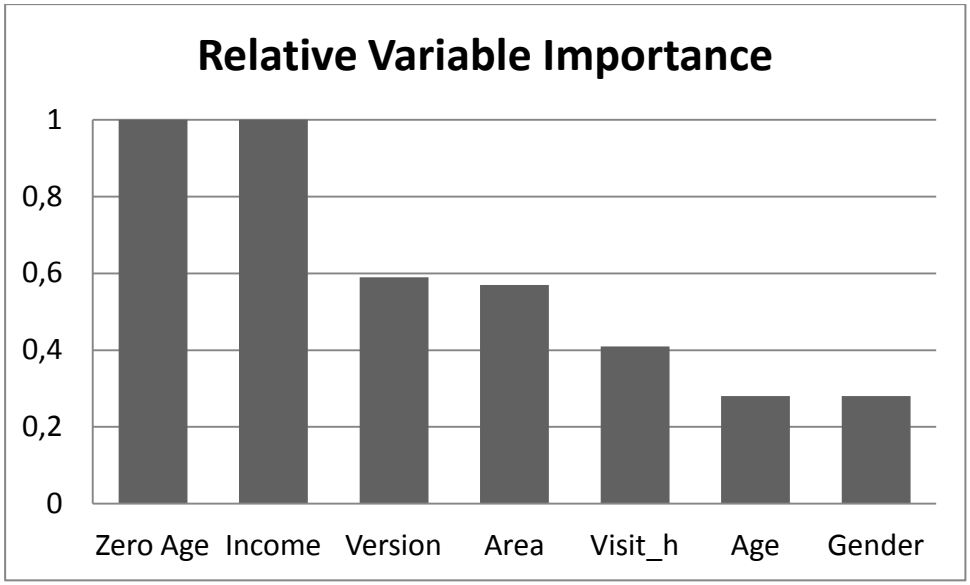

Figure 16: Relative variable importance zero-inflated negative binomial

3.2 Extrapolation of WTP

A simple extrapolation of the average WTP for each version and in total to the population of Skellefteå was done. Hereby the number of inhabitants of Skellefteå, 32.775, was multiplied with mean value of the WTP for each version times 12 (in order to get the annual value) (Statistics Sweden, 2010).

32.775 x Mean WTP x 12

This reveals the following annual amounts of Swedish Kronas:

- Version S = 17.796.825 SEK per Year
- Version M = 25.761.150 SEK per Year
- Version L = 22.345.995 SEK per Year
- Total Average = 21.969.738 SEK per Year

4. Discussion

The study was conducted to test if the complexity of the survey has an influence on the outcome of the WTP of the participants. Literature assumptions were, that complexity of the survey design has an effect on the error in obtained valuation estimates (Jim & Chen, 2006, p.84; Bishop et al., 1995, p.633). The results don't reflect this assumption, as the error doesn't decrease with increased complexity of the survey, nor does the medium complex version show the lowest SE values as assumed by Jim & Chen (2006) – on the contrary the medium complex version shows the highest SE. This partly answers the first guiding research question that was:

- How does the complexity of the survey instrument influence the quality of the outcome?

Further on in chapter 1.4.2, Contingent Valuation, it was described that a survey should not be too short, nor should it be too long – the results of this study actually revealed the biggest SE for the medium long version (Jim & Chen, 2006, p.84). What other assumptions were made by the literature? It's assumed that if inadequate information is provided and participants are not warmed up prior to the description of the hypothetical scenario, they might not be able to give reliable answers (Bergstrom et al., 1985, p.141). A warm up question was included in all of the survey versions; it was asked how much time the participant spends out in the green. This, however, cannot be seen as a warm up that is building up to the hypothetical scenario. Thematically it has little to do with the scenario. The purpose of this question was only to start of the survey with a simple question – this is a standard procedure in survey design. The results suggest the assumption that an adequate warm up is necessary can be contested. The answers of the participants of the short version, in which no effort was made to warm up the participants, seem not to be any worse in terms of the quality, if the SE serves as the quality measure. Furthermore, it was suggested by the literature that a smooth transition should be made to the description of the hypothetical scenario (Bowker & Didychuk, 1994, p.220). In the short survey version in this case study, there was no transition at all. After the general warm up question, the interviewer jumped right to the description of the hypothetical scenario. This is a practice that was not suggested by any of the reviewed literature, but that seem to not have any negative implications on the quality of the answers. Moreover, in the short version of the survey the participants were not briefed and motivated to think about ecosystem services, which is suggested by the literature (Bowker & Didychuk, 1994, p.220). Again, this seemed to not have any negative implications.

The previous interpretations and conclusions were based solely on observations concerning the SE. A regression analysis was conducted to obtain more specific insights into the effect that the complexity of the survey instrument has on the stated amount of the WTP. The second guiding question was:

- How does the survey design influence the outcome of the contingent valuation study of this thesis?

Through the conduction of the regression analysis, the effect of the variable "Version" (short version, medium complex version and most complex version) – on the variable "Money" (the maximum WTP) can be examined in more detail. The first modelling option, the negative binomial GLMM, revealed that "Version" has no significant effect on "Money". Hereby, a restriction of the model needs to be acknowledged – In regards of the variable "Version", the model cannot distinguish between whether or not a participant is willing to pay and how much a participant is willing to pay. It can only model the effect of "Version" on "Money" in total. In this model set up, "Income" was the most important variable, followed by all the other variables except for "Version". "Version" was the least important variable. The simple anova and the post-hoc comparison revealed that "Version" has no significant effect on "Money" in this model.

In the second presented modelling option, the influence of the variables on "Money" was first modelled in terms of whether a participant is willing to pay, followed by the influence of the variables on how much "Money" the participants are willing to pay. A zero-inflated negative binomial model was used. The results strongly suggest that "Age" has a great influence on whether or not a participant is willing to pay (binomial side of the model – yes/no). They also suggest that "Income" has a great influence how much a participant who is willing to pay, would actually pay. It turned out that "Version" has a much weaker influence on how much a participant is willing to pay, but this effect is positive. So in contrast to the first modelling outcome, "Version" proves to have an effect on "Money" in the sense that it might influence how much a participant is willing to pay – however that effect is small. The simple anova, the post-hoc comparison and the likelihood ratio test showed that "Version" has no significant effect on "Money", performed with a 95% confidence level. A restriction of this model set up must be acknowledged – the model structure of the zero-inflated negative binomial model that was used for the regression analysis doesn't allow to control for the variable "Street" as a random effect. If "Street" could be controlled for, the result might differ slightly from the outcome as it is now. The result of the second option is still in line with the results of the first modelling option, as both identified "Income" and "Age" as the most important variables that influence "Money". Even if "Street" cannot be controlled for, the results still reveal a general tendency.

In conclusion, it can be noted that even if the second modelling option revealed that "Version" might have a small influence on how much participants are willing to pay, the overall effect is negligible. This supports the conclusions that were drawn from the interpretation of the SE previously. This outcome leads to an interesting thought - might it be valid to combine the results of all of the surveys? Yes – because the interpretation of the SE as well as the results of the regression analysis support that "Version" is negligible, thus it is valid to combine all of the answers. This enlarges the sample size from 60 surveys per version to a total of 180 surveys. Interestingly, the SE of all versions combined is the lowest SE with 4.33. An increased sample size normally results in a smaller SE – but it needs to be kept in mind that three different versions were applied and still the SE is smaller. The results thus indicate that the length of the survey might not be as important as suggested by the literature.

What does that mean for practitioners, what recommendation can be deducted from these insights? Since the results suggest the complexity of the survey instrument seems to be not as important as assumed by the literature – there is the potential to save time and thus money as well as reallocating resources in a more meaningful manner. Designing a more complex survey obviously takes longer than designing a less complex one. Additionally, the results showed that the conduction of 60 surveys of the least complex version took the interviewer 4.4 hours net interview time in contrast to 11.31 hours net interview time - this is about two and a half times less. By conducting a shorter version in the field, a much higher frequency of replies can be reached. The results also support that the time that can be saved through survey design and survey conduction in the field should be invested in aiming for larger survey samples. This proved to have an effect on the quality of the outcome. What does that mean for the contingent valuation method as a scientific method for non-use value assessment? The results actually are in favour of the contingent valuation method, as it showed to be not very much prone to variations regarding the design of the survey instrument. If the result had shown a significant effect of the design on the outcome of the study, it would mean that contingent valuation shows great inconsistency in this regards and it would support the critique of validity – however that is not the case.

- What is the estimated value of cultural ecosystem services in the Vitberget region per year according to this study?

In total, four different samples sizes were used for simple extrapolation of the mean value of the WTP to the whole population of Skellefteå - the three different survey versions plus the result of the three surveys combined. It was shown that it is legitimate to combine the results of all versions in order to enlarge sample size and to get a better estimate. The result of the extrapolation of the WTP for all 180 surveys revealed that the estimated value for the cultural ecosystem services of the Vitberget region in Skellefteå according to this study is 21.969.738 SEK per year.

The last guiding question for this study is asking:

- How meaningful is that estimate?

In the chapter about contingent valuation, a couple of points were introduced that need to be kept in mind when talking about the reliability of a contingent valuation study. One of them is that people might over- or understate their WTP because they want to influence the study (Breffle et al., 1998, p.719). It's not safe to say that people didn't want to influence the outcome of this case study because they were hoping it could be in their interest – but there is no evidence that might lead to such conclusion. There were no outstanding high bids throughout the entire survey, the box plot (Figure 7) revealed that there are no outliers in the target variable. Additionally, the interviewer didn't provide more background information to the participants other than it being a study for a master thesis. Even though intentional over- or understates of the WTP cannot be excluded with certainty, it seems highly unlikely that it had happened. The interviewer also had the impression that the hypothetical scenario was understood well – in the result section, it was mentioned that only in rare cases further explanation of the scenario was necessary. The interviewer had the impression that

participants took the WTP question in a serious manner and put forth proper effort into answering the question. Additionally, the results suggest that it's legitimate to combine the responses of the 180 surveys – this enlarges the sample size drastically and enhances the explanatory power - the SE with 4.33 is small. Due to the mentioned reasons, it's fair to say that the quality of the data is good. The problem of validity has been treated in the contingent valuation chapter and due to the nature of the method, the estimated value cannot be checked for validity – the author would still go so far and state that the study gives a good estimate of the value of the Vitberget region to the citizens of Skellefteå. Whether the stated amount can be considered high or low goes beyond the knowledge of the author. It must be kept in mind that this estimation can never be used as a standalone argument – it must be seen as an additional tool or argument that needs to be brought in relation with other value assessments.

In the beginning, the concept of ecosystems was introduced as an abstract perception of nature that shall help to understand it better, to be able to describe and research ongoing bio-physical processes. The concept of ecosystem services as well is an abstraction with the same intentions – additionally it's ideally helping to highlight the importance of ecosystem services for humanity. The case study showed that contingent valuation could be used to draw a picture of the value of the Vitberget region to the population of Skellefteå. In cases of intended conservation measures, this might be an important additional argument. The emphasis here clearly lies on "additional" – it should only be use as an additional argument, in conjunction with others including biocentric reasoning and not as a standalone argument.

5. Conclusion

5.1. Future Research Outlook

This case study proves that predominant perceptions of the importance of survey design and survey length can be contested. The study provides a good base for continued studies of survey design in regards to the contingent valuation method. Studies with a similar study design could be conducted to derive more general rules. Continued studies specifically in the case of Skellefteå should take other variables such as participants income and their influence on the target variable into consideration for the study design. While this study considered the survey complexity observing and interpreting the influence of participants income may lead to different results as this variable ranked high in both analysis options in terms of relative variable importance. In addition, in case of the Vitberget region, people's use of the area and what they value most about it should be considered. Further learnings include a minor change in the hypothetical scenario whereby a time frame of change is added to make the scenario more clear.

5.2 Recommendations for practitioners

The complexity of the survey instrument doesn't substantially influence the target variable. The simple extrapolation to the population of Skellefteå yields a monetary value of the Vitberget region of about 22 million SEK per year. However, this number needs to be communicated with respect to the context of the assessment and the restrictions need to be

kept in mind. With respect to the restrictions this number can be used to present a additional argument in favour for the conservation of the Vitberget region.

The interpretation of the SE as well as the results of the regression analysis revealed, that the effect of the length of the survey (the complexity of the survey) is negligible. The complex versions do not produce more precise estimates than the simple version. The recommendation for practitioners is to save time and produce a short version of a survey, in which the hypothetical scenario is stated right in the beginning, followed only by the essential demographics. This will save time during the design phase and during the conduction in the field. The saved time might then in turn be invested in aiming for a larger sample size. The study provides good arguments and recommendations for practitioners in order to design and conduct contingent valuation studies more efficiently.

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Appendix

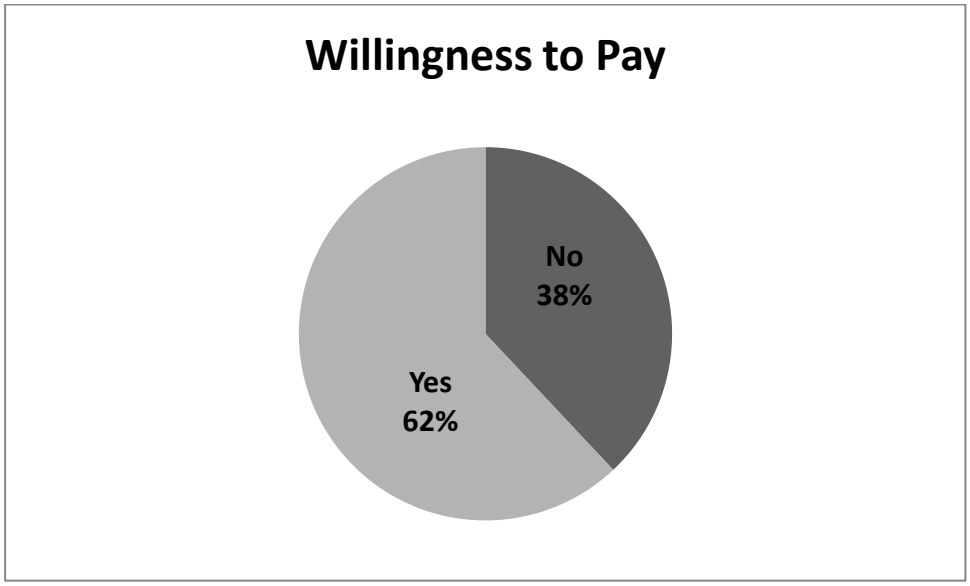

Figure 17: WTP in percent

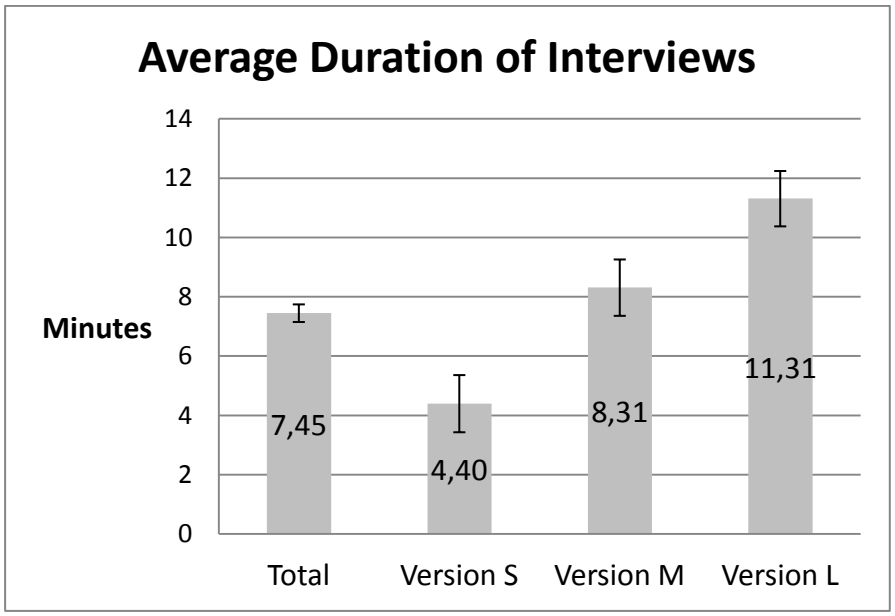

Figure 18: Average duration of interviews per version and in total

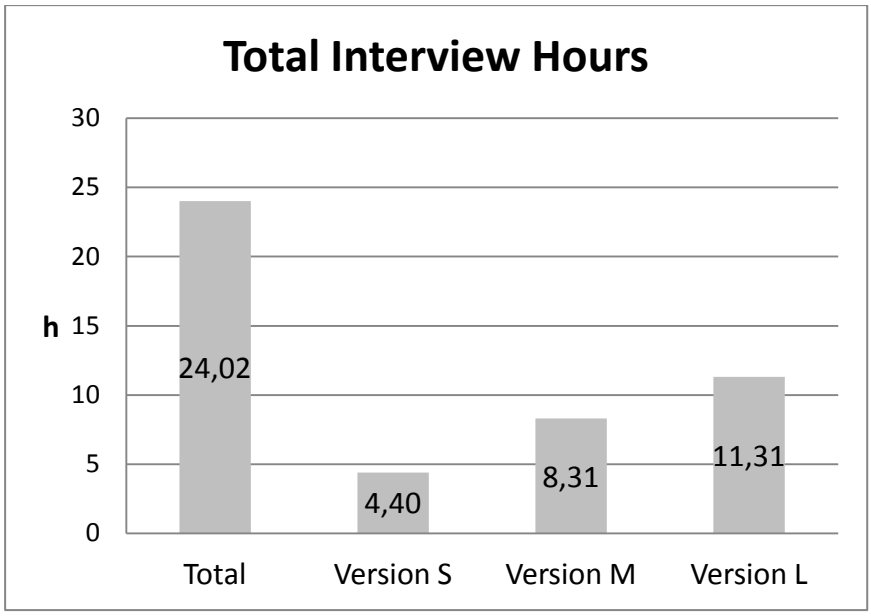

Figure 19: Total interview hours

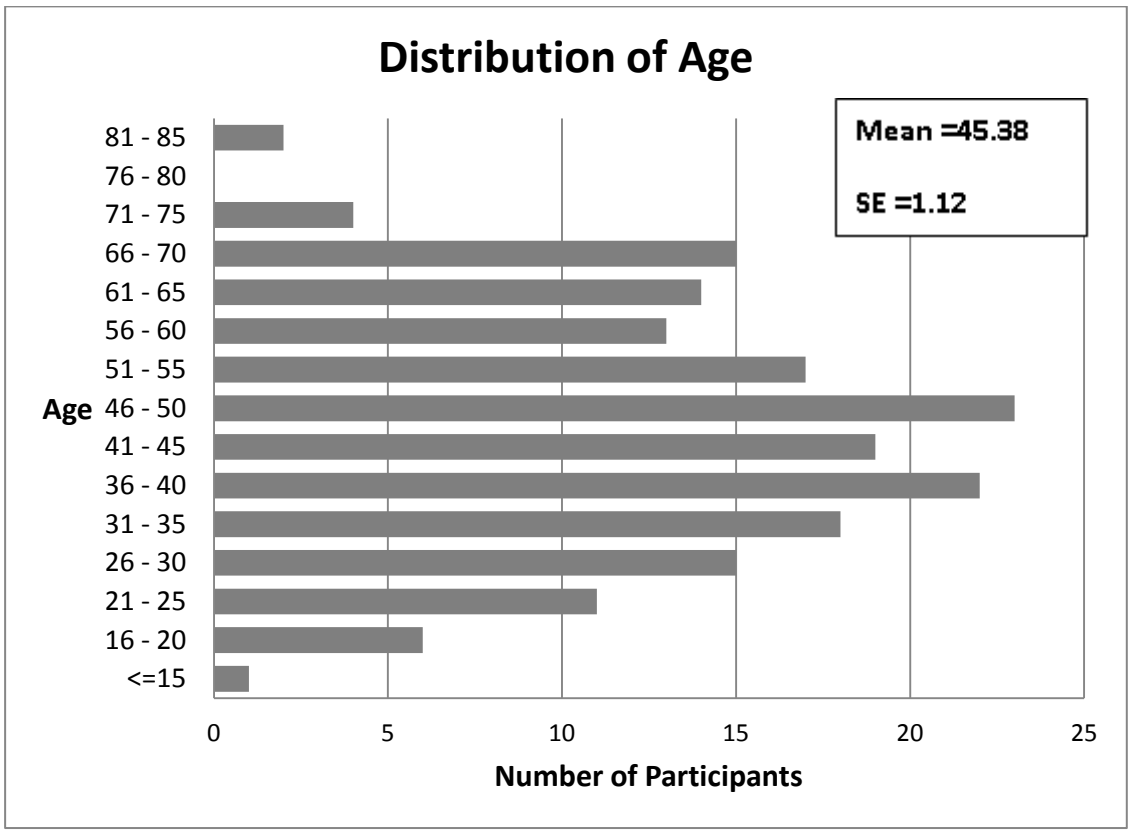

Figure 20: Distribution of Age

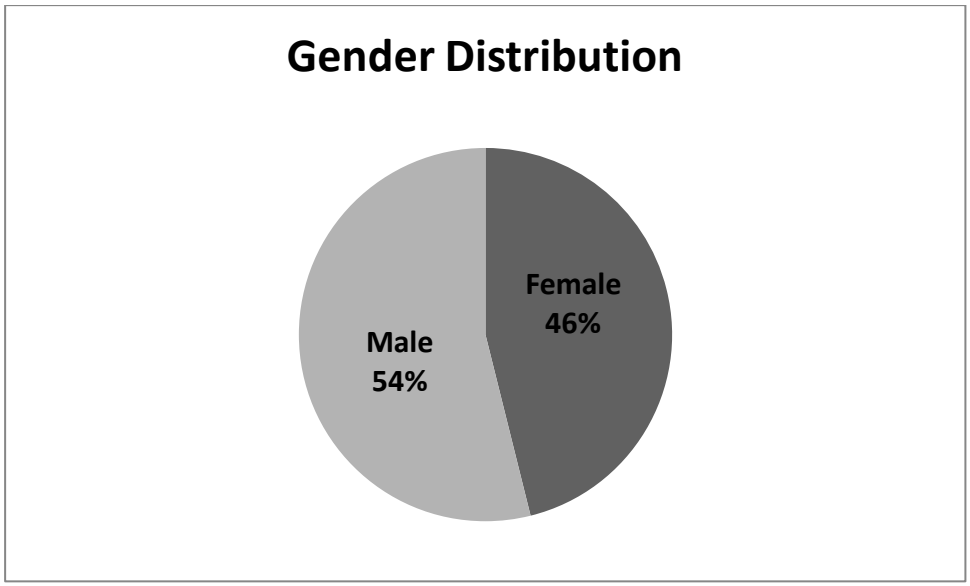

Figure 21: Gender distribution of participants in percent