Optimizing Commercial Wetlands in Rural Landscapes

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Paper submitted to the ***INTERNATIONAL CONFERENCE ON LANDSCAPE ECONOMICS, University of Natural Resources and Applied Life Sciences, Vienna, Austria, July, 2 to 4th, 2009***

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Abstract
Commercial wetlands can contribute to different policy objectives simultaneously. The aim of this study is to investigate the opinion of the Dutch population with respect to commercial wetlands. A combination of CVM and AHP is used to measure their WTP for a commercial wetland, and for the separated commercial wetland functions. The average WTP is €23.33 per household. The commercial wetland functions valued the most by the Dutch population are water treatment and water storage. Attitudes and beliefs variables appear to be much more influential on the amount of WTP for commercial wetlands than the socio-demographic variables. To conclude, the Dutch population is willing to pay for commercial wetlands in rural landscapes; a social demand for multifunctional commercial wetlands exists.

Key words (6); multifunctional land use, commercial wetland, landscape economics, Contingent Valuation method (CVM), Analytical Hierarchical Process (AHP)

1. Introduction

The RAMSAR convention[1] on wetlands defines wetlands as areas of marsh, fen, peatland or water, whether natural of artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters. Wetland-ecosystems provides substantial ecosystem services, supporting or protecting human activities or human properties without being used directly.

Constanza et al. stated that the stock of wetlands is a multifunctional resource with significant economic value. In order to conserve wetlands for future generations, sustainable management of wetlands is important. Studies addressing the socio-economic values of wetlands address wetlands as environmental goods (e.g. Brouwer et al, 1999; Constanza et al., 1997). However, most wetlands considered in the ecological economics literature deal with natural wetlands. In this paper, we will look at another type of wetlands, namely commercial wetlands. Commercial wetlands are constructed with a multifunctional aim: the wetland configuration is based on optimizing the revenues of the wetland entrepreneur. The wetlands include several functions and provide several services including public services such as water treatment or water storage. Currently, commercial wetlands entrepreneur are not compensated for the provision of these public services. Support of the population for the services will stimulate incentives to arrange new institutional arrangements to pay for the non-market services of the wetland, and for investigating the potential for privately owned commercial wetlands in the Netherlands.

To assess the efficiency of commercial wetlands, there are at least two approaches, a functional and a services approach. The functional approach is based on technical functional measurement. An example is the effectiveness of the water treatment function for water surface water. The service approach is based on the value assessment of a wetland for society. Wetland services are defined in the same way as ecosystem services are defined; as the benefits from use and non-use values of

[1] The RAMSAR convention is an intergovernmental treaty on Wetlands, signed in Ramsar, Iran, in 1971. (www.ramsar.org).

wetlands as perceived by humans (Brown et al., 2007). An example of a wetland service is improved water quality as experienced valued by human. It is possible to experience a wetland-service without using the wetland directly, for example option values associated with future use, existing values from the knowledge that wetlands exist and bequest values for the knowledge that wetlands will be available for future populations (Whitten and Bennett, 2005).

In the east of the Netherlands, at the “Het Lankheet” estate near Haaksbergen, an commercial commercial wetland pilot has been realized for research purposes (www.waterparkhetlankheet.nl). The size of this wetland is about 3 hectares, and it is designed to combine at least five functions: (i) water treatment of surface water in the form of a reed filter, (ii) the biomass production from reed, (iii) water storage in times of water logging, (iv) the improvement of biodiversity in the surrounding area by solving the desiccation problems and (v) recreation. These functions link to the character of rural landscapes as perceived by people. A social cost-benefit analysis (SCBA) showed that a commercial wetland like “Het Lankheet” estate is socially beneficial. To determine the benefits of the different services for this SCBA, the alternative cost method and a standardized benefit transfer tool were used (Blaeij and Reinhard, 2008). The alternative cost model, used by Blaeij and Reinhard, computed the replacement cost avoided if an environmental service is preserved. In the SCBA for the commercial wetland this method computes the costs of alternative measures to reach the same policy objective. The alternative cost method and the benefit transfer tool does not rely on observed of modeled behavior of the population. The alternative cost method has been used as a proxy for the value, but theoretically it is not a method for measuring benefits (Brown et al., 2007).

In this paper, we estimate the willingness to pay for the commercial wetland services of the Dutch population. To do this, we focus on commercial wetland located at agricultural land managed by farmers. To make it possible to optimize the composition of wetland functions, the contribution of the separate wetland-functions to the value is assessed. To determine the willingness to pay for the concept of multifunctional commercial wetlands, we use Contingent Valuation (CV). In addition, we apply the Analytical Hierarchical Process (AHP) method to derive values for the five different functions.

The paper is organized as follows. After a literature review on wetland valuation studies, the theoretical economic model describing the respondent’s behavior and the survey instrument is explored. Data are described and the results of the valuation exercise presented, by linking the economic model, with the empirical data, making use of the respective economic valuation exercise. Policy implications and a future research agenda conclude this paper.

2. Commercial wetlands and wetland valuation

Whether a farmer or landowner invests in an artificial wetland depends on the revenues of the services delivered by his wetland. In the case of Lankheet, there exists a market for one service. The reed grown can be harvested annually and sold, most probable as biomass. Reed is considered to be an agricultural crop. Due to the characteristics of reed (it is bulky and it floats through the oven) is actually not used yet as source of biomass. A well functioning market for biomass-reed does not exists yet. In the near future, it is not expected that biomass reed will be profitable for farmers to maintain the commercial wetlands, even if the price of biomass rises due to the expected increase in oil prices and climate change (Kuhlman et al., 2009). The remaining four functions can be regarded as non-market or public services. Payments for these public services can be an extra source of income next to the future income of reed production. Despite the potential benefits of public services provided by commercial wetlands to society, farmers do not automatically receive revenues for their investments in construction and management of commercial wetlands.

With the different public services, wetlands serve three European directives. Firstly, it contributes to the Water Framework Directive (WFD) due to the water purification of reed, Secondly, wetlands entail water storage capacity in cases of excessive rain fall or flood risk (Flood Directive). Finally, the purified water can be used to solve local desiccation problems in Nature 2000 areas and improve the biodiversity in those areas. Wetlands also contribute to additional Dutch policy objectives with respect to preventing water shortages by storing water. The other way around; storage of excess water in wetlands can prevent floods or water logging. The aforementioned possibilities of commercial wetlands to solve problems related to excess water, shortage of water etcetera are only valuable at locations where these problems exist.

The value of the services provided by commercial wetlands depends on their location. The value also depends on the insight in the preferences of the Dutch population with respect perception of the local population with respect to commercial wetlands and on whether they are willing to support farmers (landowners) to provide these wetlands. However, an option to fulfill the different directives is widely implementing (commercial) wetlands . Before commercial wetlands can be widely implemented, it is necessary to get more to this concept.

Numerous valuation studies on wetlands have been performed before. For instance Brouwer et al. (1999), Woodward and Wui (2001) and Brander et al. (2006) extensively reviewed the existing literature on wetland valuation. Based on these analyses, we can conclude that there are at least 190 wetland valuation studies. These three studies make use of meta-analyses analyze the question which wetland-functions have a significant impact on the social wetland value.

The study of Brouwer et al. (1999) focused only on CV estimates of wetlands in temperate climate zones in developed countries and it explains the WTP per household. This study took into account four different wetland function, namely, flood control, water generation, water quality and biodiversity. The main function valued in each study was assigned to one of these four groups. Due to the fact that it was impossible to identify the benefits from the functions separately, the benefits derived from the functions could not be separately taken into account in their analyses. The meta-analysis concludes that controlling for other parameters, the WTP is the highest for flood control, followed by water generation and water quality.

Brander et al. (2006) mention as main characteristics of a wetland the open-access of nature, and the public good characteristics. By use of meta-analysis, the impact of population and wetland characteristics on the annual marginal value per hectare of wetlands is investigated. Brander et al. include 215 estimates from 190 studies, from countries all over the world, based on different valuation methods in their meta-analysis. For this paper, we are interested in the influence of the availability of different wetland functions on the marginal value of wetlands. The wetland functions taken into account are flood control, water supply, water quality, habitat and nursery, hunting, fishing, material, fuel-wood, amenity and biodiversity. Wetlands providing better water quality and flood control generates the highest marginal value. Wetlands directly used as natural resources (materials and wood) have lower than average values. According to Brander et al., it is surprisingly that wetlands with a recreational function have a lower marginal value.

Woodward and Wui (2001) took into account valuation studies with different kind of methods including the contingent valuation method. This analysis explains the annual value per acre. The wetland services separated for the analysis are flood control, water quality, water quantity, recreational fishing, commercial fishing, bird hunting, bird watching, amenity, habitat and storm protection. Of the 39 studies taken into account in this study, almost two-thirds measured the value of only one of these wetland services, while more than 30% measured three or more services. The services with the highest WTP value are bird watching and commercial fishing. Amenity services provided by proximity to the environment have the lowest values. As can be seen in Table 1, the mean wetland value can be measured in different units, and can differ significantly between different studies.

Table 1: Average wetland value in 2006 Euros[2]

Study	Mean value	Median value	Measurement unit
Brouwer et al., 1999	SDR 121	SDR 66	per person for wetland function preservation*
Brander et al., 2006	€3211	€172	per hectare per year
Woodward and Wui, 2001	€72	Not available	per hectare per year

* Value is in 1990 SDRs special drawing rights (Brouwer et al., 1999)

Brouwer et al. (1999) conclude that the main wetland functions contributing to the social value are flood control and water quality. Brander et al. (2006) separates wetland services, with a comparable conclusion as Brouwer: flood control and water quality, together with water generation are the most important services. Woodward and Wui (2001) explain the value also on the bases of services instead. They conclude that the services adding the most to the total wetland value are bird watching and commercial fishing.

There is a long list of wetland valuation studies available, and the three literature reviews show numerous similarities about the values of wetland valuation based on meta-analysis to explain the determinants of the value of commercial wetlands. However, one has to be careful to transfer values (Brander et al. 2006, Rosenberger et Phipps 2001, Smith et Pattanayak 2002, Woodward and Wui 2001). Although the use of benefit transfer is attractive due to its low cost and time savings, the transfer error could be really high (in Brander the average transfer error is 74%).

Most existing CV studies mentioned in the three literature reviews estimated the WTP for the conservation of wetlands with nature as the main function. In most cases, these wetlands are managed by the government. In this study, we add to the available literature by dealing with commercial wetlands, and more specific with agricultural wetlands. Agricultural wetlands are privately owned, artificial and constructed with a multifunctional aim. The functions of a commercial and nature wetlands can be comparable, but the priorities of functions are likely to differ. The

[2] Estimates are made comparable with PPP and GDP deflators from the World Development Indicators 2008 and with information about the SDR exchange rate from www.imf.org.

aim of the commercial wetland is to maximize profits of the wetland owner. This implies that the main function in a commercial wetland will be determined by the services that generates the highest revenues. Our research identifies the priorities of commercial wetland services by the population. In addition, the willingness to pay for commercial wetland providing public services is estimated as well.

This study adds to the current literature by estimating the willingness to pay value for commercial wetland management and the willingness to pay for the separate commercial wetland services. As Woodward and Wui (2001) indicate, some wetland valuation studies measure more than 1 functions or service. In valuation studies that explicitly measure more than 1 function or ecosystem services, a description of the wetland is given in terms of functions or ecosystems. This makes the respondents aware of the different functions. The valuation question asks the WTP for the total package. No estimate of the separate functions can be given based on these question. So none of the studies included in the meta-analysis of Woodward and Wui include a water quality or water quantity function did give a monetary estimate of the value for the different functions (e.g. Dillman et al., 1993; Whitehead, 1990).

If there is a policy goal to construct a wetland with the highest social benefit, the policy maker have to be able to optimize the wetland functions. By conducting a choice experiment, a researcher is able to identify the value of separate wetland functions (e.g. Birol and Cox, 2007; Carlsson et al., 2003). To carry out a choice experiment, a design have to be constructed. The attributes have to be independent. In the case of the local multifunctional wetland, the attributes will not be independent. Almost all the functions will be highly correlated. For example, more biomass-production will simultaneously result in a better water quality. If the wetland is used for water logging, the water quality will be worse. As we want to make our questionnaire as realistic as possible, we choose not to conduct a choice experiment.

For this paper, we combine two different approaches: we use CV to obtain an aggregate willingness to pay value for multifunctional commercial wetlands, and we use the multi-criteria technique AHP to decompose the aggregated value into partial willingness to pay values for the separate functions of commercial wetlands. The Analytical Hierarchy Process methodology was developed by Saaty in the late 1970s (Saaty, 1977, 1980) as a technique to support multi-criteria decision-making in marketing. Kallas et al. (2007) used this technique to investigate the benefits of multifunctional agriculture They conclude that the private 'good' functions related to food and health, organic farm management, have the highest value. The second valued function is maintenance of population in rural area and cultural heritage. All four functions appear to be important contributors (at least 20%) to the aggregate value of multifunctional agriculture for this population.

3. Methodology

The economic model used assumes that consumers derive utility from two goods, an agricultural wetland (AW) and all other goods.;

$$U(Y - WTP_{\Delta AW}; AW_{yes}) = U(Y; AW_{no}) \qquad (1)$$

where $WTP_{\Delta AW}$ is the willingness to pay for the creation of agricultural wetlands in the Netherlands. AW_{yes} denotes the realization of the agricultural wetland, while AW_{no}

denotes the status quo situation in which no artificial wetland is realized, but the land is used as in the current situation. The monetary value of realizing an agricultural wetland can be expressed as;

$$WTP_{\Delta AW} = U(AW_{yes}) - U(AW_{no}) \tag{2}$$

The Agricultural wetland is a multifunctional wetland for which 5 different functions are separated. The econometric model is a multifunctional utility function and can be expressed as:

$$U(AW) = U(F_1, F_2, F_3, F_4, F_5) \tag{3}$$

To make it possible to estimate the individual values of the different functions, assumptions about the shape of the utility function are necessary. Assuming a linear utility function, gives the following function:

$$U(AW) = w_1F_1 + w_2F_2 + w_3F_3 + w_4F_4 + w_5F_5 \tag{4}$$

The WTP per function (F_i) of the agricultural wetland is as follows:

$$WTP_{\Delta Fi} = w_i WTP_{\Delta AW} \tag{5}$$

Contingent valuation

Contingent valuation is a survey-based valuation technique, applicable for wetland valuation (Barbier, 1996; Birol et al., 2006). In the environmental economics literature, it is used to determine the values of environmental goods that have no market. For this study, an open ended CV question is used. We ask respondents two questions; are they willing to pay for commercial wetlands and if so, how much? The WTP question elicits the maximum WTP indicated by the respondents. To make use of contingent valuation, meaningful and realistic payment scenarios have to be constructed.

The concept of multifunctional agricultural wetland is an unknown concept for a very large part of the Dutch population. Only 6% of the National respondents is familiar with agricultural wetlands (see Table 4). Due to this, we gave special attention to the introduction of the commercial wetland concept . The preference questions asked are given in table 2. The first two questions are important to get insight in the respondent’s opinion on commercial wetlands in general. These questions will be used as explaining variables for whether and how much people are willing to pay for agricultural wetlands. The last two questions are used to analyze whether individuals are willing to pay for commercial wetlands and to determine the amount they are willing to pay indicated in Euros?

Table 2: Questions asked to determine the social opinion with respect to commercial wetlands

Number	Question
1	What is your opinion with respect to the creation of commercial wetlands in the Netherlands? (Positive….. Negative)
2	According to you, is it necessary to compensate farmers for their loss in income? (not at all ….. for sure)
3a	CVM: Are you willing to pay for the construction of commercial wetlands, for example to compensate farmers? (yes, maybe, no)
3b	CVM: Which amount are you willing to pay extra per year to make the construction of commercial wetlands possible? (payment card 0-250 euro)

Analytical Hierarchical Process

The commercial wetland functions, and the ecosystem services provided by them are highly correlated, which makes it difficult to distinguish between individual functions (Brouwer et al., 1999). To avoid double counting and because separately valuing the wetland-functions through individual CV exercises could lead to seriously biased estimations, we choose to apply the Analytical Hierarchical Process (AHP). The AHP makes it possible to decompose the aggregated value of the commercial wetland into the values of its different functions. The AHP method consists of a series of pair wise comparisons between the different functions to assess the relative importance of each criterion. We will elicit weights for each of the functions. The cognitive burden of respondents are reduced because AHP always uses two clear functions comparisons (Kallas *et al.*, 2007; Moran *et al.*, 2007).

Table 3 summarizes and describes the five different functions of an agricultural wetland used in this study. From expert interviews, it followed that these five functions were most important for agricultural wetlands.

Table 3: Five separated functions of an agricultural wetland

Function		Service as described in the survey:
F_1	Water treatment	Water treatment in terms of nutrient emission reduction with helophyte-filters
F_2	Bio-mass reed	Production of renewable energy from biomass
F_3	Moisten	Solving desiccation problems in nature conservation areas
F_4	Water logging	Water storage to avoid flooding
F_5	Recreation	Recreation such as walking, cycling picnicking, jogging, playing etc

The AHP method consists of three stages. First, the Saaty matrix is determined. The elements of the Saaty matrix reflect the relative importance of the different functions. Secondly, the weights of the different functions are calculated for all individuals based upon the elements of the Saaty matrix. Finally, the overall aggregated weights of the different functions are derived from the weights for each individuals.

The elements of the Saaty matrix of the five functions of the commercial wetland are derived from a series of choice questions on the relative importance of the different functions with a 9–point scale are distributed over the respondents in a random order. Every combination of different functions is considered, so that respondents answer 10 different choice questions. Based on the 9-point scale, the answers of the choice questions are valued.

Note that the score of importance are the inverse values of the scores of the reversed combination. Kallas et al. (2007) used a similar 9-point scale to determine the scores. From the choice questions and their 9-point scale, we can derive the Saaty matrix A. The element a_{jk} reflects the score of the importance of function *j* over function *k*. The Saaty matrix can be derived for all individuals. If the function *j* is extremely more important than function *k*, then a_{jk}=9 and consequently a_{kj}=1/9. If both function j and k are equally important, a_{jk}= a_{kj}=1. By definition, a_{jj}=1.

For instance, if the water treatment (*j*) is extremely more important than biomass production (*k*), then a_{jk}=9 and consequently a_{kj}=1/9. Then, the weights for the functions w_{ijk} are calculated based on Eq. (6).

Following Kallas et al. (2007), we apply the practical approach to calculate the weights of the separate functions for each respondent based on the Saaty matrix. The weights are calculated with a geometric function, because the scores of the elements of the Saaty matrix are nonlinear:

$$w_{ij} = \left(\prod_k a_{ijk} \right)^{1/5} \tag{6}$$

The indices *j* and *k* reflect the different functions, and *i* is the index of the respondents. For each individual, the function with the highest weight is the function that is the individual's most important function. Note that an individual might have similar scores for more than one function.

In order to calculate the weights of the functions for the sample or subsamples, we calculate the geometric mean over the (sub)sample:

$$w_j = \left(\prod_i w_{ij} \right)^{1/N} \tag{7}$$

With *N* the number of individuals.

4. Empirical analysis

We present the analysis of the willingness to pay for commercial wetlands. Knowing the willingness to pay for commercial wetlands, we continue with the AHP results. These results tell us how the WTP is divided over the five different commercial wetland functions. This paragraph will finish with quantifying the socio-economic effects on the individual WTP.

4.1 Data description

In order to get insight in the preferences of sample of the Dutch population for commercial wetlands, we conducted an Internet survey on the willingness to pay for commercial wetland in the Netherlands. The data was collected in December 2008. The respondents were member of a panel of a specialized bureau (TNS-NIPO), who are paid for filling out (complete) questionnaires. The average time spend on filling in the questionnaire was 9 minutes. Many socio-demographic characteristics are known in advance, which makes it possible to sample according to some pre-specified characteristics. The sample was intended to be representative for the Dutch population. Furthermore, we have a sample of the Haaksbergen region, due to the fact that the pilot project ‘Waterpark Het Lankheet’ is located in this area. This enables us to check whether the respondents in the Haaksbergen region are familiar with the concept of an commercial wetland, also their valuation of the different function might differ from people who live further form the Lankheet estate.. The sub-sample in the region of Haaksbergen consists of 134 respondents and the sample of the Dutch population of 826 respondents.

Table 4 reports summary statistics of the two samples, called the Haakbergen and the Netherlands sample. The Netherlands sample is representative for education, age and gender. The average household size in our sample is higher than on average in the Netherlands, and the average gross household income is a bit lower. The geographical distribution over the regions is not representative distributed over the Dutch population. In the Netherlands, 48% of the population is living in the west, 10% in the North and 21 % in the South. Whether the residence of the respondents is determining the decision whether and how much people are willing to pay is unknown in advance. In some areas, water problems are more sincere, but it is the question whether respondents are aware of this fact and whether they take this into account making a willingness to pay decision.

Table 4: Summary statistics of for the sample survey

	Netherlands (n=826)				Haaksbergen region (n=134)			
Variable	mean	sd	max	min	mean	sd	max	Min
Wetland known concept	0.06	0.23	1	0	0.60	0.49	1	0
Income (*1000€)*	44.37	26.63	273	2	42.76	27.39	261	8
Household size	2.88	1.18	9	1	2.87	1.22	7	1
West	0.39	0.49	1	0				
North	0.09	0.28	1	0				
South	0.29	0.45	1	0				
East	0.23	0.42	1	0				
Age of provider	51.45	14.47	85	18	48.28	13.65	77	18
Low education class	0.22	0.42	1	0	0.19	0.40	1	0
Middle education class	0.50	0.50	1	0	0.54	0.50	1	0
High education class	0.28	0.45	1	0	0.27	0.44	1	0
Sexe (Male = 1)	0.50	0.50	1	0	0.49	0.50	1	0
Necessary to compensate farmer	0.79	0.41	1	0	0.80	0.40	1	0
No important functions	0.02	0.14	1	0	0.01	0.09	1	0
Water treatment most important	0.41	0.49	1	0	0.50	0.50	1	0
Bio-mass reed most important	0.05	0.21	1	0	0.05	0.22	1	0
Moisten most important	0.06	0.24	1	0	0.08	0.28	1	0
Water logging most important	0.40	0.49	1	0	0.30	0.46	1	0
Recreation most important	0.06	0.23	1	0	0.06	0.24	1	0
Memberships of environmental organization	0.53	0.80	5	0	0.54	0.86	4	0
Recreate in nature	0.71	0.45	1	0	0.78	0.41	1	0
Preference for more nature in the Netherlands	0.66	0.48	1	0	0.72	0.45	1	0

* Excluding non-response; Netherlands n=656; Haaksbergen n=112

The socio-demographic variables were compared to statistics of the Dutch population to assess representativeness (Statistics Netherlands; CBS, 2007). Age and gender are representative for the Dutch population. Mean income is lower than the average mean income in the Dutch population. We do not expect any influence of the variables gender and age on the decision whether and how much respondents are willingness to pay for commercial wetlands. Most probable, income will have a positive relation with the decision whether a respondent is willing to pay, and on the decision how much. The effect of education on the WTP is unknown. Educated people may be more aware of the problem, but on the other hand, there is a higher probability that they will act in a strategic way.

The respondents were asked about their attitudes and beliefs with respect to commercial wetlands and its wetland functions. About 80% of the respondents agrees on the necessity to compensate farmers for their loss in income. The question about which function is the most important is a mutually exclusive. Water treatment and water storage are the most important function according to the sample. Water treatment is experienced as the most important function of an commercial wetland for 41% of the respondents in the sample of the Dutch population. In the Haaksbergen sample this is the case according to 50% of the respondents. Water storage, in case of excess water, is more important for the Dutch population than for the Haaksbergen population (respectively 40% and 30%).

Other personal characteristics that can positively influence the decision to pay are whether they are a member of an environmental organization, and the preference with respect to nature in the Netherlands. In both sub-samples, on average one out of every two households is a member of an environmental organization. This is comparable with other Dutch studies (e.g. Haile and Slangen, 2009). Of the Dutch and the Haaksbergen sub-samples respectively 71% and 78% recreate in natural areas, while according to respectively 66% and 72% it is important to realize more natural areas in the Netherlands.

4.2 Social opinion on commercial wetlands and CV results

First of all, we want to get insight in the opinion of the respondents about commercial wetlands. The vast majority of the respondents (781 respondents out of 908 respondents; 86%) agrees upon the question that it is necessary to compensate farmers for managing commercial wetlands. Sixty respondents are negative about commercial wetlands, of whom 50 persons think that farmers should be compensated for managing commercial wetlands. Apparently, those respondents do think that farmers should be compensated if they make additional effort for society, but they do not support the concept of commercial wetlands. A possible explanation for this remarkable result is that if a farmer is obliged to create and manage an commercial wetland, it is necessary to compensate him. By being commercial, we implicitly assume that it is the farmer’s choice to manage a commercial wetland.

About 33% of the respondents who indicated that farmers should be compensated, are not willing to pay for commercial wetlands themselves. One explanation for this observation is that the wetland is one way to contribute to existing policy objectives. However, there are different ways to reach these objectives. Around 85% of the respondents whom think that farmers should be compensated have a preference for realizing these wetlands, but within the existing budget for water management.

To realize new public services, two financing mechanisms are possible, financing with extra WTP and financing through reallocation of existing revenues (Bergstrom et al., 2004). In CV studies respondents are asked what amount they are willing to pay extra. If they were not willing to pay, the question why are you not willing to pay is asked. Within valuation literature, such a question is known as a screening question to identify “real” zeros protest bidders (objections against concept of commercial wetlands) and “protest” bidders (no fundamental objections against the context, but objections against the payment vehicle resulting in a WTP of zero) (e.g. Hanley et al., 2002). To make it possible to interpret our results, we will classify our zero bids as well. The WTP answers were classified as ‘prefer reallocation of budgets’ if the reason behind their zero WTP is; “rejection of any further taxes”, “consider that they pay already enough for water” and “the government should finance these improvement by reallocating of existing revenues”. In mainstream environmental economic literature, these respondents would have been classified as protest bidders. A respondent is identified as a protest bidder if he values the good in question, but the respondent disagrees with some of the assumptions in the valuation question. According to this definition, of the respondents who do not want to pay, 79% of the Dutch sample and 70% of the Haaksbergen sample have to be identified as protest bidders. These respondents do not accept the (realistic) valuation framework. In many CV studies, these protest bidders are excluded from the analysis.

The question is whether a respondent who indicates that the wetlands should be financed through reallocation of existing revenues is a "protest" bidder. The mainstream opinion is that to reduce protest bids it is important to choose a realistic and fair payment vehicle (e.g. Navrud, 2002). Navrud (2002) indicates that such a payment vehicle could differ according to different countries with heterogeneous institutional settings, cultures and preferences. Our opinion is that even within a country not all inhabitants have homogeneous institutional preferences. This makes it important to choose a realistic and fair payment, but according to us this does not mean that this is the preferred payment vehicle for the whole population. As our valuation question is related to payment for environmental services questions, the valuation question is realistic and fair. Respondents who do not want to pay due to classical 'protest' bidders are not willing to pay for this realistic option and have to be identified as "real" zero bids.

Table 5: Frequency and average WTP for the Haaksbergen region and the Dutch subsamples

WTP	Haaksbergen region	Netherlands
0	69	417
(0 "reallocating budgets")	(48)	(328)
0-25 euro	20	135
25-50	21	131
50-100	18	107
100-150	3	25
150-200	2	3
200-250	1	8
Total	134	826
Average WTP (in €)	24.46	23.33
Standard deviation WTP (in €)	39.54	37.99

Table 5 summarizes the WTP values of the respondents. Of the respondents, 51% is not willing to pay any positive amount for commercial wetlands at all. Of the total sample, 40% of the respondents indicate that the commercial wetlands should be financed with existing taxes of water prices. The share of zero WTP corresponds with other findings (e.g. Alberini et al., 2005; Jones et al., 2008). As explained before, we will not exclude these respondents from the analysis as they react on a realistic payment vehicle.

The zero bids, including "protest' bids were analyzed in detail. Most of the respondents who are willing to pay, have a willingness to pay between 0 and 100 euro. The average WTP is slightly higher for the Haaksbergen sample than for the Dutch sample, but this difference is statistically insignificant. This means that people that living closer to an existing commercial wetlands are not willing to pay more.

The effect of excluding protest bidders and all bidders with a zero WTP is huge, due to the large amount of zero bidders in the sample. As explained earlier, we choose to include the whole sample for determining the WTP, but to know the effect of excluding “real” and “protest” zero bids, the presented results show that excluding these bids have a huge effect on the mean WTP.

AHP results

Table 6 shows the weights calculated with the AHP method as explained in Section 3., even as the shares of the different functions.

Table 6: Weights and shares of the different functions

	Haaksbergen region	Netherlands
Weights (w_j)		
– Water treatment (Nutrient reduction)	1.562	1.394
– Biomass - reed production	0.833	0.839
– Solving desiccation problems	1.156	1.019
– Water storage	1.323	1.441
– Recreation	0.502	0.576
Percentages of functions *j*		
– Water treatment (Nutrient reduction)	29.1	26.5
– Biomass - reed production	15.5	15.9
– Solving desiccation problems	21.5	19.3
– Water storage	24.6	27.4
– Recreation	9.3	10.9

The functions “Water treatment” and “Water storage” are rated the highest by the respondents. In the Haaksbergen region, “Water treatment” has the highest weight, while in the rest of the Netherlands, “Water storage” has the highest weight. The commercial wetland is hardly associated with recreation. This is also the case for the Haasbergen region in which a number of people do have experience with the Lankheet estate. The total WTP for the Haaksbergen region is slightly higher than for the rest of the Netherlands, although the difference is not statistically significant. In this case study of the multifunction commercial wetlands, the public functions such as “ Water treatment” and “Water storage” are valued higher than the private function, such as “Recreation”. The result contradicts the results of Kallas et al. (2007) which found the opposite result. One explanation could be that our study deals with multifunctional commercial wetlands, while the study of Kallas deals with multifunctional agriculture. Apparently, respondents have different perceptions about agriculture and commercial wetlands.

Based on the weights, the shares of the different functions in the WTP are calculated. These WTP values per function are summarized in Table 7. The WTP for “Water treatment” is €6.17 for the Netherlands and more than €7 for the Haaksbergen region. The WTP for “Water storage” is €6.38 for the Netherlands and slightly more than €6 for the Haaksbergen region. The WTP for Recreation is less than €3 for both samples. Biomass production WTP is around €3.75 and solving desiccation problems ranges from €4.51 for the Netherlands to €5.26 for the Haaksbergen region valued higher value.

Table 7: WTP per function

	Haaksbergen region	Netherlands
Water treatment (Nutrient reduction)	7.11	6.17
Biomass - reed production	3.79	3.71
Solving desiccation problems	5.26	4.51
Water storage	6.02	6.38
Recreation	2.29	2.55
Total Willingness to Pay (WTP)	24.46	23.33

Analysis of heterogeneity in preferences.

Next to knowing the mean WTP and the distribution of the WTP of the different functions, it is important to investigate the composition of the potential market for commercial wetlands. In this paragraph, we want to get grip on the impact of the socio-demographic characteristics on the WTP.

Respondents made two sequentially decisions; first whether they are willing to pay extra to support commercial wetlands, and secondly how much they are willing to pay. Respondents who do not see the services provided by commercial wetlands as public goods, state a zero response. Other respondents are expected to state variable amounts (including zero) depending on their socio-economic characteristics. The dependent variable in our analysis is the extra WTP for commercial wetlands. Respondents who indicate that they are not willing to pay for commercial wetlands have a zero WTP.

Due to the large number of respondents who do not want to pay extra for waterparks ("real" and "protest" zero-bids), a Tobit model was estimated to examine the heterogeneity in preferences (Tobin, 1958) of the WTP values. A Tobit model only allows one type of zero observations, namely a corner solution. In the Tobit model, the data are left censored at zero, and uncensored at the right. The explaining variables included in the analysis are based on the variables as explained in Table 4.

Table 9 presents the tobit regression results. As can be seen, preferences with respect to commercial wetlands are heterogeneous within the two samples. The explaining power of the socio-demographic variables is small. Nevertheless, it is interesting to look which variables determine the extra willingness to pay.

In the sample of the Netherlands, household income does not appear to be significant. This was also not the case if we did the analyses and exclude eduction. In the Haaksbergen region, household income matters. Respondents with a relatively low income, and respondents with a relatively high income have a higher WTP. The residence of the respondents does not have a significant correlation with their WTP, neither the size of the household.

The attitudes and beliefs variables appear to be much more influential on the WTP than the socio-demographic variables. Not surprisingly, respondents who agrees that it is necessary to compensate farmers for managing commercial wetlands have a higher WTP than respondent who not agree. Respondents who indicate that the most important function of a commercial wetland is water treatment have a higher WTP for agricultural wetlands than respondents who assign another function as the most important. An increase in the number of memberships of environmental organizations has a positive effect on the WTP for commercial wetlands. A similar effect is seen in other studies for the WTP for multifunctional agriculture (Haile and Slangen, 2009; Jongeneel et al., 2008). Respondents who recreate in nature do not have a higher WTP for commercial wetlands. People who have a preference for more nature in the Netherlands have a higher WTP for commercial wetlands.

Table 9: Estimation results for the WTP value from Tobit regression

Variables	Haaksbergen region	Netherlands
Low income class (income < 20.500 euro: 1, otherwise 0)	69.80***	3.69
High income class (income > 68.000 euro: 1, otherwise 0)	58.10**	3.20
Household size	-0.64	-2.99
Residence in the west of the Netherlands		-0.39
Residence in the north of the Netherlands		-2.93
Residence in the south of the Netherlands		-6.97
Age of provider	0.12	0.47**
Sexe (Male = 1)	7.78	1.99
High education class (HBO and university = 1, otherwise 0)	-22.51	6.78
Low education class (LO and LBO = 1, otherwise 0)	-17.92	-14.72**
Necessary to compensate farmer (yes=1; no=0)	27.31*	29.41***
Water treatment most important (yes=1; no=0)	19.76	12.66*
Water storage most important (yes=1; no=0)	9.82	2.76
Number of memberships of environmental organization	20.85***	9.40***
Recreate in nature (yes=1; no=0)	26.45	5.60
Preference for more nature in the Netherlands (yes=1; no=0)	0.31	23.50***
Intercept	-77.22*	-71.14***
σ	59.27***	60.33***
Sample size	134	826

From our analysis we can conclude that respondents value commercial wetlands heterogeneous. This heterogeneity is mainly based on attitudes and beliefs and not on socio-demographic variables.

6. Conclusions

Many valuation studies have been carried out for wetlands who are meant as natural areas, and many valuation studies have looked into one particular value of wetlands. The scientific contribution of this paper is that is presents the first valuation study for commercial wetlands, and that it presents monetary values for 5 separated potential commercial wetland functions. Commercial wetlands produce biomass reed. For the Netherlands, is not expected that a commercial wetland can be exploited only by selling reed. The social functions of a commercial wetland will also be important. This makes it necessary to get insight in the social value of the separate commercial wetland functions: (1) nutrient reduction; (2) biomass-production in relation with green energy; (3) water storage; (4) the improvement of biodiversity in the surrounding area by solving the desiccation problems; and (5) recreation. These functions of commercial wetlands contribute to the character of rural landscapes. The AHP method we used for our analysis enable the estimation of the monetary value of the 5 separated commercial wetland functions.

The results show that about half of the Dutch population is willing to pay extra for the construction of commercial wetlands, for example to compensate farmers. According to the Dutch population, the most interesting functions of a commercial wetland are the water treatment and water storage functions. Based on the average

WTP of €23.33 and given that there are 7.2 million households in the Netherlands, a simple aggregation method lead to an estimate of the total benefits for commercial wetlands of approximately €170 million.

In the Netherlands, 140,000 hectares of wetlands would be required to fulfill the water quality standards when this would be the only measure. The Ministry of Agriculture recognizes that wetlands form a promising innovative option to improve the water quality in combination with other functions. However, the Ministry of Agriculture argues that farmers should have the option (voluntary) to manage an (commercial) artificial wetland (Verburg, 2008). Assuming that the 140.000 hectares have to be realized by commercial wetlands only, the total benefits for the Netherlands have to be distributed over the 140 thousand hectares i.e. an annual social benefit per hectare of commercial wetlands of €1,200.

According to the respondents, the most important commercial wetland services are water treatment and water storage. Based on this result, social demand for commercial wetland is based on these two functions. Most probable, the institutions representing the population would be willing to pay the most for the provision of water quality and water storage.

Attitudes and beliefs variables appear to be much more influential on the amount of WTP for commercial wetlands than the socio-demographic variables. To make commercial wetlands successful, the public awareness of the opportunities of commercial wetlands have to be emphasized. In other words, the awareness of the contribution of commercial wetlands to solve (future) climate change and related water management issues has to be elaborated amongst the Dutch population..

The respondents appear not to be interested in the recreational options of commercial wetlands. The recreation function is hardly mentioned as the most important function of commercial wetlands. Also, a person who recreate in nature does not indicate a higher preference for commercial wetlands by indicating a higher WTP. An explanation for the lack of interest in the recreational function of commercial wetlands could be that the respondents are not aware of the recreational options of artificial wetlands. Moreover, the attractiveness of recreation also depends on the alternative opportunities for recreation, which are not taken into account in our analysis.

The results shows that a social demand for multifunctional commercial wetlands exists. The results also shows that most of the respondents who indicated a zero WTP nevertheless are interested in and have a demand for commercial wetlands. They are willing to reallocate existing public revenues for the construction of artificial wetlands. It will be worthwhile to examine the effect of adding a payment vehicles as reallocating existing revenues, to determine the WTP for multifunctional commercial wetlands.

Due to the high number of respondents which are positive about payments for commercial wetlands but which have zero WTP themselves, it would be interesting to examine the heterogeneity in preferences with respect to commercial wetlands. In future research, we will apply a Box-Cox Double Hurdle specification as suggested by Martinez-Espineira (2006) to account for this heterogeneity. This specification models separately individuals' choices about whether they are willing to pay extra for commercial wetlands or not and their choice about the degree of extra willingness to pay. The question is which variables explain which choices, are these variables equal for both choices, or do they differ?

Acknowledgement
This study was financed by the Ministry of Agriculture, Nature and Food Quality (KB1) and BSIK Leven met Water.

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