Ecological Economics 69 (2010) 1023–1030

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Analysis

A meta-analysis of contingent valuation forest studies

Melina Barrio [a], Maria L. Loureiro [b,*]

[a] IDEGA Universidade de Santiago de Compostela, Spain, Av. das Ciencias s/n Campus Sur. Santiago de Compostela-Spain

[b] Departamento de Fundamentos da Análise Económica, Facultade de Ciencias Económicas e Empresariais, Avda. do Burgo s/n, Campus Norte, Universidade de Santiago de Compostela, 15782 Santiago de Compostela, Spain

ARTICLE INFO

Article history:
Received 26 February 2009
Received in revised form 16 September 2009
Accepted 12 November 2009
Available online 23 December 2009

Keywords:
Contingent valuation
Management programs
Meta-analysis
Forest
Valuation

ABSTRACT

Forest ecosystems provide a variety of valuable goods and services. This paper presents a meta-analysis of forest studies using the Contingent Valuation (CV) method to value the provision of forest values around the world. In this meta-analysis, we estimate the marginal value of different management programs that provide a variety of forest goods and services. Our results show that willingness to pay (WTP) estimates for forest management programs are sensitive to the program's objectives, particularly when linked to the provision of recreational services. Other variables such as the type of forest, location, survey mode, or the type of respondent were also found to significantly affect the WTP estimates.

1. Introduction

The importance that forests have with respect to the well-being of humans is undeniable. These ecosystems provide innumerable goods and services. According to Daily (1997), forest ecosystem services can be defined as the process and condition through which the forest and the species that live there support and satisfy the human life. Forests provide raw materials for food, fuel and shelter. Without these and many other ecosystem goods and services, life as we know it would not be possible (Krieger, 2001). Forest goods and services include recreational opportunities for hiking, biking, and scenic landscapes (direct use values); waste protection, watershed services and carbon storage (indirect use values); and wildlife habitat and diversity preservation (non-use values).

In spite of the fact that forest threats are becoming very relevant,[1] there is at the same time an increased concern about conservation issues. In this regard, multiple management programs aim to prevent or ameliorate the negative effects that forests are now experiencing. The necessity of knowing which ecosystem benefits are valued more by society is crucial in the context of design of management programs. As such, the objective of this meta-analysis of contingent valuation (CV) forest studies is to assess the marginal value of the different forest management programs providing certain forests goods and services. The programs analyzed cover actions to increase the protection of flora and fauna, the use of wooded products and/or purely recreational activities.

As is well-known, a meta-analysis approach can be defined as the study of studies. It refers to the statistical analysis of a large collection of results from individual studies with the purpose of combining the main findings (Glass et al., 1981). Recent meta-analyses have been conducted in the field of economic valuation of environmental resources, impacts, and services (Brander et al., 2007). A wide amount of studies have been focused on valuation of wetlands (Brouwer et al., 1997; Brouwer et al., 1999; Woodward and Wui, 2001; Ghermandi et al., 2008); woodland recreation (Bateman and Jones, 2003; Zandersen and Tol, 2009); endangered species (Loomis and White, 1996) and general outdoor recreation (Smith and Kaoru, 1990; Walsh et al., 1992; Rosenberger and Loomis, 2000; Shrestha and Loomis, 2001).

There are also some notorious examples in the literature with respect to forest valuation. Some studies have focused on forest recreation in the UK (Bateman et al., 1999; Bateman and Jones, 2003), and other European forests (Zandersen and Tol, 2009). These studies usually compute consumer surplus estimates for activity days obtained from the travel cost method (TCM) and the CV method. As far as we know, only one meta-analysis, Lindhjem (2007), has studied the non-timber benefits from forests, specifically from Norwegian, Swedish and Finnish forests. He analyzes the factors behind preferences for protection or multiple uses of forest, including biodiversity protection.

In a similar fashion, in the present study we fit the results of multiple valuation studies of forest management programs via regression analysis. To our knowledge, this is the first meta-analysis that assesses how society values the application of different managements programs involving the provision of forest goods and services at an international level. Previous

* Corresponding author. Departamento de Fundamentos da Análise Económica Universidade de Santiago de Compostela, Spain. Tel.: +34 981 563 100x11674; fax: +34 981 59 99 35.
E-mail addresses: melina.barrio@usc.es (M. Barrio), maria.loureiro@usc.es (M.L. Loureiro).

[1] The Global Forest Resource Assessment 2005 (FAO, 2006) indicates that, on average, 27.7 million ha of forests have been burned yearly since the year 2000, generating nearly 40% of the total anthropogenic carbon dioxide (CO_2) emissions (UNEP, 2004). In the same way, deforestation and conversion of forests to agricultural lands, continues at an alarmingly high rate — about 13 million ha per year (FAO, 2006).

0921-8009/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.ecolecon.2009.11.016

forest meta-analyses have used studies from a single country (Bateman et al., 1999; Bateman and Jones, 2003) or a group of countries in the same area (Zandersen and Tol, 2009; Lindhjem, 2007). Broader meta-analyses have been conducted for other type of ecosystems, such as wetlands (Brander et al., 2006; Ghermandi et al., 2008), but as far as we know, no other international meta-analysis has been conducted yet for forest valuation. Another important characteristic of this meta-analysis is that it includes both, mean and median willingness to pay (WTP) values when reported. This allows us to assess the sensitivity of the obtained results. The time span of the present analysis includes the last 30 years, limiting our data to studies that have applied CV exclusively.

Our main hypotheses are related to the influence of the different valued services. In particular, our null hypotheses postulate that the different forest goods and services provided have no influence on the value of the program. In addition, we investigate the effects of other variables, by including different study variables such as the question format or the type of payment, together with other good-specific variables, such as the type, size and location of the forest, among others, into the estimated equations. The obtained results should be useful for implementing and elaborating management plans in forest areas according to general societal preferences. Furthermore, this meta-analysis may also allow for the estimation of benefit-transfer functions when a "first best" empirical non-market valuation study is not feasible (Shrestha and Loomis, 2003).

This paper is organized as follows: the following section contains the data description, including a literature review on the topic. It continues with the model specification, research hypotheses, empirical results, and conclusions.

2. Data Description

An intensive search of studies has been conducted in different databases such as ECONLIT, EVRI, and AGICONSEARCH among others.[2] The data comes from a review of the CV literature valuing ecosystem forests since the 1990s. Some studies reported incomplete data and were eliminated from our final data set due to a large number of missing values. As a consequence, the final data used for this meta-analysis comes from 35 studies[3] from different parts of the world. The most significant region of origin of the analyzed studies is Scandinavia (31%). The rest of the studies are distributed throughout the rest of Europe (20%), the USA (17%), and other countries (31%). From these 35 studies, we were able to include 101 observations, with a mean of 2.9 observations per study. The largest number of observations from one single study is 19 and comes from Scarpa et al. (2000), while the minimum is one single observation (from eleven different studies).

The collected studies reported their results in different currencies ($US, SEK, €, etc.) and from different periods (from 1991 to 2008). In order to homogenize all information, values were transformed to a standard measure, a per year or one-time payment, per household and per individual, and transferred into current $US dollars. We include the mean and median WTP estimates, when possible. The majority of the previous meta-analyses have used the mean instead of the median estimates (Smith and Osborne, 1996; Loomis and White, 1996; Horowitz and McConnell, 2002). According to Gürlük (2006), if the decision-maker wishes to make a choice based on efficiency criteria, then the mean is the most appropriate measure (Brent, 1998; Bateman et al., 2002). However, with the objective of assessing whether there are differences in the factors affecting both welfare measures, we estimated two common models. In Table 1, we summarize the articles from which we have taken our observations. In this abbreviated data list, we include the author's name, the mean and median estimates, and the year of the publication. The WTP values are expressed in 2008 US$ updating them through purchasing power parity (PPP) rates. We choose the PPP rate instead of the exchange rate because the latter measure may not accurately represent differences in terms of income and consumption between countries.

3. Model Specification

The dependent variable in our meta-regression equation is a vector of WTP values, labeled as y. Following Brander et al. (2006), the explanatory variables are grouped into three different categories that include the study's characteristics in X_s, the forest's and program's characteristics in X_f, and the site's and socio-economic characteristics in X_e. The estimation model corresponds with the following equation:

$$y_i = \alpha + X_{si}\beta_s + X_{fi}\beta_f + X_{ei}\beta_e + \varepsilon_i, \tag{1}$$

where α is the usual constant term, the β vectors contain the coefficients associated with the respective explanatory variables to be estimated, and ε is a vector of independently and identically distributed (i.i.d.) residuals. Subscript i stands for variable study i. According to Bijmolt and Pieters (2001) a meta-regression model can capture two levels of errors: at the measurement level and at the study level. There are several approaches to estimating this regression depending on the assumptions regarding the error variance–covariance matrix (Lindhjem, 2007). We consider that each study counts equally in the data. Then we estimate a classical ordinary least squares (OLS) regression model with the Huber–White adjusted standard errors clustered by each study. This approach has been used in several meta-analyses (Brander et al., 2006; Loomis and White, 1996; Lindhjem, 2007), and proved very useful in terms of correction of correlation of errors across studies. The presence of multicollinearity was tested and judged not to be a serious problem.[4]

Our empirical strategy contains the estimation of three models. Two of them are denoted as the restricted models, with the purpose of comparing the mean and median regressions, and the third model is an extended model, which contains a larger set of explanatory variables with the mean WTP as the dependent variable.[5]

In order to choose the functional form that better suits our regressions, we conducted a Box–Cox test. The basic idea behind testing for the appropriate functional form of the dependent variable is to transform the data so as to make the residual sum of squares (RSS) comparable. To do this, we divided each observation by the geometric mean where the geometric mean is $(y_1{*}y_2{\ldots}{*}y_n)^{1/n} = \exp^{1/n\mathrm{Ln}(y_1{*}y_2{*}\ldots y_n)}$. Then we rescaled each Y observation by this value $Y_i^* = Y_i/geometricmean$. Finally we regress Y^* on X and LnY^* on X and saved the RSS. The model with the lowest RSS is the one with the better fit. Formally, the Box–Cox test can be expressed as:

$$\text{Box}-\text{Cox} \;=\; N/2{*}\log(RSS_{\text{largest}}/RSS_{\text{smallest}}) \sim \chi^2_{(K)} \tag{2}$$

where N is the number of observations, K is the number of coefficients.

In the baseline model having the mean WTP as the dependent variable, the Box–Cox test is 151.42, and for the median WTP the Box–Cox test carries a value of 71.83. In the expanded model the Box–Cox test carries a value of 155.42. These estimated values exceed the critical

[2] Of the total sample, 31 studies are published in academic journals and only four are unpublished.

[3] Although more than 50 studies were considered at first, we were only able to get information from 35. The majority of the studies that we do not consider, as for example James (1994) or Treiman and Gartner (2006), do not include the information needed for some relevant variables, others do not use the contingent valuation method as Brey et al. (2007) or Adamowicz et al. (2004), or are in a different language, such as Bostedt and Mattson (1991), or Hoen and Veisten (1994).

[4] We estimate the pairwise correlations followed the criteria of Kennedy (2003) and Gujarati (2003) who indicate that a correlation coefficient of about 0.9 or 0.8, respectively, or higher can be problematic. Following Richardson and Loomis (2008) a test of linear restrictions is used to check if the error variance from one model, (baseline model) removing the variables with more correlation, is significantly larger than the error variance when the variables are included in the model. The final regression has included all of these considerations.

[5] Note that the number of observations for the mean WTP regression is more than twice the observations in the median regression.

Table 1
Author, publication year, observations and mean willingness to pay (WTPpp$08) and median median willingness to pay (MWTPppp$08) for each individual study.

Author	Year of Publication	Mean observations	Median observations	WTPppp$08	MWTPppp$08
Adams et al.	2007	3		0.75–1.12	
Amirnejad et al.	2006	1		34.32	
Bernath and Roschewitz	2008	1	1	57.26	32.54
Broberg	2007	1		35.43	
Duthy	2002	1	1	16.98	8.99
Gregory	2000	3		17.43–61.62	
Hadker et al.	1997	1		11.50	
Haefele et al.	1992	4		28.58–157.40	
Hoen and Winther	1993	6	6	20.93–67.56	6.81–35.04
Horton et al.	2003	2		56.08–75.92	
Hung et al.	2007	1		8.20	
Hutchinson and Chilton	1999	2		45.19–58.12	
Kleiber	2001	1	1	70.66	39.67
Kniivilä et al.	2002	1		46.76	
Köhlin	2001	2		21.48–50.62	
Kramer and Mercer	1997	2		32.22–47.57	
Kwak et al.	2003	1		2.37	
Lehtonen et al.	2003	1	1	252.89	95.43
Lockwood et al.	1993	3	1	70.04–288.05	58.74
Loomis et al.	1996	2	1	49.11–146.50	129.17
Loomis et al.	1993	6	3	64.39–288.06	0–33.89
Mäntymaa et al.	2002	3		278.86–473.11	
Mattsson and Li	1993	4		383.11–1019.18	
Mattsson and Li	1994	2		365.43–563.70	
Mill et al.	2007	3	3	44.37–53.64	60.06–170.58
Pouta	2005	2		304.92–490.90	
Reaves et al.	1999	3		10.79–17.12	
Sattout et al.	2007	5	5	22.22–52.96	2.39–20.78
Scarpa et al.	2000	19	19	2.45–6.32	1.81–4.68
Shechter et al.	1998	4	4	16.69–23.32	5.62–14.05
Svedsäter	2000	2		69.82–85.28	
Tÿrväinen	2001	3		100.04–228.48	
Tÿrvänein and Väänänen	1998	3	2	171.82–280.91	136.37–136.37
Veisten and Narvud	2006	2	2	3.78–6.42	1.13–2.78
Walsh et al.	1990	1		101.60	

value (which from the Chi-squared table at 5% significance level with 11 and 26 degrees of freedom are 19.68 and 38.89, respectively). Consequently, we *reject* the null hypothesis that the performance of the models is the same (i.e., where there is a significant difference in terms of goodness of fit). The best model for our data was the semi-log model. Previous meta-analyses, such as Brander et al. (2006) or Brander et al. (2007) have also employed this functional form.

Following Eq. (1), our empirical specifications are:

$$\ln(y) = \alpha + \beta_1 morethanonetime + \beta_2 individual + \beta_3 dc + \beta_4 facetoface + \beta_5 sample + \beta_6 onlyrecreation + \beta_7 coniferous + \beta_8 sc + \beta_9 gdp + \beta_{10} forestsurface + \beta_{11} period1 + \varepsilon \quad (3)$$

for the baseline models, and:

$$\ln(y) = \alpha + \beta_1 annpermanent + \beta_2 anntemporal + \beta_3 individual + \beta_4 dc + \beta_5 oe + \beta_6 facetoface + \beta_7 mail + \beta_8 sample + \beta_9 biodiversity + \beta_{10} onlyflora + \beta_{11} wooduse + \beta_{12} recreation + \beta_{13} avoidchange + \beta_{14} nochange + \beta_{15} oldgrowth + \beta_{16} rainforest + \beta_{17} otherf + \beta_{18} size + \beta_{19} rw + \beta_{20} sc + \beta_{21} reu + \beta_{22} urban + \beta_{23} gdp + \beta_{24} forestsurface + \beta_{25} period1 + \beta_{26} period2 + \varepsilon \quad (4)$$

for the extended model.

As noted earlier, two different vectors of WTP dependent variables were used (mean and median values) in Eq. (3). With the purpose of keeping as many observations as possible, only the mean values were used for Eq. (4), the extended model. This model controls for a larger amount of explanatory variables than the previous ones. Both regressions provide similar results in terms of the study characteristics, the characteristics of goods and the site and socio-economic characteristics.

In the reduced models (Table 2), we include the following explanatory variables: the frequency of payment, through the variable *morethanonetime* if the WTP is per year with or without specific duration; the type of respondent, through the *individual* variable, which denotes whether the respondent is an individual; the question format, through *dc* if the question is asked with a dichotomous format; the survey mode, through the variable *facetoface* if surveys were conducted face to face and finally, the variable *sample*, representing the number of respondents. With respect to the good's characteristics, we differentiate between whether the program implies mainly the provision of a recreational service (*onlyrecreation)* and if the valued forest is coniferous (*coniferous*). Lastly, in the site and socio-economic characteristics, we included variables such as the geographical origin of the study through the variable Scandinavian countries (*sc*), the gross domestic product per capita of the year of the survey (*gdp*), the size of forested land in the country of study (*forestsurface*), and the publication year, through the variable *period1* that gathers those studies published before the year 2000.

For the extended model, we have included the same type of explanatory variables as in the previous models, but more broken down, in addition to a new set of variables (Table 3). The idea behind the estimation of this extended specification is to reveal other effects that could not be properly analyzed in the regression with the median WTP as the dependent variable due to the reduced number of observations. In the first group of explanatory variables, the study characteristics, we include: the type of payment differentiating between annual permanent payments through the variable *annpermanent*, those with a specific duration through *anntemporal,* and those with one-time payments through the *one-time* variable was omitted. The type of respondent was also considered, differentiating between households and individual respondents *(individual)*. Other included variables are the question format: dichotomous choice (*dc*), open ended (*oe*), and payment card (*pc*) (omitted variable); and the survey mode, including face to face (*facetoface*), mail (*mail*), and other modes (*otherm*) as the omitted variable. The last included variable into this category is the sample size (*sample*), indicating the number of respondents. Other socio-economic characteristics that may have served well as explanatory variables, such as the mean respondent's age, education and household size of the sample, were only sporadically reported in many of the selected publications, and consequently they were not included in the present analysis.

In the second group of variables, the so-called characteristics of goods or program characteristics, we have identified five variables that gather information about the different goods and services provided by the evaluated programs. In particular, we differentiate between the management programs that had both a flora and fauna orientation (*biodiversity*), those that included only a flora orientation (*onlyflora*) and those with only a fauna orientation (*onlyfauna*), as the omitted variable. Other programs associated with commercial uses related to wood production, dung and residues use (*wooduse*), and those with recreational uses or values (*recreation*) were also included. Furthermore, in terms of the framing of the valuation question, we have identified programs that imply an avoidance of damage to the current state of forests (*avoidchange*), programs that entail no change in the quantity or quality of forest (*nochange*), and other programs that imply an improvement in the present situation of the forest (*gainchange*) as the omitted variable. In addition, the type of valued forest has also been considered. In this sense, there is a distinction between old growth forests[6] (*oldgrowth*), rain forests (*rainforest*), other forests, (those that have deciduous and perennial trees (*otherf*)), and coniferous forests (*coniferous*) as the omitted variable. The valued forest size was included measuring the size of the area in hectares (*size*).

Finally, in the third group referring to the site and socio-economic variables, we include a series of indicator variables denoting whether the study was conducted in Scandinavian countries (*sc*), other European countries (*reu*), in the rest of the world (*rw*), or in the USA (*usa*) (omitted variable). We also include as explanatory variables the location of the forest in relation to urban areas (*urban*), and the size of the forested land in each country in the year of study[7] (*forestsurface*). Another relevant variable is the gross domestic product per capita at the time of the survey (*gdps*), updated to 2008 values. Finally, and following previous meta-analyses such as Ojea and Loureiro (2009) and Loomis and White (1996), we included the publication year through the dummy variables *period1* for publications before 1995, and *period2* for publications between 1996 and 2002.

4. Results

The regression results are displayed in Tables 4 and 5. The first table presents the results for the baseline models. We show the two regression estimates corresponding with the mean and median WTP dependent variables, respectively. The two models fit the data with a R^2 of 0.83, and 0.91, respectively, quite well. For the median estimation our sample is reduced to 50 observations, given that not all studies report both welfare estimates. In all regressions, the estimated coefficients measure the percentage change in the dependent variable, given a one unit change in the explanatory variables. The results reinforce several consistent findings across the median and mean WTP regressions.

In particular, services related to the direct use or enjoyment of forests play a statistically significant role when valuing forest management programs. With respect to other studies' characteristics, CVM studies conducted with DC questions, and with periodical payment mechanisms result in higher WTP estimates. In addition, other socio-economic variables such as the country's GDP, and the period of study are also positive and statistically significant in determining WTP estimates. Furthermore, the amount of forested land has a negative impact on WTP estimates for forest management programs.

Just a few differences emerge from this first set of results between both regressions, in terms of the effects of geographical differences and types of forests valued. In the median regression, those studies that were conducted in Scandinavian countries have a significant and negative influence on the median WTP, while in the mean WTP regression this result is not statistically significant. Furthermore, the variable *coniferous* is negative and statistically significant in the median but not in the mean WTP regression. There is no clear reason for these differences to occur, although the number of observations in both regressions is quite different.

Table 5 contains the results of the extended model, with the mean WTP as the dependent variable. The results show that the model fits the data quite well, with an adjusted R^2 of 0.89. With respect to the main variables of interest, we observe a positive effect of the different forest values on WTP estimates. The *recreation* variable has a positive effect on the mean WTP and statistically significant at the 1% significance level. Variables such as *biodiversity* and *onlyflora* carry a positive coefficient but are not statistically significant. The coefficient *wooduse* is not statistically significant either. However, the joint null hypothesis that *biodiversity, onlyflora, wooduse* and *recreation* are

Table 2
Variable description and summary statistics baseline model.

Variable	Description	Mean (Std. dev.)	Mean (Std. dev.)
lnwtpppp	Dependent variable. Logarithm of mean wtp extracted from the original studies updated with purchasing power parity ($US-2008)	3.550 (1.707)	
lnmwtpppp	Dependent variable. Logarithm of median wtp extracted from the original studies updated with purchasing power parity ($US-2008)		2.375 (1.412)
Study characteristics			
morethanonetime	= 1 If the wtp is per year with or without specified duration	0.723	0.480
	= 0 If the wtp is a one-time payment	(0.450)	(0.505)
individual	= 1 If the respondents are individuals	0.347	0.500
	= 0 Otherwise	(0.478)	(0.505)
dc	= 1 If the question format has a dichotomous format	0.485	0.540
	= 0 Otherwise	(0.502)	(0.503)
facetoface	= 1 If surveys are conducted face to face	0.465	0.680
	= 0 Otherwise	(0.501)	(0.471)
sample	Number of respondents (1/10,000)	0.033 (0.027)	0.029 (0.016)
Characteristics of goods			
onlyrecreation	= 1 If the program has only a recreational component	0.327	0.480
	= 0 Otherwise	(0.471)	(0.505)
coniferous	= 1 If the forests are mainly coniferous	0.416	0.520
	= 0 Otherwise	(0.495)	(0.505)
Site and socio-economic characteristics			
sc	= 1 If the study is conducted in Scandinavian countries	0.277	0.240
	= 0 Otherwise	(0.450)	(0.431)
gdps	Gross domestic product per capita of the year of the survey (1/10,000)	3.040 (1.367)	3.019 (1.274)
forests	Forested land in hectares in the country of study (1/100,000)	0.837 (1.276)	0.232 (0.600)
period1	= 1 If the study was published before 1999	0.426	0.340
	= 0 If the study was published before 2000	(0.497)	(0.479)

Note: + indicates the omitted variable.

[6] We have done this classification as a function of the main type of forest valued in the study. In some cases, we had to complete the dataset with information outside the study.

[7] In some cases we used the publication year.

Table 3
Variable description and summary statistics expanded model.

Variable	Description	Mean	Std. dev.
lnwtpppp	Dependent variable. Logarithm of mean wtp extracted from the original studies updated with purchasing power parity ($US-2008)	3.550	1.707
Study characteristics			
annpermanent	= 1 If the wtp is per year without specified duration = 0 Otherwise	0.495	0.502
anntemporal	= 1 If the wtp is per year with specified duration = 0 Otherwise	0.208	0.408
onetime+	=1 If the wtp is one-time payment = 0 Otherwise	0.297	0.459
individual	= 1 If the respondents are individuals = 0 Otherwise	0.347	0.478
dc	= 1 If the valuation question has a dichotomous format = 0 Otherwise	0.485	0.502
oe	= 1 If the valuation question has an open-ended format = 0 Otherwise	0.327	0.471
pc+	= 1 If the question format is a payment card = 0 Otherwise	0.188	0.393
face	= 1 If surveys are conducted face to face = 0 Otherwise	0.465	0.501
mail	= 1 If surveys are conducted via mail = 0 Otherwise	0.416	0.495
otherm+	= 1 If surveys are conducted through other modes (telephone, a mix of two modes…) = 0 Otherwise	0.099	0.300
sample	Number of respondents (1/10,000)	0.033	0.026
Characteristics of goods			
wooduse	= 1 If the program has a component for management wood, dung and residues (commercial use) = 0 Otherwise	0.079	0.271
biodiversity	= 1 If the program has a component of management flora and fauna = 0 Otherwise	0.386	0.489
onlyflora	= 1 If the program has a component of management flora but not fauna = 0 Otherwise	0.208	0.408
onlyfauna+	= 1 If the program has a component of management fauna but not flora = 0 Otherwise	0.050	0.218
recreation	= 1 If the program has a component of recreation = 0 Otherwise	0.495	0.502
avoidchange	= 1 If the program implies avoidance of damages = 0 Otherwise	0.208	0.408
nochange	= 1 If the program does not imply a change in the present forest quantity or quality = 0 Otherwise	0.287	0.455
gainchange+	= 1 If the program implies an improvement in the current forest = 0 Otherwise	0.505	0.502
oldgrowth	= 1 If the forests are of old growth type = 0 Otherwise	0.238	0.428
rainforest	= 1 If the forests are of rainforest type = 0 Otherwise	0.139	0.347
otherf	= 1 If the forests are a combination of deciduous and perennial = 0 Otherwise	0.277	0.450
coniferous+	= 1 If the forests are mainly coniferous = 0 Otherwise	0.416	0.495
size	Size in hectares evaluated in the study (1/100,000)	15.391	79.245
Site and socio-economic characteristics			
rw	= 1 If the study is conducted in other countries = 0 Otherwise	0.277	0.450
sc	= 1 If the study is conducted in Scandinavian countries =0 otherwise	0.277	0.450
Site and socioconomic characteristics			
reu	= 1 If the study is conducted in European countries (outside Scandinavian countries) = 0 Otherwise	0.297	0.459
usa+	= 1 If the study is conducted in USA = 0 Otherwise	0.149	0.357
urban	= 1 If the forest is located in a urban area = 0 Otherwise	0.099	0.300
gdps	Gross domestic product per capita of the year of the survey (1/10,000)	3.040	1.367
forests	Forested land in hectares in the country of the study (1/100,000)	0.837	1.276
period1	= 1 If the study was published before 1995 = 0 Otherwise	0.257	0.439
period2	= 1 If the study was published between 1996–2002 = 0 Otherwise	0.515	0.502
period3+	= 1 If the study was published after 2003 = 0 Otherwise	0.228	0.421

Note: + indicates the omitted variable.

equal to zero, or not significant to the model can be rejected. Testing this restriction in the extended model, the result is an *F* statistic of 8.90 with degrees of freedom of (4, 74) and a *p*-value of 0.0000. This joint null hypothesis that these four variables are not significant can be rejected at the 1% level, providing justification to include them into the regression. In addition, attempting to remove one of these variables from the model seems to result in specification bias.

A prevention program that implies an avoidance of damages to forests (*avoidchange*) carries a negative effect on WTP at the 10% level of significance. This suggests that programs that avoid damages in the current state of forests generate a WTP estimate lower than those which made improvements in the state of forests (*gainchange*). According to Kahneman and Tversky (2000) people tend to value losses differently than equal-sized gains, and this could explain the sign of *avoidchange* variable with respect to the *gainchange* variable. The programs that maintain the same status or level of protection (*nochange*) are not significant in the WTP equation.

In regards to the group of forest variables, we find that the type of forest is statistically significant, particularly in the case of rain forests (*rainforest*) or deciduous and perennial forests (*otherf*). These variables are statistically significant at the 1% level. Although there is no clear reason that may justify these findings, the fact that rainforests are highly valued may be due to the extensive media attention related to their current state.

The coefficient of the size of the valued forest (*size*) is also positive, although not statistically significant. This confirms the result previously obtained by Lindhjem (2007) with respect to the insensitivity to scope of the value estimates. However, other studies by Smith and Osborne (1996), Brouwer et al. (1999), Brander et al. (2007) and Ojea and Loureiro (2009) found the opposite. Lindhjem (2007) points out that this conclusion could be a result of a combination of the weaknesses in stated preference survey design (especially an unclear scenario and good descriptions) and respondents' difficulties in assessing a complex and multidimensional forest good.

In relation with the studies' characteristics, we find that if the WTP question is asked via a dichotomous choice (DC) format, the influence on the welfare measure is positive and statistically significant at 1% level of significance. The same occurs in the case of open-ended (OE) questions. These results are as expected and confirm the findings of the previous literature suggesting that WTP estimates from binary discrete choice formats tend to be higher than those from other formats (Boyle et al., 1994; Carson et al., 2001). Specifically DC estimates tend to be larger than PC estimates (Champ and Bishop, 2006; Haefele et al., 1992). In our results, as denoted, the coefficient of the OE format is statistically significant at 5% and positive. Furthermore, if the

Table 4
Meta-regression results baseline model (OLS Huber–White adjusted standard errors).

	Lnwtpppp		Lnmwtpppp	
	Coefficients Std. err.	$P>\|t\|$	Coefficients Std. err.	$P>\|t\|$
Study characteristics				
morethanonetime	2.480 (0.475)	0.000	3.4589 (0.275)	0.000
individual	−0.690 (0.377)	0.076	−0.766 (0.503)	0.151
dc	0.530 (0.196)	0.011	1.165 (0.276)	0.001
face	−1.751 (0.226)	0.000	−1.483 (0.249)	0.000
sample	1.985 (4.503)	0.662	−1.015 (8.298)	0.905
Good characteristics				
onlyrecreation	0.081 (0.377)	0.040	1.037 (0.227)	0.001
coniferous	−0.067 (0.247)	0.786	−0.391 (0.157)	0.027
Site and socio-economic characteristics				
sc	−0.426 (0.360)	0.245	−1.951 (0.368)	0.000
gdp	0.183 (0.093)	0.058	0.428 (0.118)	0.003
forestsurface	−0.673 (0.106)	0.000	−1.123 (0.232)	0.000
period1	0.593 (0.282)	0.043	0.704 (0.246)	0.013
_cons	2.127 (0.496)	0.000	0.409 (0.342)	0.254
	N = 101		*N* = 50	
	F = 92.64 Root MSE	*P*-value = 0.000 = 0.7434	*F* = 299.99 Root MSE	*P*-value = 0.000 = 0.4904
	R-squared = 0.83		*R*-squared = 0.91	
	Number of studies clusters = 35		Number of clusters = 14	

The standard errors were corrected for heteroskedasticity and serial correlation using the robust Huber–White variance estimator using Stata version 9.0.

participant is an individual the mean WTP is higher than if the participant is a household. Quiggin (1998) finds that under certain conditions, household WTP will be higher than individual WTP. The coefficient of the variable *sample* is negative, although not statistically significant. The negative sign of this coefficient has been found in previous meta-analysis, such as Noonan (2003).

Finally, the site and socio-economic characteristics indicate that studies conducted in other European countries (different from Scandinavia) provide a lower WTP than those conducted in the USA. This variable is significant at the 5% level. The variable denoting the proximity to urban areas is not statistically significant. Another result confirming the basic principles of economic theory is the positive and statistically significant influence of the GDP on the WTP estimate, suggesting a slightly elastic income effect. This result has also been obtained in other meta-analyses as well, such as Brander et al. (2006) and Ghermandi et al. (2008) for wetlands. This implies that high-income countries have a higher WTP for the protection of environmental goods than low-income ones. Furthermore, the forested size in the country (*forests*) of study has a negative effect on WTP estimates. This result could be related to the decreasing marginal utility provided by protecting an additional forest area, when the amount protected is already considerable. Lastly, the publication period of articles is positive and statistically significant for the period between 1996 and 2002. This is an unexpected result, because as societies increase in terms of environmental consciousness and income over time, WTP estimates should be higher. However previous meta-analyses have found the same conclusion, as Ojea and Loureiro (2009) and Noonan (2003) that included a time trend, where WTP estimates appear to be falling over time. Ojea and Loureiro (2009) points out that one possible explanation for decreasing WTP over time is due to the influences of methodological refinements introduced over time; caused in part due to the recommendations by the NOAA panel in the early nineties (Arrow et al., 1993).

Table 5
Meta-regression results expanded model (OLS Huber–White-adjusted standard errors).

Lnwtpppp	Coefficients (Std. err.)	$P>\|t\|$
Study characteristics		
annpermanent	1.082 (0.451)	0.022
anntemporal	0.414 (0.629)	0.515
individual	−1.515 (0.366)	0.000
dc	1.265 (0.357)	0.001
oe	0.725 (0.349)	0.045
face	0.968 (0.757)	0.210
mail	3.306 (0.835)	0.000
simple	−0.664 (4.509)	0.884
Characteristics of goods		
biodiversity	0.003 (0.297)	0.993
onlyflora	0.839 (0.596)	0.168
wooduse	−0.161 (0.471)	0.735
recreation	1.589 (0.350)	0.000
avoidchange	−0.532 (0.302)	0.087
nochange	−0.445 (0.405)	0.279
otherforest	0.634 (0.175)	0.001
rainforest	2.388 (0.537)	0.000
oldgrowth	0.225 (0.230)	0.458
size	0.001 (0.001)	0.407
Site and socio-economic characteristics		
rw	−0.462 (0.655)	0.486
sc	−0.957 (0.701)	0.181
reu	−1.964 (0.771)	0.016
urban	−0.887 (0.586)	0.140
gdp	0.660 (0.231)	0.007
forestsurface	−1.059 (0.137)	0.000
period1	0.330 (0.464)	0.281
period2	0.796 (0.467)	0.098
_cons	−1.038 (1.464)	0.483
	N = 101	
	F = 61.91 Root MSE *R*-squared = 0.8965	*P*-value = 0.000 Root MSE = 0.6384

Note: number of study clusters = 35. The standard errors corrected for heteroskedasticity and serial correlation using the robust Huber–White variance estimator using Stata version 9.0.

5. Conclusions

The present study has provided a comprehensive review of CV forest studies and through a meta-regression we contributed to the identification of the main determinants of forest valuation of ecosystem services. In order to reach this objective, we gathered information from more than thirty studies on forest valuation around the world. These results outline some important conclusions. Overall, and in terms of forest management, it seems that programs providing recreational benefits are preferred most by society. These results can be useful from the perspective of forest management. Forest managers should be aware of citizens' preferences when designing forest programs in order to increase their acceptability.

Despite the similarities of services evaluated in this meta-analysis, the summarized benefit estimates were assessed in different geographical locations and across a long time period. We conclude that with respect to the socio-economic variables evaluated, the GDP per capita and the forest area in the country of the study, among others, have a positive influence on WTP estimates. In addition, other study design variables, such as the question format and the frequency of payment also influence WTP estimates. The question format shows that OE and DC questions produce a higher WTP than the PC format. In terms of the ecological and physical characteristics of forests, we found that rain forests and a combination of deciduous and perennial forests are more valued than coniferous.

In recent years, the use of meta-regression models, based on existing studies, that estimate the value of resources at a new policy site has become a popular alternative instead of collecting original data (Moeltner et al., 2007). However, the difficulties related to the data gathering process from the original studies are an obstacle for the proliferation of such analyses. In fact, there have been numerous calls in the past for additional explanatory data to be made readily available from original studies for use in value transfers and meta-analyses (Zandersen and Tol, 2009). There is, however, a substantial academic and political interest in the potential for and validity of value transfer as it offers a means of estimating monetary values for environmental resources without performing relatively time consuming and expensive primary valuation studies (Brander et al., 2006). For these reasons, the main implication derived from this meta-analysis is that it may facilitate the estimation of benefit values in other sites when an empirical non-market valuation study is not feasible.

Acknowledgement

The authors acknowledge funding support from the Spanish Ministry of Environment, research program for National Parks, grant number 2007/PN005, as well as funding support from the Biodiversa Research Program, grant number EUI2008-03685 (FIREMAN).

References

Adamowicz, W., Boxall, P., Zhang, M., Haener, Y., Dosman, D., Marois, J., 2004. An assessment of the impacts of forest management on aboriginal hunters: evidence from stated and revealed preference data. Forest Science 50 (2), 139–152.

Adams, C., Seroa, R., Arigoni, R., Reid, J., Ebersbach, C., de Almeida, P.A., 2008. The use of contingent valuation for evaluating protected areas in the developing world: economic valuation of Morro do Diabo State Park, Atlantic Rainforest, Sao Paulo State (Brazil). Ecological Economics 66 (2–3), 359–370.

Amirnejad, H., Khalilian, S., Assareh, M., Ahmadian, M., 2006. Estimating the existence value of North forests of Iran by using a contingent valuation method. Ecological Economics 58, 665–675.

Arrow, K., Solow, R., Portney, P.R., Leamer, E., Radner, R., Schuman, H.E., 1993. Report of the NOAA panel on contingent valuation. Federal Registrer 58, 4601–4614.

Bateman, I., Jones, L.P., 2003. Contrasting conventional with multi-level modeling approaches to meta-analysis: expectation consistency in U.K. Woodland Recreation Values. Land Economics 79 (2), 235–258.

Bateman, I., Lovett, A., Brainard, J., 1999. Developing a methodology for benefit transfers using geographical information systems: modeling demand for woodland Recreation. Regional Studies 33 (3), 191–205.

Bateman, I.J., Carson, R.T., Day, B., Hanemann, M., Hanley, N., Hett, T., Jones, M., Loomes, G., Mourato, S., Ozdemiroolu, E., Pearce, D., Sugden, R., Swanson, J., 2002. Economic Valuation with Stated Preference Techniques: A Manual. Edward Elgar, Northampton, MA.

Bernath, K., Roschewitz, A., 2008. Recreational benefits of urban forest: explaining visitors' willingness to pay in the context of the theory of planned behavior. Journal Environmental Management 89 (3), 155–166.

Bijmolt, T.H.A., Pieters, R.G.M., 2001. Meta-analysis in marketing when studies contain multiple measurements. Marketing Letters 12 (2), 157–169.

Bostedt, G., Mattson, L., 1991. Skogens betydelse för turismen: En samha¨ llsekonomisk pilotstudie. (The importance of forests for tourism: a pilot cost–benefit analysis). Arbetsrapport, vol. 141. Department of Forest Economics, Swedish University of Agricultural Sciences, Umea.

Boyle, K., Poe, G., Bergstrom, J., 1994. What do we know about groundwater values? Preliminary implications from a meta analysis of contingent valuation studies. American Journal of Agricultural Economics 76, 1055–1061.

Brander, L., Florax, R., Vermaat, J., 2006. The empirics of wetland valuation: a comprehensive summary and a meta-analysis of the literature. Environmental and Resource Economics 33, 223–250.

Brander, L., Van Beukering, P., Cesar, H., 2007. The recreational value of coral reefs: a meta-analysis. Ecological Economics 68, 209–218.

Brent, R., 1998. Cost Benefits Analysis for Developing Countries. Edward Elgar Publishing Limited, Cheltenham, UK.

Brey, R., Riera, P., Mogas, J., 2007. Estimation of forest values using choice modeling: an application to Spanish forests. Ecological Economics 64 (2), 305–312.

Broberg, T., 2007. Assessing the Non-Timber Value of Old-Growth Forest in Sweden. Umeä Economic Studies, vol. 712. Department of Economics, Umeå University.

Brouwer, R., Langford, I., Bateman, I., Crowards, T. and Turner, R., 1997. A meta-analysis of wetland contingent valuation studies. Global Environmental Change Working Paper No. 97-20, Centre for Social and Economic Research on the Global Environment (CSERGE), University of East Anglia, Norwich, and University College, London.

Brouwer, R., Langford, I.H., Bateman, I.J., Turner, R.K., 1999. A meta-analysis of wetland contingent valuation studies. Regional Environmental Change 1 (1), 47–57.

Carson, R.T., Flores, N.E., Meade, N.F., 2001. Contingent valuation: controversies and evidence. Environmental and Resource Economics 19 (2), 173–210.

Champ, P., Bishop, R., 2006. Is willingness to pay for a public good sensitive to the elicition format? Land Economics 82 (2), 162–173.

Daily, G., 1997. Nature's Services: Societal Dependence on Natural Ecosystems. Island Press, Washington (DC).

Duthy, S., 2002. Whian Whian-state forest or national park: community attitudes and economic values. Economics Analysis and Policy 32 (2), 91–111.

Food and Agriculture Organization of the United Nations (FAO), 2006. Global Forest Resources Assessment 2005. FAO Forestry Paper No. 147, Rome.

Ghermandi, A., van der Bergh, J.C.J.M., Brander, L.M., de Groot, H.L.F., Nunes, P.A.L.D., 2008. The economic value of wetland conservation and creation: a meta-analysis. Nota di Lavoro No 79.2008. Fondazione Eni Enrico Mattei.

Glass, G., McGaw, B., Smith, M.L., 1981. Meta-Analysis in Social Research. Sage Publications, Beverley Hills, CA.

Gregory, R., 2000. Valuing environmental policy options: a case study comparison of multiattribute and contingent valuation survey methods. Land Economics 76, 151–173.

Gujarati, D.N., 2003. Basic Econometrics, 4th ed. McGraw Hill/Irwin, New York.

Gürlük, S., 2006. The estimation of ecosystem services' value in the region of Misi rural development project: results from a contingent valuation survey. Forest Policy and Economics 9, 209–218.

Hadker, N., Sharma, S., David, A., Muraleedharan, T., 1997. Willingness-to-pay for Borivli National Park: evidence from a contingent valuation. Ecological Economics 21, 105–122.

Haefele, M., Kramer, R.A., Holmes, T., 1992. Estimating the Total Value of Forest Quality in High-Elevation Spruce-Fir Forests. The Economic Value of Wilderness. General Technical Report SE-78. Southern Forest Experiment Station, Research Triangle Park, NC.

Hoen, H., Winther, G., 1993. Multiple use forestry and preservation of coniferous forests in Norway. Scandinavian Journal Forest Resource 8, 266–280.

Hoen, H.F., Veisten, K., 1994. En undersøkelse blant brukere av Oslomarka: synspunkter på skogtilstand og skogbehandling (A survey of the users of Oslomarka: attitudes towards forest scenary and forestry practices). Skogforsk 6/94.

Horowitz, J.K., McConnell, K.E., 2002. A review of WTA/WTP studies. Journal of Environmental Economics and Management 44, 426–477.

Horton, B., Colarullo, G., Bateman, I., Peres, C., 2003. Evaluating non-user willingness to pay for a large-scale conservation programme in Amazonia: aUK/Italian contingent valuation study. Environmental Conservation 30 (2), 139–146.

Hung, L., Loomis, J., Tien Thinh, V., 2007. Comparing money and labour payment in contingent valuation: the case of forest fire prevention in Vietnamese context. Journal of International Development 19, 173–185.

Hutchinson, W., Chilton, S., 1999. Combining preferences ordering and contingent valuation methods to assess non market benefit of alternative afforestation projects. Journal of Rural Studies 15, 103–109.

James, D., 1994. Application of environmental economics to sustainable management of the forests of South-East Australia. The Annals of Regional Science 28, 77–89.

Kahneman, D., Tversky, A. (Eds.), 2000. Choices, Values and Frames. Cambridge University Press, Cambridge.

Kennedy, P., 2003. A Guide to Econometrics, 5th ed. The MIT Press, Massachusetts.

Kleiber, O., 2001. Valuation of Recreational Benefits and Visitor Conflicts in an Urban Forest. Fifth International Conference of the International Society for Ecological Economics (ISEE), Russian Chapter (Russian Society for Ecological Economics). Institute of Control Sciences, Russian Academy of Sciences, Moscow, Russia.

Kniivilä, M., Ovaskainen, V., Saastamoinen, O., 2002. Costs and benefits of forest conservation: regional and local comparisons in Eastern Finland. Journal Forest Economics 8, 131–150.
Köhlin, G., 2001. Contingent valuation in project planning and evaluation: the case of social forestry in Orissa, India. Environmental and Development Economics 6, 237–258.
Kramer, R., Mercer, E., 1997. Valuing a global environmental good: U.S. residents' willingness to pay to protect tropical rain forests. Land Economics 73 (2), 196–210.
Krieger, D., 2001. Economic Value of Forest Ecosystem Services: A Review. The Wilderness Society, Washington, DC.
Kwak, S., Yoo, S., Han, S., 2003. Estimating the public's value for urban forest in the Seoul Metropolitan Area of Korea: a contingent valuation study. Urban Studies 40 (11), 2207–2221.
Lehtonen, E., Kuuluvainen, J., Pouta, E., Rekola, M., Li, C., 2003. Non market benefits of forest conservation in southern Finland. Environmental Science and Policy 6, 195–204.
Lindhjem, H., 2007. 20 Years of stated preference valuation of non-timber benefits from Fennoscandian Forests: a meta-analysis. Journal of Forest Economics 12, 251–277.
Lockwood, M., Loomis, J., DeLacy, T., 1993. A contingent valuation survey and benefit–cost analysis of forest preservation in East Gippsland, Australia. Journal of Environmental Management 38, 233–243.
Loomis, J., White, D., 1996. Economic benefits of rare and endangered species: summary and meta-analysis. Ecological Economics 18, 197–206.
Loomis, J., Lockwood, M., DeLacy, T., 1993. Some empirical evidence of embedding effects in contingent valuation of forest protection. Journal of Environmental, Economics and Management 24, 45–55.
Loomis, J., González-Cabán, A., Gregory, R., 1996. A Contingent Valuation Study of the Value of Reducing Fire Hazards to Old-Growth Forests in the Pacific Northwest. United States Department of Agriculture Forest Service Pacific Southwest Research Station Research Paper PSW-RP-229-Web.
Mäntymaa, E., Mönkkönen, M., Siikamäki, J., Svento, R., 2002. Estimating the demand for biodiversity-vagueness band and open ended questions. In: van Ierland, E.C., Weikard, H.P., Wesseler, J. (Eds.), Proceedings: Risk and Uncertainty in Enviromental and Resources Economics.
Mattsson, L., Li, C.Z., 1993. The non-timber value of Northern Swedish forests — an economic-analysis. Scandinavian Journal of Forest Research 8 (3), 426–434.
Mattsson, L., Li, C.Z., 1994. How do different forest management-practices affect the non-timber value of forests? — An economic-analysis. Journal of Environmental Management 41 (1), 79–88.
Mill, G., van Rensburg, T., Hynes, S., Dooley, C., 2007. Preferences for multiple use forest management in Ireland: citizen and consumer perspectives. Ecological Economics 60, 642–653.
Moeltner, K., Boyle, K., Paterson, R., 2007. Meta-analysis and benefit transfer for resource valuation—addressing classical challenges with Bayesian modeling. Journal of Environmental Economics and Management 53, 250–269.
Noonan, D., 2003. Contingent valuation and cultural resources: a meta-analytic review of the literature. Journal of Cultural Economics 27, 159–176.
Ojea, E., Loureiro, M.L., 2009. The Measurement of the Size Changes in CVM Studies: Does it Matter for Scope Tests? Bask Centre for Climate Change, mimeo.
Pouta, E., 2005. Sensitivity to scope of environmental regulation in contingent valuation of forest cutting practices in Finland. Forest Policy and Economics 7, 539–550.
Quiggin, J., 1998. Individual and household willingness to pay for public goods. American Journal of Agricultural Economics 80, 58–311.
Reaves, D., Kramer, R., Holmes, T., 1999. Does question format matter? Valuing an endangered species. Environmental and Resource Economics 14, 365–383.
Richardson, L., Loomis, J., 2008. The total economic value of threatened, endangered and rare species: an updated meta-analysis. Ecological Economics 68 (5), 1535–1548.
Rosenberger, R., Loomis, J.B., 2000. Using meta-analysis for benefit transfer: in sample convergent validity tests of an outdoor recreation database. Water Resources Research 36, 1097–1107.
Sattout, E., Talhouk, S., Caligari, P., 2007. Economic value of cedar relics in Lebanon: an application of contingent valuation method for conservation. Ecological Economics 61, 315–322.
Scarpa, R., Chilton, S., Hutchinson, W., Buongiorno, J., 2000. Valuing the recreational benefits from the creation of nature reserves in Irish forests. Ecological Economics 33, 237–250.
Shechter, M., Reiser, B., Zaitsev, N., 1998. Measuring passive use value. Environmental and Resource Economics 12, 457–468.
Shrestha, R.K., Loomis, J.B., 2001. Testing a meta-analysis model for benefit transfer in international outdoor recreation. Ecological Economics 39, 67–83.
Shrestha, R., Loomis, J., 2003. Meta-analytic benefit transfer of outdoor recreation economic values: testing out-of-sample convergent validity. Environmental and Resource Economics 25, 79.
Smith, K., Kaoru, Y., 1990. Signals or noise? Explaining the variation in recreation benefit estimates. American Journal of Agricultural Economics 72 (2), 419–433.
Smith, V.K., Osborne, L.L., 1996. Do contingent valuation estimates pass a "scope" test? A meta-analysis. Journal of Environmental Economics and Management 31 (3), 287–301.
Svedsäter, H., 2000. Contingent valuation of global environmental resources: test of perfect and regular embedding. Journal of Economic Psychology 21, 605–623.
Treiman, T., Gartner, J., 2006. Are residents willing to pay for their community forests? Results of a contingent valuation survey in Missouri, USA. Urban Studies 43 (9), 1537–1547.
Tÿrväinen, L., 2001. Economic valuation of urban forest benefits in Finland. Journal of Environmental Management 62, 75–92.
Tÿrvänein, L., Väänänen, H., 1998. The economic value of urban forest amenities: an application of the contingent valuation method. Landscape and Urban Planning 43, 105–118.
United Nations Environment Programme (UNEP), 2004. Wildland fires, a double impact on the planet. Environment Alert Bulletin, DEWA / GRID-Europe.
Veisten, K., Narvud, S., 2006. Contingent valuation and actual payment for voluntarily provided passive-use values: assessing the effect o fan induced truth-telling mechanism and elicitation formats. Applied Economics 38, 735–756.
Walsh, R., Bjonback, D., Aiken, R., Rosenthal, D., 1990. Estimating the public benefits of protecting forest quality. Journal of Environmental Management 30, 175–189.
Walsh, R., Johnson, D., McKean, J., 1992. Benefit transfer of outdoor recreation demand studies, 1968–1988. Water Resources Research 28, 707–713.
Woodward, R.T., Wui, Y.S., 2001. The economic value of wetland services: a meta-analysis. Ecological Economics 37, 257–270.
Zandersen, M., Tol, R.S.J., 2009. A meta-analysis of forest recreation values in Europe. Journal of Forest Economics 15 (1–2), 109–130.