PERIODICUM BIOLOGORUM
VOL. 111, No 4, 515–521, 2009

UDC 57:61
CODEN PDBIAD
ISSN 0031-5362

Original scientific paper

Review of nonmarket forest goods and services evaluation methods

DIJANA VULETIĆ
MIROSLAV BENKO
TOMISLAV DUBRAVAC
SILVIJA KRAJTER
VLADIMIR NOVOTNY
KRUNOSLAV INDIR
IVAN BALENOVIĆ

Croatian Forest Research Institute
Cvjetno naselje 41
10450 Jastrebarsko
Croatia

Correspondence:
Dijana Vuletić
Croatian Forest Research Institute
Cvjetno naselje 41
10450 Jastrebarsko
Croatia
E-mail: dijanav@sumins.hr

Key words: Nonmarket Evaluation Methods, Forest service based recreation, Evaluation Methods, Quantification of benefits

Abstract

Background and Purpose: *Natural resource systems that are commercially exploitable, such as forests, are valued by using many different factors. Policy makers and other decision makers must choose between scenarios in which there can be clear market values with easy to document influences on economy or scenarios in which the value is placed on difficult to document factors, such as the importance of natural systems, forest services without market values, and the benefits to human wellbeing. Several methods are described in this paper for documenting the non-market values that forest goods and services provide. We discuss different methods and assessment tools that provide different types of information, quantitative and qualitative, with respective strengths and weaknesses from varied scientific and decision-support perspective. In an attempt to provide scientists with different views and ideas, as well as planners and managers with a general appreciation of methods and their application, we have included selected examples that influence policy and/or management practices.*

Material and Methods: *Most of the material has been developed based on a number of basic text books describing evaluation methods from the perspective of development and grounded in economical theory with a wide range of application. The second part has been developed from a list of references dealing with application in European countries and enriched with details and examples from documents based on seventeen country reports. The structure of those country reports was predefined, discussed, harmonized and completed by a group of scientists and professionals involved in COST action E-33, »Forest for recreation and tourism.« Evaluation methods related to forest goods and services were described from theoretical and practical viewpoints with emphasis on their applicability to a specific type of research.*

Results and Conclusion: *Nonmarket values of forest goods and services can be estimated in a number of different ways. The methods can be divided into two basic categories: first, based on market prices, and second, based on non-market evaluation. Our focus is on the second strategy where the market prices are not known. Further division of this method goes in two broad categories according to the nature of the data generated for modelling and estimation: (a) »stated preference methods« where individuals' preferences are not observed but rather stated, and (b) »revealed preference methods« where we can observe people acting in real-world settings where people live with the consequences of their choices.The most widely used method for valuing natural resources is the contingent valuation (CV) method. Choice experiments (CE) and hedonic pricing (HP) methods have been included in far fewer empirical studies, but the application of these methods has passed the demonstration stage. We also discuss the newly developed methods of benefit transfer and meta-analysis which use values, functions, and other descriptions from other studies to evaluate natural resources.*

Received July 10, 2009.

INTRODUCTION

Forests provide a variety of services to society that have become of crucial interest to different groups of users, as well as to policy makers and managers. Forest users are concerned with the utilization of those services for their own purposes, while other actors are focused on the preservation of natural resources in the wider sense. Policy makers are asked to craft policies that meet the concerns and demands of forest consumers. Forest managers then put those policies into practice and make the desired scenarios feasible for implementation. All three groups need data to support their arguments in different discussion forums, to enable comparison of two or more scenarios, and to choose between different policies. Why do they need values? Why is the fact that *only by the preservation of nature can we preserve our environment and life* not enough? and why is the people's right to enter the forest and use its services so difficult to incorporate in management plans? The answers lie in the scarcity of the forest resources that we use, and therefore we must make choices about how we manage the human impact on natural systems. Natural resource systems such as forests, which are commercially exploitable, are often part of many different policy scenarios. Policy makers and other decision makers must choose between scenarios in which there can be clear market values with easy to document influences on economy or scenarios in which the value is placed on difficult to document factors such as the importance of natural systems, forest services without market values, and benefits to human wellbeing. Economic evaluation of non-market natural resources has become of interest to many economists over the last 100 years, but only in the last 30 years has real progress been made in the development of the theories, methods, approaches, and tools that effect different implementations of policy.

The focus of this paper is on methods of non-market evaluation of forest services with the use of different sources of reference materials that describe basic theories and approaches to policy. These theories are enriched with country reports from seventeen European countries supported by important national references and examples of the implementation of various methods. The overall material is intended to describe methods commonly used for non-market evaluations of forest goods and services that provide scientists, planners, managers, and decision makers with different views and ideas of evaluation, along with answers to some questions on how to evaluate scenarios and support arguments.

MATERIALS AND METHODS

Much of the material has been collected from several text books that describe non-market evaluation methods from the perspective of development, their roots in economic theory, and their capabilities to measure different types of values related to forest goods and services. In addition, special attention has been given to the literature that explains different methods and background for policy and management decisions, and other relevant theoretical and policy influencing references. These materials were enriched with some findings and information from semi structured predefined country reports of seventeen European countries (members of COST action E33 »Forest for recreation and tourism«, WG1) *(1)*. Country reports were divided into three parts: economic evaluation, societal evaluation, and necessary research. The first two parts consist of descriptions of implemented methods with determined values, the scope, and policy influences enriched with examples of good practice. The last part consists of identified needs for future research and important national references. This part served for documenting implementation of different methods in different countries with special attention to policy influences that some of them had made.

All previously mentioned materials and information used for the purpose of preparing this paper are divided into two parts: 1 – division of methods and 2 – description of methods that forms the main section of Results.

Division of methods

The economic value of forest services can be estimated in a number of different ways. General division of methods can be in two basic categories *(2), (3):* the first are based on market prices and the second are based on non-market evaluation (Figure 1). Our focus will be on the second category, where the market prices for forest

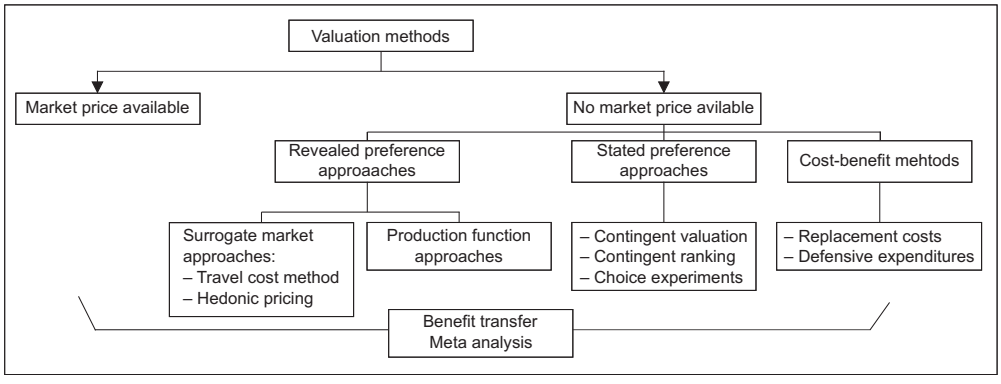

Figure 1. *General division of valuation methods (Bateman 1994).*

services are not available. Further division of this method goes into two broad categories according to the nature of the data generated for modeling and estimation: a – »stated preference methods,« where individuals' preferences are not observed but rather are stated, and b – »revealed preference methods,« where we can observe people acting in real-world settings where people live with the consequences of their choices.

Although cost-benefit analysis methods are often used for expression of costs and benefits, values for physical, technical, or economic parameters must be known for model to be effective. However, there are often situations in which the values for physical, technical, and economic parameters are not known with certainty because the measurement of environmental values has not caught up. This leads us to the fact that this method, if used for forest service evaluation, should use values from the newly developed methods by the first two groups. Tyrväinen argues that »*One of the main goals of producing value estimates is to use them in cost-benefit analysis, which means assessing whether the benefits exceed the costs of providing the services.*« *(4)*. For that reason this method will not be explained here. Other methods that use values, functions, or any other descriptions of two sites from other studies, such as those on benefit transfer method and meta-analysis, are newly developed and will be addressed shortly.

RESULTS

Description of methods

Stated preference methods

The stated preference approaches rely on answers to survey questions that differ from study to study in the methods used and the type of questions offered or asked, in the form of monetary amounts, choices, rating or other way of stating preferences. According to the applied model, answers are scaled with the aim to yield a measure of value. The main problem hindering wide acceptance of study results stems from the distrust of many economists and other professionals in people's willingness or ability to answer questions truthfully and carefully. With this in mind, it is important to stress that the main strength of this method is in carefully worded survey questions. As some authors argue *(5),* well designed surveys can avoid many of the potential problems of validity and show that surveys are often the most effective way to understand people's preferences. Also with these methods we can estimate passive use values, like values of wilderness preservation, which are not clearly linked to consumption of market goods and in which case the revealed preferences method simply does not work. In Table 1 the main characteristics of stated preference methods are presented. Although 'valuation' in economics is commonly understood as measurement of monetary values, it also refers to ordering preferences among goods or attributes. Goods can be any object, public program, habitat, environmental change, or recreation experience described by attributes that are characteristic of those goods.

Contingent valuation method

The contingent valuation method was developed in the USA in the 1960s *(6)* with an aim to measure monetary values that people place on goods, services, and amenities. It is a survey-based method providing a way to estimate values when markets do not exist. Today, it is the most frequently used stated preference method, which suggests wide academic and professional acceptance. The contingent evaluation method can be designed and applied to different policy issues ranging from recreational to health care applications *(7, 8, 9)*.

The first step in conducting a contingent evaluation study is identification of a change in quantity or quality which is to be valued and the values which are going to be estimated. This step is about setting the theoretical model of the value and developing the survey wording to describe conditions with and without the policy (project) to be valued. The second step is the selection of a data collection mode and sample size. The most common and least expensive way of collecting data is via a mail survey *(10),* but personal interviews *(11),* telephone survey *(12),* or recently developed internet or e-mail surveys can also be used. Each method has its relative strengths and weaknesses and requires different administration procedures. The next step is the development of the survey instrument which, other than the data analysis, is considered the most important factor. The survey instrument consists of two equally important parts. One is the development of the information component of the survey instrument which must a – describe the item to be valued by information on change in the quantity, quality, or probability to be valued; b – explain the provision method or mechanism by which a policy (project) will be implemented; c – select the payment vehicle (income taxes, increase in price, admission fee, utility bill or donations) and d – time frame of payment (how many and how frequently payments are required for the policy). The other

TABLE 1

Characteristics of Stated Preference Methods related to forest services.

Method	Valuation objective	Number of items judged	Object values
Contingent valuation	Monetary value	One (more)	Good (attribute)
Attribute-based methods	Preference order or monetary values	Several	Attributes

Source: Adjusted from A Primer of Nonmarket Valuation (Champ *et al*., 2003)

TABLE 2

Relative strengths and weaknesses of response formats.

Characteristics	Open Ended	Payment card	Dichotomous choice
Theoretically incentive compatible	No	No	Has some desirable properties
Bid design required	No	Yes	Yes
Responses/statistical efficiency	Continuous	Interval	Interval
Potential problems	Zero bids, fare share responses	Anchoring	Anchoring, voting as good citizen, yea saying

Source: Adjusted from A Primer of Nonmarket Valuation (Champ *et al*. 2003)

component of the survey instrument is design of two types of questions: contingent evaluation and auxiliary questions. For CV questions there are three primary formats: open ended, payment card, and the most commonly used, dichotomous choice. Relative strengths and weaknesses of each response format are given in Table 2. Dichotomous choice provides a safe approach when framed as a referendum vote although it is not always applicable for estimating forest services. In addition, it is important to allow for respondents to respond with »0« values and develop questions with the aim to screen protest and other types of misleading responses. Some respondents can hold »0« as the value of some policy, but they can also use this response to reject some component of the research that they feel is unethical as a protest, and these responses have to be dealt with differently *(13)*. The second type of question, auxiliary questions, play a role in providing covariates for statistical analyses and help in assessing the validity of evaluation responses by asking respondents about their income, baseline levels of valued policy (project) or respondents' own subjective perceptions of the resource *(14)*. For any kind of survey pre-testing, it is very important to test respondents' understanding of questions and to see if we are getting the information that we have asked for. The simplest form of pre-testing is with a face-to-face interview with a member of the target group. At the end of the project, there are a variety of procedures for data analysis that must align with the chosen guiding theory. At this stage, investigation choices can substantially affect welfare estimates, which are crucial to estimation credibility.

Attribute-based methods

The methods discussed above have been developed only recently, over last decades *(15)*. These relatively new methods of stated preferences models employ different constructs for eliciting preference with the objective of estimating economic values for a technically divisible set of attributes of an environmental good. This means that responses to survey questions can vary in levels of attributes describing an environmental good or service, and the information obtained by this method can provide managers and policy makers with detailed information about public preferences for every state of good or level of attribute. Price or any monetary amount can be included as an attribute. The most popular response formats are: ratings, rankings, and choice (refers to contingent ranking and choice experiments from Figure 1). This ability to decompose values of environmental programs (services) into implicit values associated with particular attributes of those programs (services) has made these methods attractive to environmental economists *(16, 17, 18)*. Steps in applying the attribute based experiment start with characterization of the decision problem and description of the attributes that are critical for successful application. Based on those, the experiment is designed or different alternatives are constructed to be presented to respondents. There are substantial parts of questions in surveys that can be administered in many ways: via mail, telephone, computer-assisted, intercept surveys, or internet-based. After data is collected the analysis of different parameters in chosen models are estimated econometrically. Econometric modeling depends on response format and a variety of other considerations. Depending on the aim of experiment, which can include generating welfare measures, predictions of behavior, or both, the results can be interpreted for policy analysis or to support decisions. Those methods are still in the period of early application and researchers will continue to evaluate their effectiveness by evaluating and testing their performance *(19),* improving econometric analysis of data and improving its design in general.

Revealed preference methods

Revealed preference methods estimate values people place on environmental amenities based on purchase decisions (prices paid and quantities purchased) in the real market. This means that those methods rely on data that records people's actual choices (revealed behavior) and are used to estimate use values only. Two of the four commonly used methods are frequently applied to environmental amenities and forest services: travel cost method and hedonic pricing method. The defensive behavior method can be used for estimating the value of environmental dis-amenities or people's willingness to pay to avoid negative environmental influences. Similar comparison to this method is the cost of illness method, where we simply sum the direct cost of doctor visit and medicine and indirect costs of lost time of work. This can be used for estimating the costs of treating an environmentally induced illness. The main characteristics of this method are given in Table 3.

TABLE 3

Characteristics of Revealed Preferences Methods related to forest services.

Method	Revealed Behavior	Conceptual Framework	Type of Application
Travel Cost Method	Participation in recreation activity and site chosen	Household production, weak complementarity	Recreation demand
Hedonic Pricing	Property purchased or choice of employment	Demand for differentiated goods	Property value and wage models
Defensive Behavior	Expenditures to avoid illness or death	Household production, perfect substitutes	Morbidity/mortality
Cost of Illness	Expenditure to treat illness	Treatment costs	Morbidity

Source: Adjusted from A Primer of Nonmarket Valuation (Champ *et al*. 2003)

Travel cost method

Travel cost method is often used to value recreational uses of the environment. It is a demand-based model for use of a recreation site or sites that may be close to or in forests. The single-site travel cost models need to be separated from those for multiple-sides. Single-site models have the basic premise that the number of trips to the recreation site will decrease with increases in the distance traveled, and increase with the quality of a site *(20)*. We use this model when the goal is to estimate the total use or »access value« of a site. When our goal is valuing changes in site characteristics in one or more sites, or valuing access to more than one site simultaneously, then a multiple-site model is preferred. Application of the method goes in several steps: a – definition of the site to be valued, b – definition of recreation uses and season (it can be only one use or multiple uses, as well as seasons), c – developing of a sampling strategy (on-site or off-site sampling, each with its own characteristics and issues to be addressed), d – specification of the model, e – decision on how to treat multiple purpose trips, f – designing and implementing the survey and g – data analysis and calculations (measuring trip costs, estimating model parameters and calculation of access value). It is important to note that different statistical models will be used for single-site and for multiple-sites modeling, where the model of random utility maximization (RUM) is the most widely used multiple-site model *(21, 22)*. How to treat multiple purpose trips is up to researchers and there is no easy answer to that question. The fact is that single-purpose trips fit the travel cost model well, especially one-day trips without staying overnight. Multiple purpose trips are more complicated because of the problems with apportion of trip cost across the different purpose. One solution to this is to assume that all trips are single purpose or to ask respondents to report multiple and single purpose trips separately. Also, we can exclude from analysis multiple purpose trips or accommodate multiple purpose trips in the basic model (*23*, *24*). They broaden the definition of a site to include multiple purpose trips and then apply the basic travel cost model. Designing and implementing a survey follows rules from the previous chapter, only these surveys usually consist of four groups of questions: introductory, trip count questions, last trip question, and demographic characteristics questions. Trip costs present the sum of the expenses required to make a trip possible (travel costs, access fees, equipment costs, and time costs). Estimation of model parameters together with calculation of access value will follow rules of the chosen statistical model *(25)*.

Hedonic Pricing Method

The Hedonic pricing method has been used for the last 30 years to evaluate the price of environmental commodities related to housing. The fundamental idea is that the price of a housing unit is a combination of different characteristics of that particular house or apartment, as well as its location and the quality of environment. It has been used for mainly assessing urban forest values *(26)* or values of environmental amenities attached to housing. The application of hedonic pricing method can be divided into two stages: 1 – estimating of hedonic price function using information about the price of a commodity and the characteristics of the commodity, and 2 – estimating the demand functions for the characteristics of the commodity using implicit prices obtained in the first stage. Most studies stop after the first stage due to the fairly simple data needs related to housing, but when about tourist locations placed in forests or in open space are in question it is not that simple to describe apartments or houses when there is limited data amount. Usually those apartments or houses are quite similar to each other and market transactions are infrequent. Here we can get some help from geographic information systems (GIS) which help us to describe and differentiate one location from another. Use of GIS significantly reduces the time needed for measuring extensive sets of variables describing the benefits of urban and peri-urban forests attached to housing. Steps in applying the hedonic pricing method are: a – definition of the value to be estimated, b – collection of data on property value (sales price, tax assessment, and rental or lease prices), c – choosing the functional form, d – addressing spatial dependence and e – computation of welfare measures for localized changes in amenities. The most sensitive steps are the choice of functional form and defining the sample frame when we have to consider market segmentation and the time frame of collected data.

Benefit transfer and meta-analysis methods

Benefit transfer is a general term referring to the adaptation of existing information and knowledge to a new context *(27)*. It is actually the use of existing data or information in a setting other than that for which it was collected. The use of benefit transfer to obtain estimates for non-market goods and services started only decades ago and, besides that this is our main interest, it is important to know that this method has a much broader potential.

Benefit transfer method

In the benefit transfer method we adapt economic information derived from a specific »study site« under certain resource and policy conditions to another site with similar resources and conditions (policy site). This has been suggested as a practical way to evaluate management and policy impacts when primary research is not possible or justified because of budget or time limitations. Two broad approaches are usually used 1 – value transfer and 2 – function transfer. By value transfer we mean direct application of original research summary statistics to a policy site. Here we can transfer point estimates, measures of central tendency, or administratively approved estimates. In function transfer we transfer functions or statistical models from study to policy site. Steps of application are a – definition of policy context (characteristics of a policy site), b – location and gathering of original research outcomes, c – screening of original research studies for relevance to policy site, d – selection of a point estimate or range of point estimates to be transferred, and e – transfer of estimates. The last two steps have to be adopted if function transfer is in question. For valid benefit transfer, basic requirements are a complete, searchable, and accessible database of studies together with best-practice criteria for assessing the quality of primary evaluation study outputs and for benefit transfer application as well. There are several databases developed for this purpose, some international like ENVALUE *(28)* and some national, which do not cover entire Europe. An excellent attempt is ValueBase SWE developed in Sweden *(29)* and the Canadian Environmental Valuation Reference Inventory (EVRI) *(30)* which is also open to researchers from Europe.

Meta-analysis

Meta-analysis is a function transfer approach that summarizes and synthesizes outcomes from several studies to be transferred to a policy site. There are two main approaches 1 – pooling the actual data from multiple studies, and 2 – using summary statistics from multiple studies. This analysis enables us to overcome some of the deficits of value and function transfer methods where we can have high transfer errors due to specifics of study sites. In meta-analysis, the primary focus is understanding the influence of methodological and study-specific factors on research outcomes and providing summaries of past research *(31)*. Its use on environmental and natural resources starts in the early 1990s *(32, 33),* and a number of papers suggest that meta-analysis transfers perform better than benefit function transfers *(34, 35)*.

So far, benefit transfer methods are still being developed and most researchers agree on the need of clear criteria for assessing the quality of primary study or study site values *(36)* which must consider 1 – scientific soundness regarding data collection procedures; 2 – relevance, such as affected services and commodities, property right etc. and 3 – richness in details by presenting definition of variables and means, treatment of substitutes, etc. Previously mentioned databases can serve both approaches and, in the long run, they will illustrate gaps in the body of evaluation research with respect to environmental goods and services.

DISCUSSION

Forestry has always served society in many ways, but recently societal demands from the forests are for much more than just timber, biological diversity, and ecological benefits. With growing urbanization, the linkage between forest management operations and the variety of benefits that forests provide has become clearer, which has implications on policy levels as well. This newly emerged field of delivering multifunctional services is on the agenda of most forest policies, along with the issue of values used for comparing different policies or choosing between different scenarios. When natural resources in forests are part of scenarios, the questions of values become more complex due to the nonexistence of markets for a wide range of the forest goods and services. During the last decades, a number of non-market evaluation methods were developed for the purpose of capturing and measuring the use and non-use values of natural resources. This paper deals with frequently used methods, with the intention of stressing the importance of choosing the most appropriate method, the possibilities and needs of combining the methods, and most sensible phases in application concerning the validity of results.

Both groups of methods described use surveys as the main tool for collecting information. If the surveys are well designed, researchers can avoid many of the potential problems of validity and results show that surveys are often the most effective way to understand people's preferences.

Revealed preference methods are generally accepted by economists because they are based on actual decisions people have made. The limitation of this method is in the inability to estimate non-use values and values for levels of quality that have not been experienced.

Stated preference methods are able to capture non-use values, but many scientists question the ability of respondents to value specific services and their honesty in stating the values, especially when it is about willingness to pay for some services or willingness to accept compensation for losing part of it. Carefully designed and administered, attribute based methods can provide defensible estimates of environmental value for behavioral analysis (such as recreational choice) or passive use evaluation.

However, policy makers must make decisions concerning the use of natural resources, and recently those decisions dealt with the multiple-use of forests and the in-

tegration of different demands and interests in an optimal way. To meet those demands, the general trend in evaluation methods goes in the direction of combining two or more methods to get the relevant answer on policy questions. Furthermore, there are methods that use and combine results (values, information, and preferences) from different previous studies like benefit transfer methods.

Clearly, primary research is the most desirable way of gathering the information specific to any action being evaluated. However, when this is not possible, then benefit transfer becomes an important second-best strategy for answering the need to develop and apply assessment approaches that can strengthen the science-policy interface by acting as decision-support tools within the wider forest and regional policy making context.

REFERENCES

1. SIMPSON M, PICHLER V, TYRVÄINEN L, COLLINS K, MARTIN S, STRANGE N, VULETIĆ D 2008 The economics and social values of forests for recreation and nature tourism: A research overview. COST Action E33: Forest for Recreation and Nature Tourism (FORREC). Available at: www.openspace.eca.ac.uk/cost33/outputs.htm. COST, European Science Foundation.
2. MERLO M, CROITORU L 2005 Valuing Mediterranean Forests. Towards Total Economic Value. CABI Publishing, Wallingford, UK.
3. BATEMAN J 1994 Research Methods for Valuing Environmental Benefits. *In*: Doubaard A, Bateman I, Merlo M (*eds*) Identification and Valuation of Public Benefits from Farming and Countryside Stewardship. Wissenschaftsverlag, Vauk, Kiel.
4. TYRVÄINEN L, BUCHECKER M, DEGENHARDT B, VULETIĆ D 2008 Evaluating the economic and social benefits of forest recreation and nature tourism. *In*: Bell S, Simpson M, Tyrväinen L, Sievanen T, Probstl U (*eds*) European Forest Recreation and Tourism. Taylor & Francis, London and New York, p 35–63
5. MANSKI C F 2000 Economic Analysis of Social Interactions. *Journal of Economic Perspectives 14 (3):* 115–136
6. DAVIS R K 1963 Recreation Planning as an Economic Problem. *Nat Resour J 3(3):* 239–249
7. TYRVÄINEN L 1999 Monetary valuation of urban forest amenities in Finland. Academic dissertation. Finnish Forest Research Institute. *Research papers 739:* 53–76
8. ALBERINI A, KRUPNICK A 2000 Cost-of-illness and Willingness-to-pay. Estimates of Improved Air Quality: Evidence from Taiwan. *Land Econ 76 (1):* 37–53
9. DICKIE M, GERKING S 1996 Formation of Risks, Beliefs, Joint Production and Willingness to Pay to Avoid Skin Cancer. *The Review of Economics and Statistics 78 (3):* 451–464
10. SCHNEEMANN M 1997 A Meta-Analysis of Response Rates to Contingent Valuation Surveys Conducted by Mail. Unpublished M.S. Thesis, University of Maine.
11. MITCHELL R C, CARSON R T 1989 Using Surveys to Value Public Goods: the Contingent Valuation Method. Resources for the Future, Washington, DC.
12. SCHUMAN H 1996 The Sensitivity of CV outcomes to CV Survey Methods. *In:* Bjornstad D, Kahn J (*eds*). The Contingent Valuation of Environmental Resources: Methodological Issues and Research Needs. Edward Elgan Publishing, Cheltenham, UK.
13. AHEARN M, HELLERSTEIN D, BOYLE K J 2003 Designing a Contingent-Valuation Study to Estimate the Benefits of the Conservation Reserve Program on Grassland Bird Populations. *In*: Kahn J, Bjornstad D, Alberini A (*eds*) The Contingent Valuation Handbook Cheltenham. Edward Elger, UK.
14. ADAMOWICZ W, SWAIT J, BOXAL P, LOUVIERE J, WILLIAMS M 1997 Perceptions versus Objective Measures of Environmental Quality in Combined Revealed and Stated Preference Models of Environmental Valuation. *J Environ Econ Manage 32 (1):* 65–84
15. RAE D A 1983 The Value to Visitors of Improving Visibility at Mesa Verde and Great Smoky National Parks. *In*: Rowe R D, Chesnut L G (*eds*) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Westview Press, Boulder, CO.
16. GARROD G D, WILLIS K G 1998 Using Contingent Ranking to Estimate the Loss of Amenity Value for Inland Waterways from Public Utility Service Structures. *Environ Resour Econ 12:* 241–247
17. LAYTON D F 2000 Random Coefficient Models for Stated Preference Surveys. *J Environ Econ Manage 40:* 21–36
18. MORRISON M, BOYLE K 2001 Comparative Reliability of Rank and Choice Data in Stated Preference Models. Paper presented at the European Association of Environmental and Resource Economics 2001 Conference, Southampton, UK, June.
19. CARLSSON F, MARTISSON P 2001 Do Hypothetical and Actual Marginal Willingness to Pay Differ in Choice Experiments? Application to Valuation of the Environment. *J Environ Econ Manage 41:* 179–192
20. LOOMIS J WALSH R 1997 Recreation Economics Decision: Comparing Benefits and Costs (2nd Edition). Venture Publishing, State College, PA.
21. PARSONS GR, MASSEY D M, TOMASI T 1999 A Comparison of Welfare Estimates from Four Models for Linking Seasonal Recreational Trips to Multinomial Logit Models of Site Choice. *J Environ Econ Manage 38:* 143–157
22. PARSONS G R, MASSEY D M 2003 A RUM Model of Beach Recreation. *In*: Hanely N, Shaw W D, Wright R E, Coleman J C (*eds*).The New Economics of Outdoor Recreation. Edward Elgar, Cheltenham, UK.
23. MENDELSOHN R, HOF J, PETERSON G, JOHNSON R 1992 Measuring Recreation Values with Multiple Destination Trips. *Am J Agric Econ 74:* 926–933
24. PARSON G R, WILSON A J 1997 Incidental and Joint Consumption in Recreation Demand. *Agricultural and Resource Economics Review 26:* 1–6
25. CHAMP P A, BOYLE K A, THOMAS C B 2003 A Primer on Nonmarket Valuation. Kluwer Academic Publishers, Dordrecht, Boston, London, p 1–567
26. TYRVÄINEN L, PAULEIT S, SEELAND K, DE VRIES S 2005 Benefits and uses of urban forests and trees. *In*: Nilsson K, Randrup T B, Konijnendijk C C (*eds*) Urban Forests and Trees in Europe: A Reference Book. Springer Verlag, p 81–114
27. ROSENBERGER R S, LOOMIS J B 2001 Benefit transfer of outdoor recreation use values: A technical document supporting the Forest Service Strategic Plan (2000 revision). Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, p 59
28. www.environent.nsw.gov.au/envalue/StudyCnt.asp
29. www.beijer,kva.se/valuebase.htm
30. www.evri.ca
31. STANLEY T D, JARRELL S B 1989 Meta-regression Analysis: A Quantitative Method of Literature Surveys. *Journal of Economic Surveys 3:* 161–170
32. SMITH V K, KAORU Y 1990 Signals or Noise? Explaining the Variation in Recreation Benefit Estimates. *Am J Agric Econ 72(2):* 419–433
33. WALSH R G, JOHNSON D M, MCKEAN J R 1992 Benefit Transfer of Outdoor Recreation Demand Studies: 1968–1988. *Water Resources Research 28(3):* 707–713
34. BROUWER R, SPANINKS F A 1999 The Validity of Environmental Benefit Transfer: Further Empirical Testing. *Environ Resour Econ 14:* 95–117
35. VANDENBERG T P, POE G L, POWELL J R 2001 Assessing the Accuracy of Benefit Transfers: Evidence from a Multi-site Contingent Valuation Study of Groundwater Quality. *In*: Bergstrom J C, Boyle K J, Poe G L (*eds*) The Economic Value of Water Quality. Mass: Edward Elgar Publishing.
36. DESVOUSGES W H, JOHNSON F R, SPENCER H S 1998 Environmental Analysis with Limited Information. Edward Elgar Publishing, Cheltenham.