Ph.D. School of Management and Business Administration

SUMMARY

Zsolt Krajnyik

Monetary valuation of natural resources in Hungary and Slovakia using the choice experiment method

(Ph.D. dissertation)

Supervisor:

Marjainé Szerényi Zsuzsanna, Ph.D.

head of department

Budapest, 2008

DEPARTMENT OF ENVIRONMENTAL ECONOMICS AND TECHNOLOGY

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Contents

1. Previous Research and Importance of the Topic

Environmental valuation goes back over 50 years and was considered a typically North-American practice from the 1970's. After its necessity was recognized, it started to spread first in Europe, then in countries of other continents. In Hungary, similar researches were initiated in the mid 1990's, while in Slovakia it is still at an elementary stage.

The valuation may be carried out in a monetary or a non-monetary way. The monetary evaluation is not a simple task as there is no market that could measure the price of such environmental goods as landscape, clear air, flora, fauna, national parks or cave systems, etc. Moreover, scholars representing the different fields of science are very much divided by the concept of monetary valuation of natural resources.

This dissertation solely discusses monetary valuation. Usually when evaluating interventions/investments that concern environmental goods, only the direct cost/benefits are estimated leaving out the value of altering the environment; thus decisions are made based on data reckoning with a small field of impacts and not taking into account the broader scope of social impacts. One of the main role of the monetary valuation is to try denote the positive value of the environmental goods in money within the broader scope of social impacts

Applying different methods of monetary valuation, including choice experiment, has become accepted in the United States but there is more importance attached to valuing the change in environmental goods in money throughout the European Union too. Although the number of applied cases in practice is high in European countries it is still significantly lower than those evaluation cases put to use in the United States (Marjainé Szerényi, 2000; Garrod-Willis, 1999; In: Kerekes et al., 2001; Grasso and Pareglio, 2002).

It is fundamental in those countries where monetary valuation of environmental goods has been or is practised to accept and apply the results of research in practice and to include them in decision-making to a higher degree. Turner et al. (2003) claim to that it is essential to expand research related to monetary valuation of environmental goods in the future as a consequence of which the results can be combined with social-political as well as social-cultural knowledge and thus provides more comprehensive information on the policy of sustainable development.

During my researches, I elaborated the methodology of the choice experiment method which belongs to the group of the stated preference techniques, and then I applied it to evaluate the Baradla-Domica cave system. I partly chose the choice experiment method to apply it among the first times in Hungary and for the first time in Slovakia. Also partly because its application has

become widespread all over the world for the last two decades as well as its scientific acceptance and significance have increased more and more. Beyond this, it has a comprehensive, reliable and professionally high quality based on related literature. Furthermore, up to the present it has been applied more than hundred times in several professional fields to evaluate different natural resources[1]. Moreover, such a natural good (Baradla-Domica cave system) which forms one natural unit but is situated in two countries at the same time has been valued. Besides this, I have also chosen to evaluate this natural resource as a Hungarian living in Slovakia as my intention was to enlarge the number of case studies on environmental valuation and experiences based on them. At the same time, research of a similar type regarding cave systems has not been accomplished yet to the best of my knowledge.

We uniquely expanded the studies of national and international monetary valuations by terms of the citizen evaluation of the Baradla-Domica cave system, through which we had the opportunity of international comparison of the willingness to pay and other factors (example: general-, environmental- and attitudes related to caves) . Secondly, we also examined the applicability and reliability of the choice experiment method from a methodological aspect, as well as the citizens' opinions regarding method and monetary valuation.

2. The Theoretical Background of the Research

There are several methods at our disposal for valuing natural resources/environmental goods, and they may be grouped based on whether the certain methods can capture the use and/or the non-use values of the total economic value of the given resource as well. Accordingly, stated preference methods are suitable to also evaluate non-use values which cave systems possess as well.

The use of stated preference methods has come into prominence over the last two decades among methods for the monetary valuation of environmental goods. There are many explanations for that. On the one hand, they can capture non-use values as well from the total economic value while on the other hand creating hypothetical markets make it possible to determine different preferences with them (Bateman et al., 2002; Alpizar et al., 2003; Merino, 2003).

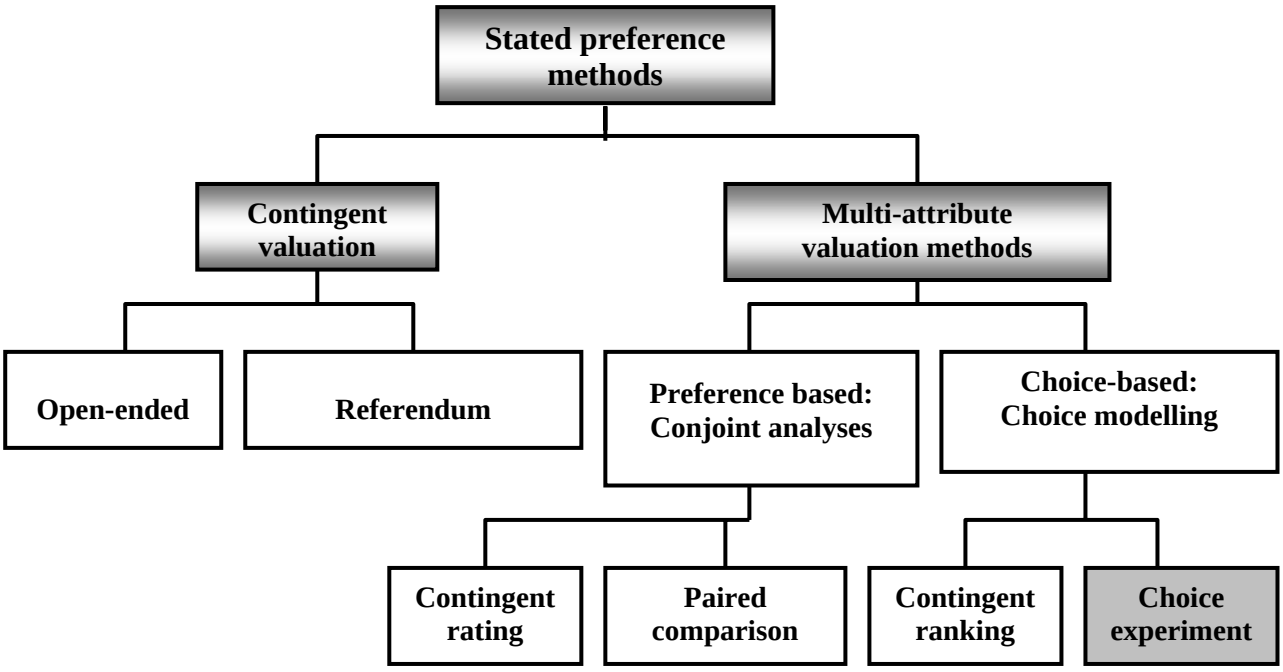
A common feature of stated preference methods is that they create a non-existing market with the help of questionnaires, and try to directly or indirectly understand through these how individuals value environmental goods, or a changes in them, in monetary terms.

[1]See table 3 in chapter 4.1: A selection of case studies applying choice experiment method. Moreover: numerous case studies can be found in the EVRI (Environmental Valuation Reference Inventory) database at http://www.evri.ca or a http://econpapers.repec.org.

Another classification of stated preference methods rests on whether the method reveals the willingness to pay in a direct or indirect way. Merino (2003) says that this widely accepted and applied classification of methods entails creating two subgroups. One is a given method, contingent valuation which estimates directly the willingness to pay while the other group consists of the valuation methods based on attributes which reveal willingness to pay in an indirect form. The choice experiment belongs to this second group of methods. This can be seen in Figure 1

.

Figure 1. Overview of stated preference valuation methods



Forrás: Merino (2003)

3. Applied Methods and the Process of the Research

3.1. The Choice Experiment Method

During the evaluation of cave systems we used the choice experiment method (CE). The method is based on a questionnaire survey where the environmental goods are evaluated by means of the determination and the different level of attributes and a number of hypothetical bundles can be created from combinations of attributes and levels of attributes. CE assumes that, as respondents express their preferences for different „hypothetical goods", they simultaneously determine the

value of other attributes by means of the ”hidden price”. Practically speaking, the method determines the economic value of the environmental goods or the extent of the value change - namely the willingness to pay with the help of these values (Hanley et al., 1998a; Louviere et al, 2000; Hanley et al., 2001; Bateman et al., 2002; Alpizar et al., 2003).

Figure 2. shows an example choice card.

Figure 2. An example choice card

Attributes	**Management A**	**Management B**	**Neither**
Protection of flora and fauna	low	low	I would not want either **A** or **B** (status quo) remains 2 200 HUF
Protection of dripstone formations	high	low	
Improvement of touring and cultural services	low	high	
Raised entry fee	4 100 HUF	2 700 HUF	
Your choice (choose one only)	**A** choice **X**	**B** choice □	Neither □

The theoretical roots of the choice experiment method go back to the so-called (demand) theory of consumer choice by Lancaster (Lancaster, 1966;[2] In: Alpizar et al., 2003), and its econometrics are based on the theory of the random utility model (Luce, 1958; McFadden, 1973;[3] In: Hanley et al., 2001). Lancaster’s theory claims that the demand for given goods is better determined by demand for the different attributes of the goods rather than taking into account only the goods themselves (Colombo et al., 2005).

At first the CE method was applied in the transport economy and in market research where the trade-off between the certain transport projects and the individual goods was examined. Later it spread to the health economy, then in environmental economics it has been among the most applied methods besides contingent valuation used to estimate environmental goods in monetary terms in the second half of the 1990’s. The CE method was first applied to evaluate environmental goods by Adamowicz et al. in 1994 to elicit the value of a water recreation (Alpizar et al., 2003; Marjainé Szerényi, 2005; Marjainé Szerényi et al., 2005). Later, its use became wide-spread and it has been applied in different fields of environmental economics several times. We selected some case studies

[2] Original work: Lancaster, K. (1966): A new approach to Consumer Theory. *Journal of Political Economy*, 74, 132-157.

[3] Original works: Luce, R. D. (1958): Individual Choice Behaviour: A Theoretical Analysis. New York, John Wiley & Sons.
McFadden, Daniel (1974): Conditional Logit Analysis of Qualitative Choice Behaviour. In: Zarembka, P. (ed.), *Frontiers in Econometrics*, New York, Academic Press.

presented in Table 1. (see on page 9.) to underpin the contention that choice experiment method can be applied successfully in many areas of environmental economics.

The choice experiment method is applied in several stages. I determined the following stages, based on the different categories of the authors[4]:

- determination of the topic of the research and the examined resource, description of current status,
- definition of the attributes and levels of the examined resource,
- selection of the type of the survey and development of the ”choice sets”,
- design and test of the questionnaire,
- determination of the sampling strategy,
- carrying out the survey,
- analysing the data, and
- evaluation of the results and the research.

[4] For different categorization of the stages see For example,: Adamowicz et al. (1998); Adamowicz and Boxall (2001); Hanley et al. (2001); Bateman et al. (2002); Marjainé Szerényi et al. (2005).

Table 1. Selected choice experiment valuation studies

Year	Authors	Subject of valuation	Country
1994	Adamowicz, V., Louviere, J. and Williams,M.	Freshwater recreation in Alberta	Canada
1998	Hanley, N., MacMillan, D., Wright, R., Bullock, C., Simpson, I., Parsisson, D. and Crabtree, B.	Valuation of the Breadalbane ESA	Scotland
1998	Hanley, N., R. Wright and W. Adamovicz	Forest landscapes	UK
1999	Garrod, Guy and Kenneth G. Willis	Polluted beaches, rivers and low flow rivers	England
2001	Alpizar, Francisco and Fredrik Carlsson	Analysis of the determinants of travel mode choice	Costa Rica
2001	Riera, Pere	Biological diversity of forests	Spain
2002	Ek, Kristina	Environmental impacts of wind power	Sweden
2002	Hanley, N., Wright, R. E. and Koop, G.	Recreation demand of climbing	Scotland
2002	Lehtonen, E., Kuuluvainen, J., Pouta, E., Rekola, M. and Li, C-Z.	Forest conservation	Finland
2002	Mogas, Joan, Pere Reira and Jeff Bennett	Environmental values of Catalonian forests	Spain
2004	Abou-Ali, Hala and Fredrik Carlsson	Welfare effects of improved water quality	Egypt
2004	Hiselius, Lena Winslott	Preferences for railway transports of hazardous materials	Sweden
2004	Pouta, E., Rekola, M., Li, C-Z., Kuuluvainen, J. and Tahvonen, O.	Natura Conservation Programs: Values of wetlands	Finland
2005	Birol, Ekin, Katia Karousakis and Phoebe Koundouri	Non-use values of wetlands	Greece
2005	Campbell, D., Hutchinson, G. and Scarpa, R.	Value farm landscape improvements	Republic of Ireland
2005	Colombo, Sergio, Nick Hanley and Javier Calatrava-Requena	Reducing the off-farm effects of soil erosion	Spain
2006	Bille, Trine, Thomas Lundhede and Berit Hasler	Protection of archaeological artefacts	Denmark
2006	Christie, M., Hanley, N., Warren, J., Murphy, K., Wright, R. and Hyde, T.	Valuing the diversity of biodiversity	UK
2006	Hanley, N., Bergmann, A. and Wright, R. E.	Renewable energy investments	Scotland
2006	Hanley, Nick, Robert E. Wright and Begona Alvarez-Farizo	Economic value of improvements in river ecology	Scotland

3.2. The Process of the Research

We accomplished our research following the stages of application of the choice experiment method, mentioned in previous chapter. Based on the related literature specialized in caves and the detailed information on the cave acquired from experts, we developed the questionnaire, where we shortly, briefly and clearly drafted the parts necessary for applying the choice experiment method (presenting the cave founded on facts, describing the protection-development program, the preparation of the overview and choice cards).

We used 3 attributes (protection of flora and fauna, protection of dripstone formations, improvement of touring and cultural services) on 2 levels, and 4 levels of the ”price” attribute (raised entry fee) in the survey relating the Baradla-Domica cave system.

The pilot and the final survey were accomplished in January and February 2008.

The Baradla-Domica cave system as the evaluated good

Divided by the Hungarian and Slovakian boundary but still forming a continuous geographical unit, the Baradla-Domica cave system is situated in the Aggtelek National Park on the Hungarian side and in the Slovak Karst (Slovenský Kras) National Park on the Slovakian side. The Baradla-Domica cave system as one of the longest and the most beautiful stalactite cave system not only in Hungary and Slovakia, but also in Europe. 20,1 km of the total length of 25,5 km is in Hungary and known under the name Baradla, while 5.4 km is situated in Slovakia, known as Domica. The caves of the Aggtelek Karst and Slovak Karst were declared a UNESCO World Heritage site at the UNESCO session in Berlin, on December 6, 1995[5]. The cave system and its watershed area also came under the ruling of the Ramsar Convention on Wetlands of International Importance in 2001[6]. The cave system is open to the public and visited by about 140 000 people on the Hungarian side and 30 000 people on the Slovakian (Bella, 2005; Székely, 2005).

[5] The cave as a natural value won the World Heritage title only twice before 1995. First the World’s longest cave, the 570 km long Mammoth-cave (USA, Kentucky) was put on the list and then, secondly the underground river-bed with the most water output, the Skocjan-cave (Slovenia) (Székely, 2005).

[6] The area represents an unique natural value, the first internationally recognised transboundary subterranean wetland of Hungary and Slovakia.

4. Hypotheses

The hypotheses related to my research follow two different lines. Some relate to the choice experiment method and its application itself whilst others relate to citizens' opinions on the monetary valuation of environmental goods and their general environmental awareness. My hypotheses regarding the valuation of the Baradla-Domica cave system are as follows:

1. Hypothesis:

Both the Hungarian and the Slovakian population think it important to protect biotic and abiotic nature; therefore the majority of them are willing to pay some amount for the protection/development of the status of the cave system.

2. Hypothesis:

People who have higher income and those for whom it is important to protect biotic and abiotic nature and/or who could have the most benefit from the protection of the cave system are usually willing to pay more for the protection/development of the cave system.

3. Hypothesis:

As the cave system is situated in two countries, the Hungarian and Slovakian people' willingness to pay may lead to different results due to several factors:

3.1. from the different income levels of the Slovakian and Hungarian population,

3.2. the different levels of preferences regarding environmental problems, and

3.3. different fungibility options deriving from the natural conditions of the two countries.

4. Hypothesis:

The uncertainty regarding the respondent's value creation is inevitable during the evaluation. In case the degree of uncertainty is significant, the respondents may choose the "status quo" option; namely the option of "keeping the current status" which influences estimated willingness to pay.

5. Hypothesis:

The choice experiment is an applicable method for both Hungarian and Slovakian citizens from a methodological point of view, and so the received results in the course of the valuation of the cave system may be considered valid:

5.1. based partly on the population' reliable value creation and interpretation of the presented protection-development program and the relating methodological issues,

5.2. partly on the results of respondents' difficulties in accomplishing the choice tasks and their relating opinions.

6. Hypothesis:

Both the Hungarian and Slovakian population find acceptable the valuation of the cave systems and other environmental goods using the choice experiment method.

5. The Results and Conclusions of the Dissertation

We accomplished the economic valuation of the Baradla-Domica cave system by terms of the application of the choice experiment survey in the framework of a citizen questionnaire survey. In the course of the survey, a total of 352 (176-176) people were interviewed, primarily those who live in the surroundings of the cave system and several tourists as well, both in Hungary and Slovakia. The most important results and conclusions of our research may be summarized as follows:

5.1. Conclusions Drawn on the Basis of the Attitude Analyses

- The two countries face similar socio-economic problems; among them unemployment/poverty and healthcare are the ones to be managed the soonest.
- The giant gap between the opinions about the priority of managing environmental issues among other problems may arise from the different levels of the state of the economy in the two countries.
- The citizens of the two countries have similar preferences regarding the management of environmental and natural conservation issues, from which air pollution and waste management are the most important.
- The citizens of both countries indicated a high degree of interest in both environment and caves.

5.2. Conclusions Drawn on the Basis of the Willingness to Pay Analyses

- The rate of those who chose the ”status quo” in all four cases (namely the respondents showing zero willingness to pay) was very low in both samples, therefore we obtained a very high value of willingness to pay. This could also mean that the rate of uncertainty regarding the program is very low.
- The value of the willingness to pay per capita for a single entry equals 1 320 in Hungary and 508 SKK (4 013 HUF) in Slovakia. This means that citizens of both countries consider the protection and development of the cave system significantly important.
- The significant difference between the results of the willingness to pay may be the consequence of the following factors: the significant difference in the initial prices of the tickets, income differences between participants of the samples, as well as the differences between the attitudes toward caves among the citizens of the two countries.
- The citizens of the two countries have the same preferences concerning the arrangements of the protection and development of the cave system. According to that they are willing to pay the most for the protection of dripstone formations, then for the protection of flora and fauna, whilst they consider the improvement of touring and cultural services of the cave system less important.
- The analysis did not give significant results when the factors influencing the value of the willingness to pay were examined.
- Based on the results of the aggregation it can be said that both Hungarian and Slovakian citizens attribute a notably high value to the protection of the cave system and to its conservation for future generations. Although according to discreet estimations, its value is still 5.48 Billion HUF for the Hungarians, while it is 2.03 Billion SKK (16.04 Billion HUF) among Slovakian citizens, which equals a total of approximately 21.5 Billion HUF.

5.3. Conclusions Concerning the Applicability and Reliability of the Choice Experiment

- The vast majority of the respondents had an appropriate level of information regarding the cave system; that is to say the valuation of the cave system was executed based on well-thought-out responses, and thus we assume that we received reliable results in the course of the survey.
- The choice experiment method is an applicable approach which is well underpinned by the fact that the citizens raised a minimum number of questions regarding the protection-development

program of the cave presented in the valuation part and the related methodological tasks, as well as by the fact that all the respondents could accomplish the valuation (the choice tasks).

- The difficulty in executing the choices primarily arose from its type of content rather than from its structural complexity.
- The citizens' opinions are very split in both countries regarding the valuation of both caves and other environmental goods based on willingness to pay as well as regarding its applicability. While almost half of the Slovakian population considers acceptable the economic valuation of caves and other environmental goods based on citizens' willingness to pay, that rate is equal to only a quarter of the citizens in Hungary.
- In our opinion, the significant rate of the citizens' negative and do-not-know responses regarding the valuation of caves and other environmental goods, based on willingness to pay, originates partly to the fact that the citizens are still uncertain in the aspect that the economic value of certain natural resources are evaluated based on their opinions and willingness to pay, and do-not-know responses were partly due to methodological reasons.
- According to the interviewers' opinions a large proportion of the respondents completely or well understood questions regarding the valuation of the cave system, which also partly confirms the applicability and reliability of the method.

5.4. The Consequences of the Results of the Research in an Environmental Policy Context

We also have to mention that in the area of European environmental policy, principally within the scope of the Water Framework Directive (WDF), there is a growing need for the application of economic analyses, thus that of environmental valuation.

In order to achieve and implement the objectives, each member state has to develop and implement so-called river basin management plans. Beside many other requirements, the river basin management plans have to include a summary of the economic analysis of water use. That is to say, that beyond technical aspects, economic aspects and the participation of society has an important role in the determination of environmental objectives. Hopefully, this integrated approach – serving the protection of further resources – will expand for other fields of environmental policy in the future.

However, we should remember that our initial situation differs very much from the situation in the USA or some of the EU countries (example: Great Britain, Germany, Sweden, , etc.) The main differences are as follows:

1. The practice of environmental valuation started to unfold much later, consequently the amount of research is very low and the gained experiences are less comprehensive. Thus the Hungarian related literature and the manuals prepared for the experts of different areas are rare; nevertheless their scientific value is undoubted. We may mention as a positive phenomenon that there is an increasing amount of related literature in Hungarian recently published on the topic of environmental valuation.
2. Primarily as a consequence of the previous reasons, the decision makers responsible for national environmental issues still have a certain fear of the establishment in practice of environmental valuation and the application of their results.
3. Research capacities dealing with the field of environmental valuation, the number of experts and the built up of the necessary institutional background are low. Hopefully this will change in the future.
4. A uniform national database is missing (where the results of previous research and the experiences gained during them are systematized).

Based on these facts it can be said that we should not draw far-reaching conclusions from the results of our research; however, some statements regarding the relation with environmental policy may be made:

- It presents a detailed methodological description of the choice experiment method from among the monetary valuation techniques of environmental goods, based on which decision makers responsible for environmental issues may receive a wider scale of the options of its theoretical and practical application (through the evaluation of the Baradla-Domica cave system).
- The protection of the cave system and its conservation for future generations are highly valued (financially), thus citizens' opinion should be taken account of in the related decisions.
- The priority order of the arrangements should be considered when – either national or regional - investments or projects related to the cave system are considered and/or implemented.

On the whole it can be said that the choice experiment method can be applied well from a methodological point of view both in Hungary and Slovakia; however, further, more comprehensive research and the harmonization of their results are fundamental as is the further development of environmental valuation and its acceptance in decision- making.

In my opinion, monetary valuation and within its framework, the choice experiment method – even if not a completely perfect but very useful tool – has a future in the two countries. And, as it tries to capture the most values possible, it may provide that common dimension which could facilitate decision-making related to several areas of environmental policy.

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7. Own Publications Related to the Topic

Krajnyik Zsolt (2008): Willingness to pay for the protection and development of Baradla-Domica cave system. EMAN-EU Conference, Sustainability and Corporate Responsibility Accounting – measuring and managing business benefits, *Proceedings*, October 6-7, Budapest, 2008, Corvinus University of Budapest, *Print*: AULA, ISBN 978-963-503-370-6.

Electronic publication (cd-version):

Krajnyik Zsolt (2008): Willingness to pay for the protection and development of Baradla-Domica cave system. EMAN-EU Conference, Sustainability and Corporate Responsibility Accounting – measuring and managing business benefits, *Proceedings*, October 6-7, Budapest, 2008, Corvinus University of Budapest, ISBN 978-963-503-371-3.

Krajnyik Zsolt (2006): A természet ára. Megközelítések a környezet pénzbeli értékelésének lehetőségeiről és korlátairól. p. 3-19, In: PONT társadalomtudományi folyóirat (1. szám), PONT Intézet, Komárno, Szlovákia, ISSN 1336-135X.

Krajnyik Zsolt (2005): A környezetértékelés dilemmája: vele vagy nélküle. In: Környezeti nézőpontok. Tanulmányok a Környezetgazdaságtani és Technológiai Tanszék 15 éves fennállása alkalmából, p. 105-114, Aula Kiadó, Budapesti Corvinus Egyetem, ISBN 963-9585-548.

Marjainé Szerényi Zsuzsanna, Csutora Mária, Harangozó Gábor, Kontár Ronald, **Krajnyik Zsolt**, Nagypál Noémi (2005): A természetvédelemben alkalmazható közgazdasági értékelési módszerek. p. 97-114, Készült a KvVM Természetvédelmi Hivatalának megbízásából, Környezetgazdaságtani és Technológiai Tanszék, Budapesti Corvinus Egyetem, ISBN963-218-307-X

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