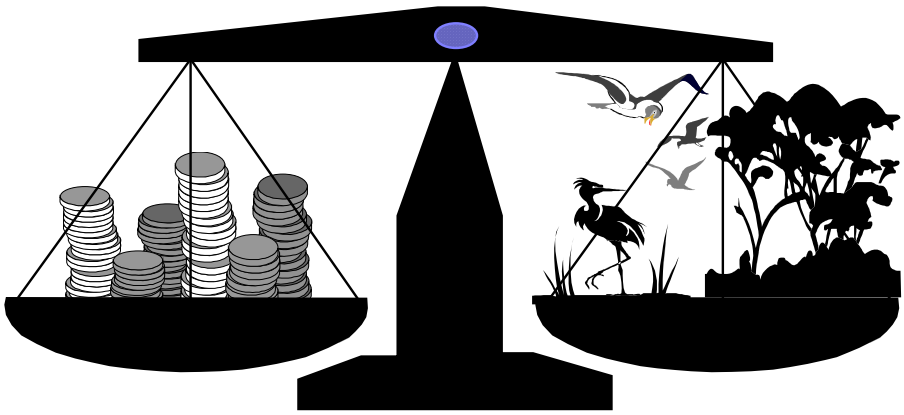
Valuation of Nature and Environment

A historical overview of Dutch socio-economic valuation studies

Third Edition



Platform for Economic Valuation of Nature
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1. Introduction

Without the socio-economic valuation of nature, environment and landscape, these unpriced goods may not be taken seriously into consideration when making decisions that require a trade off between ecological and economic interests. Trade offs between unpriced forms of welfare and financial welfare usually tend to favour the latter, although this may not be efficient from a socio-economic point of view.

Since the early 1970's, valuation studies have been done in the Netherlands. It has however become clear that valuation of unpriced goods is not a simple task. The information needs of the available economic valuation methods are considerable. In order to avoid high information gathering costs many researchers resort to benefit transfers; this means borrowing the valuation results from other studies and adjusting the information to one's own research needs. There is much criticism on benefit transfers pertaining to the reliability of the results. But in cases where only rough estimates are needed, they are a tempting option[1].

This literature study aims to inform researchers planning to do a valuation study in two ways. First, it gives them an overview of what research has been done in the Netherlands so far. Secondly, it may enable them to quickly look up information to be used in a benefit transfer. Especially when doing a definition study for a project, this may shed a light on the attainability of the proposed research. E.g. if a researcher is planning to do a cost benefit analysis for reducing air pollution by some kind of technical measure and he finds that the benefits according to other studies are very small, he may save himself a lot of trouble by changing the scope of his research.

The presented overview only lists studies that involve actual benefit estimates. Methodological discussion papers are not included. The overview is set up chronologically; each valuation study is listed by topic, author, location, year, method, results, remarks and reference. The methods are divided into Market Analysis (market prices, shadow prices, damage cost avoided and abatement costs), Contingent Valuation, Hedonic Pricing, Travel Costs and Averting Behaviour (prevention costs). It is also added what kind of value has been determined: willingness to pay, willingness to accept or market value etc. Sometimes it is mentioned which value components were included: use value or non-use values. The results are mostly presented in such a way that a researcher can easily determine whether a study is useful to him/her or not. Preferably monetary results are shown. For each study a reference is given, but all references can also be found in the alphabetical literature list. A description of the different valuation methods can be found in the Appendix.

[1] One must remark here that international benefit transfers are generally unreliable. Many researchers in the field of benefit transfers strongly reject this option. To prevent that studies on nature areas or environmental problems in the Netherlands have to resort to transfers from foreign studies, Dutch valuation studies are gathered in this overview.

The composer of this overview hopes that her work will contribute to the dissemination of information on valuation studies and to benefits transfers. Without pretending to provide a complete overview, the author hopes to have captured the majority of Dutch benefit studies. In order to be as complete as possible, additions and also corrections to the list are always welcomed.

2. Overview of Dutch valuation studies

1973

Topic:	Aircraft noise
Authors:	H.M.A. Jansen and J.B. Opschoor
Location:	Netherlands
Year:	1973
Method:	Contingent Valuation Method: willingness to accept aircraft noise.
Results:	50 % of the respondents stated not to be willing to accept any compensation for noise. This sheds doubt on the results of the average WTA.
Remarks:	-
Reference:	Jansen H.M.A. en J.B. Opschoor (1973). *Waardering van de invloed van het vliegtuiglawaai op woongebied rond de potentiële locaties van de tweede nationale luchthaven*, Amsterdam: Instituut voor Milieuvraagstukken.

Topic:	Health effects of air pollution
Author:	J.B. Opschoor
Location:	Netherlands
Year:	1973
Method:	Market analysis: production loss and medical costs due to illness caused by air pollution.
Results:	The total health costs due to air pollution, were estimated at Dfl. 934.8 million in 1967.
Remarks:	This study involves a benefit transfer from an American study.
Reference:	Opschoor, J.B. (1973). *Een raming van schade aan de gezondheid door luchtverontreiniging*, Amsterdam: Instituut voor Milieuvraagstukken.

Topic:	Economic costs of water pollution
Author:	J.Ch.W. Verstege
Location:	Netherlands
Year:	1973
Method:	Market Analysis; damage costs to horticulture and water treatment.
Results:	The damage to horticulture due to salty water was estimated to amount to Dfl. 25 - 30 mln, in the period of 1950-1969. The extra water purification

costs in this period were Dfl. 7.5 mln. From this it is concluded that the benefits from salt storage in France (in stead of dumping it in the river) amount to Dfl. 29.5 mln, which clearly surpasses the storage costs of Dfl. 15 mln.

Remarks: Only financial costs were taken into account.

Reference: Verstege, J.Ch.W. (1973). *Waterverontreiniging ten gevolge van verzilting 1950-1970*, Den Haag: Centraal Bureau voor Statistiek.

1974 - 1976

Topic: Air pollution and the value of houses

Author: J.B. Opschoor

Location: Netherlands; Rijnmond region

Year: 1974

Method: Hedonic Pricing; reduced house prices due to air pollution.

Results: The effects of air pollution on house prices due to bad odours and dirt (dust) are investigated. Differences in house prices are explained by these and by house and neighbourhood characteristics, such as price category, size and type, safety, shopping facilities and green surroundings. Multicollinearity between neighbourhood characteristics and air pollution was found. House prices were found to be significantly affected by air pollution. In neigbourhoods where more than 70 % of the households is suffering from pollution an average house price reduction of Dfl. 30,000 was found.

Remarks: -

Reference: Opschoor, J.B. (1974) *Economische waardering van milieuverontreiniging*, Meppel: Krips Repro B.V.

Topic: Value of traffic noise

Author: R.B.J.C. van Noort

Location: Netherlands

Year: 1976

Method: Averting Behaviour: costs of noise reducing measurements.

Results: The value of a noise free environment is based on the expenditures for noise reducing activities. These are estimated to amount to Dfl. 2 billion for 1976.

Remarks: No complete socio-economic valuation; damage to health and other costs were not determined.

Reference: Noort, R.B.J.C. (1976). van, *Economische waardering van wegverkeerslawaai*, Zoetermeer: s.n.

1978

Topic: Socio-economic costs and benefits associated with the development of a seaport in the Dutch Waddensea

Author: Holst, van, B., W.T.M. Molle, T.H. Botterweg, P.M. Blok, M. Koss, J.W. Meijer, G.R. Otten, R. Kattenwinkel and W.M. van Liefland

Location: Den Helder, the Netherlands

Year: 1978

Method: Market Analysis, for fish production and abatement costs for water purification.

Results: Two different scenario's have been investigated, a 35 ha and a 50 ha seaport. Two ecosystem benefits will be lost due to the seaport development. The net present value of the lost fish production benefits have been estimated at Dfl. 1.6 million and Dfl. 2.3 million respectively. The net present value of lost benefits of the water purification capacity has been estimated at Dfl. 4.2 million and Dfl. 5.9 million respectively.

Remarks: Other ecosystem damages have been only been included as p.m. aspects.

Reference: Holst, van, B., W.T.M. Molle, T.H. Botterweg, P.M. Blok, M. Koss, J.W. Meijer, G.R. Otten, R. Kattenwinkel and W.M. van Liefland (1978). *Een haven op het Balgzand? Een economische en ecologische afweging van de voor- en nadelen van een beperkte zeehavenontwikkeling ten behoeve van Den Helder.* Rotterdam/Arnhem: Stichting het Nederlands Economisch Instituut/Rijksinstituut voor Natuur-beheer.

1983

Topic: Water quality

Author: P.J.A. Baan

Location: Dutch surface waters

Year: 1983

Method: Market Analysis; Cost based benefit estimates for effects of a maximum improvement in water quality.

Results: The benefits of an improved water quality were calculated per sector. Benefits to swimming were estimated to be between Dfl. 10 -50 million a year, using entry prices of swimming pools. Benefits to recreational fishing were valued as Dfl. 100 -300 per year and benefits to commercial fishing were estimated to be Dfl. 2-4 million a year; all based on fish prices. Benefits to navigation, industry and public water supply were based on costs savings concerning sludge removal and purification: these were estimated to amount to respectively Dfl. 12-42, Dfl. 11, Dfl. 23-39 million per year. Agricultural production gains were valued as Dfl. 20-60 million a year. Benefits to improved drinking water quality were calculated by means of prices of soft drinks and valued as 20-30 million per year.

Remarks: In this study health effects and effects on ecosystems were described, but not valued.

Reference: Baan, P.J.A. (1983). *Baten milieubeleid water*, Leidschendam: Ministerie van VROM.

Topic: Material corrosion

Author: R.W. Lanting

Location: Netherlands

Year: 1983

Method: Market Analysis; restoration costs

Results: Damage to materials (metals, textile, painting, natural stones, cultural property, paper etc.) of NO_x and SO_2. Dose response relations were studied. The damage to cultural property was estimated by restoration costs and amounted to Dfl. 15 - 30 mln per year. The damage costs of paper, leather and textile were estimated at Dfl. 10 mln per year.

Remarks: The cost-based benefit estimates were transferred from other studies.

Reference: Lanting, R.W. (1983). *De aantasting van materialen door NO_x*, Leidschendam: Ministerie VROM, Directie Lucht, Afdeling Luchtkwaliteit.

Topic: Cost Benefit Analysis for the closure of the Lauwer Sea

Author: G. van Beek

Location: Netherlands

Year: 1983

Method: Market Analysis; market prices and opportunity costs.

Results: A function evaluation study was done for the enclosure of the Lauwer Sea. The benefits of improved water discharge, less salt intrusion and reduced maintenance costs for dykes were estimated to amount to Dfl. 180 million.

The benefits of agricultural land were estimated to be Dfl. 12 - 15 million. The costs of reduced fish production were estimated to be Dfl. 45.5 to 227 million and the loss of natural water purification was calculated on the basis of the costs of a treatment plant; they were estimated to be Dfl. 1,173 million. All other functions like population regulation, genetic pool, nature, recreation etc. were not valued in monetary terms.

Remarks: This study is an ex post evaluation.

Reference: Beek, G., van (1983). *Maatschappelijke evaluatie van het Lauwerzeeproject met een kosten baten analyse*, Utrecht: Rijksuniversiteit Utrecht.

1984 - 1985

Topic: Cultural property

Author: J. Feenstra

Location: Netherlands

Year: 1984

Method: Market Analysis by means of a Dose Response Model for the relation between air pollution and material corrosion.

Results: The damage to monuments caused by air pollution were estimated to be Dfl. 15 -30 million per year.The damage prevention costs for stained glass were Dfl. 20 million. The damage to carillons, textiles and papers were respectively Dfl. 0.25, Dfl. 20 and Dfl. 10 million per year.

Remarks: Estimation problems were encountered in the determination of the physical damage functions.

Reference: Feenstra, J.F. (1984). *Cultural property and air polution*, Leidschendam: Ministerie van VROM.

Topic: Noise reduction

Authors: F.H. Oosterhuis and van der Pligt

Location: Netherlands

Year: 1985

Method: Hedonic pricing: comparison of house prices with and without noise.

Results: The most likely increase in property value due to noise reduction was valued at Dfl. 400 per dB(A).

Remarks: Due to variable circumstances, results should not be generalized.

Reference: Oosterhuis, F.H. en van der Pligt (1985). *Kosten en baten van de wet*

geluidshinder, S.l.: s.n.

Topic:	Benefits of soil conservation
Author:	P.J.A. Baan
Location:	Netherlands
Year:	1985
Method:	Market Analysis: restoration costs for nature and clean up costs for drinking water and industry. Production Factor Method: market value of production loss.
Results:	A matrix showing the benefits of immission reduction of several pollutants for nature and landscape, recreation, drinking water, industry, agriculture, housing, public heath and conservation of multifunctionality. The total short term benefits were estimated to be Dfl. 34 - 155 million per year. The total long term benefits (for the year 2020) were valued at Dfl. 102 - 424 a year. Not all benefits were quantified in monetary terms.
Remarks:	The results of this study were all based on benefit transfers.
Reference:	Baan, P.J.A. (1985). *Baten milieubeleid bodem*, Den Haag: Ministerie van VROM.

1987

Topic:	Agriculture and air pollution
Author:	L.J. van der Eerden et.al.
Location:	Netherlands
Year:	1987
Method:	Market Analysis by means of a Dose Response Model for the relation between air pollution and crop yields.
Results:	A 50 % reduction of air pollution leads to a social welfare increase of Dfl. 133 million per year.
Remarks:	The relation between crop yield and air pollution turned out to be non-linear. Crop loss was found to be partly compensated for by higher prices, shifting the welfare loss from polluters to consumers. Effects of changed cropping patterns were not taken into consideration, neither were the costs of reducing air pollution.
Reference:	Eerden, J.L., van der, e.a. (1987). *Economische schade door luchtverontreining aan de gewasteelt in Nederland,* Leidschendam:

Ministerie van VROM.

Topic:	Costs and benefits of nature, forests and recreation
Author:	Grontmij
Location:	Netherlands
Year:	1987
Method:	Market analysis: financial values for production functions.
Results:	In this study financial costs and benefits for nature, forests and recreational sites were calculated. Several types of nature were taken into consideration. Benefit estimates were only done in case of harvestable products. The average benefits ranged from Dfl. 35 to 90 per ha. For the different types of forests the benefit estimates varied from Dfl. 110 to 480 per ha.
Remarks:	This is not a socio-economic, but a financial valuation study.
Reference:	Grontmij (1987). *Kosten van grondgebruik voor natuur, bos en recreatie*, De Bilt: Grontmij n.v.

1988

Topic:	Forests and Heath Areas
Authors:	J.W. van der Linden and F.H. Oosterhuis
Location:	Netherlands
Year:	1988
Method:	Contingent Valuation Method: social welfare loss of severe damage to forests and heather caused by air pollution.
Results:	The total (capitalized) benefits of conserving forests and heather were estimated to be Dfl. 29 billion. This includes a willingness to pay for conservation of Dfl. 1.45 billion per year and the damage cost to timber production of Dfl. 13.1 million per year.
Remarks:	Both willingness to pay for conservation and damage costs to timber production were determined by comparing the present situation with the expected condition of forests in 2010. The willingeness to pay was found to be dependent on respondents' income level, number of site visits, expectations about the severeness of the pollution and social characteristics. All value components (use and non-use) were included.
Reference:	Linden, J.W. en F.H. Oosterhuis (1988). *De maatschappelijke waardering voor de vitaliteit van bos en heide*, Leidschendam: Ministerie van VROM.

Topic:	A nuclear energy accident
Authors:	T. Goemans and J.J. Schwarz
Location:	Netherlands
Year:	1988
Method:	Market Analysis: calculation of financial damage costs in case of a nuclear accident.
Results:	The present value of the damage was valued at Dfl. 14-17 billion. These costs could mainly be ascribed to loss of the power plant and loss of income from foreign trade and tourism.
Remarks:	A risk analysis was also performed. The probability of a small accident was estimated to be 10^{-6}. No attention was paid to socio-economic costs.
Reference:	Goemans, T. en J.J. Schwarz (1988). *Economische schade van een ongeval met een kerncentrale*, Den Haag: s.n.

Topic:	Valuation of externalities of traffic
Author:	A.N. Bleijenberg *et.al*.
Location:	Netherlands
Year:	1988
Method:	Market Analysis and Averting Behaviour: Damage Costs and Prevention Costs.
Results:	The external effects of traffic were estimated to be Dfl. 4.2 - 6.2 billion a year. The effects taken into consideration were accidents, air pollution, space claims, congestion, noise, waste, soil pollution and energy use. The negative effects on nature and landscape were not valued in monetary terms.
Remarks:	-
Reference:	Bleijenberg, A.N. (red.) (1988). *Waardering van negatieve externe effecten van het autoverkeer*, Delft: Centrum voor energiebesparing en schone technologie.

Topic:	Environmental damage to agriculture
Authors:	A.J.M. Rennen and J.M. Stoop
Location:	Netherlands
Year:	1988
Method:	Market Analysis and Production Factor Method: damage costs
Results:	The costs of environmental pollution are estimated, but only damage to agriculture is considered. The results indicate that local air pollution leads to a damage of Dfl. 2 million a year in the agricultural sector. Diffuse pollution of air results in a damage of Dfl. 600 million per year (that is a 5 % harvest

reduction). Salty water pollution leads to a damage Dfl. 30-85 million a year. Diffuse soil pollution (eutrophication) requires extra costs for additional calcium of Dfl. 15-30 million a year, but is compensated for by a harvest increase due to its nutrious value.

Remarks: No formal valuation method was applied.

Reference: Rennen, A.J.M., en J.M. Stoop (1988). *Schade in de landbouw door milieuverontreiniging*, Utrecht: Centrum voor Landbouw en Milieu.

1989

Topic: The value of a clean environment

Authors: R. Hoevenagel and H. Verbruggen

Location: Netherlands

Year: 1989

Method: Contingent Valuation Method: Willingness to pay for a clean environment.

Results: Ozone layer depletion, acid rain, deforestation, water quality, eutrophication and air pollution were described in the survey. The mean willingness to pay turned out to be Dfl. 43 a month.

Remarks: There was a non-response of 68 %.

Reference: Hoevenagel, R. en H. Verbruggen (1989). *De waarde van het milieu*, Amsterdam: Vrije Universiteit.

Topic: Social benefits of biodynamic agriculture

Authors: D.G. Kalverkamp and D.N. Hoytema

Location: The Netherlands

Year: 1989

Method: Market Analysis: prevention and restoration costs.

Results: The benefits of a transfer to biodynamic agricultural mainly concern a reduction of environmental pollution. The environmental damage caused by the present agricultural activities was estimated on the basis of clean up costs. It amounted to Dfl. 6.1 billion a year. This transfer would lead to a reduction of the Dutch agricultural production value of Dfl. 19.8 billion a year. The results of the National Environmental Policy Plan were compared with those of Biodynamic Agriculture in terms of cost effectiveness: the costs per kg emission were respectively Dfl. 7.90 and Dfl. 4.80.

Remarks: No clear cost benefit trade-off was done.

Reference: Kalverkamp, D.G. and D.N. van Hoytema (1989). *Op zoek naar een duurzame landbouw; Een schets van de kosten en baten van de omschakeling van Nederland op biologisch-dynamische landbouw*, Utrecht: Berenschot.

Topic: Damage costs of eutrophication
Authors: P.J. Baan and C.F.A.M. Hopstaken
Location: Netherlands
Year: 1989
Method: Market Analysis: direct damage to economic sectors.
Contingent Valuation Survey: Willingness to pay for nature and recreation.
Results: For three different scenario's the damage costs of drinking water, industry, agriculture, fisheries, water management, recreation and nature are estimated. The total damage costs of eutrophication under the 'business as usual' scenario were estimated to ly between Dfl. 200 - 760 million a year.
The benefits of eutrophication abatement varied from Dfl. 40 to 200 million per year. The benefits of nature, estimated at an average willingness to pay of Dfl. 210 per person per year, were included in this result.
Remarks: The benefit of increased biodiversity was not monetarized. It is not clear whether the survey results were transferred from other studies or not.
Reference: Baan, P.J.A. en C.F.A.M. Hopstaken (1989). *Schade vermesting. Schade als gevolg van emissies van stikstof en fosfor en baten van emissiebestrijding.* Den Haag: Ministerie van VROM.

Topic: Benefits of cleaning water bottoms
Author: S.W.F. van der Ploeg
Location: Netherlands
Year: 1989
Method: Market Analysis by means of an effect matrix; clean up cost estimates
Results: Benefits of cleaning up the bottums of waterways are represented in a qualitative effect matrix. The benefits of the functioning of the ecosystem, perception value of nature, public health, water recreation, fishery, shipping, agriculture and water management, were estimated for 10 Dutch cases. The clean up of waterways without shipping activities and of estuaria, has the highest benefits. These benefits mainly concern improvement of the functioning of the ecosystem. Clean up also reduces the costs of dredging, due to a reduction in transportation and storage coss of polluted material; these benefits were estimated to amount to Dfl. 300 - 400 million in total.
Remarks: -

Reference: Ploeg, S.W.F., van der (red.) (1989). *Baten sanering waterbodems*, Amsterdam: Instituut voor Milieuvraagstukken.

Topic: Nature deterioration
Author: R. Hoevenagel
Location: Netherlands; Peat meadow region
Year: 1989
Method: Contingent Valuation Method; willingness to pay for nature
Results: Three different payment cards were used; it was found that the range on the payment cards significantly effected the stated WTP values. The mean yearly willingness to pay for measurements to restore nature in the peat meadow region, ranged from Dfl. 16.00 to Dfl. 45.80. This wide range was (partly) explained by the respondents' unfamiliarity with the topic.
Remarks: The purpose of this experiment was to find out whether elicitation methods significantly influence CVM results.
Reference: Hoevenagel, R. (1994). *The contingent valuation method: scope and validity*, Amsterdam: Vrije Universiteit.

Topic: Depletion of the ozone layer
Author: R. Hoevenagel
Location: Netherlands
Year: 1989
Method: Contingent Valuation Method: willingness to pay for recovery of the ozone layer
Results: Two different payment cards were used; it was found that the average willingness to pay for recovery of the ozone layer in the next century varied from Dfl. 45.2 to Dfl. 112.4 per year. Respondents seemed to have the tendency to stick to the values depicted on the payment card.
Remarks: The purpose of this experiment was to find out whether elicitation methods significantly influence CVM results.
Reference: Hoevenagel, R. (1994). *The contingent valuation method: scope and validity*, Amsterdam: Vrije Universiteit.

Topic: Valuation of environmental goods
Author: R. Hoevenagel
Location: Netherlands
Year: 1989
Method: Contingent Valuation Method: willingness to pay for restoration of

woodlands, for noise reduction and for the reduction of greenhouse effects.

Results: Three environmental programmes were identified: one for restoring the Dutch woodlands, one aimed at reducing noise nuisance by air and road traffic and one for reducing the greenhouse effects. A bidding game with three starting bids was used, and the three programmes were valued in different sequences. The first bid in the sequence was found to serve as an anchoring point for the following bids. In the first bid the mean willingness to pay for woodlands ranged from Dfl. 24.7 to Dfl. 27.3, the willingness to pay for noise reduction varied from Dfl. 10.4 to Dfl. 13.6, and the willingness to pay for greenhouse gasses was between Dfl. 20.7 and Dfl. 27.1.

Remarks: This experiment was conducted to deteremine the impact of different starting points and valuation sequences in applying CVM; respondents were paid Dfl. 10 for their co-operation.

Reference: Hoevenagel, R. (1994). *The contingent valuation method: scope and validity*, Amsterdam: Vrije Universiteit.

1990 - 1991

Topic: General environmental improvements

Authors: F.H. Oosterhuis and K.F. van der Woerd *et.al*.

Location: Netherlands; Limburg

Year: 1990

Method: Market Analysis: Prevention costs, based on various existing benefit studies.

Results: The benefits of the Environmental Policy Plan of the province of Limburg for the year 2010 were estimated at Dfl. 300 million to 8.9 billion per year. The damage avoided by the implementation of the Environmental Policy Plan, was the basis for this benefit estimate. Various benefit categories were taken into consideration, such as health, recreation, drinking water and agriculture. Not all benefits were monetarised.

Remarks: IVM Report R-90/01

Reference: Oosterhuis, F.H. and K.F. van der Woerd e.a. (1990). *Economische aspecten milieubeleid provincie Limburg*, Amsterdam: Instituut voor Milieuvraagstukken.

Topic:	General environmental improvements
Authors:	K.F. van der Woerd, F.H. Oosterhuis *et.al*.
Location:	Netherlands; Gelderland
Year:	1991
Method:	Market Analysis: damage costs avoided, based on various existing benefit studies.
Results:	The potential benefits of environmental policy in the province of Gelderland were estimated at Dfl. 200 million to Dfl.5 billion per year. The damage avoided by the implementation of the Environmental Policy Plan, is the basis for this benefit estimate. Various benefit categories were taken into consideration, such as health, recreation, drinking water, forestry, nature and agriculture, which were all expressed in monetary terms.
Remarks:	IVM Report R-91/04A
Reference:	Woerd, K.F., van der and F.H. Oosterhuis e.a. (1991). *Economische aspecten van het Gelders milieubeleid*, Amsterdam: Instituut voor Milieuvraagstukken.

Topic:	Salvage industry North Sea
Author:	O.J. Kuik
Location:	Southern North Sea, Netherlands
Year:	1991
Method:	Market Analysis: damage and clean up costs for oil spills. Travel Cost Method: willingness to pay for beach visits.
Results:	The total economic damage of a severe oil spill was valued at various locations in the Dutch coastal zone. The highest damage was found in deltas and amounted to Dfl. 165 million. Ecological damage was also taken into consideration, but not expressed in monetary terms. For recreation the average willingness to pay for a visit to the beach was Dfl. 10 to Dfl. 15.
Remarks:	Economic and ecological vulnerability indices were also calculated, for various locations along the Dutch coast.
Reference:	Kuik, O.J. (1991). *Benefits of the salvage industry to the southern North Sea*, Amsterdam: Institute for Environmental Studies.

Topic:	Calculation of sustainable national income
Authors:	R. Hueting, B. de Boer and P. Bosch
Location:	Netherlands
Year:	1991
Method:	Market Analysis: shadow prices for environmental pressures, based on physical sustainability standards.
Results:	A general equilibrium model for both economic activities and environmental

protection measures, 'Green National Income' and strong sustainable economic structures. Besides these, the costs (least costs) of achieving sustainability were also calculated.

Remarks: The study is not an actual valuation study, but its results can be used for cost based valuation studies.

Reference: Hueting, R., P. Bosch and B. de Boer (1992). *Methodology for the calculation of sustainable national income*, Voorburg: Centraal Bureau voor Statistiek.

1992 - 1993

Topic: The total economic value of the Wadden Sea

Author: R. de Groot

Location: The Dutch Wadden Sea

Year: 1992

Method: Mainly Market Analysis and Averting Behaviour; damage cost avoided and prevention costs.

Results: A table showing the total economic value of all regulation, carrier, production and information functions. A distinction is made between conservation value, which was estimated to be $ 5,150, a productive value estimated at $ 1,013 and an employment value of $ 535 million a year. Existence value, social value (health) and consumptive use value were also taken into consideration, but they were not expressed in monetary terms.

Remarks: All monetary values were (international) benefit transfers.

Reference: Groot, R.S. de (1992)., *Functions of Nature*, s.l.: Wolters Noordhoff .

Topic: Social value of a forest (Bentwoud)

Author: F. Verkoijen

Location: Netherlands, Province of South Holland

Year: 1993

Method: Contingent Valuation Method; willingness to pay for a forest

Results: The average lump sum willingness to pay for the construction of a forest was valued at Dfl. 71.74 per household.

Remarks: -

Reference: Verkoijen, F. (1993). *Bentwoud; een onderzoek naar de maatschappelijk waarde van een nieuw aan te leggen bosgebied*, Tilburg: Katholieke Universiteit Brabant.

Topic:	Nature conservation in agricultural areas
Author:	F. Spaninks
Location:	Netherlands; Peat meadow area to the south of Sneek.
Year:	1993
Method:	Contingent Valuation; willingness to pay for nature conservation.
Results:	The average willingness to pay for nature conservation in the peat meadow area was Dfl. 9 per household a month. This conservation would be accomplished by introducing conservation management contracts with farmers. Whether or not the costs of these contracts outweigh the benefits of conservation, remained unclear.Experiments for temporal embedding, payment card and range bias were performed. Distance to area effects were also investigated.
Remarks:	-
Reference:	Spaninks, F. (1993). *Een schatting van de sociale baten van beheersovereenkomsten met behulp van de Contingent Valuation Methode*, Wageningen: Landbouw Universiteit, Vakgroep Algemene Agrarische Economie.

Topic:	External costs of transportation
Authors:	E. Bonenschansker and A.L. 't Hoen
Location:	Netherlands
Year:	1993
Method:	Market Analysis: prevention and damage costs of traffic accidents and air pollution. Hedonic Pricing: value reduction of houses due to noise
Results:	External costs of traffic accidents, air pollution and noise were estimated to range from Dfl. 380 to Dfl. 730 mln.
Remarks:	-
Reference:	Bonenschansker, E, and A.L. ’t Hoen (1993). *Externe kosten van het goederenvervoer*, Den Haag: Instituut voor Onderzoek van Overheidsuitgaven.

1994

Topic:	Valuation of the island of Rottumeroog
Author:	E.H. Overkamp
Location:	Netherlands
Year:	1994
Method:	Contingent Valuation; willingness to pay for the conservation of Rottumeroog.
Results:	The average respondent was willing to pay DFl. 6.5 per month for the conservation of the island. Much attention was paid to the influence of attitudes and beliefs on willingness to pay.
Remarks:	This study was done to determine the validity of Contingent Valuation.
Reference:	Overkamp, E.H. (1994). *Is Rottumeroog te prijzen? Een onderzoek naar de geldigheid en betrouwbaarheid van de toepassing van de Contingent Valuation methode op het eiland Rottumeroog*, Enschede: Universiteit Twente.

Topic:	Social costs of traffic
Authors:	A.N. Bleijenberg, W.J. van den Bergh and G. de Wit
Location:	The Netherlands
Year:	1994
Method:	Market Analysis: damage costs and prevention costs
Results:	The social costs of traffic were divided into three groups: private expenditures on cars, public expenditures on infrastructure, external costs of traffic accidents and air pollution. The external costs were estimated to be Dfl. 11 billion a year. There were no significant external benefits. Optimal tariffs on fuel and optimal fixed taxes were calculated.
Remarks:	The results were based on a literature study.
Reference:	Bleijenberg, A.N., W.J. van den Bergh and G. de Wit (1994). *Maatschappelijke kosten van het verkeer*, Delft: Centrum voor Energiebesparing en Schone Technologie.

Topic:	Valuation of agricultural wildlife
Authors:	R. Brouwer and L.H.G. Slangen
Location:	Netherlands; Alblasserwaard
Year:	1994

Method: Contingent Valuation; willingness to pay for the conservation of wildlife in he peat meadow region.

Results: Randomly selected inhabitants of three provinces were asked to reveal their willingness to pay for the preservation of wildlife in the peat meadow region. A three stage budgeting schedule was used. The average willingness to pay in the provinces ranged from Dfl. 28.7 to 72.1 per person per year. Factors like disposable income and information significantly influenced the results.

Remarks: -

Reference: Brouwer, R. and L.H.G. Slangen (1995). *The measurement of the non-marketable benefits of agricultural wildlife management: the case of Dutch peat meadow land*, Wageningen: Agricultural University Wageningen.

1995

Topic: Air and noise pollution

Authors: F. Spaninks and O.J. Kuik

Location: Netherlands

Year: 1995

Method: Market Analysis by means of a Dose Response model; damage to agriculture, to public health, to materials, ecosystems and amenity.

Results: The total monetary value of damage from noise and air pollution in the Netherlands in 1990, was estimated to range from 8,627 to 21,068 ECU.

Remarks: Draft paper.

Reference: Spaninks, F. and O.J. Kuik (1995). *Accounting for air and noise pollution damage in the Netherlands*, Amsterdam: Instituut voor milieuvraagstukken.

Topic: Green surroundings

Authors: A.T. Fennema

Location: Netherlands; Apeldoorn

Year: 1995

Method: Hedonic Pricing

Results: A view on green (park, pasture, forest) increases house prices by 6 to 8 %.

Remarks: The sample was rather small and it only concerned one city.

Reference: Fennema, A.T. (1995). *Wonen in het groen; de invloed van groen op de prijs*

van een woning, Wageningen: DLO Staring Centrum.

Topic:	Risk of inundation; transition to ecological agriculture
Authors:	E. Wierstra, A. van der Veen and P. Geurts
Location:	Island of Rottummeroog, Netherlands
Year:	1995
Method:	Contingent Valuation; face-to-face personal interviews; willingness to pay
Results:	The benefits of preventing the specified risk increase along the coast were estimated to be in the range Dfl. 15 to Dfl. 23 per person per month; 25% of the respondents was not prepared to pay anything. The benefits of transforming regular agricultural methods to ecological farming were estimated to be in the range of Dfl. 35 to Dfl. 50 per person per month; 10% of the respondents was not prepared to pay anything. Finally, the mean willingness to pay for the prevention of the disappearence of the uninhabited island Rottummeroog was estimated to be approximately Dfl. 6 per person per month; 40% of the respondents was not prepared to pay anything.
Remarks:	In general, the validity of the results of a Contingent Valuation study is questioned because of the hypothetical nature whereby individuals *state* (instead of *reveal*) a valuation for a certain environmental change. This study is performed to investigate the boundaries of the domain of environmental goods for which the Contingent Valuation method is capable of producing valid results; therefore much attention was paid to testing validity and reliability.
Reference:	Wierstra, E., A. van der Veen, and P.A.Th.M. Geurts (1996). *On the domain of Contingent Valuation*, Twente: Twente University, Department of Public Policy.

Topic:	External costs of the Dutch coal fuel cycle
Authors:	C. Dorland, R. Hoevenagel, H.M.A. Jansen and R.S.J. Tol
Location:	Netherlands
Year:	1995
Method:	Various Contingent Valuation Studies and Market Analysis studies on production loss and medical costs were used for the valuation of external effects.
Results:	The external costs of the coal fuel cycle were calculated by using the Accounting framework developed within the EU-DGXII financed 'ExternE - Externalities of Energy' project. Among others issues, the costs of air pollution in terms of human health, materials, monuments, agricultural crops

and climate change were calculated.

Remarks: This study also involves benefit transfers.

Reference: Dorland, C., R. Hoevenagel, H.M.A. Jansen and R.S.J. Tol (1995). *Externalities of the Dutch coal fuel cycle*, R-95/10, Amsterdam: Instituut voor Milieuvraagstukken, Vrije Universiteit.

Topic: External costs of the Dutch gas fuel cycle

Authors: C. Dorland, R.S.J. Tol and H.M.A. Jansen

Location: Netherlands

Year: 1995

Method: Various Contingent Valuation Studies and Market Analysis studies on production loss and medical costs were used for valuation of external effects.

Results: The external costs of the gas fuel cycle were calculated by using the Accounting framework developed within the EU-DGXII financed 'ExternE - Externalities of Energy' project. Among other issues costs of air pollution in terms of human health, materials, monuments, agricultural crops and climate change were calculated.

Remarks: -

Reference: Dorland, C., R. Hoevenagel, H.M.A. Jansen and R.S.J. Tol (1995). *Externalities of the Dutch gas fuel cycle*, R-95/9, Amsterdam: Instituut voor Milieuvraagstukken, Vrije Universiteit.

Topic: External costs of the nuclear fuel cycle

Author: D.H. Dodd

Location: Netherlands

Year: 1995

Method: Various Contingent Valuation Studies and Market Analysis studies on production loss and medical costs were used for valuation of external effects.

Results: The external costs of the nuclear fuel cycle were calculated by using the Accounting framework developed within the EU-DGXII financed 'ExternE - Externalities of Energy' project. Human health damage costs of air emissions during normal operation and due to calamities at the different stages of the fuel cycle were calculated.

Remarks: -

Reference: Dodd, D.H. (1995). *External costs of the nuclear fuel cycle*, Petten: ECN-C—95-029, Netherlands Energy Research Foundation ECN.

Topic:	Damage caused by acidification
Authors:	J. Remmers
Location:	Netherlands
Year:	1995
Method:	Market analysis; abatement costs
Results:	The direct damage of acidification on nature is estimated at Dfl. 72 million a year. These are abatement costs for nature management. The indirect damage of acidification is estimated by reduced recreational expenditures (estimated at Dfl. 196 tto Dfl. 205 million per year), reduced willingness to pay (estimated at Dfl. 314 million per year).
Remarks:	All estimates are benefit transfers.
Reference:	Remmers, J. (1995). *Economische schade als gevolg van verzuring en vermesting door de landbouw*, Utrecht: Stichting Natuur en Milieu.

Topic:	Valuation of the natural capital stock
Authors:	R. Maas and P. v.d. Hoek
Location:	Netherlands
Year:	1995
Method:	Market Analysis: opportunity cost of land.
Results:	In order to make the economic interpretation of sustainable development, which allows substitution between human, social, produced and natural capital, operational, an attempt is made to value the Dutch capital stock. The natural capital stock is divided in natural sites and resources. The value of the sites was estimated as Dfl. 3,000 per capita, using market prices of land for housing. The value of our natural resources was estimated to be Dfl. 22,000 per capita. This number was based on the market prices of oil, gas, sand and ground water.
Remarks:	Discussion note of the Ministry of VROM
Reference:	Maas, R. and P. v.d. Hoek (1995)., *De kapitaalbenadering in het omgevingsbeleid*, Bilthoven: RIVM.

Topic: Cost Benefit Analysis of the National Ecological Network

Authors: F.J. Sijtsma and D. Strijker

Location: The Nationale Ecological Network of the Netherlands

Year: 1995

Method: Market Analysis: changes in agricultural production, costs of buying agricultural land for nature development and cost of nature management.

Results: The net costs of creating a national ecological network were estimated at Dfl. 3.4 billion over a period of 50 years. The benefits of increased biodiversity and aminities were not included in this figure.

Remarks: This is not a socio-economic valuation study, but a financial analysis at national level. The social-economic value of nature was not determined. Nature was valued in ecological terms. The result of this ecological valuation study is presented in part II ' Value of Nature'. It was concluded that the National Ecological Network leads to a biodiversity increase of 15 to 20 % compared to the situation without this network.

Reference: Sijtsma, F.J. and D. Strijker (1995). *Effect – analyse ecologische hoofdstructuur, Deel I – Hoofdrapport*, Grongingen: Stichting Ruimtelijke Economie.

1996

Topic: Valuation of intangible assets

Authors: W. Barris and M. Pommée

Location: Netherlands

Year: 1996

Method: Market Analysis: balance sheet valuation with the perpetual inventory method and net present value of future returns.

Results: Produced assets were divided into intangible assets (mineral exploration, software and entertainment) and valuables (art, antiques etc.). Non-produced assets were divided into tangible (land, subsoil assets, biological resources, water resources) and intangible assets (patents, leases, goodwill). The natural resources were valued on basis of future returns. E.g. biological resources were valued at Dfl. 87 million in 1990, based on the revenues from hunting licenses and fishing rights.

Remarks: This is *not* an economic benefit valuation study of unpriced goods, but a financial valuation of market goods, which are difficult to value because they are intangible or not produced.

Reference: Barris, W. and M. Pommée (1996). *Balance sheet valuation: produced intangible assets and non-produced intangible assets*, Voorburg: Centraal Bureau voor Statistiek.

Topic: Valuation of green in residential areas
Authors: F.J Sijtsma,. T.M. Stelder, J.P. Elhorst, J. Oosterhaven and D. Strijker
Location: Randstad and Noord Nederland, The Netherlands
Year: 1996
Method: Hedonic Pricing; willingness to pay for a green living environment
Result: House buyers are willing to pay 9.8 % to 11.6 % more for houses in areas with twice as much public green space than in regular areas. The benefits of a spatial planning scenario in which more people live outside the urban conglomerate Randstad were estimated at Dfl. 16 to 18 billion.
Remarks: In this study several other effects of different spatial planning scenarios, such as the reduction of traffic congestion, were estimated.
Reference: Sijtsma, F.J., T.M. Stelder, J.P. Elhorst, J. Oosterhaven and D. Strijker (1996). *Ruimte over, ruimte tekort*, Groningen: Stichting Ruimtelijke Economie.

Topic: Valuation of CO_2 fixation in fens
Authors: H. Goosen, E.C.M. Ruijgrok, M. Hoosbeek, S. Mager
Location: Netherlands
Year: 1996
Method: Market Analysis: prevention costs of CO_2 emissions.
Results: Different types of nature (broeikbos, laagvenen) were investigated for the possibilities of carbon fixation. The maximum fixation was 10 ton C per ha. The benefits of fixation were valued in order to compare it with the costs of nature development (construction and maintenance of reservations). Several cost based benefit estimates were done: the costs of emission reductions for the Dutch economy were used as a basis for valuing the benefits of carbon fixation by nature. Athough the value that may be assigned to a ton carbon fixation varies in time, an amount of DFl. 100,- per ton CO_2 was considered to be reasonable estimate.
Remarks: -
Reference: Goosen, H., E.C.M. Ruijgrok, M. Hoosbeek and S. Mager (1996). *Natuur-ontwikkeling en de mogelijkheden voor koolstofopslag*, Zeist: Wereld Natuur Fonds.

1997

Topic:	The value of a green environment
Authors:	M.G.A. van Leeuwen
Location:	The Netherlands
Year:	1997
Method:	Hedonic Pricing; willingness to pay for local and regional nature on the basis of a survey among brokers.
Results:	Houses near local parks are, on average, sold at a price which is 7 % higher than comparable house not close to local parks. Regional parks have an average price effect of 6 %. The effect of having both local and regional parks nearby was estimated at 14 %.
Remarks:	-
Reference:	Leeuwen, M.G.A., van (1997). *De meerwaarde van groen voor wonen*, Den Haag: Landbouw Economisch Instituut.

Topic:	Valuation of multifunctional types of nature the Dutch coast
Authors:	E.C.M. Ruijgrok
Location:	Voorne, Texel and Meijendel in the Netherlands
Year:	1997
Method:	Contingent Valuation: willingness to pay for recreational use and for non-use
Results:	The average willingness to pay for a visit to the areas varied from Dfl. 4.25 for the almost natural dune landscape of Voorne to Dfl. 1.93 for the tidal landscape of Meijdel. The average willingness to pay for non-use (overall value for all areas) was Dfl. 12.13 per person per year.
Remarks:	Separate calculations were made to determine the average willingness to pay of local visitors and of visitors from other regions. Also statistical tests were performed to investigate the possibilities for benefit transfers.
Reference:	Ruijgrok, E.C.M. (2000). *Valuation of nature in coastal zones*, Phd thesis Free University Amsterdam, Utrecht: Elinkwijk b.v.

Topic:	The loss of the natural and recreational values of a lake that is turned into a residential area
Authors:	B.E. Baarsma
Location:	IJburg, near Amsterdam
Year:	1997

Method:	Contingent Valuation: willingness to pay for a compensation fund for nature.
Results:	The mean willingness to pay was Dfl. 8.62 per household. The total economic benefits of nature compensation were estimated at Dfl. 3.36 million. The compensation costs of Dfl. 36 million were much higher than the benefits.
Remarks:	Also a special variant of CVM was used, which is called conjoint measurement. This is a special kind of ranking method that uses 6 vignettes (i.e. situations) comprising 3 different attributes (for nature, recreation and monetary contribution). The measured value pertained to both recreational use and non-use.
Reference:	Baarsma, B.E. (2000). *Monetary valuation of environmental goods; Alternatives to contingent valuation, Phd-study University of Amsterdam*, Amsterdam: Tinbergen Institute.

Topic:	Valuation of public green in residential areas
Authors:	J. Luttik and M. Zijlstra
Location:	Seven locations in the Netherlands: Leiden, Triangle of Berkel Rodenrijs, Berschenhoed and Bleiswijk, Zoetermeer, Utrecht, Veenendaal, Tilburg en Emmen.
Year:	1997
Method:	Hedonic Pricing: influence of green on the prices of houses.
Results:	A view on green within the residential area accounted for a value increase between 5 and 8 % of houses. Green outside the residential area did not have an impact on the price, but a view on open space led to a 12 % value increase. Gardens adjacent to water had the largest positive influence on prices: amounting to 28 %.
Remarks:	A large database with the transactions in the housing market in the period of 1989-1992 was used. In this data base not only prices but also characteristics of the houses were registered. A regression analyses was done on these data to determine the influence of different types of green, such as water, forest, open space etc. Also different types of houses were distinguished, resulting in a very detailed analysis.
Reference:	Luttik, JJ. en M. Zijlstra (1997). *Woongenot heeft een prijs; Het waardeverhogend effect van een groene en waterrijke omgeving op de huizenprijzen*, Wageningen: Staring Centrum.

Topic:	Cost Benefit Analysis of the National Ecological Network
Authors:	J. Vreke and F.R. Veeneklaas
Location:	The National Ecological Network of the Netherlands
Year:	1997
Method:	Market analysis: net value added of changing agricultural land into nature reserves.
Results:	The costs of the Nationale Ecological Network surpass the benefits. The net present value is – Dfl. 6.3 billion.
Remarks:	This is not a socio-economic valuation study, but a financial analysis at national level. If the socio-economic value of the natural qualities that are realised within the National Ecological Network had been included in the analysis, the net result would have been less negative.
Reference:	Vreke, J., and F.R. Veeneklaas (1997). *Economische kosten-baten analyse van de ecologische hoofdstructuur*, Wageningen: Staring Centrum.

1998

Topic:	Benefits that consumers derive from a nature reserve
Authors:	A.C. de Jong
Location:	National Park Hoge Veluwe
Year:	1998
Method:	Contingent Valuation, Contingent Ranking and Travel Costs.
Results:	Six types of consumers' benefits were distinguished among which recreational, non-consumption and future benefits. The average willingness to pay to prevent the disappearance of the area was estimated at a single donation of Dfl. 28,67. The average willingness to pay to prevent the closure of the area for visitor's was estimated at a single donation of Dfl. 17,33.
Remarks:	Master's thesis. It is unclear whether the six types of benefits add up and how they relate to use and non-use. The samples were small (12 to 14 respondents).
Reference:	Jong, de, A.C. (1998). *De economische waarde van natuur; naar een conceptueel raamwerk voor de monetaire waardering van natuurgebieden*, Rotterdam: Erasmus Universiteit.

Topic:	Ecosystem oriented cost benefit analysis for the Delta works
Authors:	R. Nijssen and J.J. Bouma
Location:	Grevelingenmeer, Zeeland
Year:	1998
Method:	Market analysis; damage costs avoided
Results:	The total economic value of the lake was not determined. For the ecosystem's functions of water production, water purification and flood protection different estimates were given on the basis of other studies (all benefit transfers).
Remarks:	An attempt was made to determine the ecological benefits of the lake on the basis of the net carbon production, but this turned out to be impossible.
Reference:	Nijssen, R. en J.J. Bouma (1998). *De kosten en baten van de deltawerken; Een aanzet voor een ecosysteem georienteerde kosten-baten analyse op het niveau van een watersysteem,* Rotterdam: Erasmus Universiteit, Centrum voor Milieukunde.

Topic:	Valuation of a nature reserve
Authors:	A.W.M. de Groot, K.H.S van Buiren, I.W. Overtoom en M. Zijl
Location:	Oostvaardersplassen
Year:	1998
Method:	Contingent Valuation: willingness to pay for a recreational visit. Travel Costs: travel expenses made to visit the area. Hedonic Pricing: value added of houses near the reserve. Market Analysis: prevention costs made by the Dutch rail road company to prevent damage to the area.
Results:	The total value of the area was calculated by adding but the results of the above mentioned metods. It amounted to Dfl. 600 million of which the non-use value accounted for 35 % .
Remarks:	The non-use value was not determined by means of CVM, but by adding up the results of the Hedonic Pricing study and the prevention costs incurred by the rail road company. Also several other valuation concepts were tried out. A special attempt was made to determine the explaining variables of people's willingness to pay by means of a ranking method.
Reference:	Groot, A.W.M., de, K.H.S van Buiren, I.W. Overtoom en M. Zijl (1998). *Natuurlijk vermogen; een empirische studie naar de economische waardering van natuurgebieden in het algemeen en de Oostvaardersplassen in het bijzonder*, Amsterdam: Stichting voor Economische Onderzoek der Universiteit van Amsterdam.

Topic:	Valuation of aircraft noise
Authors:	B.E. Baarsma
Location:	Schiphol Airport, Amsterdam
Year:	1998
Method:	Contingent Valuation variants: contingent ranking with vignettes and welfare evaluation by means of an income compensation.
Results:	Assuming that only noise nuisance above 35 Ku is compensated for, the noise produced by Schiphol airport requires a yearly compensation of Dfl.3.75 million. It was also found that households with a net monthly income of Dfl. 5,000 living in a house with no noise insulation, require a compensation of Dfl. 215.25 a month when the noise level rises from 220 to 30 Ku. Then their welfare level remains unchanged.
Remarks:	The ranking methods using vignettes did not produce a monetary value for aircraft noise.
Reference:	Baarsma, B.E. (2000). *Monetary valuation of environmental goods; Alternatives to contingent valuation, Phd-study University of Amsterdam*, Amsterdam: Tinbergen Institute.

Topic:	Valuation of forest expansion in urban areas
Authors:	R. van Huijssteeden, and P.J. Schep
Location:	The Hague, Randstad, Netherlands
Year:	1988
Method:	Market Analysis: indirect income effects for the recreation sector Hedonic Pricing: value increase of property (benefit transfer).
Results:	The net value added of the recreation sector that may be attributed to forests was estimated at Dfl. 3.9 million per year. The value increase of properties related to forests was estimated at Dfl. 2.5 million per 100 houses. The positive effect of forests on the attraction of business to the region was recognised but not monetarised.
Remarks:	Master's thesis.
Reference:	Huijssteeden, R., van, en P.J. Schep (1998). *Verkenning indirecte economische effecten van bosuitbreiding in de randstad*, Wageningen: Rijksinstituut voor onderzoek in de bos- en landschapsbouw.

1999

Topic:	Valuation of natural and cultural landscapes of the Dutch coast
Authors:	E.C.M. Ruijgrok
Location:	Voorne, Texel and Meijendel in the Netherlands
Year:	1999
Method:	Contingent Valuation: willingness to pay for recreational use Hedonic Pricing for perception values of cultural landscapes Market Analysis for production values
Results:	For a set of landscapes ranging from natural to cultural the economic use value was determined on the basis of production-, perception- and regulation functions. This resulted in an economic value of Dfl. 1,500 to 9,000 per ha per year. It was concluded that cultural landscapes may have a higher economic *use value* than natural landscapes and that some types of multifunctional land use have a stronger positive effect on the economic use value than others.
Remarks:	For the perception value rankings were made as well. Only the Hedonic Pricing results were based on benefit transfers. Non-use values were not deteremined.
Reference:	Ruijgrok, E.C.M., Goosen, H., en S. Vonk (2000). *Meervoudig ruimtegebruik en natuurwaarden; Een studie naar de ecologische- en belevingswaarden van multifunctionele natuurtypen*, Gouda: Stichting LWI (1999). See also: Ruijgrok, E.C.M., *Valuation of nature in coastal zones*, Phd thesis Free University Amsterdam, Utrecht: Elinkwijk b.v.

Topic:	Valuation of nature friendly river and canal banks
Authors:	E.C.M. Ruijgrok and N.J. Vlaanderen
Location:	Different locations in the Netherlands, covering almost the whole country: Engelse Werk (river IJssel, near Hattum) Loevestein (river Waal) Bocht v. Linne (river Oude Maas) Helmond (Canal Omleiding Zuid Willemsvaart) Spaarnwoude (Canal Noordzee kanaal) Noord Hollandsch Kanaal (Canal near Akersloot) Volkerak Zoommeer (a lake in Zeeland) Huys d. Donck (river Maas, Rotterdam) Dijktuin II (river Schelde, Tholen, Zeeland)

Year:	1999 and 2000
Method:	Contingent Valuation: willingness to pay for recreational use and the willingness to pay for non-use of 9 different types of nature friendly banks (i.e. aquatic ecosystems).
Results:	The average willingness to pay for non-use varied from Dfl. 14,88 per household per year for the type 'canel with dam construction' (Noordhollands Kanaal) to Dfl. 28,83 per household per year for the type 'river without dam construction' (Engelse Werk). The average willingness to pay for recreational visits amounted to Dfl. 1.30 per visit.
Remarks:	All intervieuws were held near the water course to be valued or at another location within the relevant municipality.
Reference:	Ruijgrok, E.C.M. en N.J. Vlaanderen (2001). *Sociaal- economische waardering van natuurvriendelijke oevers; Een CVM-studie in het kader van het Beheer Plan Nat*, Delft: Dienst Weg- en Waterbouwkunde.

Topic:	Costs and benefits of transforming a farm into a multifunctional estate
Authors:	M. Mulder, W. Wijnen and E. Bos
Location:	Landgoed Scholtenszathe (estate near Emmen, the Netherlands)
Year:	1999
Method:	Benefit transfers for willingness to pay for biodiversity and recreation.
Results:	The economic benefits of recreation and biodiversity were estimated to be respectively Dfl. 10.1 million and Dfl. 9.3 million. The net present value of the cost benefit analysis of transforming the farm into an estate was Dfl. 48.6 million.
Remarks:	It is not mentioned whether the benefit transfers were from CVM or other types of studies. They were from foreign studies. In this study a mathematical model is developed for cost benefit analyses of changes in land use.
Reference:	Mulder, M., W. Wijnen, E. Bos (1999). *Maatschappelijke kosten baten analyses van veranderingen in het landelijk gebied. Ontwikkeling van een operationele methode in het kader van het ruimtelijk economisch model (REM)*, Den Haag: Landbouw Economisch Instituut.

2000

Topic:	A healthy Volkerak-Zoommeer
Authors:	E.C.M. Ruijgrok and A. Brenninkmeijer
Location:	Volkerak-Zoommeer, Zealand, the Netherlands
Year:	2000
Method:	Contingent Valuation for the information function (perception value) and the non-use function: both benefit transfers Market Analysis: abatement costs for the valuation of regulation functions and market prices for the valuation of production functions.
Results:	It was investigated which production-, regulation-, information and non-use function could be performed better by a clean lake (of high ecological quality) than by the present lake. The benefits of a clean lake were estimated at Dfl. 17,6 million a year.
Remarks:	The regulation function 'fixation of heavy metals by reed vegetations' generated the largest benefit, followed by the non-use function.
Reference:	Ruijgrok, E.C.M. and A. Brenninkmeijer (2000). *Inventarisatiestudie economische baten Volkerak-Zoommeer*, Den Haag: Witteveen en Bos.

Topic:	Cash flows related to nature areas
Authors:	T. Bade, E. Bos, H. Koolen, C. Moritz, M. Mulder, P. de Putter
Location:	Two areas in the Netherlands: de Brabantse Biesbosch en de Utrechtse Heuvelrug
Year:	2000
Method:	Market Analysis: cash flows from nature management, harvest of products, recreational expenditures, value increase of houses and tax payments.
Results:	The positive direct cash flows for the Utrechtse Heuvelrug were estimated at Dfl.11.88 million, while the negative cash flowed were Dfl. 10.40 million. For the Brabantse Biesbosch the direct positive cash flows were respectively Dfl. 2.58 million and Dfl. 2.56 million.
Remarks:	Also an attempt was made to estimate the indirect cash flows. This study is not a socio-economic valuation, but a financial valuation study.
Reference:	Bade, J., E. Bos, H. Koolen, C. Moritz, M. Mulder en P. de Putter (2000). *Geldstromen verbonden met natuur, bos en landschap: de Brabantse Biesbosch en de Utrechtse Heuvelrug*, De meern: KPMG Milieu en Landbouw Economisch Instituut.

Topic:	Water quality
Authors:	R. van der Veeren
Location:	Zwemlust, Breukelen, the Netherlands
Year:	2000
Method:	Contingent Valuation; willingness to pay of recreators for clear water
Results:	The average willingness to pay varied between Dfl. 0.80 and Dfl. 1.40 per visit.
Remarks:	In this empirical study 87 % of the respondents was willing to pay for clear water. Several explaining variables such as income and education were included in the analysis.
Reference:	Veeren, R. van der (2000) "De recreatieve waarde van helder water in Zwemlust", in: *H_2O*, Vol.10, pp.36-37.

Topic:	The economic benefits of a resilient watersystem
Authors:	R. Brouwer, R. van Ek and J. Bouma
Location:	Rivers of the Netherlands
Year:	2000
Method:	Contingent Valuation: willingenss to pay for different functions of aquatic ecosystems
Results:	On the basis of a meta analysis (benefit transfers from 30 foreign studies) the economic value of river systems is estimated at Dfl. 132 per household per year. This results in a net present value of Dfl. 2 billion for the low lying Dutch rivers for the period 2000-2015.
Remarks:	-
Reference:	Brouwer, R., R. van Ek, en J. Bouma (2000). *Baten van water: naar een integrale evaluatie methodiek; Case studie ruimtelijke waterberging in het benedenrivierengebied*, Lelystad: RIZA.

2001

Topic:	Economic valuation of forest expansion
Authors:	Moons, E., Heggermont, K., Hermy, M., and S. Proost
Location:	Heverlee-Meerdaalforest in Belgium
Year:	2000
Methods:	Market Analysis, Travel Cost Method, and Contingent Valuation.
Results:	The most conservative estimation of the net recreational benefits of

	expanding the Heverlee-Meerdaalforest in Belgium varies between BEF 612-735 per person per visit using the travel cost approach. The total non-use value for the Heverlee-Meerdaalforest has been estimated using CVM, and varies between BEF 7 and 11 billion. Timber benefits are calculated using predicted-growth models and market prices. Hunting benefits are calculated using regional market prices, and carbon sequestration values are based on indicative numbers.
Remarks:	This is a Belgian study.
Reference:	Moons, E., Heggermont, K., Hermy, M., and S. Proost (2001). *Economische waardering van bossen. Een case-study van Heverleebos-Meerdaalwoud.* Leuven: Garant.

Topic:	Valuation of a land use project 'the construction of a lake'
Authors:	E. Bos and M. van Leeuwen
Location:	Kuindermeer
Year:	2001
Method:	Market analysis by means of a regional input-output matrix
Results:	The green scenario for this land use project, which involves nature, recreation, housing and water storage, generates a value added of Dfl. 24 million for an investment of Dfll. 173 million.
Remarks:	This study presents a pure cash flow analysis. Only the financial value of nature was included in the calculation. Non-market benefits were not valued. The value of nature was not separated from the other land use functions.
Reference:	Bos, E., M. van Leeuwen (2001). *Ontwikkeling van een instrumentarium voor het bepalen van regionaal economische effecten van landinrichtingsprojecten*, Den Haag: Landbouw Economisch Instituut.

Topic:	A cost benefit analysis for the creation of a new a recreation area
Authors:	M.F.M. Briene, I.J. Boeckhout, A.F.M. Verschuren, A.C.P. Verster and J.A. Annema
Location:	IJsselmonde, Rotterdam
Year:	2001
Method:	Hedonic Pricing: value increase of houses due to the creation of the new recreation area. Travel cost: the travel expenses (fuel and time) made by visitors to the new area. All benefit transfers.
Results:	In the long run the use value of nature exceeds the construction costs of the

area. The net present use value varied from Dfl. 292 million to Dfl. 524 million for the different project alternatives that were formulated.

Remarks: An attempt was made to estimate the existence value of nature by performing a benefit transfer from a Contingent Valuation study. This estimate was, however, not included in the net present value.

Reference: Briene, M.F.M. , I.J. Boeckhout, A.F.M. Verschuren, A.C.P. Verster en J.A. Annema (2001). *Kosten en baten 750 ha natuur- en recreatiegebied regio Rotterdam*, Rotterdam/Bilthoven: NEI/RIVM.

Topic: The natural benefits of abating acidification

Authors: E.C.M. Ruijgrok en R.E. Nieuwkamer

Location: Netherlands

Year: 2001

Method: Contingent Valuation: perception value and non-use value of nature (benefit transfers).
Market Analysis: avoided abatement costs for regulation functions:.

Results: The benefits of increased natural qualities (mainly increased biodiversity) of abating acidification were determined by investigating which ecosystems' functions are positively affected by reduced acidification. The benefits were estimated at Dfl. 540 million per year for all terrestrial ecosystems in the Netherlands. Different acidification abatement scenario's were used, but benefit estimates hardly varied per scenario.

Remarks: The perception and non-use value were rough estimates, determined on the basis of benefit transfers.

Reference: Ruijgrok, E.C.M. and R.J.L. Nieuwkamer (2001). *Natuurbaten van verzuringsbestrijding*, Den Haag: Witteveen en Bos.

Topic: Valuation of defragmentation of a nature area

Authors: E.C.M. Ruijgrok

Location: Renkums Beekdal, Veluwe, the Netherlands

Year: 2001

Method: Contingent Valuation for the information function and the non-use function.
Market Analysis for other functions: abatement costs for regulation functions.
All benefit transfers.

Results: The total economic value of defragmenting the area by creating ecological corridors and removing a factory, were estimated at Dfl. 177 million a year.

Remarks: It was investigated which functions nature can perform better when the area is defragmentated and how much welfare this better performance will bring.

Reference: Ruijgrok, E.C.M. (2001). *De economische baten van ontsnippering; case*

study Renkums Beekdal, Den Haag: Ministerie van LNV, unpublished.

Topic:	Costs and benefits of rail infrastructure
Authors:	UFSIA and NEA
Location:	IJzeren Rijn, a rail road from Antwerp (Belgium) to the German Ruhr area through Limburg (The Netherlands)
Year:	2001
Methods:	Hedonic Pricing Method for rail road noice (benefit transfer) Market Analysis: cost of acquiring land for nature compensation and the costs of measures to prevent disturbance and fragmentation of nature.
Results:	The economic value of rail road noise reduction by noise screens was estimated to vary from Euro 18.3 to 45.1 million. The economic value of the loss of natural quality due to rail road construction was estimated to range from Euro 112.8 to 39.3 million.
Remarks:	Nature was valued financially, not socio-economically.
Reference:	UFSIA (= Universiteit Antwerpen) and NEA (2001). *Maatschappelijke kosten baten analyse IJzeren Rijn*, Rijswijk: Railinfrabeheer.

Topic:	The economic value of lost natural functions of the Rhine River Basin. Costs of Human Development of the Rhine River Basin
Authors:	Kirsten Schuijt
Location:	the Netherlands
Year:	2001
Methods:	Market Analysis: for fish production Production Function Method: for the provision of clean drinking water, natural retention capacity, and the existence value of nature.
Results:	The annual economic value of lost natural Rhine functions amounts to $1.8 billion. The net present value of these losses over infinity, is estimated at $969.2 billion.
Remarks:	-
Reference:	Schuijt, K. (2001). *The Economic Value of Lost Natural Functions of the Rhine River Basin. Costs of Human Development of the Rhine River basin Ecosystem.* Erasmus center for Sustainable Development and Management (ESM) Rotterdam: Erasmus University.

2002

Topic:	The benefits of a more flexible management of water levels
Authors:	M.E.M. Schmitz and E.C..M. Ruijgrok
Location:	Amstelmeerboezem, Netherlands
Year:	2002
Method:	Different valuation methods for different ecological functions, among which Contingent Valuation and Abatement Costs; all benefit transfers.
Results:	The benefits of larger water level fluctuations are related to a better functioning of the ecosystem and were estimated at 0.3 million Euro per year.
Remarks:	The total economic benefits were determined by adding up the values of the ecosystem's functions that would be fulfilled better in case of larger fluctuations in the water levels. The largest value accrued to the non-use function, followed by the recreational function and the regulation function "recycling of Nitrogen and Phosphate".
Reference:	Schmitz, M.E.M. en E.C.M. Ruijgrok (2002). *Onderzoek flexibel peilbeheer Amstelmeerboezem*, Den Haag: Witteveen en Bos.

Topic:	The benefits of transferring agricultural land into a nature area
Authors:	E.J. Bos and J.C.J.M. van den Bergh
Location:	Vechtstreek, The Netherlands
Year:	2002
Method:	A benefit transfer to estimate the consumer surplus of recreational trips
Results:	The net benefits from changing an hectare of agricultural land into a nature area were estimated at Dfl. 309. This figure was calculated by subtracting the nature management costs and the foregone value added of agriculture from the net benefits from recreation.
Remarks:	-
Reference:	Bos, E.J. and J.C.J.M. van den Bergh (2002). "A cost benefit analysis of sustainable nature policy in the Dutch Vecht wetlands area", in: *Comparative Environmental Economic Assessment*, R.J.G.M. Florax, P. Nijkamp, K.G. Willis (ed.), Cheltenham: Edward Elgar.

Topic:	Benefits of existing nature areas in the Netherlands
Authors:	T. Botterweg and M. Briene
Location:	The Netherlands

Year:	2002
Method:	Combination of benefit transfers from Contingent Valuation, Hedonic Pricing and Travel Cost studies.
Results:	In this study the contribution of the existing nature in the Netherlands to various public sectors, such as health care, recreation, housing, water management and environment, is estimated at Euro 13 to 21 billion per year.
Remarks:	-
Reference:	Botterweg, T. and M. Briene (2002). *De verscholen baten van natuur*, Rotterdam: Ecorys-NEI.

Topic:	Costs and benefits of measures providing more space of natural river dynamics
Authors:	J. Kind
Location:	Rivers in the Netherlands
Year:	2002
Method:	Market Analysis: damage cost avoided and recreational expenditures Contingent Valuation Method (benefit transfers) Hedonic Pricing Method (benefit transfers)
Results:	The non use value of nature is estimated at Euro 75 million per year and the recreational use value at Euro 30 million per year. The positive effect of nature on the value of property is estimated at Euro 22 to 266 million.
Remarks:	Benefit transfers from other Dutch studies; CVM transfers from Ruijgrok, 1999 and 2000 and HPM-transfers from Luttik and Zijlstra, 1997.
Reference:	Kind, J. (2002). *Kosten en baten van rivierverruimende maatregelen; een vingeroefening MKBA voor het Spankrachtstudiegebied*, Lelystad: RIZA.

Topic:	Monetarisation of the contribution of nature areas to water management
Authors:	E. J. Bos and J. Vleugel
Location:	The Netherlands
Year:	2002
Method:	Market Analysis: damage costs
Results:	The nature management costs resulting from water use are estimated to be Euro 140 million per year in the Netherlands.
Remarks:	This study is not a benefit but a costs study, since the benefits that the water sector derives from nature were not estimated. An elaborate actor analysis of the nature and water sector is presented.
Reference:	Bos, E.J., J. Vleugel (2002). *Verzilveren van de waterbeheerfunctie van natuurgebieden*. Den Haag: Landbouw Economisch Instituut.

Topic:	Benefits and costs of nature
Authors:	W. Wijnen, H. Hofsink, E. Bos, C. van der Hamsvoort, and L. de Savornin Lohman
Location:	Roerdal, the Netherlands
Methods:	Market analysis: calculation of all financial costs and benefits associated with an improved quality of nature Contingent valuation: non-use value of the Roerdal area.
Results:	Financial costs of additional management in the improved situation have been estimated at EUR 2.1 mln for the years 1994-2000. Financial benefits (1994-2000) included additional profits for recreation-dependent firms and other firms, and increasing property values. They were estimated at EUR 4.5 mln. The non-use value of the area has been estimated at EUR 7.5 mln in 2001 values. This value cannot be added to the financial benefits as it represents the total current non-use value in 2001, whereas only additional non-use values resulting from an improved quality of nature should be taken into account here.
Remarks:	Non-use value has been estimated using the number of recreationists in the area as the relevant population.
Reference:	Wijnen, W., Hofsink, H., Bos, E., van der Hamsvoort, C., and L. de Savornin Lohman (2002). *Baten en Kosten van Natuur. Een regionale analyse van het Roerdal,* Den Haag: Landbouw Economisch Instituut.

2003

Topic:	Valuing benefits and costs with respect to housing development in a nature area
Authors:	Ruijgrok, E., Nieuwkamer, R.L.J., and S. Reinard
Location:	The Netherlands
Year:	2004
Methods:	Avoided damage cost approach to value water related effects: costs that have been made to increase the quality of quays were used as a proxy to value increased safety. Additional costs that were made to raise the surface to prevent damage due to high groundwater levels have been estimated to value ‘groundwater nuisance’. The lost option value for water storage has

been calculated using the costs of increasing the capacity of a pumping station as a proxy.

Results: Effects have been estimated for four different scenarios with respect to housing development. Each scenario consists of 38 housing locations. Effects, however, do not necessarily apply to all locations. Initially, effects have been valued per location and summed, to generate a result per scenario. Safety costs varied between EUR 1.2 – 39.2 mln depending on the scenario, and the costs of avoiding groundwater nuisance between EUR 40-277 mln. The option value for salt and nutrient seepage has been set to 0, because it is not expected that housing development will increase unwarranted seepage. The option value for water storage only applies to one scenario and has been estimated at EUR 13 mln

Remarks: Only water-related effects have been monetarised. There was not sufficient information available to quantify effects on nature and agriculture.

Reference: Ruijgrok, E.C.M., Nieuwkamer, R.L.J., and S. Reinard (2003). *De blauwe, groene, en agrarische kosten en baten van de Deltametropool-bijdrage aan de MKBA Deltametropool.* Rotterdam: Witteveen+Bos.

Topic: Valuation of a wind park in the Dutch Wadden area

Authors: H.J.B. Elzinga

Location: Makkum, Terschelling West, and Sint Annaparochie, Wadden area, The Netherlands

Year: 2003

Methods: Contingent Valuation Method, to value the openess of the Dutch Wadden area.

Results: Interviews were held in three surrounding villages: Makkum, Terschelling West, and Sint Annaparochie. The overall mean willingness to pay to preserve the openness of the landscape is EUR 20.75 per person per year. The mean willingness to pay has also been reported separately for each of the three villages. The estimated willingness to pay did, however, not differ significantly between any of the villages.

Remarks: In this study a mail survey was used, which is uncommon, and usually unwarranted when applying the contingent valuation method.

Reference:	H.J.B. Elzinga (2003). *Beleving van een windmolenpark in het Waddengebied.* MSc thesis. Rijksuniversiteit Groningen: Faculty of spatial sciences.
Topic:	The socio-economic value of natural water levels in the Frisian lakes
Authors:	R. Brouwer, R. van der Veeren, P. van Konijnenburg en L. Stronk
Location:	Frisian Lake area, the Netherlands
Year:	2003
Method:	Travel Cost Method and Contingent Valuation Method. The Travel Cost Method is used to estimate the current recreational use value of the area. The Contingent Valuation is used to calculate the benefits that both visitors and recreationists derive from maintaining a fixed and a natural water level respectively.
Results:	The travel cost study generated a consumer surplus of EUR 50.3 per visit. The total annual value is estimated at a minimum of EUR 185 mln. When the opportunity costs of travel time are included, the total annual value adds up to EUR 686 mln per year. The mean willingness to pay for extra measures to maintain a fixed water level is EUR 54 per household per year. The mean willingness to pay for extra measures to have natural water levels is EUR 76 per household per year. The total annual value for a fixed water level using CVM is estimated at EUR 11.8 mln. The total annual value for having natural water levels using CVM is EUR 14 mln.
Remarks:	This is the first Dutch study that includes both the travel cost and contingent valuation method in one single survey.
Reference:	Brouwer, R., Veeren, van der, R., Konijnenburg, van, P., and L. Stronk (2003). *De sociaal-economische waarde van natuurlijk peilbeheer in het Friese merengebied.* Lelystad: RIZA.
Topic:	Benefits of water. A manual for integrated policy evaluation
Authors:	Brouwer, R. Boer, de, J., Ek, van, R., and M. Hisschemöller
Location:	the Netherlands
Year:	2003

Methods:	Contingent Valuation
Results:	The economic value of water buffers has been estimated at a net present value of EUR 2.9 mln.
Remarks:	This is only a small example included in an elaborate manual on determining the value of water. Benefit transfers have been used.
Reference:	Brouwer, R., Boer, de, J., Ek, van, R. and M. Hisschemöller (2003). *Baten van Water. Leidraad voor integrale beleidsevaluaties.* Lelystad: RIZA.

Topic:	Benefits of swimming water quality
Authors:	R. Brouwer
Location:	the Netherlands
Year:	2003
Methods:	Contingent valuation to estimate the benefits of clean swimming water.
Results:	The mean willingness to pay varied between EUR 35-45 per household per year. This amounts to an aggregated value of EUR 170 mln -215 mln per year for all users (=60% of the Dutch population)
Remarks:	-
Reference:	Brouwer, R. (2003). *De baten van schoner zwemwater in Nederland.* Lelystad: RIZA.

2004

Topic:	The Economic Values of the World's Wetlands
Authors:	Kirsten Schuyt, and Luke Brander
Location:	Across the world (for the purpose of this overview, however, only Dutch studies have been considered)
Year:	2004
Methods:	Various: benefit transfers in the form of a meta-analysis have been used.
Results:	The total economic value of the Dutch Wadden Sea is estimated at US $ 2.3 mln per year.

Remarks:	This study presents an overview of economic values of the world's wetlands to perform a meta-analysis.
Reference:	Schuyt, K., and L. Brander (2004). *Living Waters. Conserving the source of life. The economic value of the world's wetlands.* Gland/Amsterdam: World Wide Fund for Nature/ Institute for Environmental Studies.

Topic:	Valuation of Nature, Water and Soil in Socio-economic Cost-Benefit analyses
Authors:	E.C.M. Ruijgrok, R. Brouwer, H. Verbruggen, D. de Groot, and E.J. Bos
Location:	the Netherlands
Year:	2004
Methods:	Market analysis, Abatement costs, Hedonic Pricing, Production Function Method and Contingent Valuation have been used to estimate benefits and costs to nature, water and soil due to the construction of a new railroad.
Results:	Timber benefits are generated only once and have been estimated at EUR 1.8 mln using market analysis. Additional drinking water benefits are valued at EUR 3.642 per year. Loss of clean surface water and carbon sequestration has been estimated at EUR 660 and EUR 45.988 per year respectively, using avoided abatement costs. Loss of recreational benefits has been valued using a CVM benefit transfer, at a minimum of EUR 459.900 per year. A decrease in property values due to the construction of the railroad will happen only once and has been estimated at EUR 885.000. The costs of clean groundwater have been estimated at EUR 9.585 per year, starting at year 10 using the production function method. The non-use value of lost benefits of nature have been estimated at EUR 440.000 using contingent valuation benefit transfers. The total net present value of lost benefits is estimated to vary between EUR 18.7 mln and EUR 28.3 mln.
Remarks:	This case is a fictitious example based on the real rail road project ´IJzeren Rijn´ to illustrate how to identify and value effects on nature, water and soil.
Reference:	Ruijgrok, E.C.M., Brouwer, R., Verbruggen, H. (2004). *Waardering van Natuur, Water, en Bodem in Maatschappelijke Kosten Baten Analyses. Een handreiking ter aanvulling op de OEI-leidraad.* Rotterdam: Witteveen+Bos.

Topic:	The socio-economic value of cultural heritage. A case study in the Tieler-Culemborgerwaard
Authors:	Ruijgrok, E.C.M., E.E.M Nillesen en R.E. Atman
Location:	Tieler-en Culemborgerwaarden, the Netherlands
Year:	2004
Methods:	Contingent Valuation: to estimate the recreational and non-use benefits of cultural heritage in the area. Hedonic Pricing: increase in property values due to the presence and conservation of historic elements of houses.
Results:	The estimated recreational use value of the area is to EUR 35.990 per year. The non-use benefits amount to EUR 33.8 mln per year. House buyers are willing to pay 15% more if the historical elements of a house are being preserved.
Remarks:	This is the first Dutch study that estimates the socio-economic value of cultural heritage. It is the first study worldwide in which hedonic pricing has been applied to value cultural heritage.
Reference:	Ruijgrok, E.C.M., E.E.M Nillesen en R.E. Atman (2004). *Economische waardering van cultuurhistorie, Een case studie in de Tieler- en Culemborgerwaard,* Utrecht: Projectbureau Belvedere.

Topic:	Economic valuation of infrastructural effects on nature
Author:	E.J. Bos
Location:	the Netherlands
Year:	2004
Methods:	Contingent Valuation: estimated loss of biodiversity (non-use) due to the construction of a new railroad in 'het Groene Hart' (benefit transfer) Travel Cost: estimation of the recreational use of the area (benefit transfer)
Results:	The estimated loss of biodiversity is EUR 17.6 mln per year The loss of recreational use benefits amounts to EUR 848,000 per year.
Remarks:	-
Reference:	Bos, E.J. (2004). *De economische waardering van de effecten van infrastructuur op natuur.* Den Haag: Landbouw Economisch Instituut.

Topic: Valuation of water in a regional watersystem

Author: Reinhard, S., van Bakel, J., Gaaf, A. and K. van Bommel

Location: the Netherlands

Year: 2004

Methods: Avoided damage cost approach: The monetary compensation required for potential damage, has been used as a proxy to estimate the benefits of flood prevention. Nature benefits of increased water levels have been estimated using the costs the government would otherwise make to expand current natural areas.

Production factor method: The value of water as production factor for agriculture has been calculated using potential yield reductions as a proxy.

Results: Total benefits of increased water retention have been estimated at EUR 1.3 mln per year.

Remarks: -

Reference: Reinhard, A.J., P.J.T. van Bakel, A. Gaaff and K.H.M. van Bommel (2004) *Waarderen van water in een regionaal watersysteem.* Den Haag: Landbouw Economisch Instituut.

Topic: Valuation of five types of inundation areas in the Schelt estuary

Author: Ruijgrok, E.C.M. and C. Lorenz

Location: Schelt estuary, Belgium

Year: 2004

Methods: Contingent Valuation Method, Market analysis, Hedonic Pricing (benefit transfer), Avoided Damage Cost Approach

Results: Benefits for five different types of inundation areas have been estimated in present values (at 4 % interest) and are displayed in the table below:

	Agr.I.A.	Wetland	R. Tidal A.	R. Tidal A.	River Exp.	River Exp.	W. River V.	unit
	fresh	fresh	fresh	brackish	fresh	brackish	fresh	
Aeration	0	0	87	38	87	38	0	Euro per ha
Wood	0	8.630	6.904	0	5.696	0	0	Euro per ha
Reed	0	6.421	5.137	0	4.238	0	0	Euro per ha
Erosion	0	260	260	260	0	0	0	Euro per ha
Sedimentation	0	292	20.426	20.426	20.426	20.426	0	Euro per ha

Nutrient purification	0	14.990	25.022	15.304	23.572	14.864	0	Euro per ha
rinse out (N, P)*	*0*	*1.929*	*1.929*	*1.929*	*1.929*	*1.929*	*0*	
denitrification (N)	*0*	*5.846*	*10.084*	*6.138*	*10.084*	*6.138*	*0*	
plant absorption (N, P)	*0*	*7.215*	*5.772*	*0*	*4.762*	*0*	*0*	
burial (N, P)	*0*	*0*	*7.237*	*7.237*	*6.797*	*6.797*	*0*	
C sinking	0	0	3.242	3.242	3.242	3.242	0	Euro per ha
Metal binding	0	507	35.501	35.501	35.501	35.501	0	Euro per ha
Carbon storage	0	3.421	2.737	2.808	2.257	2.808	0	Euro per ha
Recreational opportunities	1.381	1.381	1.243	1.243	2.037	2.037	374	Euro per ha
Subtotal per ha	**1.381**	**35.903**	**100.561**	**78.823**	**97.057**	**78.917**	**374**	**Euro per ha**
Fish recreation	-32.500	-32.500	-32.500	-32.500	-32.500	-32.500	-32.500	Euro per fish pond
Housing Amenity	-50.400	-50.400	-50.400	-50.400	-50.400	-50.400	-50.400	Euro per 2 houses**
Non-use	0,00	796,24	796,24	796,24	796,24	796,24	718,67	million Euro if total area is this type

Remarks: On the basis of the presented benefits per ecosystem, benefits per safety scenario are calculated.

Reference: Ruijgrok, E.C.M. and C. Lorenz (2004). *MKBA Sigmaplan Onderdeel Ecosysteemwaardering.* Rotterdam: Witteveen+Bos.

Topic: Benefits of clean water soils

Author: J. Kind et.al.

Location: Netherlands, rivers

Year: 2004

Methods: Market analysis (damage cost avoided) for benefits related to shipping, agriculture, recreation and flooding.
Contingent Valuation for the benefits related to biodiversity.

Results: The average willingness to pay for the contribution of clean water soils to biodiversity amounted to € 25 to € 30 per household per year. On the basis of this result the present value of the economic benefit of biodiversity was estimated at € 2.8 billion. The benefits of shipping, safety and agriculture were respectively € 0.89, € 0.07 and € 0.46 billion (all present values). These benefits surpass the estimated costs of cleaning water soils of € 1.06 billion.

Remarks: The presented results were obtained from a publication in preparation.

Reference: Kind, J., W. Korving, H.Eenhoorn, L. Osté, D. Beerda, D.Bakker, E. de Boer, R. Brouwer, L. Goedemans en s. Katz (2004). *MKBA Waterbodems*. Lelystad: RIZA.

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4. Appendix: Description of valuation methods

Table 1 presents a number of widely-used economic valuation methods. It indicates which aspects of nature they are suited to value, if they measure preferences, and whether they can capture both use and non-use values.

Table 1 Economic valuation methods

Method	Suitable for	Value type	Consumer surplus	Cost/benefit-based	Use versus non-use value
CVM	Amenities and other perceived attributes of natural sites	Willingness to pay	Included	Benefit-based; Stated preference	Both
HPM	Amenities/nuisances related to capital goods	Hedonic price	Included	Benefit-based; Revealed preference	Use
TCM	Recreational value of natural sites	Travel costs	Included	Benefit-based; Revealed preference	Use
PFM	Natural qualities that influence economic production	Market price Economic rent	Excluded	Cost-based; damage costs Revealed preference	Use
ABM	Natural qualities effecting consumer behaviour	Prevention costs	Excluded	Cost based; prevention costs Revealed preference	Use
Acronyms: CVM = Contingent Valuation Method; HPM = Hedonic Pricing Method; TCM = Travel Cost Method; PFM = Production Factor Method; ABM = Averting Behaviour Method.					

This table only includes valuation methods that measure preferences. There are also several economic valuation methods that are not based on social preferences, such as Energy Analysis and Implicit Valuation (Hoevenagel, 1994). These non-preference based methods do not really measure the welfare provided by nature and are therefore not elaborated upon here.

The Contingent Valuation Method (CVM)

CVM is a survey method in which respondents are asked how much they are willing to pay for the use or conservation of natural goods[2]. Their stated preferences are assumed to be contingent upon the alternative goods that are offered in a 'hypothetical market'. Essential elements of the survey are: description of the natural good that is to be valued, description of the payment vehicle and description of the hypothetical market. *Describing the natural good* includes identifying all valuable attributes of the good. The *payment vehicle* pertains to how the money will be paid. One can pay for a good in cash every time it is used or by means of an increased income tax. The *description of the hypothetical market* should include an identification of who will provide and who will pay for the nature improvement. It should be made clear that the payment is a collective action; everybody else will also pay, otherwise respondents may refuse to pay although they appreciate the good. Respondents should also be reminded of the possibility of spending their income on goods other than nature, to prevent overestimates (Hoevenagel, 1994).

CVM measures benefit-based preferences and it includes the consumers' surplus. It is said to be an appropriate economic valuation method for environmental goods that have no indirect effects on other goods. It is therefore suited for the valuation of amenities or other easy to perceive aspects of nature, but not for the valuation of natural processes, such as climate regulation, where effects on human welfare are difficult to grasp. However, CVM does not produce valid measurements when it concerns goods that people are not familiar with. Nor does it work when people reject responsibility for the good in question (de Boer *et al*., 1997). If people are asked, for example, about their willingness to pay for clean soil, they may state that it is zero, because they feel the polluter should pay. This does not mean that they do not appreciate clean soil. One may also remark here that it is better to value goods that have an international character on a cost basis, because in a CVM-survey respondents will not know what to answer if they realise that reducing pollution in their own country does not solve the global pollution problem, if the other countries do not make an effort too.

Several authors (Freeman, 1986; Hoevenagel, 1994; Wierstra *et al.*, 1995) argue that CVM works best where it is least needed. It does not provide valid estimates when people are unfamiliar and inexperienced with the good. Validity may be a problem, since it is very difficult to describe a natural good in such a way that all its attributes are accounted for. Freeman (1986) notes that CVM works best for those goods resembling ordinary commodities. This means that it is best suited for valuing consumption goods that people consume more of as their income increases (and the price decreases). When goods are not easily commoditised, as in choices concerning entire ecosystems, CVM results are doubtful.

[2] Or what compensation they need to be given in order to accept not being able to use or losing a natural good (i.e. their willingness to accept).

Supporters of this notion argue that an environmental good has several attributes and that compressing the values of these attributes into a single metric (such as willingness to pay) leads to an information loss. The same argument is, however, also relevant to private goods, but in that case people seem to accept their prices as their true value. The idea behind this is that people have experience in valuing and making trade-offs for attributes of private goods, whereas they do not have any experience in valuing environmental goods. In fact, they may not even be aware of all attributes. This situation makes people liable to construct their values heuristically on the basis of the information provided by the elicitation setting (Vatn and Bromley, 1994). Taking account of the restrictions of valuation experience and commodity resemblance, it seems that CVM is most accurate for the valuation of publicly-managed goods with private characteristics such as natural sites.

In CVM surveys one can encounter various sources of bias, such as samples which are not representative, strategic behaviour of respondents or confusion about the size of the good that is to be valued (part-whole bias).

Although CVM studies are known to have large data requirements, they do not require secondary data. Since one can gather all necessary data, i.e. the willingness to pay and its explaining variables such as income and attitude towards nature, by means of one survey (Hoevenagel, 1994), CVM seems suited for gathering input data for a decision support tool.

Since CVM is only suited for 'easy to perceive aspects' of the natural environment, one may conclude that the method does not allow us to determine the total economic value of nature. However, CVM can be used to estimate the non-use value of nature.

The Hedonic Pricing Method (HPM)

HPM is based on the idea that market goods are often traded at prices in which amenities are internalised. For example, the price of a house in quiet and beautiful surroundings is likely to be higher than the price of the same kind of house next to a smelly factory. The HPM starts with a regression of house prices (or wages) against all their valuable characteristics. This leads to a hedonic price function of the following shape: Value(house) = F(architecture, contents, amenities, local taxes, noxious facilities, etc.). From this function one can calculate the willingness to pay for a marginal change in each of these explaining variables. This is the implicit price of the amenity under investigation. From these implicit prices, the demand curve for a specific amenity can be derived. The demand curve is then used for estimating the economic value of an amenity such as natural beauty.

The HPM has often been used to measure the (negative) values of noxious facilities and for the value of environmental goods such as air quality improvement. It has also been applied to value job risks and to value natural sites or parks that might have a positive influence on

house prices.

The HPM measures revealed preferences and it includes the consumers' surplus as it measures the total area underneath the derived demand curve. There are, however, several arguments which shed doubt on the validity of the results of the method.

The validity of the method may be questioned because the shape of the hedonic price function is not known. It is also possible that there are several amenities that influence the price of a house in opposite directions. There may, for example, be a positive influence of a park nearby, but at the same time two noxious facilities which supply jobs. It is also possible that the house market is distorted due to governmental interventions (Pearce and Markandya, 1989). Since the number of explaining variables can be numerous, one runs the risk of not including an important variable or encountering multi-collinearity and thus drawing spurious conclusions about the value of an amenity.

HPM has a very large data requirement because both primary data (characteristics of the surroundings) and secondary data (market transactions) need to be collected The value of a house or wage depends on many factors: there are social factors, such as employment opportunities, taxes and accessibility. Data need to be gathered for all these factors. This makes HPM less suited for application in a decision support tool.

A possible source of bias is the representativeness of the sample for the population. The value of, for instance, parks may be underestimated, because people who do not live near a park may also appreciate it. Their appreciation is, however, not reflected in the price of their house and they are not included in the sample (de Boer *et al*., 1997).

Although HPM can be used to value amenities such as natural beauty, this may not be enough to capture the total economic value of a natural site. Beauty is only one attribute of a natural site. All other welfare-generating characteristics of the site, such as biomass production cannot be captured by this method. The HPM was not developed to determine the total value of nature, but to determine the value of amenities only. HPM cannot be used to determine non-use values of nature.

The Travel Cost Method (TCM)

TCM relies on the assumption that people make repeated trips to recreational sites until the marginal utility derived from a trip equals the marginal costs of a trip. The marginal costs are travel costs in terms of time cost and transportation cost. These travel costs can be regarded as a directly revealed preference for recreation and an indirectly revealed preference for nature.

The TCM assumes that the demand for trips to a specific site is dependent on travel costs,

income, characteristics of the site, prices of substitutes, etc. Travel costs are, however, related to distance. In order to determine the willingness to pay of visitors from various distances, distance circles are drawn in the service area of a site. The percentage of inhabitants of each circle that will visit the site at a fixed amount of travel cost per circle is determined by means of a survey. Now it is assumed that if, say, 25 % of the population in the second circle will visit the site at a cost price of, say, $10, while 50 % of the population of the first (closer) circle will visit at a cost price of $5, then the actual willingness to pay of a quarter of the visiting population in the first circle is $10, even though they only have to pay $5 now because they live nearby. In this way a demand curve for the site is derived. The TCM assumes that people in all circles have homogeneous preferences.

TCM measures revealed preferences for natural sites in terms of willingness to pay for site visits. As such, it includes the consumers' surplus. The TCM has often been applied on water recreation, wetland visitations and hunting.

The validity of TCM can be doubted because it is unclear whether the method actually measures preference for nature. People might not have been aware of the total pleasure or costs before they decided to go on a trip. They may also combine a visit to a natural site with a family visit (multipurpose trip). It is debatable whether the full travel cost to a natural site may be attributed to nature, because these expenditures may not have been made purely for nature. One could argue that the expenditures were also made for the enjoyment of the transportation, leaving less money to spend on nature. In fact, attributing the full costs of services, such as travel, to the final products they were aimed at such as nature, means that the value of these services is reduced to zero. This does not seem compatible with reality.

A bias of TCM concerns the representativeness of the sample. People who do not visit a site may still value the site, but they are excluded from the sample. On the other hand, people who really appreciate the site may have very low travel cost, because they have moved to live closer to the site. Population distribution (far from/close to the site) has an impact on the demand for recreation and thus on the valuation of the site. The strength of this impact depends on whether one is looking at the total value of a site or at the value per visit. Most technical problems with TCM relate to this (Stynes, 1990).

The data requirements of TCM are rather large, since one has to interview visitors of sites to determine their travel costs. One also has to determine the percentages of subpopulations within the service area of a site that will visit the site.

TCM can only capture part of the total economic value of nature. The recreational value is only part of the total value of nature, since society does not only derive welfare from nature through recreation. A consequence of the fact that TCM only reveals the welfare realised by the visiting population is that it can only measure use values.

The Production Factor Method (PFM)

PFM is based on the fact that many natural resources, processes and qualities are used as production factors. Improvement of natural quality may lead to a reduction of production costs for the sector making use of the relevant quality. The PFM tries to value natural qualities by valuing their impacts on production costs. The method consists of two steps: first, the relation between a dose of pollution/pressure and an effect on production (the response) is determined. Secondly, the response must be translated into economic terms. This is can be done by means of the previously described valuation methods (de Boer *et al.*, 1997) and consequently the PFM is not really a separate valuation method. The valuation part of PFM is mostly done by simply multiplying the quantity change by the market price. It would, however, be better to investigate all economic effects, such as changes in demand and supply and in prices.

The PFM has been applied to value the effects of water quality on agriculture, fishery and industry and the effects of air quality on buildings, crops and livestock. The method is meant to determine the value of changes in natural qualities on the economic production system. Consequently, it is not directly suited to determine the economic value of natural sites which are not cultivated.

Due to the use of market prices to value certain environmental qualities, the validity of the PFM is doubtful. PFM can only produce cost-based estimates of the value of the production capacity of nature and it does not include consumers' surplus when market prices are used. The costs of production losses may not cover the full social preference for nature.

A bias of the PFM is that effects on production may have been distorted by averting behaviour. Producers will try to avert the effects of reduced natural qualities by undertaking all sorts of prevention activities, such as shifting to different crops or products, adapting cultivation or harvesting techniques. They may even have left the market to become involved in other types of economic production.

Because PFM is based on dose-response relations which involve a considerable amount of ecological information and because it requires economic data on natural products as well, it has a large data requirement. If one wishes to account for demand and supply dynamics in the valuation of responses, data requirements will only become larger.

PFM allows one to determine the value of the production capacity of nature. For example, a reduction of water quality may cause the fish population to decline and consequently reduce the income from fisheries. At the same time the poorer water quality may cause a rise in the production costs of drinking water (i.e. increased treatment costs). The total economic value

of nature does, however, comprise more attributes than fish production and water purification, and therefore the PFM can only capture part of the total economic value of nature. The PFM cannot capture the non-use value of nature.

The Averting Behaviour Method (ABM)

ABM is especially suited for valuing natural qualities. This is done by looking at expenditures made to avert or mitigate negative effects from the reduction of a natural quality. ABM relies on the assumption that people perceive the negative effects of environmental deterioration on their welfare and that they are able to adapt their behaviour to avert or reduce these effects. This means, for instance, that people experience the negative effects of ozone depletion and that they will buy products such as hats and suncream to prevent damage to their health. The willingness to pay for a clean environment is deducted from people's purchases of products and services to avert the negative effects of pollution.

Most applications of the ABM concern the purchase of protective items in relation to an environmental quality. As such, ABM is a cost-based method, since the costs of purchasing these items are used to value environmental qualities, even though the social preferences for a healthy environment may be much greater than the expenditures on these products. Since the market prices of products are used to value the environment, this method cannot capture the consumers' surplus[3].

The validity of ABM is questionable because of the assumption that people actually purchase certain goods to protect themselves against environmental deterioration. In fact, people may make the purchase for the sake of the product (in the case of suncream it would be cheaper to stay away from the sun) and not to avert negative effects from their living environment. Buying such products actually means that they have less money to spend on the environment. Another concern with ABM is that people may not react to small changes in environmental quality. They may only react when a certain threshold has been passed. Besides that, one may remark that such defensive purchases will not wipe out and will certainly not reverse the negative effects of environmental quality deterioration.

Determining the value of a clean environment in terms of the expenses made to avert negative effects of environmental deterioration, automatically introduces a bias; only the willingness to pay of people who display certain averting behaviour is measured, while people who behave differently may also have a willingness to pay for a clean environment.

The data requirements of ABM may be large, depending on the number of ways in which people try to avert the effects of an unhealthy environment. On top of that, health-behaviour

[3] Unless the market prices are used to construct aggregate demand curves.

and health-environmental quality relations are difficult to determine and are not easy to verify in practice.

Since ABM is mainly oriented toward health risks, it can only capture the value of certain attributes of nature (clean air in this case) but it cannot be used to determine the total economic value of nature. It cannot be used to determine non-use values.

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