

Bräuer, Ingo; Marggraf, Rainer

Working Paper

Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams

Nota di Lavoro, No. 54.2004

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Bräuer, Ingo; Marggraf, Rainer (2004) : Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams, Nota di Lavoro, No. 54.2004, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<http://hdl.handle.net/10419/117935>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

**Valuation of Ecosystem Services
Provided by Biodiversity
Conservation: An Integrated
Hydrological and Economic Model
to Value the Enhanced Nitrogen
Retention in Renaturated Streams**

Ingo Bräuer and Rainer Marggraf

NOTA DI LAVORO 54.2004

MARCH 2004

NRM – Natural Resources Management

Ingo Bräuer and Rainer Marggraf, *Department of Agricultural Economics,
Environmental and Resource Economics Research Unit, Georg-August University*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
<http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm>

Social Science Research Network Electronic Paper Collection:
<http://ssrn.com/abstract=541106>

The opinions expressed in this paper do not necessarily reflect the position of
Fondazione Eni Enrico Mattei

Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams

Summary

The importance of ecosystem functions for humankind is well known. But only few attempts have been undertaken to estimate the economic value of these ecosystem services. In particular, indirect methods are rarely used, even though they are most suitable for the task. This discrepancy is because quantitative knowledge of changes in ecosystem functions is scarce. This paper presents a user-friendly procedure to quantify the increased N-retention in a renaturated river using easily available data. In a case study of the renaturated River Jossa (Germany) the benefits of increased nitrogen retention caused by beaver reintroduction are determined by using the replacement cost method. The quantification of chemical processes is discussed in detail, as well as the problems of defining an adequate reference scenario for the substitute costs. Results show that economic benefits from the evaluated ecosystem service (€12,000/annum) equal 12% of the total costs of the corresponding conservation scheme.

Keywords: Biodiversity conservation programmes, Cost-benefit-analysis, Replacement cost method, Ecosystem services, Nutrient retention

JEL Classification: D61, D62, Q2, Q25

This paper has been presented at the 4th BioEcon Workshop on “Economic Analysis of Policies for Biodiversity Conservation”, Venice, Italy, August 28-29, 2003, organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL).

Financial support from the scholarship programme of the German Federal Environmental Foundation (DBU) as well as from the Graduiertenkolleg 642/2 of the DFG is gratefully acknowledged.

Address for correspondence:

Ingo Bräuer
UFZ Centre for Environmental Research Leipzig-Halle
Department of Economics, Sociology and Law
PO Box 500136
04301 Leipzig
Germany
E-mail: ingo.braeuer@ufz.de

1 Introduction

Nature conservation has to cope with two problems which are coming to a head. On one hand there is an increasing pressure on remaining natural habitats from alternative land use (MITCH & GOSSELINK 2000, TURNER *et al.* 2000). On the other hand, budgets for conservation agencies to cope with the accelerating problems are decreasing (STRATMANN 2002).

In this situation, efficiency and acceptance of conservation policy are crucial. Efficiency, as tested by cost-benefit-analysis, is to make sure that money is spent according to public preferences and that no money is wasted (ZANDER 2000, BROUWER & SLAGEN 1998, MARGGRAF & STREB 1997). Acceptance will help to ensure further public spending in the field of nature conservation. One way to promote acceptance is to visualise the benefits of conservation programmes which have been neglected so far. The feedback to economic studies underlines this assumption (e.g. PIMENTEL *et al.* 1997, COSTANZA *et al.* 1997). Thus, acceptance and efficiency can be promoted by cost-benefit-analysis.

To undertake environmentally sensitive cost-benefit-analysis, all relevant benefits of nature conservation have to be taken into account and hence estimated. This study focuses on the evaluation of indirect use values (according to TURNER *et al.* 1993:112). The procedure will be demonstrated in a case study of a beaver reintroduction programme in the centre west of Germany. One of the assumed benefits of the programme is the enhanced nitrogen retention in rivers, which have been altered by beaver activity. To monetise the changes in that ecosystem service, the Replacement Cost Method (RCM) is used.

So far, economic evaluations have concentrated on either direct use values or non-use values. Particularly in the field of nature conservation, where the focus has been set on species and landscape evaluation, the valuation of indirect use values derived from ecosystem services have been of less interest. Often it has been claimed that these values have already been considered by the use of the Contingent Valuation Method (CVM) (GREN 1995, COSTANZA *et al.* 1997). In some studies this might have been the case, depending on the design of the CVM. But, due to the complexity of ecosystems it is questionable if the CVM is the appropriate method for a sound evaluation of particular ecosystem functions.

The Replacement Cost Method allows us to focus on single ecosystem functions. This makes the importance of single ecosystem services more obvious. A further advantage of this

valuation procedure is the use of technical substitutes and their market prices. Together with the easily understandable valuation procedure this will ensure an improved public acceptance of the results, which cannot be taken for granted. The political input of many Contingent Valuation Studies suffers from low acceptance. The main reason for this is the welfare-economic concept of the method and the measurement of consumer's surplus which is difficult to communicate. On the other hand, values estimated by the Replacement Cost Method will always mark the lower boundary of the true value, because the consumer's surplus is not implied.

1.1.1 The value of the ecosystem function “nutrient retention”

Since the nutrient import in aquatic ecosystems has increased considerably during the last few decades, the self purification potential of river systems becomes more and more important to guarantee ecosystem integrity (MITCH & GOSSELINK 2000). Furthermore, the nitrate content in stream or ground water often exceeds critical values of drinking water legislation. Nitrogen removal becomes an increasingly important factor with regard to the cost of drinking water purification (GRÜNEBAUM 1993). Thus, it is not astonishing that in studies which deal with ecosystem services, the self purification potential is often evaluated (BYSTRÖM 2000, 1998, DEHNHARDT 2002, GREN *et al.* 1995, FOLKE 1991).

Various studies have shown that the self purification potential of a river depends on its structure and its surrounding buffer strips. Restoration of the old stream structures can help to improve the nitrogen removal in these systems. The reasons for this are manifold (VOUGHT *et al.* 1994). One important factor is the stream velocity. The higher the residence time of the water in the river system, the higher is the denitrification (BEHRENDT & OPITZ 2000).

Another factor is the area of flooded river banks. Flooded soils have a denitrification potential, which is up to 100 times higher than under dry conditions (GÄTH *et al.* 1999). Thus, flooding causes an increase in denitrification by enhancing the microbiological activity in the soils.

2 Investigated conservation programme and study site

The study area is the Spessart Mountains in Hesse, Germany, where a beaver reintroduction programme was launched in 1987/88. In the context of this scheme, 18 beavers were released

in the local rivers and buffer strips were purchased. The population numbers are now around 200 individuals and dam building occur in 16 home ranges (LOOS pers. com.).

The significant impact on structure and hydrology of highland brooks by beavers is well known (WOO & WADDINGTON 1991, SMITH *et al.* 1991) and similar results were reported in the Spessart study (HARTHUN 2000).

3 Materials and Methods

A higher self purification potential of beaver modified rivers is one of the assumed benefits of the investigated beaver conservation programme. To assess the economic benefits of this improved ecosystem function, the Replacement Cost Method (RCM) is used. This technique looks at the costs of replacing a damaged asset e.g. water quality standard to recover its original state (PEARCE & MORAN 1994).

The RCM requires a three step procedure:

1. Quantification of the retention effects (*estimation of the ecosystem function*)
2. Definition of the reference scenario (*substitute and its marginal costs*)
3. Economic valuation (*estimation of the ecosystem service*)

These three steps will be described in detail.

As mentioned above, nitrogen retention occurs in the river as well as in the flooded areas of the floodplains. Beavers affect both areas. Their dam building activities lead to an increase of flooded area along the river sides and to a decrease of flow velocity in the river. Both effects have to be estimated separately (Fig. 1). Direct measurements of nitrogen retention are very complicated to conduct (PETERSON *et al.* 2001). In this study, parameters are measured which are known to influence the denitrification (flooded area, running velocity) instead. In a second step, effects of these changes in the river system on the denitrification are estimated. For the floodplain and the river two different approaches are used (Fig. 1).

As for all economic evaluations, only gradual changes are relevant and suitable for valuation. In this particular case only changes caused by the conservation programme are of interest. Relevant parameters are the additional flooded area in the floodplain and the decreased running velocity in the river. To estimate the latter, changes in the overall area of the river

system are assessed by analysing aerial views of the study side from the year 2000 by means of geographic information system (ARC-VIEW).

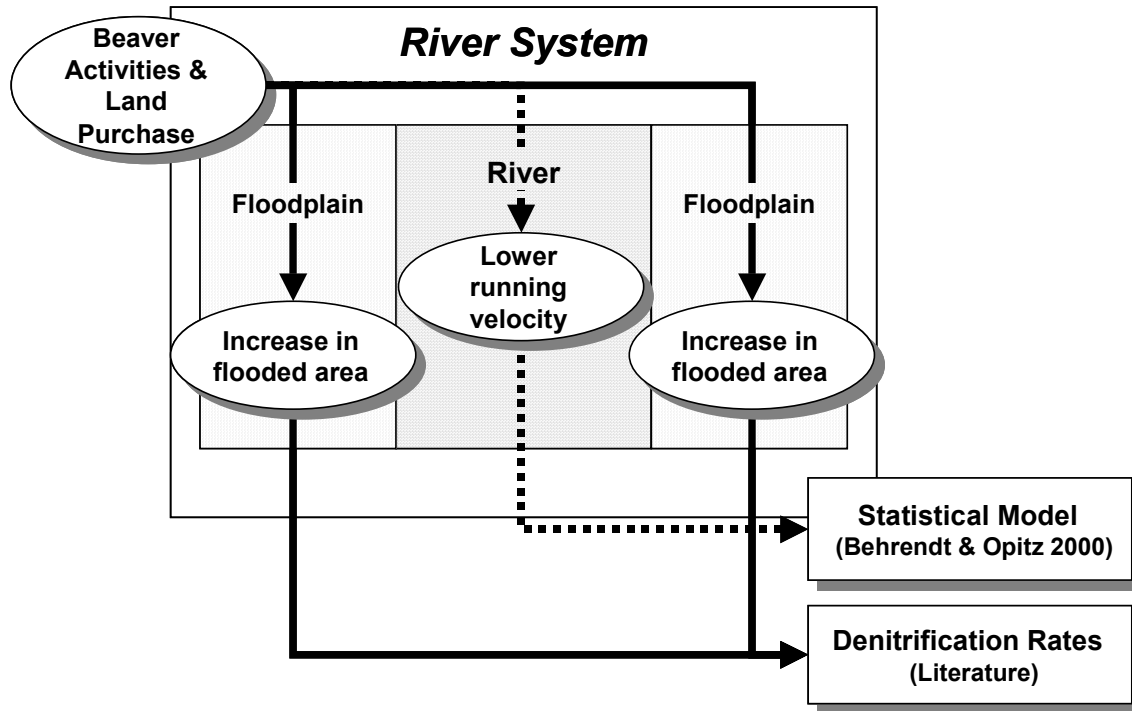


Fig. 1: The hydrological model: Influence of the beaver reintroduction scheme on the river system and the different quantification procedures of nitrogen retention. (Effects are caused by impounding by beavers and additional buffer strips)

To quantify the influence of the altered flow velocity on the nitrogen retention within the river, a statistical model from BEHRENDT & OPITZ (2000) is used. For this model the N-retention is derived by comparing the net transport of the river with the theoretically expected loads from the nitrogen emissions inventory. The nitrogen retention (R_N) is linked to the Emissions (E_N) and the load weighted retention potential (R_L) by Equation (1).

$$R_N = E_N - \frac{E_N}{1 + R_L} \quad (1)$$

A regression analysis of 100 river basins in Europe shows that the load weighted retention potential (R_L) depends on the hydraulic load of the river. For river basins with a size of less than 1,000 m², BEHRENDT & OPITZ (2000) derived the following equation (Eq. 2)

$$R_L = a * x^b \quad \text{The specific coefficients are } a = 3.3; b = -0.65. \quad (2)$$

This model explains 44% of the variance in the observed nitrogen retention.

To estimate the denitrification in the flooded areas, denitrification rates from literature are used. The recorded rates vary between 30 and 1200 kgN/(ha*a) (e.g. BYSTRÖM 1998, DÖRGE 1994, GALE *et al.*1993). For the following calculations a mean denitrification rate of 300 kgN/(ha*a) is taken as a basis.

To deal with the high variances of both the statistical model and the nitrification rates for soils, two different variants are calculated (Table 1). In the minimum variant the lower bond of the 90% prediction intervals is used. In the maximal variant the upper bond of the 90% prediction intervals is used. A minimal denitrification rate of 100 kgN/(ha*a) is assumed, for the maximal variant a rate of 500 kgN/(ha*a). Both numbers are common appraisal values for either conservative estimations (GREN *et al.* 1995, KRONVANG *et al.* 1999) or average nitrification rates (GREN *et al.* 1995).

Table 1: Assumptions for the calculation of the minimal and the maximal variant

Area	Procedure	V _{Min}	V _{Max}
river	statistical model	lower bound 90% interval	upper bound 90% interval
floodplain	denitrification rates	100 kgN/ha*a	500 kgN/ha*a

The fieldwork is done at one river only, the River Jossa. This is due to the availability of site-specific data, but the river is a very suitable reference. The four beaver territories along its course differ significantly from each other. They represent the whole spectrum of dam building consequences. For the whole study area the results of the Jossa are projected. For this procedure, the ratio of territories with dam building activities in the Jossa compared to the entire investigated area is taken into account.

To assess the replacement cost value of the estimated nitrogen retention the costs necessary to provide an equivalent service have to be determined. Here, costs reported in the literature come into operation.

4 Results

According to the three step procedure of the Replacement Cost Method, the chapter is divided into three parts: the quantification of the ecosystem function, the definition of the technical substitute and its marginal costs, and finally, the valuation step.

4.1 Quantification of the ecosystem function

The four beaver territories along the river Jossa have significant influence on the morphology of the river. The dam building causes 11 pools and ponds and 2 secondary ponds (Table. 2). These ponds increase the total river surface by 17%. The measure relevant for denitrification, the hydraulic load, diminishes by 15%. In addition, 15,500 m² of floodplain are flooded.

Table 2: Morphological changes in the investigated river system

		Jossa (original)	Jossa (Beaver)	Changes	
				abs.	rel.
Runoff	[m ³ /s]	1,58	1,58	–	–
River area	[m ²]	122.268	142.816	20.548	+17 %
Hydraulic load	[m/a]	408	349	59	–15 %
Flooded area	[m ²]	– ¹	15.505 ¹	15.505	

¹ To estimate the benefits of the reintroduction programme only the additional flooded area is of interest.

These changes in river structure result in significant changes in self purification (Table 3). The increased hydraulic load leads to an additional nitrogen retention of 700 kgN/a in the river according to the model from BEHNDE & OPITZ (2000). Taking the 90% confidence interval into account, values range from 520 – 900 kgN/a. Depending on the assumed denitrification rates, the additional retention in the floodplain amounts to 160 – 780 KgN/a. The mean is 470 KgN/a. The total additional retention in the Jossa and the surrounding floodplains total up to 1,200 kgN/ year.

Table 3: N-Retention in the river and the floodplain of the river Jossa and the whole investigated area. Results of minimum and maximum setting and the mean.

		Mean	V _{Min} ¹	V _{Max} ¹	+/-
River	[kg N/a]	700	520	900	26,8%
Floodplain	[kg N/a]	470	160	780	66,6%
Jossa	[kg N/a]	1,200	670	1,670	42,7%
Spessart	[kg N/a]	4,700	2,690	6,680	43%
Project duration ²	[kg N]	115,633	66,354	164,991	

¹ Variants according to the assumptions see Table 1.

² Population development is considered during the project duration (1987-2012).

To scale these results up for the investigated area, the ratio of territories with dam building activities are taken into account. In the investigated area there are a total of 16 beaver territories with dam building. Assuming that the four investigated territories are representative, the overall effect adds up to ca. 4700 kgN/a in the whole project area (Table 3).

4.2 Definition of the substitute and its marginal costs

The valuation of the assessed ecosystem enables the identification of the potential technical substitute and ascertainment of the costs to provide an equivalent service. The following selection is in accordance with the criteria of BOCKSTAEL *et al.* (1998): (a) the substitute must be able to cope with the main problem and (b) cope in the most cost efficient way. Theoretically, there are three potential substitutes to improve the water quality: drinking water purification, sewage plants and political programmes to avoid nitrogen emissions.

The substitute most commonly used to value self purification potential of rivers is sewage plants (BYSTRÖM 2000, GREN 1995, DEHNHARDT 2002). Here, the functional process and the final effect are very similar: microbiological activity to improve the water quality of the river.

However, the main source of nitrogen input in aquatic ecosystems is emissions from agriculture (VOUGHT *et al.* 1994). These non-point loads can only be eliminated by drinking water purification or political programmes and not by sewage plants. Drinking water treatment offers a higher quality standard than necessary in rivers, thus it is not cost efficient. The most cost effective alternative to reduce non-point agricultural nutrient loads in the river is their avoidance by political strategies. Most common are agricultural schemes to compensate farmers for special regulations for the application of fertilisers. This compensation refers either to the technique or the amounts of application.

The choice of an adequate substitute does not define the replacement costs automatically. There is a big variety of measures and marginal costs within the agricultural schemes to reduce nitrogen emissions (for a review see BRÄUER 2002:214 and HENNIES 1996 unpublished).

Depending on the production system and the intended reduction level, the replacement costs vary between €1-23 /kgN (HENNIES 1996 unpublished). For the calculations in the presented study, average costs of €2.56 /kgN are assumed to guarantee a conservative calculation.¹ To make this number comparable: for nitrogen removal in sewage plants marginal costs of €5-8 /kgN are reported in Germany (GRÜNEBAUM 1993).

When using replacement costs in a cost-benefit analysis (CBA) it has to be kept in mind that distorted markets exist. Thus, either shadow prices have to be used or - if the CBA includes changes in prices and income only – the economic costs of the respective agricultural schemes are the right figure. In the latter case, the excess-burden of the expenditures have to be added. This would increase the benefits of the ecosystem service. In these calculations excess-burden is not taken into account for two reasons: (i) values in literature vary between 7 and 28% (MUSGRAVE *et al.* 1993:113) and (ii) to ensure conservative calculations.

4.3 Valuation of the ecosystem service

If marginal costs of €2.56 /kgN are assumed, the economic value of the mean estimated additional nitrogen retention in the Jossa has a value of €3,000 (Table 4). The replacement value of the ecosystem service in the whole investigated area accounts for €12,000 in 2000 (Table 4). According to the different assumptions in the estimation of the chemical processes (Table 1 and Table 3), the deviation from the mean value is plus minus 43%.

¹ The original value for the calculations was 5 DM.

For a better judgement of the results it is necessary to compare the calculated benefits with the costs of the conservation programme. Therefore, the retention processes of the year 2000 have to be extrapolated for the whole project duration. The project duration is assessed to last 25 years (1987-2012). A definition of a project duration is necessary to account for the standing expenses (e.g. land purchase at the beginning of the project) with the variable costs. The total costs of the reintroduction scheme amount to €1.89 million (BRÄUER 2002).

Table 4: Economic value of measured nitrogen retention

		Econ. Value	Deviation
Jossa	(2000)	€3,000	€1,700 – 4,300
Investigated area	(2000)	€12,000	€6,900 – 17,100
Project duration ¹		€250,300	€143,700 – 356,900
Portion of project costs		12 %	8 – 17 %

¹ Values for the whole project duration (1987-2012). Population development is considered.

² Deviation according to the results of V_{Min} und V_{Max} in Table 3.

The increased nitrogen retention in rivers is directly correlated to the beaver activities. To extrapolate the results of the year 2000 to the project duration, they have to be adjusted with the size of the beaver population. For this adjustment the population size has been computed using a linear regression. The model describes a highly significant correlation between population size and time after the reintroduction ($y = 12,45 \cdot x - 24770$; $r^2 = 0,97$; $p < 0,001$; $F = 297$; $n = 10$). According to this model, the beaver population will expand until ca. 320 individuals in the year 2012. This population size and hence the statistical model is realistic because there are enough habitats in the area.

The corrected retention potential in the investigated area is estimated at 115,600 kgN (+- 49,300 kgN) for the period between 1987-2012. The economic value of this service corresponds to €250,300 (+-€106.600). The economic benefits of the ecosystem service nitrogen retention make up 12% of the total investment costs.²

² Sewage plants as reference scenario (see 4.2) would result in a value of €35.980 /annum. This corresponds to 40% of the project costs.

5 Discussion

Results show that one ecosystem function alone makes up a significant part of the total costs of the investigated conservation programme, even though the calculations have been very conservative (choice of the replacement costs, waiving of excess-burden etc.) and consumer surplus has not been considered. The results are surprising because improving the self purification potential has not been the main objective of the beaver conservation programme. However, the results underline the importance of a systematic consideration of all consequences of nature conservation programmes. So far this is an exception. If at all, economic evaluations of species conservation programmes apply the Contingent Valuation Method only where ecosystem functions are not taken into consideration explicitly.

Unfortunately, the results show a high variance. The presented results have to be discussed in two ways. On one hand there are problems with the quantification of chemical processes. Are the methods applied suitable? On the other hand, the valuation step has to be discussed as well. Here it has to be clarified whether the used technical substitute is appropriate.

The hydrological processes have been estimated using a statistical model and general denitrification rates from literature. Both values are only rough estimates because local characteristics which are relevant for the denitrification are not taken into account. To narrow the results down, conservative assumptions have been made to guard against overestimation.

An even more important factor for the final results is the definition of the technical substitute. Theoretically, there are two other plausible technical substitutes next to the chosen substitute “agricultural policies”: “drinking water purification” and “sewage plants”. The marginal costs per unit abated nitrogen are much higher in these cases than for the chosen substitute. These substitutes would lead to results three to twenty times as high. The applied scenario “agricultural policies” is the most cost-efficient alternative, but it offers less services than the ecosystem, because atmospheric emissions are not included. This results in an underestimation of the “true value”. Once again, the chosen valuation procedure guarantees the prevention of overestimation. Thus, the estimates denote the lower bound and can be used in practice as a minimum value.

Conservative calculations are essential to ensure credibility of the valuation procedure, but it opens the door for a massive and dangerous underestimation of ecosystem services. In this context it is essential to point out exactly what the valuation subject was. For example, it

might be tempting to equal the evaluated nitrogen retention with the value of the renaturated river. That's not the case at all. There are several ecosystem services which have been neglected so far, like an increased flood control or higher groundwater recharge. Even the ecosystem service of self purification is only evaluated from one point of view: the nitrogen retention. Yet other aspects of self purification in the river such as phosphate retention, have been neglected.

If these limitations are considered and the results are interpreted with caution, economic valuation can offer big advantages. Results of economic evaluations do not only help to decide whether a given programme has been efficient or not, but also whether enough money has been spent for a special task (BROUWER & SLAGEN 1998, ZANDER 2000). The knowledge also helps to design new programmes and offers the possibility of new approaches in landscape design, respectively. Examples for the latter are studies by BYSTRÖM (2000) or GREN *et al.* (1997), which have shown that restoration or building of new flood plains are cost-efficient alternatives to wastewater treatment plants to meet the goal "reduction of nitrogen loads to the Baltic Sea".

6 Conclusions

Benefits derived from ecosystem services, in this case the enhanced nitrogen retention potential of a renaturated river, can play an important role in the judgement of conservation programmes. The estimated benefits as a by product of a species conservation programme make up an important part of the total costs of that programme and should not be neglected. This observation underscores the importance of an evaluation of all relevant consequences of conservation programmes. A systematic procedure, which uses an adequate evaluation procedure for each particular category of consequences respectively, is essential for this task. To gather all use and non-use values of a biodiversity conservation programme a combination of Contingent Valuation and Replacement Cost Method seems to be essential.

The RCM is particularly suitable for the evaluation of ecosystem services because it offers a straightforward and easily understandable procedure. Nevertheless, the results are only rough estimates and should be interpreted with caution. To ensure that no overestimation takes place the calculations are based on conservative assumptions (at the level of the chemical processes as well as at the level of the choice of the technical substitute).

The model from BEHRENDT & OPITZ (2000) offers the possibility to calculate denitrification rates in a relatively easy way. This will help to reduce the costs of estimating the benefits of an ecosystem function, a figure very complicated to measure directly. Cost and time savings of the presented procedure will help to establish an economic evaluation of nature capital in the political decision making process.

References

- BEHRENDT, H. & OPITZ (2000): Retention of nutrients in river systems: dependence on specific runoff and hydraulic load. *Hydrobiologia* 410(1):111-122.
- BOCKSTAEL, N.E., FREEMAN III, A.M., KOPP, R.J., PORTNEY, P.R. & SMITH, V.K. (1998): On Valuing Nature. Unpublished manuscript, 1998 (Raymond J. Kopp Working Papers), Resources for the Future.
- BRÄUER, I. (2002): Artenschutz aus volkswirtschaftlicher Sicht. Die Nutzen-Kosten-Analyse als Entscheidungshilfe. *Hochschulschriften Band 76*. Metropolis Verlag, Marburg. 322 S.
- BROUWER, R. & SLANGEN, L.H.G. (1998): Contingent Valuation of public Benefits of agricultural Wildlife Management: The case of Dutch peat meadow land. *European Review of Agricultural Economics*: 25:53-72.
- BYSTRÖM, O. (1998): The nitrogen abatement cost in wetlands. *Ecological Economics* 26:321-331.
- BYSTRÖM, O. (2000): The Replacement Value of Wetlands in Sweden. *Environmental and Resource Economics* 16:347-362.
- COSTANZA, R., D'ARGE, R., DEGROOT, R., FARBER, S., GRASSO, M., HANNON, B., LIMBURG, K., NAEEM, S., O'NEILL, R.V., PARUELO, J., RASKIN, R.G., SUTTON, P. & VAN DEN BELT, M. (1997): The value of the world's ecosystem services and natural capital. *Nature* 387:253-260.
- DÖRGE, J. (1994): Modelling nitrogen transformation in freshwater wetlands. Estimating nitrogen retention and removal in natural wetlands in relation to their hydrology and nutrient loadings. *Ecological Modelling* 75/76: 409-20.

- GÄTH, S. & ANTONY, F. (1999): Bewertung der standortlichen Denitrifikationsleistungen und N-Vorratsdüngung von Böden und Bodennutzungssystemen. *Mitteilungen der deutschen bodenkundlichen Gesellschaft*. 91, KfA Jülich; 1213-13.
- GALE, P.M., DÉVAL, I., REDDY, K.R. & GRAETZ, D.A. (1993): Denitrification potential of soils from constructed and natural wetlands. *Ecological Engineering* 2:119-30.
- GREN, I.-M. (1995): The value of investing in wetlands for nitrogen abatement. *European Review of Agricultural Economics* 22:157-172.
- GREN, I.-M., GROTH, K.H. & SYLVÉN, M. (1995): Economic Values of the Danube Floodplains. *Journal of Environmental Management* 45:333-345.
- GREN, I.-M., SÖDERQVIST, T., & WULFF, F. (1997): Nutrient Reductions to the Baltic Sea: Ecology, Costs and Benefits. *Journal of Environmental Management* 51:123-143.
- GRÜNEBAUM, T. (1993): Stoffbezogene Kosten der kommunalen Abwasserreinigung. In: Neue Ansätze im integrierten Umweltschutz – Eine Herausforderung für Staat, Wirtschaft und Bürger. *Schriftenreihe Gewässerschutz – Wasser – Abwasser*. Achen; Bd. 139:23/1-15.
- HARTHUN, M. (2000): Einflüsse der Stauaktivität des Bibers (*Castor fiber albicus*) auf physikalische und chemische Parameter von Mittelgebirgs-Bächen (Hessen, Deutschland). *Limnologica* 30:21-35.
- HENNIES, H. (1996): Ökonomische Beurteilung von baulichen Auflagen für Güllebehälter. Diplomarbeit, Institut für Agrarökonomie, Universität Göttingen (unpublished).
- KRONVANG, B., HOFFMANN, C.C., SVENDSEN, L.M., JENSEN, J.P. & DÖRGE, J. (1999): Retention of nutrients in river basins. *Aquatic Ecology* 33:29-40.
- MARGGRAF, R. & STREB, S (1997): *Ökonomische Bewertung der natürlichen Umwelt: Theorie, politische Bedeutung, ethische Diskussion*. Spektrum Verlag, Heidelberg, u.a.O.
- MITSCHE, W.J. & GOSSELINK, J.G. (2000): *Wetlands*, 3rd. Ed.; Wiley, NY, u.a.
- MUSGRAVE, R.A., MUSGRAVE, P.B. & KULLMER, L. (1993): *Die öffentlichen Finanzen in Theorie und Praxis*. 2. Band UTB für Wissenschaft, Tübingen.
- PEARCE, D. & MORAN, D. (1994): *The Economic Value of Biodiversity*. Earthscan, London, UK.
- PETERSON, B.J. *et al.* (2001): Control of Nitrogen Export from Watersheds by Headwater Streams. *Science* 292:86-90.

- PIMENTEL, D. , WILSON, C., McCULLUM, C., HUANG, R., DWEN, P., FLACK, J., TRAN, Q., SALTMAN, T. & CLIFF, B. (1997): Economic and Environmental Benefits of Biodiversity. *BioScience* 74(11):747-757.
- SMITH, M.E., DRISCOLL, C.T., WYSKOWSKI, B.J., BROOKS, C.M. & COSENTINI, C.C. (1991): Modification of stream structure and function by beaver (*Castor Canadensis*) in the Adirondack Mountains, New York. *Can. J. Zool.* 69: 55-60.
- Stratmann, U. (2002): Aufgabenspezifische Erfassung der Naturschutzausgaben von Bund und Ländern (1985 - 2001): Methode, Analyse und Ergebnisse - Gutachten im Auftrag des Bundesamtes für Naturschutz, (unpubl.).
- TUNER, R.K. & PEARCE, D.W. (1993): Sustainable economic development: economic and ethical principles. In: Barbier, E.B. (ed.): *Economics and Ecology*. Chapman & Hall, London; 177-94.
- TURNER, R.K., VAN DEN BERGH, J.C.J.M., SÖDERQVIST, T., BARENDREGT, A., VAN DER STRAATEN, J., MALTBY, E. & VAN IERLAND, E. (2000): Ecological-economic analysis of wetlands: scientific integration for management policy. *Ecological Economics* 35(1):7-23.
- VOUGHT, L.B.-M, DAHL, J., PEDERSEN, C.L. & LACOURSIÉRE, J.O. (1994): Nutrient Retention in Riparian Ecotones. *Ambio* 23(6):342-48.
- WOO, M.-K. & WADDINGTON, J.M. (1990): Effects of Beaver Dams on Subarctic Wetland Hydrology. *Arctic* 43(3):223-230.
- ZANDER, K. (2001a): Der Einfluss von Information auf die Zahlungsbereitschaft. In: Elsasser, P & Meyerhoff, J.: *Ökonomische Bewertung von Umweltgütern: Methodenfragen zur Kontingenten Bewertung und praktische Erfahrungen im deutschsprachigen Raum*. Metropolis-Verlag; 141-160.

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

Our Note di Lavoro are available on the Internet at the following addresses:

<http://www.feem.it/Feem/Pub/Publications/WPapers/default.html>

<http://www.ssrn.com/link/feem.html>

NOTE DI LAVORO PUBLISHED IN 2003

PRIV	1.2003	<i>Gabriella CHIESA and Giovanna NICODANO</i> : <u>Privatization and Financial Market Development: Theoretical Issues</u>
PRIV	2.2003	<i>Ibolya SCHINDELE</i> : <u>Theory of Privatization in Eastern Europe: Literature Review</u>
PRIV	3.2003	<i>Wietze LISE, Claudia KEMFERT and Richard S.J. TOL</i> : <u>Strategic Action in the Liberalised German Electricity Market</u>
CLIM	4.2003	<i>Laura MARSILIANI and Thomas I. RENSTRÖM</i> : <u>Environmental Policy and Capital Movements: The Role of Government Commitment</u>
KNOW	5.2003	<i>Reyer GERLAGH</i> : <u>Induced Technological Change under Technological Competition</u>
ETA	6.2003	<i>Efrem CASTELNUOVO</i> : <u>Squeezing the Interest Rate Smoothing Weight with a Hybrid Expectations Model</u>
SIEV	7.2003	<i>Anna ALBERINI, Alberto LONGO, Stefania TONIN, Francesco TROMBETTA and Margherita TURVANI</i> : <u>The Role of Liability, Regulation and Economic Incentives in Brownfield Remediation and Redevelopment: Evidence from Surveys of Developers</u>
NRM	8.2003	<i>Elissaios POPYRAKIS and Reyner GERLAGH</i> : <u>Natural Resources: A Blessing or a Curse?</u>
CLIM	9.2003	<i>A. CAPARRÓS, J.-C. PEREAU and T. TAZDAÏT</i> : <u>North-South Climate Change Negotiations: a Sequential Game with Asymmetric Information</u>
KNOW	10.2003	<i>Giorgio BRUNELLO and Daniele CHECCHI</i> : <u>School Quality and Family Background in Italy</u>
CLIM	11.2003	<i>Efrem CASTELNUOVO and Marzio GALEOTTI</i> : <u>Learning By Doing vs Learning By Researching in a Model of Climate Change Policy Analysis</u>
KNOW	12.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO and Dino PINELLI (eds.)</i> : <u>Economic Growth, Innovation, Cultural Diversity: What are we all talking about? A critical survey of the state-of-the-art</u>
KNOW	13.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO, Dino PINELLI and Francesco RULLANI (lix)</i> : <u>Bio-Ecological Diversity vs. Socio-Economic Diversity. A Comparison of Existing Measures</u>
KNOW	14.2003	<i>Maddy JANSSENS and Chris STEYAERT (lix)</i> : <u>Theories of Diversity within Organisation Studies: Debates and Future Trajectories</u>
KNOW	15.2003	<i>Tuzin BAYCAN LEVENT, Enno MASUREL and Peter NIJKAMP (lix)</i> : <u>Diversity in Entrepreneurship: Ethnic and Female Roles in Urban Economic Life</u>
KNOW	16.2003	<i>Alexandra BITUSIKOVA (lix)</i> : <u>Post-Communist City on its Way from Grey to Colourful: The Case Study from Slovakia</u>
KNOW	17.2003	<i>Billy E. VAUGHN and Katarina MLEKOV (lix)</i> : <u>A Stage Model of Developing an Inclusive Community</u>
KNOW	18.2003	<i>Selma van LONDEN and Arie de RUIJTER (lix)</i> : <u>Managing Diversity in a Globalizing World</u>
Coalition		
Theory	19.2003	<i>Sergio CURRARINI</i> : <u>On the Stability of Hierarchies in Games with Externalities</u>
Network		
PRIV	20.2003	<i>Giacomo CALZOLARI and Alessandro PAVAN (lx)</i> : <u>Monopoly with Resale</u>
PRIV	21.2003	<i>Claudio MEZZETTI (lx)</i> : <u>Auction Design with Interdependent Valuations: The Generalized Revelation Principle, Efficiency, Full Surplus Extraction and Information Acquisition</u>
PRIV	22.2003	<i>Marco LiCalzi and Alessandro PAVAN (lx)</i> : <u>Tilting the Supply Schedule to Enhance Competition in Uniform-Price Auctions</u>
PRIV	23.2003	<i>David ETTINGER (lx)</i> : <u>Bidding among Friends and Enemies</u>
PRIV	24.2003	<i>Hannu VARTIAINEN (lx)</i> : <u>Auction Design without Commitment</u>
PRIV	25.2003	<i>Matti KELOHARJU, Kjell G. NYBORG and Kristian RYDQVIST (lx)</i> : <u>Strategic Behavior and Underpricing in Uniform Price Auctions: Evidence from Finnish Treasury Auctions</u>
PRIV	26.2003	<i>Christine A. PARLOUR and Uday RAJAN (lx)</i> : <u>Rationing in IPOs</u>
PRIV	27.2003	<i>Kjell G. NYBORG and Ilya A. STREBULAIEV (lx)</i> : <u>Multiple Unit Auctions and Short Squeezes</u>
PRIV	28.2003	<i>Anders LUNANDER and Jan-Eric NILSSON (lx)</i> : <u>Taking the Lab to the Field: Experimental Tests of Alternative Mechanisms to Procure Multiple Contracts</u>
PRIV	29.2003	<i>TangaMcDANIEL and Karsten NEUHOFF (lx)</i> : <u>Use of Long-term Auctions for Network Investment</u>
PRIV	30.2003	<i>Emiel MAASLAND and Sander ONDERSTAL (lx)</i> : <u>Auctions with Financial Externalities</u>
ETA	31.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>A Non-cooperative Foundation of Core-Stability in Positive Externality NTU-Coalition Games</u>
KNOW	32.2003	<i>Michele MORETTO</i> : <u>Competition and Irreversible Investments under Uncertainty</u>
PRIV	33.2003	<i>Philippe QUIRION</i> : <u>Relative Quotas: Correct Answer to Uncertainty or Case of Regulatory Capture?</u>
KNOW	34.2003	<i>Giuseppe MEDA, Claudio PIGA and Donald SIEGEL</i> : <u>On the Relationship between R&D and Productivity: A Treatment Effect Analysis</u>
ETA	35.2003	<i>Alessandra DEL BOCA, Marzio GALEOTTI and Paola ROTA</i> : <u>Non-convexities in the Adjustment of Different Capital Inputs: A Firm-level Investigation</u>

GG	36.2003	<i>Matthieu GLACHANT</i> : <u>Voluntary Agreements under Endogenous Legislative Threats</u>
PRIV	37.2003	<i>Narjess BOUBAKRI, Jean-Claude COSSET and Omrane GUEDHAMI</i> : <u>Postprivatization Corporate Governance: the Role of Ownership Structure and Investor Protection</u>
CLIM	38.2003	<i>Rolf GOLOMBEK and Michael HOEL</i> : <u>Climate Policy under Technology Spillovers</u>
KNOW	39.2003	<i>Slim BEN YOUSSEF</i> : <u>Transboundary Pollution, R&D Spillovers and International Trade</u>
CTN	40.2003	<i>Carlo CARRARO and Carmen MARCHIORI</i> : <u>Endogenous Strategic Issue Linkage in International Negotiations</u>
KNOW	41.2003	<i>Sonia OREFFICE</i> : <u>Abortion and Female Power in the Household: Evidence from Labor Supply</u>
KNOW	42.2003	<i>Timo GOESCHL and Timothy SWANSON</i> : <u>On Biology and Technology: The Economics of Managing Biotechnologies</u>
ETA	43.2003	<i>Giorgio Busetti and Matteo MANERA</i> : <u>STAR-GARCH Models for Stock Market Interactions in the Pacific Basin Region, Japan and US</u>
CLIM	44.2003	<i>Katrin MILLOCK and Céline NAUGES</i> : <u>The French Tax on Air Pollution: Some Preliminary Results on its Effectiveness</u>
PRIV	45.2003	<i>Bernardo BORTOLOTTI and Paolo PINOTTI</i> : <u>The Political Economy of Privatization</u>
SIEV	46.2003	<i>Elbert DIJKGRAAF and Herman R.J. VOLLEBERGH</i> : <u>Burn or Bury? A Social Cost Comparison of Final Waste Disposal Methods</u>
ETA	47.2003	<i>Jens HORBACH</i> : <u>Employment and Innovations in the Environmental Sector: Determinants and Econometrical Results for Germany</u>
CLIM	48.2003	<i>Lori SNYDER, Nolan MILLER and Robert STAVINS</i> : <u>The Effects of Environmental Regulation on Technology Diffusion: The Case of Chlorine Manufacturing</u>
CLIM	49.2003	<i>Lori SNYDER, Robert STAVINS and Alexander F. WAGNER</i> : <u>Private Options to Use Public Goods. Exploiting Revealed Preferences to Estimate Environmental Benefits</u>
CTN	50.2003	<i>László Á. KÓCZY and Luc LAUWERS</i> (Ixi): <u>The Minimal Dominant Set is a Non-Empty Core-Extension</u>
CTN	51.2003	<i>Matthew O. JACKSON</i> (Ixi): <u>Allocation Rules for Network Games</u>
CTN	52.2003	<i>Ana MAULEON and Vincent VANNETELBOSCH</i> (Ixi): <u>Farsightedness and Cautiousness in Coalition Formation</u>
CTN	53.2003	<i>Fernando VEGA-REDONDO</i> (Ixi): <u>Building Up Social Capital in a Changing World: a network approach</u>
CTN	54.2003	<i>Matthew HAAG and Roger LAGUNOFF</i> (Ixi): <u>On the Size and Structure of Group Cooperation</u>
CTN	55.2003	<i>Taiji FURUSAWA and Hideo KONISHI</i> (Ixi): <u>Free Trade Networks</u>
CTN	56.2003	<i>Halis Murat YILDIZ</i> (Ixi): <u>National Versus International Mergers and Trade Liberalization</u>
CTN	57.2003	<i>Santiago RUBIO and Alistair ULPH</i> (Ixi): <u>An Infinite-Horizon Model of Dynamic Membership of International Environmental Agreements</u>
KNOW	58.2003	<i>Carole MAIGNAN, Dino PINELLI and Gianmarco I.P. OTTAVIANO</i> : <u>ICT, Clusters and Regional Cohesion: A Summary of Theoretical and Empirical Research</u>
KNOW	59.2003	<i>Giorgio BELLETTINI and Gianmarco I.P. OTTAVIANO</i> : <u>Special Interests and Technological Change</u>
ETA	60.2003	<i>Ronnie SCHÖB</i> : <u>The Double Dividend Hypothesis of Environmental Taxes: A Survey</u>
CLIM	61.2003	<i>Michael FINUS, Ekko van IERLAND and Robert DELLINK</i> : <u>Stability of Climate Coalitions in a Cartel Formation Game</u>
GG	62.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>How the Rules of Coalition Formation Affect Stability of International Environmental Agreements</u>
SIEV	63.2003	<i>Alberto PETRUCCI</i> : <u>Taxing Land Rent in an Open Economy</u>
CLIM	64.2003	<i>Joseph E. ALDY, Scott BARRETT and Robert N. STAVINS</i> : <u>Thirteen Plus One: A Comparison of Global Climate Policy Architectures</u>
SIEV	65.2003	<i>Edi DEFRANCESCO</i> : <u>The Beginning of Organic Fish Farming in Italy</u>
SIEV	66.2003	<i>Klaus CONRAD</i> : <u>Price Competition and Product Differentiation when Consumers Care for the Environment</u>
SIEV	67.2003	<i>Paulo A.L.D. NUNES, Luca ROSSETTO, Arianne DE BLAEIJ</i> : <u>Monetary Value Assessment of Clam Fishing Management Practices in the Venice Lagoon: Results from a Stated Choice Exercise</u>
CLIM	68.2003	<i>ZhongXiang ZHANG</i> : <u>Open Trade with the U.S. Without Compromising Canada's Ability to Comply with its Kyoto Target</u>
KNOW	69.2003	<i>David FRANTZ</i> (Iix): <u>Lorenzo Market between Diversity and Mutation</u>
KNOW	70.2003	<i>Ercole SORI</i> (Iix): <u>Mapping Diversity in Social History</u>
KNOW	71.2003	<i>Ljiljana DERU SIMIC</i> (Ixi): <u>What is Specific about Art/Cultural Projects?</u>
KNOW	72.2003	<i>Natalya V. TARANOVA</i> (Ixi): <u>The Role of the City in Fostering Intergroup Communication in a Multicultural Environment: Saint-Petersburg's Case</u>
KNOW	73.2003	<i>Kristine CRANE</i> (Ixi): <u>The City as an Arena for the Expression of Multiple Identities in the Age of Globalisation and Migration</u>
KNOW	74.2003	<i>Kazuma MATOBA</i> (Ixi): <u>Glocal Dialogue- Transformation through Transcultural Communication</u>
KNOW	75.2003	<i>Catarina REIS OLIVEIRA</i> (Ixi): <u>Immigrants' Entrepreneurial Opportunities: The Case of the Chinese in Portugal</u>
KNOW	76.2003	<i>Sandra WALLMAN</i> (Ixi): <u>The Diversity of Diversity - towards a typology of urban systems</u>
KNOW	77.2003	<i>Richard PEARCE</i> (Ixi): <u>A Biologist's View of Individual Cultural Identity for the Study of Cities</u>
KNOW	78.2003	<i>Vincent MERK</i> (Ixi): <u>Communication Across Cultures: from Cultural Awareness to Reconciliation of the Dilemmas</u>
KNOW	79.2003	<i>Giorgio BELLETTINI, Carlotta BERTI CERONI and Gianmarco I.P. OTTAVIANO</i> : <u>Child Labor and Resistance to Change</u>
ETA	80.2003	<i>Michele MORETTO, Paolo M. PANTEGHINI and Carlo SCARPA</i> : <u>Investment Size and Firm's Value under Profit Sharing Regulation</u>

IEM	81.2003	<i>Alessandro LANZA, Matteo MANERA and Massimo GIOVANNINI: <u>Oil and Product Dynamics in International Petroleum Markets</u></i>
CLIM	82.2003	<i>Y. Hossein FARZIN and Jinhua ZHAO: <u>Pollution Abatement Investment When Firms Lobby Against Environmental Regulation</u></i>
CLIM	83.2003	<i>Giuseppe DI VITA: <u>Is the Discount Rate Relevant in Explaining the Environmental Kuznets Curve?</u></i>
CLIM	84.2003	<i>Reyer GERLAGH and Wietze LISE: <u>Induced Technological Change Under Carbon Taxes</u></i>
NRM	85.2003	<i>Rinaldo BRAU, Alessandro LANZA and Francesco PIGLIARU: <u>How Fast are the Tourism Countries Growing? The cross-country evidence</u></i>
KNOW	86.2003	<i>Elena BELLINI, Gianmarco I.P. OTTAVIANO and Dino PINELLI: <u>The ICT Revolution: opportunities and risks for the Mezzogiorno</u></i>
SIEV	87.2003	<i>Lucas BRETSCGHER and Sjak SMULDERS: <u>Sustainability and Substitution of Exhaustible Natural Resources. How resource prices affect long-term R&D investments</u></i>
CLIM	88.2003	<i>Johan EYCKMANS and Michael FINUS: <u>New Roads to International Environmental Agreements: The Case of Global Warming</u></i>
CLIM	89.2003	<i>Marzio GALEOTTI: <u>Economic Development and Environmental Protection</u></i>
CLIM	90.2003	<i>Marzio GALEOTTI: <u>Environment and Economic Growth: Is Technical Change the Key to Decoupling?</u></i>
CLIM	91.2003	<i>Marzio GALEOTTI and Barbara BUCHNER: <u>Climate Policy and Economic Growth in Developing Countries</u></i>
IEM	92.2003	<i>A. MARKANDYA, A. GOLUB and E. STRUKOVA: <u>The Influence of Climate Change Considerations on Energy Policy: The Case of Russia</u></i>
ETA	93.2003	<i>Andrea BELTRATTI: <u>Socially Responsible Investment in General Equilibrium</u></i>
CTN	94.2003	<i>Parkash CHANDER: <u>The γ-Core and Coalition Formation</u></i>
IEM	95.2003	<i>Matteo MANERA and Angelo MARZULLO: <u>Modelling the Load Curve of Aggregate Electricity Consumption Using Principal Components</u></i>
IEM	96.2003	<i>Alessandro LANZA, Matteo MANERA, Margherita GRASSO and Massimo GIOVANNINI: <u>Long-run Models of Oil Stock Prices</u></i>
CTN	97.2003	<i>Steven J. BRAMS, Michael A. JONES, and D. Marc KILGOUR: <u>Forming Stable Coalitions: The Process Matters</u></i>
KNOW	98.2003	<i>John CROWLEY, Marie-Cecile NAVES (Ixxiii): <u>Anti-Racist Policies in France. From Ideological and Historical Schemes to Socio-Political Realities</u></i>
KNOW	99.2003	<i>Richard THOMPSON FORD (Ixxiii): <u>Cultural Rights and Civic Virtue</u></i>
KNOW	100.2003	<i>Alaknanda PATEL (Ixxiii): <u>Cultural Diversity and Conflict in Multicultural Cities</u></i>
KNOW	101.2003	<i>David MAY (Ixxiii): <u>The Struggle of Becoming Established in a Deprived Inner-City Neighbourhood</u></i>
KNOW	102.2003	<i>Sébastien ARCAND, Danielle JUTEAU, Sirma BILGE, and Francine LEMIRE (Ixxiii) : <u>Municipal Reform on the Island of Montreal: Tensions Between Two Majority Groups in a Multicultural City</u></i>
CLIM	103.2003	<i>Barbara BUCHNER and Carlo CARRARO: <u>China and the Evolution of the Present Climate Regime</u></i>
CLIM	104.2003	<i>Barbara BUCHNER and Carlo CARRARO: <u>Emissions Trading Regimes and Incentives to Participate in International Climate Agreements</u></i>
CLIM	105.2003	<i>Anil MARKANDYA and Dirk T.G. RÜBBELKE: <u>Ancillary Benefits of Climate Policy</u></i>
NRM	106.2003	<i>Anne Sophie CRÉPIN (Ixiv): <u>Management Challenges for Multiple-Species Boreal Forests</u></i>
NRM	107.2003	<i>Anne Sophie CRÉPIN (Ixiv): <u>Threshold Effects in Coral Reef Fisheries</u></i>
SIEV	108.2003	<i>Sara ANIYAR (Ixiv): <u>Estimating the Value of Oil Capital in a Small Open Economy: The Venezuela's Example</u></i>
SIEV	109.2003	<i>Kenneth ARROW, Partha DASGUPTA and Karl-Göran MÄLER(Ixiv): <u>Evaluating Projects and Assessing Sustainable Development in Imperfect Economies</u></i>
NRM	110.2003	<i>Anastasios XEPAPADEAS and Catarina ROSETA-PALMA(Ixiv): <u>Instabilities and Robust Control in Fisheries</u></i>
NRM	111.2003	<i>Charles PERRINGS and Brian WALKER (Ixiv): <u>Conservation and Optimal Use of Rangelands</u></i>
ETA	112.2003	<i>Jack GOODY (Ixiv): <u>Globalisation, Population and Ecology</u></i>
CTN	113.2003	<i>Carlo CARRARO, Carmen MARCHIORI and Sonia OREFFICE: <u>Endogenous Minimum Participation in International Environmental Treaties</u></i>
CTN	114.2003	<i>Guillaume HAERINGER and Myrna WOODERS: <u>Decentralized Job Matching</u></i>
CTN	115.2003	<i>Hideo KONISHI and M. Utku UNVER: <u>Credible Group Stability in Multi-Partner Matching Problems</u></i>
CTN	116.2003	<i>Somdeb LAHIRI: <u>Stable Matchings for the Room-Mates Problem</u></i>
CTN	117.2003	<i>Somdeb LAHIRI: <u>Stable Matchings for a Generalized Marriage Problem</u></i>
CTN	118.2003	<i>Marita LAUKKANEN: <u>Transboundary Fisheries Management under Implementation Uncertainty</u></i>
CTN	119.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>Social Conformity and Bounded Rationality in Arbitrary Games with Incomplete Information: Some First Results</u></i>
CTN	120.2003	<i>Gianluigi VERNASCA: <u>Dynamic Price Competition with Price Adjustment Costs and Product Differentiation</u></i>
CTN	121.2003	<i>Myrna WOODERS, Edward CARTWRIGHT and Reinhard SELTEN: <u>Social Conformity in Games with Many Players</u></i>
CTN	122.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>On Equilibrium in Pure Strategies in Games with Many Players</u></i>
CTN	123.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>Conformity and Bounded Rationality in Games with Many Players</u></i>
	1000	Carlo CARRARO, Alessandro LANZA and Valeria PAPPONETTI: <u>One Thousand Working Papers</u>

NOTE DI LAVORO PUBLISHED IN 2004

IEM	1.2004	<i>Anil MARKANDYA, Suzette PEDROSO and Alexander GOLUB:</i> <u>Empirical Analysis of National Income and So2 Emissions in Selected European Countries</u>
ETA	2.2004	<i>Masahisa FUJITA and Shlomo WEBER:</i> <u>Strategic Immigration Policies and Welfare in Heterogeneous Countries</u>
PRA	3.2004	<i>Adolfo DI CARLUCCIO, Giovanni FERRI, Cecilia FRALE and Ottavio RICCHI:</i> <u>Do Privatizations Boost Household Shareholding? Evidence from Italy</u>
ETA	4.2004	<i>Victor GINSBURGH and Shlomo WEBER:</i> <u>Languages Disenfranchisement in the European Union</u>
ETA	5.2004	<i>Romano PIRAS:</i> <u>Growth, Congestion of Public Goods, and Second-Best Optimal Policy</u>
CCMP	6.2004	<i>Herman R.J. VOLLEBERGH:</i> <u>Lessons from the Polder: Is Dutch CO2-Taxation Optimal</u>
PRA	7.2004	<i>Sandro BRUSCO, Giuseppe LOPOMO and S. VISWANATHAN (lxv):</i> <u>Merger Mechanisms</u>
PRA	8.2004	<i>Wolfgang AUSSENEGG, Pegaret PICHLER and Alex STOMPER (lxv):</i> <u>IPO Pricing with Bookbuilding, and a When-Issued Market</u>
PRA	9.2004	<i>Pegaret PICHLER and Alex STOMPER (lxv):</i> <u>Primary Market Design: Direct Mechanisms and Markets</u>
PRA	10.2004	<i>Florian ENGLMAIER, Pablo GUILLEN, Loreto LLORENTE, Sander ONDERSTAL and Rupert SAUSGRUBER (lxv):</i> <u>The Chopstick Auction: A Study of the Exposure Problem in Multi-Unit Auctions</u>
PRA	11.2004	<i>Bjarne BRENDSTRUP and Harry J. PAARSCH (lxv):</i> <u>Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders</u>
PRA	12.2004	<i>Ohad KADAN (lxv):</i> <u>Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values</u>
PRA	13.2004	<i>Maarten C.W. JANSSEN (lxv):</i> <u>Auctions as Coordination Devices</u>
PRA	14.2004	<i>Gadi FIBICH, Arieh GAVIOUS and Aner SELA (lxv):</i> <u>All-Pay Auctions with Weakly Risk-Averse Buyers</u>
PRA	15.2004	<i>Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (lxv):</i> <u>Competition and Cooperation in Divisible Good Auctions: An Experimental Examination</u>
PRA	16.2004	<i>Marta STRYSZOWSKA (lxv):</i> <u>Late and Multiple Bidding in Competing Second Price Internet Auctions</u>
CCMP	17.2004	<i>Slim Ben YOUSSEF:</i> <u>R&D in Cleaner Technology and International Trade</u>
NRM	18.2004	<i>Angelo ANTOCI, Simone BORGHESI and Paolo RUSSU (lxvi):</i> <u>Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamics</u>
SIEV	19.2004	<i>Anna ALBERINI, Paolo ROSATO, Alberto LONGO and Valentina ZANATTA:</i> <u>Information and Willingness to Pay in a Contingent Valuation Study: The Value of S. Erasmo in the Lagoon of Venice</u>
NRM	20.2004	<i>Guido CANDELA and Roberto CELLINI (lxvii):</i> <u>Investment in Tourism Market: A Dynamic Model of Differentiated Oligopoly</u>
NRM	21.2004	<i>Jacqueline M. HAMILTON (lxvii):</i> <u>Climate and the Destination Choice of German Tourists</u>
NRM	22.2004	<i>Javier Rey-MAQUIEIRA PALMER, Javier LOZANO IBÁÑEZ and Carlos Mario GÓMEZ GÓMEZ (lxvii):</i> <u>Land, Environmental Externalities and Tourism Development</u>
NRM	23.2004	<i>Pius ODUNGA and Henk FOLMER (lxvii):</i> <u>Profiling Tourists for Balanced Utilization of Tourism-Based Resources in Kenya</u>
NRM	24.2004	<i>Jean-Jacques NOWAK, Mondher SAHLI and Pasquale M. SGRO (lxvii):</i> <u>Tourism, Trade and Domestic Welfare</u>
NRM	25.2004	<i>Riaz SHAREEF (lxvii):</i> <u>Country Risk Ratings of Small Island Tourism Economies</u>
NRM	26.2004	<i>Juan Luis EUGENIO-MARTÍN, Noelia MARTÍN MORALES and Riccardo SCARPA (lxvii):</i> <u>Tourism and Economic Growth in Latin American Countries: A Panel Data Approach</u>
NRM	27.2004	<i>Raúl Hernández MARTÍN (lxvii):</i> <u>Impact of Tourism Consumption on GDP. The Role of Imports</u>
CSRM	28.2004	<i>Nicoletta FERRO:</i> <u>Cross-Country Ethical Dilemmas in Business: A Descriptive Framework</u>
NRM	29.2004	<i>Marian WEBER (lxvi):</i> <u>Assessing the Effectiveness of Tradable Landuse Rights for Biodiversity Conservation: an Application to Canada's Boreal Mixedwood Forest</u>
NRM	30.2004	<i>Trond BJORN DAL, Phoebe KOUNDOURI and Sean PASCOE (lxvi):</i> <u>Output Substitution in Multi-Species Trawl Fisheries: Implications for Quota Setting</u>
CCMP	31.2004	<i>Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI:</i> <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part I: Sectoral Analysis of Climate Impacts in Italy</u>
CCMP	32.2004	<i>Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI:</i> <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part II: Individual Perception of Climate Extremes in Italy</u>
CTN	33.2004	<i>Wilson PEREZ:</i> <u>Divide and Conquer: Noisy Communication in Networks, Power, and Wealth Distribution</u>
KTHC	34.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI (lxviii):</i> <u>The Economic Value of Cultural Diversity: Evidence from US Cities</u>
KTHC	35.2004	<i>Linda CHAIB (lxviii):</i> <u>Immigration and Local Urban Participatory Democracy: A Boston-Paris Comparison</u>
KTHC	36.2004	<i>Franca ECKERT COEN and Claudio ROSSI (lxviii):</i> <u>Foreigners, Immigrants, Host Cities: The Policies of Multi-Ethnicity in Rome. Reading Governance in a Local Context</u>
KTHC	37.2004	<i>Kristine CRANE (lxviii):</i> <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u>
KTHC	38.2004	<i>Kiflemariam Hamde (lxviii):</i> <u>Mind in Africa, Body in Europe: The Struggle for Maintaining and Transforming Cultural Identity - A Note from the Experience of Eritrean Immigrants in Stockholm</u>
ETA	39.2004	<i>Alberto CAVALIERE:</i> <u>Price Competition with Information Disparities in a Vertically Differentiated Duopoly</u>
PRA	40.2004	<i>Andrea BIGANO and Stef PROOST:</i> <u>The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?</u>
CCMP	41.2004	<i>Micheal FINUS (lxix):</i> <u>International Cooperation to Resolve International Pollution Problems</u>

KTHC	42.2004	<i>Francesco CRESPI</i> : <u>Notes on the Determinants of Innovation: A Multi-Perspective Analysis</u>
CTN	43.2004	<i>Sergio CURRARINI and Marco MARINI</i> : <u>Coalition Formation in Games without Synergies</u>
CTN	44.2004	<i>Marc ESCRIHUELA-VILLAR</i> : <u>Cartel Sustainability and Cartel Stability</u>
NRM	45.2004	<i>Sebastian BERVOETS and Nicolas GRAVEL</i> (lxvi): <u>Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach</u>
NRM	46.2004	<i>Signe ANTHON and Bo JELLESMARK THORSEN</i> (lxvi): <u>Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits</u>
NRM	47.2004	<i>John MBURU</i> (lxvi): <u>Wildlife Conservation and Management in Kenya: Towards a Co-management Approach</u>
NRM	48.2004	<i>Ekin BIROL, Ágnes GYOVAI and Melinda SMALE</i> (lxvi): <u>Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transitional Economy</u>
CCMP	49.2004	<i>Gernot KLEPPER and Sonja PETERSON</i> : <u>The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects</u>
GG	50.2004	<i>Scott BARRETT and Michael HOEL</i> : <u>Optimal Disease Eradication</u>
CTN	51.2004	<i>Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG</i> : <u>Simple Priorities and Core Stability in Hedonic Games</u>
SIEV	52.2004	<i>Francesco RICCI</i> : <u>Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory</u>
SIEV	53.2004	<i>Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON</i> : <u>Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?</u>
NRM	54.2004	<i>Ingo BRÄUER and Rainer MARGGRAF</i> (lxvi): <u>Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams</u>

- (lix) This paper was presented at the ENGIME Workshop on “Mapping Diversity”, Leuven, May 16-17, 2002
- (lx) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by the Fondazione Eni Enrico Mattei, Milan, September 26-28, 2002
- (lxi) This paper was presented at the Eighth Meeting of the Coalition Theory Network organised by the GREQAM, Aix-en-Provence, France, January 24-25, 2003
- (lxii) This paper was presented at the ENGIME Workshop on “Communication across Cultures in Multicultural Cities”, The Hague, November 7-8, 2002
- (lxiii) This paper was presented at the ENGIME Workshop on “Social dynamics and conflicts in multicultural cities”, Milan, March 20-21, 2003
- (lxiv) This paper was presented at the International Conference on “Theoretical Topics in Ecological Economics”, organised by the Abdus Salam International Centre for Theoretical Physics - ICTP, the Beijer International Institute of Ecological Economics, and Fondazione Eni Enrico Mattei – FEEM Trieste, February 10-21, 2003
- (lxv) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications” organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003
- (lxvi) This paper has been presented at the 4th BioEcon Workshop on “Economic Analysis of Policies for Biodiversity Conservation” organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL), Venice, August 28-29, 2003
- (lxvii) This paper has been presented at the international conference on “Tourism and Sustainable Economic Development – Macro and Micro Economic Issues” jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003
- (lxviii) This paper was presented at the ENGIME Workshop on “Governance and Policies in Multicultural Cities”, Rome, June 5-6, 2003
- (lxix) This paper was presented at the Fourth EEP Plenary Workshop and EEP Conference “The Future of Climate Policy”, Cagliari, Italy, 27-28 March 2003

2003 SERIES

CLIM	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
GG	<i>Global Governance</i> (Editor: Carlo Carraro)
SIEV	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KNOW	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
IEM	<i>International Energy Markets</i> (Editor: Anil Markandya)
CSR	<i>Corporate Social Responsibility and Management</i> (Editor: Sabina Ratti)
PRIV	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
CTN	<i>Coalition Theory Network</i>

2004 SERIES

CCMP	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
GG	<i>Global Governance</i> (Editor: Carlo Carraro)
SIEV	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KTHC	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
IEM	<i>International Energy Markets</i> (Editor: Anil Markandya)
CSR	<i>Corporate Social Responsibility and Management</i> (Editor: Sabina Ratti)
PRA	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
CTN	<i>Coalition Theory Network</i>