

Bosetti, Valentina; Locatelli, Gianni

**Working Paper**

## A Data Envelopment Analysis Approach to the Assessment of Natural Parks# Economic Efficiency and Sustainability. The Case of Italian National Parks

Nota di Lavoro, No. 63.2005

**Provided in Cooperation with:**

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Bosetti, Valentina; Locatelli, Gianni (2005) : A Data Envelopment Analysis Approach to the Assessment of Natural Parks# Economic Efficiency and Sustainability. The Case of Italian National Parks, Nota di Lavoro, No. 63.2005, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<http://hdl.handle.net/10419/74248>

**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.*

**A Data Envelopment Analysis  
Approach to the Assessment of  
Natural Parks' Economic  
Efficiency and Sustainability.  
The Case of Italian National Parks**  
Valentina Bosetti and Gianni Locatelli

NOTA DI LAVORO 63.2005

**MAY 2005**

NRM – Natural Resources Management

Valentina Bosetti, *Fondazione Eni Enrico Mattei*  
Gianni Locatelli, *DISCo, Università di Milano Bicocca*

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=718621>

# **A Data Envelopment Analysis Approach to the Assessment of Natural Parks' Economic Efficiency and Sustainability. The Case of Italian National Parks**

## **Summary**

Wilderness protection is a growing necessity for modern societies, and this is particularly true for areas where population density is extremely high, as for example Europe. Conservation, however, implies very high opportunity costs. It is thus crucial to create incentives to efficient management practices, to promote benchmarking and to improve conservation management. In the present paper we propose a methodology based on Data Envelopment Analysis, DEA, a non parametric benchmarking technique specifically developed to assess the relative efficiency of decision-making units. In particular, the objective of the discussed methodology is to assess the relative efficiency of the management units of the protected area and to indicate how it could be improved, by providing a set of guidelines. The main advantage of this methodology is that it allows to assess the efficiency of natural parks' management not only internally (comparing the performance of the park to itself in time) but also by external benchmarking, thus providing new and different perspectives on potential improvements. Although the proposed methodology is fairly general, we have applied it to the context of Italian National Parks in order to produce a representative case study. Specifically, the choice of adequate cost and benefit indicators is a very important and delicate phase of any benchmark analysis. For this purpose, a questionnaire was used to investigate the opinions of Italian National Parks managers and stakeholders and to define the relevant indicators for the analysis. Finally, relevant policy implications for the case study are given.

**Keywords:** Data envelopment analysis, Natural park management

**JEL Classification:** Q01, Q26, Q56

*Address for correspondence:*

Valentina Bosetti  
Fondazione Eni Enrico Mattei  
Corso Magenta 63  
20123 Milano  
Italy  
Phone: +390252036938  
Fax: +390252036946  
E-mail: valentina.bosetti@feem.it

## **Introduction**

Since ancient eras, the idea of protecting portions of the land has appeared as a necessity. The reasons for this have intrinsically changed over time, going from the mere necessity of preserving hunting areas to the idea of biological conservation, which remains one of today's driving causes. Although in different times and places, and motivated by different concerns, this idea has led to the same result: the conservation of ecosystems that would otherwise have disappeared. Indeed, if on the one hand the first example of a modern National Park is quite recent (Yellowstone, Wyoming, instituted in 1872), on the other hand, examples of protected areas can be traced back to game reserves. The first example, which can be dated back to 7.500-7000 B.C., shows the existence of hunting areas in archaeological sites in South-west Iran. During the history of Indo-European civilizations, the aristocracy used to create game preserves in forests with the effect of conserving wide pristine areas which solely a very restricted number of individuals could make use of. This was also the case for Italy where many areas which are still protected today, were originally game preserves. The preservation of wilderness is also linked to religious activities, for example the holy woods of Mediterranean cultures. During the Middle Ages, almost all of the forests surrounding monasteries were turned into preserves and the population was forbidden to harvest these areas. In Italy, the Apennine forest of Abetone and the "Foreste Casentinesi" National Park have been preserved to the present day thanks to the presence of eremitical places (Massa, 1999). However, the origins of the concept of 'holy forests' can be traced back to the Etruscan and Greek civilizations, when natural areas

surrounding towns were consecrated to divinities and any human activity was forbidden.

The modern idea of protected areas, which underpinned the Yellowstone Park institution, was based on the recognition of the value of wilderness amenity and of the recreational services it produces.

The American “Protection Ethics” sprung from the ideas of three naturalists: Ralph Waldo Emerson, Henry David Thoreau and John Muir. In their interpretation, for the first time wilderness was as important as religion. Nature could not be exploited for purely economic reasons. Moreover, the beauty of Nature had to be safeguarded in that its contemplation was recognized as a basic need for human beings; this ‘use value’, mainly centered on human needs, was at the foundation of this early protection ethic.

At the beginning of the twentieth century, a new idea took shape: that of Gifford Pinchot. He based his thought on the philosophical outlook of John Stuart Mill and believed that preserving nature has first of all an economic rationale behind it.

It was only around the 1950s that along with these different interpretations of nature’s conservation, essentially based on an anthropocentric perspective, a new thought emerged: that of Aldo Leopold. It was based on the recognition of the intrinsic value of the existence of nature and it constituted, in subsequent years, the foundation of modern evolutionary ecology.

During the twentieth century, particularly in Europe, the erosion of territory, hence of ecosystems, due to human activities was dramatically increasing. This led to a growing concern for wilderness conservation issues, tracing back from the first meetings in Paris (1902) and London (1937), up to the 1987 report “Our Common Future”, prepared as a discussion basis for the Earth Summit held in Rio de Janeiro in

1992. During these subsequent meetings, the concept of a preserved natural area, the 'natural park', has undergone several successive transformations, until a new interpretation emerged. Natural parks should be government- managed territories, where development and preservation forces are kept in balance. Management should not only be concerned with environmental issues, but more broadly with the socio-economic features of the territory. Indeed, in a dynamic perspective, it might turn out more appropriate for conservation purposes, to open a protected area to some human activities, rather than to close it completely, preventing any development, even under a pure non-anthropocentric ethic of conservation. Indeed, it is now widely recognized that untouchable territories are bound to slowly disappear, because of land scarcity, and this is particularly true for highly populated areas as Europe. Therefore, in a long-term perspective, the involvement and sustainable development of human activities within protected areas may prove to be a win-win strategy.

Within this enlarged vision, natural areas' management entails the dynamic assessment of environmental quality indicators as well as the sustainability level of management activities, thus increasing the need for comprehensive indicators. Qualitative and quantitative indicators may support the decision- maker in comparing different realities, in evaluating the environmental and economic performance of its management's policies, and in trying to forecast the effectiveness of potential changes in management strategies.

There is a long tradition of benchmarking methodologies, however most of them are commonly restrained to cover an internal perspective and do not investigate how the analysed protected area is performing when compared to others.

The main objective of the present paper is the external benchmarking of protected areas. To this aim, it is necessary to introduce a common benchmarking methodology, capable of taking into account specific features of different realities. Data Envelopment Analysis (DEA) is an extremely flexible and useful methodology, which provides an indicator of the relative efficiency for each different analysed decision-making unit (in our case National Park Management offices), where efficiency is a measure of different features related to the environmental as well as to the economic or social impacts of the protected area.

In this paper we present and discuss the application of DEA to the case of Italian National Parks. In order to create a common set of indicators, a preliminary questionnaire was administered to investigate the opinion of parks' managers and other stakeholders at a qualitative level. A follow-up questionnaire was subsequently carried out in order to collect intertemporal quantitative data for all the indicators that were considered more relevant by managers and stakeholders. DEA analysis was carried out on the data set.

The paper is organized as follows. Section 1 provides a brief literature review. In Section 2 a brief description of the DEA methodology is given, while in Section 3 the data set and the data collection methodology are discussed, together with the types of DEA analysis performed. Section 4 is a description of the main results and Section 5 concludes with a summary of the main findings along with the final remarks and future extensions.

## 1 DEA and the environment

DEA is a multivariate technique for monitoring productivity and providing insights on the possible directions of improvement of the status quo, when inefficient. It is a non-parametric technique, i.e. it can compare input/output data, making no prior assumptions about the probability distribution under study. The origin of non-parametric programming methodology, with respect to the relative efficiency measurement, lies in the work of Charnes *et al.* (1978, 1979, 1981).

DEA has been applied to several benchmarking studies and to the performance analysis of public institutions, such as schools (Charnes *et al.*, 1981), hospitals (Nyman and Bricker, 1989), but also of private ones, such as banks (Charnes *et al.*, 1990). An exhaustive analysis of its underlying theory and main applications can be found in Charnes *et al.* (1993), while a comprehensive literature review in Tavaresa (2002).

Applications to environmental and resource management problems are less frequent. An interesting overview of the role of DEA in environmental valuation can be found in Kortelainen and Kuosmanen (2004), while a survey of indicators of firm's environmental behavior can be found in Tyteca (1996). We briefly report some application studies in the following.

<b>Application</b>	<b>Author</b>
Measure ecological efficiency	Dyckhoff and Allen, (2001)
Measure environmental impacts of different production technology	De Koeijer, et al. (2002)
Measure different systems of waste management	Sarkis and Weinrach (2001)
Measure efficiency of environmental regulation schemes	Hernandez-Sancho et al. (2000)



## 2 Methodology

Although DEA is based on the concept of efficiency that approaches the idea of a classical production function, the latter is typically determined by a specific equation, while DEA is generated from the data set of observed operative units (Decision Making Units or DMUs). The DEA efficiency score of any DMU is derived from the comparison with the other DMUs that are included in the analysis, considering the maximum score of unity (or 100%) as a benchmark. The score is independent of the units in which outputs and inputs are measured, and this allows for a greater flexibility in the choice of inputs and outputs to be included in the study.

An important assumption of the DEA is that all DMUs face the same unspecified technology and operational characteristics, which defines the set of their production possibilities.

The idea of measuring the efficiency of DMUs with multiple inputs and outputs is specified as a linear fractional programming model. A commonly accepted measure of efficiency is given by the ratio of the weighted sum of outputs over the weighted sum of inputs. It is however necessary to assess a common set of weights and this may give rise to some problems. With DEA methodology each DMU can freely assess its own set of weights, that can be inferred through the process of maximizing the efficiency. Given a set of  $N$  DMUs, each producing  $J$  outputs from a set of  $I$  inputs, let us denote by  $y_{jn}$  and  $x_{in}$  the vectors representing the quantities of outputs and inputs relative to the  $m$ -th DMU, respectively. The efficiency of the  $m$ -th DMU can thus be calculated as:

$$e_m = \frac{\sum_{j=1}^J u_j y_{jm}}{\sum_{i=1}^I v_i x_{im}}, \quad \begin{cases} j = 1, \dots, J \\ i = 1, \dots, I \end{cases} \quad (1)$$

where  $u_j$  and  $v_i$  are two vectors of weight that DMU  $m$  uses in order to measure the relative importance of the consumed and the produced factors. As mentioned, the set of weights, in DEA, is not given, but is calculated through the DMU's maximization problem, that is stated below for the  $m$ -th DMU.

$$\begin{aligned} & \max e_m \\ & s.t. \\ & \frac{\sum_{j=1}^J u_j y_{jm}}{\sum_{i=1}^I v_i x_{im}} \leq 1 \quad \forall n = 1, \dots, N \\ & 0 \leq u_j \leq 1 \\ & 0 \leq v_i \leq 1 \end{aligned} \quad (2)$$

To simplify computations it is possible to scale the input prices so that the cost of the DMU  $m$ 's inputs equals 1, thus transforming problem set in (2) in the ordinary linear programming problem stated below:

$$\begin{aligned} & \max h_m = \sum_{j=1}^J u_j y_{jm} \\ & s.t. \\ & \sum_{i=1}^I v_i x_{im} = 1 \\ & \sum_{j=1}^J u_j y_{jn} - \sum_{i=1}^I v_i x_{in} \leq 0 \quad \forall n = 1, \dots, N \\ & \varepsilon \leq u_j \leq 1, \quad \varepsilon \leq v_i \leq 1, \quad \varepsilon \in \mathfrak{R}^+ \end{aligned} \quad (3)$$

In addition to the linearization constraint, weights have to be strictly positive in order to avoid the possibility that some inputs or outputs may be ignored in the process of determination of the efficiency of each DMU.

If the solution to the maximization problem gives a value of efficiency equal to 1, the corresponding DMU is considered to be efficient or non-dominated, if the efficiency value is inferior to 1 then the corresponding DMU is dominated, therefore does not lie on the efficiency frontier, which is defined by the efficient DMUs.

As for every linear programming problem, there is a dual formulation of the primal formulation of the maximization problem outlined in (3), which has an identical solution. While the primal problem can be interpreted as an output- oriented formulation (for a given level of input, DMUs maximizing output are preferred), the dual problem can be interpreted as an input- oriented formulation (for a given level of output, DMUs minimizing inputs are preferred).

Scale effects can be accounted for modifying the model as presented in (3), in order to account for variable returns to scale (we adopt the solution suggested in Banker *et al.*, 1984).

Finally, the dynamic analysis was performed using the window approach, first put forward by Charnes and others (Charnes *et al.*, 1978), in order to produce not only a static picture of efficiency, but also the evolution of efficiency of each municipality. The DEA is performed over time using a similar moving average procedure, where parks' performances in one year are compared with their performances in another year.

### 3 Data Collection and Analysis

To define environmental efficiency is a very challenging task; several different definitions of ecological efficiency exist in the literature. In the case of protected areas, the problem becomes even more complicated, because management and financial features have to be considered as well. As mentioned above, in a DEA study, the most crucial phase is indeed the choice of the representative benefit and cost indicators, which will be extremely influential in defining each DMU level of efficiency.

For this reason, the direct involvement of stakeholders is appropriate, if not fundamental. The managers of all the National Parks<sup>1</sup> in Italy were therefore interviewed through mail questionnaires in order to understand what they perceived as the most relevant indicators. In particular, for each proposed indicator, the respondent could choose among different qualitative definitions (very relevant, VR, relevant, R, not very relevant, NVR, and not relevant, NR). On the basis of the survey's results, which are summarized in Table 1, a second survey was designed in order to obtain quantitative definitions of each of the indicators (the final set of indicators used in the DEA analysis is reported in Table 2 divided in three models, see section 4).

On the output side, first the number of visitors to the park was considered as an indicator of its attractiveness, providing potential indirect benefit to the local economy. Second, the number of the parks' employees, as an indicator of the social and economic indirect and direct benefits. Third, the number of economic businesses which are directly linked empowered or created thanks to the presence of the park (e.g. parks

---

<sup>1</sup> There are 21 National Parks in Italy. The analysis was performed on the 17 parks which were able to produce the required data, which are: Abruzzo, Lazio and Molise; Arcipelago la Maddalena; Arcipelago Toscano; Asinara; Aspromonte; Cilento and Vallo di Diano; Circeo; Monti Sibillini; Gargano; Dolomiti Bellunesi; Foreste Casentinesi; Gran Paradiso; Gran Sasso and Monti della Laga; Majella; Val Grande; Vesuvio.

certifying farmers producing within the protected area). Fourth, the number of protected species, which is a good proxy of the environmental quality and biodiversity of the park (in some models the inverse of this biodiversity indicator was included as an input). Finally, the number of students who visit the park for environmental education trips, as a proxy of the social and educational benefits deriving from the park.

On the input side, economic costs, computed aggregating management costs and variable costs and extraordinary expenses were considered. Moreover, the area extension was also considered as a proxy of fixed costs, which are assumed to be proportional to the area covered by the park.

#### **4 Results**

Three different models have been used to perform DEA analysis. The choice of using more than one model specification derives from the consideration that the DEA technique is extremely sensitive to the choice of indicators. Hence, coherent responses obtained by different models prove to be more reliable and robust, diminishing the degree of subjectivity of the efficiency scores produced. Moreover, each different model mimics the three main existing management strategies, namely a ‘pure socio-economic development oriented’ (Model 1), a ‘pure conservation oriented’ (Model 2) and an ‘in between’ strategy (Model 3).

In Table 3, results for Model 1, 2 and 3 (for the maximization of outputs approach, MAXOUTPUT) are shown, respectively. Parks scoring a 100% efficiency in Model 1 (as for example the National Park *Foreste Casentinesi*) are successfully promoting the development of the area. DMUs efficient according to Model 2 prove to have a high

natural performance, in terms of biodiversity conservation, attractiveness and capacity of diffusing awareness among new generations (as for example the National Park *Gran Sasso and Monti della Laga*).

When a DMU is scoring maximum efficiency according to all three models, then one can argue the management has attained the sustainable development goal in a very broad sense. In the case of DMUs which are partially inefficient (as for example the National Park *Gran Paradiso*) it is possible to use the DEA analysis to obtain information concerning potential improvements of the management<sup>2</sup> (see Figure 1).

Finally, the total potential improvements, described in Figure 2, are defined by aggregating over all inefficient DMUs, in order to provide guidelines to properly allocate government incentives.

## **Conclusions**

In recent years, a substantial re-interpretation of wilderness management objectives has occurred. According to this conceptual ‘revolution’, management strategies should aim at harmonizing human and nature’s interests, in the attempt of finding a balance between development and preservation, rather than a “put under a glass bell” approach. Nowadays a protected area has a new function: it is also a place where the concept of sustainable development can be put into practice and where traditional economic activities can be consistent with preservation needs.

This is the interpretation of nature protection, and specifically of Natural Parks, underpinning the design of environmental protection strategies.

---

<sup>2</sup> *Parco Nazionale del Gargano, Parco del Vesuvio, Parco delle Foreste Casentinesi and Parco del Gran Sasso e dei Monti della Laga* compose the peer group for the *Parco Nazionale delle Dolomiti*, used to define the virtual efficient DMU, thus providing information on potential improvements, *P*.

Accordingly, it becomes increasingly important to monitor multi-objectives efficiency, a task which can be successfully accomplished by adopting benchmarking techniques (as for example DEA). These techniques provide information about efficiency, interpreted as a multi dimensional object, but also enable a detailed analysis of potential improvements.

The present study represents the first attempt to apply this methodology to this complex and experimental area. In particular, the methodology has been applied to the case of Italian National Parks; the resulting rankings and information to improve the management status have been provided as a feedback to their questionnaires to Parks' managers and to the Italian authority. The next step on the research agenda is the enlargement of the data set to include a broader variety of parks (for example national parks of other countries in Europe) in order to produce a more reliable and useful efficiency classification.

## References

- Banker, R.D., Charnes, A., Cooper, W. W. 1984. Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*. 30 (9), 1078-1092.
- Banker, R.D. and Morey, R.C. 1986. Efficiency analysis for exogenously fixed inputs and outputs. *Operations Research*. 34 (4), 513-521.
- Bevilacqua, M., Braglia M. 2002. Environmental efficiency analysis for ENI oil refineries. *Journal of cleaner production*. Vol: 10, Issue: 1, February, 2002 pp. 85-92.
- Bosetti V., Cassinelli M., Lanza A. 2003. Using data envelopment analysis to evaluate environmentally conscious tourism management. Paper prepared for the conference Tourism and Sustainable Development, Chia Sardegna September 19-20, 2003.
- Charnes, A., Cooper, W. W., and Rhodes, E. 1978. Measuring efficiency of decision making units. *European Journal of Operational Research*. 2, 6, 429–444.
- Charnes, A., Cooper, W. W., and Rhodes, E. 1979. Measuring efficiency of decision making units. *European Journal of Operational Research*. 3, 4, 339.
- Charnes, A., Cooper, W. W., and Rhodes, E. 1981. Evaluating program and managerial efficiency: an application of data envelopment analysis to follow through. *Management Science*. 27, 6, 668–696.
- Charnes, A., Clark, T., Cooper, W.W., and Golany, B. 1985. A development study of data envelopment analysis in measuring the efficiency of maintenance units in the U.S. Air force. *Annals of Operations Research*. 2, 95-112.
- Charnes, A., Cooper, W. W., Huang, Z. and Sun, D. 1990. Polyhedral cone-ratio DEA models with an illustrative application to large commercial banks. *Journal of Econometrics*, 46 (1/2), 73-91.
- Charnes, A., Cooper, W. W., Lewin, A:Y. and Seiford, L.M. 1993. Data Envelopment Analysis: theory, methodology and application. Boston: Kluwer Academic Publishers.
- DeCanio, S J., 1997. Economic modeling and the false tradeoff between environmental protection and economic growth. *Contemporary Economic Policy*, Vol. 15 (4), pp10-27.
- Dyckhoff, H., Allen, K. 2001. Measuring ecological efficiency with data envelopment analysis (DEA). *European Journal of Operational Research* Vol: 132, Issue: 2, July 16, pp. 312-325.
- De Koeijer, TJ, Wossink, GAA, Struik, PC, Renkema, JA. .2002. Measuring agricultural sustainability in terms of efficiency:, the case of Dutch sugar beet growers. *Journal Of Environmental Management*, Sep Vol 66 (1), pp 9 - 17
- Lyons, D. M. 1997. Performance measurement in urban transit: A comparative analysis of single and partial measures of transit performance. *Transportation research part. A: policy and practice* Vol: 31, Issue: 1, January, 1997 pp. 69
- Michael J.B. Grenn e James Paine 1997. State of the world's protected areas at the end of the twentieth century. IUCN.



Nyman, J.A. and Bricker, D.L. 1989. Profit incentives and technical efficiency in the production of nursing home care. *Review of Economics and Statistics*. 71 (4), 586-594.

Pacudan, R., de Guzman, E. 2002. Impact of energy efficiency policy to productive efficiency of, electricity distribution industry in the Philippines. *Energy Economics*, Jan Vol 24 (1), pp 41 - 54

Sarkis, J., Weinrach, J. 2001. Using data envelopment analysis to evaluate environmentally conscious waste treatment technology. *Journal of cleaner production* Vol: 9, Issue: 5, October, 2001 pp. 417-427

Sueyoshi, T., Goto, M. 2001. Slack-adjusted DEA for time series analysis: Performance, measurement of Japanese electric power generation industry in, 1984-1993. *European Journal Of Operational Research*, Sep 1 Vol 133 (2), pp 232 - 259

Tavares G. 2002. A bibliography of Data Envelopment Analysis (1978-2001). *Rutcor Researc Report*, 01-02, JANUARY, 2002

## Tables and Figures

	<b>OUTPUT</b>	<b>VR-R</b>	<b>NVR-NR</b>
<b>a</b>	Number of annual visitors	100%	0%
<b>b</b>	Number of historical buildings	100%	0%
<b>c</b>	Number of protected species	89%	11%
<b>d</b>	Number of students which visit the park for environmental education trips	88%	12%
<b>e</b>	Number of equipped areas	56%	44%
<b>f</b>	Area extension	56%	44%
<b>g</b>	Number of parks employees	56%	44%
<b>h</b>	Number of environmental illegal acts	55%	45%
<b>i</b>	Restored environmental area extension	45%	55%
<b>l</b>	Presence of a certification system with park labels	44%	56%
<b>m</b>	Gadget sale	22%	78%
<b>n</b>	Number of economic business directly linked, empowered or created thanks to the presence of the park	22%	78%
	<b>INPUT</b>	<b>VR-R</b>	<b>NVR-NR</b>
<b>a</b>	Management costs	100%	0%
<b>b</b>	Variable costs	89%	11%
<b>c</b>	Area extension	56%	44%

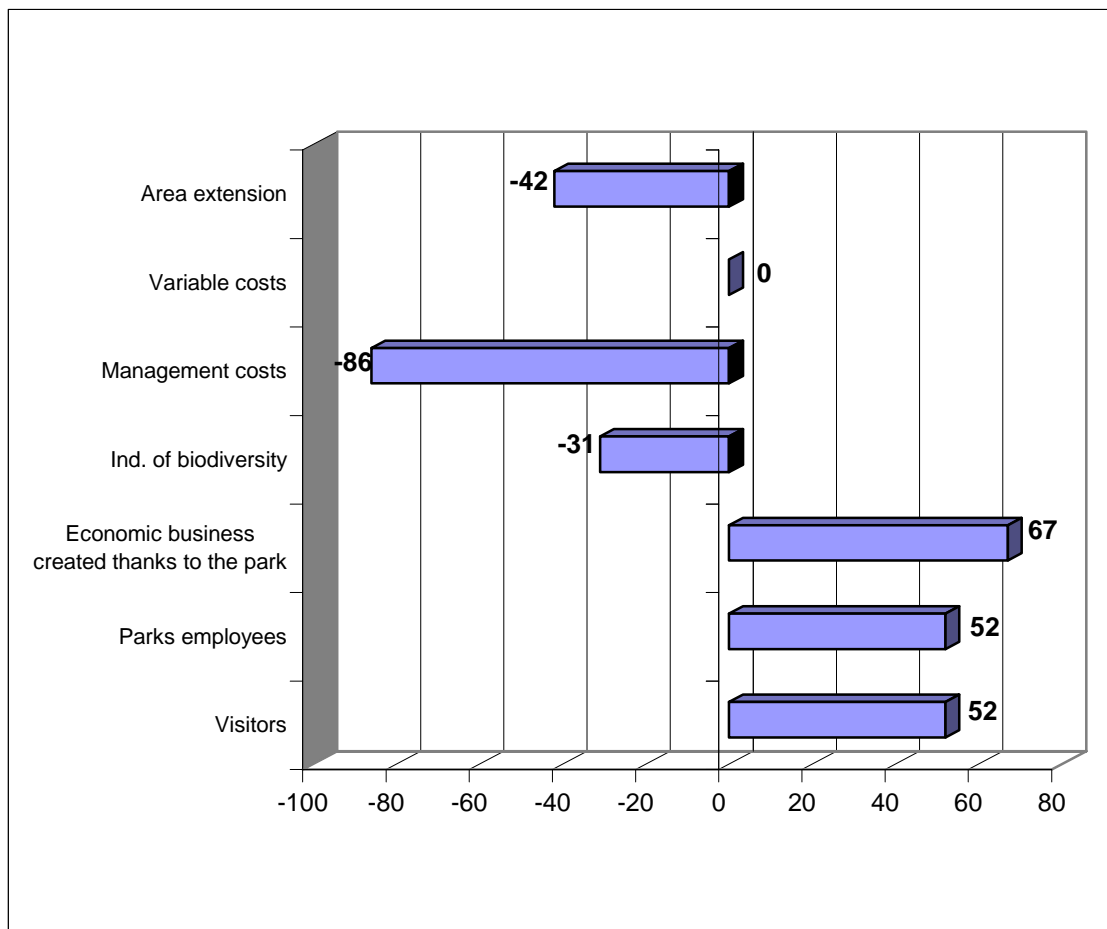
**Table 1 - Results to questionnaire. The column VR-R presents the sum of the answers VR and R. The column NVR-NR presents the sum of the answers NVR and NR. (author)**

	Output			Input			
<b>Model 1</b>	Visitors	Parks employees	Economic business created thanks to the park	Ind. of biodiversity	Management costs	Variable costs	
<b>Model 2</b>	Visitors	protected species	environmental education trips	Total costs		Area extension	
<b>Model 3</b>	Visitors	Parks employees	Economic business created thanks to the park	Ind. of biodiversity	Management costs	Variable costs	Area extension

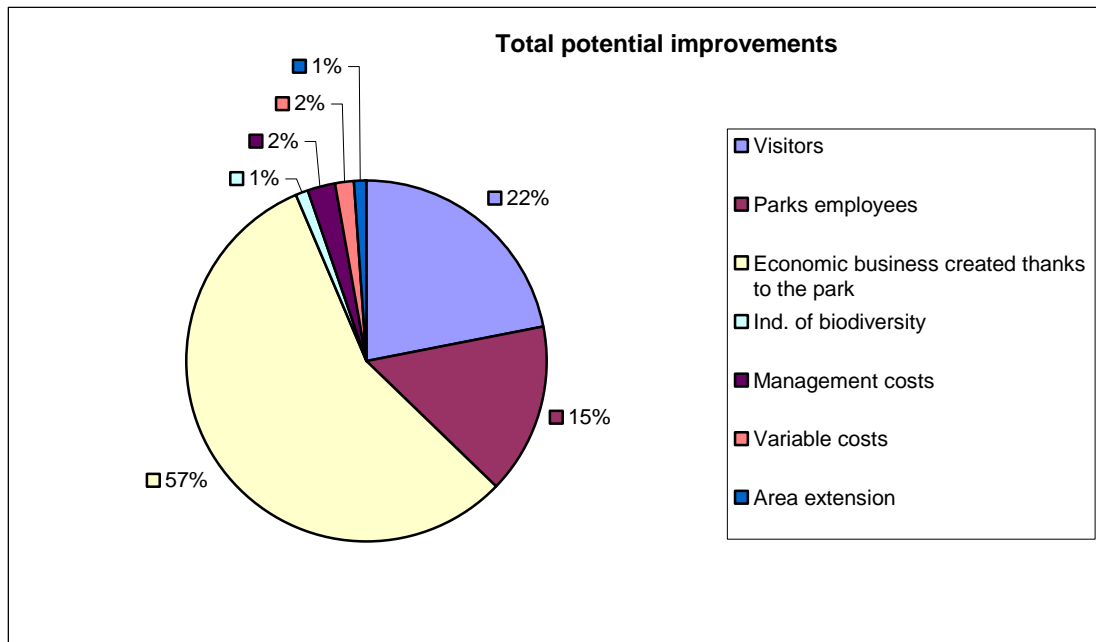
**Table 2 - Definition of input-output for the three models. Grey indicates input assumed as uncontrollable. (author)**

DMU	MODEL 1	MODEL 2	MODEL 3
	Efficiency	Efficiency	Efficiency
<b>Abruzzo, Lazio e Molise</b>	100	100	100
<b>Arcipelago la Maddalena</b>	6,54	45,2	22,94
<b>Arcipelago Toscano</b>	54,82	100	100
<b>Asinara</b>	100	100	100
<b>Aspromonte</b>	7,3	51,77	21,81
<b>Cilento Vallo di Diano</b>	16,56	30,14	35,33
<b>Circeo</b>	93,27	100	100
<b>Dolomiti Bellunesi</b>	23,56	62,28	33,07
<b>Foreste Casentinesi</b>	100	68,07	100
<b>Gargano</b>	68,23	100	100
<b>Gran Paradiso</b>	58,62	48,16	65,62
<b>Gran Sasso e Monti della Laga</b>	34,02	42,94	100
<b>Majella</b>	100	100	100
<b>Monti Sibillini</b>	100	92,45	100
<b>Val Grande</b>	9,43	100	53,32
<b>Vesuvio</b>	100	100	100

**Table 3 - Efficiency results for the three models. (author)**



**Figure 1 - Suggested potential improvements to obtain full efficiency. (author)**



**Figure 2 -Total potential improvements. (author)**

## 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>

<http://www.repec.org>

### NOTE DI LAVORO PUBLISHED IN 2004

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

KTHC	36.2004	<i>Franca ECKERT COEN and Claudio ROSSI</i> (Ixviii): <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</i> (Ixviii): <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u>
KTHC	38.2004	<i>Kiflemariam HAMDE</i> (Ixviii): <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</i> (Ixix): <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 ESCRHUELA-VILLAR</i> : <u>Cartel Sustainability and Cartel Stability</u>
NRM	45.2004	<i>Sebastian BERVOETS and Nicolas GRAVEL</i> (Ixvi): <u>Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach</u>
NRM	46.2004	<i>Signe ANTHON and Bo JELLES MARK THORSEN</i> (Ixvi): <u>Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits</u>
NRM	47.2004	<i>John MBURU</i> (Ixvi): <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> (Ixvi): <u>Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transition al 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> (Ixvi): <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>
NRM	55.2004	<i>Timo GOESCHL and Tun LIN</i> (Ixvi): <u>Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices</u>
NRM	56.2004	<i>Tom DEDEURWAERDERE</i> (Ixvi): <u>Bioprospection: From the Economics of Contracts to Reflexive Governance</u>
CCMP	57.2004	<i>Katrin REHDANZ and David MADDISON</i> : <u>The Amenity Value of Climate to German Households</u>
CCMP	58.2004	<i>Koen SMEKENS and Bob VAN DER ZWAAN</i> : <u>Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios</u>
NRM	59.2004	<i>Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA</i> (Ixvii): <u>Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management</u>
NRM	60.2004	<i>Timo GOESCHL and Danilo CAMARGO IGLIORI</i> (Ixvi): <u>Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon</u>
CCMP	61.2004	<i>Barbara BUCHNER and Carlo CARRARO</i> : <u>Economic and Environmental Effectiveness of a Technology-based Climate Protocol</u>
NRM	62.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH</i> : <u>Resource-Abundance and Economic Growth in the U.S.</u>
NRM	63.2004	<i>Györgyi BELA, György PATAKI, Melinda SMALE and Mariann HAJDÚ</i> (Ixvi): <u>Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis</u>
NRM	64.2004	<i>E.C.M. RUIJGROK and E.E.M. NILLESEN</i> (Ixvi): <u>The Socio-Economic Value of Natural Riverbanks in the Netherlands</u>
NRM	65.2004	<i>E.C.M. RUIJGROK</i> (Ixvi): <u>Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method</u>
ETA	66.2004	<i>Giannis VARDAS and Anastasios XEPAPADEAS</i> : <u>Uncertainty Aversion, Robust Control and Asset Holdings</u>
GG	67.2004	<i>Anastasios XEPAPADEAS and Constadina PASSA</i> : <u>Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach</u>
GG	68.2004	<i>Michael FINUS</i> : <u>Modesty Pays: Sometimes!</u>
NRM	69.2004	<i>Trond BJØRNDAL and Ana BRASÃO</i> : <u>The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications</u>
CTN	70.2004	<i>Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT</i> : <u>On Coalition Formation with Heterogeneous Agents</u>
IEM	71.2004	<i>Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA</i> : <u>Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants</u>
IEM	72.2004	<i>Alessandro LANZA, Matteo MANERA and Michael MCALEER</i> : <u>Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns</u>
SIEV	73.2004	<i>Margarita GENIUS and Elisabetta STRAZZERA</i> : <u>The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests</u>



CCMP	74.2004	<i>Rob DELLINK and Ekko van IERLAND</i> : <u>Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment</u>
ETA	75.2004	<i>Rosella LEVAGGI and Michele MORETTO</i> : <u>Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach</u>
CTN	76.2004	<i>Salvador BARBERÀ and Matthew O. JACKSON</i> (lxx): <u>On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union</u>
CTN	77.2004	<i>Àlex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERA and Fernando VEGA-REDONDO</i> (lxx): <u>Optimal Information Transmission in Organizations: Search and Congestion</u>
CTN	78.2004	<i>Francis BLOCH and Armando GOMES</i> (lxx): <u>Contracting with Externalities and Outside Options</u>
CTN	79.2004	<i>Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE</i> (lxx): <u>Merger Performance under Uncertain Efficiency Gains</u>
CTN	80.2004	<i>Francis BLOCH and Matthew O. JACKSON</i> (lxx): <u>The Formation of Networks with Transfers among Players</u>
CTN	81.2004	<i>Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO</i> (lxx): <u>Bicameralism and Government Formation</u>
CTN	82.2004	<i>Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon RAPOPORT</i> (lxx): <u>Potential Maximization and Coalition Government Formation</u>
CTN	83.2004	<i>Kfir ELIAZ, Debraj RAY and Ronny RAZIN</i> (lxx): <u>Group Decision-Making in the Shadow of Disagreement</u>
CTN	84.2004	<i>Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ</i> (lxx): <u>Economics: An Emerging Small World?</u>
CTN	85.2004	<i>Edward CARTWRIGHT</i> (lxx): <u>Learning to Play Approximate Nash Equilibria in Games with Many Players</u>
IEM	86.2004	<i>Finn R. FØRSUND and Michael HOEL</i> : <u>Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power</u>
KTHC	87.2004	<i>Elissaios PAPHAKIS and Reyer GERLAGH</i> : <u>Natural Resources, Investment and Long-Term Income</u>
CCMP	88.2004	<i>Marzio GALEOTTI and Claudia KEMFERT</i> : <u>Interactions between Climate and Trade Policies: A Survey</u>
IEM	89.2004	<i>A. MARKANDYA, S. PEDROSO and D. STREIMIKIENE</i> : <u>Energy Efficiency in Transition Economies: Is There Convergence Towards the EU Average?</u>
GG	90.2004	<i>Rolf GOLOMBEK and Michael HOEL</i> : <u>Climate Agreements and Technology Policy</u>
PRA	91.2004	<i>Sergei IZMALKOV</i> (lxx): <u>Multi-Unit Open Ascending Price Efficient Auction</u>
KTHC	92.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI</i> : <u>Cities and Cultures</u>
KTHC	93.2004	<i>Massimo DEL GATTO</i> : <u>Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus devolution</u>
CCMP	94.2004	<i>Pierre-André JOUVET, Philippe MICHEL and Gilles ROTILLON</i> : <u>Equilibrium with a Market of Permits</u>
CCMP	95.2004	<i>Bob van der ZWAAN and Reyer GERLAGH</i> : <u>Climate Uncertainty and the Necessity to Transform Global Energy Supply</u>
CCMP	96.2004	<i>Francesco BOSELLO, Marco LAZZARIN, Roberto ROSON and Richard S.J. TOL</i> : <u>Economy-Wide Estimates of the Implications of Climate Change: Sea Level Rise</u>
CTN	97.2004	<i>Gustavo BERGANTIÑOS and Juan J. VIDAL-PUGA</i> : <u>Defining Rules in Cost Spanning Tree Problems Through the Canonical Form</u>
CTN	98.2004	<i>Siddhartha BANDYOPADHYAY and Mandar OAK</i> : <u>Party Formation and Coalitional Bargaining in a Model of Proportional Representation</u>
GG	99.2004	<i>Hans-Peter WEIKARD, Michael FINUS and Juan-Carlos ALTAMIRANO-CABRERA</i> : <u>The Impact of Surplus Sharing on the Stability of International Climate Agreements</u>
SIEV	100.2004	<i>Chiara M. TRAVISI and Peter NIJKAMP</i> : <u>Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents</u>
SIEV	101.2004	<i>Chiara M. TRAVISI, Raymond J. G. M. FLORAX and Peter NIJKAMP</i> : <u>A Meta-Analysis of the Willingness to Pay for Reductions in Pesticide Risk Exposure</u>
NRM	102.2004	<i>Valentina BOSETTI and David TOMBERLIN</i> : <u>Real Options Analysis of Fishing Fleet Dynamics: A Test</u>
CCMP	103.2004	<i>Alessandra GORIA e Gretel GAMBARELLI</i> : <u>Economic Evaluation of Climate Change Impacts and Adaptability in Italy</u>
PRA	104.2004	<i>Massimo FLORIO and Mara GRASSEN</i> : <u>The Missing Shock: The Macroeconomic Impact of British Privatisation</u>
PRA	105.2004	<i>John BENNETT, Saul ESTRIN, James MAW and Giovanni URGA</i> : <u>Privatisation Methods and Economic Growth in Transition Economies</u>
PRA	106.2004	<i>Kira BÖRNER</i> : <u>The Political Economy of Privatization: Why Do Governments Want Reforms?</u>
PRA	107.2004	<i>Pehr-Johan NORBÄCK and Lars PERSSON</i> : <u>Privatization and Restructuring in Concentrated Markets</u>
SIEV	108.2004	<i>Angela GRANZOTTO, Fabio PRANOVI, Simone LIBRALATO, Patrizia TORRICELLI and Danilo MAINARDI</i> : <u>Comparison between Artisanal Fishery and Manila Clam Harvesting in the Venice Lagoon by Using Ecosystem Indicators: An Ecological Economics Perspective</u>
CTN	109.2004	<i>Somdeb LAHIRI</i> : <u>The Cooperative Theory of Two Sided Matching Problems: A Re-examination of Some Results</u>
NRM	110.2004	<i>Giuseppe DI VITA</i> : <u>Natural Resources Dynamics: Another Look</u>
SIEV	111.2004	<i>Anna ALBERINI, Alistair HUNT and Anil MARKANDYA</i> : <u>Willingness to Pay to Reduce Mortality Risks: Evidence from a Three-Country Contingent Valuation Study</u>
KTHC	112.2004	<i>Valeria PAPPONETTI and Dino PINELLI</i> : <u>Scientific Advice to Public Policy-Making</u>
SIEV	113.2004	<i>Paulo A.L.D. NUNES and Laura ONOFRI</i> : <u>The Economics of Warm Glow: A Note on Consumer's Behavior and Public Policy Implications</u>
IEM	114.2004	<i>Patrick CAYRADE</i> : <u>Investments in Gas Pipelines and Liquefied Natural Gas Infrastructure What is the Impact on the Security of Supply?</u>
IEM	115.2004	<i>Valeria COSTANTINI and Francesco GRACCEVA</i> : <u>Oil Security. Short- and Long-Term Policies</u>

IEM	116.2004	<i>Valeria COSTANTINI and Francesco GRACCEVA: <u>Social Costs of Energy Disruptions</u></i>
IEM	117.2004	<i>Christian EGENHOFER, Kyriakos GIALOGLOU, Giacomo LUCIANI, Maroeska BOOTS, Martin SCHEEPERS, Valeria COSTANTINI, Francesco GRACCEVA, Anil MARKANDYA and Giorgio VICINI: <u>Market-Based Options for Security of Energy Supply</u></i>
IEM	118.2004	<i>David FISK: <u>Transport Energy Security. The Unseen Risk?</u></i>
IEM	119.2004	<i>Giacomo LUCIANI: <u>Security of Supply for Natural Gas Markets. What is it and What is it not?</u></i>
IEM	120.2004	<i>L.J. de VRIES and R.A. HAKVOORT: <u>The Question of Generation Adequacy in Liberalised Electricity Markets</u></i>
KTHC	121.2004	<i>Alberto PETRUCCI: <u>Asset Accumulation, Fertility Choice and Nondegenerate Dynamics in a Small Open Economy</u></i>
NRM	122.2004	<i>Carlo GIUPPONI, Jaroslav MYSLAK and Anita FASSIO: <u>An Integrated Assessment Framework for Water Resources Management: A DSS Tool and a Pilot Study Application</u></i>
NRM	123.2004	<i>Margaretha BREIL, Anita FASSIO, Carlo GIUPPONI and Paolo ROSATO: <u>Evaluation of Urban Improvement on the Islands of the Venice Lagoon: A Spatially-Distributed Hedonic-Hierarchical Approach</u></i>
ETA	124.2004	<i>Paul MENSINK: <u>Instant Efficient Pollution Abatement Under Non-Linear Taxation and Asymmetric Information: The Differential Tax Revisited</u></i>
NRM	125.2004	<i>Mauro FABIANO, Gabriella CAMARSA, Rosanna DURSI, Roberta IVALDI, Valentina MARIN and Francesca PALMISANI: <u>Integrated Environmental Study for Beach Management: A Methodological Approach</u></i>
PRA	126.2004	<i>Irena GROSFELD and Iraj HASHI: <u>The Emergence of Large Shareholders in Mass Privatized Firms: Evidence from Poland and the Czech Republic</u></i>
CCMP	127.2004	<i>Maria BERRITTELLA, Andrea BIGANO, Roberto ROSON and Richard S.J. TOL: <u>A General Equilibrium Analysis of Climate Change Impacts on Tourism</u></i>
CCMP	128.2004	<i>Reyer GERLAGH: <u>A Climate-Change Policy Induced Shift from Innovations in Energy Production to Energy Savings</u></i>
NRM	129.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH: <u>Natural Resources, Innovation, and Growth</u></i>
PRA	130.2004	<i>Bernardo BORTOLOTTI and Mara FACCIO: <u>Reluctant Privatization</u></i>
SIEV	131.2004	<i>Riccardo SCARPA and Mara THIENE: <u>Destination Choice Models for Rock Climbing in the Northeast Alps: A Latent-Class Approach Based on Intensity of Participation</u></i>
SIEV	132.2004	<i>Riccardo SCARPA Kenneth G. WILLIS and Melinda ACUTT: <u>Comparing Individual-Specific Benefit Estimates for Public Goods: Finite Versus Continuous Mixing in Logit Models</u></i>
IEM	133.2004	<i>Santiago J. RUBIO: <u>On Capturing Oil Rents with a National Excise Tax Revisited</u></i>
ETA	134.2004	<i>Ascensión ANDINA DÍAZ: <u>Political Competition when Media Create Candidates' Charisma</u></i>
SIEV	135.2004	<i>Anna ALBERINI: <u>Robustness of VSL Values from Contingent Valuation Surveys</u></i>
CCMP	136.2004	<i>Gernot KLEPPER and Sonja PETERSON: <u>Marginal Abatement Cost Curves in General Equilibrium: The Influence of World Energy Prices</u></i>
ETA	137.2004	<i>Herbert DAWID, Christophe DEISSENBERG and Pavel ŠEVČIK: <u>Cheap Talk, Gullibility, and Welfare in an Environmental Taxation Game</u></i>
CCMP	138.2004	<i>ZhongXiang ZHANG: <u>The World Bank's Prototype Carbon Fund and China</u></i>
CCMP	139.2004	<i>Reyer GERLAGH and Marjan W. HOFKES: <u>Time Profile of Climate Change Stabilization Policy</u></i>
NRM	140.2004	<i>Chiara D'ALPAOS and Michele MORETTO: <u>The Value of Flexibility in the Italian Water Service Sector: A Real Option Analysis</u></i>
PRA	141.2004	<i>Patrick BAJARI, Stephanie HOUGHTON and Steven TADELIS (lxxi): <u>Bidding for Incomplete Contracts</u></i>
PRA	142.2004	<i>Susan ATHEY, Jonathan LEVIN and Enrique SEIRA (lxxi): <u>Comparing Open and Sealed Bid Auctions: Theory and Evidence from Timber Auctions</u></i>
PRA	143.2004	<i>David GOLDREICH (lxxi): <u>Behavioral Biases of Dealers in U.S. Treasury Auctions</u></i>
PRA	144.2004	<i>Roberto BURGNET (lxxi): <u>Optimal Procurement Auction for a Buyer with Downward Sloping Demand: More Simple Economics</u></i>
PRA	145.2004	<i>Ali HORTACSU and Samita SAREEN (lxxi): <u>Order Flow and the Formation of Dealer Bids: An Analysis of Information and Strategic Behavior in the Government of Canada Securities Auctions</u></i>
PRA	146.2004	<i>Victor GINSBURGH, Patrick LEGROS and Nicolas SAHUGUET (lxxi): <u>How to Win Twice at an Auction. On the Incidence of Commissions in Auction Markets</u></i>
PRA	147.2004	<i>Claudio MEZZETTI, Aleksandar PEKEČ and Ilia TSETLIN (lxxi): <u>Sequential vs. Single-Round Uniform-Price Auctions</u></i>
PRA	148.2004	<i>John ASKER and Estelle CANTILLON (lxxi): <u>Equilibrium of Scoring Auctions</u></i>
PRA	149.2004	<i>Philip A. HAILE, Han HONG and Matthew SHUM (lxxi): <u>Nonparametric Tests for Common Values in First-Price Sealed-Bid Auctions</u></i>
PRA	150.2004	<i>François DEGEORGE, François DERRIEN and Kent L. WOMACK (lxxi): <u>Quid Pro Quo in IPOs: Why Bookbuilding is Dominating Auctions</u></i>
CCMP	151.2004	<i>Barbara BUCHNER and Silvia DALL'OLIO: <u>Russia: The Long Road to Ratification. Internal Institution and Pressure Groups in the Kyoto Protocol's Adoption Process</u></i>
CCMP	152.2004	<i>Carlo CARRARO and Marzio GALEOTTI: <u>Does Endogenous Technical Change Make a Difference in Climate Policy Analysis? A Robustness Exercise with the FEEM-RICE Model</u></i>
PRA	153.2004	<i>Alejandro M. MANELLI and Daniel R. VINCENT (lxxi): <u>Multidimensional Mechanism Design: Revenue Maximization and the Multiple-Good Monopoly</u></i>
ETA	154.2004	<i>Nicola ACOCELLA, Giovanni Di BARTOLOMEO and Wilfried PAUWELS: <u>Is there any Scope for Corporatism in Stabilization Policies?</u></i>
CTN	155.2004	<i>Johan EYCKMANS and Michael FINUS: <u>An Almost Ideal Sharing Scheme for Coalition Games with Externalities</u></i>
CCMP	156.2004	<i>Cesare DOSI and Michele MORETTO: <u>Environmental Innovation, War of Attrition and Investment Grants</u></i>

CCMP	157.2004	<i>Valentina BOSETTI, Marzio GALEOTTI and Alessandro LANZA: <u>How Consistent are Alternative Short-Term Climate Policies with Long-Term Goals?</u></i>
ETA	158.2004	<i>Y. Hossein FARZIN and Ken-Ichi AKAO: <u>Non-pecuniary Value of Employment and Individual Labor Supply</u></i>
ETA	159.2004	<i>William BROCK and Anastasios XEPAPADEAS: <u>Spatial Analysis: Development of Descriptive and Normative Methods with Applications to Economic-Ecological Modelling</u></i>
KTHC	160.2004	<i>Alberto PETRUCCI: <u>On the Incidence of a Tax on PureRent with Infinite Horizons</u></i>
IEM	161.2004	<i>Xavier LABANDEIRA, José M. LABEAGA and Miguel RODRÍGUEZ: <u>Microsimulating the Effects of Household Energy Price Changes in Spain</u></i>

#### NOTE DI LAVORO PUBLISHED IN 2005

CCMP	1.2005	<i>Stéphane HALLEGATTE: <u>Accounting for Extreme Events in the Economic Assessment of Climate Change</u></i>
CCMP	2.2005	<i>Qiang WU and Paulo Augusto NUNES: <u>Application of Technological Control Measures on Vehicle Pollution: A Cost-Benefit Analysis in China</u></i>
CCMP	3.2005	<i>Andrea BIGANO, Jacqueline M. HAMILTON, Maren LAU, Richard S.J. TOL and Yuan ZHOU: <u>A Global Database of Domestic and International Tourist Numbers at National and Subnational Level</u></i>
CCMP	4.2005	<i>Andrea BIGANO, Jacqueline M. HAMILTON and Richard S.J. TOL: <u>The Impact of Climate on Holiday Destination Choice</u></i>
ETA	5.2005	<i>Hubert KEMPF: <u>Is Inequality Harmful for the Environment in a Growing Economy?</u></i>
CCMP	6.2005	<i>Valentina BOSETTI, Carlo CARRARO and Marzio GALEOTTI: <u>The Dynamics of Carbon and Energy Intensity in a Model of Endogenous Technical Change</u></i>
IEM	7.2005	<i>David CALEF and Robert GOBLE: <u>The Allure of Technology: How France and California Promoted Electric Vehicles to Reduce Urban Air Pollution</u></i>
ETA	8.2005	<i>Lorenzo PELLEGRINI and Reyer GERLAGH: <u>An Empirical Contribution to the Debate on Corruption Democracy and Environmental Policy</u></i>
CCMP	9.2005	<i>Angelo ANTOCI: <u>Environmental Resources Depletion and Interplay Between Negative and Positive Externalities in a Growth Model</u></i>
CTN	10.2005	<i>Frédéric DEROLAN: <u>Cost-Reducing Alliances and Local Spillovers</u></i>
NRM	11.2005	<i>Francesco SINDICO: <u>The GMO Dispute before the WTO: Legal Implications for the Trade and Environment Debate</u></i>
KTHC	12.2005	<i>Carla MASSIDDA: <u>Estimating the New Keynesian Phillips Curve for Italian Manufacturing Sectors</u></i>
KTHC	13.2005	<i>Michele MORETTO and Gianpaolo ROSSINI: <u>Start-up Entry Strategies: Employer vs. Nonemployer firms</u></i>
PRCG	14.2005	<i>Clara GRAZIANO and Annalisa LUPORINI: <u>Ownership Concentration, Monitoring and Optimal Board Structure</u></i>
CSRM	15.2005	<i>Parashar KULKARNI: <u>Use of Ecolabels in Promoting Exports from Developing Countries to Developed Countries: Lessons from the Indian LeatherFootwear Industry</u></i>
KTHC	16.2005	<i>Adriana DI LIBERTO, Roberto MURA and Francesco PIGLIARU: <u>How to Measure the Unobservable: A Panel Technique for the Analysis of TFP Convergence</u></i>
KTHC	17.2005	<i>Alireza NAGHAVI: <u>Asymmetric Labor Markets, Southern Wages, and the Location of Firms</u></i>
KTHC	18.2005	<i>Alireza NAGHAVI: <u>Strategic Intellectual Property Rights Policy and North-South Technology Transfer</u></i>
KTHC	19.2005	<i>Mombert HOPPE: <u>Technology Transfer Through Trade</u></i>
PRCG	20.2005	<i>Roberto ROSON: <u>Platform Competition with Endogenous Multihoming</u></i>
CCMP	21.2005	<i>Barbara BUCHNER and Carlo CARRARO: <u>Regional and Sub-Global Climate Blocs. A Game Theoretic Perspective on Bottom-up Climate Regimes</u></i>
IEM	22.2005	<i>Fausto CAVALLARO: <u>An Integrated Multi-Criteria System to Assess Sustainable Energy Options: An Application of the Promethee Method</u></i>
CTN	23.2005	<i>Michael FINUS, Pierre v. MOUCHE and Bianca RUNDSHAGEN: <u>Uniqueness of Coalitional Equilibria</u></i>
IEM	24.2005	<i>Wietze LISE: <u>Decomposition of CO2 Emissions over 1980–2003 in Turkey</u></i>
CTN	25.2005	<i>Somdeb LAHIRI: <u>The Core of Directed Network Problems with Quotas</u></i>
SIEV	26.2005	<i>Susanne MENZEL and Riccardo SCARPA: <u>Protection Motivation Theory and Contingent Valuation: Perceived Realism, Threat and WTP Estimates for Biodiversity Protection</u></i>
NRM	27.2005	<i>Massimiliano MAZZANTI and Anna MONTINI: <u>The Determinants of Residential Water Demand Empirical Evidence for a Panel of Italian Municipalities</u></i>
CCMP	28.2005	<i>Laurent GILOTTE and Michel de LARA: <u>Precautionary Effect and Variations of the Value of Information</u></i>
NRM	29.2005	<i>Paul SARFO-MENSAH: <u>Exportation of Timber in Ghana: The Menace of Illegal Logging Operations</u></i>
CCMP	30.2005	<i>Andrea BIGANO, Alessandra GORIA, Jacqueline HAMILTON and Richard S.J. TOL: <u>The Effect of Climate Change and Extreme Weather Events on Tourism</u></i>
NRM	31.2005	<i>Maria Angeles GARCIA-VALIÑAS: <u>Decentralization and Environment: An Application to Water Policies</u></i>
NRM	32.2005	<i>Chiara D'ALPAOS, Cesare DOSI and Michele MORETTO: <u>Concession Length and Investment Timing Flexibility</u></i>
CCMP	33.2005	<i>Joseph HUBER: <u>Key Environmental Innovations</u></i>
CTN	34.2005	<i>Antoni CALVÓ-ARMENGOL and Rahmi İLKILIÇ (Ixxii): <u>Pairwise-Stability and Nash Equilibria in Network Formation</u></i>
CTN	35.2005	<i>Francesco FERI (Ixxii): <u>Network Formation with Endogenous Decay</u></i>
CTN	36.2005	<i>Frank H. PAGE, Jr. and Myrna H. WOODERS (Ixxii): <u>Strategic Basins of Attraction, the Farsighted Core, and Network Formation Games</u></i>

CTN	37.2005	<i>Alessandra CASELLA and Nobuyuki HANAKI</i> (lxxii): <u>Information Channels in Labor Markets. On the Resilience of Referral Hiring</u>
CTN	38.2005	<i>Matthew O. JACKSON and Alison WATTS</i> (lxxii): <u>Social Games: Matching and the Play of Finitely Repeated Games</u>
CTN	39.2005	<i>Anna BOGOMOLNAIA, Michel LE BRETON, Alexei SAVVATEEV and Shlomo WEBER</i> (lxxii): <u>The Egalitarian Sharing Rule in Provision of Public Projects</u>
CTN	40.2005	<i>Francesco FERI</i> : <u>Stochastic Stability in Network with Decay</u>
CTN	41.2005	<i>Aart de ZEEUW</i> (lxxii): <u>Dynamic Effects on the Stability of International Environmental Agreements</u>
NRM	42.2005	<i>C. Martijn van der HEIDE, Jeroen C.J.M. van den BERGH, Ekko C. van IERLAND and Paulo A.L.D. NUNES</i> : <u>Measuring the Economic Value of Two Habitat Defragmentation Policy Scenarios for the Veluwe, The Netherlands</u>
PRCG	43.2005	<i>Carla VIEIRA and Ana Paula SERRA</i> : <u>Abnormal Returns in Privatization Public Offerings: The Case of Portuguese Firms</u>
SIEV	44.2005	<i>Anna ALBERINI, Valentina ZANATTA and Paolo ROSATO</i> : <u>Combining Actual and Contingent Behavior to Estimate the Value of Sports Fishing in the Lagoon of Venice</u>
CTN	45.2005	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>Participation in International Environmental Agreements: The Role of Timing and Regulation</u>
CCMP	46.2005	<i>Lorenzo PELLEGRINI and Reyer GERLAGH</i> : <u>Are EU Environmental Policies Too Demanding for New Members States?</u>
IEM	47.2005	<i>Matteo MANERA</i> : <u>Modeling Factor Demands with SEM and VAR: An Empirical Comparison</u>
CTN	48.2005	<i>Olivier TERCIEUX and Vincent VANNETELBOSCH</i> (lxx): <u>A Characterization of Stochastically Stable Networks</u>
CTN	49.2005	<i>Ana MAULEON, José SEMPERE-MONERRIS and Vincent J. VANNETELBOSCH</i> (lxxii): <u>R&amp;D Networks Among Unionized Firms</u>
CTN	50.2005	<i>Carlo CARRARO, Johan EYCKMANS and Michael FINUS</i> : <u>Optimal Transfers and Participation Decisions in International Environmental Agreements</u>
KTHC	51.2005	<i>Valeria GATTAI</i> : <u>From the Theory of the Firm to FDI and Internalisation: A Survey</u>
CCMP	52.2005	<i>Alireza NAGHAVI</i> : <u>Multilateral Environmental Agreements and Trade Obligations: A Theoretical Analysis of the Doha Proposal</u>
SIEV	53.2005	<i>Margaretha BREIL, Gretel GAMBARELLI and Paulo A.L.D. NUNES</i> : <u>Economic Valuation of On Site Material Damages of High Water on Economic Activities based in the City of Venice: Results from a Dose-Response-Expert-Based Valuation Approach</u>
ETA	54.2005	<i>Alessandra del BOCA, Marzio GALEOTTI, Charles P. HIMMELBERG and Paola ROTA</i> : <u>Investment and Time to Plan: A Comparison of Structures vs. Equipment in a Panel of Italian Firms</u>
CCMP	55.2005	<i>Gernot KLEPPER and Sonja PETERSON</i> : <u>Emissions Trading, CDM, JI, and More – The Climate Strategy of the EU</u>
ETA	56.2005	<i>Maia DAVID and Bernard SINCLAIR-DESGAGNÉ</i> : <u>Environmental Regulation and the Eco-Industry</u>
ETA	57.2005	<i>Alain-Désiré NIMUBONA and Bernard SINCLAIR-DESGAGNÉ</i> : <u>The Pigouvian Tax Rule in the Presence of an Eco-Industry</u>
NRM	58.2005	<i>Helmut KARL, Antje MÖLLER, Ximena MATUS, Edgar GRANDE and Robert KAISER</i> : <u>Environmental Innovations: Institutional Impacts on Co-operations for Sustainable Development</u>
SIEV	59.2005	<i>Dimitra VOUVAKI and Anastasios XEPAPADEAS</i> (lxxiii): <u>Criteria for Assessing Sustainable Development: Theoretical Issues and Empirical Evidence for the Case of Greece</u>
CCMP	60.2005	<i>Andreas LÖSCHEL and Dirk T.G. RÜBBELKE</i> : <u>Impure Public Goods and Technological Interdependencies</u>
PRCG	61.2005	<i>Christoph A. SCHALTEGGER and Benno TORGLER</i> : <u>Trust and Fiscal Performance: A Panel Analysis with Swiss Data</u>
ETA	62.2005	<i>Irene VALSECCHI</i> : <u>A Role for Instructions</u>
NRM	63.2005	<i>Valentina BOSETTI and Gianni LOCATELLI</i> : <u>A Data Envelopment Analysis Approach to the Assessment of Natural Parks' Economic Efficiency and Sustainability. The Case of Italian National Parks</u>

(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 4<sup>th</sup> 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

(lxx) This paper was presented at the 9<sup>th</sup> Coalition Theory Workshop on "Collective Decisions and Institutional Design" organised by the Universitat Autònoma de Barcelona and held in Barcelona, Spain, January 30-31, 2004

(lxxi) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by Fondazione Eni Enrico Mattei and Consip and sponsored by the EU, Rome, September 23-25, 2004

(lxxii) This paper was presented at the 10<sup>th</sup> Coalition Theory Network Workshop held in Paris, France on 28-29 January 2005 and organised by EUREQua.

(lxxiii) This paper was presented at the 2nd Workshop on "Inclusive Wealth and Accounting Prices" held in Trieste, Italy on 13-15 April 2005 and organised by the Ecological and Environmental Economics - EEE Programme, a joint three-year programme of ICTP - The Abdus Salam International Centre for Theoretical Physics, FEEM - Fondazione Eni Enrico Mattei, and The Beijer International Institute of Ecological Economics.

#### 2004 SERIES

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

#### 2005 SERIES

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