

Lin, Tun; Goeschl, Timo

Working Paper

Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices

Nota di Lavoro, No. 55.2004

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Lin, Tun; Goeschl, Timo (2004) : Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices, Nota di Lavoro, No. 55.2004, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/117936>

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.

**Biodiversity Conservation on
Private Lands: Information
Problems and Regulatory Choices**

Timo Goeschl and Tun Lin

NOTA DI LAVORO 55.2004

MARCH 2004

NRM – Natural Resources Management

Timo Goeschl, *Department of Land Economy, University of Cambridge*
Tun Lin, *Department of Economics, University of Cambridge*

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=541107>

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

Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices

Summary

This survey paper examines various information insufficiencies in biodiversity conservation and their impact of regulatory choices. We surveyed the literature in the field and identified four major types of informational insufficiencies in making efficient biodiversity conservation decisions: 1) biological uncertainty 2) natural uncertainty 3) individual information, and 4) monitoring problem. The consequences of these four types of information insufficiencies on the choice of regulatory tools are explored. We discuss in this context three types of regulatory tools: land takings, environmental fees/charges, and contracts. The efficiency of each type of regulatory tools is shown dependent on the specific informational constraints that the regulatory faces.

Keywords: Biodiversity conservation, Information, Regulatory tools

JEL Classification: Q20, Q28, D82, D83

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).

Address for correspondence:

Tun Lin
Department of Economics
University of Cambridge
Cambridge, CB3 9DD
United Kingdom
E-mail: T1220@cam.ac.uk

1. Introduction

The single greatest threat to biodiversity in the U.S. and around the globe is the loss of natural habitat to development and agriculture. Changing patterns of land use have reduced the carrying capacity of the environment in terms of the numbers of species that it can sustain. As Oldfield (1984, 1991) puts it, "Developments are proposed, the development alternatives are evaluated, the social costs of habitat losses or extinction are ignored or casually considered, and the decision to develop is given the go-ahead, actually on the basis of incomplete economic information. It is by this gradual process of land conversion that entire ecosystems and wildlife species have disappeared." Agriculture is following a trend in that more productive systems tend to have fewer species (Pimm and Gittleman, 1992). Both agriculture practice and urban sprawl are converting species' natural habitats with an alarming speed - for example a net loss of approximate 65 million hectares of forests is estimated in developing countries between 1990 and 1995, representing 3.7% of the total remaining forests in these countries (UNEP, 2000, p. 38).

Current economic systems have often led to over-exploitation of biological resources for reasons common to other public goods' over-exploitation: weak ownership, missing markets, severe free ridings and large externalities etc (see Clark, 1973a; Dasgupta, 1982; Fisher, 1981b; Norgaard, 1984; Pearce, 1976; and Randall, 1979 for more detailed discussions). Frequently, externalities exist in cases where it is not possible to identify the particular individuals who are negatively affected by the actions of others but where public goods which accrue to society at large are affected. This holds particularly in the case of biodiversity. If a given ecosystem disappears, the negative impact on each individual might be too small to warrant individual action, but nevertheless the total impact, due to the large number of individuals affected, might be considerable and require policy intervention. Governments therefore are called upon to implement incentive measures to achieve a sustainable use of land in those cases in which private utility-maximization causes imperfect outcomes, as individuals do not take into account the impacts of their activities on the well-being of other individuals or the public at large.

Most instruments developed by environmental economists and regulators to correct for externality problems have been studied in the context of environmental pollution. Examples include the imposition of artificial shadow prices in the form of environmental taxes or charges which reflect the damage to public goods, the better definition of property rights with the enabling markets, and the payment for / subsidization of behaviors more sympathetic to public interests etc.

The situation concerning the conservation or the sustainable use of biodiversity is comparable but not identical. This is mainly due to greater information insufficiencies that prevent the regulatory measures being effective for biodiversity conservation.

Compared to other environmental degradation, biodiversity losses is more difficult to measure in extent and value - oftentimes the value of biodiversity resides in its pure existence, or possibly in its – as yet still unknown – future uses. The presumption for effective government intervention in correcting/internalizing externalities relies in that government has superior information and vastly reduced transaction costs in ensuring that public health and amenity considerations are adequately reflected in the actions of individual producers. This is oftentimes not true in case of biodiversity conservation. Individual landowners oftentimes either have better information on the species habituated in their lands (and the costs associated to preserve them) or are in a better position to discover this information because of legal boundaries that prevent government investigation of the lands.

This paper examines various information insufficiencies in biodiversity conservation and their impact of regulatory choices. The structure of the paper is the following: In the next section, we shortly review various types of information insufficiencies in biodiversity conservation efforts. In section 3, we examine major regulatory tools for biodiversity and their bearings on information constraints. Section 4 concludes.

2. Information Insufficiencies in Biodiversity Conservation

Information insufficiency presents one of the greatest challenges to biodiversity conservation (OECD, 1999). Information insufficiency arises from many aspects for the regulator to take effective conservation measures. The efficiency of many regulatory tools (e.g. standards and limits, charges and taxes, contracts etc.) that are used to internalize the environmental externalities critically depends on the amount of information regulator has on the marginal benefits and costs of abatement / conservation. Besides serving as a prerequisite for effective regulation, information per se can well be a goal of regulation in dynamic settings. In this section we review various informational constraints faced by regulators and identify four types of information failures in making conservation decisions: biological uncertainty, natural variability, hidden individual information, and monitoring problem¹. All these four types of informational failures result in insufficient information on the marginal benefit and cost curves of conservation that are essential for regulatory tools to effectively internalize the externalities.

First type of information insufficiency comes from biological uncertainty. Even though recent years ecological research has greatly furthered our knowledge of the complex aspects of biodiversity, such as ecosystem changes, habitat patchiness, and the role of natural and human-induced disturbances on biota (e.g. Reid and Miller, 1989), we still only have very limited knowledge for biology process (e.g. threshold

¹ We refer to Dosi, C and M. Moretto's work on non-point source pollution in defining various information insufficiencies.

values), which results in the uncertain forms of relationships in the system. Many fundamental questions about several aspects regarding the specific levels and their linkage at which biodiversity may be considered remain unanswered. We do not know, for example, how many species the world holds, even to an order of magnitude, much less the range and habitat each species inhabits. The impacts of habitat loss / fragmentation on genetic diversity and how biodiversity influences the ability of ecosystems to withstand stress are poorly known; so are the impacts of landscape fragmentation on the functioning of ecosystems, population viability and the functions and activities of many individual species (Myers, 1995; Ehrlich and Daily, 1993; Myers and Simon, 1993; Perrings et al, 1992; Solbrig, 1991). The impact of changing pattern of land use upon biodiversity is highly complicated and research has just begun. We poorly understand in quantity, if not in quality, how the encroachment of agricultural production system (especially in an uncoordinated manner) cause habitat loss and fragmentation, how air and /or water pollution, excessive sedimentation of water course and excessive hunting and logging lead to species loss even when natural habitat remain intact; how adoption of new farming practices contributes to decline of biodiversity of crop species on farm; and certain agrochemicals leads to decline in biodiversity within species (Srivastava, et. al. 1996)

Biological uncertainty inherent probably is the greatest obstacle for proper evaluation of biodiversity enhancing activities, but there are possibilities for improving information over time. Learning aspect of this process provides interesting research prospects. According to Tomas et. al., learning may be passive or active. Passive learning has not been addressed in any substantive fashion in the biodiversity literature, although there exist more general economics analyses upon which such analyses could be based. For example, the exact locations of the thresholds are unknown until the biodiversity loss process passes the threshold, and information jumps. Some work on dynamic resource problems with uncertain technology might offer some insights to this problem (e.g. Dasgupta and Stiglitz, 1981), but little research has been conducted in the biodiversity context. Active learning refers to “social experiments” whose main purpose is to generate information. These would involve deliberately manipulating the system in what may appear to be a sub-optimal way in order to improve our understanding of the relevant relationships. While such experiments may be politically unpopular, they might improve efficiency in the long run.

Second type of information insufficiency is natural variability. Natural variability in biodiversity conservation context is associated mainly with stochastic shocks from uncontrollable factors such as climate change and invasion of some alien species to local ecosystem. The distinction between natural variability and biological uncertainty arises from the ability to learn over time regarding the latter, while natural variability is mainly uncontrollable and stochastic. Unlike crop markets, there are not even partial risk and insurance markets to hedge/control the randomness in environmental effect. Therefore any state-contingency must be built into the

conservation policies under consideration. This physical uncertainty feature implies that there will be a range of possible biodiversity outcomes observed by regulator with any conservation effort. The disappearance of certain birds in one area for example might well be a result of weather change rather than the actual logging activities taken in that area. Researchers are increasingly aware of the stochastic influence resulted from physical uncertainty (e.g. Segerson, 1988). In the model Segerson presented in 1988 in the context of non-point source pollution, for example, the ambient level is represented by a probability function that is conditional on the abatement practice. This type of models also corresponds to the situation where the environmental impact is deterministic, but the regulator can only observe the impact level imprecisely and inaccurately with a probability distribution.

Third type of information insufficiency, hidden individual information, stems from asymmetric information between the regulator and landowners. Landowners to be regulated are diverse and heterogeneous in land development potentials, production technology, conservation awareness, habitat and species situation, conservation skills, and attitude toward risks (Smith 1995, Smith and Tomasi 1995, Horowitz and Hueth 1995, Wu and Babcock 1995), for which oftentimes landowners either have better information or are in a better position to collect the information (Goeschl and Lin, 2003). When serious information asymmetry exists between a regulator and landowners, the design of efficient environmental policy is hampered.

There are two types of information asymmetries studied by literature, one related to information stock (status information asymmetry) and the other related to information flow (ability information asymmetry) (Goeschl and Lin, 2003). Status information asymmetry comes from landowner's superior information about her own (e.g. production technology) and the land (e.g. habitat and species situation), while ability information asymmetry states the ability differences between the regulator and landowners in collecting these information. Conventional arguments for status information asymmetry root in specialization but recent literatures emphasize the role of self-conscious investment in information discovery (Cremer et. al. 1998a, 1998b). It is the ability asymmetry that gives rise to these investment decisions in collecting information. There are many plausible reasons that both types of information asymmetries (status and ability) exist, with legal barrier being an important one in biodiversity conservation context. In United States of America, for example, according to Natural Heritage Data Center Network's estimate, 70% of species listed under the Endangered Species Act depend on nonfederal land for the majority of their habitat (Polasky and Doremus 1998). Without land owners' consent, legal barriers exist for the regulator to enter the private land and collect biodiversity-related information on these lands, which implies the cost / ability asymmetry in collecting information between the regulator and the landowners.

Status information asymmetry, and the efficiency loss associated with it, is well studied in economics literature built on the seminal work on mechanism design theory

under asymmetric information by Hurwicz (1972), Groves (1973), Mirrlees (1971), Baron and Myerson (1982) and others. Not until recent years did economists start studying ability information asymmetry (Cremer et. al. 1992, 1998, 1998a, Sobel 1993, Lewis and Sappington 1997). These studies, all starting with the assumption that there is only information acquisition cost (ability) difference between the regulator and agent, try to endogenize the information structure and evaluate the regulated agent's incentives to acquire information. Goeschl and Lin (2003) studied dual information asymmetry situation where both types of asymmetry exist in the context of biodiversity conservation. There are also some literatures on the incentives of agents to acquire information about the value of an object before participating the auction (Lee, 1982; Matthews, 1984; Milgrom, 1981; etc.)

Last type of information insufficiency arises with monitoring problems closely associated with regulator's inability to observe directly individual's conservation efforts and impact on the biodiversity or to infer them from observable inputs (i.e. land development) or the total biodiversity loss.

There are a number of contributing factors to regulator's inability to monitor input (effort level) and output (impact) of conservation measures, as Xepapadeas observed in the context of pollution, "such as equipment and personnel limitations, or inability to enter the polluter's premises. On the other hand, while it is relatively easy to determine whether the polluter has installed adequate equipment for pollution abatement, it is difficult to make sure that this equipment is being operated at the desired level. As a result, the development of efficient measurement methods could be very costly" (Xepapadeas, 1991). Therefore, the government faces a situation where it could be prohibitively costly to measure with sufficient precision the individual's production of / contribution to conservation. In environmental economics literature, this is addressed by standard moral hazard models in which conservation efforts are privately observable (see Laffont and Tirole 1993 among others).

Monitoring problem sharpens when the number of landowners increases. When there is only one landowner in a setting – either where one farm accommodates all the species under consideration, or where many landowners are sufficiently independent one another to allow them to be regulated individually – there is no question of "responsibility" for observed biodiversity loss (Dosi and Moretto, 1994, 1997). However, it is more likely that many landowners' (diffuse) activities combine to determine a single measure of biodiversity loss at a given location. This is similar to non-point source water pollution question in the literature and moral hazard models and adverse selection with multiple firms are discussed by, respectively, Segerson (1988) and Xepapadeas (1991, 1992) and Shortle and Dunn (1988). The existence of multiple landowners raises a number of difficult regulatory issues, most of which relate to information and monitoring. It is no longer possible to attribute the biodiversity loss to the activities of any one landowner since "damages" are not

separable across landowners. Thus, it is necessary to infer each landowner's potential contribution in case of violation. The larger the number of landowners, the more difficult is the monitoring, and the more difficult is the information problem for both regulator (obtaining information about landowners) and the landowners themselves (obtaining information about each other). The existence of more landowners implies a greater potential free-rider problem, if each landowner perceives its own damage to biodiversity to be small relative to the group, and decreases the likelihood of cooperation among landowners to reduce biodiversity loss. Moreover, this observability problem is particularly severe in biodiversity conservation as many species (e.g. migrating birds and animals) roam across a vast territory. The regulator in general is in a difficult position to detect biodiversity loss /specie endanger in a certain location, not to mention to attribute this loss to individual landowners. Researchers and regulators duly discuss in this context regulatory options like team reward/punishment (e.g. Groves, 1973) and random reward/punishment (e.g. Xepapadeas, 1991) which we will discuss later.

Even though information is one of the greatest constraints in effective conservation regulation, the effort of collecting information is no less controversial. Property owners and regulators have sharply divergent view of the desirability of increased information about species status and distribution. In North America, for example, the Endangered Species Act has been the center of a fierce debate. On one side, groups representing various economic interests have called for radical reform of the law in order to reduce economic impacts and to protect private property rights. On the other side, environmental groups vehemently oppose any weakening of the current law, contending that it must be maintained or strengthen to ensure the long-term survival of endangered species. Conservation proponents favor greater efforts to collect information about the status of species, including location and health of population and habit (e.g. Wilson, 1992). By contrast, property rights advocates vociferously attack any move to expand government information collection efforts, such as the short-lived National Biological Survey.

3. Regulatory Instruments for Biodiversity under Information Constraints

Environmental economist and regulators have been developing and practicing a wide array of regulatory tools to preserve the biodiversity around the world, each of which subjects to different information constraints. We discuss in this section three major types of regulatory tools, namely land takings, environmental taxes, and contracts, and the informational constraints they face. Summarized in Table 1, these three measures portrait a wide spectrum of regulatory choices, under which many other regulatory tools, land access restrictions for example, fall into. In practice, a

combination of different regulatory measures oftentimes is a more desirable choice to tackle the pressures that lead to biodiversity loss (OECD, 1999; Smith, 1995).

Table 1: Three Regulatory Choices for Biodiversity Conservation

Regulatory Choices	Land Takings and Land Access Restriction	Environmental Taxes/ Changes and Removal of Adverse Incentives/Subsidies	Contracts
Producer of Public Goods	Public	Private	Private
Financial Costs to the Regulator	High	Low	Medium
Landowners' Cooperation	Often times mandatory	Mandatory	Voluntary

Land Takings and Land Access Restrictions

The traditional instruments of biodiversity conservation in Europe and North America have been the acquisition of land (takings) by the state with or without compensation and the imposition of restrictions on the use privilege of private property. Examples include establishment of national parks and reserve zones worldwide. The advantages of these approaches are that they are “conceptually easy to understand and that pre-formulated goals can be achieved with high probability, as long as adequate monitoring and enforcement can be assured.” (OECD, 1999)

These approaches however have several problems and limitations besides imposing high financial costs to the regulator. The problems have been discussed widely in the literature and many have to do with insufficient information (see Shogren and Tschirhart 2001 for a review). As a consequence of insufficient information on land's conservation values (because of any type of aforementioned informational failures), regulator's land acquisition decisions are prone to efficiency losses. Without sufficient conservation value information it is imaginably difficult for the regulator to make trade-offs among conservation projects given a limited governmental budget. When it comes to a specific land parcel, an acquisition decision has to be made upon the comparison between conservation value and market value, which is problematic without sufficient information on the former (Polasky and Doremus 1998). In the case of acquisition, the government not only asserts ownership of the land, but usually also takes on a management role. Similar to other settings, generating a public good, in this case conservation, through public production is prone to suffer from efficiency losses implicit in public production such as lower productivity and excessive opportunity and management costs of the conservation activity (Innes 2001). Apart from the problem of the government as an inefficient producer, compensation is fraught with various difficulties. If compensation is absent or too low, governments may be tempted to oversupply conservation. Also problematic incentives may be

created for landowners (such as ‘shoot, shovel, and shut up’, see Brown and Shogren 1998), and little cooperation can be expected from landowners in prospecting for biodiversity (Polasky and Doremus 1998). If on the other hand a compensation scheme is implemented, basing compensation on opportunity costs (market value of the land mainly) may be problematic since it will encourage early development of land in order to raise the payment (Blume et al 1984). Basing compensation on benefits (paying for number of birds increased for example) on the other hand will be problematic since, with only a few exceptions that the results can be monitored through satellite (Pagiola et. al. 2003), it generally requires the cooperation of the landowner and cannot be relied on to produce a reliable result (Polasky and Doremus 1998). Imposition of land use restrictions is less drastic than land takings, but to the extent that they are imposed, their impact is fundamentally identical to that of land takings in direction, if not in volume (Innes 2001).

Both land takings and land use restrictions are quantity-base instruments. Compared to price-base instruments such as taxes discussed in the next section, quantity-base instruments were traditionally regarded less affected by environmental benefit (damage) uncertainties (due to aforementioned biological uncertainties and natural variability) (Weitzman 1974 and others). Environmental economists acknowledged that benefit uncertainty on its own has no effect on the identity of the optimal efficient control instrument, but that cost uncertainty can have significant effects, depending upon the relative slopes of the marginal benefit damage and marginal cost functions. Adar and Griffin (1976, p180) stated “. . . the introduction of uncertainty in the damage function has nothing to say about the choice of policy instruments” and similar views were held by other environmental economists (Fishelson 1976; Baumol and Oates 1988). Starvins (1996) observed “in the real world, we rarely encounter situations in which there is exclusively either benefit uncertainty or cost uncertainty” and in the presence of simultaneous uncertainty in both marginal benefits and marginal costs and some statistical dependence between them, benefit uncertainty expressed through the covariance term can make a difference for identifying the efficient policy instrument. A positive correlation tends to favor the quantity instrument, and a negative correlation favors the price instrument. Research along this direction however has been slighted since.

Apart from the theoretical shortcomings of the traditional approach of providing conservation, over the last twenty years this model of biodiversity conservation has encountered several practical and political limitations. First, conservation opportunities on public land are naturally limited when significant amounts of target species exist on private land (see for example Innes, Polasky and Tschirhart 1998). At the same time, this model of conservation cannot reach forms of biodiversity, such as agro-biodiversity, where conservation is inherently tied up with continuing private production activities. In the managed landscapes of Europe that have been in productive agri- or silvicultural use for many centuries, a significant proportion of biodiversity falls into this category. The involvement of the landowner as the manager

of the essential production input land is critical in these circumstances. A second limitation has been the increasing political cost of limiting the property rights of landowners and practical experiences with the adverse conservation incentives contained in some of these measures. The third limitation has been the questioning of the logic of public production of public goods and a shift in economic policy in many European countries, leading to a retreat of the state from production activities. This had two effects: On the one hand, for new projects there has been an interest in alternatives to the conventional model, such as contracts, through which the private production of public goods would be carried out. On the other hand, for existing conservation projects the retreat of the state has created a necessity to develop alternative instruments as a result of management of significant land assets having been transferred to newly privatised entities. To manage these fundamentally new relationships between public bodies and private corporations, new instruments have to be developed.

Environmental Taxes/Fees and Removal of Adverse Incentives

One important change in biodiversity regulation over the past twenty years has been the move towards new instruments for the private production of public goods through price mechanisms – imposing environmental fees /taxes, removing adverse incentives / subsidies, or both. We include in environmental taxes the wide range of non-compliance fees, nature taxes, and conservation levies being applied around the world to discourage biodiversity damaging activities. Removal of the adverse subsidies, which are usually the results of government support programmes to agriculture, is fundamentally equivalent to imposition of environmental taxes (See OECD 1999 for a review of countries' practices).

These price-based incentives measures which aim to internalize the externalities are easily understandable but only applicable in situations where impacts are easily measurable (e.g. hunting) and sources of impacts can be easily monitored. Informational insufficiencies can greater jeopardize the efficiency of these measures. For the discussion below, we focus on two types of these taxes – the Pigouvian type and the Ambient Tax type. Most taxes we find in biodiversity conservation are Pigouvian type and ambient tax, originated in water and air pollution regulation, is often applied in biodiversity conservation projects where collective/team reward/punishment is implemented.

There are considerable amount of literature on how a system of Pigouvian taxes can generate efficient outcomes by internalizing the negative externalities and therefore inducing individual agents to produce the public goods (biodiversity) at the socially desirable levels (e.g. Baulmol and Oats, 1988). However, this is critically dependent on the condition that marginal benefit and cost curves are observable with sufficient accuracy and at a sufficiently lost cost. Weitzman (1974) and others show how uncertainties of marginal benefit and cost curves can result in inefficiency of such

taxes.

However, when an individual's damage to biodiversity cannot be observed with sufficient accuracy at a reasonable cost because of unknown biological process (biological uncertainty), stochastic influences (natural variability) and / or because of the inability to measure individual contribution to the environmental problem (monitoring problem), Pigouvian taxes will be not appropriate. An ambient tax system has been proposed by some economists such as Segerson (1988) and Xepapadeas (1991, 1992) in context of environmental pollution.

“[Ambient] taxes are essentially a charge per unit deviation between a desired and a measured ambient concentration level, and are imposed on every potential polluter once measured ambient pollutant levels exceed some desired cutoff level” (Xepapadeas, 1995a).

The approach proposed by Segerson is composed of two parts. The first is tax/subsidy payment that depends upon the extent to which the total ambient level (observable) exceed the cutoff level, the suspected polluter pays a tax proportional to the excess, while ambient levels below the cutoff result in a subsidy. The second part is fixed penalty imposed whenever ambient levels exceed the cutoff. This scheme is similar to on described by Holmstrom as a solution to free riding in the context of organizational structure. By eliminating the need for firm level monitoring of emissions or abatement effort, the mechanism can lower a regulator's administration costs. In addition, Segerson' approach solves free rider problem by imposing a penalty equivalent to the full marginal benefit of reduced ambient pollutant levels, rather than just paying a share of it, on each firm². However, Segerson's “penalize all” mechanism does not have government's budget balancing condition, which would require the regulator to dip further into a general revenues (in case of subsidies) than would the random penalty scheme proposed by Xepapadeas (1991).

Xepapadeas (1991) advocates a combination of subsidies and random penalties when only aggregated ambient level can be observed. This random penalty approach was much criticized because of its limits (Kritikos, 1993; Herriges et al, 1994). First, contrary to the original claim in Xepapadeas, random penalties cannot be used to achieve compliance if firms are risk natural. Budget balancing still requires that each firm pay, on average, only a fraction of the damages associated with pollution emissions. Second, the random penalty mechanism may face problems in both political and legal arenas, due to the random assignment of the penalty in the event of shirking. Firms that consistently comply with their assigned abatement objective can still be penalized. Finally, the random penalty mechanism relies on the assumption

² “For example, if marginal damages are valued at \$100, the regulatory agency will collect \$100 from each pollutant for the marginal unit of ambient pollution, for a total collection of \$ (100n)” (Segerson, 1988).

that each firm treats the other firms as being in compliance otherwise multiple equilibria problem remains to be solved.

Mix of Pigouvian tax and ambient tax is further proposed by Xepapadeas (1995b). The paper argues that severe monitoring problems make Pigouvian taxes preferable to ambient taxes as the latter does not require individual level of observability. However, when the information insufficiencies increase along the dimension of natural variability or biological uncertainty, increase in observability of individual emissions through, for example, investment in pollution monitoring equipment might be desirable for both the regulator and the agents – given agents are risk averse. Increase in observability of individual emissions will lead to a reduction or even abolition of ambient taxes and increase of Pigouvian tax. Therefore, Xepapadeas (1995b) shows that under uncertainty the efficient regulatory scheme is a mix of Pigouvian and ambient taxes. The Pigouvian fees are imposed on emissions / environmental damages revealed by the polluting firms in exchange for a lower ambient tax.

Contracts

Another important phenomenon of the move towards new instruments for the private production of public goods has been the rise of contracts between the relevant public entity (such as conservation agencies) and private landowners. Contract mechanisms are receiving increasing attention in recent years worldwide to encourage biodiversity-friendly agricultural practices. One example is the Regional Integrated Silvopastoral Ecosystem Management Project implemented by the World Bank in Colombia, Costa Rica, and Nicaragua (Pagiola et al., 2003). Under these types of contracts, locals are paid to generate biodiversity conservation.

A key concern for both researchers and policy makers in the development of such contracts has been to ensure that the conservation contracts are drawn up as efficiently as possible. Contract design is therefore a major consideration and has increasingly attracted the attention of environmental economists.

Initially, the literature identified as the source of such efficiency losses the asymmetry of contract-relevant information (hidden information) between the conservation agency (the regulator) and the conservation provider (the landowner) with respect to the cost of conservation (Smith 1995, Smith and Tomasi 1995, Hueth 1995, Wu and Babcock 1995). This perspective leads to casting the problem in terms of a standard principal-agent problem with two types (typically low- and high-efficiency) or a continuum of types. (Hurwicz 1972, Groves 1973, Mirrlees 1971, Baron and Myerson 1982 and others)

It has been noted subsequently that one serious shortcoming in that literature is the underlying assumption that the costs and/or benefits of preservation are actually

known to the agent. This assumption has been attacked as unrealistic on a number of grounds: Often, there are no existing markets for the outputs of conservation activities, so both agent and principal will find it hard to assign a proper cost and/or benefit estimate to a particular conservation activity. Also, collecting information about the cost structure of complying with obligations regarding inputs and/or outputs is costly so that landowners will not enter negotiations fully informed about their own costs while the regulating agency cannot collect this information without considerable cost, consent, and often support of the landowner (Polasky and Doremus 1998). A second generation has therefore started to explore the issue of information collection in the context of biodiversity conservation in order to provide answers to situations where the both principal and agent are imperfectly informed, but differ in their ability to collect information either for technical (capital) or legal (property rights) reasons (Polasky 2001).

Goeschl and Lin (2003) studies a mixture of asymmetries between the conservation agency and the contracting landowner, one relating to asymmetric status regarding information about the type of landowner (low- or high efficiency) involved in the contract and the other relating to asymmetric ability to collect contract-relevant information that is unknown to both parties at the outset of the contract negotiations. As a typical example, think of a conservation contract that requires the contracting farmer to provide adequate habitat for some species. Informational asymmetry will arise on the one hand because the farmer will have information about the opportunity cost of giving up agricultural land based on his intimate knowledge of his land assets. This information will not be available to the conservation agency. On the other hand, prior to a careful inspection under the consideration of habitat provision neither the agency nor the farmer will know whether additional resources will be required to provide adequate habitat on the land under consideration. Examples would be measures to ensure higher soil moisture or different cultivation patterns. On one farm, the land may be adequate as it is, on another, certain measures will be required to ensure adequacy. Since there will commonly not have been a need to collect this information at some previous point in time, both the farmer and the conservation agency will not know the additional cost to the farmer of providing adequate habitat. What makes this information deficiency relevant to consider in the contract, however, is that the farmer will have much greater scope to ascertain the adequacy of his land for the activities to be contracted over than the agency for both legal and technical reasons. In situations that involve such a combination of informational asymmetries between the conservation agency and the landowner, the agency needs to consider not only the static information asymmetry, but also the differential ability of the parties to become informed about contract-relevant parameters. If conservation agencies take these aspects into consideration, we show that we would expect to observe very different contract negotiation strategies than those optimal under either pure status or pure ability asymmetry.

4. Concluding Remarks

Informational constraint represents one of greatest challenges to both environmental economists and policy makers in regulatory choices. The nature, type, and extent of informational insufficiencies have profound impacts on regulatory measure choices, research of which is of both intellectual vitality and real-world relevance. This review suggests an integrated framework that explicitly consider efficiency trade-offs of different regulatory measures under various informational structures will be a key step in enhancing our understanding of this area further.

References:

- Adar, Z. & J. M. Griffin. 1976. Uncertainty And The Choice Of Pollution Control Instruments. *Journal of Environmental Economics and Management* (3): 178-188.
- Baron, D.& R. Myerson. 1982. Regulating A Monopolist With Unknown Costs. *Econometrica* 50 (4): 911-930.
- Baumol, W. J. & Oates, W.E. 1988. *The Theory of Environmental Policy*. 2nd ed., Cambridge Univ. Press, Cambridge, UK.
- Blume, L., Rubinfeld, D. & Shapiro, P. 1984. The Taking of Land: When Should Compensation Be Paid? *Quarterly Journal of Economics* 99(1): 71-92.
- Brown, G & J. Shogren. 1998. Economics of the Endangered Species Act. *Journal of Economic Perspectives* 12(3): 3-20.
- Cabe, R. & Herriges, A. 1992. The Regulation of Non-Point-Source Pollution under Imperfect and Asymmetric Information. *Journal of Environmental Economics and Management* 22(2): 134-46.
- Chambers, R.G. & Quiggin, J. 1996. Non-Point-Source Pollution Regulation as a Multi-Task Principal-Agent Problem. *Journal of Public Economics* 59(1): 95-116.
- Clark, C. 1973a. The Economics of Overexploitation. *Science* 181: 630–634.
- _____. 1973b. Profit Maximization and the Extinction of Animal Species. *J. Pol. Econ.* 81:950–961.
- Cr  mer, J.,& F. Khalil. 1992. Gathering Information Before Signing a Contract. *American Economic Review* 82 (3): 566-578.
- _____, F. Khalil, & J.C. Eochet. 1998a. Contracts and productive information gathering. *Games and Economic Behavior* 25:174-193.
- _____, F. Khalil,& J.C. Eochet. 1998b. Strategic information gathering before a contract is offered. *Journal of Economic Theory* 81: 163-200.
- Dasgupta, P. 1982. *The control of resources*. Cambridge, Mass., Harvard University Press.
- _____. & J. Stiglitz. 1981. Resource Depletion under Technological Uncertainty. *Econometrica* 49: 85-104.
- Dosi, C. & Tomasi. 1994. *Nonpoint Source Pollution Regulation: Issues and Analysis*. Fondazione Eni Enrico Mattei Series on Economics, Energy and Environment. Dordrecht and Boston: Kluwer

Academic.

_____ & M. Moretto. 1994. Nonpoint Source Externalities and Polluter's Site Quality Standards under Incomplete Information. *Nonpoint Source Pollution Regulation: Issues and Analysis*. Fondazione Eni Enrico Mattei Series on Economics, Energy and Environment. Dordrecht and Boston: Kluwer Academic, 1994: 107-36

_____ & M. Moretto. 1997. Pollution Accumulation and Firm Incentives to Accelerate Technological Change under Uncertain Private Benefits. *Environmental and Resource Economics* v10 (3): 285-300

Dunn, J. & J. Shortle. 1988. Agricultural Nonpoint Source Pollution Control in Theory and Practice. *Marine Resource Economics* v5(3): 259-70

Ehrlich, P; A. Ehrlich & G. Daily. 1993. Food Security, Population, and Environment. *Population and Development Review* v19 (1): 1-32.

Fishelson, G. 1976. Emission Control Policies under Uncertainty. *Journal of Environmental Economics and Management* 3:189-197.

Fisher, A.C. 1973. Environmental Externalities and the Arrow-Lind Public Investment Theorem. *Am.Econ. Rev.* 63(4):722-725.

_____. 1981a. Economic Analysis and the Extinction of Species. Report No. ERG—WP—81—4. Energy and Resources Group, Berkeley, CA.

_____. 1981b. *Resources and Environmental Economics*. Cambridge University Press, Cambridge, UK.

_____ & F.M. Peterson. 1976. The Environment in Economics: A Survey. *Journal of Economic Literature* 14:1-33.

_____ & W.M. Hanemann, 1985. Endangered Species: the Economics of Irreversible Damage. pp 129-138 In D.O. Hall, N. Myers and N.S. Margaris (eds.), *Economics of Ecosystem Management*. W. Junk Publishers, Dordrecht, The Netherlands.

_____ J.V. Krutilla, & C.J. Cicchetti, 1972. The Economics of Environmental Preservation: A Theoretical and Empirical Analysis. *Am. Econ. Rev.* 62:605-619.

Goeschl, T. & T. Lin. 2003. *Conservation Contracting Under Dual Information Asymmetry*. Meimo. University of Cambridge.

Greiner, R. & O. Cacho. 2001. On the Efficient Use of a Catchment's Land and Water Resources: Dryland Salinization in Australia. *Ecological Economics*. 38(3): 441-58.

- Groves, T. 1973. Incentives in Teams. *Econometrica* v41(4): 617-31
- Hanemann, W.M. 1989. Information and the Concept of Option Value. *Journal of Environmental Economics and Management* 16: 23-37.
- Herriges, J.; R.Govindasamy & J. Shogren.1994. Budget-Balancing Incentive Mechanisms. *Journal of Environmental Economics and Management* 27(3): 275-85
- Horowitz, J. & D. Hueth. 1995. Impact of Government Regulation on Agricultural Competitiveness: Discussion. *American Journal of Agricultural Economics* 77(5): 1183-85
- Hurwicz, L. 1972. On Informationally Decentralized Systems. in C.B. McGuire and R. Radner (eds.), *Decision and Organization*. Amsterdam: North-Holland: 297-336.
- Innes, R. 1997. Takings, Compensation and Equal Treatment for Owners of Developed and Undeveloped Property. *Journal of Law and Economics* 40:403-432.
- _____, S. Polasky & J. Tschirhart. 1998. Takings, Compensation And Endangered Species Protection On Private Land. *Journal of Economic Perspectives* 12(3): 35-52.
- _____. 2001. Economics of Land Takings. In Shogren, J F. and J. Tschirhart (eds.). *Protecting Endangered Species In The United States: Biological Needs, Political Realities, Economic Choices*. Cambridge; New York and Melbourne: Cambridge University Press, 2001
- _____. 2003. Stochastic Pollution, Costly Sanctions, and Optimality of Emission Permit Banking. *Journal of Environmental Economics and Management* 45(3): 546-68
- Iossa, E. & F. Stroffolini. 2002. Price Cap Regulation And Information Acquisition. *International Journal of Industrial Organization* 20: 1013-1036.
- Kritikos, A. 1993. Environmental Policy under Imperfect Information: Comment *Journal of Environmental Economics and Management* 25(1): 89-92
- Laffont, J.J. & J. Tirole. 1986. Using Cost Observation to Regulate Firms. *Journal of Political Economy* 94: 615-641.
- _____ & J. Tirole. 1993. *A Theory Of Incentives In Procurement And Regulation*. Cambridge, Mass. MIT Press.
- Lee, D. 1982. On the Pricing of Public Goods. *Southern Economic Journal* 49(1): 99-105.
- Lewis, T. & D. Sappington. 1988. Regulating A Monopolist Within Unknown Demand And Cost Functions. *Rand Journal of Economics* 19:438-457.

_____ & Sappington, D. 1997. Information Management In Incentive Problems. *Journal of Political Economy* 10: 797-819.

Matthews, S. 1984. Information Acquisition in Discriminatory Auctions. *Bayesian Models in Economic Theory*: 181-207

Milgrom, P. 1981. Rational Expectations, Information Acquisition, and Competitive Bidding. *Econometrica* 49(4): 921-43

Miltz,D; J.B. Braden & G.V. Johnson. 1988. Standards versus Prices Revisited: The Case of Agricultural Non-point Source Pollution. *Journal of Agricultural Economics*; 39(3): 360-68.

Mirrlees, J. 1971. An Exploration in the Theory of Optimum Income Taxation. *Review of Economic Studies* 38(114): 175-208

Myers, N. 1995. Biodiversity. *Environmental Awareness* 18:50-51.

_____ & J.L. Simon. 1993. *Scarcity or Abundance: A Debate on the Environment*. W.W. Norton

Norgaard, R.B. 1984. *Environmental Economics: An Evolutionary Critique and a Plea for Pluralism*. Division of Agricultural Sciences, University of California, Berkeley, CA. Working Paper 299:1–24.

_____. 1987. The Economics of Biological Diversity: Apologetics or Theory?. In: Southgate, D.D. and J.F. Disinger (eds.). 1987. *Sustainable Resource Development in the Third World*. Westview Press, Boulder, CO.

Norgaard, R.B. 1988. The Rise of the Global Exchange Economy and the Loss of Biological Diversity. pp. 206–211 in Wilson, E.O. (ed.). *Biodiversity*. National Academy Press, Washington, D.C.

OECD. *Handbook Of Incentive Measures For Biodiversity Design And Implementation*. 1999. Paris, France.

Oldfield, M.L. 1984. *The Value of Conserving Genetic Resources*. Washington D.C.: US Dept. of the Interior, National Park Service

_____. & J.B. Alcorn, 1991. *Biodiversity: Culture, Conservation, and Ecodevelopment*. Boulder, CO: Westview Press.

Pagiola, S., P. Agostini, C. de Haan, & M. Ibrahim. 2003. *Contracting For Biodiversity Conservation in Agricultural Landscapes*. BioEcon Workshop proceedings, Montpellier, France.

Pearce, D. W. 1976. *Environmental Economics*. London ; New York : Longman, 1976

Perrings, C.; C. Folke & K. Mäler. 1992. The ecology and economics of biodiversity loss: the research agenda. Stockholm, Sweden : Beijer International Institute of Ecological Economics, the Royal Swedish Academy of Sciences, 1992

Pimm, S.L. & J.L. Gittleman. 1992. Biological Diversity: Where Is It? *Science* 255:940

Polasky, S. & Doremus. 1998. Conservation on Private Land. *Journal of Environmental Economics and Management* 35: 22-47.

_____. 2001. Investment, Information Collection And Endangered Species Conservation On Private Land. In *Endangered Species Protection in the United States: Biological Needs, Political Realities, Economic Consequences*, J. Shogren and J. Tschirhart (eds.). Cambridge: Cambridge University Press.

Randall, A. 1979. *Resource Economics: An Economic Approach to Natural Resource and*

Randhir,T & J.G. Lee. 1997. Economic and Water Quality Impacts of Reducing Nitrogen and Pesticide Use in Agriculture. *Agricultural and Resource Economics Review*; 26(1):39-51.

Ready, R. C. & K. Henken, 1999. Optimal Self-Protection from Nitrate-Contaminated Groundwater. *American Journal of Agricultural Economics* 81:321-334.

Reid, H. & W. Miller. 1989. *Keeping Options Alive: The Scientific Basis For Conserving Biodiversity*. Washington: World Resources Institute, 1989.

Segerson, K. 1988. Uncertainty and Incentives for Nonpoint Pollution Control. *Journal of Environmental Economics Management* 15, 87-98.

Shogren, J F. & J. Tschirhart (eds.). 2001. *Protecting endangered species in the United States: Biological needs, political realities, economic choices* Cambridge; New York and Melbourne: Cambridge University Press, 2001

Shortle, J. & J. Dunn. 1988. The Relative Efficiency of Agricultural Source Water Pollution Control Policies. *American Journal of Agricultural Economics* 68(3): 668-77

Smith, R. & T.D. Tomasi. 1995. Transaction Costs and Agricultural Nonpoint-Source Water Pollution Control Policies. *Journal of Agricultural and Resource Economics* 20(2): 277-90

_____ & Y. Tsur. 1997. Asymmetric Information and the Pricing of Natural Resources: The Case of Unmetered Water. *Land Economics* 73(3): 392-403

_____. 1995. The Conservation Reserve Program as a Least-Cost Land Retirement Mechanism. *American Journal of Agricultural Economics* 77(1): 93-105

_____ & T. Tomasi. 1999. Multiple Agents, and Agricultural Nonpoint-Source Water Pollution Control Policies. *Agricultural and Resource Economics Review* 28(1): 37-43

Sober, J. 1993. Information Control In The Principal-Agent Problem. *International Economic Review* 34: 259-269.

Solbrig, O. T. 1991. Biodiversity: Scientific Issues And Collaborative Research Proposals. Paris: United Nations Educational, Scientific and Cultural Organization, 1991

_____. 1991. From Genes to Ecosystems : a Research Agenda for Biodiversity. Report of a IUBS-SCOPE-UNESCO workshop, Harvard Forest, Petersham, Ma., USA, June 27-July 1, 1991 Cambridge, Mass. : IUBS, 1991

Srivastava J. J.H.S. Nigel & D. Forno. 1996. Biodiversity and Agriculture: Implications for Conservation and Development. World Bank Technical Paper 321.

Stavins RN. 1996. Correlated Uncertainty and Policy Instrument Choice. *Journal of Environmental Economics and Management* 30(2):218-32.

United Nations Environmental Program (UNEP). Global Environmental Outlook 2000. London: Earthscan Publications Ltd.

Weitzman, M. L. 1978. Optimal Rewards for Economic Regulation. *American Economic Review*. 68: 683-691.

Weitzman, M.L. 1974. Prices vs. Quantities. *Review of Economic. Studies* 41: 477-491.

Wilson, E.O. 1992. The Diversity of Life. New York: W.W. Norton& Co.

Wu J. & B Babcock. 1995. Optimal Design Of A Voluntary Green Payment Program Under Asymmetric Information. Ames, Iowa.

Xepapadeas,A. 1991. Environmental Policy Under Imperfect Information: Incentives and Moral Hazard. *Journal of Environmental Management* 20: 113-126.

_____. 1992. Environmental Policy Design and Dynamic Nonpoint Source Pollution. *Journal of Environmental Economics and Management* 23: 22-39.

_____. 1995a. Environmental Policy under Imperfect Information: Incentives and Moral Hazard. *Journal of Environmental Economics and Management* 20(2):113-26.

_____. 1995b. Observability and Choice of Instrument Mix in the Control of Externalities. *Journal of Public Economics* 56: 485-498.

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

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 (Ixi)</i> : <u>The Minimal Dominant Set is a Non-Empty Core-Extension</u>
CTN	51.2003	<i>Matthew O. JACKSON (Ixi)</i> : <u>Allocation Rules for Network Games</u>
CTN	52.2003	<i>Ana MAULEON and Vincent VANNETELBOSCH (Ixi)</i> : <u>Farsightedness and Cautiousness in Coalition Formation</u>
CTN	53.2003	<i>Fernando VEGA-REDONDO (Ixi)</i> : <u>Building Up Social Capital in a Changing World: a network approach</u>
CTN	54.2003	<i>Matthew HAAG and Roger LAGUNOFF (Ixi)</i> : <u>On the Size and Structure of Group Cooperation</u>
CTN	55.2003	<i>Taiji FURUSAWA and Hideo KONISHI (Ixi)</i> : <u>Free Trade Networks</u>
CTN	56.2003	<i>Halis Murat YILDIZ (Ixi)</i> : <u>National Versus International Mergers and Trade Liberalization</u>
CTN	57.2003	<i>Santiago RUBIO and Alistair ULPH (Ixi)</i> : <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 (Ixi)</i> : <u>Lorenzo Market between Diversity and Mutation</u>
KNOW	70.2003	<i>Ercole SORI (Ixi)</i> : <u>Mapping Diversity in Social History</u>
KNOW	71.2003	<i>Ljiljana DERU SIMIC (Ixi)</i> : <u>What is Specific about Art/Cultural Projects?</u>
KNOW	72.2003	<i>Natalya V. TARANOVA (Ixi)</i> : <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 (Ixi)</i> : <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 (Ixi)</i> : <u>Glocal Dialogue- Transformation through Transcultural Communication</u>
KNOW	75.2003	<i>Catarina REIS OLIVEIRA (Ixi)</i> : <u>Immigrants' Entrepreneurial Opportunities: The Case of the Chinese in Portugal</u>
KNOW	76.2003	<i>Sandra WALLMAN (Ixi)</i> : <u>The Diversity of Diversity - towards a typology of urban systems</u>
KNOW	77.2003	<i>Richard PEARCE (Ixi)</i> : <u>A Biologist's View of Individual Cultural Identity for the Study of Cities</u>
KNOW	78.2003	<i>Vincent MERK (Ixi)</i> : <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 (Ixi): <u>Anti-Racist Policies in France. From Ideological and Historical Schemes to Socio-Political Realities</u></i>
KNOW	99.2003	<i>Richard THOMPSON FORD (Ixi): <u>Cultural Rights and Civic Virtue</u></i>
KNOW	100.2003	<i>Alaknanda PATEL (Ixi): <u>Cultural Diversity and Conflict in Multicultural Cities</u></i>
KNOW	101.2003	<i>David MAY (Ixi): <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 (Ixi) : <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: <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 AUSSENEGG, 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, Arie 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&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 BJØRNDAL, 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 (lxviii): <u>Foreigners, Immigrants, Host Cities: The Policies of Multi-Ethnicity in Rome. Reading Governance in a Local Context</u></i>
KTHC	37.2004	<i>Kristine CRANE (lxviii): <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u></i>
KTHC	38.2004	<i>Kiflemariam Hamde (lxviii): <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></i>
ETA	39.2004	<i>Alberto CAVALIERE: <u>Price Competition with Information Disparities in a Vertically Differentiated Duopoly</u></i>
PRA	40.2004	<i>Andrea BIGANO and Stef PROOST: <u>The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?</u></i>
CCMP	41.2004	<i>Micheal FINUS (lxix): <u>International Cooperation to Resolve International Pollution Problems</u></i>

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 JELLES MARK 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>
NRM	55.2004	<i>Timo GOESCHL and Tun LIN</i> (lxvi): <u>Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices</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)
CSRM	<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)
CSRM	<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>