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BOOK OF ABSTRACTS

Session 1

Evolutionary approaches

The economic repercussions of fisheries-induced evolution

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Despite growing evidence that harvest can cause rapid evolution of key yield-determining life-history traits, the economic effects of fisheries-induced evolution have yet to be formally investigated. The world's largest stock of Atlantic cod, the Northeast Arctic cod, experienced an intensification of fishing pressure in the 1930s to 1950s, when open-ocean trawling was introduced in the stock's Barents Sea feeding grounds. Since this increase in exploitation, the stock exhibited a pronounced reduction in the mean age and size at maturation, a trend paralleled by observations in many other commercially harvested species. Evidence suggests that these life-history changes have a genetic basis and that they could diminish the stock's productivity and sustainable yield by reducing the mean body size of fish in the population. Considering that, in addition, large fish are disproportionately more valuable than smaller fish, the removal of late-maturing or large-sized genotypes from exploited populations could lead to considerable economic losses. Here, we merge ecology, evolution, and economy by evaluating the economic cost of fisheries-induced evolution in Northeast Arctic cod under realistic assumptions about the behaviour of fishermen. We demonstrate that, within a few decades, the evolution of life-history traits induced by fishing significantly reduces the economic returns generated by the stock's feeding-ground fishery. This shows how disregard for evolutionary change can be economically costly over a relatively short time horizon. Our results therefore caution against ignoring the consequences of fisheries-induced evolution.

Session 2

Crop diversity

Agro-Ecosystem Productivity in Developing Countries:
The Economics of Crop Biodiversity in the Highlands of Ethiopia

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The paper investigates the value of biodiversity as it relates to the productive value of services provided by an ecosystem. It analyzes how the value of an ecosystem can be "greater than the sum of its parts." First, it proposes a general measure of the value of biodiversity. Second, this measure is decomposed into four components, reflecting the role of complementarity, scale, convexity and catalytic effects. This provides new information on the sources and determinants of biodiversity value. Third, the methodology is applied to analyze the productive value of diversity of an agroecosystem in the Highlands of Ethiopia. The analysis provides estimates of the value of diversity and its components. The value of diversity is estimated to be positive. The complementarity component is found to be large and statistically significant: it is the main source of biodiversity value in this agroecosystem of Ethiopia. However, the convexity component is negative, indicating that non-convexity contributes to reducing the value of biodiversity.

Session 3

R&D

IPR and North-South Hold-up Problem in Sequential R&D

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North-South relations in the life sciences industries are rife with tensions and disagreement about the appropriation of benefits from genetic resources and pharmaceuticals. Both sides blame the other for piracy or bio-piracy. The South claims its right in biological resources – from which the North derives many useful medicines – is not recognised and not duly compensated while the North claims its intellectual property right on new drugs is at best poorly enforced in the South. On both sides, the failure of property rights to gain recognition across jurisdictions may hinder investment in maintaining genetic diversity on the one hand and investment in drug development on the other hand. This paper develops a model of North-South bargaining in a sequential R&D framework to shed light into the mechanism by which under-investment in maintaining genetic diversity and inefficient flow of information in bioprospecting occurs. We also set out to explain the extent to which poor recognition of IPR by the South through parallel trade may result in inefficient investment in R&D. We show that hold up is the main reason for under-investment and highlight the role that legal institutions in both regions may play in shaping the incentives to invest. Under certain conditions and legal remedies, we show that enforcement of property rights across jurisdictions helps circumvent the hold up problem and encourages socially optimal investments.

Session 4

Evolutionary approaches

The evolution of social norms for renewable resource exploitation

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Many case studies indicate that social norms play a key role in explaining why certain local communities are capable of managing renewable natural resources in a sustainable and profitable way We explore a model in which agents harvest a common resource and take the monetary incentives of resource exploitation into account, but also the corresponding social consequences. Agents' appreciation for modest agents, and disapproval of greedy agents evolve over time. Adaptive dynamics techniques (Dieckmann et al., 1996; Geritz et al., 1998; Metz et al., 1996) will be used to analyze these evolutionary pressures that operate at different time scales. While the appropriate exploitation level is revised frequently, the social trait changes much more slowly.

Animal Rationality and Implications for Resource Management – The Case of Biological Reserves for Moose and Pine.

By

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One logical implication of the Darwinian hypothesis of 'survival of the fittest' is that animals exhibit optimizing behavior. Surprisingly, this has not been included in the resource economics literature. This paper explores the implications of optimizing behavior in a model where moose face migration decisions and humans wish to keep moose out of an area to protect young pine trees. The results show that if moose are rational, a given hunting effort will lead to better outcomes for humans than if the moose only focus on harvesting opportunities. This finding suggests that the validity of the standard assumption that animal migration behavior is density-dependent should be re-examined.

Session 5

Optimal conservation

Efficient Biodiversity Management through Shadow Price Evaluation: On Instruments of Landscape Design, Farmers' Supply and Citizens' Demand

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Any management of biodiversity has to deal with priority setting. Priority setting contributes to allocative efficiency of managing biodiversity. Practical management has to cope with scarcity measurement. Scarcity is normally, i.e. in a market economy, measured in prices. Since no market exists for diversity or species, in particular, surrogates are needed. This paper deals with the problem of finding relative values (prices) for species in the case of an eco-system management in a cultural landscape. It combines the concepts of willingness to pay and willingness to accept through an ecologically motivated redesign of a landscape. For instrument combination we use the concept of shadow prices. Shadow prices are obtained from constrained maximization. The conflicting problem of "objective", i.e. market like, joint valuation of biodiversity by citizens, farmers, and experts is solved by behavioral equations which allow a simulation. This simulation provides the equilibrium for likely species appearance and assigned shadow prices based on behavioral equations. The paper is organized such as that (1) the theory of shadow price derivation in a framework of linear and non-linear programming is presented. (2) From this we obtain quadratic objective functions for each participant in a valuation process. (3) Quasi demand and supply functions are conceptualized by which we simulate a market. (4) Specific roles of ecologists as experts and potential managers of a landscape are addressed and (5) a balanced solution on values, value oriented management, and species prevalence is provided. The paper serves to develop a tool which will help to solve the problem of joint ecological and economic evaluation of biodiversity as complex non-market good. Monetary valuation is only part of the approach, though integrated into the priority setting.

Sushi or Fish Fingers? Preferences for diversity and the sustainability of fisheries

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We consider consumers' preferences for food _sh diversity in a multispecies fishery model. Studying both the long-run equilibria and the dynamics of an open-access fishery we conclude that the outcome is generally less sustainable the stronger preferences for diversity are. We show that even without biological interactions the optimal landing fees for the different species are dynamically interdependent and have to be adjusted in a non-monotonic way. One policy implication is that substantial landing fees should be levied also on a fish species with a healthy stock if it is a substitute for an endangered species.

Session 6

Genetic diversity

Potentials of green consumerism for landrace conservation: evidence from eggplant production sector of India

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The study examines the least-cost option of conserving landraces *in situ* by the development of market friction instruments, taking the case of eggplant production sector of India. The study uses the farm level data on production of hybrid and landrace eggplant and also relies on consumer preference data for fruit attributes. An examination of the cost and return structure of eggplant farming in the study area reveals that the incremental farm price of eggplant products of landrace origin eclipses the yield advantage of hybrids varieties. Box-Cox model, fitted for hedonic price estimation, indicates that along with the external fruit characteristics the landrace status is the main reason behind their higher farm price. We observe that there is potential for green markets in emerging economies such as India, even though the existing markets are highly informal and inadequate in catering to the needs of eco-friendly consumers. It is also observed that the increment in the farm price of eggplant landraces over hybrids is realized in the complete absence of formal market segmentation, that is, without any formal labelling or certification scheme. Further, the study examines the consumptive value of landrace attribute, using the consumer household data from urban India and the stated preference methods. Possibly due to the information asymmetries and other imperfections existing in this market, the price increment currently realized by the eggplant farmers is only a fraction of consumers' willingness to pay for landraces. The study concludes that, by employing friction instruments to eliminate the information asymmetries in the market, sustained on-farm use of landraces could be assured in an effective way.

Field coffee collections at risk: can cryopreservation help to ensure their long term security?

By
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Germplasm collections represent a store house of useful traits for crop improvement and their conservation is of vital importance for ensuring food security and people's livelihoods. Coffee is one of the world's most valuable agricultural exportcommodities produced mostly by small scale farmers. Their genetic resources have traditionally been conserved as live plants in field genebanks, which presents many challenges for conservation and new techniques of *in vitro* and cryopreservation (storage in liquid nitrogen) have been developed to improve their long term conservation. The question remains whether these newer techniques are more cost efficient and effective, and make a difference in reducing genetic erosion over the long term compared to field collections. In this study we compared the costs of maintaining the coffee field collection at the Tropical Agricultural Research and Higher Education Center (CATIE) Costa Rica, one of the largest coffee collections in the world, with those of establishing a coffee cryo-collection at the centre. The study demonstrates that cryopreservation costs less (in perpetuity, per accession) than conservation in field genebanks. A comparative analysis of the costs of cryopreservation and field genebanks showed that there are economies of scale associated with cryopreservation, since the more accessions there are in cryopreservation storage, the lower the per-accession cost. In addition to cost, we discuss the advantages of cryopreservation over field collections and show that for those species which traditionally can only be conserved as live plants, cryopreservation may be the method of choice for long term conservation of genetic diversity.

Session 7

Wildlife

Economic interdependency through interconnected species exploitation

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When exploiting a wildlife stock, economic interdependency between the species or sub populations may rise without direct ecological interdependency. In the paper, economic interdependency resulting from an interconnected exploitation of one species is considered. We use Scandinavian moose hunting as an application. Management schemes are studied under different market situations and cost assumptions.

Coping with spatial structure in the collaborative management of a mobile ecological resource

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We study management of deer populations in a landscape where reciprocal externalities between landholders affect net benefits from management. The net benefits arising from deer populations at particular densities typically differ among landowners. Higher densities are preferred by landowners primarily interested in shooting revenues, whereas lower densities are generally required for biodiversity imperatives. An individual-based model is used to represent interactions among landholders' decisions in a mosaic landscape. Emergence of cooperative strategies is explored among each type of ownership and related to the interaction between the local density of the managed deer population and the costs and benefits which arise from management action.

Session 8

Ecosystem assessment

Orientation on the mapping of biodiversity values:
A plural perspective

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Biodiversity loss is a problem of global concern affecting ecosystem functioning and services provided to humans. The Millennium Ecosystems Assessment approach is built on a conceptual framework that links the services ecosystems provide to society and human welfare. These services can be translated into economic values obtained from market and non-market valuation techniques, where numerous studies have yet measured ecosystems' goods and services in terms of economic revenues. Based on this background information and on the conceptual framework of the Millennium Ecosystem Approach, we compile market and non-market forest values and conduct a world wide meta-analysis where biodiversity loss indicators are also included. This way, our main aim is to explain to what extent biodiversity loss is affecting human welfare through the goods and services ecosystems provide and how this effect is distributed among the globe. We find that endangered flora and fauna do have an effect on ecosystem values depending on the type of services and world geo-climatic regions, where endangered flora is decreasing forest values and endangered fauna is increasing forest cultural values in the higher latitudes.

An Environmental Economics Outlook of the Climate Change Impact of Forest Ecosystem Goods and Services Biodiversity on Human Wellbeing: Results from a MEA application to Europe

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In this paper we present an original study on the economic valuation of climate change impacts on forest biodiversity and human welfare at the European scale. The paper first groups the 34 selected European countries in terms of their latitude locations so as to identify the respective predominantly tree species and the related sensitivities to climate change. Next, the Millennium Ecosystem Assessment (MEA) approach is applied to provide a comprehensive mapping of the forest ecosystem goods and services (EGS) and to assess the interrelation between forest ecosystem and human wellbeing. Furthermore, projections are constructed to estimate the future trends of the same EGS in both physical and monetary terms, following the newest IPCC storylines. Particular attention is given to the development of economic valuation strategies with respect to each type of MEA ecosystem service. Finally, some preliminary results are presented and discussed.

Session 9

Auctions

Applying Competitive Tenders for the Provision of Ecosystem Services at the Landscape Scale

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Auctions, or competitive tenders, overcome information asymmetries to efficiently allocate limited funding for the provision of ecosystem services. Most tenders focus on ecosystem services on individual properties to maximise the total amount provided across the landscape. However, for many services it is not just the total quantity but their location in the landscape relative to other sites that matters. For example, biodiversity conservation is often much more effective if conserved sites are connected to other conserved areas to form a corridor or to increase suitable habitat area. Adapting competitive tenders to address ecosystem services at the landscape scale requires a good scientific understanding of the biophysical system. It also requires an auction mechanism which can promote coordination while maintaining the competition required to overcome information asymmetries. Iterated auctions, in which bidding is spread out over a number of rounds, with information provided between rounds on the location of other bids in the landscape, provides an approach to cost effectively deliver landscape scale ecosystem services outcomes. Experimental economic testing shows that these auctions work best when the number of rounds is unknown in advance, which minimises rent seeking behaviour. It also shows that a bid improvement rule facilitates coordination and reduces rent seeking. Where the biophysical science is well developed, such auctions should be relatively straightforward to implement and participate in, and have the potential to provide significantly better outcomes than standard 'one shot' tenders.

Private ex-ante transaction costs for repeated biodiversity conservation auctions: a case study

By
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The European Union's Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development has introduced promising changes in rewarding farmers by the implementation of conservation auctions and granting farmers' transaction costs. The paper therefore deals with the evaluation of private transaction costs within a case study using repeated auctions to reward plant biodiversity. Based on a review of the current literature the paper develops a specific definition of transaction costs as well as a methodology to measure and calculate the farmers' private transaction costs. The case study enfolds two field experiment auctions and two corresponding surveys. The transaction costs are measured by the use of written questionnaires and will be discussed both as a first reference value of farmers' transaction costs as well as compared to the individual payments within the case study auctions in order to investigate the real-life performance of this specific application of repeated conservation auctions in biodiversity protection efforts.

Session 10

Social Norms

Local common property exploitation with rewards

By

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This paper analyses coalition formation in a livestock-pasture system where livestock are privately owned and the pasture is a common property. While the standard models on coalition formation predict rather low prospects of cooperation, this paper introduces a cost advantage of cooperation based on Saami reindeer herding which may explain higher coalition participation. In contrast to the existing fishery literature on coalition formation, all players are assumed *ex ante* homogenous, but may differ *ex post* due to the cost advantage. A stable equilibrium with cooperation can be reached and a moderate exploitation level can be sustained compared to the 'tragedy of the commons' outcome.

A tale of two carrots: The effectiveness of multiple reward stages in a common pool resource game

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Economic efficiency in social dilemma experiments can be increased by allowing for one-shot peer-to-peer sanctions or rewards. In case of sanctions the efficiency gain disappears if the experiment design allows for retaliation, or `reciprocity in punishment'. We examine whether efficiency increases or decreases when allowing for reciprocity in rewarding. We find that allowing for reciprocity in rewards increases the number of reward tokens exchanged but at the cost of reduced efficiency in the social dilemma situation.

Session 11

Compliance

Payments for ecosystem services and motivation in the context of illegal behaviours; opportunities for biodiversity conservation or perverse incentives?

By
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Frequently, environmental services are ensured ostensibly through national laws, yet poor monitoring and enforcement result in insufficient provision of the services. This is often the case for biodiversity conservation with respect to bushmeat hunting and forest agricultural expansion. Payments for Ecosystem Services (PES) have been proposed as a tool to transfer economic value to the individuals or communities that ensure the provision of the service. However, the role of economic transfers in motivating individual conservation behaviour is poorly understood. This study examines the relative importance of payments and monitoring in motivating a change in individual conservation behaviours.

Over 800 individuals were interviewed in 8 villages participating in a PES program run by an international NGO and 5 non-participating villages in the Menabe region of Madagascar. Changes in a selection of reported behaviours including agricultural expansion, lemur hunting and other forest products from before and after the PES scheme were compared within villages and as well as between participating and non-participating villages. An analysis of reasons for changing behaviour demonstrates that the monitoring of compliance to calculate annual payments has been responsible for more of the behaviour change than the payments themselves. This case study thus suggests that PES may be effectively used a conservation tool when behaviours are technically illegal; however changes in behaviour may not necessarily be driven by monetary transfers. While the impact of PES can be improved through increased monitoring; payments, or other forms of tangible transfers of value, act as an important factor in engaging individuals or communities through their effect on attitudes. PES improves attitudes and creates an important justification for third party monitoring of compliance.

Quantity control and optimal response to non-compliance

By
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This note advocates the following simple modification of current practice quantity control. Every firm is allowed to exceed the quota quantity specified by its permit holding. If it does, however, it must pay a tax. On the other hand, if the firm emits less than the specified quantity, it is granted a reward. With a fully competitive market for permits, the planner can induce the first best outcome by equating the rate of the tax/reward scheme with marginal damage.

Session 12

Ecosystem assessment

Long run outcomes of conservation expenditures: Watershed destruction, rehabilitation and protection in Hawaii

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We examine quantitatively the deterioration of, and subsequent rehabilitation of, forested watersheds on Oahu, Hawaii, in order to determine the long run outcomes of conservation activities in the early part of the 20th century. Our analysis calculates long run net benefits to water from these conservation activities, which have served to protect water quantity, water quality, species habitat, and a variety of related forest amenities. We incorporate remote-sensing data on forest cover, expert opinion on the state of the watersheds today, and an integrated economic and hydrological model of Oahu's freshwater supply and demand with detailed reports of annual conservation activities from 1910-1960 to assess these long run net benefits and the returns on conservation investments. We find that the net value of fresh water used on Oahu since 1880 is approximately $42 trillion dollars, and that conservation investments of $156-208 million contributed $1.5 trillion dollars in value by reducing losses in groundwater volume. At a minimum, then, forest conservation has had a long run benefit-cost ratio of about 8-1, even without consideration or quantification of potentially high in-situ values like endangered species habitat.

Eliciting Biodiversity and Landscape Trade-off in Landscape Projects: Pilot Study in the Anciens Marais des Baux, Provence, France

By

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The purpose of this paper is to elicit preferences for various organizational and managerial changes in the "Ancien Marais des Baux", a valley dominated by agriculture at the foothill of the Alpilles mountain chain, in Provence. We present results from a pilot survey conducted in neighbouring cities in the winter of 2008. We use the Choice Experimental Method to determine what the preferred landscape is, and under wetland restoration, the most desired features that the wetland should provide. The random parameter logit model is employed to take into account variances in unobserved preference heterogeneity. Consistent with expectations, we observed that respondents who are neither green, have little attachment to wetlands, have poor understanding of wetland services, are WTP less ceteris paribus for all the attributes in question, compared to those without these characteristics. Not surprisingly, the respondents considering the wetland in Marais des Baux, part of their cultural heritage, wants to visit it in the future, and preserve it for future generations, have the greatest WTP for any combination of attributes. We also observed the importance of mosquito control in any support of wetland restoration among respondents. Indeed, restoration on an advanced scale is only accepted in the presence of biological mosquito control. Distinct landscape features, such as tree hedges which still allows for the view of the massif of the Alpilles are valued equally high as the recreational opportunities related to the wetland. Biodiversity is low on the priority list compared to other attributes, but still positively valued.

Session 13

Auctions

Testing for scope and scale efficiencies in water quality tenders: A north Queensland case study.

By

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The design of competitive tenders to purchase environmental services requires judgements to be made about the funding scale and tender scope, with the latter incorporating considerations of geographic area, industries involved and the types of environmental outputs required. Increasing the scale of tenders allows more environmental services to be purchased, while increasing the scope allows a greater range of proposals to be advanced. As well, there may be some administrative efficiency gains in running fewer and larger tenders. These potential efficiency gains have to be balanced against potential indirect effects on participation and bid setting, where larger scale and scope tenders may generate perverse incentives for landholders to be involved. In the study reported here, these issues have been tested with a water quality tender run in north-eastern Australia in 2007 and 2008. The results show scale and scope changes can have large direct and indirect effects on the cost-efficiency of these mechanisms.

Designing and testing an outcome focused conservation auction: evidence from a field trial targeting ground nesting birds

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Design of efficient and effective biodiversity incentives is hampered by information asymmetry and moral hazard (hidden action) problems amongst other issues. Incentives are typically based on changes to management or on the modelled impact of management changes. Government accepts the risk of failure but has little opportunity to manage this risk – particularly where adverse selection is involved. We describe an auction design intended to address asymmetric information, moral hazard and adverse selection concerns as well as being built around a set of key ecological requirements. The results of a field trial of the auction design are reported for an auction targeting ground nesting birds in Australia. Our results suggest that an outcome focused design is more efficient, has greater incentive compatibility, and is more acceptable to landholders than a prescriptive management based approach.

Session 14

Protected Areas

Location Affects Protection: Observable Characteristics Drive Park Impacts in Costa Rica

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To support conservation planning, we ask whether a park's impact on deforestation varies with observable characteristics that planners could use to prioritize sites. Using matching methods to avoid common biases in impact estimation, we find that deforestation impact varies with site characteristics. Avoided deforestation is greater on parks located closer to the capital city, on land closer to a national road, and on flatter land. In allocating scarce conservation resources, policy makers have to consider many factors, such as ecosystem services provided by a site and the costs of acquiring a site. Holding such factors fixed, Pfaff et al. 2004 conjecture that impact can be raised by protecting first, in a sequencing of protection, the sites less likely to survive outside parks. We provide empirical support for this argument in the context of Costa Rica's renowned park system. This insight, combined with information on eco-services and land costs, should guide investments.

Stay by thy neighbor? Structure formation, coordination and costs in tradable permit markets with spatial trading rules

By
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Market-based instruments have been proposed as a means of implementing cost-effective and adaptive policies for biodiversity conservation. Their very foundation is a well-defined measure of ecological value; only the latter makes conservation services comparable and translates them into a commodity which can be traded among market participants. But what is the right value when local conservation decisions affect ecological functions on a larger scale and thus create spatial externalities (site synergies) on neighboring sites? By means of an agent-based model, we analyze different spatial trading rules and their implications on land use decisions in a dynamic cost environment. The model contains a number of alternative submodels which differ in the individual assignment of market values and in the social organization of agents, the latter including cheap talk coordination and cooperation. We show that spatially explicit trading rules can effectively adapt land use towards species requirements and individual costs. For a certain class of submodels (local decisions), we find thresholds for the effectiveness of spatial incentives along a curve of critical parameter values. The progression of this curve is derived analytically and shown to agree with the simulation results. Further, we show that cases of low social organization (e.g. no communication) are particularly prone to suboptimal land allocations due to misinformation and coordination failure.

Session 15

Contingent valuation

Consumers versus non-consumers' benefits from recovering an overexploited fish stock

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Controversies exist in the Contingent Valuation literature about the role that respondents play when facing a willingness to pay (WTP) question. Referendum question format is seen to produce *citizen* like responses, instead of *consumer* like responses. In the present paper, the role of consumers versus citizens is further investigated. Real consumers are identified and WTP are assessed for two different levels of an environmental resource. Consumers are found to be sensitive to scope. However, when isolating non-consumers, the scope test criterion is not satisfied. Differences between consumers and non-consumers are further discussed with respect the valuation exercise. Policy implications based on these results are further discussed and analyzed.

Economic Valuation of Environmental Damages caused by the Prestige Oil Spill

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This paper presents a summary of the main findings of the contingent valuation study conducted with the aim of measuring the environmental passive loses due to the Prestige oil spill. This is the first large CVM study conducted in Europe after a large oil spill. The main findings indicate that on average respondents in the sample are willing to pay €55 per household to avoid a similar future oil spill in Spain. This means that on average, the Spanish society places a value of the environmental losses occasioned by the Prestige oil spill around €774 million, being this quantity the total amount of money Spanish are willing to pay to prevent a future similar accident. Results are compared with those obtained in the Exxon Valdez study.

Session 16

Impact assessment

Deforestation Impacts of Environmental Services Payments: the evolution (2000-2005) of the Costa Rican PSA program

By

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Costa Rica's environmental services payments (Pagos por Servicios Ambientales or PSA) program started in 1997 and was the true pioneer in this area. It is broadly cited and led to numerous calls to emulate the approach in various ways. It has itself evolved over time, with acknowledged shifts in focus. To evaluate the impacts of changed implementation, following prior work on the 1997-2000 payments (Sanchez et al. 2007, Pfaff et al. 2008) we evaluate here the impact of the PSA forest protection contracts during 2000 and 2005. We find that less than 1 in 100 (about 0.4%) of the parcels enrolled in the program would have been deforested annually without payments, i.e. due to net impact of the land returns in agriculture versus in ecotourism as well as the effects of other conservation policies. This low return on investment is, to first order, the same as was found for 1997-2000. However, we find that shifts in implementation have eliminated the bias in PSA location towards places where PSA's impact on deforestation is even lower than on average plots. Thus, we show a conservation impact of the changes in how program parcels are chosen. Yet it would appear that there remain significant potential gains from increased targeting of areas with some deforestation pressure, including with payments that differ over space.

An evaluation of the impact of the Natural Forest Protection Programme on Rural Household Livelihoods

By

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In this paper, we estimate the impact on local household livelihoods of the Natural Forest Protection Programme (NFPP), the largest logging ban programme in the world that aims to protect watershed and conserve natural forests. In doing so we use a series of policy evaluation micro-econometric techniques to assess the impacts of the NFPP on two interrelated facets of household livelihoods, namely income and off farm labour supply. We find that the NFPP has had a negative impact on incomes from timber harvesting but has actually had a positive impact on total household incomes from all sources. Further, we find that off farm labour supply has increased more rapidly in NFPP areas than non-NFPP areas. This result is strongest for employment outside the village. On the basis of these results policy implications for household livelihoods are drawn.

Session 17

Species conservation

State and Not-For-Profit delivery of species conservation. Cost utility analysis of multiple-species projects.

By
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Conservation of species is challenging, and there is continuing interest in finding more effective means to achieve conservation goals. State provision of conservation occurs in many countries, alongside a growing range of alternative providers including Not For Profit organisations and the private sector. Few studies have compared the effectiveness and efficiency of State provision against Not For Profit or private sector provision. This research assesses the effectiveness and cost-effectiveness of multiple-species projects in regard to the conservation of threatened and endangered species using a cost-utility analysis. Three State managed projects, three Not For Profit managed projects and one project managed by the State yet funded privately, were evaluated. All of the Not For Profit managed projects were enclosed by predator-proof fences, while the other projects relied on natural barriers and/or intensive predator control methods. Results indicate that State managed multiple-species projects are both more effective and cost-effective than those projects managed by Not For Profits. While the Not For Profit managed projects are not so effective in improving national population totals, they are essential for ensuring regional biodiversity of threatened and endangered species. The objectives set by the projects appear to have a significant impact on their outputs. A number of recommendations are made for improving conservation efforts in the future. Most importantly, the development of a threatened and endangered species database to be contributed to by all conservation project providers. The importance of standardized reporting techniques is highlighted to allow comparisons both over time and between projects.

Optimal conservation, extinction debt, and the augmented quasi-option value

by
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The literature on optimal conversion defines rules that determine the rate at which land is irreversibly moved out of conservation into production. This paper explores the implications on these rules of allowing for a feedback between conversion decisions and the stochasticity of conservation benefits, using the well-known ecological mechanism of extinction debt as an illustration. This yields a model with a controlled-diffusion process at its core that is solved using a real-options approach and that leads to the conventional conversion rule as a special case. Calibrating the model to a specific case (Costa Rica), the paper demonstrates the presence of an augmented quasi-option value depending on the strength of the feedback. This results in quantifiable changes in land values and the amount of conservation.

Session 18

Ecotourism

A meta-analysis of international ecotourism recreation values

By
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This paper presents a meta-analysis of international ecotourism recreation based on 41 original valuation studies for 24 countries undertaken from 1986 to 2006, to determine factors which influence the total domestic and overseas recreational value of ecotourism sites. Models were estimated for consumer surplus per trip, and consumer surplus per hectare. Mean consumer surplus per trip was $84.80, with values ranging from $0.29 to $1824.36 Mean consumer surplus per hectare was $542.76, with values ranging from $0.003 to $7426.39. Both models provide a reasonably high degree of explanatory power, with adjusted R^2 of 0.6717 and 0.5478, respectively. Results of the model indicate that beach sites generate higher consumer surplus per trip and per hectare, and lake and river sites generate higher consumer surplus per trip than other types of habitat or environmental feature; grassland and mountain sites generate lower consumer surplus per hectare than other types of habitat or environmental feature; and international protected area designation has a positive effect on consumer surplus per hectare. Results also support existing evidence that the use of stated preference techniques has a negative effect on estimated consumer surplus per hectare, and the inclusion of substitute sites has a negative effect on estimated consumer surplus per trip. A number of poorly understood factors are also identified. Travel and Tourism Competitiveness appears to have a negative effect on consumer surplus, as does study year, public management and national protected area designation, while distance from the equator appears to have a positive effect in one or both models. Despite the relatively high explanatory power, the very large variation in consumer surplus suggests that the models are unlikely to provide accurate estimates of the value of individual sites.

Assessing the impact of biodiversity on tourism flows: a case study from Ireland

By
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This analysis provides an example of how biodiversity can be measured via different indicators, and how those can be used to assess the influence of the biodiversity profile of a region on the tourism flows towards it. Previous studies consider environmental amenities as one of the determinants of tourism destination choice. A central hypothesis of this paper is that the destination's biodiversity profile can be considered as a key component of environmental amenities. The main objective of this study is to propose a different perspective on the topic, considering the role of biodiversity on tourists' choice of destination and duration of stay. Domestic Irish tourist flows have been chosen as a case study. The first step of the analysis required the construction of biodiversity indicators suitable for developing a biodiversity profile of each Irish county. Subsequently, a model has been developed so as to explain the total number of nights spent in any location as a function of a set of explanatory variables including information about socio-demographic characteristics of respondents, biodiversity and landscape profile of the county of destination and features of the trip. Results show that most of the biodiversity and landscape indicators included in the analysis turn out to be statistically significant in determining tourists' choices about the duration of their trips.

Session 19

Effectiveness of conservation rules

Effectiveness and cost-effectiveness of yellow-eyed penguin recovery

By
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Although an estimated US$6 billion is invested annually in our planet's biological diversity, little research has been conducted on which conservation treatments work best or provide best value for money. Where controlled experiments are not possible, econometric techniques can be used to determine the effectiveness of conservation treatments. We use a long-running yellow-eyed penguin (Megadyptes antipodes) nest count in New Zealand to compare the effectiveness and cost-effectiveness of three commonly used endangered species recovery treatments—trapping of introduced predators, revegetation, and intensive management. Following ecological theory, we specify a density-dependent population growth rate. We control for year effects and site characteristics such as land cover, slope, and elevation. The possibility of selection bias in treatment is confronted with site fixed effects and with an instrumental variable based on site accessibility. Of the three treatments that we analyze, only intensive management is significantly correlated with increases in annual site-level yellow-eyed penguin population growth rate. We estimate that intensive management increased the yellow-eyed penguin population by 9% above the counterfactual, and that the average cost of producing an additional yellow-eyed penguin nest through intensive management is NZ$68,600.

How do avoidance behaviours, monitor 'cheating' and individual heterogeneity affect individual incentives to comply with conservation rules?

By
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Enforcement of rules is necessary for the effective conservation of natural resources, whether it is to be achieved through a command-and-control approach or alternative instruments. Using a simulated, mutually-enforced resource harvesting agreement this paper expands upon previous analyses of enforcement measures, exploring the importance of individual heterogeneity, costly avoidance behaviours and dishonest or incompetent monitoring of compliance. These novel features are found to significantly alter the model's predictions. Sensitivity analyses show how behaviourally heterogeneous groups within the resource user population can introduce non-linearities in the system's response to various policy levers, such as the level of fine or the fee paid for monitoring compliance with rules. Several possible objectives are considered for the resource manager, showing how biological and welfare-oriented goals might trade-off against one another. These findings suggest that the design and implementation of instruments for conservation should explicitly consider the behavioural complexity within heterogeneous socio-ecological systems.

Session 20

Habitat fragmentation

An agglomeration payment for cost-effective biodiversity conservation in spatially structured landscapes

By

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A key challenge when designing payments for biodiversity is to account for the spatial arrangement of habitats, considering that connected habitats are ecologically more valuable than isolated habitats. Based on the idea of an agglomeration bonus we consider a scheme in which land-owners only receive payments if habitats are arranged in an ecologically favourable configuration. We compare the cost-effectiveness of agglomeration payments with that of spatially homogeneous payments on a conceptual level and find that efficiency gains of agglomeration payments are nonnegative. For an analysed real world case agglomeration payments lead to cost-savings of up to 70%.

Incentive mechanisms for spatially contiguous habitat management: The Agglomeration Bonus in the presence of technological externalities in different neighbourhoods

By

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Recent advances in ecological research indicate that there are substantial benefits from conservation of parcels of lands which are contiguous to each other. The Agglomeration Bonus is an incentive mechanism which has been proposed to this effect and has been experimentally validated to achieve desired spatial patterns. In this study we analyze the effect of this payment scheme in the presence of technological interdependencies (externalities) between different landowners participating in the conservation activity. We show that in the presence of such externalities, the Agglomeration Bonus is not successful in achieving the desired spatial pattern in conservation behaviour. To this effect, we change the structure of the Agglomeration Bonus by introducing a third pay component into it. This payment compensates farms who suffer the negative effects of the externality and is successful in theory in spatially coordinating landowner decisions to the ecologically beneficial management pattern.

Session 21

Risk management

The optimal management of wetlands: quantifying trade-offs between flood risks, recreation and biodiversity conservation

By
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This paper employs a simple choice experiment to estimate the value of management options for the Bobrek wetland in Poland. The local public's valuation of several wetland management attributes, including flood risk reduction, biodiversity conservation and improvement of recreational access, are investigated. A latent class model is estimated to account for heterogeneity in the preferences of the local public. The results reveal that there is considerable preference heterogeneity among the local public; however on average they derive the highest values from reductions in flooding risk. The results of this study are expected to assist policy makers in undertaking effective flood risk reduction measures and formulating efficient, equitable and sustainable wetland management policies in accordance with the European Union's Water Framework Directive (2000/60/EC).

Managing increasing environmental risks through agro-biodiversity and agri-environmental policies

By
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Agro-biodiversity can provide natural insurance to risk-averse farmers by reducing the variance of crop yield, and to society at large by reducing the uncertainty in the provision of public-good ecosystem services such as e.g. CO2 storage. We analyze the choice of agro-biodiversity by risk-averse farmers who have access to financial insurance, and study the implications for agri-environmental policy design when on-farm agro-biodiversity generates a positive risk externality. While increasing environmental risk leads private farmers to increase their level of on-farm agro-biodiversity, the level of agro-biodiversity in the laissez-faire equilibrium remains inefficiently low. We show how either one of two agri-environmental policy instruments can cure this risk-related market failure: an ex-ante Pigouvian subsidy on on-farm agro-biodiversity and an ex-post compensation payment for the actual provision of public environmental benefits. In the absence of regulation, welfare may increase rather than decrease with increasing environmental risk, if the agroecosystems is characterized by a high natural insurance function, low costs and large external benefits of agro-biodiversity.

Session 22

Optimal conservation

A Meta-analysis of Forest Management Valuation Programs: What Management Alternatives are Most Preferable?

By
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Forests ecosystems provide a variety of valuable goods and services. This paper presents a meta-analysis of forests studies around the world that have applied the Contingent Valuation Method (CVM) to value different management programs. The dataset covers 24 studies in 13 countries. We estimate the marginal value of each of the main characteristics of the diverse management plans. The main management programs are linked to protection of biodiversity, wildfire risk prevention, increment of non timber forest product uses, and land use restrictions. Our results show that WTP for a forest management program is sensitive to the program's characteristics, being highly valued the management programs linked to fire risk reduction and habitat protection.

Indirect Management of Invasive Species through Bio-controls: A bioeconomic model of salmon and alewife in Lake Michigan

By
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Invasive species are typically viewed as an economic bad because they cause economic and ecological damages, and can be difficult to control. When direct management is limited, another option is indirect management via bio-controls. Here management is directed at the bio-control species population (e.g., supplementing this population through stocking) with the aim that, through ecological interactions, the bio-control species will control the invader. Given the potential complexity of interactions among the bio-control agent, the invader, and people, this approach may produce some positive economic value from the invader. We focus on stocking salmon to control invasive alewives in Lake Michigan as an example. Salmon are valuable to recreational anglers, and alewives are their primary food source in Lake Michigan. We illustrate how stocking salmon can be used to control alewife, while at the same time alewife can be turned from a net economic bad into a net economic good by providing valuable ecosystem services that support the recreational fishery. We present a dynamic model that captures the relationships between anglers, salmon, and alewives. Using optimal control theory, we solve for a stocking program that maximizes social welfare. Optimal stocking results in cyclical dynamics. We link concepts of natural capital and indirect management, population dynamics, non-convexities, and multiple-use species and demonstrate that species interactions are critical to the values that humans derive from ecosystems. This research also provides guidance on Lake Michigan fishery management.

Session 23

Fisheries valuation

Framing and training to reduce starting point bias in choice experiments

By
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Starting point bias is common problem in closed-ended non-market valuation studies. This paper analyses two possible methods to reduce starting point bias in choice experiments: letting respondents discover their preferences through a payment ladder; and framing the choice experiment in a familiar context. The two methods are applied in a valuation study of sustainable flatfish fisheries in the North Sea. Neither of the two methods have a significant impact on starting point bias, although the payment ladder treatment has a strong impact on respondents' sensitivity to the financial attribute. Moreover, respondents' WTP in the payment ladder correlates strongly with their WTP in the choice experiment.

Session 24

Water resources

An Optimal Pricing Approach for the Control of EU Urban Pollution: Implementation of the Urban Wastewater Treatment Directive

By
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Several EU Directives have been adopted and influenced the control of urban pollution especially the EU UrbanWastewater TreatmentDirective (UWWTD) and the Integrated Control and Preventive Directive. The Water Framework Directive (WFD) will also have an additional impact in the coming years on the control of urban pollution in particular related to storm overflows. The WFD requires the achievement of good ecological and chemical status in all waters. Our analysis will focus on public wastewater utilities, required to be financially self-sufficient, facing demand and capacity shocks. The paper deals with the simultaneous determination of incentive pricing policies and investment rules under an ex ante maximum demand charge. We will characterize the welfare-optimal capacity selection rule and the welfare-optimal maximum demand pricing rule. Heterogeneous consumers demands are considered when tariffs are set ex ante, before demands are known. Our results are state-contingent nonlinear pricing that responds to demand fluctuations and capacity constraints.

Estimating household water demand using Revealed and contingent behaviors: evidence from Viet Nam

By

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This article separately estimates water demand by households utilizing (i) municipal water exclusively and (ii) municipal water and household well water in Buon Ma Thuot, Viet Nam. Demand estimates are obtained from a panel dataset formed by pooling household-level data on observed municipal water purchases and stated intended water usage contingent on hypothetical water prices. Estimates show households using municipal water exclusively have very price inelastic demand, whereas households using both municipal and household well water have more price elastic, but still inelastic, simultaneous water demands and readily substitute between water sources in response to increasing prices. Household water usage is conditioned by water storage and supply infrastructure, income and socio-economic attributes. The demand estimates are used for forecasting municipal water usage as well as the municipal water supply company's likely revenue stream following an increase to the municipal water tariff and also for modeling consumer surplus losses from municipal water supply disruptions.