

# PROCEEDINGS



**TWELFTH ANNUAL BIOECON CONFERENCE  
FROM THE WEALTH OF NATIONS  
TO THE WEALTH OF NATURE:  
RETHINKING ECONOMIC GROWTH**

27 • 28 September 2010  
Centro Culturale Don Orione Artigianelli  
Venice, Italy







# List of Contents

List of Contents .....	pag. 3
Executive Summary .....	pag. 5
Programme Overview .....	pag. 8
Scientific Report .....	pag. 9
Abstracts of the Presented Papers .....	pag. 34
About BIOECON .....	pag. 76
Conference Partners.....	pag. 77





## Executive Summary

The 12th Annual BIOECON Conference, held in Venice on 27-28 September 2010, was organised by the Fondazione Eni Enrico Mattei in association with the Basque Centre for Climate Change, Conservation International, the International Union for Conservation of Nature, and the United Nations Environment Programme.

BIOECON is an interdisciplinary network aiming to advance economic theory and policy for biodiversity conservation. Each year its annual meeting represents an opportunity for networking, and sharing lessons and experiences with other researchers, environmental professionals, international organizations and policy makers who are interested in working on the design and implementation of cutting-edge economic incentives for biodiversity conservation.

The 2010 edition was devoted to the identification of the most effective and efficient instruments for biodiversity conservation, such as auctions of biodiversity conservation contracts, payment-for-services contracts, taxes, tradable permits, voluntary mechanisms and straightforward command and control measures. Special attention was given to the role of public bodies/NGOs in the creation of innovative mechanisms for the delivery of ecosystem benefits and in promoting the participation of a wider range of economic agents (business/families/local communities) in biodiversity conservation. Moreover, policy reforms were recognized to be essential for the sustainable development of many economic sectors, including agriculture, urban planning and green buildings, fisheries, forests, industry, renewable energy, waste management and water, tourism and transport.

In addition, a significant portion of the research presented in the conference has focused on analysing the impacts and dependencies of different businesses on biodiversity and ecosystems, and the potential contributions of corporations to a more resource-efficient economy. The role of biodiversity as an employment generator was also addressed. Finally, many studies have investigated on the beneficiaries of biodiversity and ecosystem services, exploring the potential use of these resources for poverty alleviation, and with examples of successful policies to this end.

In conclusion, the papers presented in the 12th meeting ranged from theoretical investigations to practical applications, experiences and case studies at different geographical scales across nations. Many studies have shown specific applications in a number of developing countries, including India, Kenya, Nigeria, Iran, Vietnam, Philippines, Colombia and Cuba. The topics presented have covered the following themes: 1) assessment of the effectiveness and efficiency of biodiversity conservation instruments, taking into account spatial considerations and/or governance settings; 2) the development of new, incentive-based instruments to conserve biodiversity and ecosystem services; 3) the determination of ecosystem services opportunities for business and management, with particular emphasis on the potential for minimizing corporate risk with respect to these services; 4) the potential contribution of businesses to the implementation of more

ecosystem services-based economic development; 5) application of ecosystem services assessment and valuation methodologies in the public, private and non-governmental settings; 6) innovative, participatory, economic valuation methods of biodiversity and their social implications; 7) assessment and valuation of marine and coastal ecosystems and their contribution to human livelihoods; 8) the role of property rights in the provision of ecosystem services and employment opportunities for local communities; 9) the role of local community members in the creation and enforcement of norms and regulations that lead to successful and sustainable economic governance models; 10) the role of forestry in poverty alleviation and in supporting human livelihoods in developing countries; and 11) macroeconomic indicators/national accounting systems adjusted to include the values of provision, flows and benefits of ecosystem services, and ultimately human well-being (i.e. Genuine Progress Indicator, Index of Sustainable Economic Welfare, GDP of the poor, etc.).

The presented state-of-the-art research has shown an innovative view on the identification and analysis of locally owned and locally developed solutions that can prevent and/or resolve tensions arising from existing and new methods of natural resource use. There have also been successful cases with respect to policy implementations in national or sub-national contexts. Finally, empirical research was also found in the emerging fields of economic valuation of tangible and intangible cultural heritage benefits, exploring the role of intercultural dialogue in the promotion of regional sustainable development.

The Conference was structured in two days. Each day hosted a plenary session, where leading international environmental economists presented their latest research, and twelve parallel sessions; at the end of each day a panel discussion gave the audience an interesting perspective that is the link between theory and practice. A round table closed the first day's works.

The first plenary session was held by Geoffrey HEAL (Columbia Business School, USA), whose speech revolved around how to treat natural resources as assets. From a definition of natural capital the presentation moved to the definition of ecosystem services, stating the biggest challenge in sustainability: how to link changes in the biogeochemical state of an ecosystem to changes in flows of ecosystem services and subsequent welfare losses.

The second key-note speech, by Joshua BISHOP (International Union for Conservation of Nature, Switzerland) focused on The Economics of Ecosystems and Biodiversity ([www.teebweb.org](http://www.teebweb.org)) initiative, "a major international initiative to draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics and policy to enable practical actions moving forward".

The panel discussions closing each day's programme have become a highly appreciated tradition in the last BIOECON annual conferences. The first one, organised by Conservation International, discussed the critical role of forests in mitigating climate change and focused on REDD+ carbon markets as an incentive to maintain forest on the land. REDD+ is an incentive program that goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. The key speeches were given by: Andrew MITCHELL (Global Canopy Programme, UK), Celia HARVEY and Jonah BUSCH (Conservation International, USA).

The second panel discussion was organised by Fondazione Eni Enrico Mattei. The panellists, Pushpam KUMAR, (University of Liverpool, UK), Nicholas HANLEY (University of Stirling, UK) and Rudolf S. DE GROOT (Wageningen University, Germany), examined the innovations in participatory methods on valuation from a social point of view. Particular attention has been given to the use of an ecosystem-based valuation approach to assess the economic benefits of biodiversity and their contributions to human wellbeing.

The plenary roundtable presented a brief overview of the development of The Inclusive Wealth Report (IWR)- joint initiative by the World Bank, UNEP and IHDP. The Inclusive Wealth Indicator is an index that provides a framework to give an idea of the degree of substitutability among capitals. Three speakers composed the round table: Karl-Göran MÄLER (The Beijer Institute, Sweden), Anantha Kumar DURAJAPPAH (International Human Dimensions Program, Germany), Pablo MUÑOZ (International Human Dimension Program).

In conclusion, the conferences readdressed the many important issues with embedded socio-economic and political reasons, such as climate change, growing population and economy, land conversion that cause the significant loss of biodiversity and the underpinning ecosystem services. In addition to the theoretical exploration, a lot of efforts have been devoted to field study and empirical applications that seek solutions to halt the continuous loss of biodiversity and ecosystem degradation at regional and national scales. Finally, to correct market failure and reallocate resources among identified winners and losers, issues such as property right and equity over nature resources should be reinforced, as they are of particular importance for promoting economic incentives and designing effective policy instruments for biodiversity conservation. Innovative approaches/techniques such as the integration of GIS mapping tools and economic valuation techniques should be encouraged in future research, both in terms of methodological investigation and empirical applications.

The conference hosted in total 135 participants, coming mainly from Europe, United States, Canada, and Australia. This year, 10 grants to researchers coming from developing countries offered by Fondazione Eni Enrico Mattei and the United Nations Environment Programme raised the number of Countries represented (we registered presences from India, Kenya, Nigeria, Iran, Vietnam, Philippines, Colombia, Cuba), thus offering a more complete vision of biodiversity economics issues worldwide.

The 2010 edition of the BIOECON Conference introduced a novelty with respect to the past, which registered a complete success: the Ecosystem Services Training Day, held the day after the Conference and co-organised by the Fondazione Eni Enrico Mattei and Conservation International. This training format was conceived to give an overview on the following aspects of Ecosystem Services: Valuation of Ecosystem Services, Payment for Ecosystem Services, Climate Mitigation and Adaptation, REDD+, Decision-Making Tools followed by the presentation of case studies. The invited instructors brought along with them the most updated knowledge, including model work and software that cover the above-mentioned themes. During the lectures, interaction between the instructors and the trainees was encouraged. This provided an excellent studying ground and learning process for students from different backgrounds, including law, economics, biology, ecology, and so on and greatly encouraged an interdisciplinary exchange of knowledge.



# Programme Overview

## **SUNDAY 26 September 2010**

---

18.30 – 19.30 REGISTRATION AND WELCOME COCKTAIL

## **MONDAY 27 September 2010**

---

08.30 - 08.45 REGISTRATION  
08.45 - 09.00 WELCOME ADDRESS  
09.00 - 10.30 PLENARY SESSION I  
10.30 - 11.00 COFFEE BREAK  
11.00 - 13.00 PARALLEL SESSIONS A1 – A 4  
13.00 - 14.00 LUNCH  
14.00 - 15.30 PARALLEL SESSIONS B1 – B4  
15.30 - 16.00 COFFEE BREAK  
16.00 - 17.30 PARALLEL SESSIONS C1 – C4  
17.30 - 18.30 PLENARY DISCUSSION PANEL I  
18.30 - 19.15 UNEP ROUND TABLE  
20.30 CONFERENCE SOCIAL DINNER

## **TUESDAY 28 September 2010**

---

09.00 - 10.30 PLENARY SESSION II  
10.30 - 11.00 COFFEE BREAK  
11.00 - 13.00 PARALLEL SESSIONS D1 - D4  
13.00 - 14.00 LUNCH  
14.00 - 15.30 PARALLEL SESSIONS E1 – E4  
15.30 - 16.00 COFFEE BREAK  
16.00 - 17.30 PARALLEL SESSIONS F1 – F4  
17.30 - 18.30 PLENARY DISCUSSION PANEL II



# Scientific Report

**Monday, September 27th**

## **PLENARY SESSION I: SUSTAINABILITY, NATURE'S SERVICES AND PROSPERITY**

**Professor Geoffrey Heal (Columbia Business School, USA)**

Roosevelt stated that a “nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased, and not impaired, in value.” Starting from this opening quotation, the presentation revolved around how to treat natural resources as assets. From a definition of natural capital the presentation moved to the definition of ecosystem services, stating the biggest challenge in sustainability: how to link changes in the biogeochemical state of an ecosystem to changes in flows of ecosystem services and subsequent welfare losses.

The difficulty in addressing this question stems from the complexity of natural systems, which operate in non-linear ways. Thresholds and irreversible phenomena are particularly hard to capture (as exemplified in the case of Lake Mendota in which phosphorus dynamics of sedimentation and release show clear non-linearities and three different equilibrium points).

**Geoffrey Heal** warns against the use of marginal analysis given that even relatively simple systems (like lake Mendota) can exhibit non-marginal changes.

A review of most commonly used valuation techniques and a definition of sustainability follows. Historical patterns of economic growth are not sustainable, the only way we can sustain welfare is by maintaining the value of our asset base. This has not been traditionally the case, as exemplified by industrial England where natural capital was replaced with intellectual and physical capital. It is unfortunately not known to what point economies can substitute for natural capital without compromising natural functions and welfare. If we correct economic investments for their environmental impacts (including the intensity of energy use), we rarely see that they translate in genuine wealth as exemplified by Arrow et al (2004) who show that for example growth rates of per capita genuine wealth were less than zero in Africa. Markets for ecosystem services such as carbon markets, wetland mitigation banking, water quality trading, biodiversity markets and offsets are reviewed. Challenges remain in establishing new markets or perfecting the existing ones due to the lack of clear definitions of ecosystem services and their associated property rights, overall current markets are rather thin and cover a small percentage of the economy. Questions from the audience include the concern for biodiversity markets that focus solely on a single given species rather than a diversity of species as in the case of biodiversity trading related to the Endangered Species Act in the United States. Other concerns were voiced regarding the limitations of valuation methods and the lack of understanding of natural processes and biodiversity. Heal comments that economic

valuations are serious underestimates (and yet better than a zero value), that the concept of biodiversity is not precise enough to inform valuation, and that economists should rather focus on returns on conservation.

## PARALLEL SESSION A1

All four papers of this session were dedicated to biodiversity, giving insights into different aspects of the topic. The first paper was presented by **Jonah Busch**, who used a simple numerical illustration and a simulated global REDD+ mechanism to examine the climate and biodiversity benefits of three supplemental mechanisms. He found that reallocating fixed funding from carbon payments to biodiversity payments can increase climate benefits and biodiversity benefits under certain conditions, and benefits both sellers and buyers of reduced deforestation emissions.

**Rafat Alam** raised an interesting topic whether green consumerism in the Northern countries can have positive impacts on biodiversity conservation in the South through international trade. The model results showed that the unilateral conservation effort by Northern producers would compel the South to move towards more sustainable production process, if and only if the source of products or 'eco-labelling' is identified.

The third paper was presented by **Helen Ding**, who conducted an empirical investigation on the relationship between biodiversity and the values of ecosystem goods and services to quantify the magnitudes of this complex relationship. Her model results showed that an increase of 1°C in the local temperature can contribute proportionally to the decrease of the marginal value of ecosystem services, but the magnitudes of the impacts vary dramatically depending on the choice of biodiversity indicators, the types of ecosystem services, the geo-climatic region in which the ecosystem is located, and the specific IPCC scenarios under consideration.

The session was closed with the last presentation of **Tim Swanson**, who outlined a basic policy framework for thinking about how international conservation financing might be institutionalised. In particular, two options were considered, i.e. (1) international cooperation under the CBD and mimicking the CDM, and (2) national symmetric cooperation via parallel adoptions and enforcement. Both regimes gave an idea of the basics of how such policies might give effect to the demand for conservation across boundaries.

## PARALLEL SESSION A2

The four contributions of this parallel session were examples of different study cases in which stated preference methods were used in order to study the perceptions of stakeholder groups towards biodiversity conservation and ecosystem services, as well as, to explore key methodological aspects such as vehicle payments and protest answers in choice experiment and contingent valuation techniques. The first paper by **Petronella Chaminuka** and colleagues analysed tourist preferences for ecotourism activities in rural communities adjacent to the Kruger National Park (South Africa). Village tours, craft markets, accommodation space, and a monetary attribute were the characteristics selected for the exercise. The results suggested that there is an interest in the village tours

and the craft markets, and there was no interest in staying in village-based accommodation. The research concluded that there is potential for the development of ecotourism in the surrounding areas close to the National Park, in terms of complementing existing activities inside the Park. These results aid decision making for development of ecotourism by local communities.

The paper presented by **Kiriaki Remoundou** and colleagues studied the use of a reallocation of the existing public budget scheme as the payment vehicle in a valuation exercise aiming to elicit public preferences for a marine rehabilitation program in the West Black Sea and examined whether valuation estimates are sensitive to different public budget sources. The research concluded that the choice of the alternative public good significantly affected the preferences structures and thus researchers applying the reallocation scheme should be careful when defining the public good whose budget would be reduced from the existing tax burden.

In this paper by **Zoltán Szabó**, the main aims were to advance the methodology of valuing impacts on biodiversity and to propose ways to refine monetary valuation procedures. The author demonstrated that deliberative monetary valuation techniques improve on the limitations of conventional contingent valuation surveys. The author found that this methodology tackled the problem of lack of time and information available for respondents in contingent valuation exercises. Even, the rate of protest respondents was reduced by more than half (from 29% to 13%).

Finally, the research presented by **Maria Loureiro** used attitudinal questions to identify protest and non-protest in a choice experiment exercise among the residents and tourists for the management in the Illas Cies National Park (Spain). Using attitudinal questions about taxes, the use of existing funds, or the impossibility to afford a payment nowadays, among others, allowed the identification of heterogeneity preferences between two different classes of individuals: protesters and non-protesters. In this sense, neglecting protest beliefs in the estimations could result in the omission of heterogeneity in the sample.

### PARALLEL SESSION A3

The session addressed existing systems aimed to incentivize the provision of public goods presenting a framework of analysis, examples from Costa Rica, examples from Sweden, and worldwide.

**Elodie Brahic** stated that regulation has been the traditional way to guarantee the provision of public goods. Regulation, though, is inherently economically inefficient. The growing interest for market-based mechanisms seems justified by the assumption that they are less expensive and more efficient from an economic standpoint. The question is whether payments for ecosystem services are environmentally effective. Successful examples are described, including the Forest Heritage Fund, Conservation contracts in Central Karelia herb-rich Forest Network. Procurement auctions are also presented as a promising instrument for the provision of public goods. Questions from the audience reveal scepticism about the effectiveness of procurement auctions in that they are prone to be monopolized by large landholders and can be influenced by secret deals made

beforehand among prospective participants. The issue was raised whether procurement auctions are in the end more effective than land purchases.

**Géraldine Froger** in her presentation posed the question of whether the payment system adopted in Costa Rica since 1996 to protect watersheds, biodiversity and scenic beauty has been effective for conservation. From 1997 to 2005 forest cover in Costa Rica increased from 42% to 48% of the national territory. The increase in forest cover might not be necessarily a consequence of PES, for example the decline in the profitability of cattle might have led to the abandonment of pastureland and spontaneous reforestation. PES might also have increased environmental awareness among the population and landowners with a consequent decrease in forest conversion. The program did not differentiate between landowners under different pressures of conversion and did not address poverty alleviation until 2009. Concerns were raised by the presenter on the long-term sustainability of the program due to the fact that transaction costs have increased considerably and demand for participation in the program is three times higher than the offer.

The work presented by **Knut Per Hasund** centred on developing socially efficient policy measures to compensate farmers for the provision of public goods by traditional and semi-natural meadows in Sweden. The Common Agricultural Policy of EU (CAP) is considered inefficient with respect to the provision of positive environmental externalities. The Swedish PG-scheme is criticized for not considering varying site conditions, rigidly enforcing uniform management measures, providing insufficient remuneration to the most environmentally valuable land, and being administratively cumbersome.

In principle, heterogeneous farmlands supplying heterogeneous goods should receive payments differentiated per hectare according to the production of public goods. A system of seven composite state indicators, expressing the public goods of the respective fields or field elements, was developed and tested to assess if the model worked in practical policy implementation. A major challenge of this interdisciplinary approach was to develop indicators that reflect the presence of public goods and that complied with criteria of low monitoring costs and transparency.

The evaluation indicated a more efficient resource allocation, better dynamic incentives and lower transaction costs, compared to the current Swedish payment programs.

**Ahmad Jafari Samimi** discussed the application of the Environmental Performance Index (EPI) in 20 developing countries. The EPI index allows cross-country comparisons to identify best practices, leaders, and performance changes over time with respect to clearly identified, achievable targets. Main goals for the use of the EPI are 1) Reducing environmental stresses on human health and 2) Promoting ecosystem vitality and sound natural resource management. Specifically, the report evaluates overall environmental performance of developing countries and the performance of each developing country individually. Based on data of the Yale Center for Environmental Law & Policy, the top 5 performing developing countries in the EPI score in 2006 are Lebanon, Israel, United Arab Emirates, Turkey and Iran.

#### PARALLEL SESSION A4

**John D. Clarke** presented the C-CHANGE project, a joint Canada-Caribbean initiative to assist coastal communities to plan for and adapt to the changes anticipated from sea level rise and severe storm events. The C-CHANGE partner communities were selected to reflect a range of conditions including population, reliance on ecological services, and economic conditions, and encouraged sharing of interests and ideas across the project. Relying largely on available information and data, C-CHANGE teams will assist each partner community in the development of a pragmatic and locally relevant Community Adaptation Action Plan.

The second presentation concerned the paper “The wellbeing of future generations: new perspectives on economic growth”, by **Federica Roccisano**. It highlights the fact that generational equity needs to be placed at the base of both the legal reforms in order to focus the needs of new generations. Each choice of public policy, both national and supranational, has consequences not only on the present generation but also on future generations, affecting their growth prospects and quality of their lives. The protection of public goods intergenerational ambitious supranational policy, generational accounting and budgetary actions are necessary to facilitate a targeted use of public spending anticyclical in nature and does not harm the natural balance, social and economic medium term.

The last paper of this session, presented by **Karl Wurster**, was devoted to analyzing the impact of charcoal harvest and land management type on vegetation regeneration in the Tambacounda Region of Senegal. Households throughout Sub-Saharan Africa depend on fuelwood as their primary source of energy. In Senegal, increasing demands for charcoal by urban consumers has led to intensified harvesting of wood for charcoal production in the Tambacounda region. Forest management projects have been created in the region to reduce degradation caused by charcoal production. This study analyzed tree diversity and regeneration patterns in the Tambacounda region to determine the effect of tree harvesting for charcoal production on plot structure, tree species composition and forest regeneration and to assess the effect of forest management types on forest composition and regeneration near charcoal production sites.

#### PARALLEL SESSION B1

The economic relevance of ecosystem resilience derives from the fact that ecosystems flips may entail welfare losses. Indeed, such ecosystem flips may severely affect human well-being. Since an increase in ecosystem resilience reduces the probability of a system flip to occur, the paper presented by **Sebastian Strunz** interpreted investments in ecosystem resilience as an effort toward self protection. Results showed that choosing the level of ecosystem resilience in order to maximize the expected utility from the income lottery leads to interior solutions only when the set of parameter values of the management problem is restricted. Also boundary solutions to the self-protection problem do frequently occur.

The study conducted by **Christine Bertram** explored the effects of integrating a biodiversity index that accounts for both species richness and evenness into a multi-

species optimal control model. The model considered interactions between a general economic activity and the growth of two competing living resources. The paper showed that it is possible to derive a unique equilibrium that satisfies sufficient conditions for a welfare maximum in spite of using a non-concave value function to express the value of the living resources. Moreover, the analysis presented indicates that the properties of the biodiversity index crucially influence the equilibrium of the model.

Finally, the paper by **Shiri Shamir** considered the symbiotic problem in which pine trees (*Pinus halepensis*) were defined as a keystone species, while the mushroom *Saillus* granulates were a keystone-dependent species. The study was carried out in Israel's Mt. Carmel National Park. The results showed that under uncertainty environments, when there is no independence property, the unique optimal policy is interior policy. Also, under an interior optimal policy, the expenditure on the keystone species was greater than half the given budget.

## PARALLEL SESSION B2

Session B2 was centered on the valuation of the ecosystem goods and services that are provided by coastal ecosystems. The first speaker was **John Rolfe**, who presented an application of choice modeling experiment to the valuation of policy options for the protection of the Great Barrier Reef in Australia. The study is aimed at valuating a marginal improvement in the protection of the reef. From a methodological perspective, the study investigates in particular how labelling different management policies and providing information on the level of certainty of the desired outcome of the policies may affect the estimates generated by the contingent choice survey. The study findings suggest both these aspects may affect the response to the valuation exercise.

**Tamara Figueredo Martín** provided a discussion on the potential welfare benefits from the creation of a National Park in Jardines de la Reina, Cuba. The study aims at assessing the Total Economic Value of the future park, by using different methods to elicit forecasted cash flows and user preferences. The discussion following the presentation highlighted the need for more primary valuation studies in the Caribbean area and South America and the desirability of encouraging researchers from those areas to present their results to international audiences.

**Andrea Ghermandi**, the last speaker in this session, presented a paper where meta-analysis and value transfer are applied to the valuation of the recreational benefits of coastal ecosystems. For this study a dataset of stated and revealed preference studies was collected and GIS techniques were applied in order to identify the main drivers of recreation values. Benefit transfer and scaling up techniques were used to spatially explore the distribution of the recreational values of coastal ecosystems worldwide.

## PARALLEL SESSION B3

In session B3 two studies were presented. **J. C. Elnaboulsi** presented the paper "Environmental Regulation under Firms' Strategic Interdependence". The paper considers a polluting oligopoly and examines the effects of market structure and the number of active

firms on environmental taxes in a two-stage full-information Cournot oligopoly game. The goal is to understand the performance of environmental taxes and the influence of the market structure on the efficiency in setting environmental taxes. Subsidies may be implemented when the ecological conscience of the regulator is sufficiently low, or when it is moderate. Further investigations are needed to analyze the case of subsidies. Future work that further explores and extends these results can help shed more light on the optimal environmental taxes in large industrial markets with information asymmetry.

The second paper was “On The Empirics of Ecosystem Services Schemes: Technology, Risk and Compliance”, presented by **Johannes Sauer**. The overall aim of the study is to empirically investigate the cost structure of a management agreement type agri-environmental instrument and to identify factors for cost variation over space and time.

The analysis comprehends variables such as compliance weighting, technological and economic performance measures and risk proxies; in addition, heterogeneity or path dependency with respect to unknown administrative, spatial and farm specific factors are considered. This paper contributes to the literature since there are still only a very few empirical studies available investigating the performance of environmental schemes using microdata at the farm level.

#### PARALLEL SESSION B4

Two papers were presented in this session, both of them focusing on the link between biodiversity and climate change mitigation.

**Marko Heiskanen** treated the issue of the conversion of grasslands into CDM plantations. The reforestation of grasslands in developing countries is analyzed as one eligible project type under the CDM. Grasslands are rich in biodiversity and have a high potential for carbon sequestration. The presentation focused on grassland habitats in developing countries, analysing them from the perspective of multidisciplinary biodiversity science. The paper suggests the possibility to incorporate biodiversity benchmarks into CDM projects, measuring permanence, additionality and leakage of grassland carbon sequestration. The main conclusion is that grassland ecosystems and their biodiversity could be conserved and restored under the CDM framework.

The second paper was entitled “Local and national REDD income under alternative designs: theory and illustration from Sumatra”, by **Solenn Leplay**. Slowing down deforestation in developing countries is one of the main priorities for the future of climate change mitigation. Moreover, mitigation of climate change by curbing deforestation in Southern countries is estimated to be less costly than abatement of industrial emissions in Northern countries. The Copenhagen Accord recognises projects classified as Reduction of Emissions from Deforestation and forest Degradation (REDD), by which Northern countries provide monetary transfer to the Southern countries which reduce their emissions from deforestation below an agreed level called the baseline. This results in a form of payment for ecosystem services schemes (PES), working both at the global and the local level. The paper analyses two different types of PES schemes, the first based on opportunity cost compensations and the second based on fixed price compensations per units of avoided deforestation.

The presentations were followed by an interesting discussion focusing on the need to promote the link between biodiversity and climate change mitigation. Biodiversity protection can have a positive impact on the reduction of greenhouse gases concentration in the atmosphere, while at the same time enhancing livelihoods and economic activities in developing countries.

#### PARALLEL SESSION C1

In this session, the first paper presented by **Ajay Kumar Mahapatra** explored the relationship between trade in natural products, cash income and livelihood in Sub tropical forest regions of Eastern India and examined the underlying causes and household dynamics to deal product uses in the context of their livelihoods and income. The finding affirmed that trade in natural products is an important component of the livelihood strategy of the rural masses in forested zones. Although it might not be able to substantially boost income, it supported the poor people in coping with hardship.

The presentation by **Kaysara Khatun** presented a study that provided a quantitative appraisal of the carbon and timber stocks and flows of tropical (primary) forests and the associated trade-offs by evaluating them simultaneously using data and market values from a number of sources. Once again, the paper stated that the provision of reliable and accurate estimates of the economic value of these services is crucial to plan adequate conservation policies that encourage the protection and sustainable management of tropical forests such as those under REDD/REDD+.

The last presentation was given by **David Simpson**, who used a very simple and schematic model to explore under what circumstances a farmer would adopt an “ecosystem services” approach to production rather than a “conventional” approach. In summary, the model results supposed that a transition to an ecosystem service approach to agriculture would not alleviate, but might rather exacerbate, tradeoffs between food production and conservation.

#### PARALLEL SESSION C2

The three contributions of this parallel session were examples of different study cases in which the social perceptions were taken into account in order to improve appropriate policies for the ecosystem services management and biodiversity conservation.

The first paper presented by **Daija Angeli** and colleagues explored the benefits that people would derive from implementing a national strategy on biological diversity in Germany through the contingent valuation approach. Six ecosystem specific conservation programmes (forest, arable land, pastures and meadows, peatlands, flood plains, and dry grasslands) plus an additional climate change precaution program by implementing protection measures on a 20% bigger area were developed and offered to participants of an online survey. More than 60% of all the respondents were at least willing to pay for one of the offered programmes. The forest program obtained the highest economic support while the dry program obtained the lowest.

The research presented by **Felicita Scapini** aimed at proposing a reflection on the real contribution of current scientific environmental research and advice to biodiversity

conservation and its socio-economic benefits. The study was developed in the Nature Park of El Hondo (Alicante, Spain), taking as case study the conservation of the endangered white-headed duck (*Oxyura leucocephala*). The conservation policy for this endangered species has generated a conflict among local stakeholders which puts at risk the sustainability of the whole system. The paper discusses how normal scientific advice neglects the complexity of the real socio-ecological context. It also provides some examples showing that when the social considerations are taken into account through the stakeholders' engagement, the ecological scientific advice on the importance of biodiversity can be assumed and actively promoted by local stakeholders.

Finally, **Susan Durden** presented the case of the Department of Defenses in U.S.A. It is one of the largest managers of Federal Lands. Military bases and related sites are havens and habitat for threatened and endangered species and the communities within which they thrive. These bases, with 30 million acres of land, constitute the largest and most secure habitat available. How this value is captured in the decision making process and how economic techniques could contribute to the discussion for uses of this land were aspects considered in this study.

### PARALLEL SESSION C3

The first paper, "Pesticide use and wildlife loss: a bioeconomic model of the optimal pesticide policy", was presented by **Jorge Gutiérrez-García**. The goal of the study is to analyze the optimal pesticide policy when pesticides released from farms harmfully affect wildlife. The study comprehends a dynamic model that incorporates the change in farmers' welfare and the social benefits when a pesticide policy is implemented. The analysis shows that the pesticide policy depends highly on the economic range in which agriculture is a profitable activity, as well as the pesticide stock threshold that drives wildlife to extinction.

**Luca Di Corato**. Presented the paper on "An Equilibrium Model of Habitat Conservation under Uncertainty and Irreversibility". The aim of this paper is the investigation of habitat conservation by a multitude of landholders under uncertainty about the value of environmental services and irreversible development. One of the specific variables of this study is the land conversion under competition on the agricultural market in presence of voluntary and mandatory measures; in the end, the impact of uncertainty is determined analytically and some numerical simulations are provided.

The third paper of the session was "Urban water restrictions: what drives compliance behaviour?", presented by **Bethany Cooper**. The study is conducted in southern Australia and embodies data from water rich and water poor communities and metropolitan and regional settings. The results suggest that segments of the community have very diverse, strong and often diametrically opposed preferences for compliance measures, making the adoption of a one-size-fits-all approach fraught with political risk.

The paper by **Johannes Sauer** examines the cost of marginal ecosystem changes and the effectiveness of green payments based on a theoretical and empirical analysis of the bio-economic production relationships at the micro (farm) level. In this case, the supply curves should be estimated at a low level of aggregation accounting for biophysical and socio-economic variability. Also, the analysis examines the relationships between marketed and non-marketed ES (Ecosystem Services), and assesses the direct and opportunity costs at the margin. The approach used is a new theoretical based on a generalized joint production model which allows complementary, substitutive and competitive relationships. This theoretical framework is a transformation function including farm/farmer specific impacts and use of panel data analysis.

The theoretical model has two outputs which are produced simultaneously. However, since these are multiple outputs there is a separate production function used for each output, resulting in a generalised joint production model. This model allows for joint inputs and the possibility of varying the proportion of agricultural output and ES. The conclusion of the study shows that most farms produce agricultural output and ecosystem services in a complementary relationship. The generation of multiple ecosystem services on the same farm showed either a substitutive or competitive relationship. Moreover, changing the composition of the ecosystem services output would have very different implications for individual farms. Future works will include spatial patterns and examine the significant characteristics of the farms as estimated in our paper.

**Frank Wätzold** suggests that proactive conservation may lead to lower costs than delay-and-repair outcome. The costs of measures necessary to bring a species population back above a critical size may outweigh the costs of maintaining the species above this size, even if these costs occur over a longer period. The paper first derives the cost functions that capture the main economic and ecological aspects relevant for a comparison of the costs of a proactive approach and a delay-and-repair outcome.

Following the cost function estimations, a case study is applied where the conservation of the common hamster, protected by the EU Habitats Directive, is compared to the hypothetical costs of proactive conservation with costs of actual delay-and-repair outcome. The main habitat of the common hamster in Western Europe is arable land and agricultural intensification has been largely responsible for population decline. The case study shows all signs of a typical delay-and-repair outcome.

The paper presented by **Antti Miettinen** compares the costs of two biodiversity measures from the viewpoint of a private landowner. The measures considered are: a biodiversity zone established on the border of a field and a biodiversity zone established on the border of a forest abutting to a field. The purpose of both measures is to produce semi-natural habitats particularly suitable for pollinator insects and to increase the abundance and diversity of pollinators. Establishing and managing biodiversity zones incur extra costs and income losses and thus decrease the landowner's net income streams, since land previously used solely for agriculture (or forestry) is transferred to the joint production of crops and environmental benefits (or wood and environmental benefits).

The method applied is 30 test plots in southern Finland where the costs of biodiversity zones established on arable land neighbouring forest test plots were evaluated by means

of profit margin calculations on crop and animal farms. The inventories of tree stands were made and forest management was simulated by means of SIMO simulator ([www.simo-project.org](http://www.simo-project.org)). The landowner's costs and income losses were calculated by subtracting the present values of net income streams of biodiversity zones from the present values of net incomes of the corresponding fields and forests managed according to current recommendations.

The results show that the costs of biodiversity zones on arable land depend on the productivity of the field and the price of the original crop and whether the farm is able to utilise plants grown on the biodiversity zone.

## PLENARY DISCUSSION PANEL I

### Bringing science to action: Insights from conservation practitioners on REDD+

The panel discussed the critical role of forests in mitigating climate change and focused on REDD+ carbon markets as an incentive to maintain forest on the land.

REDD+ is an incentive program that goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.

**Andrew Mitchell** stated that investments of \$38 billion per year in REDD+ programs would reduce forest conversion by 50%. Agribusiness such as soy cultivation for beef production is the strongest driver of deforestation. Savings from avoided deforestation and forest degradation would be in the order of 1.5 – 4.5 trillion dollars per year. The development of REDD+ was described through one short video available at [www.redddesk.org](http://www.redddesk.org).

**Celia Harvey** focused on the co-benefits of REDD+, including habitat protection, employment opportunities, ecosystem services provision. Perceived social risks associated with REDD+ are loss of sovereignty by local communities, displacement of people, restriction of forest use, reduced availability of land for food production.

REDD+ projects need first to assess who owns the land, who depends on it, who is deforesting, what governance structures would be needed for administering the project and who will be affected. REDD+ recognizes the importance of traditional land use rights and forest tenure.

**Jonah Busch** introduced in more detail the timeline of REDD+ implementations and discussed emerging questions regarding the management and design of such initiative including the real costs involved, how to ensure that it is effective and equitable, not prone to leakage, and owned by local communities and countries that implement it. Initiatives to make REDD+ pro-poor are discussed in conjunction with examples of country-level efforts to build a low-carbon economy in addition to avoid deforestation and forest degradation (e.g. Guyana's low-carbon development strategy or Suriname Green).

Questions from the audience included concerns on how to deal with corruption as in the case of a nation where the military is mainly responsible for logging. Other concerns related to how feasible REDD+ is in the face of growing demand for timber (knowing that most timber still comes from natural forests rather than plantations) and that demand for agricultural products is also going up.

## UNEP ROUND TABLE

### The Inclusive Wealth Report

The plenary roundtable presented a brief overview of the development of The Inclusive Wealth Report (IWR)- joint initiative by the World Bank, UNEP and IHDP.

The two most commonly used reports by the development community to gauge progress in human well-being have been the World Bank's World Development Report and the United Nations Development Programme's Human Development Report (HDR). The former report uses the Gross National product per capita (GNP/capita) as the yardstick for measuring economic progress which is used as a proxy for measuring well-being progress. The HDR in turn reports on a composite indicator called the Human Development Index (HDI) that includes literacy and life expectancy and GNP/capita. Both indicators tell us that the world on the average has progressed over the last 50 years.

On the other hand the Millennium Ecosystem Assessment (MA) reported in 2005 that 15 of the 24 ecosystem services it assessed were in decline with the major drivers causing these declines occurring over the last 50 years. It goes on to report that the probability of many developing countries to achieve their Millennium Development Goals (MDGs) will be in jeopardy if the present rate of ecosystem services decline continues. There seems to be a dichotomy here between what the two most influential reports are saying of human progress and the main findings of the MA. The question we have to ask ourselves is if these two indicators are giving us an accurate picture of progress or if they are misleading us.

That they mislead can be deduced from the fact that neither GNP/capita nor HDI say anything about the state of the natural environment (natural capital, as it is now called). Like reproducible capital (roads, buildings, machinery) and human capital (education, health) and public knowledge (science and technology), nature is a capital asset. The MA took pains to show that natural capital produces a multitude of services, some of which are essential for survival (e.g. air, pollinators) or useful in the production of goods and services (forest cover, fisheries). Recent studies (Arrow et.al 2004, Dasgupta 2006, Perrings 2006, Barbier 2005) have shown how natural capital can be combined with manufactured capital, human capital, public knowledge, and institutions in such a way that the resulting index (which can be called Inclusive Wealth or the sustainability index) is able to reflect the progress or regress of economies.

The Inclusive Wealth Indicator, explained **Anantha Kumar Duraiappah**, is an index that provides a framework to give an idea of degree of substitutability among capitals, a framework to link ecosystem services with natural capital, and a development approach versus a conservation approach for developing countries, thus becoming a guidance for policymakers on components to invest to ensure sustainability.

**Karl-Göran Mäler** demonstrated how ecosystems can be included in wealth measurements . One of the major challenges in accounting for ecosystems is how to transform often abstract calculation models into workable and quantifiable systems. In order to do this, the necessary parameters for tangible measurements (size of the system, including how many stocks are relevant to the system, and an estimate of accounting prize and growth functions for each stock) were identified.

One of the examples of measuring ecosystem values, is the relation between the North American rapeseed (Canola) and bumble bees. Research has shown that the seed weight per plant can increase by over 80 percent when pollinated by bumble bees that thrive in open crop landscapes. By using a GIS (Arv View) and information on the area and the geographic location of Canola fields, the pollination potential in each circle was calculated. By changing the land use according to future land use forecasts, it is possible to estimate the change on the pollination potential of the crop.

**Pablo Muñoz's** speech focused on accounting for natural resources embodied in trade and its implications for measuring changes in wealth. Developing 'greener' national accounts holds the promise of placing environmental considerations into a framework that key economic ministries in any government will understand. How to account for countries' Environmental Responsibility (ER) Production-Based Principle (PBP) is based on geographical considerations, that is environmental responsibilities 'stop' at the respective national borders of the countries concerned. The Kyoto Protocol relies on this sort of accounting system. The World Bank is currently focusing on two prominent indicators linking the macro-economy, the environment and sustainability. These indicators are built on the idea that the generation of well-being depends on a country's asset base, which includes natural resources as well as produced and human capital. Adjusted Net Saving is an indicator of the sustainability of an economy. It measures changes in wealth from one year to the next by looking at increases in produced capital (through investments), depletion of natural resources (e.g. through the extraction of oil or timber from forests), investments in human capital (e.g. through education) and damages to health caused by pollution. Adjusted Net Savings estimates are available for 140 countries for the period 1970-2008.

## Tuesday, September 28

### PLENARY SESSION II

#### Reflections on the economics of ecosystems and biodiversity (and the TEEB Report for Business)

**Dr Joshua Bishop (International Union for Conservation of Nature, Switzerland)**

**Joshua Bishop's** presentation focused on the Economics of Ecosystems and Biodiversity ([www.teebweb.org](http://www.teebweb.org)) initiative, "a major international initiative to draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics and policy to enable practical actions moving forward". TEEB was inspired by the Stern Report and built on the Millennium Ecosystem Assessment. It is a three-year endeavour that begun in 2007 under the supervision of the United Nations Environmental Programme.

The focus of the initiative has not been to publish "big numbers" like in the first generation of economic valuations of ecosystem services, but rather to raise awareness on the consequences of not acting timely on the loss of biodiversity. TEEB is also concerned with the link between poverty and conservation (which ecosystem services are important to the poor, what management regimes are more conducive to sustainability and poverty reduction).

A whole specific focus of TEEB has been the ethical implications of discounting, advising that low discount rates are best for guaranteeing fair sustainable resource uses for future generations. The corporate sector is also another area of interest of TEEB in that companies depend and have impacts on ecosystem services as part of their productive activities. TEEB has developed a specific document for corporate business and ways for them to not only mitigate impacts but also achieve net positive impact (such as in the case of biodiversity offsets that bring biodiversity to a higher level than before a company's intervention).

#### PARALLEL SESSION D1

The first paper presented by **S. Amjath Babu** was "Gifting for ecosystem services: Economic and ecological analysis of soil biodiversity services in agricultural lands". The aim of this paper is to contribute towards gifting and reciprocity as mechanisms to coordinate exchange between humans and nature in general and farmers and soil biota in particular.

**Traci Birge** presented a paper entitled "Using Social-Ecological Inventory to Identify Ecosystem Services and Stewards of Traditional Rural Biotopes in SW Finland". The case study of the paper is related to the "disappearing" of grazed forests. An evaluation on the likelihood of respondents having TRBs was developed using questionnaire responses. This system was employed to reduce error in respondent interpretations and to identify participants for follow-up research.

The third paper, presented by **Norman Kwikiriza** analyses the role of banana variety diversity in reducing yield losses associated with biophysical production constraints in Uganda. Results indicate that banana variety diversity contributes positively in reducing yield losses caused by biophysical constraints particularly pests and diseases, but trade-offs exist.

**Andreas Kontoleon**, in his review work "Dependence of the poor on biodiversity: which poor, what biodiversity?", examines the evidence on the extent to which the poor depend upon biodiversity. The review focused on two particular types of dependence: (a) biodiversity as offering a means of subsistence or income to the poor; and (b) biodiversity as offering insurance to the poor from risks and shocks, thereby preventing them from falling deeper into poverty.

#### PARALLEL SESSION D2

**Dafna DiSegni** presented a paper on "Estimating the Economic Value of Climate Change effect on ecosystem services via fluctuations in the Genuine Saving index of sustainability". She illustrated a new macro-economic approach to value changes in ecosystem services, which relates the value of the stock of resources to its impact on the optimal national growth path. The Replacement Cost (RC) has been used to identify the monetary value of a change in natural stocks, responsible for a range of ecosystem services, as a result of climate change, and to compute its economic value via its local effect on the national Genuine Saving Indicator of sustainability. The economic rationale for using the index of sustainability is supported by the theoretical model developed in the paper, demonstrating that the optimal national path of growth, derived from a classical growth model is equivalent to the Genuine Saving Indicator proposed by the World Bank.

This approach has been used to value the impact of Climate Change on ecosystem services at four distinctive climatic areas along an aridity gradient in the eastern Mediterranean basin: Arid, Semi-Arid, Mediterranean and Mesic Mediterranean ecosystems.

**Mattia Cai**'s paper examined how tourist arrivals and the average length of their stay respond to variation in local weather conditions. An 8-year panel dataset of the region's 254 municipalities was assembled.

Both static and dynamic model specifications have been used and separate analyses for domestic and foreign tourists have been conducted. The results show that there is evidence of a non-negligible effect of climate variation on tourist flows. In broad terms, warmer winters and hotter summers are associated with reduced tourist inflows, whereas higher temperatures in the intermediate seasons seem beneficial for tourism. These general results appear to hold regardless of the place of origin of the tourists, even though the observed statistical associations seem stronger for domestic than for foreign tourists, which may reflect their different ability to take the weather conditions into account at the time their travel arrangements are made. The effect of local climate on tourist inflow varies remarkably among destinations offering different types of tourism attractions.

**Surendra Kumar Sharma** presented a paper on the role of social forestry in poverty alleviation. Main contents of this presentation are the explanation of the role of social forestry in poverty alleviation in India. The forest in India plays a significant role in biodiversity protection, global environment conservation, landside prevention and soil preservation, headwater conservation, health, recreational and cultural, material production (timber, food such as mushrooms etc, fertilizers, feeds, raw material for pharmaceutical and other industrial products, extracted ingredients, greening materials etc). The role of tropical evergreen forests raising the Willow (*salix*) and bamboos in North-East India has been studied vis-à-vis employment generation and poverty alleviation through social forestry program.

The last speech was given by **Carlos Adrián Saldarriaga Isaza**, on the cost-effectiveness analysis of species conservation, applied to a biological corridor in the land of the Cordilleran Protection Area (CPA), Region VIII, Chile, for the conservation of a highly threatened species: the Huemul (*Hippocamelus bisulcus*, Cervidae).

Different possibilities of land allocation to identify cost-effective alternatives in the provision of both conservation and income have been evaluated. The confirmed hypothesis of this research is twofold. First, it is seen that the current management of the CPA is not cost-effective. Second, it can be proved that an alternative allocation of the land in the CPA could produce greater economic benefits while maintaining, or even increasing the Huemul population at the current level. The latter being an idea currently envisioned and shared by different organizations involved in the site.

### PARALLEL SESSION D3

The session focused on the relationship between landscape, biodiversity and economic activities.

The first presentation, entitled "Wildlands and Woodlands. A Vision for the New England Landscape" and presented by **Rob Lielieholm**, described a long term conservation

programme set up to protect the Harvard Forest in Maine. The paper analysed the history of change of the land cover patterns of the area and stressed the different benefits deriving from the local forest ecosystem, in particular recreation, carbon storage and water cleaning. It also focused on the different stakeholders involved.

Abu Sumon presented a research on incentive-based conservation planning and management through ecological zoning and community-based ecotourism in ecologically critical areas of Bangladesh. In 2002, the Government of Bangladesh through its Department of Environment (DoE) started to institutionalize a model of management to ensure the conservation and sustainable use of globally significant biodiversity within environmentally critical areas. The main management actions required to reduce threats to biodiversity conservation include the control of adverse activities through law enforcement and awareness-raising, the provision of alternative livelihoods and incomes for the poorest and most highly dependent resources users, the in-situ and ex-situ conservation of species and the rehabilitation of endangered habitats.

**Margaret M. Calderon** discussed the potential of developing a Payment for Environmental and Cultural Services system that can help in the conservation of the Ifugao Rice Terraces. The rice terraces in four municipalities of Ifugao were inscribed in the UNESCO World Heritage List in 1995, however they have suffered severe deterioration over the years. The burden of maintaining this global heritage lies on the farmers, who are experiencing increasing damages due to landslides and earthworms, inadequate water supply and poor irrigation systems, and pest infestation. One option to avoid the abandonment of the terraces is the creation of a market for environmental and cultural services with a good potential, where the sellers and buyers of these services will be the farmers and tourists, water users, and electricity users, among others.

**Giulia Macagno** presented the paper entitled “The influence of agricultural landscape on tourism flows: an application to Tuscany”. Tuscany is a major touristic region in Italy renowned for its pleasant climate and enchanting countryside. The paper analyses the impact of agricultural landscape and the production of high quality wines on international and domestic tourism demand. The outcome of the analysis leads to the conclusion that agricultural landscape, high quality wine production positively influence tourism flows and that the magnitude of that impact is differentiated across the international and domestic tourist. This has important policy implications for the marketing and branding of tourism attraction factors.

The section provided an interesting picture of how the link between economic activities and biodiversity and ecosystem services can be analysed under different angles and how the value of the benefits generated by ecosystem services can be enhanced to the profit of local economic systems both in developed and in developing countries.

#### PARALLEL SESSION D4

Session D4 focused on the issue of the integration of spatial considerations into the valuation of ecosystem services and the assessment of environmental policies. The first presenter, **Inge Liekens**, described an application of the choice experiment method that is specifically aimed at developing a framework for the assessment of the impact of large infrastructural projects on the provision of ecosystem goods and services in the region of

Flanders in Belgium. The function used in the study for the valuation of amenity and non-use values explicitly includes spatial aspects such as the distance of respondents from the recreational site and the proximity to industrial or agricultural sites. **Maia David** offered a discussion on the importance of spatial patterns in designing reserve areas for the protection of biodiversity. The case-study application was the development of managed spatial mosaics of grassland and agricultural areas for the protection of the little bustard bird (*Tetrax tetrax*) in France. Alternative management policies resulting in different spatial allocation patterns were evaluated. **Katrin Rehdanz** elaborated on the role of species diversity as determinants of subjective human well-being. She provided an overview of the use of the concept of happiness in economics and put forward an approach that is proposed as an alternative to valuation methods such as those based on the elicitation of stated preferences. Spatial dependencies of the happiness level across neighbouring countries were identified. The last speaker in this session, **Felicita Scapini**, presented some results of the WADI (WATER Demand Integration) project, which focused on the benefits of coastal water to people through the analysis of several different case-studies in the Mediterranean. She highlighted the need to acknowledge beaches as ecosystems that are rich in biodiversity and subject to dynamics of constant change. The opportunity to combine nature conservation in the Maremma regional Park in Tuscany, Italy, with economic uses of the area was discussed.

#### PARALLEL SESSION E1

This session addressed different issues in the design and effectiveness of conservation approaches.

**Frans De Vries** focused on the importance of spatial coordination in conservation planning. Connected habitats are more valuable for conservation purposes and therefore spatial coordination to achieve the connectedness plays an important role. The presenter discussed a theoretical approach to assess the effects of an “agglomeration bonus”, an incentive measure to encourage neighbours to coordinate conservation practices (a premium paid to entice the neighbour to undertake the same conservation action so as to increase connectivity of conserved areas). To better evaluate the effects of spatial coordination, three scenarios are analyzed: 1) no coordination action is taken and payments are granted to any farmer who converts a parcel of agricultural land into a wetland 2) coordination actions with a payment only if at least one neighbour switches an agricultural site to a wetland site (goal is to increase connectivity of wetland sites); 3) coordination action with a payment only if at least one neighbour switches to wetland in the proximity of another existing cluster of wetland parcels (so as to achieve the largest possible cluster of connected wetland sites). The analysis proceeds by assuming that conversion to wetland happens when costs of conversion are lower than the benefits of the aggregation scheme. Results of the analysis show that a slight increase in the payment produces smooth increase in the parcels converted to wetlands. Linear increases in payments have non-linear responses for scenarios 2 and 3. For example a small increase in payments generates a high level of connectivity (scenario 2) whereas there needs to be a minimum payment before the largest possible cluster of wetland sites can be generated.

**Davinder Kumar Grover** discussed trade-offs between conservation practices and agricultural production in Punjab, India. Cropping intensity in Punjab is estimated at 189%, meaning that each inch of soil is reused at least twice a year. This has resulted in depletion of ground water reservoirs and soil degradation. Conservation practices among other things advise to retain crop residues in the field for increasing organic matter in the soil. This practice directly reduces the amount of crop residue for livestock feed, creating a trade-off between livestock production and soil improvement. Livelihood conditions and soil quality were compared for farmers adopting conservation practices (crop residue on the land and no tillage) and farmers who did not adopt such practices in 6 different villages. Farmers who agreed on adopting conservation practices were generally wealthier and with higher education levels. Their investments in inputs (e.g. fertilizers and pesticides) were 8.3% lower than in conventional farms, and their wheat production was 13.5% less. Rice production was 23% lower in conservation farms. Conservation measures are facing a widespread resistance especially in transitioning to zero-tillage practices for which new knowledge and machinery would be needed. The use of subsidies and extension services are suggested as a mechanism to support transition to conservation practices.

**Stewart Whitten** raised the question of what economic and policy instruments work better for biodiversity conservation in the context of economic design and adaptive management. The economic design cycle addresses: 1) problem definition, 2) solution selection, 3) solution implementation, and 4) monitoring, evaluation and assembly of lessons for the future. The economic design process is applied within these steps as a process for deciding whether an intervention is warranted, what market and regulatory failures any intervention would need to be overcome, which mechanisms are available and the type of refinements required for effective application, and to guide what should be monitored and evaluated for future interventions. Case studies of Australian conservation initiatives (such as Greening Australia Vegetation Incentive Project) were used to identify lessons from practical experience in design and implementation of biodiversity conservation measures and to identify the opportunities that an economic design approach may offer for improving these measures. When analyzed in an economic design framework all these cases showed excellent knowledge of the biophysical conditions and risks for biodiversity but very few had an understanding of the human and institutional factors affecting the conservation problem. Very few cases had a plan for communication of actions and results or monitoring plans for effectiveness and replicability. Ample opportunities exist to use the economic design framework to assist existing or emerging conservation initiatives.

## PARALLEL SESSION E2

This session comprised three papers covering very different aspects of environmental issues. The first paper presented by **Maarten Punt** explored the use of game theoretical analysis to find the optimal size of marine protected areas in the EU context with multiple uses by multiple countries, and to investigate the influences of multiple uses on cooperation. The results of the paper suggested that EU marine policies might help to secure the highest possible benefits from these MPAs if these policies induce cooperation among countries and if the policies force the countries to consider all possible uses of marine protected areas. The results also indicated that cooperation might be hard to achieve because of defector incentives.

The second presentation by **Isis Spinola-Schwartz** focused on the social aspects of the homelessness problem. Empirical data of the Marin country were explored to develop a qualitative, and whenever possible, a quantitative analysis of the social, environmental, and human cost of homelessness. The author concluded that we needed to have the political and social drive to execute a plan, which will benefit all future generations and stop the cycle of homelessness in our community.

The last paper presented by **Duncan Knowler** conducted an economic analysis of management strategies for three invasive plant species in British Columbia, Canada: hawkweed, Scotch broom and Eurasian Watermilfoil. The result suggested that efforts to develop successful biological control programs should continue for hawkweed and other invasive plant species. Land management actions such as grazing management and seeding were also an important component of control programs even though these actions may be costly in the short term. For the management of invasive plants along utility and transportation corridors, nearby areas surrounded by vulnerable, un-invaded habitat should be given priority over those that are not.

### PARALLEL SESSION E3

The three contributions of this parallel session were case studies of the application of the ecosystem service framework in marine and coastal ecosystems. The objective of the paper presented by **Ngoc Thi Khanh Quach** was to apply the principal-agent model to define the optimal reserve area, fishing effort, and transfer payment in the context of symmetric and asymmetric information between managers and fishermen. Among other results, the author showed that the optimal reserve size under asymmetric information is smaller than under symmetric information. Also, fishing efforts encouraged with a transfer payment were always less compared to those without payment.

The study presented by **Ana Ruiz-Frau** and colleagues was focussed on societal preference and non-use values of marine protected areas revealed by stated preference methods. Particularly a choice experiment exercise was conducted in Wales in order to analyse the social support regarding the establishment of marine protected areas. Characteristics related with the size of the protected area, its management, and the monetary attribute were taken into account. An interesting result is that there was general support for the establishment of marine protected areas among the general public and that society was willing to bear an additional economic cost derived from marine conservation.

Finally, **Aline Chiabai** presented a methodological framework to identify, analyze, map, and evaluate the loss and degradation of natural habitats and related ecosystem goods and services that would occur as a result of sea level rise in coastal zones. The ecosystem services under analysis include: carbon sequestration, water regulation, natural hazard control and resilience to climate extreme events, soil erosion, scenic beauty, passive use, and recreational values. The analysis was conducted in terms of loss of welfare associated with an increase in the sea level rise in the Basque Coast (North of Spain) for 2100. According to projections, a substantial area of the Basque coast is predicted to flood by the year 2100, as a result the associated goods and services will be negatively impacted. The total economic loss associated with a sea level rise and measured by the loss of use and non-use values, ranges from 210 to 550 million € in 2100 (evaluated at the 2005

prices and using a 1% discount rate). The results contributed to raise awareness of local policy makers and urgency of action to address natural ecosystems degradation face to climate change while providing a range of estimates, vital to make investment decision in adaptation strategies.

#### PARALLEL SESSION E4

The paper presented by **Fan Zhang** investigates the East Australian Current (EAC), its separation and resultant eddy field along the coast of Southeast Australia. There are potential economic benefits from NSW-IMOS. The study conducts a cost benefit analysis of NSW-IMOS and shows one benefit of the system for commercial fishing which can be improved by greater knowledge about water temperature and salinity. Also, maritime transportation could gain from ocean current information to decrease transit time and thus decrease shipping costs. Moreover, beach recreational activities could be improved by more accurate weather and ocean-related information.

The potential benefits from the NSW-IMOS are estimated as the difference between the expected economic benefits after using the NSW-IMOS forecasting information and the economic benefits without using the NSW-IMOS information. Some of the future works will optimize the new model and consider tourism as a case study to evaluate the potential benefits for tourism from NSW-IMOS.

**Ayumi Onuma** presented a paper entitled "Optimum Population and Long-run Conservation of Natural Capital Stock". The population is expected to exceed 9.0 billion in 2050. Population growth consequently, increases demand for natural resources such as water, forest and fisheries. Ehrlich and Holdren (1971) claim that population growth causes a disproportionate negative impact on the environment. Hence, problems of population size and growth, resource utilization and depletion, and environmental deterioration must be considered jointly. Dasgupta (2000, 2003) also stresses that population growth as well as the magnitude of poverty have a relation with the degradation of natural capital stock (NCS). Size of population is a key to determine how the economy conserves NCSs in the long-run. Control of population is important for the conservation of NCSs. The economy then controls population size to maximize the utilitarian welfare function. However, Dasgupta ignores the aspect of natural resources. Brander and Taylor (1998) construct a dynamic model in which the harvest of a natural resource (forest) is determined by the size of population under an open-access system. Based on the model, they derive a time path that explains the rise and fall of Easter Island. They do not deal with "optimum population".

The purpose of the paper is to explore the types of stationary states which maximize the various criteria selected. Also, the paper examines the different states under profit maximization and open access. Moreover, the study compares profit maximizing and open access states where populations are under profit maximization. There is an owner of NCS and he/she determines the population that works there so as to maximize the profit. The population is under open access, thus the immigrants are not excluded. The population increases until the profit reaches zero.

The last paper, presented by **Anders Skonhoft**, was centred on fishing vs. Conservation. The salmon population has faced various threats including: migratory pattern, freshwater threats, parasites (*Gyrodactylus salaricus*), acid rain, river water regulations, overfishing, ocean threats, escaped farmed salmon, competing management and interbreeding and salmon lice (transmitted from the farmed salmon industry). Moreover, another problem is of wild vis-à-vis farmed salmon. This paper introduces the age structured model which is compared to the biomass model: a simple and illuminating analysis of driving forces (e.g., Clark 1990). In case of fishing there is the 'young' and 'old'. A complex dynamic system is applied to the study which simulates the effects of variations in fishing mortalities (stock growth, 'sustainability'). However the method is difficult to optimize i.e. optimal fishing mortalities due to certain goals. Nevertheless, the dynamic system model is considered in the reduced form where the system is assumed in biological equilibrium (stable population) with two stock variables and two fishing mortalities (control variables).

The maximum sustainable yield problem is then to evaluate the fishing mortalities and stock sizes subject to the biological constraints. In conclusion, for the management of salmon it is plausible to select between age classes in harvesting and because of seasonal variation in migration it is feasible (at some levels) to target size and age of the salmon.

#### PARALLEL SESSION F1

In Session F1 three papers were presented which focus on the valuation of either threatened species management options or forest ecosystem services. **Nick Hanley** presented the results of a choice experiment which was performed in Scotland and in which respondents were asked to select among three alternative management regimes for the predator bird Hen Harrier. The potential controversies in the evaluation of different land management options which arise from conflicting stakeholders' preferences (e.g., game management for sport, endangered species conservation) are highlighted. The paper aims at eliciting public preferences for the different management strategies, with the understanding that commanding a large majority support in the population is a key requirement for successful conflict resolution.

The second paper in this session was presented by **Elena Ojea**. The paper investigates the methodological issues with the classification of ecosystem services and highlights the importance of the type of scheme adopted when the purpose of investigation is economic valuation. The paper makes explicit reference to the classification proposed in the Millennium Ecosystem Assessment (MEA) and discusses alternative approaches. An application to the valuation of the water-related services provided by tropical forests is presented, where the results from applying the MEA approach are compared with those obtained with an output-based classification. The latter is found to provide more accurate economic estimates.

The third paper in the session was presented by **Aline Chiabai**. The paper proposes a methodological framework for the valuation of the goods and services from forest ecosystems, focusing in particular on the provision of forest products, recreation and passive uses, and carbon sequestration. A worldwide assessment of values concludes that carbon sequestration is the most highly valued forest service. The implications of the valuation results are discussed in light of the losses or gains that can be associated with policy inaction during the period from 2000 to 2050.

## PARALLEL SESSION F2

The presentation given by **Stefan Baumgärtner** was on rain-index insurance and the sustainability of rangeland management. Rain-index insurance is strongly advocated in many parts of the developing world to help farmers cope with climatic risks that prevail in (semi-)arid rangelands due to low and highly uncertain rainfall. The research presented one model to analyse how the availability of rain-index insurance affects the sustainability of rangeland management. The results show that a rain-index insurance with frequent payoffs, i.e. a high strike level, leads to the choice of less sustainable grazing management than without insurance available. However, rain-index insurance with a low to medium strike level enhances the farmer's well-being while not impairing the sustainability of rangeland management.

**Rahim Darma** analysed the development of local organization for agricultural development in Indonesia. Rural economic development as the largest part of agricultural development which could evolve into an autonomous unit of government in a rural area. Rural development could be achieved by self-support and by strengthening local organization with a set of norms and by using available resources. The data used in this paper were the result of the research on the strengthening of local institutions that was carried out in the Martaya Village, West Sulawesi Province, Indonesia. Research results showed that the development of irrigation infrastructure, farmer groups, and rice mill business could be achieved on the basis of farmer needs. The development of farmer groups encouraged the construction of village roads and the definition of village regulations to support the government of autonomous villages. The community development activities could be carried out by local organizations committed to supporting the village development planning and sustainable agricultural development. Local organizations could be involved in the activities of joint discussion meetings (Musrenbang) at the village level which was one of the stages in the system of national development planning.

Agriculture vs. the Environment on the Australian rangelands was the theme developed by **Daniel Gregg**. Policy makers in Australia face challenges to manage rangelands in ways that will optimise both agricultural production and conservation outcomes. Public conservation is difficult because the extent of rangelands, a history of pastoral uses, and complexities in management mean that large areas remain used for private purposes. Over the last two decades there has been an increasing use of public money to directly fund private landholders to increase the output of environmental goods in order to improve conservation management on private lands. However, despite significant investments in purchasing environmental services from rangeland farmers there is little evidence which can show a net improvement in the environmental performance of the rangelands. The lack of evidence for net environmental improvements may be due more to impacts on the decision function of producers than to a lack (due to the inherent difficulties) of monitoring. Using basic economic decision theory, the study aimed at understanding why current grant-based financial incentive approaches may result in lower environmental outcomes than expected on the Australian rangelands. An alternative approach which, in the long-run, is at least as efficient as competitive tenders has been proposed. This alternative approach would reinforce existing duty of care clauses, personal conservation motivations, and would be potentially self-funding.

The setting for this research was the Australia rangelands, however the results are potentially relevant across a greater scale (rangelands in other countries) and scope (other agricultural industries).

### PARALLEL SESSION F3

This session opened with the speech given by **Jianhua Zhou**. His paper presents a case study to explore how the community-based common resource management works. Local communities in 9 villages (5 with sustainable management and 4 without) in the Baimaxueshan National Nature Reserve in Yunnan Province, China were surveyed in 2006 and 2007. *Tricholoma matsutake* is a common pool resource which has an open access, is competitive and has common property rights.

The harvest of *Tricholoma matsutake* in the area has been a long history of subsistence harvesting where harvest is done during June and early November. The peak seasons are in August and September hence creating conflict with agriculture activities. It has been mainly an income generating source since the NR established in 1988, and it accounts for about 75% of total net income in recent years.

However, there is resource degradation since the late 1990s due to many harvesters from other communities crowding the collective forest and causing over-exploitation of the resource. Also, harvesting the young and the over-matured *Tricholoma matsutake* speeds up the depletion of the resource and inappropriate tools and approaches used in harvesting and its habitat were destroyed. The result is resource degradation of *Tricholoma matsutake*. Of five villages surveyed, four prohibited the harvest of young and over-matured *Tricholoma matsutake*. The key findings indicate that *Tricholoma matsutake* resources can be restored and successful common resources governance relies on the following factors: high motivation, less enforcement costs and reliable enforcement power.

**Philippe Delacote's** paper was devoted to deforestation's consequences. Agricultural risks in developing countries are high, i.e. price shocks, seasonal flooding and crop diseases. Forests act as insurance when forest products are used as a safety net against agricultural uncertainty. Two important points are presented in the paper. First, most households find a variety of products in the forest and have various management tools and second, forestry harvesting has low returns to labour and is not a poverty alleviation activity. This paper introduces a theoretical analysis of the effect of these points on the forests.

The paper examines the extensive vis-à-vis intensive effects of forests. The former effect is the land use allocation of agriculture and forests with two assumptions. In the former effect, the household reduces agricultural risks and may increase deforestation, in other words agricultural activities will increase and deforestation will also increase. For the second effect i.e. intensive it involves the labour allocation between the two activities: heterogeneous and homogeneous returns for the agriculture and forests respectively.

There are four types of equilibria mentioned in the study although the focus is on the mixed-activities equilibrium. In this case, households need to mix activities in the most profitable and safe way, the results are: in the short run, the land use doesn't change and it becomes easier for the households i.e. less labour for harvesting etc. In the long run, the risk reduction increases deforestation and households increase their fields thereby cutting

down the forests. In conclusion, there is a short inertia of land use in the short run, and risk reduction will have two different impacts in the short and in the long run.

The paper of **Nir Becker** introduces the economic problem of nature reserves as public goods where valuation methods are generally used to estimate total value. However, pricing and financial issues are usually neglected by environmental economists particularly when budget stresses are experienced. Hence, there is a need to foster synergy between these two issues where the role of pricing and ways to manage access of nature reserves interact. The key questions posed in this paper include: should visitors pay? And if yes, in which form and how much?

The paper compares the various arguments for and against “free access”; nature “exists” and there is no cost involved; and also the issue of the public good argument. The paper further explores what are the “right” ways of pricing for the various arguments, and how to meet the ultimate objective of a balanced social justice, economic reasoning and ecological responsibility. Two research sites are examined in the paper namely: Gamla natural reserve (a priced reserve) and Darga national reserve (non-priced reserve). Pricing policies for the two NR sites are provided where the pricing is given for a given site’s characteristics to develop the area. The results shows that cross subsidy enables better flexibility in managing and developing NR’s and the entrance fees shouldn’t be the same across all NR’s. However, the pricing decision should not be done independently.

#### PARALLEL SESSION F4

The first presentation was made by **Julia Touza**. Her paper “Strategic interactions in provision of international environmental public goods” reports the implications of the current state of the art on the science of strategic behaviour for the national treatment of different kinds of international environmental public goods. This paper aims to estimate the likelihood that independent voluntary actions may produce a ‘good enough’ outcome, understanding the nature of the environmental public goods, the socio-economic conditions in which they are provided, and the nature of the strategic interactions involved.

**Nicola Gallai** presented a work on the dependence of social welfare upon ecosystem services through the example of insect pollination as a key factor for social welfare. What would be the consequences of a production loss due to an insect pollinator decline considering the adaptation of the overall economy and more particularly considering the possible spillovers on other markets? Results related to these questions are presented considering two scenarios.

The last paper was “Institutionalizing global genetic-resource commons: Towards alternative models for facilitating access in the global biodiversity regime” presented by **Tom Dedeurwaerdere**. This paper presents a comparative analysis of three cases of global genetic-resource commons, in the fields of microbial, plant and animal genetic resources, with the aim to contribute to the understanding of the challenges faced and to analyze institutional solutions. The analysis in this paper shows that the use of standard contracts and an initial investment in the creation of social networks, global genetic resource commons could bring major benefits both for developing and industrialized countries.

## PLENARY DISCUSSION PANEL II

### Innovative participatory methods on valuation: a social take on biodiversity values

The panel discussed innovations in participatory methods on valuation. **Pushpam Kumar** opened the panel addressing some of the biggest challenges in accounting for nature in every-day decision-making. There are trade-offs between productive and regulatory ecosystem services, there are non-linearities in the relationship between biodiversity and ecosystem services that are difficult to capture, cultural values are inherently more difficult to value, many benefits from ecosystem services are public goods. The economic dimensions of economic valuations that are generally neglected include the psychological meaning of relating with nature and seeing the relation with an ecosystem as an identification. There is a psychological dimension of nature. Discourse-based valuations seem to get closer to this dimension for example by identifying consensual societal values of scarcity indicators through participatory processes. Kumar warns that the purpose of valuation must be clear in order to respond to different values and a pluralism of methodologies is therefore advisable.

**Rudolf De Groot** started off by reminding us of the unprecedented rate of biodiversity loss and that conservation is still perceived as a cost rather than an investment. Between 6 and 9 million US dollars are spent globally every year for conservation. To protect the most threatened species and ecosystem services between 45 and 50 billion US dollars per year would be needed. This amount is in the same range of what is commonly spent in one single day on Valentine's day (13 billion US dollars) or yearly for cigarettes (50 billion US dollars per year). There is evidence though that investing in natural capital pays (presenter referred to Costanza et al 1997, Balmford et al 2002) such as in the case of mangrove forest conservation in Honduras.

**Nicholas Hanley** remarks that current economic valuation methods are oftentimes not developed enough to capture real values that people hold regarding nature's services. Contingent valuation is specifically cited as inadequate in this respect. Participatory valuation methods are more amenable to capture these values.

Contingent valuations in a participatory setting can deliver different values for willingness to pay. For example does it make a difference if people discuss values with family and friends? The participatory process itself can modify the perception of value. For as much as participatory approaches are important in identifying how people construct preferences it is difficult to do research on them as sample sizes are typically not amenable for standard statistical assessments.

#### *Acknowledgement*

*A sincere thanks to all the people who have contributed to the preparation of this report: Sabah Abdullah, Silvia Bertolin, Marta Ceroni, Paolo Cominetti, Helen Ding, Marina Garcia Llorente, Giulia Macagno, Andrea Ghermandi, Fan Zhang.*



## Abstracts of the Presented Papers

### Monday, September 27th

09.00 - 10.30

PLENARY SESSION I

AULA MAGNA

Geoffrey HEAL, Columbia Business School, USA

#### **Sustainability, nature's services and economic progress**

Roosevelt stated: "A nation behaves well if it treats its natural resources as assets that can be turned over to the next generation with the same value if not more valuable". From this onset, the presentation revolved around how to treat natural resources as assets. From a definition of natural capital the presentation moved to the definition of ecosystem services and stating the biggest challenge in sustainability: how to link changes in the biogeochemical state of an ecosystem to changes in flows of ecosystem services and subsequent welfare losses.

The difficulty in addressing this question stems from the complexity of natural systems, which operate in non-linear ways. Thresholds and irreversible phenomena are particularly hard to capture (as exemplified in the case of Lake Mendota in which phosphorus dynamics of sedimentation and release show clear non-linearities and three different equilibrium points).

PARALLEL SESSION A1

AULA MAGNA

Jonah BUSCH, Conservation International, USA

#### **Mechanisms for increasing the biodiversity benefit of reducing emissions from deforestation**

An international mechanism to reduce emission from deforestation (REDD+) is likely to deliver substantial benefits for biodiversity. Biodiversity benefits of REDD+ can be increased further through the development of supplemental mechanisms. These mechanisms will be easier to implement if they advance rather than hinder the delivery of climate benefits. In this paper we use a simple numerical illustration and a simulated global REDD+ mechanism to examine the climate and biodiversity benefits of three such supplemental mechanisms: reallocation of fixed funding; additional carbon payments; and supplemental biodiversity payments. In contrast to previous literature, we find that reallocating fixed funding from carbon payments to biodiversity payments can increase climate benefits under certain conditions. Our findings support the consideration of reallocation of fixed funding for REDD+ programs at the national level. Additionally, we find that supplemental biodiversity payments would always directly increase biodiversity benefits, increase climate benefits, and benefit both sellers and buyers of reduced deforestation emissions. Our findings support the promotion of supplemental biodiversity payments for REDD+ at the both international and national level.

Rafat ALAM, Grant MacEwan University, Canada

### **Species conservation with green consumerism**

The paper models green consumerism and its impact on species conservation under North-South trade between a capital intensive product and a „biodiversity“ intensive product. The paper shows how environmentally sensitive consumers' preferences for biodiversity can send market signals to conserve biodiversity. Northern green consumers can significantly affect biodiversity conservation in the South when biodiversity rich South is exporting product that affects biodiversity conservation. Under the first scenario of no differentiation of the product source by the green consumers, the terms of trade for the biodiversity intensive product improve no matter where the producers of the product are located when they increase the number of conserved species. But the caveat in this scenario is that the Southern producers can free ride on green consumerism of the North and conservation effort of the Northern producers. In the alternative scenario where green consumers can differentiate the source of the products, Southern consumers can not free ride anymore. In this scenario, if Southern producers do not take conservation efforts - their terms of trade declines. It implies that unilateral conservation effort by Northern producers will compel the South to move towards more sustainable production process. The result emphasizes that identification of the source of products or „eco-labeling“ is an essential tool for conservation. But under this scenario, the South may decide to move towards conserving more species only for the exported biodiversity intensive product and have lax measures for the capital intensive product. The southern terms of trade will still be increasing in this case. It has important policy implications for the conservation of biodiversity worldwide. As the terms of trade for capital intensive product will be falling in this case and the South will have lax environmental regulations for capital intensive products, it may lead to relocation of capital intensive industries from North to South. Due to an increase in pollution from this relocation, it can lead to a deterioration of Southern biodiversity and all the gains attained from conservation efforts in the biodiversity intensive product may be lost. Also it may give rise to more North-South rift in international trade, as North uses more sustainable practices for both products and south uses only for biodiversity-intensive product and free rides the Northern environmental conservation efforts for the capital intensive product.

Helen DING, Fondazione Eni Enrico Mattei, Italy

### **Modeling climate change and biodiversity effects on the value of ecosystem goods and services: an empirical investigation on the European forest ecosystem**

The paper conducts an empirical investigation on the relationship between biodiversity and the values of ecosystem goods and services that are supported by biodiversity and ecosystem functioning and tries to quantify the magnitudes of this complex relationship. Climate change, here interpreted as increase in temperature, is one of the major drivers today that alter the pattern of biodiversity distribution, affect the ecosystem functioning and change the flows of ecosystem goods and services to be provided by a healthy ecosystem. Therefore, it is an essential first step to determine the most suitable biodiversity indicator that is both sensitive to climate change impact and useful to explain its interaction with ecosystem services. Furthermore, a two-step model is developed to capture the marginal impacts of changes in biodiversity on the value of ecosystem goods

and services due to climate change. Our results show that an increase of 1°C in the local temperature can contribute proportionally to the decrease of marginal value of ecosystem services, but the magnitudes of the impacts vary dramatically depending on the choice of biodiversity indicators, the types of ecosystem services, the geo-climatic region in which the ecosystem is located, and the specific IPCC scenarios under consideration.

Timothy SWANSON, The Graduate Institute- Geneva, Switzerland

#### **A policy framework analysing financial mechanisms for international conservation**

This paper outlines a basic policy framework for thinking about how international conservation financing might be institutionalised. It develops two basic alternatives: a) the creation of a more centralised mechanism for matching suppliers of biodiversity lands with those willing to pay for those supplies; and/or b) the creation of symmetric but linked domestic financing mechanisms to enable domestically registered supplies to be matched to transnational demands. The object of the paper is simply to provide some input to an orderly discussion about such mechanisms, and their relative merits.

### PARALLEL SESSION A2

### SALA GOLDONI

Petronella CHAMINUKA, Wageningen University, The Netherlands

#### **Tourist preferences for ecotourism in rural communities adjacent to Kruger National Park: a choice experiment approach**

Ecotourism is viewed as a possible solution to promote wildlife conservation and rural development in communities adjacent to Kruger National Park (KNP) in South Africa. Some rural communities adjacent to the KNP have expressed an interest to exploit the potential of ecotourism to generate income and promote cultural awareness amongst tourists. There is, however, limited information on tourists' preferences for ecotourism in the area, and their willingness to pay for ecotourism goods and services. The aim of this study is to determine the preferences of tourists, according to origin and income levels, to engage in ecotourism as well as their marginal willingness to pay (MWTP) for three specific ecotourism attributes; namely village accommodation, village tours and visits to crafts markets. Data were collected from 319 tourists through choice experiments, and analysed using a conditional probit model. The study found a reluctance on the part of all tourists to use accommodation facilities outside KNP, although there is interest among tourists of all origin and income groups to purchase village tours and visit village-based craft markets. The MWTP was negative for accommodation for all income groups, but positive for village tours and crafts markets. Among international and high income groups of tourists, MWTP was even much higher than fees proposed for village tours. These results, which are relevant for planners, project managers and other policy makers, suggest there is potential for development of ecotourism in villages adjacent to KNP.

Kiriaki REMOUNDOU, Athens University of Economics and Business, Greece

**More is not always preferred to less: evidence from the use of a public bad in a tax reallocation scheme to value marine ecosystem services in the West Black Sea**

This paper explores the use of a reallocation of the existing public budget scheme as the payment vehicle in a valuation exercise aiming to elicit public preferences for a marine rehabilitation program and examines whether valuation estimates are sensitive to different public budget sources. A split sample approach was used with the two treatments differing only with respect to the alternative public good whose expenditures reduction from the national budget would finance the environmental program under evaluation. Results suggest that, in the context of this study, the alternative public good in the tax reallocation scheme influences preference formation. More interestingly, when respondents perceive the alternative good, whose budget is to be reduced to finance the marine program under evaluation a public bad, a Pareto improvement is achieved through the redistribution of tax revenues.

Although the inclusion of a public good perceived as a bad in the reallocation scheme does not allow for welfare estimates to be elicited, the relative ranking of the attributes of the good under evaluation are estimated. Formal testing revealed that the marginal rate of substitution between attributes is also affected by the choice of the alternative public good. Speculations as to what drives the results and implications for future valuation studies are discussed.

Zoltán SZABÓ, Corvinus University of Budapest, Hungary

**Increasing the validity of valuing biodiversity: reducing protest responses by deliberative monetary valuation**

This paper focuses on increasing the validity of biodiversity valuation. A group deliberation technique (Deliberative Monetary Valuation) is supplemented by a contingent valuation (CV) survey. An exceptionally large number of deliberative forums provided the basis for applying a relatively unproven methodology and comparing the results with CV. Evidence is presented that our interpretation of DMV tackles some of the limitations of CV: a prevalence of lexicographic preference orderings based on psychological reasons and the lack of a priori or well-formed preferences. Both of these may result in protest responses which decrease the validity of results.

Our interpretation of DMV significantly reduced the rate of protest responses by more than half (from 29% to 13%). Along the lines of preference formation issues, a rethinking of the general practice of DMV applications is suggested. A secondary aim of the paper is to explore the wider realm of social value. Elicited new forms of monetary value (fair price, social fair price) indicate a relatively high social value for biodiversity improvements in Middle-Mezőföld, Hungary.

Maria LOUREIRO, Universidade de Santiago de Compostela, Spain

### **An alternative approach to identifying protest attitudes in choice experiments**

Protest responses have been a traditional topic in stated preference (SP) methods, and more specifically in contingent valuation (CV). However, applications dealing with this issue are limited in choice experiments (CE). In this paper we present a novel assessment of protest responses, based on the fact that protest may be hidden under the selection of any choice alternative, and not only behind the status-quo option. Through attitudinal questions and applying a latent class model (LCM) we identify two different classes of individuals, through which we denote protest and non-protest respondents.

We analyze the heterogeneity between both groups and compare our results with a random parameter logit (RPL) model. The results show that if we do not take into account the protest beliefs in our estimations, we would be omitting heterogeneity in the sample.

## PARALLEL SESSION A3

SALA VIVALDI

Elodie BRAHIC, CEMAGREF / LAMETA, France

### **Which instruments to preserve forest biodiversity?**

In general, neither the social norms nor market dynamics stimulate spontaneously activities and practices conducive to biodiversity. The nature of public good of biodiversity leads to its rapid erosion. Even if it can respond positively to social expectations and improve welfare in the long term, taking into account biodiversity often leads to changes in the way we produce or how to exercise its property right. The consideration of biodiversity may determine production losses and income decreases. The forest owners receive their income solely from the wood production, which limits their interest vis-à-vis biodiversity, but more importantly, biodiversity being a public good, they are strongly encouraged to leave up to other owners to maintain biodiversity on their property, to obtain some benefits without bearing the costs. In addition, the length of the production cycle and the difficult integration into the quantitative approaches of the concepts of risk and resilience make it difficult, but not impossible, the development of cost-benefits analysis that would allow a forester (but also the public authority) to estimate the value of maintaining some forms of biodiversity, and their opportunity cost.

Thus, the development of a strategy to stem biodiversity loss requires incentives to change behaviour of different actors. To this end, public policies use various kinds of incentives. The instruments the most frequently used are taxes and levies, subsidies or tradable permits. In most cases, these instruments are applied to the preservation of habitats and ecosystems, only one third of the examples involve direct conservation of species. The use of financial mechanisms or the principle of compensation for preserving biodiversity are still poorly developed.

Through an analysis of the international literature, this paper reviews the incentive schemes designed to influence actors' behaviour, especially managers and owners of private forests, in order to support biodiversity. The aim is to establish a typology of incentives measures to improve the provision of ecological services and to identify novel solutions used abroad that could be used in the French private forest sector.

Géraldine FROGER, Centre for the Study on Globalisation, Conflicts, Territories and Vulnerabilities, University of Versailles Saint Quentin-en-Yvelines, France

### **The efficiency of the Costa Rican payment for environmental services program under discussion**

Since the mid 90's, the ecosystem services and environmental services concepts have enjoyed a growing popularity at the academic and operational levels. According to the authors of the Millennium Ecosystem Assessment (MEA, 2005), ecosystem services are the benefits provided by ecosystems to man. They are divided into four categories: provisioning services (food, water...), regulating services (regulation of floods, droughts, soils degradation, diseases), supporting services (soils formation, nutritional cycle development...) and cultural and amenity services. Environmental services are only one part of ecosystem services: they correspond to the benefits generated by man with the support of ecosystems (Lugo, 2008). They are often considered as public goods and positive externalities by economics theory, not being adequately valued and thus underproduced.

Several works consider either the monetary valuation of environmental services (Costanza and al. 1997; Pagiola and al. 2004; Chevassus-Au-Louis and al. 2009), or the tools allowing to internalize positive externalities induced by these services. To promote the provision of these services, several schemes are possible, one of those being the remuneration of some actions for the maintaining, the restoration or the improvement of a clearly defined service. This refers to "Payment for Environmental Services" (PES).

Largely experimented in developed countries (Europe, USA, Australia), this tool appears less widespread in developing countries where significant obstacles seem to slow down its implementation. Some Latin American countries, such as Costa Rica or Mexico, are often quoted as precursors in implementing PES.

Our contribution will focus on the case of Costa Rica to shed light on the debates over the assessment of PES. In Costa Rica, the PES program (PESP ; «Programa de Pago por Servicios Ambientales» – PPSA), instituted in 1996 by the forest law 7575, is part of a 20 years-long process of forest policy evolution and appears undeniably as a precursor and a model in the developing world (Pagiola, Bishop and Landell-Mills, 2002 ; Sembrès, 2007).

Knut Per HASUND, Swedish University of Agricultural Sciences and Swedish Board of Agriculture, Sweden

### **Indicator-based agri-environmental payments for the efficient supply of public goods**

Biodiversity, cultural heritage, and scenery are major public goods produced in the agricultural landscape. Theoretically, Indicator-based Agri-Environmental Payments have the properties of providing socially efficient production. A system of seven composite state indicators, expressing the public goods of the respective fields or field elements, was developed and tested to assess if the model worked in practical policy implementation. The evaluation indicated a more efficient resource allocation, better dynamic incentives and lower transaction costs, compared to the current Swedish payment programmes. A disadvantage is that such value-differentiated payments do not comply with tailoring and with present WTO- or CAP-regulations of cost-based payments.

Ahmad Jafari SAMIMI, University of Mazandaran, Iran

**Environmental performance index and economic growth: evidence from some developing countries**

The Sustainable economic development is indebted to appropriate use of water, soil, natural resources and the available capacity of human force. The purpose of present paper is to estimate and evaluate the relationship between Environmental Performance Index (EPI) and economic growth in selected developing countries. The studies about this issue have emphasized on economic growth in environment's demolition. But the impact of improvements in environment quality is pointed in this paper, which is the main distinction of this study in comparison with other studies on this issue. To do so we have used a sample of 20 developing countries for which the necessary data were available in 2008. Our findings based on cross-section Weighted Least Squares (WLS) econometrics method indicate that the impact of Environmental Performance Index on economic growth in the countries under consideration is positive and significance.

PARALLEL SESSION A4

SALA CANOVA

John D. CLARKE, Telfer School of Management, University of Ottawa, Canada

**Proactive adaptation to climate change: Building bridges between science and local government**

The global climate is changing. Impacts are increasingly visible, and the trends are undeniable. Nowhere will these impacts be more severely felt than in the human and natural environments that comprise coastal areas. Through support received from the Canadian government, researchers at the University of Ottawa in Canada and the University of the West Indies in Trinidad and Tobago have initiated a joint Canada-Caribbean initiative to assist coastal communities to plan for and adapt to the changes anticipated from sea level rise and severe storm events. Impending changes to coastal ecosystems and to local infrastructure are anticipated to have both direct and indirect impacts to local societies and economies. The C-CHANGE partner communities were selected to reflect a range of conditions including population, reliance on ecological services, and economic conditions, and encouraged to share interests and ideas across the project. Relying largely on available information and data, C-CHANGE teams will assist each partner community in the development of a pragmatic and locally relevant Community Adaptation Action Plan (CAAP). Each CAAP will direct mitigation of sea level rise and severe storm impacts to existing ecosystems and infrastructure and serve as a guide for future development. Working over a five year period, the C-CHANGE university-community alliances will collaboratively evaluate potential impact scenarios, assess adaptation and mitigation tools and recommend changes to policy and planning instruments. The project will also increase capacity to manage climate change impacts through the training of community decision-makers and the creation of a cadre of highly trained graduates skilled in interdisciplinary work.

Federica ROCCISANO, Medalics, Research Centre for Mediterranean Relations, Italy

### **The wellbeing of future generations: new perspectives on economic growth**

Today, developed countries are severely constrained by data such as an aging population and low birth rate, which is recorded in many European Union countries. This kind of data affects not only population growth but also the levels of public spending in each state. This is an extremely urgent problem. Already in 2004 the European Commission Green Paper "A new solidarity between the generations of demographic change" had expressed serious concerns about the future of young people: an aging population on the one hand and the level of public spending on the other, in fact, make unsustainable trends in public finances.

Among the countries most at risk are those that are impacted to a greater liabilities arising from unfunded government pension programs: more than 200% of GDP in France and Italy, and more than 150% of GDP in Germany. In view of this development, it is clear that depending on the level of public spending future scenario could be more or less optimistic for new generations.

Objective of the paper is to show how the idea of generational equity needs to be placed at the base of both the legal reforms in order to focus the needs of new generations, and that fiscal policy to maintain the same capital stock and the same opportunities for present and future generations. In particular, the work omits to deepen the intra-generational equity or equity within the same generation, but deals mainly with the appearance of fairness between generations and therefore different generations (e.g. young and old) and between present and future generations.

Rajinder SIDHU, Punjab Agricultural University, India

### **Economic valuation of innovative agriculture conservation technologies and practices in Indian Punjab**

Indian Punjab, a small state comprising only 1.5 per cent of geographical area of the country and producing about 20 per cent of wheat and 11 per cent of rice production of the country, is an outstanding success story of increasing food grain production. It not only improved food availability to its population but also turned the state into 'food basket' of the country significantly contributing to the national food stocks procured through public agencies. However, serious environment changes were seen with agricultural development in Punjab since 1990. Rice-wheat rotation has disturbed the general water balance of the state. Eighty five per cent of area of the state is facing the problem of falling water table. The fertility of Punjab soils has diminished over the years with deficiency in organic matter, phosphorus and micronutrients such as iron, zinc, manganese, magnesium, etc. Changes in the climate are also showing adverse impact on agricultural production in the state stressing food system. The negative consequences of modern agriculture, based on chemical production technologies and intensive use of natural resources, are becoming more evident in the Punjab state during recent times.

Till the positive impacts of these technologies exceeded their negative fallouts, these were strongly promoted by the policy environment facilitating fast and widespread adoption by the farmers. Recently, however, the Punjab agriculture seems to have been approaching towards a stage, where negative outcomes have started overshadowing the economic as well as noneconomic benefits of intensive agriculture.

Various technologies have been developed and promoted for addressing the negative outcomes of the intensive agriculture. Most of these technologies, aim at conserving ground water, improving soil health, preventing soil erosion/run-off, reducing the use of plant protection chemicals, promoting crop residue management, providing protective environment for crop cultivation (net-houses), and improving resource productivity in watershed regions of the state. Although, there exists a large set of evidence on the extent of resource degradation and impact of such technologies, in physical terms, a serious effort on estimating the economic impact has been lacking. Such lack of information, perhaps, is the most important reason for poor adoption of such technologies by the farmers, seriously undermining the sustainability of natural resources and economic viability of farming in the state. This investigation, therefore, attempts to examine the extent of such diverse degradation of resources in agriculture and estimates the economic implications of various agricultural conservation technologies and practices aiming at achieving the long-term economic and ecological sustainability.

Karl WURSTER, U.S. Agency for International Development, Morocco

**Analyzing the impact of charcoal harvest and land management type on vegetation regeneration in the Tambacounda region of Senegal**

Households throughout Sub-Saharan Africa depend on fuelwood (firewood and charcoal) as their primary source of energy. In Senegal, increasing demands for charcoal by urban consumers has led to intensified harvesting of wood for charcoal production in the Tambacounda region. Forest management projects have been created in the region to reduce degradation caused by charcoal production. This study analyzes tree diversity and regeneration patterns in the Tambacounda region to determine the effect of tree harvesting for charcoal production on plot structure, tree species composition and forest regeneration and assess the effect of forest management types on forest composition and regeneration near charcoal production sites. Results from this study demonstrate that species composition and structure in harvested and undisturbed plots are significantly different. Regeneration of common species such as *Combretum glutinosum* (53% of the total surveyed population) is robust in all harvested plots. Large, hardwood tree species are rare in both harvested and undisturbed plots and lack sufficient populations replace the current population. Harvesting is spread throughout the regions and plots regardless of proximity to villages, roads and park edges are equally susceptible to changes in forest structure and composition. Forest management type also appears to have little impact on forest composition before and after harvesting with the exception of species diversity. Co-managed plots have higher species diversity values than government managed plots, but large declines of over 50% in species diversity values were observed between undisturbed and harvested plots. Steady growth rates of resilient species are occurring in all forest management types, but trees are still much smaller in height (4.5m) and diameter at breast height (dbh) (5.4cm) six years after cutting than undisturbed plots (7.7m and 17.5 cm, respectively). A new forest landscape is taking shape in the Tambacouda region, one dominated by fast growing and resilient species. Forest management could play an important role in slowing this change, but currently is having little influence on forest composition, structure and regeneration rates.

Sebastian STRUNZ, Leuphana University of Lüneburg, Germany

**Management of ecosystem resilience as optimal self-protection: A simple, but often non-convex problem**

We interpret management of ecosystem resilience as a problem of finding the optimal level of self-protection. Economists commonly assume that the optimization problem within a simple self-protection framework is convex. We argue, however, that under reasonable assumptions on the ecosystem manager's risk-aversion and properties of the ecosystem this convexity assumption is not generally justified. By numerically scanning the parameter space for risk-aversion and properties of the ecosystem, we show that optimal investment in resilience often implies full self-protection or no selfprotection.

Christine BERTRAM, Kiel Institute for the World Economy, Germany

**Integrating biodiversity indices into a multi-species optimal control model**

Biodiversity is often adversely affected by human activities. This reduces social welfare but may be external to private economic decisions. Consequently, these external effects on biodiversity need to be considered explicitly in economic models, which is only partly reflected in the literature. Biodiversity is either treated only implicitly in models of multiple renewable resources, or it is considered in terms of (genetic) variability or species richness only, but not in terms of biodiversity indices that simultaneously account for both species richness and evenness. However, both constitute important dimensions of biodiversity. This paper explores the effects of integrating such biodiversity indices into an economic optimal control model. It thus integrates non-use values derived from the existence of multiple renewable or living resources into a social welfare function. The model considers interactions between a general economic activity and the growth of two competing living resources. Conditions for optimal management are derived. The main findings include that a unique equilibrium that satisfies sufficient optimality conditions can be determined even though the biodiversity index is non-concave. Compared to a model set-up with a monotonically increasing, concave value function, steady state stocks are distributed more evenly and biodiversity is higher when the biodiversity index is applied. However, the total number of individuals in steady state is higher when a monotonically increasing, concave value function is applied.

Shiri SHAMIR, University of Haifa, Israel

**An interior optimal species preservation policy for the symbiotic Noah's ark problem**

Weitzman's (1998) seminal work applied the metaphor of Noah's ark to the problem of species preservation under budget constraints. One of Weitzman's main results is that the optimal policy is an extreme policy (almost all species either survive or die out). Here we consider the symbiotic Noah's Ark problem with two types of species: a keystone species and a keystone-dependent species, which relies on the keystone species for survival. We prove that under uncertainty environments, as in Weitzman (1998), without the independence property, in our symbiotic model, there exists a unique optimal policy which is also interior. Moreover, we find that under an interior optimal policy, the expenditure on the keystone species is greater than half the given budget.

John ROLFE, Centre for Environmental Management - CQUniversity, Australia

**Valuing protection of the Great Barrier Reef with choice modelling by management policy options**

In this paper the results of a choice modelling experiment to value increased protection of the Great Barrier Reef in Australia is reported. The valuation experiment that has been conducted is novel in two important ways. First, different management policies to increase protection have been included as labels in the choice experiment to test if the mechanisms to achieve improvements are important to respondents. Second, the level of certainty associated with predicted reef health has been included as an attribute in the choice profiles, helping to distinguish between outcomes of different management policies. The results show that protection values are sensitive to whether protection will be generated by improving water quality entering the reef, increasing conservation zones or reducing greenhouse gas emissions, and the level of certainty of outcomes. The average household willingness to pay for five years for each additional 1% of protection is approximately \$26.37 when the broad management options to generate improvements were included in the choice sets. These results can be extrapolated to a total value held by Queensland households of \$132.8M to \$171.5M per 1% improvement, depending on the assumptions used about the discount rate.

Tamara FIGUEREDO MARTÍN, Centro de Investigaciones de Ecosistemas Costeros, Cuba

**Economical feasibility of the implementation of the Jardines de la Reina National Marine Park**

In the last 10 years, a lot of scientific information from Jardines de la Reina has been gathered, but this information mainly focuses on ecological issues. There is no research on the environmental benefits of ecosystems. This area is still pending approval as a National Park (JRNP), thus an analysis of economic benefits is compelling to determine the goods and services the area could generate as a result of the conservation of its natural resources (new management tools), evaluating in the long term if it is feasible or not. Cost – benefit methodology was used to evaluate whether the most feasible scenario is the current one or the future one. The future one aims at the implementation of new management and conservation tools and the improvement of tourism infrastructure in the JRNP. To do that, the Net Present Value was used, through the projection of a cash flow for a period of 15 years, with a discount rate of 10 %. To calculate benefits for both scenarios, Total Economic Value Methods were used. For the evaluation of EGS were used different methods, like the Contingent Valuation method; Travel Cost Method, Transfer Method and the analysis of statistical and financial data from users of the area. 38 EGS were identified, 12 were evaluated for Scenario I and 17 for Scenario II. The sum of biotic and abiotic components in Scenario I represents 77 % of the economic and non – economic benefits. In both scenarios, NPV and benefit-cost is above zero, so financially speaking, both are feasible. Nonetheless, the difference of 4.1 US yr<sup>-1</sup> X 10<sup>6</sup> between benefit-cost and 33.8 US yr<sup>-1</sup> X 10<sup>6</sup>, between NPV of scenario II and Scenario I, indicates that under any circumstance, the establishment of a National Park in the Jardines de la Reina area is economically feasible.

Andrea GHERMANDI, Ca' Foscari University of Venice and Fondazione Eni Enrico Mattei, Italy  
**Mapping the global values of recreation in coastal ecosystems: results from a meta-analysis**

The values of the recreational services provided by coastal ecosystems are examined through a meta-analysis of an expanded database of value estimates. This study provides a substantially new contribution in relation to previous meta-analyses in its use of GIS techniques for the characterization of the valued ecosystems, the determination of the spatial variables of the meta-regression model and their application to value transfer. Furthermore, a series of explanatory variables including site accessibility, anthropogenic pressure, level of human development and richness in biodiversity are introduced for the first time in a meta-analysis of coastal recreation and are found to substantially influence values. The meta-analytical value transfer function is applied to produce the first global map of the economic value of the recreational services provided by coastal ecosystems.

### PARALLEL SESSION B3

### SALA VIVALDI

Danesh MIAH, Institute of Forestry and Environmental Sciences, University of Chittagong, Bangladesh

#### **Growth in national income and forest transition in Bangladesh**

Growth in national income is seemed to be interlinked with environmental ups and down. Where economy develops by taking resources from environment, after a level an economy must have to help the environment to keep up both of their sustainability. Environmental Kuznets Curve (EKC) hypothesis explains the interrelationships between the development paths of a nation with its total environmental quality. Deforestation in Bangladesh is the critical environmental concern to the ecologists and environmentalists. The dictation of the national economic growth to the deforestation can be found through the study of EKC. To understand the EKC phenomena for deforestation, the study was undertaken through reviewing the literatures. With the understanding of the different EKC trajectories for deforestation in the different developing countries, the economic development of Bangladesh was attempted to implicate with the EKC. The proven EKC trajectories for deforestation in some regions/countries show a higher income per capita requirement for the turning point.

The study suggests to tunneling in the EKC trajectories for Bangladesh. The type of economic and forest policy that Bangladesh should follow to retard the deforestation is also revealed. Clean Development Mechanism (CDM) and Reduced Emissions from Deforestation and Degradation (REDD) have been suggested for tunneling the EKC in Bangladesh. The study is expected to be useful in forestry development in Bangladesh.

Jihad C. ELNABOULSI, CRESE, SJEPEG, Université de Franche-Comté, France

#### **Environmental regulation under firms' strategic interdependence**

In this paper, we consider a polluting oligopoly and examine the effects of market structure and the number of active firms on environmental taxes in a two-stage full-information Cournot oligopoly game. Firms have different production and abatement costs which depend on dirty or clean used technology. Thus, per unit efficient

environmental taxes are not the same. In the case of full information, firms' production and abatement cost are common knowledge. We analyze the effects of strategic behavior of firms having market power on optimal pollution taxes. Our goal is to understand the performance of environmental taxes and the influence of the market structure on the efficiency in setting environmental taxes. We will show how the government can optimally set environmental taxes to remedy both environmental problems and the industry production inefficiency problem. To do this, we assume that the regulator maximizes an un-weighted social welfare in a two-period game. In the first stage, the government sets firm-specific environmental taxes, and in the second stage, firms compete as Cournot rivals considering environmental taxes as given.

Johannes SAUER, University of Manchester, UK

### **On the empirics of ecosystem services schemes: technology, risk and compliance**

The overall aim of this study is to empirically investigate the cost structure of a management agreement type agri-environmental instrument and to identify factors for cost variation over space and time. We control for the actual level of compliance by using compliance weighted average scheme cost ratios. Beside technological and economic performance measures, we also incorporate risk proxies. In addition, we consider unobserved heterogeneity or path dependency with respect to unknown administrative, spatial and farm specific factors.

Hence, we try to disentangle random and fixed scheme cost effects by applying a bootstrapped mixed-effects regression approach using the empirical case of the Environmental Stewardship Scheme in the UK. Regional and sectoral variation in the scheme uptake and the cost of compliance for the participating farms lead to significant cost effects reflecting heterogeneity with respect to management skills and attitudes, production focus, location, technologies, economic performance and risk.

## PARALLEL SESSION B4

SALA CANOVA

Marko HEISKANEN, University of Eastern Finland, Finland

### **Incorporating biodiversity considerations into conversion of grasslands to CDM plantations**

The reforestation of grasslands in developing countries is analyzed as one eligible project type under the CDM. Third World grasslands are discussed from the perspective of multidisciplinary biodiversity science. Three dual assessments of permanence, additionality and leakage are introduced for biodiversity-specialized carbon management. Similarly, six standardized project types are described. The new biodiversity benchmarks are also initially integrated into the Noss framework. To exemplify the current CDM rules, the paper examines the small-scale CDM project 2694. One result suggests that grassland ecosystems and their biodiversity could be conserved and restored as such under the CDM.

Solenn LEPLAY, SupAgro Montpellier, UMR LAMETA, France

### **Local and national REDD income under alternative designs: theory and illustration from Sumatra**

Implementation of the REDD scheme at the national level requires that participating Southern countries choose their own domestic policies to achieve their emission-reduction target and adequately control domestic emission displacements from one area where emissions are reduced to another area. They can adopt efficient control and command tools to regulate deforestation, as well as incentive mechanisms to change the behavior of agents responsible for deforestation. Payments for environmental services (PES) are frequently cited as an appropriate tool to reduce deforestation caused by agricultural activities in forest frontier area and to help achieve national REDD goals. In the deforestation context, PES are most often contracts signed between individual farmers and a governmental institution in charge of reducing deforestation. Farmers entering the PES scheme accept to change their behavior in order to improve the provision of the environmental service in return for a payment. There is a large array of PES contracts, but the two main payment schemes are either fixed price contracts or opportunity cost schemes. Developing countries wishing to participate to REDD will both have to decide on their deforestation goal and the type of PES contract they want to implement at the subnational level. This choice will mostly depend on their preference in terms of public money management and agricultural surplus.

The aim of this paper is therefore twofold: (1) to compare the outcomes of the fixed price PES and the opportunity cost PES schemes in order to highlight the domestic policy choice of Southern countries with respect to their preferences (2) to analyze what type of Southern countries the donor countries might want to select if not all countries can enter the REDD scheme.

Paul MWEBAZE, Environmental Economics Research Hub, Crawford School of Economics & Government, Australia

### **Quantifying the value of ecosystem services: A case study of honeybee pollination in the UK**

There is concern that insect pollinators, such as honey bees, are currently declining in abundance, and are under serious threat from environmental changes such as habitat loss and climate change; the use of pesticides in intensive agriculture, and emerging diseases. This paper aims to evaluate how much public support there would be in preventing further decline to maintain the current number of bee colonies in the UK. The contingent valuation method (CVM) was used to obtain the willingness to pay (WTP) for a theoretical pollinator protection policy. Respondents were asked whether they would be WTP to support such a policy and how much would they pay? Results show that the mean WTP to support the bee protection policy was £1.37/week/household. Based on there being 24.9 million households in the UK, this is equivalent to £1.77 billion per year. This total value can show the importance of maintaining the overall pollination service to policy makers. We compare this total with estimates obtained using a simple market valuation of pollination for the UK.

Ajay Kumar MAHAPATRA, Regional Plant Resource Center, India

**Environment and poverty: exploring relationship between trade in natural products, cash income and livelihood in sub tropical forest regions of Eastern India**

A growing wealth of information on contribution of forest and other natural products to rural households' livelihoods and local economy in India has come up (Rao and Singh, 1996, Hedge 1997; Narendran et al., 2001). In most of the studies the entire array of products is considered as one group without disaggregating it in term of its nature or market. Further most research so far were in either western dry lands, principally gum-resins belt, or in south western coast's moist forest areas. All in all, there are still a lot of studies needed from 14 agro-ecological regions to have a reliable national statistics on the contributions of non wood forest products to regional and national economy in India. One of the geographic regions understudied is the dry subtropical forest zone of eastern India where live country's maximum number of poor. Orissa and Jharkhand region has more than 40 million people living below national poverty line (Planning commission,...) Owing to its diverse ecosystem and relatively rich biodiversity, the region has a good repository of natural products but role of wild resources in the rural livelihoods is little documented. A non appreciation and non accounting of natural goods into GDP is one of the reason of low investment (2% of state budget) in natural resource management system in the region. Recently, several development efforts have been undertaken to reconcile economic development with livelihood but with meagre attention on biodiversity conservation and its sustainable use. A better grasp of how and why local people use resources around them including forests is deemed critical to the long term realization of both objectives. Therefore, the objective of this study is to provide information on the role of local trade in natural products collected from forest, farm land, upland and to examine the underlying causes and household dynamics to deal product uses in the context of their livelihoods and income. Arguments and counterarguments over the link between poverty and environment has intensified but many regional studies fails to capture intra community variation those who are uniformly poor on a given landscape (Mamo et al., 2007). The attempt is therefore to investigate income from products that poor community have free access but use differently and how it addresses poverty and livelihood issues in a poorest region of India.

Kaysara KHATUN, Basque Centre for Climate Change, Spain

**Competing ecosystem services: An assessment of carbon and timber in the tropical forests of Central America**

The forestry sector is unique in that it not only contributes significantly to global carbon dioxide (CO<sub>2</sub>) emissions through deforestation, pests and fire, but it can also provide opportunities to lower the levels of CO<sub>2</sub> by reducing the amounts already in the atmosphere through storing and sequestering it in soils and vegetation as well as in wood products. In the past, the rationale for forest conservation was simply to sustain the forests' productive role for the timber industry; we now acknowledge forests provide a number of services, timber production being one of them. The Millennium Ecosystem

Assessment (MEA 2005) has classified a number of ecosystems good and services (EGS) provided by tropical forests, namely cultural, provisioning, regulatory and support services. Forest loss is expected to accelerate in the future and according to the MEA, serious impacts are projected on ecosystems and the related services, such as watershed protection, soil erosion control, recreation etc. These impacts will be further exacerbated due to the impacts of climate change, particularly in developing countries, where ecosystems are likely to shift and natural forests areas are expected to decline (Ravindranath et al 2006).

In Central America, deforestation is mainly due to timber extraction as well as land use conversion of forests to agricultural land, thus compensating farmers and nations for the environmental services provided through conservation is generating growing interest worldwide from policy makers to nongovernmental and private decision-makers (FAO 2007). The primary focus of this paper is to carry out an economic assessment by comparing the financial costs and returns of selected EGS, namely carbon and timber in the tropical forests of Central America. Timber is unusual from the other EGS provided by forests in that it competes with the other services, i.e. biodiversity, recreation and water services. Carbon storage is the non-timber value most often included in forest accounts and can be equated directly with timber available in terms of biomass content.

The study provides a quantitative appraisal of the carbon and timber stocks and flows of tropical (primary) forests and the associated trade-offs by evaluating them simultaneously using data and market values from a number of sources. The provision of reliable and accurate estimates of the economic value of these services is crucial to plan adequate conservation policies that encourage the protection and sustainable management of tropical forests such as those under REDD/REDD+. This is in line with climate change issues that are currently being debated regarding the role of forestry in the stabilization of Green House Gas (GHG) emissions, officially recognized at COP13 in Bali in December 2007.

David SIMPSON, National Center for Environmental Economics, US Environmental Protection Agency, USA

### **How many times could you replicate polyface farm? A schematic model of ecosystem services in agriculture**

In this paper I ask under what circumstances a farmer would adopt an “ecosystem services” approach to production rather than a “conventional” approach. In the conventional approach farmers are assumed to cultivate all the land available to them (in the interest of brevity, I will use the term “cultivate” to mean “use directly in the production of agricultural output”). They make up for the lack of natural fertilizers, pest control agents, water retention, etc. that preserved natural ecosystems would afford by purchasing inputs. In contrast, farmers adopting an ecosystem services approach preserve land in a more-or-less natural state so as to obviate the need to purchase artificial substitutes.

There is a big difference between the practices of the handful of practitioners of more ecologically benign agriculture, even within the same region. A model describing the choice between approaches should generate sharply different results depending on relatively small differences in underlying factors. I do this by taking at face value the assertion that ecosystem services are very good – in the limit, and in my model, perfect –

substitutes for purchased inputs.

Given this assumption, the model does what it is intended to do: it yields the prediction that farmers will adopt a discontinuous strategy. If the cost of purchased inputs is relatively modest in comparison to the price of output and/or preserved land is not very effective in generating the services that could be obtained from purchased inputs, farmers will adopt the conventional approach of cultivating all available land and purchasing other required inputs. Under the opposite conditions, farmers will adopt the ecosystem services approach, preserving a significant fraction of the land they have available and, by so doing, obviating the purchase of other inputs.

## PARALLEL SESSION C2

SALA GOLDONI

Daija ANGELI, Technische Universität Berlin, Germany

### **Social benefits of implementing a national strategy on biological diversity in Germany**

The Millennium Ecosystem Assessment has drawn the attention of both economists and the public to the meaning of ecosystem services for human well-being and the role biodiversity plays in maintaining these services. In this paper we present results from a contingent valuation study determining the benefits people would derive from implementing a national strategy on biological diversity in Germany, i.e., the provision the ecosystem service maintenance of biodiversity. In an online survey respondents were presented three randomly selected conservation programmes from the following six ecosystem specific programmes: forests, arable land, pastures and meadows, peatlands, flood plains, and dry grasslands. Subsequently, respondents were presented one of two different overall programmes for Protecting biological diversity in Germany. One programme consists of all six ecosystem specific programmes, the other additionally included a climate change precaution by implementing protection measures on a 20% bigger area. Each time respondents were presented a single bounded dichotomous choice question asking for their willingness to pay (WTP) framed as a referendum. Results indicate that benefits from implementing the strategy would be substantial. Modelling results from the random effects probit reveals that the choices are significantly influenced by observable explanatory variables such as number of nature related trips and conservation activity and shows that the four choices are correlated. However, using different functional forms reveals that the results are very prone to model specification, especially when response uncertainty is taken into account. Thus, the preferred WTP estimates results from the non-parametric Turnbull lower bound estimator based on responses adjusted for response uncertainty.

Carlos MARTIN-CANTARINO, Multidisciplinary Institute for the Environmental Studies, University of Alicante, Spain

### **May current scientific ecological knowledge be part of the problem?: the role of scientific advice in promoting (or hindering) biodiversity conservation - A case study at El Hondo Nature Park (SE Spain)**

The guiding principles of the EU biodiversity conservation policy, as expressed in their main Directives, are strongly based on the contributions made by scientific knowledge, specially

from the biological and ecological sciences. However, their translation to regional and local policies (the real arena where the conservation of European biodiversity must be played) have in many cases caused conflicts among stakeholders and have not been as effective in guaranteeing the conservation of biodiversity as desired. We expose some cases studied at El Hondo Nature Park (Valencia Region, Spain) where the measures taken by the Environmental Administration, according to the result of a specific EU-funded LIFE research project, for the conservation of the important local population of white-headed duck (*Oxyura leucocephala*), a species protected by the EU Birds Directive, and of the halophilous plant formations existing in the Park, considered priority habitats by the European Directive, have generated a very conflictive situation among local stakeholders which puts at risk the sustainability of whole system. We discuss how normal scientific advice, although scientifically sound, frequently neglects the complexity of the real socioecological system where it must be applied, and precludes political considerations, so jeopardizing the survival of the biodiversity it tries to protect. On the contrary, we give some examples showing that, when these complexity and social considerations are taken into account through a real collaboration with stakeholders, and taking into account their socio-cultural and economic expectations, the ecological scientific advice on the importance of biodiversity can be assumed and even actively promoted by local stakeholders. However, this requires important changes both in the organization/behaviour of the environmental institutions, at different levels, and in the way that scientific research is conceived and supported by the academic institutions.

Susan DURDEN, U. S. Army Corps of Engineers, Institute for Water Resources, USA

#### **The value of biodiversity - decision making for public lands**

Many public lands, particularly those owned and managed by the U. S. Federal government, are havens for biodiversity. This seems intuitively logical for parks, coastal protected areas and other parcels designated for the stated purpose of environmental preservation. However, the Department of Defense is one of the largest managers of Federal lands. With 30 million acres of land, military bases and related sites are havens and habitat for threatened and endangered species and the communities within which they thrive. For some species, these bases are the largest and most secure habitat available. How is this value captured in the decision making process for current and future uses of this land? This paper addresses the issues surrounding this topic and how economic techniques can contribute clarity and rigor to the discussion. It offers case studies of military bases and dredged material disposal areas where explicit efforts are being made to incorporate the value of biodiversity in the decision making process.

#### PARALLEL SESSION C3

#### SALA VIVALDI

Jorge GUTIERREZ-GARCIA, Alfred-Weber-Institut, Universität Heidelberg, Germany

#### **Pesticide use and wildlife loss: a bioeconomic model of the optimal pesticide policy**

We analyze the optimal pesticide policy when pesticides released from farms harmfully affect wildlife. We develop a dynamic model that incorporates the change in farmers'

welfare and the social benefits when a pesticide policy is implemented. We derive the optimal pesticide policy using a bioeconomic model that gives account of the trade-offs between agricultural production and wildlife. The analysis shows that the pesticide policy depends highly on the economic range in which the agricultural is a profitable activity, as well as the pesticide stock threshold that drives wildlife to extinction. The economic instrument to implement the policy is a discrete tax. We deal in the last section with the tax level and the timing of such policy.

Luca DI CORATO, Swedish University of Agricultural Sciences, Sweden

### **An equilibrium model of habitat conservation under uncertainty and Irreversibility**

In this paper stochastic dynamic programming is used to investigate habitat conservation by a multitude of landholders under uncertainty about the value of environmental services and irreversible development.

We study land conversion under competition on the market for agricultural products when voluntary and mandatory measures are combined by the Government to induce adequate participation to a conservation plan. We determine analytically the impact of uncertainty and policy optimal conversion dynamic and discuss different policy scenarios on the basis of the relative long-run expected rate of deforestation. Finally, some numerical simulations are provided to illustrate our findings.

Bethany COOPER, School of Business, La Trobe University, Australia

### **Urban water restrictions: what drives compliance behaviour?**

An extended and severe drought in southern Australia accompanied by policy failures in the allocation of water resources has created a difficult environment for urban water managers. Mandated restrictions over the use of water are now common place and substantial attention is focussed on the efficacy of different approaches to deal with water shortages (see, for example, ABC News 2009). It has become common for proponents of restrictions to claim that the public supports water restrictions in general and, by implication, the punitive measures that attend them. However, media reports regarding numerous instances of social conflict arising directly from water restrictions appear to be at odds with these views (see, for example, Wells 2007). It is against this background that the interest in compliance, the structure of compliance regimes, and the attitudes of the citizenry in this field is investigated in this study.

Theoretically at least, closer alignment of enforcement with individual preferences implies an increase in social welfare, or at least a fall in the costs of gaining compliance.

In this paper, choice modelling has enabled the development of empirical models of individual preferences for modifying the attributes of a compliance regime. The study is conducted in southern Australia and embodies data from water rich and water poor communities and metropolitan and regional settings. The results suggest that segments of the community have very diverse, strong and often diametrically opposed preferences for compliance measures, making the adoption of a one-size-fits-all approach fraught with political risk.

Johannes SAUER, University of Manchester, UK

### **The marginal cost of producing ecosystem services**

We provide a new approach for assessing the cost of marginal ecosystem changes and the effectiveness of agrienvironmental schemes. The approach is based on a theoretical and empirical analysis of the bio-economic production interactions between marketed outputs and non-marketed ecosystem services at the micro level. To frame the economic nature of the problem, we employ a generalized joint production model in combination with cost minimization. The generalized joint production framework allows for the consideration of complementary, substitutive and competitive relationships between agricultural production and non-marketed ecosystem services generation and avoids double counting. From this theoretical model we distinguish three theoretical cases depending on the imposed minimum acceptable level of the non-marketed ecosystem services. We employ farm level panel data for the UK to empirically investigate these cases. More specifically, to represent and evaluate the production structure, we estimate first- and second-order elasticities derived from a flexible transformation function. Results show that the majority of farms produce agricultural output and ecosystem services in a complementary relationship. Generation of multiple ecosystem services on the same farm showed either a substitutive or competitive relationship. A change in the composition of the ecosystem services output would have very different implications for individual farms.

Frank WÄTZOLD, University of Greifswald, Division of Landscape Economics, Germany

### **Does proactive biodiversity conservation save costs?**

Ecologists usually argue for a proactive approach to species conservation – it should start before a species is endangered so that a significant risk of extinction can be avoided. In reality, however, conservation often only starts when species populations are already in a critical state. We show that this —laissez-faire approach is not only inferior in terms of conservation; it may also be more costly. This is somewhat surprising because the costs of maintaining populations at a level at which they are not endangered occur over a longer period. However, the costs of bringing species populations back to those levels may be so high that they outweigh the costs of the pro-active approach. We develop simple cost functions that capture the main economic and ecological parameters relevant to our argument and apply them for an assessment of the costs of common hamster (*Cricetus cricetus*) conservation in Mannheim, Germany. We find that a proactive approach would have saved between €17.2 mn and €36.4 mn compared to the laissez-faire policy that was actually employed. As laissez-faire policies are widespread our findings suggest that becoming more proactive would not only be better for conservation but also generate significant cost-savings.

Antti MIETTINEN, MTT Agrifood Research Finland, Finland

### **On production costs of biodiversity zones on arable land and in forests adjacent to fields**

Biological diversity in agricultural environments has decreased as a result of intensified farming and monoculture. In the European Union, the measures of agri-environment

support schemes aim at responding to this decrease, but novel and cost-effective measures to safeguard and conserve biological diversity are required.

This study compares costs and income losses incurred to a private landowner from biodiversity zones established on the border of a field and on the border of a forest adjacent to a field. The purpose of the biodiversity zone located in a forest abutting to a field is also to increase the diversity of species in the agricultural environment and to produce meadow-like habitats particularly suitable for pollinator insects offering ecosystem services to humans.

A biodiversity zone on the border of a field refers to a 25-m wide zone covered by perennial grasses. No pesticides or fertilisation are allowed on the biodiversity zone and the zone must be mowed annually. An alternative for the biodiversity zone established on a field is a biodiversity zone established in the border of a forest. This zone is also 25-m wide and it consists of a 5-m wide meadow-like treeless part and a 20-m wide transitional zone. The 5-metre wide zone closest to the field is immediately deforested and kept treeless with clearings repeated every 6-7 years. The 20-metre wide transitional zone deeper in the woods is thinned to the basal area of 8 m<sup>2</sup>/ha and the trees of the transitional zone are managed with light selection fellings every 20 years.

Establishing and managing biodiversity zones incur extra costs and income losses. The zones decrease the landowner's net income streams, since land previously used solely for agriculture (or forestry) is transferred to the joint production of crops and environmental benefits (or wood and environmental benefits). The production costs of biodiversity zones are calculated by subtracting the present values of net income streams of biodiversity zones from the present values of net incomes received of the corresponding fields and forests managed according to current practices and recommendations.

## Tuesday, September 28th

### PLENARY SESSION II

### AULA MAGNA

Joshua BISHOP, International Union for Conservation of Nature, Switzerland

#### **The Economics of Ecosystems and Biodiversity (TEEB): Overview and research implications**

The Economics of Ecosystems and Biodiversity ([www.teebweb.org](http://www.teebweb.org)) initiative is a major international initiative to draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics and policy to enable practical actions moving forward. TEEB was inspired by the Stern Report and built on the Millennium Ecosystem Assessment. It is a three-year endeavour that begun in 2007 under the supervision of the United Nations Environmental Programme.

The focus of the initiative has not been to publish “big numbers” like in the first generation of economic valuations of ecosystem services, but rather to raise awareness on the consequences of not acting timely on the loss of biodiversity. TEEB is also concerned with the link between poverty and conservation (which ecosystem services are important to the poor, what management regimes are more conducive to sustainability and poverty reduction).

A whole specific focus of TEEB has been the ethical implications of discounting, advising that low discount rates are best for guaranteeing fair sustainable resource uses for future generations. The corporate sector is also another area of interest of TEEB in that companies depend and have impacts on ecosystem services as part of their productive activities. TEEB has developed a specific document for corporate business and ways for them to not only mitigate impacts but also achieve net positive impact (such as in the case of biodiversity offsets that bring biodiversity to a higher level than before a company’s intervention).

## PARALLEL SESSION D1

## AULA MAGNA

Amjath BABU, Institute for Agricultural Policy and Market Research, Germany

### **Gifting for ecosystem services: Economic and ecological analysis of soil biodiversity services in agricultural lands**

Soil organisms are essential service providers for all ecosystems by providing a variety of functions such as recycling of nutrients, controlling physical structure of soil, enhancing nutrient absorption by plants, protecting plants from diseases and augmenting plant health (Altieri, 1999). In ecological terms, soil organisms have value in the sense that they contribute to the condition or to the „fitness“ of an ecological system where the ultimate objective is the „survival“ (Farber et al., 2002). Nevertheless, ecological services provided by the soil biota have value in an economic sense, only when they are scarce (Underwood, 1998). The value is reflected by the price, which is the willingness to pay for a marginal increase in their scarce services (Heals, 2000). The appreciation of functions soil biota when a price can be attached to their services leads to unappreciation of a major share of their contributions to the ecosystem survival. In this scenario a discussion on alternatives to monistic valuation of ecosystem services based on willingness to pay instrument is essential (Norton and Nooman, 2007).

In a capitalistic framework, it is implicitly assumed that goods are having value only when they are exchanged through a market. In this paper, we discuss gifting and reciprocity as an alternate mode of exchange.

Traci BIRGE, ARONIA Research Institute - Åbo Akademi University and Novia University of Applied Sciences, Finland

### **Using social-ecological inventory to identify ecosystem services and stewards of traditional rural biotopes in SW Finland**

Grazed forests, semi-natural meadows, and other traditional rural biotopes (TRBs) in Finland have nearly disappeared, with only 20,000 ha of identifiable TRB biotope left (Raunio et. al. 2008). Traditional rural biotopes are recognized as important ecologically

and culturally. Within the European Union, for example, special agri-environmental subsidies are available to farmers for conservation of these types of landscapes. However, not all landowners and managers of TRBs participate in subsidy or conservation programmes targeting traditional rural biotopes. Postal questionnaires were sent out to all farmers in Raasepori Municipality in SW Finland to try to identify where TRBs associated with agriculture are located and who manages them. The return rate on the 326 postal questionnaires sent out was 40%. An independent evaluation on the likelihood of respondents having TRBs was developed using questionnaire responses and data from the Finnish Agency for Rural Affairs (MAVI). This system was employed to reduce error in respondent interpretations of what traditional rural biotopes are and because inconsistencies were noticed in questionnaire responses. It was also used to identify participants for follow-up research. This study is part of an on-going social-ecological inventory of traditional rural biotopes in SW Finland. The inventory is part of COAST-MAN sub-global assessment under the UNEP-led Millennium Ecosystem Assessment Follow-up Programme.

Norman KWIKIRIZA, Biodiversity International, Uganda

#### **Estimating the role of spatial varietal diversity on crop productivity within an abatement framework: a case of banana in Uganda**

Increasingly, research has indicated that in more risky production environments, genetic variation within species and within population increases the ability to respond to the increasing challenges of environmental stress. This paper analyses the role of banana variety diversity in reducing yield losses associated with biophysical production constraints in Uganda. A damage abatement framework is applied to enable the estimation of the contribution of both direct and indirect inputs to the banana yield per unit area. Primary data was gathered from 120 households. Results indicate that banana variety diversity contributes positively in reducing yield losses caused by biophysical constraints particularly pests and diseases but trade-offs exist.

High banana variety diversity has also a significant but negative direct impact on banana yields. These trade-offs imply that while banana variety diversity should be promoted for its risk reducing effects, its adoption beyond what farmers are practicing will largely depend on their objectives, access to alternative abatement agents and their ability to bear risk. Given the current banana production environment of limited abatement agents and high biotic stress, enhancing diversity appears an important option despite trade-offs.

Andreas KONTOLEON, Department of Land Economy, University of Cambridge, UK

#### **Dependence of the poor on biodiversity: which poor, what biodiversity?**

This State of Knowledge Review examines the evidence on the extent to which the poor depend upon biodiversity. It specifically focuses on the question: which groups of the (differentiated) poor depend, in which types of ways, on different elements of biological diversity? The review focused on two particular types of dependence: (a) biodiversity as offering a means of subsistence or income to the poor; and (b) biodiversity as offering insurance to the poor from risks and shocks, thereby preventing them from falling deeper into poverty.

The methodology for the review included an examination of the peer-reviewed literature, as published in journals and books, and an examination of websites and portals of major organisations/forums working on biodiversity conservation and poverty alleviation. Literature identified through these processes was systematically analysed to examine the empirical evidence on the extent and nature of dependence. Aggregation of the findings from this meta-analysis is difficult, given the methodological differences in the underlying case studies, but this paper reports on the trends that have emerged from this review. There is considerable variation reported in the extent of household income that is contributed by biodiversity-based resources. Some of this dependence is very specific to particular groups, especially the poor. Some multi-sited studies demonstrate variability across different sites, reflecting both the availability of alternative income sources, as well as access issues and previous resource use patterns. Levels of participation in biodiversity based livelihood activities are also high, although there is some variation when this is broken down by wealth class, with the poor typically showing higher levels of dependence. The reviewed studies suggest that the poor tend to depend disproportionately on relatively low value or 'inferior' goods and services from biodiversity, while the more affluent groups may get interested in such resources if they have higher commercial values (often crowding out the poor in the process). Similarly, risk dependence of the poor on biodiversity takes the form of a last resort, in the absence of alternatives. This dependence of the poor on low value activities (and on biodiversity as a last resort against various forms of risk) may confirm the suggestion in some recent literature of a resource-based 'poverty trap'. This may have important policy implications, as it suggests that the poor may need to break their dependence on biodiversity in order to improve their livelihood outcomes.

## PARALLEL SESSION D2

## SALA GOLDONI

Dafna M. DiSEGNI, School of Management, University of Haifa, Israel

### **Estimating the economic value of climate change effect on ecosystem services via fluctuations in genuine saving index of sustainability**

The present paper presents a new macro-economic approach to value changes in ecosystem services, which relates the value of the stock of resources to its impact on the optimal national growth path. We use the Replacement Cost (RC) to identify the monetary value of a change in natural stocks, responsible for a range of ecosystem services, as a result of climate change, and compute its economic value via its local effect on the national Genuine Saving Indicator of sustainability. The economic rationale for using the index of sustainability is supported by the theoretical model developed in the paper, demonstrating that the optimal national path of growth, derived from a classical growth model is equivalent to the Genuine Saving Indicator proposed by the world bank. We propose to use the approach to value the impact of Climate Change (CC) on ecosystem services at four distinctive climatic areas along an aridity gradient in the eastern Mediterranean basin: Arid, Semi-Arid, Mediterranean and Mesic Mediterranean ecosystems.

Mattia CAI, University of Padua and Fondazione eni Enrico Mattei, Italy

### **Climate and tourism in Tuscany: responsiveness of tourist inflows to climate variation**

The suitability of a location for a number of tourist activities is largely determined by its climate. Regions where tourism and related activities represent an important part of the economy can suffer potentially large economic damages as a result of climate change. This paper presents a fine-scale investigation of the effect of climate conditions on tourist flows to the municipalities of Tuscany, one of Italy's 20 administrative regions.

In order to examine how tourist arrivals and the average length of their stay respond to variation in local weather conditions, an 8-year panel dataset of the region's 254 municipalities was assembled. Using both static and dynamic model specifications, we conduct separate analyses for domestic and foreign tourists.

We find evidence of a non-negligible effect of climate variation on tourist flows. In broad terms, warmer winters and hotter summers are associated with reduced tourist inflows, whereas higher temperatures in the intermediate seasons seem beneficial for tourism. These general results appear to hold regardless of the place of origin of the tourists, even though the observed statistical associations seem stronger for domestic than for foreign tourists, which may reflect their different ability to take the weather conditions into account at the time their travel arrangements are made. The effect of local climate on tourist inflow varies remarkably among destinations offering different types of tourism attractions (e.g. arts-and-business, hill-and-countryside, sea or mountain destinations).

Surendra Kumar SHARMA, Environmental Research Institute and Carman School, India

### **The role of social forestry in poverty alleviation – a case study from India**

The total forest cover of India as per State of Forest Report 2003 is 678,333 km<sup>2</sup>, which constitutes 20.64 % of the geographic area of the country, plays a significant role in biodiversity protection, global environment conservation, landside prevention and soil preservation, headwater conservation, health, recreational and cultural, material production (timber, food such as mushroom etc, fertilizers, feeds, raw material for pharmaceutical and other industrial products, extracted ingredients, greening materials etc). The role of tropical evergreen forests raising the Willow (*salix*) and bamboos in the North-East India has been studied vis-à-vis employment generation and poverty alleviation through social forestry program.

Carlos Adrián SALDARRIAGA ISAZA, Universidad Nacional de Colombia, Colombia

### **Cost-effectiveness analysis of species conservation: an application to a biological corridor in Chile**

Economic development and biodiversity conservation have often been perceived as conflicting activities. In this paper we study the cost-effective allocation of the land in the Cordilleran Protection Area (CPA), Region VIII, Chile, for the conservation of a highly threatened species: the Huemul (*Hippocamelus bisulcus*, *Cervidae*). This area was created under an Act of the Chilean government in 1974. Using a production possibilities frontier (PPF) approach, a linear programming optimization model for a 10-year time period is proposed. Our model takes into account both the preferences of

the species for different habitats and the opportunity cost of the land. We evaluate different possibilities of land allocation and identify cost-effective alternatives in the provision of both conservation and income.

The confirmed hypothesis of this research is twofold. First, it is seen that current management of the CPA is not cost-effective. This happens mainly because the close relationship of the species with its habitat has been neglected. Second, it can be proved that an alternative allocation of the land in the CPA could produce greater economic benefits while maintaining, or even increasing, the Huemul population at the current level. The latter being an idea currently envisioned and shared by different organizations involved in the site.

#### PARALLEL SESSION D3

SALA VIVALDI

Rob LILIEHOLM, The University of Maine, School of Forest Resources, USA

#### **Wildlands and woodlands. A vision for the New England landscape**

New England's distinctive landscape is a testament to the resiliency of the land and the conservation ethic of its people. The remarkable return of the region's forests following an early history of forest clearing and intensive logging offers an unprecedented opportunity to secure a more sustainable future. Today there is more forest cover between Long Island Sound and the Canadian border than at any time in the past two centuries. The 33 million acres of trees, waters, and wetlands that blanket New England provide areas for recreation, hunting, and other traditional uses; wood and other forest products; clean and abundant water; a continental-scale habitat corridor; and a globally important source of renewable energy and carbon storage—key factors in slowing the rate of climate change. It is an expansive landscape worthy of a vision commensurate in its ambition and reach.

The Wildlands and Woodlands vision calls for an unparalleled, long-term conservation effort to retain at least 70 percent of the region in forestland, permanently free from development. This threefold increase in conserved land—spanning treelined communities to rural farm woodlots and vast forestlands—would be achieved through easements from willing private land owners paired with strategic conservation acquisitions and enhanced economic incentives to retain forestland.

Abu SUMON, UNDP Bangladesh, Bangladesh

#### **Incentive based conservation planning and management through ecological zoning and community based ecotourism in ecologically critical areas of Bangladesh**

In 1999 several areas of Bangladesh were declared 'ecologically critical areas' (ECAs). In 2002, the Government of Bangladesh through its Department of Environment (DoE) started to institutionalize a model of management to ensure the conservation and sustainable use of globally significant biodiversity within ECAs. One of the key outputs of the initiative was to prepare eco-specific conservation management plans for the ECAs, one of which is the Sonadia Island. This paper is prepared based on the documentation and learning from GOB/UNDP funded biodiversity management project to which I was a part for long four years.

The main management actions required to stem threats to biodiversity conservation within the ECA include, simultaneously, the control of adverse activities through law enforcement and awareness raising, the provision of alternative livelihoods and incomes for the poorest and most highly dependent resources users, the in-situ and ex-situ conservation of species and the rehabilitation of habitats. Specific requirements include legislating and enforcing existing and new ECA regulations, mangrove regeneration, mudflat reclamation, sand dune stabilization, fishing controls, stray dog control, the use of zoning to protect core habitat and species and the provision of alternative livelihoods via ecotourism and agricultural diversification. A model of comanagement between the government and the local community is necessary for effective biodiversity conservation. Development of an integrated Conservation Management Plan would be the central focus of such initiative.

Zoning is an integral part of Conservation Management Plans, as it is a tool by which conservation plan is realized. Zones, in this regard, are used to describe management actions and to guide and control the human and development activities. Additionally, it is difficult to describe, or even consider, the management of large or complicated sites unless they are divided into a series of zones. In order to develop functional and meaningful zones, an analysis based on the ecological information derived from relevant sources is used. This analysis is supported by field based information and good understanding of current land use and development pattern on the ground. Planning for alternative sustainable livelihoods would be the central purpose of ecosystem specific operational zoning.

Current tourism at the site is virtually non-existent, however a limited amount of tourism in the form of ecotourism is recommended for the site as an important component the strategy for biodiversity conservation. Ecotourism activities around turtle observation, bird watching and mangrove and mudflat appreciation are tentatively recommended. Interpretation to enhance visitor experience and help them understand, appreciate and enjoy the site and its conservation features will need to be developed in line with ecotourism development requirements.

Margaret M. CALDERON, Institute of Renewable Natural Resources, University of the Philippines, Philippines

#### **Payments for environmental and cultural services and the conservation of the Ifugao rice terraces**

This paper discusses the potential of developing a Payments for Environmental and Cultural Services system that can help in the conservation of the Ifugao Rice Terraces. The rice terraces in four municipalities of Ifugao were inscribed in the UNESCO World Heritage List in 1995 as the Rice Terraces of the Philippine Cordilleras under the category of organically evolved landscapes. However, the terraces have deteriorated over the years, and those inscribed in the World Heritage List have been reclassified to the World Heritage in Danger List in 2001.

The burden of maintaining this global heritage lies in the hands of the Ifugao farmers, whose ancestors carved the terraces from the mountains more than 2,000 years ago. However, there are many problems besetting the terraces, such as damaged terraces due to landslides and earthworms, inadequate water supply and poor irrigation system, and pest infestation. These have resulted in the abandonment of the terraces, which has compromised the sustainability of the rice terraces.

Conserving the Ifugao Rice Terraces in general, and the rice terraces inscribed in the UNESCO World Heritage List in particular, requires substantial funds on a continuing basis, which the limited budget of the local government cannot support. At present, only three municipalities charge minimal fees from tourists, but the revenues from these fees have not trickled down to the level of the farmers. The results of a contingent behavior survey conducted by the authors reveal that the willingness-to-pay of local and foreign tourists for the conservation of the rice terraces is higher than what the municipalities charge. The creation of a market for environmental and cultural services has a good potential, where the sellers and buyers of these services will be the farmers and tourists, water users, and electricity users, among others. The authors thus recommend the development and institutionalization of a Payments for Environmental and Cultural Services system as a sustainable financing mechanism for the conservation of the rice terraces.

Giulia MACAGNO, School of Advanced Studies in Venice Foundation (SSAV) -Ca' Foscari University of Venice and Fondazione Eni Enrico Mattei, Italy

### **The influence of agricultural landscape on tourism flows: An application to Tuscany**

It is widely acknowledged that landscape features can play a major role in determining the tourist destination choice. The analysis presented in this work aims at assessing the impact of agricultural landscape and landscape diversity on regional tourism flows. This paper focuses on Tuscany, a major touristy region in Italy renowned for its pleasant climate and enchanting countryside. Thus, it seemed important to analyse the impact of complex cultivation patterns, and other landscape indicators which have been included as explanatory variables in a regression model encompassing socio-demographic and geographical characteristics of each municipality, accommodation availability, the share of protected area on the municipal territory and in its surroundings, the production of high-quality wines in each municipality and the types of tourism attraction factors. This model has been run to account for total tourist demand, which has then been disentangled into the international and domestic markets. Results allow concluding that landscape diversity indicators can be usefully employed in the description of the tourist destination choice. Agricultural landscape and the production of quality wines appear to exert a positive influence on tourism flows and, interestingly, different choice patterns emerge between international and domestic tourists.

## PARALLEL SESSION D4

## SALA CANOVA

Inge LIEKENS, Unit Environmental Modelling, VITO, Belgium

### **Spatial elements in a valuation function for nature development**

Since the nineties ecosystem goods and services and their evaluation are given a growing interest. Although a large number of studies are done, it is very difficult to use the results in policy. Until now, the value of nature and landscape is mostly taken into account in social cost benefit analysis in a qualitative way. This is due to a lack of good and reliable key indicators. We developed a valuation function for the creation of natural areas, taking into account that the results need to be easily applicable for benefit transfer and cost-benefit

analyses. We generate this function through a choice experiment taking account of the following attributes: type of nature, distance to the home of the respondent, size of the (semi) natural land use, availability of walking and biking trails, biodiversity (richness in species) and adjacent land use. This function is based on an internet-based choice experiment, completed by 2000 respondents. Socio-demographic variables are used to check representativeness.

The results learn that people appreciate an increase of nature area in their neighbourhood. Forest is valued higher than other types of nature (natural grassland, heathland, marshes...). A scope effect is found in the sense that every extra ha of natural land use has an additional value. Distance decay effects are found, meaning that people attach less value to natural land use further away.

The function has important informative value for policy makers considering the creation (and removal) of natural land use on a large scale (region, provinces...). According to our knowledge this is the first paper including size and distance together with so many nature types as attributes in the choice experiment what makes benefit transfer easier

Maia DAVID, AgroParisTech - INRA, UMR Economie Publique, France

#### **Agri-environmental policies when the spatial pattern of biodiversity reserves matters**

The aim of this paper is to compare different policy instruments for cost-effective habitat conservation on agricultural lands, when the desired spatial pattern of reserves is a random mosaic. We use a spatially explicit mathematical programming model which studies the farmers' behavior as profit maximizers under technical and administrative constraints. Facing different policy measures, each farmer chooses its land-use at the field level, which determines the landscape at the regional level. A spatial pattern index (Ripley L function) is then associated to the obtained landscape, indicating on the degree of dispersion of the reserve. We compare a subsidy per hectare of reserve with an auction scheme and an agglomeration malus. We find that the auction is superior to the uniform subsidy both for cost-efficiency and for the spatial pattern of the reserve. The agglomeration malus does better than the auction for the spatial pattern but is more costly.

Katrin REHDANZ, Christian-Albrechts University of Kiel, Germany

#### **Species diversity and human well-being: a spatial econometric approach**

Economic valuation of biodiversity is generally carried out by applying revealed or stated preference approaches to determine people's willingness to pay for small changes in management options. Studies on species preservation investigating passive or nonuse values typically rely on stated preference methods such as the contingent valuation approach and often focus on single animal species. The total value of species preservation can only be derived by aggregating the various values. This paper proposes a different approach by investigating country level data on life-satisfaction attempting to explain differences in subjective well-being by reference to amongst other things species diversity. While most recent papers have concentrated on finding determinants of life-satisfaction other than income, little attention has been drawn to spatial interdependencies. Most researchers investigating the determinants of life-satisfaction implicitly assume that subjective well-being is unaffected by events in neighbouring locations. The existence of spatial relationships in the data has implications for the

econometric techniques typically employed including misleading inference testing procedures, bias and inconsistency depending on the precise form of the spatial relationship. We extend our analysis by a spatial econometric approach investigating whether and to what extent spatial relationships exist. Spatially weighted variables are shown to be a highly significant determinant of life-satisfaction. As nature does not respect man-made borders, neither does peoples happiness. Furthermore, even when controlling for a range of other factors we find a significant relationship with species diversity; the higher a countries number of bird or mammal species or the lower the percentage of bird species threatened the more satisfied the people are. Overall and from a human perspective, bird species seem to be a better indicator for biodiversity.

Felicita SCAPINI, University of Florence, Italy

### **Spatial issues in biodiversity conservation – the case of the Maremma Regional Park**

A simple definition of species as invariant unit follows from the naïve requirement that science should simplify the reality. Bachelard (1934) pointed out that the scope of science is to make reality complex in order to understand it. And reality is indeed complex. The multifold relations of the elements (species, populations, communities...) of an ecosystem are generally simplified to deal with, especially when mathematical descriptive models are searched for. Regarding biodiversity, (apparently) simple indices have been developed to measure and compare biodiversity of different habitats as well as biodiversity changes.

The variety of these indices witness the complexity intrinsic in the concept. It is generally proposed to calculate more than one index and possibly analyze gradients (Colinvaux, 1973; Scapini, 2002). Biologists are currently well aware of the complexity of the biodiversity concept and the difficulty to measure biodiversity, but, when they want to start a dialogue with stakeholders (managers and policy makers at all levels, from local to national and international) they are using the concept as it was clearly defined. Taleb N.N. (2007) pointed out that people tend to show higher certainty when they are in fact uncertain about the real relationships.

Moreover, while the concept of biodiversity applies both on the spatial and time dimensions, environmental management is generally made on the spatial dimension only, as the latter dimension would be too complicated to deal with and in some cases appears not necessary for management. However, the increasing concern about the effects of climate change poses the question of the maintenance of biodiversity over time and of the trends of the natural (evolutionary) changes in the long-term. Also the functional dimensions is important for the ecosystems and it is necessary to maintain the functional links between neighbor systems if we want to conserve the ecosystems over time. It may be however very difficult to apply the concept of open-system to a local context, where the real management takes place.

Frans DE VRIES, Stirling Management School, University of Stirling, UK

**On spatial coordination, site clustering and agglomeration payment: the case of wetland management**

This paper employs percolation theory to study how an agglomeration bonus affects the choice of land management practice and subsequently the spatial connectivity of patches of (wet)land. An agglomeration payment without accounting for spatial connectivity results in a smooth transition of farmland into wetland. In case the agglomeration payment accounts for spatial connectivity (payment made to farmers and neighbouring farmers), a small increase in the agglomeration payment can already result in a highly connected cluster of wetland. If the objective is to maximize a single connected area of wetland, then there exists a sharp transition from a non-connected to a connected wetland cluster. Finally, creating a connected cluster of wetland requires a higher financial budget.

Davinder Kumar GROVER, Agro – Economic Research Centre, Punjab Agricultural University, India

**Conservation agriculture, livestock and livelihood strategies in Indian Punjab: synergies and trade offs**

The rapid and significant intensification of rice-wheat cultivation in response to the availability of improved inputs and policy/institutional support has eventually resulted into stagnant or declining grain yields, falling underground water tables and soil degradation, making the present agriculture system as non sustainable in Indian Punjab. Applying conservation agriculture practices typically implies the need to retain crop residues on the soil surface to improve soil organic matter, which reduces the availability of crop residue for livestock production. Thus, to adopt conservation agriculture practices, farmers faced trade-offs between crop and livestock production. Under this context, the present study attempted to research the crop-livestock interactions in the rice-wheat livestock systems of the Indo Gangetic Plains (IGP) to quantify the trade-offs faced by farmers who have adopted or are considering conservation agriculture practices. The research focused to assess: (i) the trade-offs affecting crop and livestock production and natural resource management (NRM); (ii) the impacts of the trade-offs on the livelihoods of poor households; and (iii) their implications for the design of research and extension programmes in support of improved livelihoods and NRM in the IGP. The study has been conducted in six villages of Patiala districts of Indian Punjab based on the sample of 120 farmers adopting Resource Conserving Technologies (RCT) and Non RCT. Study highlighted that RCT households were bigger land holders, larger family sized with better education of the household heads and even better equipped with farm machinery as compared to their counterpart i.e. Non RCT households. At present, a great deal of emphasis is being laid on the modernization of agriculture, with a view to raise the production per unit area, the income of the farmers under sustainable environment. The goal can be achieved only, if the scientific agricultural technology is efficiently adopted at proper time and stage by large number of farmers at their farm. Though, the farmers in Indian Punjab have started picking up RCT, yet its adoption level /rate has been very slow rather disadoption process has also

been started. The main reason responsible for such reverse trend was that the farmers adopted conservation agriculture without following the full package of practices required for conservation agriculture. Conservation agriculture demands to leave more and more crop residues on the soil itself, the RCT farmers rather used the crop residue especially of wheat as feed for their own livestock and or sell in the market for earning of their livelihood. Under such faulty crop residues management practices, the conservation agriculture rather reduced the soil fertility and hence the crop productivities and profitabilities, putting the adoption of RCT under the question mark. Farmers observed that due to inadequate exposure, non-availability of required machines and lower yield had been the major hindrances in the fast adoption of conservation agricultural practices in the state. Keeping in view the multifaceted merits of RCT, the farmers need to be encouraged for its fast adoption. RCT represents a major departure from the past way of doing things. This implies that the whole range of management practice will need to be evolved, evaluated & matched in the context of new systems and disseminated its practices to the farmers for achieving sustainable economic development in general and environment/natural wealth friendly agricultural development in particular.

Stuart WHITTEN, CSIRO Sustainable Ecosystems, Australia

### **Conserving biodiversity through private land managers: integrating adaptive management, economic design and field experience**

In this paper we present an economic design approach to integrate the biophysical and management implementation aspects of the adaptive management cycle. The economic design cycle contains four steps which can be loosely summarised as: problem definition; policy mechanism selection; solution implementation; and monitoring, evaluation and assembly of lessons for the future. The economic design process aids in identifying when a policy intervention is warranted, what market and regulatory failures any intervention would need to overcome, which policy mechanisms are available and the type of refinements required for effective application, and to guide what should be monitored and assessed for future interventions. The theoretical framework presented through the economic design construct is complemented by lessons from the field through case studies of mechanisms implemented in various Australian jurisdictions. Case study results emphasise the benefits from synergies with existing organisational capacities but also suggest the possibility of improved biodiversity conservation measures from an economic design approach.

## PARALLEL SESSION E2

SALA GOLDONI

Maarten PUNT, Wageningen University, The Netherlands

### **Planning marine protected areas: a 1 multiple use game**

The EU Marine Strategy Directive has a regional focus in its implementation. The Directive obliges countries to take multiple uses and the marine strategies of neighboring countries into account when formulating marine strategies and when designating marine protected area (MPA's). We use game theoretical analysis both to find the optimal size of marine protected areas with multiple uses by multiple countries, and to investigate the

influences of multiple use on cooperation. To this end we develop a model in which two specific uses, fisheries and nature conservation, by multiple countries are considered in a strategic framework.

The results of the paper suggest that EU marine policy such as the Marine Strategy Directive and the coming Maritime Policy may help to secure the highest possible benefits from these MPAs if these policies induce cooperation among countries, but only if the policies force the countries to consider all possible uses of marine protected areas. In fact cooperation on a single issue may give a worse outcome than the non-cooperative equilibrium. The results also indicates that cooperation may be hard to achieve because of defector incentives, and therefore if the current policy measures should be strict in enforcing cooperation on all possible uses of MPAs.

Isis SPINOLA-SCHWARTZ, Sustainable Plans International, USA

### **Valuing housing and social services in Marin County**

This report attempts to define the social and economic cost of homelessness in Marin County. Data for the cost analysis comes from various sources including the department of Health and Human Services, Police department, and Ritter Center, a homeless services provider in the County. We also utilized national data from similar studies to fill in the blank where data was unavailable, as some of the costs are based on national or state-wide available funds granted towards assistance in various categories. Because of the lack of a sampling of the homeless population in Marin County, we utilized data from Los Angeles and San Francisco Counties, both in California and that have similar medium household income and medium housing prices, similar jail and incarceration costs, and that also have the same access to State and Federal Funds to assist the homeless population. San Francisco and Los Angeles have developed a 10 Year Plan to End Homelessness and have published complex studies of economic the impact of homelessness on the local, State, and Federal budget, often times these studies focus on the “cost of avoidance” to deal with the issue of homelessness and its consequences, as well as a way to better allocate local, State, and Federal funds. However, the financial impact of dealing with homelessness does not paint a full picture. Costs to society of raising children without shelter and the long term health and psychological impact on their lives, the long term health care costs for individuals sleep outdoors in adverse weather conditions, and the high level of criminalization that impact the homeless population are just a few of the examples often overlooked by the studies.

This paper examines the overlooked costs to individuals and society and proposes to develop a qualitative, and whenever possible, a quantitative analysis of the social, environmental, and human cost of homelessness. Social impacts are difficult to quantify as there is no way to place a value on personal well-being and security that comes from having shelter.

Duncan KNOWLER, Simon Fraser University, Canada

### **A multi-scale framework for evaluating the costs and benefits of alternative management strategies against invasive plants**

According to the Millennium Ecosystem Assessment, invasive alien species (IAS) are one of the most important drivers of biodiversity loss and, furthermore, growing global trade

and transportation are encouraging a rise in the rates of introduction of invasive species. In this paper, we carry out an economic analysis of management strategies for three invasive plant species in British Columbia, Canada: hawkweed, Scotch broom and Eurasian Watermilfoil. For each species, we partitioned the landscape into five alternative states and used a logistic growth model to simulate the invasive species population falling into each state over time. Transitions between states occur as a result of natural processes or management actions. The management strategies we considered include conventional treatment activities and biological control, and we additionally examined an escalation in control costs and specialized management along utility and highway corridors. Based on these analyses we recommend that efforts continue to develop successful biological control programs for hawkweed and other invasive plant species. Land management actions such as grazing management and seeding are also an important component of control programs even though these actions may be costly in the short term. For the management of invasive plants along utility and transportation corridors, nearby areas surrounded by vulnerable, un-invaded habitat should be given priority over those that are not.

#### PARALLEL SESSION E3

#### SALA VIVALDI

Ngoc Thi Khanh QUACH, Nha Trang University, Vietnam

##### **Creation of marine reserves and incentives for biodiversity conservation**

Despite a number of benefits, marine reserves provide neither incentives for fishermen to protect biodiversity nor compensation for financial loss due to the designation of the reserves. To obtain fishermen's support for marine reserves, some politicians have suggested that managers of new marine reserves should consider subsidizing or compensating those fishermen affected by the new operations. The objective of this paper is to apply principal-agent theory, which is still infrequently applied to fisheries, to define the optimal reserve area, fishing effort, and transfer payments in the context of symmetric and asymmetric information between managers and fishermen. The expected optimal reserve size under asymmetric information is smaller than that under symmetric information. Fishing efforts encouraged with a transfer payment are always less compared to those without payment. This reflects the fact that as the manager induces the fishermen to participate in the conservation program, the fishermen will take into account their effects on fish stock by decreasing their effort. Examples are also supplied to demonstrate these concepts.

Ana RUIZ-FRAU, School of Ocean Sciences, Bangor University, UK

##### **Societal preference and non-use values of marine protected areas revealed by choice experiments**

Despite a number of benefits, marine reserves provide neither incentives for fishermen to protect biodiversity nor compensation for financial loss due to the designation of the reserves. To obtain fishermen's support for marine reserves, some politicians have suggested that managers of new marine reserves should consider subsidizing or

compensating those fishermen affected by the new operations. The objective of this paper is to apply principal-agent theory, which is still infrequently applied to fisheries, to define the optimal reserve area, fishing effort, and transfer payments in the context of symmetric and asymmetric information between managers and fishermen. The expected optimal reserve size under asymmetric information is smaller than that under symmetric information. Fishing efforts encouraged with a transfer payment are always less compared to those without payment. This reflects the fact that as the manager induces the fishermen to participate in the conservation program, the fishermen will take into account their effects on fish stock by decreasing their effort. Examples are also supplied to demonstrate these concepts.

Aline CHIABAI, Basque Centre for Climate Change BC3, Spain

### **Valuing the impacts of sea level rise on coastal habitats and ecological services: case study for the Basque Country**

The valuation of the economic losses derived from the decreased level of provision of ecosystem services is currently lacking in most policy-making decision process, but is a necessary step for an efficient allocation of financial resources for conservation and sustainable use of natural habitats, especially under the current climate change threats. Degradation of ecosystems, arising from climate change impacts and consequent sea level rise, could bring serious consequences to human well-beings. However, this is not included in national accounting and in the gross domestic product. This is a major lack in the current national accounting having implications especially in the policy decisions. The economic valuation of ecosystems degradation would play an important role in policy as it could provide highly valuable information to justify the amount of resources that should be invested in order to ensure that the stock of natural capitals is maintained over time. Having accurate information on the welfare changes associated with ecosystem services is therefore of crucial importance for the design of effective conservation strategies.

The paper presents a methodological framework to identify, analyze, map and evaluate the loss and degradation of natural habitats and related ecosystem goods and services (EGSs) that would occur as a result of sea level rise in the coastal zones of the Basque Country, North of Spain. The most appropriate methodology is selected for each type of habitat to get monetary estimates, according to the type of service, type of benefit generated and availability of data.

Preliminary results are presented in terms of loss of welfare associated with an increase in the sea level rise in the Basque Coast for 2100. The ecosystem services under analysis include carbon sequestration, water regulation, natural hazard control and resilience to climate extreme events, soil erosion, scenic beauty, passive use and recreational values.

The results of this study should contribute to raise awareness of local policy makers and urgency of action to address natural ecosystems degradation face to climate change while providing a range of estimates that are vital to make investment decisions in adaptation strategies. The study aims at improving the understanding of the benefits of ecosystems and biodiversity and of the costs of losing biodiversity services that would be imposed to the society.

Fan ZHANG, School of Physical, Environmental and Mathematical Sciences, University of New South Wales, Australian Defence Force Academy, Australia

**Evaluation of the potential economic benefits of NSW-IMOS using improved ocean forecasts**

The Integrated Marine Observing System (IMOS) is an Australian national program for observing the oceans around Australia. As one of its important nodes, the New South Wales Integrated Marine Observing System (NSW-IMOS) aims to provide more accurate descriptions of the East Australian Current (EAC). The purpose of this paper is to introduce and implement a quantitative method to evaluate the economic benefits of the NSW-IMOS to the NSW ocean related sectors. To further explain the method, an example showing the potential economic benefits arising from greater prediction accuracy of factors affecting beach recreation users is provided.

Ayumi ONUMA, Faculty of Economics, Keio University, Japan

**Optimum population and long-run conservation of natural capital stock**

This paper aims at showing how the conservation of a natural capital stock (NCS) differs in the long run, depending on the objective of a local community or economy that owns and utilizes the NCS, by controlling the size of population. We suppose that the economy has the objective to maximize the individual well-being or the total well-being. We show that the NCS will be higher in the long-run under maximizing individual well-being than the total well-being. We also compare them with the states under profit maximization and open access. It is demonstrated that the highest NCS will be attained under maximizing individual well-being, followed by that under profit maximization, which is also higher than the other two states. We also give the necessary and sufficient condition to ensure that the state under the utilitarianism is lower than that under open access.

Anders SKONHOFT, Norwegian University of Science and Technology, Norway

**The maximum sustainable yield management of an age structured salmon population. Fishing vs. Conservation**

This paper aims at showing how the conservation of a natural capital stock (NCS) differs in the long run, depending on the objective of a local community or economy that owns and utilizes the NCS, by controlling the size of population. We suppose that the economy has the objective to maximize the individual well-being or the total well-being. We show that the NCS will be higher in the long-run under maximizing individual well-being than the total well-being. We also compare them with the states under profit maximization and open access. It is demonstrated that the highest NCS will be attained under maximizing individual well-being, followed by that under profit maximization, which is also higher than the other two states. We also give the necessary and sufficient condition to ensure that the state under the utilitarianism is lower than that under open access.

Nicholas HANLEY, Management School, University of Stirling, UK

**Economic values of species management options in human-wildlife conflicts: hen harriers in Scotland**

In this paper, we use the choice experiment method to investigate public preferences over alternative management regimes for a top-level predator in UK moorlands, the Hen Harrier. These birds are at the centre of a conflict between moorland managers and conservation organisations. Illegal killing of Hen Harriers on moorland managed for Red Grouse is considered to be one of the main factors limiting harrier population growth in the UK. Incentives for persecution arise due to the impacts of Hen Harriers on populations of Red Grouse, which are managed for commercial shooting. Numerous alternatives have been proposed to manage this system. We considered three which have emerged from stakeholder debates and scientific enquiry: tougher law enforcement, moving “excess” birds from grouse moors, and feeding of harriers. Results showed that respondents, sampled from the Scottish general public, were willing to pay both for avoiding reductions in harrier populations and for increases, but that these values were lower than those associated with equivalent changes for another raptor sharing the same moorland habitat, the Golden Eagle. Respondents valued a move away from current management, but were largely indifferent to which management option was taken up, suggesting that management options should be selected in terms of relative costs, and on who bears these costs. Differences within our sample of respondents in preferences across management options emerge when a latent class model is estimated.

Elena OJEA, Basque Centre of Climate Change, Spain

**Classifying ecosystem services for economic valuation: the case of forest water services**

Since the release of the Millennium Ecosystem Approach (MEA), studies valuing ecosystem services have grown in the literature. As a consequence of this growing literature, different interpretations exist on the classification of services as derived from MEA, and several studies have argued that this may not be the most appropriate framework when the aim of the analysis is economic valuation. The present work contributes to this debate by reviewing and comparing these critical views in order to: firstly, to clarify the existing confusion in the terminology and interpretations; and secondly, shed some light into a desirable classification and conceptualization of ecosystem services for valuation. To illustrate this, we present an examination of existing primary valuation studies of water related services provided by tropical forests, that we analyze under the MEA classification framework and compare it with an output-based classification, in which the service is defined in terms of their benefits (outputs) to humans. Our results support the idea that an output-based classification should provide with more accurate values and could contribute avoid certain problems such as double counting and potential underestimation of services values.

Chiara TRAVISI, Fondazione Eni Enrico Mattei, Italy

**Economic assessment of forest ecosystem services losses: cost of policy inaction**

This paper presents a bottom-up methodological framework for estimating some of the key ecosystem services provided by forests biomes worldwide. We consider the provision of wood and non-wood forest products, recreation and passive use, and the forests' contribution to climate regulation in terms of carbon sequestration capacity. The valuation framework derives per hectare estimates by applying meta-analysis, value transfer and scaling up procedures in order to control for the existing heterogeneities across world regions and forest biomes. The first part of the study estimates stock values per hectare for each forest ecosystem service in the baseline year 2000 and in the year 2050. Carbon stocks represent, in general, the highest value per hectare, followed by provisioning services, passive use and recreational values. The second part provides an estimation of the welfare loss (or gain) associated with policy inaction in the period 2000-2050 leading to a change in the forest area. Welfare results are mixed and require a careful interpretation. In different world regions, no policy initiative can result in both gains and losses, which appear to be sensitive to the use of lower or upper bounds values per hectare.

**PARALLEL SESSION F2**

**SALA GOLDONI**

Stefan BAUMGÄRTNER, Leuphana University of Lüneburg, Germany

**Pitfalls and potential of institutional change: Rain-index insurance and the sustainability of rangeland management**

Rain-index insurance is strongly advocated in many parts of the developing world to help farmers to cope with climatic risk that prevail in (semi-)arid rangelands due to low and highly uncertain rainfall. We present a modeling analysis of how the availability of rain-index insurance affects the sustainability of rangeland management. We show that a rain-index insurance with frequent payoffs, i.e. a high strike level, leads to the choice of less sustainable grazing management than without insurance available. However, rain-index insurance with a low to medium strike level enhances the farmer's well-being while not impairing the sustainability of rangeland management.

Rahim DARMA, Hasanuddin University, Indonesia

**The development of local organization function for agricultural development in Indonesia**

Rural economic development as a largest part of agricultural development which could be developed as an autonomous unit of government in rural area. Rural development could be done by self-supporting through the strengthening of local organization function with a set of norms and supported by available resources.

Data used in this paper was the result of the research related to the strengthening of local institutions that was carried out in the Martaya Village, West Sulawesi Province, Indonesia. Research results shown that development of irrigation infrastructure, farmer group, and rice mill business could be done based on farmer needs. Farmer group members were dominated by from Bali as self-support transmigration. The development of farmer group encouraged village roads and village regulations that support the government of

autonomous village. The community development activities could be done by local organization and supporting the village development planning and sustainable agricultural development.

Local organizations could be functioned in the activities of joint discussion meeting (Musrenbang) in the village level which was one of the stages in the system of national development planning.

Daniel GREGG, Centre for Environmental Management - CQUniversity, Australia

### **Agriculture vs. the Environment on the Australian rangelands: The case for an alternative to competitive tenders for procuring environmental outcomes**

Policy makers in Australia face challenges to manage rangelands in ways that will optimise both agricultural production and conservation outcomes. Public conservation is difficult because the extent of rangelands, a history of pastoral uses, and complexities in management mean that large areas remain used for private purposes. Over the last two decades there has been an increasing use of public money to directly fund private landholders to increase the output of environmental goods in order to improve conservation management on private lands. However, despite significant investments in purchasing environmental services from rangeland farmers there is little evidence which can show a net improvement in the environmental performance of the rangelands.

The lack of evidence for net environmental improvements may be due more to impacts on the decision function of producers than to a lack (due to the inherent difficulties) of monitoring. In this paper we show, using basic economic decision theory, why current grant-based financial incentive approaches may result in lower environmental outcomes than expected on the Australian rangelands.

This is important as it suggests potential for, at least, poor value for money from such programs and, at worst, undermining of the extant duty of care and/or the natural incentives for the sustainable utilisation of natural resources on rangelands properties in Australia. We propose and describe an alternative approach which, in the long-run, is at least as efficient as competitive tenders. This alternative approach would reinforce existing duty of care clauses, personal conservation motivations, and potentially be self-funding.

The setting for this research was the Australia rangelands, however the results are potentially relevant across a greater scale (rangelands in other countries) and scope (other agricultural industries).

## PARALLEL SESSION F3

## SALA VIVALDI

Jianhua ZHOU, School of economics and management, Beijing Forestry University, China

### **Governing the commons: A case study of the *Tricholoma Matsutake* resource management**

Hardin's seminal paper presents a tragedy of the commons, that is, rationality to individuals sometimes causes irrational result to the society, which is widely confirmed with our observations. How to avoid the Tragedy of the Commons?

There are three different policy proposals: using the public ownership, and providing

public goods and public resources management through a strong central government; privatization, enhanced by clear property rights, exclusive to reduce over-utilization of resources; through community cooperation to achieve sustainable use of public resources. In this paper, a case on the sustainable *Tricholoma Matsutake* management in the Baimaxueshan Nature Reserve in Yunnan Province is presented.

It describes the current problems existing in the utilization of the *Tricholoma Matsutake* resources, introduces the practices of the sustainable *Tricholoma Matsutake* management for *Tricholoma Matsutake* and finally points out the conditions in achieving success community governing the common pool resources and avoiding the tragedy of the commons.

Philippe DELACOTE, INRA- Laboratoire d'Economie Forestière, France

### **Forest products as safety net, deforestation and the tragedy of the commons**

Non-timber forest products (NTFP) are commonly used by poor agricultural households of developing countries to smooth their consumption and to cope with agricultural risk. This paper explores the potential implications of this safety-net use on the landuse choice and labor allocation. We consider that the land-use is a long-run choice variable, while labor allocation is a short-term choice variable. In this context, it appears that risk reduction may have two opposite implications. In the short run, risk reduction tends to reduce the pressure on common resource extraction, while in the long run, risk reduction may tend to increase deforestation.

*Discussant: Jianhua Zhou*

Nir BECKER, Tel-Hai Academic College, Israel

### **A comparative analysis of nature reserves pricing systems**

The issue of pricing nature reserves becomes more relevant as budgetary constraints become a limiting factor for their proper operation. This paper considers and compares different pricing alternatives for managing Nature Reserves (NRs) and applies them to two nature reserves in Israel. We compare 4 pricing strategies: Free entrance, maximum revenue pricing, cost recovery pricing and differential pricing.

These strategies were implemented to both the existing situation and to a development scenario in which an upgrade in the Nature reserve is considered. The analysis was implemented on two nature reserves in Israel: Darga Nature Reserve (DNR), an open reserve where no entrance fee is charged, and Gamla Nature Reserve (GNR), a closed reserve, where an entrance fee is charged. Benefits were derived using the Travel Cost Method (TCM).

Results show that differential pricing is the most cost effective policy. It recovers costs in both policy scenarios with the least dead weight loss (DWL). The consequence of the differential pricing however, is that there is a cross subsidy of the Gamla NR in 45 – 80 percent depending on the scenario analyzed. It was shown that there are conditions in which only a cross subsidy can make a development plan sustainable.

Usually, policy makers differentiate pricing according to the characteristics of the visitors. That is, different prices are determined for domestic and international visitors, the elderly and the young, etc. Differential pricing among different reserves provides another tool for policy makers that can be consistent with cost recovery while minimizing DWL. Another potential advantage is that site differentiating causes less social tension due to the pricing being tailored not to a person, but rather to a site.

Julia TOUZA, University of Vigo Spain

### **Strategic interactions in provision of international environmental public goods**

The paper reports the implications of the current state of the art on the science of strategic behavior for the national treatment of different kinds of international environmental public good.

While many environmental public goods are managed through multilateral environmental agreements aimed at building consensus over time (social norms), others are not. Many of the regulating services identified by the MA, for example, are not subject to agreement. Their provision depends on the independent actions of many countries. For such public goods it is important to have answers to these questions: Is it necessary to cooperate or coordinate with other countries in their provision? Will unilateral action provide a good-enough outcome? When can individual countries or small coalitions of countries enhance provision of public goods? To answer such questions it is necessary to understand the nature of the environmental public goods, the socio-economic conditions in which they are provided, and the nature of the strategic interactions involved. With such an understanding, it is possible to estimate the likelihood that independent voluntary action may produce a 'good enough' outcome.

Nicola GALLAI, Laboratoire Montpelliérain d'Econométrie Théorique et Appliquée and Institut National de la Recherche Agronomique, France

### **Ecosystem services in a general equilibrium setting: The case of insect pollination**

We study the dependence of social welfare upon ecosystem services through the example of insect pollination. Insect pollination is widely used for agricultural production and contributes significantly to the global value of crops. The impact of insect pollinators on the social welfare is assessed within a general equilibrium. What would be the consequences of a production loss due to an insect pollinator decline considering the adaptation of the overall economy and more particularly considering the possible spillovers on others markets? More specifically, how are the consequences on wages and the profits distributed between the producers of pollinated goods and other producers? These questions will be studied within two alternative scenarios for the distribution of property rights over the firms: the case when agents possess and equal share of the productive sector (the egalitarian ownership structure) and the case when each agent possesses one firm (the "polarized" ownership structure). The main result is that all the agents suffer from the shock, hence there is a reduction of welfare, which it is lessen due to the possibility to substitute goods. Furthermore we found that, depending on the parameters qualifying preferences of consumers and technology of firms, the agent who possesses the pollinated activity experiences an utility reduction, whereas the other agent can experience a higher utility. Under the egalitarian distribution of property right this result holds when the technological capacity of firms and the preference for goods are sufficiently high. Under the polarized ownership structure, this result holds when: the technological capacity of firms is sufficiently low. In either case, welfare can increase if the second agent is granted a relatively more important weight in the social welfare criterion.

Tom DEDEURWAERDERE, Université catholique de Louvain, Centre for the Philosophy of Law, Belgium

**Institutionalizing global genetic-resource commons: Towards alternative models for facilitating access in the global biodiversity regime**

The proliferation of intellectual property rights has led to increasing restrictions and commercial pressures on access to and use of genetic resources. These changes present a formidable challenge for the incipient commons-based sharing practices for genetic resources on a global scale amongst scientists, breeders, and between ex-situ collections of microbial genetic material, which have been made possible by new technological breakthroughs. This paper presents a comparative analysis of three cases of global genetic-resource commons, in the fields of microbial, plant and animal genetic resources, with the aim to contribute to the understanding of the challenges faced and to analyze possible institutional solutions. The analysis in this paper shows that, under conditions of appropriate quality control, the use of standard contracts against misappropriation and an initial investment in the creation of social networks, global genetic resource commons can be a desirable and effective solution to provide essential knowledge assets that contribute to conservation and sustainable use of biodiversity with major benefits both for developing and industrialized countries.



## About BIOECON

BIOdiversity and Economics for CONservation (BIOECON) is an interdisciplinary network aiming to advance economic theory and policy for biodiversity conservation. BIOECON assembles economists, lawyers and scientists from leading European academic and research institutions and main European policy organisations working on design and implementation of cutting edge economic incentives for biodiversity conservation.

The network is the outgrowth of a project supported by the European Commission under the Fifth Framework Programme contributing to the implementation of Key Action 2: Global Change, Climate and Biodiversity within the Energy, Environment and Sustainable Development Programme. Fourteen academic and research institutions co-operate in the project headed by the University College of London. Prominent policy organisations also collaborate with the Network to the enhancement of its activities.

The principal aim of BIOECON is to investigate the economic and policy driven forces responsible for decline of biodiversity, and accordingly, to develop and implement tools, i.e. incentive mechanisms, that could halt if not reverse the effects of these forces.

If the objectives of the BIOECON project were to assess, systematise and agree the social science of incentive design for biodiversity conservation at the local, national and global levels, the aims of the derived BIOECON network are: (i) to utilise a multidisciplinary approach to assess the social forces behind biodiversity change; (ii) to assess the ecological and socio-economic consequences of this change, (iii) to comprehend the interplay of these consequences; and (iv) to provide concrete policy responses for addressing biodiversity change. These overarching aims are pursued via individual projects on all three levels of biodiversity, namely the genetic, species, and ecosystem level.



## Conference Partners



### FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei (FEEM) is a nonprofit, nonpartisan research institution devoted to the study of sustainable development and global governance. Officially recognized by the President of the Italian Republic in 1989 and in full operation since 1990, FEEM has grown to become a leading research centre, providing timely and objective analysis on a wide range of environmental, energy and global economic issues.

FEEM's mission is to improve – through the rigor of its research – the credibility and quality of decision-making in public and private spheres. This goal is achieved by creating an international and multidisciplinary network of researchers working on several innovative programmes, by providing and promoting training in specialized areas of research, by disseminating research results through a wide range of outreach activities, and by delivering directly to policy makers via participation in various institutional fora.

FEEM's operations are inspired by some guiding principles. FEEM sets a bold research agenda addressing big questions and emerging issues in the economic and social context. While strictly linked with the academic community, it embraces intellectual curiosity and supports risk-taking in pursuing research. Its agenda emphasizes real world issues and the policy relevance of the outputs.

FEEM brings together researchers from various fields at different levels of experience, in order to fertilize ideas and foster the accumulation of human capital inside and outside the organization. FEEM promotes excellence, boldness of ideas and creativeness, but quality, rigor and impact remain the distinctive features of its activity. Research outputs are theoretically sound, fact-based, and generally validated by the scientific community through peer review processes. FEEM aims at translating analyses into practical ideas, and at presenting them in user-friendly formats to inform and shape the public debate.

While remaining thoroughly Italian in location and perspective, FEEM promotes the international dimension of activities by selecting topics of global importance, by creating networks and partnerships in various countries, and by attracting researchers trained and working abroad.



BASQUE CENTRE  
FOR CLIMATE CHANGE  
Klima Aldaketa Ikergai

### BASQUE CENTRE FOR CLIMATE CHANGE

The BC3 is an excellence research centre created in 2008 as jointly promoted by the Basque government and the Basque University, with the goal of contributing to knowledge on the causes and impacts of climate change, as well as drive advancements in high level research on these

issues. The BC3 has been created both as part of the determined commitment of the Basque government to the promotion of science and research and as an initiative to recruit internationally renowned researchers for the Basque science system.

BC3's research project revolves around four main lines of research: analysis of the adaptation measures to the climate change impacts, research on policies for the mitigation of GHGs emissions, grasping the international dimensions of climate policies and support of the research to complement and inform climate policy making in the Basque Country.

To that end, in 2010 the BC3 relied on a multidisciplinary team of 19 people led by Prof Anil Markandya, an authority in this field. For the following years, the BC3 has set itself the goal to raise the number up to the thirty members of staff projected for 2012.

Despite its humble size, the centre has the capability of generating an important added value for the Basque and the European research system as well as pushing the climate change field as one of the preferential areas of research. The BC3 also has the advantage of its International Scientific Assessment Committee (ISAC), made up by six scientists of global renown: Professor Martin Parry (United Kingdom), Professor David Ulph (United Kingdom), Professor Bert Mertz (Netherlands), Professor Pedro Maria Echenique, Professor Paulina Beato and Inés Macho-Stadler, PhD (Spain).



## CONSERVATION INTERNATIONAL

Conservation International (CI) achieves strategic and lasting conservation outcomes through its work with a vibrant network of global partners. CI is focused on addressing urgent environmental threats as well as the longterm health of Earth's most vital land and marine ecosystems. Working with more than 1,000 partners worldwide, from multinational corporations to local community groups, CI has protected 1.2 million square kilometers on land, in freshwater habitats and at sea—an area large enough to be seen from space.

CI works in more than 40 countries in Latin America, Africa, Asia and the Pacific. CI makes a difference by developing bold, science-based conservation strategies; focusing on the role of biodiversity conservation in improving human well-being; and catalyzing partners to work toward shared goals. The work of CI is demonstrating that conservation can benefit humanity by allowing ecosystems to continue supporting life and so provide the core services that humanity needs; offering ways for communities to create livelihoods from sustainable products; and preserving local aesthetic, cultural and spiritual values. CI leverages conservation achievement through partnerships, engaging nongovernmental groups, local communities, private businesses and government agencies as partners, and providing financial, technical and other support to hundreds of local and international organizations whose visions complement our own. Through these relationships, CI shapes policies, motivate public and private sector change, help communities steward their local resources and encourage the public to embrace conservation.



## **INTERNATIONAL UNION FOR CONSERVATION OF NATURE**

IUCN, International Union for Conservation of Nature, helps the world find pragmatic solutions to our most pressing environment and development challenges. It supports scientific research, manages field projects all over the world and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practice.

IUCN is the world's oldest and largest global environmental network - a democratic membership union with more than 1,000 government and NGO member organizations, and almost 11,000 volunteer scientists in more than 160 countries.

IUCN's work is supported by more than 1,000 professional staff in 60 offices and hundreds of partners in public, NGO and private sectors around the world. The Union's headquarters are located in Gland, near Geneva, Switzerland.



## **UNITED NATIONS ENVIRONMENT PROGRAMME - DEPI**

The United Nations Environment Programme (UNEP) coordinates United Nations environmental activities, assisting developing countries in implementing environmentally sound policies and practices. It was founded as a result of the United Nations Conference on the Human Environment in June 1972 and has its headquarters in Nairobi, Kenya. UNEP also has six regional offices and various country offices.

UNEP is the designated authority of the United Nations system in environmental issues at the global and regional level. Its mandate is to coordinate the development of environmental policy consensus by keeping the global environment under review and bringing emerging issues to the attention of governments and the international community for action.

The Division of Environmental Policy Implementation (DEPI) is responsible for the implementation of environmental policy in order to foster sustainable development at global, regional and national levels. It is also UNEP's focal Division for capacity building, which characterizes most of UNEP's work.

In cooperation with international and national partners DEPI adopts an integrated approach in providing technical assistance, advisory services, and strengthening the environmental management capacity of developing countries and countries with economies in transition. The activities of the Division are needs driven; based on global regional and national priorities.

# ORGANISER



FONDAZIONE ENI  
ENRICO MATTEI

# PARTNERS



**Basque Centre for Climate Change**



**Conservation International**



**International Union for Conservation of Nature**



**United Nations Environment Programme**