



19th Annual BIOECON Conference
**EVIDENCE-BASED ENVIRONMENTAL POLICIES AND THE OPTIMAL
MANAGEMENT OF NATURAL RESOURCES**

21 - 22 September 2017, Tilburg University, The Netherlands

CONFERENCE BOOK



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19th ANNUAL BIOECON CONFERENCE

Evidence-based environmental policies and the optimal management of natural resources

20–22 September 2017, Tilburg University

FINAL PROGRAMME

WEDNESDAY 20 SEPTEMBER	DAY 1: THURSDAY 21 SEPTEMBER		DAY 2: FRIDAY 22 SEPTEMBER	
	8.30	Departure buses Mercure–TiU	8.30	Checkout , and departure buses Mercure–TiU
	8.45 – 9.15	Registration	8.45 – 9.15	Registration
	9.15 – 9.30	Welcome Address	9.15 – 9.30	Final announcements and conference closure
	9.30 – 10.30	Key note lecture 1	9.30 – 10.30	Key note lecture 2
	10.30 – 11.00	Coffee break	10.30 – 11.00	Coffee break
	11.00 – 12.30	Parallel Sessions A1 – A5	11.00 – 12.00	Parallel Sessions D1 – D5
17.30	12.30 – 13.30	Lunch	12.00 – 13.00	Lunch
Departure taxis Auberge – Dudok	13.30 – 15.00	Parallel Sessions B1 – B5	13.00 – 14.30	Plenary Panel Session 2
	15.00 – 15.30	Coffee break	14.30 – 15.30	Parallel Sessions E1 – E5
18.00 – 20.00	15.30 – 17.00	Parallel Sessions C1 – C5	15.30	End of Bioecon 2017
WELCOME COCKTAIL Dudok	17.00 – 18.30	Plenary Panel Session 1	16.15 – 17.30	Farewell lecture Aart de Zeeuw
	18.30	Departure buses TiU – Mercure	17.30 – 19.00	Farewell reception Aart de Zeeuw
	18.45 – 19.30	BIOECON internal member meetings at De Vier Jaargetijden	19.00 – 23.00	Aart de Zeeuw's farewell dinner (special invitation only)
	19.00	Departure taxis Auberge – social dinner location (De Vier Jaargetijden)		
	19.30 – 20.00	Pre-dinner Drinks at De Vier Jaargetijden		
	20.00 – 22.30	Social Dinner at De Vier Jaargetijden		
	22.30	Taxis to Auberge		

Wednesday 20 September 2017

18:00 – 19:30 Registration and Welcome Cocktail

Dudok, Tilburg

Thursday 21 September 2017

08:45 – 09:15 Registration

Foyer Grand Auditorium

09:15 – 09:30 Welcome Address

Grand Auditorium

- Professor Emile AARTS, Rector Magnificus, Tilburg University
- Professor Steve CARPENTER, University of Wisconsin–Madison
- Professor Daan VAN SOEST, Tilburg University

09:30 – 10:30 KEY NOTE LECTURE 1

Professor Martin QUAAS, Christian-Albrechts-Universität zu Kiel
Combining Economics and Ecology for the Optimal Use of Natural Resources

Grand Auditorium

10:30 – 11:00 Coffee break

Foyer CZ109/CZ110

11:00 – 12:30 PARALLEL SESSIONS A1 – A5

11.00 – 12.30 **PARALLEL SESSION A1: Space, Networks and Renewable Resource Extraction**

Chair: Renan GOETZ

C187

Heidi ALBERS, University of Wyoming

Location Choice for Natural Resource Extraction with Multiple Non-Cooperative Extractors: A Spatial Nash Equilibrium Model and Solution Method

Discussant: Efthymia Kyriakopoulou (please contact author for a copy of the paper)

Efthymia KYRIAKOPOULOU, Université du Luxembourg

Natural Resource Management: A Network Perspective

Discussant: Renan Goetz

Renan GOETZ, University of Girona

Tragedy of the Commons and Evolutionary Games on Social Networks: The Economics of Social Punishment

Discussant: Heidi Albers

11:00 – 12.30 **PARALLEL SESSION A2 – Fisheries**

Chair: Maarten PUNT

C186

Max STOEVEN, University of Kiel

Numbers vs Biomass: Second-Best Quota Management for Age-Structured Fisheries

Discussant: Sabrina Eisenbarth

Sabrina EISENBARTH, University of Oxford

Do Exports of Fisheries Products Foster Fisheries Collapse?

Discussant: Maarten Punt

Maarten PUNT, Syddansk Universitet

Sunk Costs Equal Sunk Boats? The Effect of Entry Costs in a Transboundary Sequential Fishery

Discussant: Max Stoeven

11:00 – 12.30 **PARALLEL SESSION A3 – Voluntary Contribution Mechanisms**

Chair: Andries RICHTER

CZ109

Ann-Kathrin KOESSLER, University of Osnabrueck

Exploiting Conformity Concerns to Create Commitment for Public Good Provision

Discussant: Erik Ansink

Erik ANSINK, VU University Amsterdam

Crowd-funding Conservation (and other Public Goods)

Discussant: Andries Richter

Andries RICHTER, Wageningen University

Reciprocal Citizen – Cuts in Public Spending Reduce Voluntary Contributions in a Field Experiment

Discussant: Ann-Kathrin Koessler

11:00 – 12.30 **PARALLEL SESSION A4 – Conservation**

Chair: Jan Tore SOLSTAD

CZ110

Julie SUBERVIE, French National Institute for Agricultural Research

Paying Smallholders not to Cut Down the Amazon Forest: Impact Evaluation of a REDD+ Pilot Project

Discussant: Ben Groom

Ben GROOM, London School of Economics and Political Science

Land Sparing VS Land Sharing: Which Strategy Minimised the Impact of Food Production on Biodiversity in England

Discussant: Jan Tore Solstad

Jan Tore SOLSTAD, Norwegian University of Science and Technology
Economic Perspective on the Nordic Wolf Re-colonization: The Role of Compensation Payments
Discussant: Julie Subervie

11:00 – 12.30 **PARALLEL SESSION A5 – Valuation**

Chair: Amy ANDO

CZ122

Maria LOUREIRO, University of Santiago de Compostela
The Role of Reference Points in Discrete Choice Experiments
Discussant: Thomas Badura

Thomas BADURA, University of East Anglia
A New Approach to Capturing the Spatial Dimensions of Value within Choice Experiments
Discussant: Amy Ando

Amy ANDO, University of Illinois Urbana–Champaign
Valuing Urban Beaches: Distribution of Benefits across Race and Income
Discussant: Maria Loureiro

12:30 – 13:30 Lunch

Foyer Grand Auditorium

13:30 – 15:00 PARALLEL SESSIONS B1 – B5

13:30 – 15:00 **PARALLEL SESSION B1 – Climate Change, Droughts and Adaptation**

Chair: Charles PALMER

C187

Angela DOKU, University of Geneva
Self Confidence and Climate Adaptation in the Nile Basin of Ethiopia
Discussant: Xiaojun Yang

Xiaojun YANG, Xi'an Jiaotong University
Water Scarcity and Cooperation: Evidence from Rural China
Discussant: Charles Palmer

Charles PALMER, London School of Economics
Threshold Effects of Extreme Rainfall Events and Their Impacts on Indian Agriculture
Discussant: Angela Doku (please contact author for a copy of the paper)

13:30 – 15:00 **PARALLEL SESSION B2 – Networks, Nudges and Coordination**

Chair: Anne STENGER

C186

Marie FERRE, Federal Institute of Technology ETH Zürich

External Validity of Experiments in Environmental Economics: Framing and Subject Pool Effects
Among Students and Professionals

Discussant: Laure Kuhfuss

Laure KUHFUSS, University of St Andrews

Spatial Coordination in Payment for Ecosystem Service schemes: Can we Nudge the Agglomeration
bonus to Enhance its Effectiveness?

Discussant: Anne Stenger

Anne STENGER, INRA

Nudging with Heterogeneity in Environmental Sensitivity: A Public Goods Experiment in Networks

Discussant: Marie Ferré

13:30 – 15.00 **PARALLEL SESSION B3 – Imperfect Competition and Environmental Regulation**

Chair: Carolyn FISCHER

CZ109

Cees WITHAGEN, VU University Amsterdam

On OPEC's Evaporating Market Power and Climate Policies

Discussant: Santiago Rubio

Santiago RUBIO, University of Valencia

Consistent Taxation for a Polluting Monopoly

Discussant: Carolyn Fischer

Carolyn FISCHER, VU University Amsterdam

When the Tail can Wag the Dog: Common-Pool Risk Management and Market Power

Discussant: Cees Withagen

13:30 – 15:00 **PARALLEL SESSION B4 – Risk and Insurance**

Chair: Felix JOHN

CZ110

Yuki HENSELEK, University of Freiburg

The Economic Insurance Value of Wild Pollinators in Almond Orchards in California

Discussant: Martin Quaas

Martin QUAAS, University of Kiel

Technology Adoption and Crop Diversity

Discussant: Felix John

Felix JOHN, Helmholtz Centre for Environmental Research
Ecological Vulnerability through Insurance? Potential Unintended Consequences of Index-based
Livestock Insurance
Discussant: Yuki Henselek

13:30 – 15:00 **PARALLEL SESSION B5 – Valuation of Water Ecosystem Services**

Chair: Laetitia PETTINOTTI

CZ122

Valeria TOLEDO–GALLEGOS, University of St Andrews
Relative Willingness to Pay for Ecosystem Services in Scotland: A Comparative Analysis
Discussant: Jasper Meya

Jasper MEYA, University of Oldenburg
Income Inequality and the International Transfer of Environmental Values
Discussant: Laetitia Pettinotti

Laetitia PETTINOTTI, Basque Centre for Climate Change
Benefits form Water Ecosystem Services in Africa and Adaptation to Climate Change
Discussant: Valeria Toledo–Gallegos

15:00 – 15:30 Coffee break

Foyer CZ109/CZ110

15:30 – 17.00 PARALLEL SESSION C1 – C5

15:30 – 17.00 **PARALLEL SESSION C1 – Social Preferences, Imitation, and the Environment**

Chair: Marius OCHEA

C187

Alistair ULPH, University of Manchester
A Theory of Consumption Norms and Implications for Environmental Policy
Discussant: Ngo Van Long

Ngo VAN LONG, McGill University
Sustainable Fishery with Endogenous Evolution of Fisherfolk's Behavior and Biomass Dynamics
Discussant: Marius Ochea

Marius OCHEA, Université de Cergy–Pontoise
Imitation Dynamics in Oligopoly Games with Heterogeneous Players
Discussant: Alistair Ulph

15:30 – 17.00 **PARALLEL SESSION C2 – Tipping Points**

Chair: Florian WAGENER

C186

Matti LISKI, Aalto University

Tipping Points, Delays, and the Control of Catastrophes

Discussant: Anne–Sophie Crépin

Anne–Sophie CREPIN, The Beijer Institute of Ecological Economics

Migrant Remittances can reduce the Potential for Forest Transitions

Discussant: Florian Wagener

Florian WAGENER, University of Amsterdam

Stable Partial Cooperation in Managing Ecological Systems with Tipping Points

Discussant: Matti Liski

15:30 – 17.00 **PARALLEL SESSION C3 – Invasive Species and Pesticide Resistance**

Chair: Justus WESSELER

CZ109

Melina KOURANTIDOU, University of Southern Denmark

Allocation of Research Resources for Invasive Species with a Commercial Value: The Case of the Red King Crab

Discussant: Zachary Brown

Zachary BROWN, North Carolina State University

Voluntary Programs to Encourage Compliance with Refuge Regulations for Pesticide Resistance Management: Results from a Quasi Experiment

Discussant: Justus Wesseler

Justus WESSELER, Wageningen University

Irreversibility, Uncertainty, and Dynamic Pest Resistance

Discussant: Melina Kourantidou

15:30 – 17.00 **PARALLEL SESSION C4 – Species Interactions**

Chair: Emily MOBERG

CZ110

Jons OLAUSSEN, Norwegian University of Science and Technology

Livestock and Carnivores: Economic and Ecological Interactions

Discussant: Anders Skonhøft

Anders SKONHOFT, Norwegian University of Science and Technology

Wildlife Conflicts: Wolves vs. Moose

Discussant: Emily Moberg

Emily MOBERG, Rutgers University
Capital Investment for Optimal Exploitation of Renewable Resource Stocks in the Age of Global
Change Biology
Discussant: Jons Olaussen

15:30 – 17.00 **PARALLEL SESSION C5 – Valuation of Biodiversity Aspects**

Chair: Nir BECKER

CZ122

Ganga SHREEDHAR, London School of Economics and Political Science
Seeing Red, but Acting Green? The Impact of Media Exposure on Altruism towards Biodiversity
Conservation
Discussant: Nonka Markova–Nenova

Nonka MARKOVA–NENOVA, Brandenburg University of Technology Cottbus–Senftenberg
What Counts More – Fairness to Dairy Cows or Fairness to Farmers? The Preference of Conventional
Milk Buyers for Ethical Attributes of Milk
Discussant: Nir Becker

Nir BECKER, Tel–Hai College
Opportunity Costs of Alternative Management Options in an LTER: Application to Ramat Hanadiv,
Israel
Discussant: Ganga Shreedhar

17:00 – 18:30 WB SPONSORED PANEL: Scarcity, resilience and collective action *Grand Auditorium*

Global environmental change (including climate change) is expected to increase the variability of supply of many essential resources, such as freshwater and fish stocks, and where local scarcity or abundance may threaten the livelihood of many people. This increased variability could manifest as regime shifts – large abrupt and persistent changes in the structure and function of the system producing the resource. In developing countries, the government is not always able to effectively manage the use of these resources, and collective action by local communities is needed to ensure their continued availability.

This panel will address under what circumstances increased scarcity of resources may strengthen collective action, and when collective action will break down. The panel will also address what policies are effective in increasing the system's resilience – resilience of the natural system, and of the social system. Special attention will also be given to the intersection between the two, in the form of the insurance value of nature.

Panelists:

Dr. Anne-Sophie CREPIN, Assoc. Professor and Deputy Director, Beijer Institute of Ecological Economics
Dr. Thérèse LINDAHL, Researcher, the Beijer Institute of Ecological Economics
Prof. Stefan BAUMGAERTNER, Albert-Ludwigs-Universität Freiburg

19.30 – 20.00 Pre-dinner drinks

De Vier Jaargetijden

20:00 – 22:30 Conference social dinner

De Vier Jaargetijden

Friday 22 September 2017

8.45 – 9.15 Registration

Foyer Grand Auditorium

9:15 – 9:30 Final Announcements

Grand Auditorium

09:30 – 10:30 KEY NOTE LECTURE 2

Grand Auditorium

John A. LIST, Kenneth C. Griffin Distinguished Service Professor of Economics, University of Chicago
Field Experiments in Environmental and Resource Economics

10:30 – 11:00 Coffee break

Foyer CZ109/CZ110

11:00 – 12:00 PARALLEL SESSIONS D1 – D5

11:00 – 12:00 PARALLEL SESSION D1 – Nudges and Environmentally Friendly Behavior 1

Chair: Haoran MIAO

C187

Mike BROCK, University of East Anglia

The Green, Green-Eyed Monster: Exploring the Impact of Group Cohesion and Environmental Attitudes and Using this Evidence for Energy Policy

Discussant: Haoran Miao

Haoran MIAO, University of Rhode Island

The Effect of Informational Nudges to Promote Voluntary Behavior to Reduce Nonpoint Source Pollution: A Randomized Controlled Trial in the Field

Discussant: Mike Brock

11:00 – 12.00 **PARALLEL SESSION D2 – International Environmental Agreements**

Chair: Michèle BRETON

C186

Hans–Peter WEIKARD, Wageningen University

Members, Supporters and Free–Riders in Public Goods and Common Pool Resource Games

Discussant: Michèle Breton

Michèle BRETON, HEC Montréal

The Impact of Adaptation on the Stability of International Environmental Agreements

Discussant: Hans–Peter Weikard

11:00 – 12.00 **PARALLEL SESSION D3 – Biological Invasions and Pest Control**

Chair: Zachary BROWN

CZ109

Brooks KAISER, University of Southern Denmark

A Case for the Commons: The Snow Crab in the Barents

Discussant: Zachary Brown

Zachary BROWN, North Carolina State University

Bioeconomic Feedbacks from Large–Scale Adoption of Transgenic Pesticidal Corn in the Philippines

Discussant: Brooks Kaiser

11:00 – 12.00 **PARALLEL SESSION D4 – Forests 1**

Chair: Shadi ATALLAH

CZ110

Jonas NGOUHOUE POUFOUN, INRA

Households Livelihoods and Deforestation in the Tridom Transboundary Conservation: A Spatial Analysis

Discussant: Shadi Atallah

Shadi ATALLAH, University of New Hampshire

The Bio–Economics of Managing Invasive Plant Externalities in Forests with Heterogeneous Landowner Preferences

Discussant: Jonas Ngouhou Poufoun

11:00 – 12.00 **PARALLEL SESSION D5 – Management and Valuation of Flood Risks**

Chair: Godwin VONDOLIA

CZ122

Frits BOS, CPB Netherlands Bureau for Economic Policy Analysis

Cost–Benefit Analysis for Flood Risk Management and Water Governance in the Netherlands: An Overview of One Century

Discussant: Godwin Vondolia

Godwin VONDOLIA, The Arctic University of Norway
Preferences of Farmers for Reductions in Flood Risk under Heterogeneous Payment Modes
Discussant: Frits Bos

12:00 – 13:00 Lunch

Foyer Grand Auditorium

13:00 – 14:30 UN-ENV SPONSORED PANEL: SDGs and the Road to Sustainability *Grand Auditorium*

The Sustainable Development Goals (SDGs) have been designed by the United Nations to end poverty, protect the planet, and to ensure prosperity to all. There are 17 Global Goals such as “affordable and clean energy”, “quality education”, “climate action” and “responsible consumption and production”. The SDGs are intended as a call for action, but also as a guideline how current policies need to be revised (and what new policies need to be implemented) in order to achieve the objectives by the year 2030.

This panel, sponsored by the United Nations Environment Programme (UN Environment), will address the issue to what extent SDGs are expected to provide a significant push towards sustainability, and whether alternative measures of sustainability, like Inclusive Wealth and Genuine Progress, can act as complements or substitutes for the SDGs – as a measure of progress towards sustainability, and as a guideline for action. The panel will also address the issue to what extent the SDGs influence actual policy making. Special attention will be paid to the two major factors that critically affect the feasibility of sustainable development – population growth, and the existence of positive feedbacks in the climate system – and how they are addressed in the SDGs.

Chair/ Moderator: Pushpam Kumar, UN Environment

Panelists:

Sir Partha DASGUPTA, Frank Ramsey Professor Emeritus of Economics, Cambridge University
Rick VAN DER PLOEG, Professor of Economics and Director of OxCarre, Oxford University
Herman VOLLEBERGH, Policy Advisor, Netherlands Environmental Assessment Agency (PBL)
Anastasios XEPAPADEAS, Professor of Economic Theory and Policy, Athens University of Economics and Business and University of Bologna, Department of Economics

14:30 – 15:30 PARALLEL SESSIONS E1 – E5

14:30 – 15:30 **PARALLEL SESSION E1 – Climate Change**

Chair: Michael HOEL

C187

Moritz DRUPP, University of Kiel

The Relative Price of Environmental Goods and Climate Policy Evaluation

Discussant: Michael Hoel

Michael HOEL, University of Oslo
The Rise and Fall of Bioenergy
Discussant: Moritz Drupp

14:30 – 15:30 **PARALLEL SESSION E2 – Forests 2**

Chair: Edwin VAN DER WERF

C186

Bryan PARTHUM, US Geological Survey, Science and Decisions Center
Benefits of a Fire Mitigation Ecosystem Service in the Great Dismal Swamp National Wildlife Refuge
Discussant: Edwin van der Werf

Edwin VAN DER WERF, Wageningen University
Logging damage and injured tree mortality in tropical forest management
Discussant: Bryan Parthum

14:30 – 15:30 **PARALLEL SESSION E3 – Sustainability and Natural Capital Management**

Chair: George ZACCOUR

CZ109

Eli FENICHEL, Yale School of Forestry & Environmental Studies
Spatial Aggregation and the Value of Natural Capital
Discussant: Georges Zaccour

Georges ZACCOUR, HEC Montréal
A Survey of Applications of Viability Theory to the Sustainable Exploitation of Renewable Resources
Discussant: Eli Fenichel

14:30 – 15:30 **PARALLEL SESSION E4 – Nudges and Environmentally Friendly Behavior 2**

Chair: Daan VAN SOEST

CZ110

Gert-Jan ROMENSEN, University of Groningen
Tailored Feedback and Worker Green Behavior: Field Evidence from Bus Drivers
Discussant: Daan van Soest

Daan VAN SOEST, Tilburg University
Habits, Intrinsic Motivation and Environmental Policy: A Field Experiment on Household Waste Sorting
Discussant: Gert-Jan Romensen (please contact author for a copy of the paper)

15.30 END OF BIOECON 2017

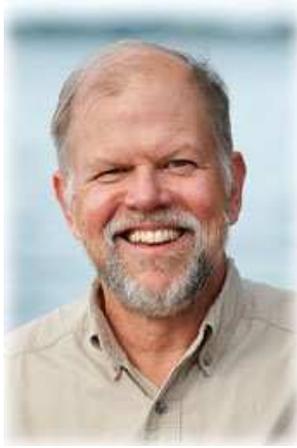
16.15 – 17.30 Farewell lecture Aart de Zeeuw

17.30 – 19.00 Reception for Aart de Zeeuw's farewell

19.00 – 23.00 Aart de Zeeuw's farewell dinner (EXPLICIT INVITATION ONLY)

KEYNOTE SPEAKERS

Steve CARPENTER



Steve Carpenter (Ph.D Economics, University of Wisconsin-Madison, 1979) is a leader of whole-ecosystem experiments and adaptive ecosystem management focused on freshwaters. Topics include trophic cascades and their effects on production and nutrient cycling, contaminant cycles, freshwater fisheries, eutrophication, nonpoint pollution, ecological economics of freshwater, and resilience of ecosystems and social-ecological systems. Carpenter serves as the Director of the Center for Limnology at the University of Wisconsin-Madison, where he is the Stephen Alfred Forbes Professor of Zoology. Carpenter is winner of, among others, the Stockholm Water Prize, the Robert H. MacArthur Award from the Ecological Society of America, the Naumann-Thienemann medal of the International Society for Limnology, and the Martin Award from the Association for the Sciences of Limnology and Oceanography. Carpenter has published 5 books and more than 400 scientific papers, book chapters, reviewed reports and commentaries.

Martin QUAAS



Martin QUAAS is currently Professor of Environmental, Resource and Ecological Economics at the Christian-Albrechts-Universität zu Kiel. Martin Quaas studied Physics at the University of Duisburg-Essen. In 2004 he received his doctorate in Economics at the University of Heidelberg. After working at the Helmholtz Centre for Environmental Research in Leipzig and in the Netherlands, in 2007 Martin Quaas became Professor of Environmental, Resource, and Ecological Economics at Kiel University. He has published some 70 papers on environmental economics and management.

John A. LIST



John List (Ph.D. Economics, University of Wyoming, 1996) is currently the Kenneth C. Griffin Distinguished Service Professor of Economics at the University of Chicago after positions at the University of Central Florida, the University of Arizona and the University of Maryland. John has been at the forefront of environmental economics and has served as senior economist on the President's Council of Economic Advisors for Environmental and Resource Economics. John is also a Research Associate at the National Bureau of Economic Research, a Research Fellow at the Institute for the Study of Labor (IZA), and a University Fellow at Tilburg University in the Netherlands. John has pioneered work using field experiments in which he developed scientific methods for testing economic theory directly in the marketplace. He received the Kenneth Galbraith Award in 2010 and 2008 Arrow Prize for Senior Economists for his research on Behavioral Economics in the field. His work has provided insight on such issues as pricing behavior, market structure, the valuation of non-marketed goods and services, the impact of environmental regulation, the economics of charitable giving and the impact of incentives on education and weight loss.

PARALLEL SESSION A1: Space, Networks and Renewable Resource Extraction

Location Choice for Natural Resource Extraction with Multiple Non-Cooperative Extractors: A Spatial Nash Equilibrium Model and Solution Method

Heidi ALBERS, University of Wyoming, USA

Erik Sterner, Elizabeth Robinson

Abstract: The distribution and extraction of many renewable resources in open access settings reflects the uncoordinated spatial extraction decisions of multiple extractors, especially in lower-income countries with limited property rights. Such extraction settings can be found for timber, non-timber forest products, fish, and wildlife. Yet most economic analyses of extraction decisions, and the resulting spatial patterns of resource use, rely on simplifying assumptions that do not reflect the full spatial decisions of extractors in response to the resource distribution and other extractors' actions. This paper presents a model and solution method that finds spatial Nash equilibria that result from many extractors making uncoordinated decisions about the pattern and number of locations they extract from, and the amount of extraction, in a patchy resource environment. Using variations of the solution method, multiple equilibria with different characteristics are found and analyzed for varying distances between patches. The different model assumptions generally suggest small differences in resource profiles, but much greater differences in the number of extractors found in each patch and the extraction paths used. The solution method obviates the need for outcome-impacting assumptions such as single extraction locations, representative agents, and unmodeled location assignment institutions, and investigates the effects of using these.

Natural Resource Management: A Network Perspective

Efthymia Kyriakopoulou, Université du Luxembourg

Anastasios Xepapadeas

Abstract: Network structures seem to characterize a lot of environmental problems and behaviours. In this paper, we study the role of networks in the management of natural resources by assuming a finite number of agents who exploit a specific natural resource. Harvesting is subject to three external effects, namely resource stock externalities, crowding externalities and positive technological spillovers. We show that the structure of network and the interaction among the agents, as well as the strength of the external effects, determine both the equilibrium and the optimal harvesting amount and the corresponding value of the network. We also study the decisions of harvesting agents with respect to the creation or elimination of cooperation links, which are shown to affect total harvest and aggregate welfare. Moreover, we introduce heterogeneity by assuming different geographical distance between each agent and the resource, which changes agents' incentives for collaboration. Finally, we show that conservation plans change the regulator's objective and increase even further the gap between the decentralized and the optimal outcomes.

Tragedy of the Commons and Evolutionary Games on Social Networks: The Economics of Social Punishment

Renan GOETZ, University of Girona, Spain

Jorge Marco

Abstract: This study revisits the problem of the tragedy of the commons. Extracting agents participate in an evolutionary game on a complex social network and are subject to social pressure if they do not comply with the social norm. Social pressure depends on the dynamics of the resource, the network and the population of compliers. We analyze the influence of the network structure on the agents' behavior and determine the economic value of the intangible good – social pressure. For a socially optimal management of the resource an initially high share of compliers is necessary but not sufficient. The study suggests that the origin of the problem – shortsighted behavior – is at the same time the starting point for a solution in form of a one-time payment. A numerical analysis with a social network formed by 7500 agents and a realistic topological structure is accomplished with empirical data of the Western La Mancha Aquifer in Spain.

PARALLEL SESSION A2: Fisheries

Numbers vs. Biomass: Second-Best Quota Management for Age-Structured Fisheries

Max Stoeven, University of Kiel

Florian Diekert, Martin Quaas

Abstract: Fisheries are often managed by harvest quotas and additional gear restrictions to protect young fish. We study the idea to deregulate fishing gear choice, leaving fishing quotas as the only instrument of the regulator. In this second-best setting, we study a simple change of "currency" for individual fishing quotas: Measuring quotas in terms of numbers rather than in terms of biomass could improve the incentives to target larger fish, thus solving the persistent growth over fishing problem without gear restrictions. The intuition is clear: A fisher has much stronger incentives to select for large fish when she or he has the right to catch a number x of individual fish, rather than x tons of fish. We theoretically derive conditions under which this simple change in the type of quotas leads to welfare gains. We find that the age-dependence of prices, fish weights and natural mortality rates all play a role in determining whether biomass quotas outperform number quotas. We then quantify the effect of biomass and number quotas in an age-structured bio-economic model for the Eastern Baltic Cod trawl fishery. We find that steady-state profits under second-best number-quota management are only 0.5% below the first-best.

Do Exports of Fisheries Products Foster Fisheries Collapse?

Sabrina Eisenbarth, University of Oxford

Abstract: This paper analyses empirically whether exports of fisheries products foster fisheries collapse. A fisheries collapse in Japan is used as an instrument for fisheries exports in countries which do not share fish stock with Japan. The findings suggest that an increase in exports by one percent raises the likelihood of fisheries collapse by around 0.17 to 0.27 percentage points in fisheries which are not shared with Japan.

Sunk Costs Equal Sunk Boats? The Effect of Entry Costs in a Transboundary Sequential Fishery

Maarten Punt, Syddansk Universitet

Abstract: Climate change is likely to result in the uncertain relocation of fish stocks. As a result new countries will emerge that compete for the resource. Although several authors have investigated this issue, most authors assume that entry is free. Although true for some fisheries, this ignores the fact that for other fisheries substantial sunk investments are needed. In this paper I investigate the effect of such sunk entry costs in a sequential fisheries. I model the uncertainty as a shock to the stock dependent fishing costs, in a two player game, where one of the players faces sunk entry costs. I find that, depending on parameters, sunk costs can i) increase the competitive pressure on the fish stock compared to a game where entry is free ii) act as a deterrence mechanism and iii) act as a commitment device. I conclude that entry costs can play a crucial role, and should not be ignored if they are thought to be present.

PARALLEL SESSION A3: Voluntary Contribution Mechanisms

Exploiting Conformity Concerns to Create Commitment for Public Good Provision

Ann-Kathrin KOESSLER, University of Osnabrueck

Abstract: Sustainability pledges for companies are en vogue, but also in climate negotiations pledges on emission reductions are commonly observed. First experimental studies investigated the effectiveness of such public promises in the controlled environment of the laboratory. Contrary to this research, pledges in reality are not taken simultaneously, but in succession. In this study we examine how conformity concerns impact the decision to make a pledge and consequent behaviour. In a public good game, subjects have prior play the possibility to pledge publicly to provide social optimal contributions. These pledges are made voluntarily and taken simultaneously or sequentially. We find sequential elicitation increases pledge-making, particularly when individuals' inherent social orientation is considered in the elicitation order. If initial high-contributors are asked first, also previously low contributors make the pledge due conformity concerns. This commitment nudge however does not come negative behavioural effect. On the contrary, previous low contributors increase their contributions significantly and the pledge helps groups to coordinate on better social outcomes.

Crowd-funding Conservation (and other Public Goods)

Erik ANSINK, Vrije Universiteit Amsterdam

Jetske Bouma, Dominik Hauck, Mark Koetse, Daan van Soest

Abstract: We assess the impact of crowd-funding design on the success of crowd-funded public goods using a lab-in-the-field experiment. Our design treatments aim to increase the efficiency of crowd-funding campaigns by decreasing possible coordination problems that may occur when potential donors are faced with a multitude of projects to contribute to. Amongst others, we explore the potential of seed contributions and the impact of the attraction effect. We implement our crowd-funding experiment using a web-based user interface with multiple threshold public goods over the course of four days, similar in style to conventional crowd-funding websites. Our results show that such alternative crowd-funding designs do not affect the total amount of contributions, but they do affect coordination. These results are of interest for platforms, funders, and project owners of so-called civic crowd-funding projects, many of which relate to nature conservation and environmental protection.

Reciprocal Citizen – Cuts in Public Spending Reduce Voluntary Contributions in a Field Experiment

Andries RICHTER, Wageningen University

Stijn Reinhard

Abstract: Contributions to public goods, such as natural areas, are often made by private actors, as well as governmental agencies. Typically, the motivation of citizens to voluntarily contribute depends on the role of the government and wider motivational factors. An open question is how the motivation changes if the government decreases public spending. We are looking into this in an experiment in The Hague Forest in the Netherlands, which is a large forest in the center of an urban area. Using a field experiment, we ask citizens to perform a small task that generates funding for the forest. We find that, when highlighting that the government does less, the contribution goes down significantly: Surprisingly, this drop can be entirely attributed to frequent visitors, who are the most committed one. Also, we find that the money that is been offered for the task does not significantly affect the probability to participate. Our findings show that decreasing public spending may have unexpected repercussions on citizens motivation to voluntarily contribute. Generally, citizens are unwilling to compensate for such decreases. Even more striking, the probability that the most committed citizens contribute less is actually cut in half. Such behavior, which can be explained with citizens being reciprocal, may pose an additional cost on government policy. Overall, our findings urge governments to consider the effects of public policy on citizens motivations.

PARALLEL SESSION A4: Conservation

Paying Smallholders not to Cut Down the Amazon Forest: Impact Evaluation of a REDD+ Pilot Project

Julie SUBERVIE, French National Institute for Agricultural Research

Gabriela Simonet, Driss Ezzine-de-Blas, Marina Cromberg, Amy Duchelle

Abstract: After decades of command-and-control regulation, it is often argued that new mechanisms targeting small landowners are required in order to achieve further reductions in deforestation in the Amazon. In this context, offering Payments for Environmental Services (PES) has emerged as a potential strategy to achieve both equity and conservation goals. A question of primary importance is therefore: to what extent can a PES program contribute to avoided deforestation? In this paper we evaluate the effectiveness of an early PES-based REDD+ project launched in the Brazilian Amazon. We find that a clear reduction in deforestation rates among participants – although forest cover continues to decline in the treatment group, the loss is smaller than in the control group.

Land Sparing VS Land Sharing: Which Strategy Minimised the Impact of Food Production on Biodiversity in England

Ben GROOM, London School of Economics and Political Science

Charles Palmer, Simon Gillings, Steve Langton

Abstract: With a focus on bird species, this paper examines whether the 'sparing' or 'sharing' of agricultural land in England minimised the impact of food production on biodiversity. The production, species abundance and biodiversity impacts of two policies are evaluated: the European Union's set-aside programme ('land sparing') and Entry Level Stewardship (ELS, 'land sharing'). Fixed-effects are applied to a panel dataset of agricultural land uses, yield, inputs, and bird counts, collected between 1994 and 2014. Preliminary results suggest that set-aside increased bird species abundance but had no impact on biodiversity as measured by a Shannon–Wiener Index.

Economic Perspectives on the Nordic Wolf Re-Colonization – the Role of Compensation Payments

Jan Tore SOLSTAD, Norwegian University of Science and Technology

Eivind Egeland Aronsen, Anders Skonhoft

Abstract: The paper presents some economic perspectives on the Nordic wolf re-colonization with a specific focus on redistribution and compensation policies. We argue that the compensation arrangement of the current wolf management in Norway violates the efficiency criteria both in terms of Pareto optimality and the potential Pareto improvement test. From the perspective of welfare economics, we consider various policies which may remedy the problem. In particular, we discuss whether compensation payments as a management tool may facilitate or impede the process of institutional change and environmental protection.

PARALLEL SESSION A5: Valuation

The Role of Reference Points in Discrete Choice Experiments

Maria LOUREIRO, University of Santiago de Compostela

Abstract: The effect of a reference point on choice decisions is often ignored when analyzing consumer preferences. This reference point may be crucial for understanding choices. In order to show the importance of considering a reference point when assessing preferences, we carried out an application in the context of discrete choice experiments (DCEs) for hybrid electric vehicles (HEV). The novelty of our application relies on the use of individually specified reference points according to elicited data. Three models considering three different potential reference points were estimated and compared to a traditional no-reference model. The results demonstrate that choices are affected by reference points. Furthermore, in the current dataset, the results show that vehicle preferences are strongly based on individuals' current vehicle (status quo). The findings suggest that not considering the reference point may reduce the ability of DCEs to explain actual behavior.

A New Approach to Capturing the Spatial Dimensions of Value within Choice Experiments

Thomas BADURA, University of East Anglia

Silvia Ferrini, Ian J. Bateman, Michael Burton, Amy Binner

Abstract: Both theoretical expectations and empirical regularities indicate that individuals' preferences for spatially located goods vary with distance to those goods. Understanding how value of environmental goods and services is influenced by their location relative to respondents can allow designing optimal spatial distribution of conservation interventions across landscapes. We propose and implement a novel approach to bringing space into choice experiments (CE). Using an investigation of preferences concerning land use change in Great Britain (GB), CE scenarios are presented on individually generated maps, tailored to each respondent's home location. Each choice situation is underpinned by spatial experimental designs relevant to the individual's spatial context and a matrix of British current land uses defined at a 2km scale resolution. We test the effect of our map format for presenting spatial attributes against a commonly applied tabular approach, finding that the former yields both significantly different and more robust preference estimates.

Valuing Urban Beaches: Distribution of Benefits across Race and Income

Amy ANDO, University of Illinois Urbana–Champaign

Claire Munaretto

Abstract: Much research has estimated the recreational values of natural areas, but that research has largely neglected the values of natural areas in urban environments, and has focused on generating total or median household values rather than exploring how benefits are distributed among racial, ethnic, and socio-economic sub-groups of society. This paper fills those gaps by estimating the value of public beaches in the third largest city in the U.S., Chicago, and how the distribution of that value is affected by income, race, access to transportation, and age. We analyze data from a travel cost survey of over 750 diverse households in the greater Chicago area. Results indicate that willingness to pay (WTP) for these urban beaches is especially high among African-Americans in the community, and that WTP first increases but then declines with increasing income. We find that the average resident would be willing to pay about \$385–\$815 for a year's beach season, and that the total net value of the beach system (\$ 2.12–\$4.75 billion) is orders of magnitude more than the cost of maintaining the system. And while other research makes clear that the costs of environmental degradation often fall disproportionately on low-income and minority communities, in this case at least the benefits of this public environmental good accrue disproportionately to them as well.

PARALLEL SESSION B1: Climate Change, Droughts and Adaption

Self Confidence and Climate Adaptation in the Nile Basin of Ethiopia

Angela DOKU, University of Geneva

Abstract: NA

Water Scarcity and Cooperation: Evidence from Rural China

Xiaojun YANG, Xi'an Jiaotong University

Zihan Nie

Abstract: This study examines the impact of long-term exposure to water scarcity on farmers' cooperation. A unique historically formed irrigation water quota system in western China provides an opportunity to exogenously measure variation of water scarcity within an otherwise homogenous region. Specifically, we use the ratio of the arable land to the irrigation water quota of each village as our measure of water scarcity. Moreover, we use both survey questions and economic experiment to measure cooperation. We find a positive and robust relationship between long-term water scarcity and cooperation measured by both the irrigation-related collective activities and contribution in the public goods game. The result suggests that long-term exposure to water scarcity does not only improve collective actions in irrigation-related activities, but also strengthen farmers' preference for cooperation. It implies that as water is more scarcity, the value of collective action increases and thus farmers work more closely together. This better collective action experience in agricultural activities fosters a stronger culture of cooperation, which then spill over to other aspects of life such as their behavior in our experiment.

Threshold Effects of Extreme Rainfall Events and their Impacts on Indian Agriculture

Charles PALMER, London School of Economics

Francisco Fontes, Ashley Gorst

Abstract: Climate change is predicted to be associated with a rise in the intensity and frequency of extreme rainfall events. Such patterns are already observed in India, which is highly dependent on rain-fed and irrigated agriculture. This paper examines the hypothesis that large deviations, either positive or negative, from long-term average rainfall have significant and large impacts on crop production in India. A precipitation-temperature index and a threshold regression approach are applied to meteorological and agricultural data to test for the existence of thresholds in the relationship between rainfall and agricultural production, over the period 1966–2009. Identified thresholds are then used to estimate the magnitude of impact on productivity and frequency of extreme rainfall events over time. For India, significant marginal negative impacts of rainfall deficiency are found for deviations as small as 10% from long-term average rainfall. These impacts become much larger at deviations of about 30%, and even more dramatic at deviations in excess of 40%. Thresholds in arid and semi-arid areas occur at larger negative deviations and impacts at small deviations tend to be smaller than in humid areas. Very large impacts for arid areas are reported at large negative deviations. Sorghum, millet and maize have lower thresholds than rice, wheat and barley. Sub-humid zones displayed a stable, yet increasing (after 1980) proportion of districts affected by extreme rainfall events. The other zones have a more volatile frequency of affected districts over time.

PARALLEL SESSION B2: Networks, Nudges and Coordination

External Validity of Experiments in Environmental Economics: Framing and Subject Pool Effects among Students and Professionals

Marie FERRE, Federal Institute of Technology

Stefanie Engel, Elisabeth Gsottbauer

Abstract: Laboratory experiments are increasingly used to study environmental policy questions. Yet, the external validity of these studies has been generally questioned. We contribute to this methodological discussion by investigating the effect of framing and subject pool in laboratory experiments aimed at studying environmental policy questions. We designed an experiment to study incentives for the adoption of more sustainable land management practices using a modified coordination game. In one treatment, the experiment is highly contextualized and characterizes the situation of farmers and cultivation of their land, while the other treatment uses abstract and context-free wording. We conducted the experiment with professional farm apprentice students as well as with generic university students. We find significant differences in behaviour between the two subject pools, while we find no impact of framing. This result stresses the importance of conducting policy-relevant experiments preferably with individuals that relate more to the subject matter. Yet, for the treatments explored in this study, behavioral differences between subject pools concern the amplitude of the results and not their direction.

Spatial Coordination in Payment for Ecosystem Service Schemes: Can we Nudge the Agglomeration Bonus to Enhance its Effectiveness?

Laure KUHFUSS, University of St Andrews

Nick Hanley, Raphaële Préget, Sophie Thoyer, Frans de Vries

Abstract: The ecological effectiveness of Payment for Ecosystem Service (PES) schemes can often be enhanced if farmers can be induced to enrol in a spatially-coordinated manner. This is because the achievement of many targets for biodiversity conservation policy or water quality improvement is increasing in the spatial connectedness of enrolled land. One incentive mechanism which has been proposed by economists to achieve such connectedness is the Agglomeration Bonus (the AB). There has also been an interest within the literature on PES design in using “nudges” to enhance participation and performance. In this paper, we test whether a specific nudge, more precisely an environmental performance group ranking, can enhance or even replace the impacts of the AB in terms of participation and spatial coordination. The social norm is generated in the lab based on real contributions to an environmental charity representing the environmental benefits generated by a PES scheme, making use of the idea that in real PES schemes, participants may derive utility from the environmental outputs of the scheme as well as the monetary payoffs they receive. Interestingly, we find that this nudge do not significantly supercharge the AB, and can even worsen its performance. Moreover, the nudge mechanism generates too little of incentive to be able to replace the monetary rewards offered by the AB.

Nudging with Heterogeneity in Environmental Sensitivity: A Public Goods Experiment in Networks

Anne Stenger, INRA

Benjamin OUVARD

Abstract: We propose an experimental test of the theoretical predictions obtained in Ouvard and Stenger (2017), namely that the reaction to a nudge implemented in a network depends on the network structure, and on individuals' sensitivity to the environment. They obtain that the most sensitive individuals in a circle network should contribute more under nudge implementation coordinating their actions (i.e. strategic uncertainty is reduced). In the star network, the result depends on the content of the nudge. Indeed, it is necessary for the regulator to know each individual position in the network, in order to propose a nudge for which the content is adequate to their position. In the experiment we first elicited the subjects' sensitivity to environmental matters. We then determined subjects' inequity aversion (Blanco et al. 2010, Teyssier 2012). Finally, the subjects played a twice ten period public goods game in network (circle or star), similar to the one proposed in Rosenkranz and Weitzel (2012). The first ten periods served as a baseline. Then, a nudge (announcement of the socially optimal level of contribution) was implemented both under complete information (the content of the nudge takes into account individuals' position) and under incomplete information (the nudge cannot rely on individuals' position and targets one individual). We show that nudge implementation does not

PARALLEL SESSION B3: Imperfect Competition and Environmental Regulation

On OPEC's Evaporating Market Power and Climate Policies

Cees WITHAGEN, Vrije Universiteit Amsterdam

Hassan Benchekroun, Gerard van der Meijden

Abstract: We develop an oligopoly–fringe model to understand the consequences of recent developments on the global energy market: the collapse of OPEC as a cartel and the shale oil revolution in the US and Canada. Our model is able to explain simultaneous supply of conventional and shale oil, despite differing extraction costs. We show that a final limit–pricing regime will occur, during which the OPEC oligopolists just undercut the price of renewable energy, if the stock of the shale fringe is not too large. The break–down of OPEC has an ambiguous effect on climate damages. On the one hand, aggregate oil extraction will become less conservative, which increases damages from climate change. On the other hand, extraction of the fringe is postponed, which lowers climate damage if the fringe's resource is relatively dirty (e.g., tar sands). The recent shale oil revolution not only leads to increased climate damages, but may even lower global welfare. We also show that renewables subsidies do not cause a Weak Green Paradox if the relative stock of the oligopolists is large enough, compared to the fringe.

Consistent Taxation for a Polluting Monopoly

Santiago RUBIO University of Valencia

Guiomar Martin–Herran

Abstract: This paper evaluates the effects of a limited regulatory commitment on the emission tax paid by a polluting monopoly comparing two alternative equilibria of a policy (differential) game: the stagewise feedback Stackelberg equilibrium (SFSE) and the Markov perfect equilibrium with limited commitment (LCMPE). For both equilibria no commitment for the entire time horizon is assumed. However, for the SFSE the regulator moves first in each period whereas for the LCMPE in a first stage the regulator and the monopolist simultaneously choose the emission tax and abatement effort respectively, and in a second stage the monopolist selects the output level. We find that the SFSE is not intratime consistent, i.e. it is not time consistent for the game played in each period. We also find that a limited commitment leads to lower taxation and abatement that yield larger production and emissions and, consequently, a larger steady–state pollution stock. Moreover, the increase of environmental damages because of the increase in the pollution stock more than compensates the increase in consumer surplus and the decrease in abatement costs resulting in a reduction of net social welfare when there is a limited commitment.

When the Tail Can Wag the Dog: Common–Pool Risk Management and Market Power

Carolyn FISCHER, Resources for the Future

Abstract: As the marketplace for resource–based commodities is increasingly globalized, risks related to local production can have effects on global markets. For example, disease outbreaks in aquaculture that decimate enough production can drive up global prices, as occurred with the infectious salmon anemia outbreak in Chile and the emergence of early mortality syndrome in the Southeast Asian shrimp industry. Outbreaks of listeria, cyclospora, and salmonella tied to packaged salads have prompted widespread recalls for multiple brands and safety concerns depressed demand for the products, at least for a time. High–profile environmental and health and safety disasters among suppliers (such as the 2012 garment factory fire in Dhaka, Bangladesh or scandals revealing illegal labor

or environmental practices in China) can also affect the perception and profits of multiple well-known brands. Multinationals may thus have particular interests in the management of risks across a portfolio of locations. Meanwhile, regulatory regimes and enforcement can differ vastly across countries. In this paper, we develop a model of multinational risk management, market structure, and asymmetric environmental regulation. Profit outcomes depend on both production and process measures across multiple jurisdictions. We propose a general model, but the essential components are (1) multinational (or multi-region) producers; (2) world product price consequences of major risky events in a given location (which may require spillover effects across firms within a given location to have a big enough output effect); and (3) meaningful differences in regulation across jurisdictions. The relevance is heightened for (4) industries with a high degree of market concentration. The model suggests several mechanisms that lead to suboptimal risk management behavior that could contribute to problems like disease outbreaks. The basic intuition is that, in the event of a major supply disruption in one location, multinational firms will receive some price compensation on production in other locations as long as market demand is not perfectly elastic. This possibility creates incentives to invest less in risk avoidance. Furthermore, when risk avoidance is inherently collective in nature—a common-pool problem—investments in risk management are already underprovided.

PARALLEL SESSION B4: Risk and Insurance

The Economic Insurance Value of Wild Pollinators in Almond Orchards in California

Yuki Henselek, University of Freiburg

Alexandra-Maria Klein, Stefan Baumgärtner

Abstract: Biodiversity can provide an economic insurance value against the uncertain provision of ecosystem services for risk-averse economic agents. For uncertain pollination services, we determine the risk premium and the economic insurance value of wild pollinators in almond orchards for a risk-averse farmer with alternative types of risk-preferences. For this, we describe pollination services as a distribution, which can be analysed by statistical methods. We convert this pollination distribution into an income distribution for the farmer relying on pollination services. Further, we develop an ecological-economic framework to determine the risk premium and insurance value of wild pollinators in general for different types of risk preferences, and apply this model to empirical data on owner visits of honeybees (*Apis mellifera*) and wild pollinators such as several wild bee species (e.g., *Andrena* spp., *Osmia* spp.) and other wild insect pollinator species to almond trees in California. Results show that wild pollinating species can both increase or decrease the riskiness of a pollination and thus, income distribution and therefore can or cannot have an insurance value. That is, the economic insurance value of wild pollinators is dependent on the exact type of risk preferences of the farmer.

Technology Adoption and Crop Diversity

Martin Quaas, University of Kiel

Frederik Noack, Ashley Larsen

Abstract: Uninsured risk is a major obstacle for technology adoption in rural areas of low income countries. Overcoming this obstacle is of particular importance to increasing food production and thus food security in developing countries, where technology such as improved or high value seeds may be available but uptake remains low. In this paper we study to what extent farmers use crop diversity as a self-protection measure against volatile yields. Using both theoretical and empirical models we

evaluate whether poor rural households use crop diversity to mitigate risk from cash crop adoption or whether cash crop adoption is a substitute for crop diversity. Our theory predicts that cash crop adoption reduces crop diversity. Using an instrumental variables approach with theoretically derived instruments applied to household panel data from rural Uganda we find that an increase of cash crops by 1 % reduces crop diversity by 0.5 %. These findings caution that policies to increase the uptake of high yielding varieties can lead to a loss of crop diversity. Such policies should consider the welfare effects of reduced diversity as it relates to food security and the provision of valuable ecosystem services.

Ecological Vulnerability through Insurance? Potential Unintended Consequences of Index-Based Livestock Insurance

Felix JOHN, Helmholtz Centre for Environmental Research

Russell Toth, Karin Frank, and Birgit Müller

Abstract: Increasing droughts pose one of the greatest challenges for dryland pastoralists in the Horn of Africa. To manage drought risks, weather index insurance has been proposed and with the Index-Based Livestock Insurance a pilot program has been introduced in 2010. In this paper, we study the long-term effects of weather index insurance on pasture conditions with the help of a stylized agent-based model. We hypothesize that if insurance is taken up at scale, the maintained high grazing pressure can cause pasture degradation. Our results show that especially under harsh grazing conditions, insurance can indeed produce additional instability and engender pasture degradation that results in a lower carrying capacity in the long run. Unfortunately, the unintended ecological consequences are most likely where insurance is needed the most.

PARALLEL SESSION B5: Valuation of Water Ecosystem Services

Relative Willingness to Pay for Ecosystem Services in Scotland: A Comparative Analysis

Valeria TOLEDO–GALLEGOS, University of St Andrews

Nick Hanley, Jed Longa

Abstract: Environmental valuation studies rarely account for the complexity and feedbacks in Estuarine Ecosystem Services (EES). This paper explores how environmental preferences and EES values are influenced by a study site characteristics and by user characteristics. We developed a Discrete Choice Experiment (DCE) to estimate society's Willingness to Pay (WTP) for improving flood control, recreation and biodiversity with a restoration project in the catchment area in Scotland. A positive and significant WTP for improving EES provisioning was found. However, respondents stated differences in the WTP values for all EES, across regions and between user types. Firstly, respondents ranked the Tay area at first and Clyde area at last at last when stating their WTP, which are the regions with the best and worse environmental quality, respectively. Secondly, flood control is the most valued EES followed closely by biodiversity. Recreation value was found to be smaller by a factor of two when compared to both of them. In this sense, management options which target flood control and biodiversity are more likely to be accepted among Scottish citizens. Finally, being a visitor is a relevant factor for seeking an environmental change and having higher annual average WTP values. Thus, policies that help to increase the "place attachment" of the overall public could, in turn, increase the willingness of people to fund restoration policies environmental policies.

Income Inequality and the International Transfer of Environmental Values

Jasper MEYA University of Oldenburg

Moritz Drupp, Nick Hanley

Abstract: How the valuation of environmental goods is related to income is a key question for environmental economics, but the role of income inequality is often neglected. We study how income inequality affects the international transfer of the valuation of environmental goods—a practice called value or benefit transfer. Specifically, we apply theory-driven transfer factors to examine whether adjusting for income inequality can reduce errors made in benefit transfer, drawing on a multi-country valuation study on water quality improvement. Our convergent validity analysis shows that income inequality adjustment reduces benefit transfer errors by more than 1.5 percentage points on average across all transfers. The adjustment for inequality is particularly important when income is distributed more unequally at the policy site relative to the study site, yielding reductions in transfer errors of up to 33 percentage points. Our results are relevant for policy appraisal, environmental accounting, and more generally for the role of income inequality in non-market valuation.

Benefits from Water Ecosystem Services in Africa and Adaptation to Climate Change

Laetitia PETTINOTTI, Basque Centre for Climate Change

A. De Ayala, E. Ojea

Abstract: The present study collects original monetary estimates for ecosystem service benefits on the African continent from 36 available valuation studies. A database of 178 monetary estimates is constructed to conduct a meta-analysis that digs into what factors drive water ecosystem services values in Africa for the first time. We find that the service type, biome, author affiliation and other socioeconomic variables are significant in explaining benefits from water services. In order to understand the importance that benefits from ecosystem services have for climate change adaptation, we explore the relationship between these benefits and the countries vulnerability and readiness to climate change. We find that countries face synergies in terms of how valuable their ecosystem services are and their potential adaptation capacity. More vulnerable countries are associated with lower benefits from ecosystem services, especially regarding provisioning and regulating services. On contrast, countries with a higher adaptation potential are associated with higher ecosystem services values. These results highlight the important role of ecosystem services and their benefits in climate change vulnerability and adaptation.

PARALLEL SESSION C1: Social Preferences, Imitation, and the Environment

A Theory of Consumption Norms and Implications for Environmental Policy

Alistair ULPH, University of Manchester

Abstract: In this paper we assume that for some commodities individuals may wish to adjust their levels of consumption from their normal Marshallian levels in order to conform to the consumption norms for a group of people to which they wish to belong. Unlike conspicuous consumption this can mean that some individuals may reduce their consumption of the relevant commodities. We first model the decisions of an individual using a two-stage game in which individuals first decide whether or not they wish to adhere to a norm, then decide their actual consumption. Next we assume there is a population of individuals with differing tastes and analyse which consumption norms constitute an equilibrium norm, and how many equilibrium norms might exist. Finally we study the implications of our model for

redistributive policies, environmental policies and econometric analysis of consumer demand. We show that the introduction of consumption norms can have striking policy implications: predicting the use of taxes, subsidies or no policy interventions in contexts where without norms there be either no policy intervention or a tax on consumption; in situations where there are environmental externalities we predict there are cases where Pigovian taxes are either ineffective or welfare-reducing.

Sustainable Fishery with Endogenous Evolution of Fisherfolk's Behavior and Biomass Dynamics

Ngo VAN LONG, McGill University

Abstract: This paper studies the relationship between a community's renewable resource stock and the incentives for parents to take collective action to instill a sense of Kantian morality in their children. I show that the size of a community's natural resource stock plays a prominent role in the parental incentives to build up prosocial traits in their offspring. A prediction yielded by the model is that small communities that are better endowed with natural resource stocks tend to foster higher levels of cooperation. The reason is simple: the larger the resource stock, the greater the potential gain from cooperation among the community's members, and this recognition creates the incentive for parents to collectively instill the cooperation spirit in their children. I investigate the joint dynamics of the resource stock and of cultural norms, and find that there is a possibility of multiplicity of steady states. There exists a threshold resource stock level such that if the system start any initial resource stock smaller than that threshold, the community will have no interest in cultivating the sense of cooperation.

Imitation Dynamics in Oligopoly Games with Heterogeneous Players

Marius I. OCHEA, Université de Cergy–Pontoise

Daan Lindeman

Abstract: We investigate the role and performance of imitative behaviour in a class of quantity–setting (Cournot) games. Within a framework of evolutionary competition between rational, best–response and imitators players we found that the equilibrium stability depends on the intensity of the evolutionary pressure and on the stability of the cheapest heuristic(s). When the cheapest behavioural rule is the stable heuristic (i.e. imitation), the dynamics converge to a situation where most firms use this behavioural rule and all firms produce the Cournot–Nash equilibrium quantity. When the cheapest heuristic is unstable one (i.e. best–response), complicated endogenous fluctuations may occur.

PARALLEL SESSION C2: Tipping Points

Tipping points, delays, and the control of catastrophes

Matti LISKI, Aalto University

Francois Salanie

Abstract: We set up a simple but general model in which a decision–maker controls a flow variable (e.g., consumption) that contributes to a stock (e.g., greenhouse gases). If the stock variable passes an unknown tipping point, a catastrophe may follow after an unknown delay: each increase in the stock triggers an experiment, the outcome of which is learned only gradually over time. Experimentation stops when the stock is stabilized; yet, historical experiments continue to have welfare implications. For this reason, the history at which the planning starts determines how much experimentation is

optimal in total. Optimal policies can be non-monotonic, for example, if the impacts of past experiments can be limited by reducing the stock.

Migrant Remittances can reduce the Potential for Forest Transitions

Anne Sophie Crépin, The Beijer Institute of Ecological Economics

Abstract: In rural areas, labor scarcity partially driven by growing opportunities for employment in urban sectors, can lead to farmland abandonment and subsequent forest regrowth. This mechanism is a one of the core of the forest transition (FT) theory. However, labor is not the only aspect that is mobilized in this process of rural out-migration. The remittances sent by migrants to their households have the potential to significantly shape the land use outcomes as well. But the empirical evidence on this matter is mixed and the effects of migration and remittances on land use are often found to be countervailing.

With the purpose of bringing some clarity to this discussion, we extend an existing theoretical socio-ecological model of migration, farmland abandonment, and forest regrowth in two ways by incorporating: 1) a dynamic forest regrowth rate, representing the changing resilience of the forest and 2) feedback mechanisms that represent remittances, which can be used to hire labor, and/or supplement consumption.

The dynamics of the extended model suggest that migration on its own is unlikely to lead to the forest resurgence suggested in the FT theory. Rather, low forest regimes even after the conditions of the 'economic development' pathway of the FT theory are given. This can happen both with low or high out-migration. However, in some/most these cases, relatively minor interventions to reduce the resilience of the low forest cover regime (e.g. active reforestation, or incentives for farmers to do so) can then set in motion the socio-ecological feedback of forest resurgence in abandoned farmlands, despite the effects of remittances.

Stable Partial Cooperation in Managing Ecological Systems with Tipping Points

Florian WAGENER, University of Amsterdam

Aart de Zeeuw

Abstract: This paper combines two strands of literature. In the literature on managing ecological systems with tipping points, such as the well-known lake system, an important conclusion is that non-cooperation may lead to low welfare, because initial conditions may yield a Nash equilibrium in the bad state of the system. In the literature on cartels or international environmental agreements, an important conclusion is that stable coalitions are small, where stable means balancing the incentives to cooperate and the incentives to free ride. In this paper it is shown that larger stable coalitions exist in managing ecological systems with tipping points. The reason is that the incentives to cooperate increase, either in order to prevent tipping to a bad state of the system, or in order to induce tipping to a good state of the system. This implies that if the ecological system is initially in a bad state, the policy advice is to first form a stable coalition to shift to a good state, and then to form a stable coalition to prevent shifting back to a bad state.

PARALLEL SESSION C3: Invasive Species and Pesticide Resistance

Allocation of Research Resources for Invasive Species with a Commercial Value: The Case of the Red King Crab

Melina Kourantidou, University of Southern Denmark

Brooks Kaiser

Abstract: The purpose of this paper is to model the allocation of research resources for a species population that has a dual role as a nuisance and as a valuable economic resource. For the purposes of the analysis we are using the Red King Crab (*Paralithodes camtschaticus*) as a case study. The Red King Crab is a well-established invader in the Barents Sea (mainly in Norwegian and Russian coastal waters), that conveys both harvesting benefits and ecosystem damages, which may be spatially differentiated. The damages can be alleviated by harvest, which creates a positive externality. We distinguish the research in different types based on their potential to reveal successfully the marginal external benefits from commercial harvesting. We illustrate how misallocation of research resources can be avoided when decision-makers are faced with the allocation dilemma and there is a significant amount of uncertainty on the ecosystem impacts that makes impact studies notoriously difficult to perform. The model highlights the importance of the prioritizing criterion in research resource allocation for invasive species with a commercial value, as a means of identifying the underlying bioeconomic trade-off.

Voluntary Programs to Encourage Compliance with Refuge Regulations for Pesticide Resistance Management: Results from a Quasi-Experiment

Zachary Brown, North Carolina State University

Abstract: Pesticide resistance can be viewed as an open-access resource problem. While traditional economic incentives are the standard prescription for this market failure, non-pecuniary behavioral approaches have also shown promise in managing these resources. I empirically evaluate the performance of an intervention in the latter class of instruments to promote compliance with refuge regulations in the context of genetically engineered *Bacillus thuringiensis* (Bt) corn. Refuge regulations are important policies for reducing the risk of Bt resistance. To encourage refuge compliance, the agricultural company Monsanto piloted a behavioral intervention in 17 North Carolina counties in 2013/2014. Using seed sales data, I estimate econometric models combining difference-in-differences with propensity-score-matching (PSM) to identify the effect of the program on grower behavior and overall refuge planting. A simple difference-in-differences (DID) estimator implies the program increased the share of refuge (non-Bt) seed sales sold to the average grower by 2.9%, whereas the DID-PSM estimator implies an effect of 5.6%. Non-pecuniary behavioral instruments deserve further consideration as a means of managing Bt resistance.

Irreversibility, Uncertainty, and Dynamic Pest Resistance

Justus Wesseler, Wageningen University

Abstract: The susceptibility of pests to control agents has been viewed by economists as a non-renewable resource, and hence the appearance of pest resistance as an irreversibility. Biologists and entomologists in particular argue that susceptibility to control agents, pesticides in particular, should be viewed as a renewable resource. That is, if pests become resistant to a control agent and consequently the use of the control agent stops, pest resistance breaks down after a while and pests

do become susceptible again. The important question within the context of this paper is whether or not an irreversibility effect exists, i.e. timing of using a new control strategy matters – at least at the theoretical level. This paper develops a four period discrete time, discrete model with uncertainties about the benefits of a new technology as well as uncertainty about the time pest resistance will develop and disappear. The results show the irreversibility effect decreases at a decreasing rate with respect to the length of the pest susceptibility and increases at a decreasing rate with respect to the length of pest resistance. Interestingly, the length of third period pest susceptibility can be as important as the length of first period pest susceptibility with important implications for pest management.

PARALLEL SESSION C4: Species Interactions

Livestock and Carnivores: Economic and Ecological Interactions

Jon OLAUSSEN, Norwegian University of Science and Technology

Abstract: Carnivores-livestock interactions cause human-wildlife conflicts worldwide. These interactions are present under a wide range of ecological and economic circumstances. In this paper, predation mortality takes place due to food availability limiting the growth conditions for semi-domestic livestock. An age-structured bio-economic model is presented, where predation impacts livestock density, and thereby livestock weights and natural mortality. While predation mortality may be additional to natural mortality in absence of food limitation, it can compensate for natural mortality in situations of food scarcity. Furthermore, due to density dependency in livestock weights, predation may increase the slaughter value of livestock. The paper analyzes how predation affects livestock production and economic performance under different livestock management schemes. While predation may impose serious economic loss in an optimized scheme, it may be beneficial in situations with overgrazing and food limitations due to, e.g., common property problems.

Wildlife Conflicts: Wolves vs. Moose

Anders Skonhoft, Norwegian University of Science and Technology

Jan Tore Solstad

Abstract: During the last few decades the grey wolf (*Canis lupus*) has re-colonized Scandinavia. The current population number is some 430 individuals, and is distributed in small packs along the Swedish–Norwegian border. With the wolf re-colonization, several conflicts have arisen. One conflict is due to wolf predation on livestock, especially sheep and reindeer. Another is predation on wild ungulates. As the wolves have shown a strong preference for moose (*Alces alces*), a smaller moose population is available for game hunting. Game hunting is an important source of income for many landowners, but at the same time, a lower moose population implies reduced browsing damages to the landowners. How the landowners are affected in total by the predation also depends on their management goal. The present paper examines the cost and benefit of wolf predation on moose under the assumption of profit maximization as well as routinized harvesting behaviour of the landowners. First, we analyse the costs to landowners, comprising the loss of animals potentially available for hunting less the reduction in browsing damage associated with a smaller moose population. Second, we study the effects of introducing compensation for the predation loss. Thirdly, we examine the problem from a broader point of view, where costs external to landowners are included. By far the

most important cost here is damage related to collisions between moose and motor vehicles and trains. The paper provides several results.

Capital Investment for Optimal Exploitation of Renewable Resource Stocks in the Age of Global Change Biology

Emiliy Moberg, Rutgers University

Eli Fenichel

Abstract: The world is rapidly changing, and people must adapt to changes in the amount and spatial distribution of natural capital. One option is to change the way people interact with natural capital, for example changing harvest levels of fisheries. Alternatively, people can invest in reproducible or human capital, which may be a substitute or complement for natural capital stocks. The economic and ecological details of the system jointly determine the optimal investment in human or reproducible capital as well as investment decisions in natural capital. We focus on the spatial case of capital that enables targeted ecological management. In the case where capital investment is necessary to enable targeting, it is not clear that such investments will always be made. Such investments are most valuable when there are economic differences and ecological interactions among natural capital stocks. Ecological interactions alone may not be sufficient to lead to targeting. This is particularly relevant to fisheries facing climate change and the spread of invasive species. In fisheries impacted by climate change, the market substitutability of many fish products may work against investment in species specific targeting. In the case of invasive species, economic interest may lead to capital investments to avoid invasive species damages while permitting the pest to spread causing an environmental damage that is not capitalized by decision makers.

PARALLEL SESSION C5: Valuation of Biodiversity Aspects

Seeing Red, but Acting Green? The Impact of Media Exposure on Altruism towards Biodiversity Conservation

Ganga SHREEDHAR, London School of Economics and Political Science

Susana Mourato

Abstract: This paper evaluates whether exposure to appeal films impacts charitable donations towards biodiversity conservation. We run two lab experiments, with over 550 subjects, and exogenously vary the media content used in the donation appeal, including the type of biodiversity used in the film (charismatic species, non-charismatic species and complex habitats), and information about the anthropogenic cause of threat. We also examine whether a pro-social incentive via the offer of public recognition of donors impacts donations. We find evidence that using charismatic species in donation appeals increases the likelihood of making a donation, but does not increase the level of donations, conditional on having decided to donate. We also find evidence supporting the hypothesis that people donate more when they are provided with information about anthropogenic cause of threat. This 'outrage effect' is accompanied by an increase in reported anger, sadness, sympathy, and heightened interest. Finally, we find support for the hypothesis that moral reputation through greater public visibility increases donations, but only for those who have previously donated to charities.

What Counts More – Fairness to Dairy Cows or Fairness to Farmers? The Preferences of Conventional Milk Buyers for Ethical Attributes of Milk

Nonka MARKOVA–NENOVA, Brandenburg University of Technology Cottbus–Senftenberg

Frank Wätzold

Abstract: Stable organic milk producer prices over the course of the recent conventional milk price crisis in the EU suggest that product differentiation according to the preferences of buyers for including ethical attributes could be a good marketing strategy for conventional milk producers. The preferences of organic milk buyers have been investigated in different countries, using different valuation methods and ethical attributes. The preferences of conventional milk buyers have received less attention, although they are still the majority of consumers. Through a choice experiment conducted online in Germany we contribute to the understanding of the preferences of conventional milk buyers for certain ethical attributes of milk. We especially concentrate on the trade-offs between animal welfare (indicated by the housing system for dairy cows) and fairness to farmers (to all farms or to small, below-average income farms). Further ethical attributes which we include in the experiment are biodiversity protection and regional production. Our results show highest preferences for the most animal friendly housing system included – free-stall with summer pasture. Surprisingly, and in contrast to the results of previous studies, regional production is much less valued. In addition, overall preferences for fair prices to small, below-average income farms and for biodiversity protection are somewhat higher than for regional production. Overall, respondents have positive willingness to pay for support of small, below-average income farms in combination with tethering, which suggests that animal welfare concerns are to some extent outbalanced by fairness to poor farmers.

Opportunity Costs of Alternative Management Options in an LTER: Application to Ramat Hanadiv, Israel

Nir BECKER, Tel-Hai College

Itai Divinsky and Pua Bar (Kutiel)

Abstract: In the last few decades open space has been rapidly disappearing, replaced by urban areas and infrastructure. This decline in open space, coupled with other processes adversely affecting ecosystems and the environment, highlights the importance of protected areas. Protected areas enable ecosystems to maintain their balance, thereby safeguarding many important ecological assets and services provided by ecosystems. The purpose of this study was to economically value multiple ecosystem services (ES) and the tradeoffs between them and species richness across different management alternatives in the LTER sites at the Ramat Hanadiv Nature Park, located in northern Israel. Ecological data was retrieved from previous ecological research conducted at the sites, and valuation of scenic values was performed using the replacement cost method and a contingent valuation survey. The relationship between ES value and species richness was found to be inverse. Of all management alternatives studied only the Planted forest alternative was found to be inefficient; moving to other alternatives would enhance ES provision levels and species richness. This research demonstrates a fairly simple path for providing land managers an ecological data-based tool for comparing management alternatives in monetary terms.

PARALLEL SESSION D1: Nudges and Environmentally Friendly Behavior 1

The Green, Green-Eyed Monster: Exploring the Impact of Group Cohesion and Environmental Attitudes and using this Evidence for Energy Policy

Mike Brock, University of East Anglia

Abstract: Using tools from behavioural economics and psychology to establish non-financial ways to incentivise people to reduce domestic energy usage has become a popular and ever-expanding area of research. This study builds upon the existing literature by providing subjects with energy performance information at group-level in a controlled field experiment setting. Results suggest that the provision of relative information does stimulate energy-conserving behaviour, with this being most pronounced among those who held pre-trial preferences for sustainable living. These variations in usage and responsiveness indicate evidence that the attitudes and structure of social groups are key drivers in determining the extent to which behavioural change is achievable. This in turn has relevance for energy policy, and implies that whilst both regulators and firms could improve consumer welfare and optimise the management of their resources within their industry by issuing relative information on performance. Nevertheless, the role of group cohesion and affiliation could heavily determine the magnitude of these benefits.

The Effect of Informational Nudges to Promote Voluntary Behavior to Reduce Nonpoint Source Pollution: A Randomized Controlled Trial in the Field

Haoran Miao, The University of Rhode Island

Simona Trandafir, Emi Uchida

Abstract: Policy makers often use voluntary programs to control nonpoint source pollution from residential lawns. We run a field experiment to test whether informational nudges can motivate residents to choose green-certified lawn care services voluntarily. We find that the informational nudges spur voluntary behavior conditionally. However, a small financial incentive to encourage behavior does not reinforce the effect of the informational nudges. These findings are potentially important for state and federal agencies as well as advocacy groups interested in promoting best management practices.

PARALLEL SESSION D2: International Environmental Agreements

Members, Supporters and Free-Riders in Public Goods and Common Pool Resource Games

Hans-Peter WEIKARD, Wageningen University, Netherlands

Erik Ansink

Abstract: For the class of games with externalities, prominent in the literature on international environmental agreements, this paper generalizes the standard cartel formation game by allowing for supporters. Some players may not want to join a coalition that jointly provides a public good or manages a resource. Still they might want to support the coalition to set incentives for others to join. We show the existence of stable coalition structures with support. Support increases the size of the coalition and mitigates the inefficiencies in public goods games. We also show significant impacts of support on the equilibria of common pool resource games such as fisheries games.

The Impact of Adaptation on the Stability of International Environmental Agreements

Michèle BRETON, HEC Montréal

Lucia Sbragia

Abstract: We examine the stability of international environmental agreements when they include both adaptation and mitigation policies. We assume that adaptation requires a prior irreversible investment and presents the characteristics of a private good by reducing a country's vulnerability to the impact of pollution, while mitigation policies produce a public good by reducing the total pollution. Using a stylized model, we show that adaptive measures can be used strategically and that their inclusion in environmental agreements enhances their stability and can even lead to full cooperation. However, adaptation does not help cooperation on mitigation policies. Finally, we evaluate how including adaptive measures to climate change in international environmental agreements affect welfare and total pollution.

PARALLEL SESSION D3: Biological Invasions and Pest Control

A Case for the Commons: The Snow Crab in the Barents

Brooks KAISER, University of Southern Denmark

Melina Kourantidou, Linda Fernandez

Abstract: The open access harvesting of a valuable crustacean species, *C. Opilio* (Snow Crab) in the Barents Sea in international waters is generating a positive externality by slowing the westward spread of the species to sensitive benthic ecosystems. Reclassification of the species to a 'sedentary species'¹ shifts the regulatory environment for the crab in such a way that the crab is no longer in international waters. Rather it becomes part of the extended Russian and Norwegian Continental Shelves in the International Loophole or the Norwegian Continental Shelf in the Svalbard Fisheries Protection Zone, each area facing different management challenges. The economic incentives of the Russians and Norwegians regarding the Snow Crab have thus shifted in ways that exacerbate the invasion aspects of the Snow Crab rather than alleviate them. The asymmetric incentives between the two countries lead to differences for each as a potential source of the crab spreading to new areas. The spread of the crab has both known ecosystem and commercial fishery risks and unknown risks, particularly to uncertain ecosystem values. Therefore, not only will knowable damages accrue more rapidly, there is less time for research and evaluation of ecosystem risks and damages about which we currently have poor understanding. We argue that optimal decision-making regarding profitable invasive species must include analysis that extends beyond standard fisheries economics. Furthermore, this extension must include not only the consideration of ecosystem risks and damages but also the institutional shifts that may occur in response to the economic incentives presented by the invasion.

Bioeconomic Feedbacks from Large-Scale Adoption of Transgenic Pesticidal Corn in the Philippines

Zachary Brown, North Carolina State University

Lawson Connor, Rod Rejesus, and Jose Yorobe

Abstract: Farmer control of agricultural pests raises the possibility of bio-economic feedbacks and spillovers, whereby greater aggregate effort exerted on pest control lowers overall pest densities. This in turn decreases individual growers' marginal incentives for pest control. This negative feedback is analogous to a congestion externality. While economists have written theoretically about this feedback or modeled it in simulations of bio-invasions, they rarely measure it econometrically. Here

we introduce an econometric methodology developed for endogenous sorting models in the environmental and urban economics literatures to study bio-economic feedbacks in pest control. We apply this framework to study area-level use of Bt and potential feedbacks from individuals' decisions to use of transgenic Bt corn, using a panel dataset from the Philippines. In a simple conceptual model, we confirm that a bio-economic feedback through pest suppression should manifest as a congestion effect. Identification in the econometric model is achieved by combining fixed effects conditional logit estimation of crop choice with instrumental variables methods. We find some evidence for a negative feedback associated with the use of transgenic corn in the Philippines, though this feedback appears to be mostly outweighed by other beneficial traits of Bt corn (especially when combined with herbicide tolerance traits). Consistent with this bio-economic view, weighting regression observations by farm size greatly strengthens the evidence for a pest suppression feedback in crop variety choice.

PARALLEL SESSION D4: Forests 1

Households Livelihoods and Deforestation in the Tridom Transboundary Conservation: A Spatial Analysis

Jonas NGOUHOUO POUFOUN, INRA

Sabine Chaupain-Guillot, Philippe Delacote

Abstract: This paper aims to examine the determinants of household' deforestation in the Tridom transboundary conservation landscape (Tridom-TCL). It investigates the role of households' livelihoods strategies. It also tests the effects of crop damage caused by elephants (human-elephant conflict) on the households' decision of deforestation, using a unique dataset gathered with 1035 households in the Tridom-TCL. The results of the spatial autoregressive model show that: (1) households tend to imitate deforestation decisions of their neighbors. (2) When accounting cash crops as part of a diversification livelihoods' strategy, households' deforestation increases significantly with a significant indirect impact on neighboring households' deforestation. In fact, a one-unit increase in the income of households that include cash crops in their portfolio, leads to six to seven times increases in households' deforestation compared to the effect of income increase in households choosing other livelihoods' strategies. Also, (3) the indirect effects of these choices on neighboring households' deforestation have almost the same magnitude as the direct impact resulting from other strategies. (4) We find no substitutability between leisure and work in land use choices. Indeed, the Pygmies, who constitute the principal labour with low cost, are employed in activities related to larger deforestation, while household labour duration does not significantly drive households' deforestation. The share of households' self-consumption is associated with a low deforestation, therefore, a bigger integration of the market can lead to increased deforestation, if practices remained unchanged.

The Bio-Economics of Managing Invasive Plant Externalities in Forests with Heterogeneous Landowner Preferences

Shadi ATALLAH, University of New Hampshire

Abstract: Forest invasive plants can cause market (MES) and non-market ecosystem service (NMES) losses to private forest landowners. Because the bio-invasion creates spatial-dynamic ecological-economic linkages among landowners, bio-invasion control is a weaker-link public good and is likely to be underprovided. We hypothesize that heterogeneity in forest landowner preferences is a major

determinant of bio-invasion spatial externalities. To test this hypothesis, we develop a spatial-dynamic model of bio-invasion and control with two agents that value differently the MES and NMES produced by the forest. Landowners choose control strategies and ignore the impact of their decisions on their neighbors. In the absence of long-distance dispersal, they both control the bio-invasion regardless of their preferences. In the presence of long-distance dispersal, a central planner controls the bio-invasion as well. However, when landowners have heterogeneous preferences, the MES landowner implements bio-invasion control, but the NMES landowner does not, creating a wedge between the central planner and decentralized management solutions. We compare uniform and non-uniform payments for ecosystem services (PES) and find that a PES to the NMES landowner is enough to mitigate the externality whereas a non-uniform PES is costlier and leads to a non-additional participation of the MES landowner.

PARALLEL SESSION D5: Management and Valuation of Flood Risks

Cost-Benefit Analysis for Flood Risk Management and Water Governance: One Century of Innovation and Practice in the Netherlands

Frits Bos, CPB Netherlands Bureau for Economic Policy Analysis

Peter Zwaneveld

Abstract: The Netherlands is a global reference for flood risk management. This reputation is based on a mix of world-class civil engineering projects and innovative concepts of water governance. For more than a century, cost-benefit analysis has been important for flood risk management and water governance in the Netherlands. It has helped to select the most effective and efficient flood risk projects and to coordinate and reconcile the interests of various policy areas, levels of government and private stakeholders. This paper provides for the first time an overview of this well-developed practice. This includes the cost-benefit analysis in the 1901 act for enclosure of the Zuiderzee, van Dantzig's famous formula for the economically optimal strength of dikes and a whole set of cost-benefit analyses for More Room For Rivers and the Delta Program for the next century. Dutch practice illustrates how cost-benefit analysis can support and improve flood risk management and water governance; other countries may learn from this. Rough calculations indicate that investing in cost-benefit analysis has been a highly profitable investment for Dutch society.

Preferences of Farmers for Reductions in Flood Risk under Heterogeneous Payment Modes

Godwin Vondolia, The Arctic University of Norway

Stale Navrud

Abstract: Uninsured agro-climatic disasters impose huge costs on farmers. To ease liquidity constraint on the purchase of insurance, both insurance practitioners and academic studies propose alternative designs and delivery of insurance products such as in-kind premiums to increase the purchase of insurance in developing countries. This paper uses split-sample discrete choice experiments to investigate the effects of heterogeneous payment modes on purchase of insurance and analyze the preferences in these heterogeneous payment modes for flood risk insurance among smallholder irrigation farmers in Ghana. Specifically, we compare the purchase of flood risk insurance and marginal willingness-to-pay for flood occurrence and coverage among three insurance premium modes: monetary, labour time and crops harvests. A comparison of shares of respondents who purchase flood insurance under monetary and in-kind insurance premium does not support claims that in-kind

premiums increase insurance up-take. In addition, we estimate that farmers are willing to pay about 6.5 hours, 20 kg in rice and 104 GHS (US\$ 35) per annum to delay flood occurrence by one year. Furthermore, the marginal willingness-to-pay to increase insurance is about 2 hours, 4 kg of rice and 12 GHS (US\$ 4). These high marginal willingness-to-pay values may reflect preferences for reductions in agro-climatic risk among farmers in West Africa.

PARALLEL SESSION E1: Climate Change

The Relative Price of Environmental Goods and Climate Policy Evaluation

Moritz Drupp, University of Kiel

Abstract: As environmental goods become relatively scarcer due to climate change, it is increasingly important to consider their relative price changes when evaluating long-term policies. This paper provides a comprehensive analysis of the determinants of the relative price of environmental goods, which amounts to the difference in the good-specific discount rates. Based on the integrated climate-economy model DICE, we show that the relative price effect is substantial compared to the effect of commonly assumed discount rates. It ranges from 6 percent in 2020 to 3 percent in 2100. In terms of peak temperature stabilization, considering relative prices is equivalent to reducing societal pure time preference by more than 1 percentage point. Neglecting relative prices would lead to an underestimation of the social cost of carbon of more than 30 (130) percent in 2020 (2100). Our findings offer guidance for environmental policy and provide an argument for more stringent climate policies.

The Rise and Fall of Bioenergy

Michael Hoel, University of Oslo

Abstract: The production and use of bioenergy may have a negative impact on the climate. However, if it has a less negative impact than carbon (fossil) energy, it may be socially optimal to have a significant increase in the use of bioenergy towards a future decarbonized economy. The paper demonstrates that due to the difference in the way the climate is affected by the two types of energy, the path of bioenergy towards a long-run steady state may be non-monotonic: It may be socially optimal to first have an increase in the use of bioenergy, and later a reduction towards the long-run value. The optimal taxes and subsidies are also derived, both for the first-best case and for the case of a constraint on the carbon tax or the energy price.

PARALLEL SESSION E2: Forests 2

Benefits of a Fire Mitigation Ecosystem Service in the Great Dismal Swamp Nat. Wildlife Refuge

Bryan Parthum, US Geological Survey, Science and Decisions Center

Emily Pindilli, and Dianna Hogan

Abstract: The Great Dismal Swamp (GDS) National Wildlife Refuge delivers multiple ecosystem services, including fire mitigation. Our analysis estimates benefits of this service through its potential to reduce catastrophic wildfire related impacts on the health of nearby human populations. We use a combination of high-frequency satellite data, ground sensors, and air quality indices to determine periods of public exposure to dense emissions from a wildfire within the GDS. We examine emergency

department (ED) visitation in seven Virginia counties during these periods, apply measures of cumulative Relative Risk (cRR) to derive the effects of wildfire smoke exposure on ED visitation rates, and estimate economic losses using regional Cost of Illness (COI) values established within the US Environmental Protection Agency BenMAP framework. Our results estimate the value of one avoided wildfire within the refuge to be \$3.96 million (2015 USD), or \$306 per hectare of burn. Reducing the frequency or severity of unexpected and uncontrolled peatland wildfire events has additional benefits not included in this estimate, including costs related to fire suppression during a burn, carbon dioxide emissions, impacts to wildlife, and negative outcomes associated with recreation and regional tourism. We suggest the societal value of the public health benefits alone provides a significant incentive for refuge managers to implement strategies that will reduce the severity of catastrophic wildfires.

Logging Damage and Injured Tree Mortality in Tropical Forest Management

Edwin VAN DER WERF, Wageningen University

Yonky Indrajaya, Frits Mohren, and Ekko van Ierland

Abstract: Selective logging in tropical forests can lead to severe damages on the remaining stand. The use of Reduced Impact Logging (RIL) techniques can reduce these damages relative to Conventional Logging (CL) techniques but comes with higher fixed costs. Injured trees have very low or zero commercial value but negatively affect the growth of other trees. This fact has been ignored in the economic literature on the optimal management of tropical forests. We analyse how logging damage and the presence of injured trees affect key variables for a forest manager using a Faustmann model and data for a tropical forest on Kalimantan.

PARALLEL SESSION E3: Sustainability and Natural Capital Management

Spatial Aggregation and the Value of Natural Capital

Eli Fenichel, Yale School of Forestry & Environmental Studies

Ethan Addicott

Abstract: The appropriate spatial scale at which to measure the value of natural capital has received scant attention despite rapidly growing interest in valuing natural capital. Perhaps this is because valuing natural capital is associated with wealth accounting, and that wealth accounting has been strongly associated with national accounts. Yet, appropriate valuation methods reflect the scale of the relevant economic jurisdiction, or geographic extent of the population of individuals who value a resource. Important differences in value can arise depending on the aggregation scale and method chosen when natural capital asset values and prices are aggregated across areas with high variability in economic values, preferences, or other characteristics that pertain to local resource use and scarcity. Theory provides two results relevant to the choice of spatial scale. First, spatial heterogeneity of resource characteristics can impact approximations of the value function and accounting price for a resource because spatial aggregation generally implies greater arbitrage opportunities and reduced scarcity. Second, aggregation of observed values across variation in resource and institutional characteristics leads to a selection bias. These results apply to abiotic and biotic natural capital assets. We explore the value of groundwater in the Kansas High Plains Aquifer across five groundwater management districts (GMDs) to test this theory. We demonstrate a less elastic accounting price for groundwater aggregated by GMD than by aggregation across the entire state. Choosing the appropriate scale across which to aggregate natural capital has implications for the calculation of national aggregates of natural capital and some reproducible capital assets.

A Survey of Applications of Viability Theory to the Sustainable Exploitation of Renewable Resources

Georges Zaccour, HEC Montréal

Aïchouche Oubraham

Abstract: In this paper, we survey the literature applying viability theory to the sustainable management of renewable resources. After a refresher on the main concepts of viability theory, we provide a general map of the contributions and next discuss them by area of application, including ecosystems and population biology, climate change, forestry and others. We conclude by pointing out issues that deserve more attention and should be part of a research agenda.

PARALLEL SESSION E4: Nudges and Environmentally Friendly Behavior 2

Tailored Feedback and Worker Green Behavior: Field Evidence from Bus Drivers

Gert-Jan Romensen, University of Groningen

Adriaan Soetevent

Abstract: How to engage workers in conservation efforts when the company pays the bill? We collaborate with a large public transport company and investigate the potential of targeted peer-comparison feedback and on-the-road coaching among 409 bus drivers. In a natural field experiment, drivers are assessed on multiple driving dimensions and randomly assigned to individualized reports with varying numbers of peer-comparison messages. Coaches operate alongside these reports and maintain detailed logs that pinpoint driver-specific coaching moments. Benefiting from the introduction of electronic on-board recorders (EOBR) in the entire fleet of buses, we gather over 800,000 trip-level observations to evaluate both feedback programs. We find that peer-comparison messages are detrimental to driving behavior when drivers received prior coaching. Uncoached drivers, in contrast, show some improvement after being exposed to the messages. Coaching itself positively affects driving on multiple dimensions but these effects diminish over time.

Habits, Intrinsic Motivation and Environmental Policy: A Field Experiment on Household Waste Sorting

Daan van Soest, Tilburg University

Ben Vollaard

Abstract: Commuter modal transportation choice, residential energy usage, and household waste recycling are examples of persistent behaviors of that are better described as habits than as the outcome of continuous deliberate decision making. From an environmental policy perspective, the notion of pollution-intensive behaviors being habitual implies that the focus should shift from influencing cost-benefit ratios to policies targeted at breaking old habits and introducing new ones. At the same time, intervening in consumer and household behaviors is oftentimes viewed as hazardous because of the risk of crowding out citizens' intrinsic motivation. We implement a large-scale field experiment, targeted at improving waste sorting by 65,000 households in the city of Tilburg, where we test the short- and long-run effectiveness of a temporary enforcement policy aimed at changing sorting habits by means of intensive monitoring and fines. We find that the enforcement policy is very effective in improving waste sorting not only in the short run but also in the long run, with the effect remaining long after the enforcement actions ceased – suggesting that the impact of enforcement on changing habits dominates its possible negative impact on households' intrinsic motivation to help protect the environment.

LOGISTICAL DETAILS

Getting to Tilburg

Getting to Tilburg from Schiphol Airport:

- Take the train from Schiphol Airport with destination Maastricht. Get off at 's Hertogenbosch ("Den Bosch") and switch trains to Tilburg.
- Get off at Tilburg Station.

Getting to Tilburg from Eindhoven Airport

- From Eindhoven airport, take the shuttle bus to Eindhoven Central Station, and take the direct train to Tilburg. Get off at Tilburg Station.

For information to get to the hotels, see below.

Conference venue

The 19th BIOECON Conference will take place at Tilburg University, Building C (Cobbenhagen Building). During the conference we will make use of the following rooms: Grand Auditorium, C187 ("Ruth First"), C186, CZ109, CZ110 and CZ122. All plenary sessions (welcome address, key note lectures, and the plenary sessions) will take place in the Grand Auditorium. The parallel sessions are scheduled in the other rooms. There will also be signs to navigate you to the rooms. Coffee breaks will be held in front of rooms CZ 109/110. Lunches will take place in the Foyer of the Grand Auditorium.

Welcome reception

The welcome reception and buffet will be held on September 20, 18.00 hrs, at Dudok, Veemarktstraat 33, Tilburg.

Registration

On Thursday September 21 and Friday September 22 the registration desk is in the Foyer in front of the Grand Auditorium. If you have any questions during the conference, please contact the people at the registration desk.

Conference dinner

The conference dinner will be held on September 21, 19.30 hrs, at Villa de Vierjaargetijden, Noordstraat 36, Tilburg.

Leaving Tilburg

- For those leaving Tilburg on Friday September 22, railway station "Tilburg University" is 10 minutes walk from the Campus.
- For participants who need a taxi to one of the (Tilburg University Station, or Tilburg Station), please contact the registration desk.

Additional logistical information for participants staying in Auberge du Bonheur

Address

Hotel Auberge du Bonheur, Bredaseweg 441, Tilburg, phone: 0031 13 468 6942. For more information see: www.bonheurehorecagroep.nl/en/auberge-du-bonheur

Getting to from Tilburg Station to Hotel Auberge du Bonheur

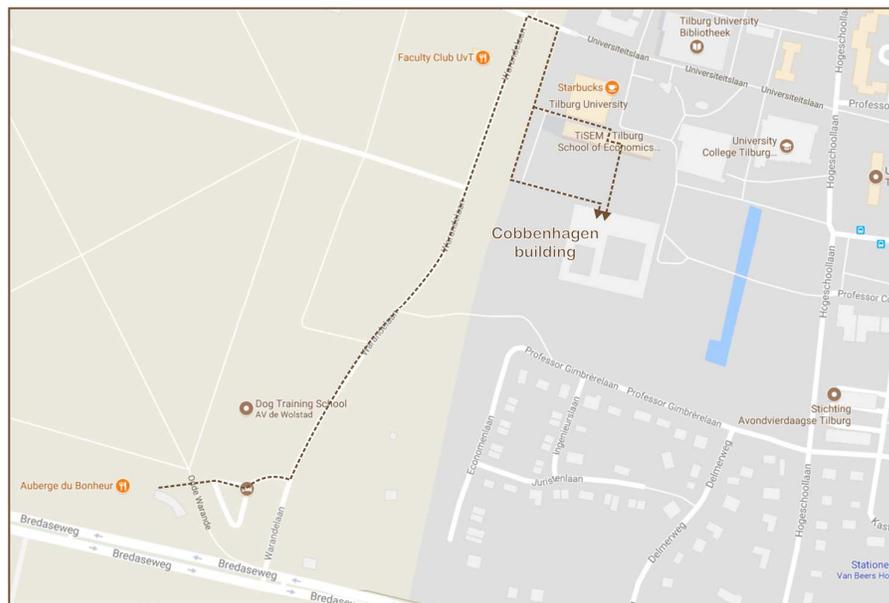
- Take a taxi (recommended), or
- Take bus line 4 in the direction "Reeshof". Get off at Zwartvenseweg, and then walk back in the direction of where the bus came from, and within 5 mins or so the hotel is on your left hand side.

Getting to the reception in Dudok and back, Wednesday September 20

- Taxis to Dudok will depart from the Auberge at 17.30 hrs.
- Taxis from Dudok to Auberge depart at 20.00 hrs.

Getting to the conference venue (Tilburg University, Cobbenhagen Building – Building C)

- Leave the premises via the big car park. Turn left on the road (*not* in the direction of the main road), and walk 5 minutes to Tilburg University Campus.



Getting to the social dinner in *De Vier Jaargetijden* and back, Thursday September 21

- A bus will depart at **19.00 hrs.** from **Hotel Auberge du Bonheur** to the dinner location (Villa de Vier Jaargetijden).
- For returning to Hotel Auberge du Bonheur, taxis will depart from *De Vier Jaargetijden* at **22.30 hrs.**

Additional logistical information for participants staying in Hotel Mercure

Address:

Hotel Mercure Tilburg Centrum, Heuvelpoort 300, Tilburg, phone: 0031 13 535 4675. For more information see: www.mercure-tilburg.nl/site/EN/home/

Getting to Hotel Mercure from Tilburg Station

- Take the city center exit of Tilburg Station, and turn left.
- At the traffic lights (400m), turn right (cross the street). Continue onto the square (“Heuvelplein”), and the Mercure hotel is towards the far left corner of the square.

Getting to the reception in Dudok, Wednesday September 20

- Turn right when leaving the hotel’s main exit. Cross the street, continue straight ahead, and take the first street to the left.
- Dudok, Veemarktstraat 33, is 100m on your left.



Getting to the conference venue (Tilburg University, Cobbenhagen Building – Building C)

- Buses to the conference venue will depart on Thursday (September 21) and Friday (September 22) at **8.30 hrs.** in front of the hotel.
- Remember where the buses stop near the campus; this is where you will be picked up again in the evening to bring you back to the Mercure.
- For directions to get to the conference venue (Cobbenhagen Building), see below.

CONFERENCE SPONSORS

 <p>TILBURG UNIVERSITY</p>	<p>Tilburg University is a public research university specializing in the social and behavioral sciences, economics, law, business sciences, theology and humanities, located in Tilburg in the southern part of the Netherlands. Tilburg University's research on sustainability and the environment is concentrated in Tilburg Sustainability Center, which specializes in environmental economics and environmental law.</p>
 <p>UN environment United Nations Environment Programme</p>	<p>United Nations Environment Programme (UN Environment), established in 1972, is the voice for the environment within the United Nations system. UN Environment acts as a catalyst, advocate, educator and facilitator to promote the wise use and sustainable development of the global environment. UN Environment's work encompasses assessment of global, regional and national environmental conditions and trends, developing international and national environmental instruments, and strengthening institutions for the wise management of the environment.</p>
 <p>THE WORLD BANK IBRD • IDA</p>	<p>The World Bank is a vital source of financial and technical assistance to developing countries around the world. We are not a bank in the ordinary sense but a unique partnership to reduce poverty and support development. The World Bank Group comprises five institutions managed by their member countries. Established in 1944, the World Bank Group is headquartered in Washington, D.C.</p>
 <p>THE BEIJER INSTITUTE OF ECOLOGICAL ECONOMICS KUNGL. VETENSKAPS-AKADEMIEN THE ROYAL SWEDISH ACADEMY OF SCIENCES</p>	<p>The Beijer Institute is an international research institute under the auspices of the Royal Swedish Academy of Sciences. The Institute was established in 1977 and was reorganized in 1991 with a focus on ecological economics. Core funding is provided by the Kjell and Märta Beijer Foundation.</p>
 <p>Christian-Albrechts-Universität zu Kiel</p>	<p>Kiel University is a university of dynamic, interacting academic cultures, which considers the dialogue between the disciplines and approaches an essential prerequisite for understanding and solving complex issues of our time. Topics such as health, nutrition, the environment, climate and societal development are consistently dealt with on a trans- and interdisciplinary basis.</p>
 <p>Ministerie van Infrastructuur en Milieu</p>	<p>The Netherlands' Ministry of Infrastructure and the Environment is committed to improving quality of life, access and mobility in a clean, safe and sustainable environment. The Ministry strives to create an efficient network of roads, railways, waterways and airways, effective water management to protect against flooding, and improved air and water quality.</p>
 <p>UNIVERSITY OF CAMBRIDGE</p>	<p>The University of Cambridge is one of the world's foremost research universities. The University is made up of 31 Colleges and over 150 departments, faculties, schools and other institutions. Cambridge has many notable alumni, including 90 Nobel laureates who have been affiliated with it. The Department of Land Economy is a leading international centre, providing a full programme of taught courses and research groups focusing on the law and economics of property, spatial planning, and environment.</p>

ABOUT BIOECON



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 international academic and research institutions and main 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. After its conclusion, the partners have continued to operate the conference in recognition of the large group of students and academics interested in working in this field, and in recognition of the need for a forum for their work. Over the past ten years, the network and conference has also served as a forum for policy organisations and government analysts to gather and to consider biodiversity and conservation issues as well.

In 2011 the Network was institutionalised, enlarging its partnership to outstanding institutions and research centres all over the world, working on biodiversity issues under different perspectives, reaching thus the number of thirty members.

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.

BIOECON wants to encourage: (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 developed within the network partnership on all three levels of biodiversity, namely the genetic, species, and ecosystem level.

BIOECON serves as a catalyst to spread the main results of research and practices on these themes, through a series of activities, amongst which its annual meeting, that represents an opportunity for networking, and sharing lessons and experiences with other researchers, environmental professionals, international organizations and policy makers.

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