

2012/2013
ANNUAL REPORT **The Beijer Institute of Ecological Economics**



The Beijer Institute of Ecological Economics ©2013

The Royal Swedish Academy of Sciences

Editor Agneta Sundin

Design Futerra Sustainability Communications

Print Edita Västra Aros AB, Västerås

ISBN 1654-6024

Cover Photo Max Troell, Agneta Sundin, Caroline Schill, Cagan Sekercioglu, Cecilia Nordstrand, Frank Gregersen/Nofima, Tom Hermansson Snickars/Azote, Anders Tedeholm/Azote, Veronika Chobotova



The Beijer Institute of Ecological Economics is an international research institute under the auspices of the Royal Swedish Academy of Sciences. Since 1991, the Beijer Institute has been an institute of ecological economics.

The major objectives of the Institute are to carry out research and stimulate cooperation between scientists, university departments, research centres and institutes to promote a deeper understanding of the interplay between ecological systems and social and economic development.

Cooperation efforts include collaborative research between economists and ecologists and related disciplines on fundamental and applied problems in relation to sustainability, as well as teaching and training on those issues nationally and internationally.

The Beijer Institute's major activities are international research programmes, synthesis workshops, a broad set of research projects, teaching and training programs, dissemination of results, the science-policy interface and collaborative communication.

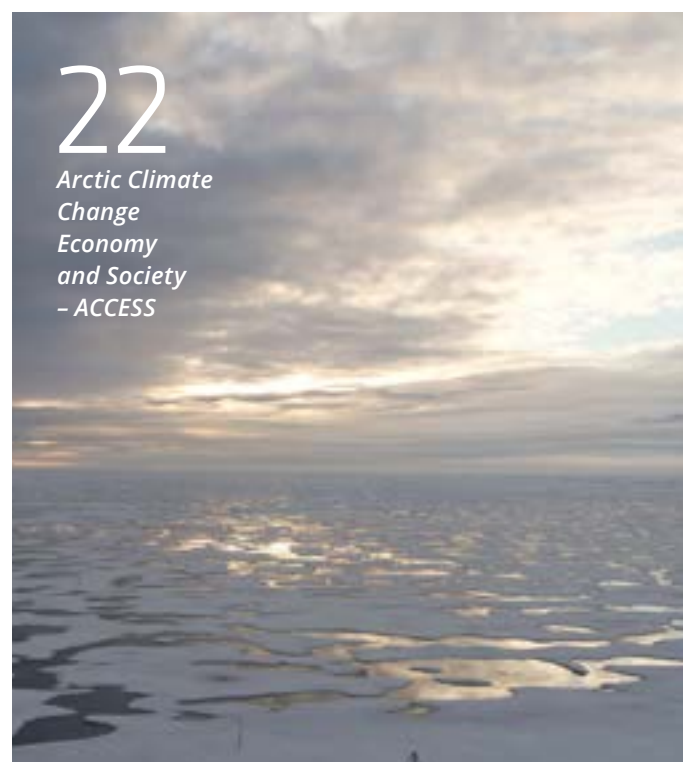
Core funding is provided by Kjell och Märta Beijer Foundation.

Funding is also provided by Swedish and international research councils, foundations and other organizations.

This Annual Report covers the period 1 July 2012 – 30 June 2013

More information can be found on: www.beijer.kva.se

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Director's column

By Carl Folke

People are embedded parts of the biosphere and shape it, from local to global scale, from the past to the future. At the same time, people are fundamentally dependent on the capacity of the biosphere to sustain human development. This interconnection between people and the biosphere and its implications for a prosperous future for humanity is at the very core of the work of the Beijer Institute.

It is exciting to follow the developments of our five research areas, with great progress achieved during the year, in collaboration with close partners and networks in Sweden and internationally. These areas cover studies of human behaviour, seafood production, urban futures, complex systems and global change. Workshops, joint projects, new funding and high-quality publications have formed part of the creative and productive process.

The programme Behaviour, economics and nature network (BENN) has been revived under the leadership of Therese Lindahl and now also in collaboration

with Marty Anderies from Arizona State University, who will join us as programme director of BENN and also serve on the Beijer Board. The experiments being performed are leading to exciting findings in relation to tipping points and regime shifts. There is progress in the Arctic programme – ACCESS – orchestrated by Anne-Sophie Crépin, with research trying to unravel the socio-economic consequences of climate change in the Arctic. In collaboration with Stockholm Resilience Centre, the Beijer Institute is engaged in the Arctic Resilience Assessment supported by the Arctic Council. Several of those efforts feed into the programme Complex Systems, a programme of great relevance for modelling ecological and economic interactions in new ways and for theory development. The programme Urban Social-Ecological Systems continues to make progress in its innovative work on green city space, biodiversity, social-ecological memory and urban ecosystem services in relation to city planning, in collaboration with researchers in architecture and urban design.

Significant work is also emerging from the programme Global Dynamics and Resilience, with several important publications on the new global dynamics of speed and connectivity on a human-dominated planet and with new findings in the pipeline. The same is true for the programme Aquaculture and Sustainable Seafood Production, which is moving into a deeper understanding of what an

We have now produced over 375 scientific publications

in respected journals and books and the level of citations has stabilised at well above 1500 per year (ISI Web of Science).



intertwined global system of people and nature implies for sustainable seafood production. These two programmes will benefit greatly from synergies in process with the recently established Family Erling Persson Academy Programme on Global Economic Dynamics and the Biosphere, funded through a grant to the Royal Swedish Academy of Sciences. We are most pleased to have Beatrice Crona as executive director of the programme. Of course we continue to have inspiring collaborations with the marine social-ecological systems theme and the global resilience theme of the Stockholm Resilience Centre, where Max Troell and Anne-Sophie Crépin do great work as theme leaders.

Researchers and staff at the Beijer Institute are deeply engaged in the Stockholm Resilience Centre and its activities and it is most rewarding that the evaluation team which performed

the recent assessment of the Centre in May 2013 concluded that “Since its inception in 2007, Stockholm Resilience Centre has become a world-leading research centre advancing interdisciplinary research on the dynamics of interconnected social-ecological systems”.

To be a world leader requires skilful, committed people and it is in this spirit that we continue to encourage and develop the Beijer Young Scholars group, a most inspiring endeavour supporting a new generation of researchers collaborating across the disciplines on profound issues. Providing space for and nurturing the next generation of highly qualified scholars that can take on the challenges humanity is facing is indeed essential. It is in the same spirit that we continue the engagement with the networks in environmental economics in Africa, Asia and Latin America, the journal Environment and Development Economics, the Mäler Scholarships and the appreciated courses in relation to international economics conferences.

The Beijer Institute is a small institute in terms of staff, operating with a network of hundreds of respected scholars worldwide. The key focus of the Beijer continues to be to promote a deeper understanding of the interplay between ecological systems and social and economic development and stimulate collaborative research between economists and ecologists and

related disciplines on fundamental and applied problems in relation to resilience and sustainability. Our strength lies in combining a long-term research focus, providing new insights and forming new research frontiers, with selected efforts highlighting the new understanding and supporting its implementation in society. As an example of the former, we have now produced over 375 scientific publications in respected journals and books and the level of citations has stabilised at well above 1500 per year (ISI Web of Science). A few of last year's publications are covered in more detail in this report. As an example of the latter, Johan Colding and colleagues have produced a major report in collaboration with the Office for Regional Growth, Environment and Planning (TMR) at Stockholm County Council. The report, “Ecosystem Services in the Stockholm Region”, will be used in urban development and planning in Sweden. At the national level, we are serving as advisors for the forthcoming Swedish Government Report on making ecosystem services visible in society, and internationally we have been engaged with the UN City Biodiversity Outlook project.

I would like to take this opportunity to thank those who have provided support for our activities during the year. As always, and in particular, we are very grateful to Anders Wall and the members of the Kjell and Märta Beijer Foundation for their unique and important long-term investment and commitment to the Beijer Institute.



PHOTO: CECILIA NORDSTRAND

“The Beijer Institute is a small institute in terms of staff but with a network of hundreds of respected scholars worldwide”

It is a great pleasure to direct an Institute that performs well, it is exciting and rewarding. I am indebted to the staff, the programme directors, my deputy Anne-Sophie Crépin, and especially to Christina Leijonhufvud and Agneta Sundin for their excellence in providing Beijer resilience in all its dimensions!

Research

The Beijer Institute of Ecological Economics provides a forum for researchers in economics and ecology and related disciplines to interact and develop joint research, seeking a deeper understanding of social-ecological systems. Research at the Beijer Institute is organised into five international programmes that comprise a diverse set of projects.



PHOTO: MAX TROELL

Aquaculture and sustainable seafood production

by Max Troell

This research programme analyses aquaculture development and its interplay with fisheries and coastal and marine ecosystems. The main focus is on opportunities for sustainable and equitable use of global food resources and ecosystem services, and how aquaculture contributes to food production, economic development and poverty alleviation in a changing world.

A research article from the 2011 Askö meeting (Aquaculture – enhancing the resilience of the global food portfolio?) has now reached the final stage and is almost ready for submission. Parts of the results were presented at AAAAS in Boston in February 2013. This work has run in parallel with the collection of global aquaculture data to feed into two global initiatives; one aiming at modelling scenarios for human well-being (Make it Fit Project; University of Minnesota) and another aiming at producing a global aquaculture model that will be linked to the global ocean model within the Nereus programme. The aquaculture model includes high spatial production data on land and in the ocean for modelling environmental impacts and resource flows (Nereus programme, UBC, PBL/Netherlands Environmental Assessment Agency).

Collaboration with WorldFish has resulted in two recent publications. One relates to seafood certification and is described later in this Annual Report. (AMBIO: Eco-certification of farmed seafood: Will it make a difference?), and another to the role of aquaculture in food security (Journal of Fisheries: Meeting the food and nutrition needs of the poor: The role of fish and the opportunities and challenges emerging from the rise of aquaculture). The latter identifies the nutritional value of smaller fish in particular and discusses how this can be relevant for aquaculture development.



From research to policy

Collaboration with the World Bank has resulted in a policy statement (Agriculture and Environmental Services Department, Issue 5: Growing Aquaculture in Sustainable Ecosystems) that will be instrumental for the World Bank's future focus and investments related to aquaculture. Aquaculture is considered here to be a food system offering many qualities compared with other food systems, but there are also some key challenges that need to be addressed. These include spatial planning to identify sites suitable for aquaculture, developing eco-certification systems that include a broader set of sustainability indicators and more studies to assess the sustainability of existing aquaculture production to apply knowledge in future projects.

The Mekong river delta in Vietnam hosts substantial aquaculture production. The Beijer Institute is part of a Sida-funded project which has the overall objective of generating knowledge that can provide guidance and technical support to local policy makers and managers in the Mekong delta related to maximise societal benefits from aquaculture development. A large workshop held at An Giang University, Long Xuye, Vietnam, between 23-26 October 2012, involved participants from several universities in Vietnam and also some national NGOs, including WWF Vietnam.

Beijer Institute researchers have been actively engaged in discussions about the potential for Swedish aquaculture development through advising the Swedish Foundation for Strategic Environmental Research (MISTRA) in its forthcoming research programme on aquaculture (SEK 68 million for sustainable production

systems), and also through contributing to the book produced by the Swedish Research Council FORMAS on sustainable seafood (Chapter: Sustainable Aquaculture - potential and challenges. In: Sustainable Seafood Production). At the EU level, the Beijer Institute is represented in the ICES Study Group on Socio-Economic Dimensions of Aquaculture and the group's Spring 2013 meeting resulted in a policy paper that is under submission.

Future activities

Activities in the near future will include an in-depth study on resilience aspects of aquaculture in relation to other food production systems. This will be a continuation of the Askö paper on aquaculture. It is also anticipated that ongoing collaboration with Stanford University on Chinese aquaculture and its relationship to forage fish consumption will continue. A workshop planned for Autumn 2013 aims to look further into the sustainability of sourcing fish for animal feeds, i.e. its resulting resource efficiency and implications for overall social well-being. Another workshop being planned together with WorldFish collaborators will focus on whether aquaculture production has led to reduced fishing pressure on wild stocks. The Beijer Institute research programme Aquaculture and sustainable seafood production will have close links with The Family Erling Persson Academy Programme on Global Economic Dynamics and the Biosphere.



Behaviour, Economics and Nature Network – BENN

By Therese Lindahl



PHOTO: CAROLINE SCHILL

There is mounting scientific evidence that human actions have become the main driver of global environmental change. If the impacts of these human activities cause critical thresholds to be crossed, there is a risk of unpredictable and abrupt environmental change on local, regional and global scale. The potential for such abrupt change vastly increases the complexity and difficulty of managing human impacts through environmental policy.

The mission of BENN is to move beyond current approaches to environmental policy and explore alternative approaches for living within planetary boundaries that emphasise achieving a good 'fit' between human behaviour, the biophysical environment and governance. As the name suggests, BENN focuses on the relationship between human behaviour and the environment, and seeks to generate new mechanisms that strengthen basic attributes of human behaviour that may lead to pro-environmental choices. To ensure that positive behavioural changes are sustained beyond the short term, BENN also seeks to understand fundamental drivers of behaviour and how behavioural patterns and processes are maintained.

Finally, given the rapid changes our global society faces, we must identify elements of feedbacks between

A Norwegian hotel chain lowered food waste by

20% after deciding to use smaller plates in its buffet restaurants



behaviour and the environment that make governance systems robust vis-à-vis those that make them fragile. What are the attributes of human behaviour (from individual to community level) that we need to

understand and possibly change? How do they affect the robustness and resilience of the social-ecological systems of which they form part? Addressing such questions is the core of the BENN research programme.

The new programme director for BENN since January 2013 is Dr. Marty J. Anderies, School of Sustainability, Arizona State University (see presentation in the Appendix section), while Therese Lindahl will continue to lead the programme in Stockholm. Professors Simon Levin, Princeton University, Karine Nyborg, University of Oslo, and Jason Shogren, University of Wyoming form the international advisory group of BENN.

Current research activities

When building an empirically grounded theory of human behavioural change in a rapidly changing world, we need to rely on an interdisciplinary (e.g. ecological, economic and psychological) and multi-method (e.g. empirical, theoretical and experimental) approach. We believe such an approach will be necessary to gain a more comprehensive understanding of the social-ecological mechanisms and drivers underlying the negative environmental changes we are currently observing and will potentially experience, and how we can overcome them. Empirical data on human behaviour are collected mainly through laboratory and field experiments, supplemented by surveys and interviews. To formulate hypotheses and to analyse results, we use insights and theories from behavioural

economics, game theory, ecology, resilience theory, network analysis and agent-based modelling.

Response to threats of abrupt changes

Human activities are triggering regime shifts of increasing severity (e.g. due to pollution, resource extraction, climatic warming) and their frequency seems to be increasing.

In the research project Regime shifts in common pool resource systems, Beijer Institute researchers Therese Lindahl, Caroline Schill and Anne-Sophie Crépin, with the assistance of Nikolina Oreskovic, are using laboratory and field experiments to investigate how cooperation strategies and resource management are influenced when users face a potential abrupt and persistent shift in the regrowth of their resource. The project is being funded by Riksbankens Jubileumsfond and the EU project ACCESS and was described in greater depth in last year's Annual Report.

A gentle nudge to help the environment

A Dutch environmental NGO painted bright red strips along the floor leading to the stairs at the entrance to their office building and suddenly the frequency of people opting to take the stairs rather than the elevator rose by 70%. A Norwegian hotel chain wanting to lower food waste in its buffet restaurants decided to use smaller plates, lowering waste by 20%.

These are examples of nudging, i.e. changing a person's behaviour through manipulation of the choice set. In the past, interventions implemented with the purpose of changing human behaviour have been top-down instruments such as regulations, market-based approaches and information. A policy approach that is now increasing in popularity is based on the type of nudges described above.

Today there are only a handful of studies demonstrating how nudging can promote more environmentally friendly behaviours. We want to look more closely at this method and explore the obvious and less obvious constraints to applying nudges for environmental protection. Moreover, we aim to examine how best to design nudges so that they do not crowd out existing 'good' behaviours and policies, and to ensure that we target not only behaviours that are more easily manipulated, but also behaviours with high ecological impacts. To get the project underway, Therese Lindahl and SRC Master student Britt Stikvoort are writing a review article on scientific studies addressing nudges.

Governing complex systems – the role of interdependent resources

Ecosystem complexity can entail a number of factors (e.g. spatial dynamics, potential abrupt changes and uncertainties). The main focus of this research project is the aspect of resource interdependencies. Imagine for example a group of fishermen with common access to a fishing ground close to the shore and another smaller group with larger fishing vessels that can also access offshore fishing grounds. The two fish populations are of course interdependent. Within this (or similar) settings, this research project aims to answer questions regarding how resource interdependencies and user asymmetry affect the behaviour of resource users and the implications for management. The project is being carried out in partnership by Therese Lindahl and researchers at Stockholm Resilience Centre.

Future plans

- An international workshop is planned at the Royal Swedish Academy of Sciences in June 2014 to discuss the questions above and to start developing new research questions in cooperation with other scholars from different fields.

- A project proposal on field experiments in Thailand and Colombia has been submitted to several potential funders. If this proposal is successful in obtaining funding, we plan to test how fishermen respond to potential abrupt changes in fish stocks. Beijer researchers Therese Lindahl, Caroline Schill and Anne-Sophie Crépin and the Mäler Scholar Rawadee Jarungrattanapong and Juan Carlos Rocha, SRC, will be involved in this project.

Lab experiments during the Arizona workshop



PHOTO: VERONIKA CHOBOTOVA



PHOTO: VERONIKA CHOBOTOVA



Field experiments with fishermen in Senjahopen in northern Norway

PHOTO: CAROLINE SCHILL

Global dynamics and resilience

By Anne-Sophie Crépin



Working group in action during May workshop

PHOTO: AGNETA SUNDIN

Human well-being has improved substantially during the past century but global-scale challenges, such as climate change, declining fisheries and other substantial problems connected with human development, are giving rise to concerns about future well-being. Such unintended consequences often surprise us because we have failed to see important linkages between cause and effect.

In this research programme we want to see if there are ways to anticipate these consequences by taking a more

systemic view of human-environment interactions. Are there ways to reform institutions to take complex interlinkages into account?

Within this joint research programme by the Beijer Institute and Stockholm Resilience Centre, we assume that we can do better in anticipating and accounting for systemic effects and risks. We are exploring critical social-ecological interactions and feedbacks and looking at the kind of governance structures that can be developed to avoid catastrophic shifts in the Earth system and to transform societal development towards global sustainability.

Big steps forward in spring workshop

The fourth workshop of this programme, on 27–29 May 2013, attracted approximately thirty

Swedish and international researchers in various disciplines. The objectives were to synthesise the outcomes of the programme, identify gaps in current achievements and identify particular topics and directions to focus on in coming years. The organising team, consisting of staff from the Beijer Institute and Stockholm Resilience Centre, made a major effort to shape the meeting in ways that contributed to achieving our objectives.

The first day of the workshop was devoted to bringing participants up to date with current achievements and projects. The morning session mixed series of speed talks presenting particular results with substantial discussions around the research direction and results. The afternoon session, called “Global dynamics and resilience: insights, uncertainties and controversies”, was open to a



PHOTO: AGNETA SUNDIN

broader public of researchers in the field. The idea was to inform colleagues at Stockholm Resilience Centre of programme achievements and get feedback from researchers outside the programme. After an introduction by the moderator Anne-Sophie Crépin, programme researchers Jeroen van den Bergh, Sarah Cornell, Thomas Homer Dixon and Victor Galaz each gave a presentation. These presentations were followed by a panel debate and discussions with the audience.

In contrast, the second day of the workshop was a creative day to come up with new ideas worth investigating further during the coming years. To boost creativity, we chose a location in the Stockholm archipelago, on the beautiful island of Söderarm. We divided into different focus groups to think more deeply about some particular topics. People reconvened around lunch to present preliminary results and form new group constellations for the afternoon. This day was led by SRC PhD students Andrew Merrie and Juan Carlos Rocha.

The third and last day of the workshop was spent back at the Academy and aimed at setting clear targets for the coming years, assigning tasks and commitments and discussing funding allocations and needs. The careful planning and varied forms of the meetings proved a success and the Beijer Institute is grateful for the enthusiasm and engagement shown by the participants in the urgent issues addressed within this programme. We plan to present the results of the programme in a synthesis article on global feedbacks that was drafted during the workshop. In addition, the main programme results will be published in the form of a book.

Financial support for this workshop by the Anna-Greta and Holger Crafoord Foundation is gratefully acknowledged.

Askö group 2012. Back row: Jim Wilen, Paul Ehrlich, Terry Chapin, Karine Nyborg, Eric Lambin, Max Troell and Carl Folke. Middle row: Tasos Xepapadeas, Steve Carpenter, Ken Arrow, Roz Naylor, Marten Scheffer, Gretchen Daily, Simon Levin, Nils Kautsky, Karl-Göran Mäler, Steve Polasky, Scott Taylor and Scott Barrett. Front row: Caroline Schill, Christina Leijonhufvud and Anne-Sophie Crépin



PHOTO: THE BEIJER INSTITUTE

Other activities

On 8–10 September 2012, the Beijer Institute hosted the 20th Askö meeting on a topic closely related to this programme: the challenge of feeding a global population of soon nine billion people. The global food markets are becoming more vulnerable due to the high connectivity and the pressure for increased productivity. The discussions focused on identifying critical features and elements of flexibility to promote in order to nurture the necessary flexibility to achieve increased production, given the moving baseline caused by current global change.

Financial support for the 2012 Askö meeting by the Brothers Jacob and Marcus Wallenberg Memorial Foundation is gratefully acknowledged.

Economist Gustav Engström successfully defended his PhD thesis "Essays on Economic Modeling of Climate Change" on 28 September 2012, in which several articles originating from the programme appear. (See separate article later in this report.)

On 13–16 May 2013, the second Beijer Young Scholars workshop was held as part of the global dynamics and resilience research programme. The workshop gathered 13 of the Beijer young scholars and several joint research projects were initiated (see separate article later in this report).

Staff and partnership news

From June 2013 the coordination capacity has been reinforced with Megan Meacham, who will assist programme leaders. The programme Global Dynamics and Resilience is evolving in tight collaboration with two essential nodes in Stockholm: the research theme Global and cross-level dynamics in the Anthropocene, of Stockholm Resilience Centre led by Anne-Sophie Crépin and Victor Galaz, and the emerging Academy Programme on Global Economic Dynamics and the Biosphere, funded by the Family Erling Persson Foundation, led by Carl Folke and Beatrice Crona.

Examples of manuscripts that have been published or advanced during the past year within the Global dynamics and resilience programme:

Anderies, JM, S Carpenter, W Steffen, and J. Rockström. The Topology of Non-linear Global Carbon Dynamics: From Tipping Points to Planetary Boundaries. Under revision

Bennett, EM, SR Carpenter, LJ Gordon, N Ramankutty, P Balvanera, B Campbell, W Cramer, J Foley, C Folke, L Karlberg, J Liu, H Lotze-Campen, N Mueller, G Peterson, S Polasky, J Rockstrom, RJ Scholes, M Spirenborg. Resilience Thinking for Sustainable Agriculture. Manuscript

van den Bergh, J, C Folke, S Polasky, M Scheffer, and W Steffen. What if Energy Becomes Cheap and Clean? The Issue of Environmental Problem Shifting. Manuscript

Crona, B, T Daw, W Swartz, A Norström, M Nyström, M Thyresson, C Folke, J Hentati-Sundberg, H Österblom, L Deutsch, and M Troell. Masked, Diluted, Drowned Out: Global Seafood Trade Weakens Signals from Marine Ecosystems. Manuscript.

Engström, G. 2012. *Essays on Economic Modeling of Climate Change*. Doctoral thesis in Economics at Stockholm University. Sweden, 2012.

Engström, G. and A. Xepapadeas. Solow meets Lovelock. Manuscript.

Galaz, V, F Biermann, B Crona, D Lorbach, C Folke, P Olsson et al. 2012. Planetary boundaries – exploring the challenges for global environmental governance. *Current Opinion in Environmental Sustainability* 4:80-87.

Galaz, V, F Biermann, C Folke, P Olsson and M Nilsson, eds. 2012. *Special Section: "Planetary Boundaries"* and Global Environmental Governance. *Ecological Economics* 81:1-180.

Homer-Dixon, T, R Biggs, E Lambin, L Deutsch, C Folke, E Naevdal, G Peterson, J Rockström, M Scheffer, W Steffen, M Troell, and B Walker. Synchronous Failure: The New Architecture of Global Crisis. Manuscript.

Peterson, G, R Biggs, A-S Crépin, V Galaz. Pathological Dynamics in Global Environmental Problems. Manuscript.

Polasky, S, et al. Make it Fit. Manuscript.

Mroell, M, et al. Food security and aquaculture development in a globalized world – links and tradeoffs between marine and terrestrial production systems. Manuscript.

Yu, H and CZ Li. Economic growth and welfare under global environmental thresholds. Manuscript.

Urban social-ecological systems

By Johan Colding



PHOTO: MAX TROELL


Urban regions are hubs of services, knowledge, capital and innovation that offer solutions for humans and the environment, but they also create great demands for resources and ecosystem services and generate large volumes of waste. The continuing increase in the number and size of urban regions and the ensuing transformation of landscapes pose challenges to ensuring human welfare and a liveable, sustainable environment.

The Millennium Ecosystem Assessment concluded that about 60% of global ecosystem services are currently being degraded or used unsustainably. As urbanisation proceeds, cities will need to build capacity to sustain ecosystem services, not least for building resilience to climate change effects. This research programme

aims at promoting resilient urban development through integrated research on ecosystem services generation, social dynamics, governance networks and the built environment. Understanding the ecological dynamics of different types of land use and the role played by informal institutions, local ecological knowledge, management practices and social networks in resilience building of urban ecosystems is a key focus, another is investigating ways of promoting cognitive resilience building to broaden city dwellers' understanding of their dependence on ecosystems inside and outside cities.

Urban green commons

Over the year, a number of new publications emerged in the urban programme, as well as exciting workshops. Worth highlighting is the series of new scientific articles on urban common property systems, representing the first review of its kind addressing urban ecosystems that depend on collective organisation and management, and referred to as urban green commons. In the journal *Landscape and Urban Planning* researchers Pim Bendt, Stephan Barthel and Johan Colding looked at how community gardens in Berlin

More than
60% 
of the land
expected to be urbanised by 2030
has yet to be built.
What an opportunity!

can help teach local communities in cities about the importance of urban ecosystems and green areas. (see more in the Selection of Publications section of this report).

In an *Ecological Economics* article, Colding and Barthel provide insights into how common property systems could contribute to urban resilience building by managing cultural and biological diversity in cities.

Furthermore, in *Global Environmental Change*, Colding, Barthel and co-writers apply a property rights analytic perspective and synthesise information on urban green commons from Sweden, Germany and South Africa, elaborating on their role for biodiversity conservation. In summary, several benefits can be

associated with urban green commons, such as a reduction in the costs of ecosystem management and designs for reconnecting city inhabitants to the biosphere. In addition, the emergence of urban green commons appears closely linked to dealing with societal crises and the need for reorganising cities. Hence, urban green commons can play a key role in transforming cities toward more socially and ecologically benign environments.

From research to policy

Researchers in the Urban Social-Ecological Systems programme are producing a number of policy-orientated publications in close cooperation with Stockholm County Council and the Royal Institute of Technology (KTH). The purpose is to spread knowledge and understanding about the fundamental role that ecosystems and their services play for urban resilience building. Two reports on how to incorporate ecosystem services in regional urban planning have been published and have attracted great interest (see more in the Science and Policy section), and a report on social-ecological building designs for resilience building in the greater Stockholm region is planned.

A number of writing workshops have taken place throughout the year, devoted to completing a critical review paper on the environmental validity of the smart growth paradigm. Smart growth or compact cities are concepts widely used in contemporary urban planning and design and, among other things, promote densification of urban areas. The project involves researchers at the Beijer Institute and the School of Architecture at KTH in Stockholm.

The scientific analyses and assessment synthesis of the "Cities and Biodiversity Outlook" (CBO) is now in publication. It focuses on the links between urbanization and biodiversity and the impact that urbanization has on ecosystem services. Beijer Institute researchers have served as lead and co-authors of the synthesis.

Sharing new perspectives

A workshop that received immense appreciation among participants was the joint open seminar between the Korean Academy of Science and Technology (KAST) and the Royal Swedish Academy of Sciences, which was hosted by the Urban Social-Ecological Systems. The seminar, entitled *Global Change and Resilience Building of Cities*, is described in the Selected events section of this Annual Report.



PHOTO: THE BEIJER INSTITUTE

Participants of the workshop Perspectives on Growing and Shrinking Human Habitats. Heekyung Park, Annika Björklund, Lars Marcus, Marianne Krasny, Carole Crumley, Stephan Barthel, Christian Isendahl, Johan Colding and Teresa Marat-Mendes. Missing: Håkan Forsell, Åsa Gren and Lars Nilsson

An event of similar memorable impact was the international workshop *Perspectives on Growing and Shrinking Human Habitats*, which took place on 11–13 June. It centred on providing different perspectives on shrinking and growing human habitats, with cities and rural human habitats regarded as a continuum, intimately linked and connected. Scholars from different disciplines and countries met and shared new perspectives and research results, dealing with sustainable building of human habitats from different parts of the world, with examples ranging from a contemporary community in the Swiss Alps to urban centres built by the ancient Mayans. Mutual opportunities were identified and the twelve participants agreed to share workshop insights further by developing and producing a policy article with the aim of broadening the quite narrow notion of sustainable urban development.

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Complex systems

By Aart de Zeeuw and Chuan-Zhong Li

PHOTO: TOM HERMANSSON SNICKARS/AZOTE

The aim of this research programme is to develop economic theory and policy instruments for improving the management of social-ecological systems. By employing small-scale integrated models, we are exploring the essential links, feedbacks and thresholds in complex systems, as well as their implications for resource management strategies.

Scientific research on these issues has expanded dramatically during the past ten years and the time is ripe to synthesise this knowledge in order to sum up current achievements and highlight the gaps where more effort should be directed in the future. We published two such exercises last year as the results of the Askö meetings. Carpenter et al. (2012) identified

conditions which can support the development of general resilience in the face of extreme events. This article resulted from the Askö 2010 meeting. Levin et al. (2013) reviewed the modelling and policy implications of viewing social-ecological systems as complex adaptive systems. They illustrate some recent advances in modelling and present new challenges using examples of coral reefs and grasslands. This article resulted from the Askö 2007 meeting.

In addition, we have produced two articles that discuss the management of social-ecological systems in light of the potential for regime shift. That by Crépin et al. (2012) is aimed at the scientific audience, while that by Crépin et al. (2013) is published in an encyclopaedia and targets a more general public, using a glossary list and descriptive figures. Both explore the literature devoted to regime shifts and management. They synthesise different strategic responses suggested by the literature. For example, it is beneficial to increase system resilience and lower the

"For example, it is beneficial to increase system resilience and lower the probability of regime shifts when regime shifts are likely to reduce human well-being."

probability of regime shifts when regime shifts are likely to reduce human well-being.

Given the risk that a regime shift cannot be avoided, it may also be beneficial to build capacity to adapt, should a regime shift occur.

Digging deep into theory

Besides the series of syntheses, we continued our theoretical research with several scientific papers devoted to particular modelling aspects, such as the role of regime shifts and uncertainty in pollution control (de Zeeuw and Zemel, 2012). A project related to green accounting and

sustainability produced one paper dedicated to genuine saving under stochastic growth (Li and Löfgren, 2012a) and another on growth, pollution and money-metric welfare in imperfect markets (Li and Löfgren, 2012b).

In autumn 2012, Gustav Engström successfully defended his thesis "Essays on Economic Modeling of Climate Change" at Stockholm University. Among other things, this thesis shows how spatial and endogenous issues in energy-climate modelling can alter the results of the DICE model, with multiple steady states and different mitigation policy recommendations. A related paper "Energy balance climate models, damage reservoirs and the time profile of climate change policy" is forthcoming in "The [Oxford] Handbook of the Macroeconomics of Climate Change" (Brock et al., 2013).

Work in progress includes a study by Dieter Grass, Anastasios Xepapadeas and Aart de Zeeuw on the economics of lakes.

In May 2013, Professor Jinhua Zhao from Michigan State University visited the Beijer Institute. He held an academic seminar on "Adaptation and Extreme Events: Land use decisions under uncertainty" and a Stockholm seminar on "Economics of adaptation to global climate change – past lessons and future strategies". Beijer researchers had the opportunity to interact with him and share his broad competence.

Developing empirically based theory

While complex systems research at the Beijer Institute has traditionally been more theory- and model-orientated, we have now expanded our empirical work to test the models using empirical data or gather data to build new empirically based theory. Chuan-Zhong Li, Sebastián Villasante and Xueqin Zhu are currently revising their paper on Argentinean hake management focusing on the resilience value and corrective taxes under the risk of fishery collapse. Haishan Yu and Chuan-Zhong Li are also working on a paper "Economic growth and social welfare under global environmental thresholds" with special reference to climate change and oceanic acidification risks. They have developed a general formula for the social cost of carbon emissions under double and correlated thresholds, and will conduct simulation studies with available data. Together with Dr. Ranjula Swain at Uppsala University, Chuan-Zhong Li is working on a water economics project concerning accounting prices, resilience and sustainability in South Africa. Therese Lindahl, Anne-Sophie Crépin and Caroline Schill are conducting a series of experiments to explore factors affecting how people react to potential abrupt changes in common resource management. Find out more

under the heading 'Behaviour, Economics and Nature Network – BENN'.

Future steps

In the coming academic year, we plan to develop small-scale economic models on the optimal trade-offs between mitigation and adaptation under the risk of extreme events, and organise a workshop on the economics of complex social-ecological systems.

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Arctic Climate Change Economy and Society – ACCESS

By Anne-Sophie Crépin and Agneta Sundin



View taken from the icebreaker Polarstern during an expedition in the Arctic of the ACCESS programme. The multidisciplinary group featured sea ice physicists, biologists and oceanographers.

PHOTO: MARCEL NICOLAUS

The Arctic region is changing rapidly, in ways that could dramatically affect people's lives and natural ecosystems. Climate change is a major concern, as Arctic sea ice is melting faster than global models predicted, but rapid economic development and social transformation could also make significant impacts.

The Beijer Institute is part of a major EU research project within the European Commission Seventh Framework Programme to address these issues, called Arctic Climate Change Economy and Society – ACCESS. Its main objective is to assess climate change impacts on marine

transportation (including tourism), fisheries, marine mammals and the extraction of oil and gas in the Arctic Ocean. ACCESS is also focusing on Arctic governance and strategic policy options. Particular attention is given to environmental sensitivities and sustainability in the Arctic domain. ACCESS works in cooperation with indigenous people and other key stakeholders.

One of 27 European partners, the Beijer Institute is responsible for three sub-projects related to aquaculture and fisheries. In addition, Anne-Sophie Crépin is co-leading work focusing on governance and synthesis. Gustav Engström, Åsa Gren, Therese Lindahl and Max Troell are also part of ACCESS.

Arctic aquaculture in the face of climate change

Aquaculture production in the Arctic region is by far dominated by Norway,

followed by Iceland and Russia and, at a smaller scale, Finland and Sweden. How this production is likely to be affected by climate change and what measures the industry needs to take in order to meet that and other changes was the subject of a report by Max Troell, the Beijer Institute, and his colleague Oystein Hermansen from Nofima, Norway. The report, *Aquaculture in the Arctic – a Review*, was presented to the EU during spring 2013. It gave an overview of current production and showed that a rise in water temperature (predicted to be 0.5-2.5 degrees in Norwegian coastal waters) is generally positive for the aquaculture industry in the region. However, other changes following climate change, in oxygen content, disease, algae blooms and storm outbreaks for example, may have a negative effect and it is difficult to predict how severe these changes will be. Apart from the ecological and

economic effects of climate change on aquaculture, Troell and Hermansen reviewed current governance systems, as such knowledge is helpful for developing scenarios for responses by aquaculture producers to climate change. The authors pointed to the need for a broad stakeholder involvement when assessing future challenges for the governance of the Arctic.

Mid-term achievements

ACCESS has now reached mid-term and the annual meeting in Barcelona in March 2013 was dedicated to presenting achievements made so far and to outlining the synthesis of the project. The Beijer Institute organised and led four sessions dedicated to synthesising work performed within ACCESS. The results of these sessions are now being summarised and will serve as a starting point for the next meeting concerning governance and synthesis issues, to be held in Bremen in September 2013.

Max Troell held a plenary session with Oystein Hermansen presenting the report described above. This work is part of the Beijer Institute research programme Aquaculture and Sustainable Seafood Production.

Therese Lindahl, Caroline Schill and Anne-Sophie Crépin, with the assistance of Nikolina Oreskovic, have started several new experiments linked to the ACCESS project, including a set of pilot field experiments among Norwegian fishermen. This work is a substantial part of the BENN programme and is described in that section of this Annual Report.

The sub-project dedicated to building a framework for integrated ecosystem-based management has also made substantial progress. Anne-Sophie Crépin, Åsa Gren and Gustav Engström contributed to the organisation of the synthesis sessions during the annual meeting. Results and notes from these sessions complement a written questionnaire to the participants, aiming at highlighting the interactions between the different ACCESS sectors. This material is under compilation and will help link ACCESS sectors with impacts on ecosystem services and assess indirect effects of climate change through socio-economic changes.

Report found rapid changes in the Arctic

Anne-Sophie Crépin participated as a representative of ACCESS to the Arctic Resilience Interim Report (ARR), released in spring 2013 (see www.arctic-council.org/arr). It found that rapid – even abrupt – changes are occurring on multiple fronts across the Arctic, raising the risk of crossing thresholds that would cause irreversible changes to ecosystems, environmental processes and societies. According to the interim report, it is the combination of multiple, dramatic changes that is pushing social-ecological systems to their limits. The final report of the ARR will be released in May 2015 and in the next two years the Beijer Institute envisages close collaboration with the ARR team, which is led by Stockholm Resilience Centre and the Stockholm Environment Institute.



Salmon farming in Troms county, northern Norway

PHOTO: FRANK GREGERSEN, NOFIMA

The Beijer young scholars

By Marc Metian



PHOTO: CHRISTINA LEIJONHUFVUD

Last year a network of young scientists was initiated: the Beijer Young Scholars (BYS) programme. The aim of the programme is to create an international network of young researchers conducting research related to social-ecological systems in order to stimulate the emergence of new research pathways and new ways of cooperating across disciplines for the global challenges facing humanity.

Therefore, 17 post-docs, young faculty members (within five years of completed PhD) and advanced PhD students with a background in economics, ecology, political science and related disciplines were selected in 2012 to meet annually for a period of 3 years.

Conditions for Sustainable Development Goals

The network is already functioning well. During the past year, the BYS group has developed a scientific paper on the basis of the discussions of last year's meeting. This work was led by Albert Norström, Astrid Dannenberg, Geoff McCarney and Manjana Milkoreit and Marc Metian has served as network coordinator during the past year. A full-length paper discussing the best conditions to establish and achieve effective Sustainable Development Goals

(SDGs) through social-ecological perspectives is now ready for submission. In line with this topic, Albert Norström wrote a short correspondence to *Nature* on behalf of the group in order to complement what Griggs et al. (2013) presented in an article on the subject.

Food for thought

The second Beijer Young Scholars workshop was held on 13-16 May 2013 at the Royal Swedish Academy of Sciences and on the island of Fejan in the Stockholm Archipelago. The overarching theme was "Cross-scale dynamics of food production and consumption". Three interdisciplinary working groups emerged during the workshop and work plans for the year were sketched out by the end of the meeting. These groups will investigate yield gaps, consumption behaviour and the food crisis, all of which will be

analysed across scales and with social, economic and ecological perspectives.

This second workshop was again a great success, facilitated by the philosophy promoted by the Beijer Institute for its workshops: to create interdisciplinary dialogue and come up with innovative ideas for research in a friendly environment. Brainstorming sessions were broken up by some non-scientific activities in order to create the best atmosphere for thinking and discussing across disciplines.

The group particularly appreciated a dinner preparation session organised with the eco-chef Carola Magnusson at the Matmekka restaurant. Closely related to the overarching topic, it provided a unique opportunity for dialogue between BYS scholars and Carola, who

strongly advocates production and consumption of sustainable food in Sweden.

The Beijer Institute received financial support for this workshop from the Anna-Greta and Holger Crafoord Foundation.

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Efi Kyriakopoulou, Johan Gars, Marc Metian and Kyle Meng preparing organic dinner during BYS-workshop

PHOTO: MANJANA MILKOREIT



PHOTO: MANJANA MILKOREIT



BYS workshop 2013. Gustav Engström, Manjana Milkoreit, Marc Metian, Albert Norström, Johan Gars, Martin Sjöstedt, Maja Schlüter, Astrid Dannenberg, Geoff McCarney, Kyle Meng, Efi Kyriakopoulou, Ram Fishman, Christina Leijonhufvud and Carl Folke.

PHOTO: MANJANA MILKOREIT

Community gardens as arenas for environmental learning

By Sturle Hauge Simonsen

One concern about increasing urbanisation and reduced access to green areas is that it can create generational amnesia about people's relationships to ecosystems and dependence upon them.

In an article in *Landscape and Urban Planning*, Pim Bendt (formerly of the Beijer Institute of Ecological Economics) along with Beijer Institute colleague Johan Colding and Stephan Barthel of Stockholm Resilience Centre examined how public access community gardens in Berlin can help teach communities the importance of urban ecosystems and green areas.

They found that gardens that intertwine gardening with social, political and economic practices can boost learning about the interdependencies between humans and nature and help develop a sense of place in degraded neighbourhoods.

Through geographical mapping and in-depth interviews, Barthel and his colleagues selected four community gardens in Berlin as case studies. Interviewing community members involved in those gardens allowed the researchers to analyse their perceptions of gardening practices and community dynamics and the interactions between communities and local authorities.

"We found that the gardens constitute learning environments that engage individuals in the community and provide them with an increased understanding of local ecological

conditions such as soil quality," says lead author Pim Bendt.

The four gardens differed in types of activities, openness and number of members, factors reflected in the types of learning and knowledge generated. Public access gardens combining collective gardening with other activities, e.g. art, political activity or business development, draw in people from diverse backgrounds and are promising for countering extinction of experience and assisting learning in a wide array

of issues. Gardens with fewer active members concentrating on gardening over a longer period of time can in turn develop more in-depth local ecological knowledge.

Bendt, P., S. Barthel and J. Colding. 2013. Civic greening and environmental learning in public-access community gardens in Berlin. *Landscape and Urban Planning* 109:18–30.



Prinzessinnengarten, a public access community garden in Berlin

PHOTO: JOHAN COLDING

Improving seafood eco-certification

By Sturle Hauge Simonsen

Seafood is among the most internationally traded food commodities in the world and with a steadily growing population, there is an increased demand for animal source proteins such as fish and shellfish.

Aquaculture is also the fastest growing sector of animal food production in the world, with about half of all seafood products now originating from farming and 90% of farmed seafood being produced in Asia. As with other food production systems, aquaculture can negatively impact ecosystems and affect global flows of energy and resources. Tools aimed at mitigating the environmental impacts of aquaculture include eco-certification.

In an article in *AMBIO*, Beijer Institute researcher Max Troell, together with colleagues from Gotland University, Sweden and WorldFish Center in Malaysia, analysed whether certification can be an effective tool for achieving more sustainable aquaculture production.

What they found was a range of uncertainties. Currently, only around 4% of the total production from aquaculture is estimated to be eco-certified. Compliance with agreed standards is inconsistent, with a lack of mechanisms or incentives for improvement among the worst performers. More importantly, however, current certification schemes focus on species predominantly



PHOTO: CAMILLA BOLLNER/AZOTE

consumed in Europe and the US, with limited coverage of the Asian markets.

"Asia, a major consumer and already producing 90% of farmed seafood, has experienced an increase in demand for animal source foods of 2.5-5 % per year. Future certification should therefore focus on Asia. A growing middle class with a large appetite for seafood together with accelerated urbanisation will amplify seafood production in the years to come," according to Max Troell.

What to do

In addition to this geographical shift of focus, Troell and his colleagues present a range of improvements to eco-certification schemes:

- Additional species need to be explored for eco-certification: certification so far has focused on environmentally demanding species like salmon and shrimp, while mostly ignoring groups that have the potential to be produced more sustainably in large quantities, such as carp.

- Invest in small-scale farmers: improved technical and financial assistance to small-scale farmers

and enterprises that face barriers to certification is required to enable their participation in certification schemes.

- Better alignment: certification standards should also consider actions that can improve the management of feed ingredients, habitat rehabilitation for biodiversity and ecosystem services, energy consumption and impacts on climate change - e.g. by applying Life Cycle Analysis.

Jonell, M., M. Phillips, P. Rönnbäck and M. Troell. 2013. Eco-certification of farmed seafood: Will it make a difference? *AMBIO* (Published online: 23 April 2013).

Adaptive governance to curb illegal fishing

By Sturle Hauge Simonsen

Overfishing has historically caused widespread stock collapses in the Southern Ocean and illegal, unreported and unregulated (IUU) fishing has also threatened to eradicate some of the remaining fish stocks in the region. Thanks to 15 years of international collaborative efforts, however, this has now been substantially reduced.

In *Ecology and Society*, Beijer Institute Director Carl Folke and Henrik Österblom of Stockholm Resilience Centre provide a synthesis of the international governance systems that have developed around IUU fishing in the Southern Ocean. They describe in detail how the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) has developed into an effective international institution for dealing with the fisheries crisis. Official estimates suggest that unsustainable and illegal fishing has been reduced to less than 10% of former levels.

In their study, Österblom and Folke analyse how four features of governance – actors, networks, organisations and institutions – contribute to the effectiveness of CCAMLR. In combination with similar studies on the emergence of robust governance structures elsewhere, they show how adaptive governance has emerged at global scale and



improved the management of regional, marine ecosystem services.

Based on qualitative interviews, quantitative social network and survey data and literature reviews, the authors describe how individuals, by mobilising social networks, formalising cooperation and integrating novel formal and informal rules, have created an adaptive governance system that enables complex problem solving.

Adequate incentives to act

The authors describe the development of the CCAMLR as an example of how key actors, networks, organisations and institutions interact and mobilise the necessary capacity to address complex challenges. The goals for such cooperation appear to have been sufficiently clear and the threats

sufficiently imminent, providing strong motivation among stakeholders to engage.

The study concludes that the four phases of governance described for the CCAMLR case study, starting from individual actors and expanding to informal social networks and then establishment of targeted organisations, which later become part of existing formal institutions, may represent a more general way in which governance efforts are mobilised.

Österblom, H. and C. Folke. 2013. Emergence of global adaptive governance for stewardship of regional marine resources. *Ecology and Society* 18(2):4.

General resilience to cope with extreme events

By Fredrik Moberg

Throughout history, unprecedented and unexpected catastrophes have occurred, such as the Krakatoa eruption in 1883, which killed 36 000 people and lowered the Earth's temperature in the following years through the ash particles released.

Examples from recent years include the Japanese earthquake and tsunami of 2011 and the outbreak of mad cow disease.

To better cope with such events, economists and ecologists at the Beijer Institute's annual Askö meeting point to the increasing need for general resilience. In an article in the journal *Sustainability*, they suggest nine important conditions to achieve this, stating that:

"General resilience is the capacity of social-ecological systems to adapt or transform in response to unfamiliar, unexpected and extreme shocks. Processes for building general resilience are an emerging and crucially important area of research."

Absorb shocks of all kinds

General resilience is about strengthening the capacity to absorb shocks such as storms and floods, even financial meltdowns. Building such broad resilience to unknown disturbances is far more difficult than planning for specific resilience to known types of disturbances. In



fact, large-scale disturbances like mad cow disease and the huge Japanese earthquake and tsunami were outside the scope of experience.

"Such events are unusually so intense or extensive that they require another type, more 'all-purpose kind' of resilience building," argue the authors.

Diversity, openness and trust

Diversity entails for example having species that have similar functions but different responses to disturbance (response diversity), so the function is maintained even if one component of an ecosystem is damaged. Diversity of perspectives and experience also matters as much as individual ability when teams of people are solving complex problems.

Modularity is important because it helps to contain disturbances by separating social-ecological systems from each other, e.g. land management that uses firebreaks

to limit the spread of fires. Similarly, quarantine mechanisms can restrict the spread of epidemics or invasive species. In other cases, openness of a social-ecological system might be the key to general resilience, e.g. seed dispersal as a way to recover from large, infrequent forest fires.

"Development of trust is another important aspect when building general resilience, determining whether people will be able to collaborate effectively in relation to unfamiliar, unexpected and extreme shocks," the authors conclude.

Carpenter, S.R., K.J. Arrow, S. Barrett, R. Biggs, W.A. Brock, A.-S. Crépin, G. Engström, C. Folke, T. Hughes, N. Kautsky, C.-Z. Li, G. McCarney, K. Meng, K.-G. Mäler, S. Polasky, M. Scheffer, J. Shogren, T. Sterner, J. Vincent, B. Walker, A. Xepapadeas and A. de Zeeuw. 2012. General resilience to cope with extreme events. *Sustainability* 4:3248–3259.

Economic modeling of climate change

By Gustav Engström

In autumn 2012, Gustav Engström successfully defended his thesis “Essays on Economic Modeling of Climate Change” at Stockholm University.

The thesis consists of four self-contained articles exploring different aspects of economic models and their assumptions in relation to climate and global environmental change. The overarching goal is to challenge current state-of-the-art climate economy modelling by introducing into existing models new elements not previously dealt with in this area.

The first article explores how optimal mitigation policies for carbon dioxide emissions differ when economic sectors are affected in different ways. Models for calculating the optimal mitigation policies typically look at the economy as one sector. The factors dealt with include whether the sectors are interchangeable, the productivity of each sector, and the climate change effects on each sector.

The second and third articles are closely related to each other. Both explore spatial aspects of the climate problem. A standard macroeconomic growth model of the world economy is coupled to a one-dimensional climate model known by climate scientists as an energy balance model. It includes heat diffusion across latitudes and human drivers of climate change. Energy balance models have a long history in climate science and have been used to explore many different angles of the Earth’s climate system.

Connecting these models to economic models opens up new possibilities to explore economic aspects of climate science.

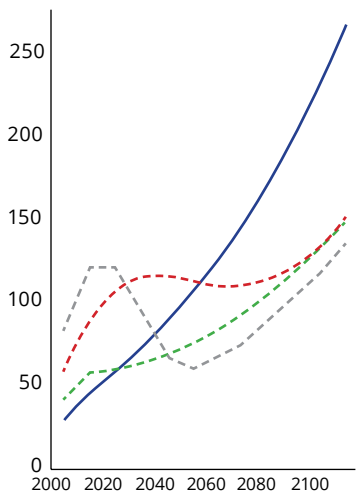
The results in the second article suggest that if transfers of resources across regional borders are not possible or are expensive, then optimal taxes differ across regions and may be lower in poorer places. The degree to which they differ depends on how much the temperature increases in different locations due to climate change.

Global warming can cause direct damage to the economy and can also cause melting of the polar ice caps, which in turn can lead to the release of methane gas stored in the permafrost, causing further damage to the society. The third article shows that when this is taken into account the optimal carbon policy strategy differs dramatically from the optimal policy resulting from conventional climate-economy models.

The fourth essay in the thesis explores how sustainable development in terms of society’s future production possibilities can be analysed within an integrated assessment model of climate change (the DICE model). This is closely related to the concept of inclusive wealth developed by Partha Dasgupta and Karl-Göran Mäler, among others, at the Beijer Institute.

Engström, G. 2012. Essays on Economic Modeling of Climate Change. Department of Economics, Stockholm University, Stockholm, Sweden.

Carbon price/tax
(2005 U.S. dollars per ton)



This figure depicts optimal carbon prices between the years 2000 and 2100. The grey, red and green dotted curves show optimal simulated carbon prices in a model that includes the melting Arctic ice cap for three independent sets of alternative damage calibrations. The solid blue line shows policy simulations for the standard linear DICE climate model without any particular ice sheet related damages.

Selected events

The Beijer Institute organises and engages in a wide range of scientific events, all designed to advance frontiers of knowledge and real-world problem solving. This section highlights some of the many conferences, seminars and workshops over the past year.

View over Ulvön, Sweden



PHOTO: CAROLINE SCHILL

Different perspectives on building resilient cities

By Johan Colding

The joint open seminar between the Korean Academy of Science and Technology (KAST) and the Royal Swedish Academy of Sciences, hosted by the Beijer urban research team at the Academy on the snowy day of November 29th, was a memorable workshop appreciated by all those who attended. The seminar entitled Global Change and Resilience Building of Cities addressed key urban challenges and research frontiers in the area of urban resilience building. Swedish and Korean researchers, including architects, engineers, urban planners and ecologists, met and shared insights from their respective fields in the most rewarding way.

The subjects presented and discussed were strategies to mitigate and adapt cities to climate change; the role of ecosystem services; responses to changing public demands; novel urban regeneration policies and green technologies; community-driven urban regeneration projects; urban green commons; urban design and new building technologies.

Since 2001, KAST and the Swedish Academy of Sciences have had an agreement on knowledge sharing. Seminars dealing with many different subjects and disciplines are held in alternate years in South Korea and Sweden.



PHOTO: AGNETA SUNDIN

Participants at the Ulvön conference
on ecological economics



The Ulvön conference on environmental economics

By Anne-Sophie Crépin

The week before midsummer, when the sun is shining, the air is warm and the lilac is in full bloom, is the perfect time to visit Ulvön, a small, attractive old fishing hamlet located on the east coast of Sweden, about 500 km north of Stockholm.

At that time every year since 1993, the island is invaded by environmental economists and occasionally some ecologists, who gather for the Ulvön Conference on Environmental Economics. The key purposes of the conference are to provide a forum for the dissemination of high-quality research in environmental economics and to allow PhD students to present their work and interact with leading researchers in the field from around the world.

As a PhD student, I used to attend the Ulvön Conference every year and it has meant a lot for my own career development. The small format, around 30 participants and no parallel sessions, concentrates the attention of all participants during the whole conference. Every presentation is treated with the same respect,

no matter whether the speaker is a first year PhD student or the winner of Sveriges Riksbank's prize for economics in memory of Alfred Nobel. Therefore, I was very happy to have the opportunity through the Beijer Institute to help organise the conference on its 20th anniversary and bring my own group of PhD students and post-docs for a session on the economic aspects of social-ecological systems.

The Beijer staff presentations were appreciated by other conference participants and sparked a great deal of discussion. As the sun hardly ever goes down in northern Sweden at that time of the year, these discussions were able to continue into the small hours at the top of the Lotsberget (Pilot's Rock).

The Ulvön Conference on Environmental Economics 2013 was organised by Centre for Environmental & Resource Economics (CERE), Umeå, Sweden; the Beijer Institute of Ecological Economics and the Mid-Sweden University. The Plenary speaker was Torsten Persson, Institute

Beijer staff at the 20th Ulvön Conference on Environmental Economics:

JOHAN GARS: The tragedy of the commons versus the love of variety

CAROLINE SCHILL: The influence of threshold uncertainty on group behaviour in common dilemmas: Evidence from a laboratory experiment

GUSTAV ENGSTRÖM: Energy balance climate models and general equilibrium optimal mitigation policies

ANNE-SOPHIE CRÉPIN: Price vs. quantity for complex ecosystems --- Dealing with non-convexities

MARK SANCTUARY: Heterogeneous effects of a domestic electricity price increase on the structure of intermediate inputs.

for international Economic Studies, Stockholm University.

Selected events

Transformation in a changing climate

By Carl Folke

Climate change is considered by many to be the greatest challenge to humanity. It is a "perfect storm" that can lead to unprecedented social and ecological impacts unless urgent measures are taken. Change or, more specifically, transformation is needed.



An international conference that took place in Oslo 19–21 June 2013 aimed at pulling together the knowledge that we have on transformation. Beijer Institute director Carl Folke gave the plenary talk on his perspectives on transformation on the first day of the conference. Reminding us of the importance of ecological literacy, Carl Folke admitted he was "embarrassed as a human" that in two generations we have created a mindset where we believe we can live without nature and act independently of the biosphere.

Gathering some 300 researchers, policy makers, students and practitioners from a variety of fields and interests, the conference dealt with the topics "What is transformation?", "How do we do transformation?" and "How to make transformation just, deliberative and equitable?". The conference was organised by Stockholm Resilience Centre, the University of Oslo and the Center for International Climate and Environmental Research (CICERO).

Reconnecting to the biosphere through ecosystem services

By Agneta Sundin

The concept of ecosystem services has become a useful tool in highlighting the value of healthy ecosystems for human well-being.

Ecosystem services are the benefits people obtain from ecosystem processes. These include water and air purification, flood control, erosion control, generation of fertile soils, resistance to pollination, and aesthetic and cultural benefits that derive from nature.

In November 2012 the Beijer Institute, together with Stockholm Resilience Centre and the Volvo Environment Prize, arranged a seminar at the Royal Swedish Academy of Sciences to explore key challenges and research frontiers when moving from theory to real-world application in achieving more sustainable land management practices using the concept ecosystem services.

The seminar was given in honour of Beijer Fellow Gretchen Daily, Stanford University, a leading expert in this field and awarded the Volvo Environment Prize in 2012 for her pioneering work on quantifying and valuing natural capital.



Gretchen Daily gave a talk entitled 'Driving innovation and impact of natural capital approaches'. Presentations were also held by Beijer Institute researcher Åsa Gren and Thomas Hahn, Garry Peterson and Maria Tengö of Stockholm Resilience Centre. These were followed by a panel discussion where Gretchen Daily called for feedback from the many policy makers and researchers in the audience on where they thought research in this area should be heading and how to better spread knowledge of successful local models to incorporate the values of ecosystem services into society.

Science & Policy

Beijer Institute researchers have deep collaborations underway with policy makers, to convey scientific results but also to create a fruitful dialogue between the science and policy communities.

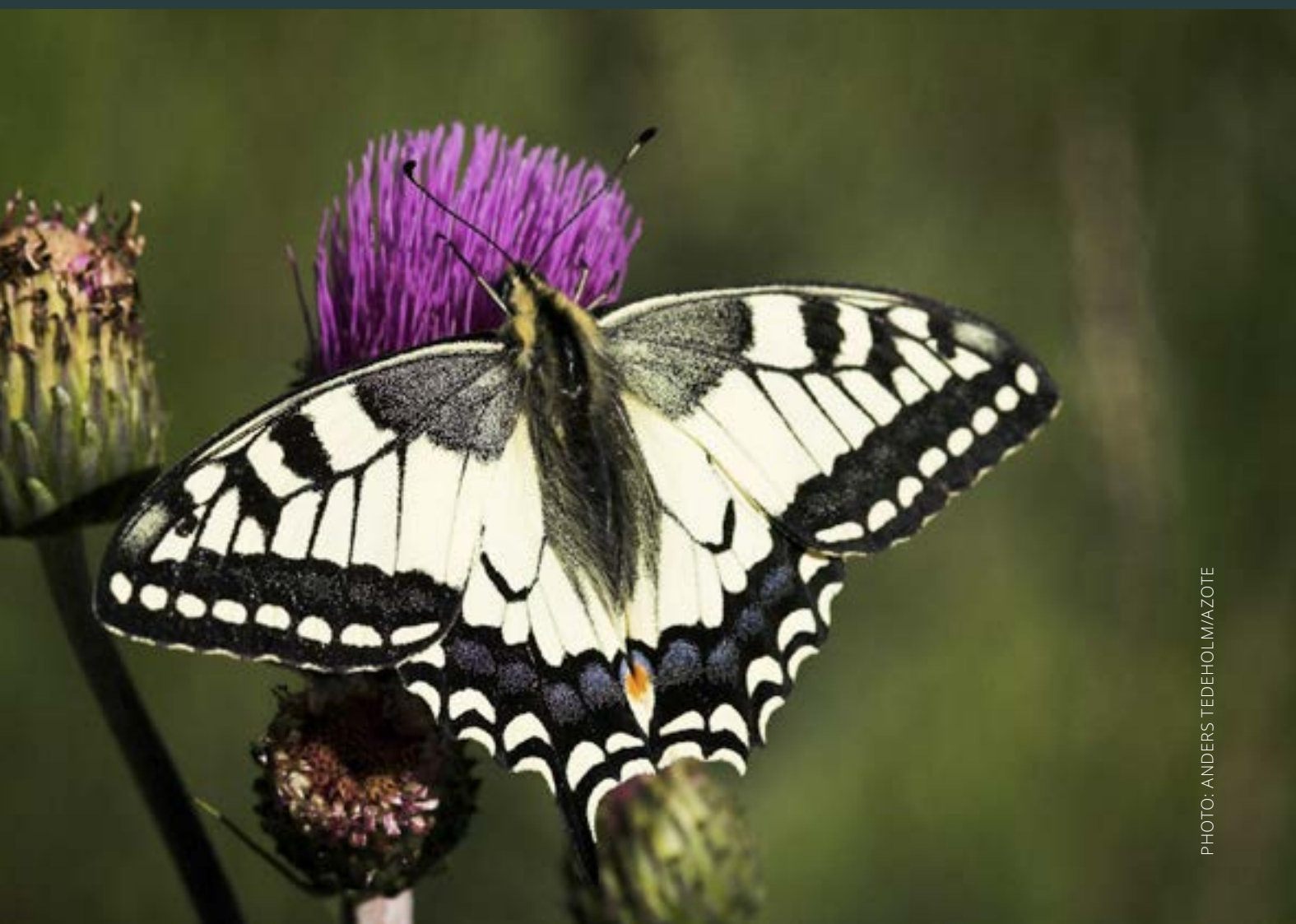


PHOTO: ANDERS TEDEHOLM/AZOTE



Johan Colding presenting at the launch of the report Ecosystem services in the Stockholm region

PHOTO: AGNETA SUNDIN

Ecosystem services for urban planning

By Johan Colding

“Few reports have been so in demand in the region, before they were even printed”. That was a message from Stockholm County Council when launching a report on the concept of ecosystem services and how it can be useful in urban planning.

Incorporating ecosystem services in the regional urban planning framework of Stockholm is an important step in providing novel policy directions for resilience adaptability and urban transformation. Researchers from the Beijer Institute have been instrumental in the integration of the concept of ecosystem services (ES) in the regional planning of Stockholm. So far, two key reports (in Swedish) with this purpose have been produced.

The report *Ecosystem Services in the Stockholm Region: A Basis for Discussion and Planning* (Ekosystemtjänster i Stockholmsregionen - ett underlag för diskussion och planering) gives a general introduction to ecosystem services and provides specific examples from the Stockholm region. This report was launched on 18 June 2013 and its main purpose is to spread knowledge and understanding about the fundamental role that ecosystems and their services play for urban resilience building. The report is intended for use by local and regional urban practitioners, advising on policy directions for resilience adaptability and urban transformation.

It is a collaborative effort by the Office for Regional Growth, Environment and Planning (TMR) at Stockholm County Council, the Beijer Institute of Ecological Economics, Stockholm Resilience Centre, the School

of Architecture at the Swedish Royal Institute of Technology and the County Administration Board in Stockholm. Johan Colding from the Beijer Institute and Lars Marcus from the Swedish School of Architecture were lead authors, with support from Stephan Barthel, Erik Andersson, Åsa Gren and Sara Borgström from the Beijer Institute and Stockholm Resilience Centre. The authors concluded: “Ecosystem services can both decrease our impact on climate and build resilience for urban environments to handle negative effects of climate change. By promoting biodiversity in urban areas, managing green areas and water and providing habitats for pollinators, for example, resilience in urban systems can be increased.”

The above report complements the 2012 report *Weak Links in the Green Wedges of Stockholm* (Svaga Samband i Stockholmsregionens Gröna Kilar), produced by TMR with Johan Colding and the Beijer Institute/SRC team serving as scientific advisors and contributors. It is a factual and inspirational document to act as support for various stakeholders in the work to strengthen these weak links. It represents a summary of current knowledge, relevant legislation, best practices and tips on financing and more.

The value of ecosystem services

By Carl Folke

The imprint of the pioneering work in previous Beijer Institute research programmes involving biodiversity, ecosystem services and their governance is increasingly spreading in society, magnified by the UN Millennium Ecosystem Assessment (MA), the EU-initiated Economics of Ecosystem Services and Biodiversity (TEEB) and other initiatives.

The Swedish Government has recently commissioned a major report on how to incorporate and implement ecosystem services into policy and practice in Sweden. The Beijer Institute has been engaged in the initiation, formulation, focus and content of the report in progress, named *Making the Value of Ecosystem Services Visible* (Synliggöra värdet av ekosystemtjänster). Beijer Institute researchers are supporting the work of the investigation team and serving on the reference group of the commission. The work on the report is being led by Maria Schultz of Stockholm Resilience Centre (SRC), with Thomas Hahn, SRC, and Louise Hård af Segerstad, Albaeco and Lars Berg, Ministry of the Environment, as the commission secretaries.

International Council for the Exploration of the Sea

By Carl Folke

ICES, the International Council for the Exploration of the Sea, a global intergovernmental organisation for enhanced ocean sustainability, is central in recommending quotas and other measure to support sustainable fisheries.

At its annual science conference in Bergen in September 2012, Beijer Institute Director Carl Folke was invited as a plenary speaker to present a broad systems perspective on the fisheries challenge, with overfished stocks and new marine pressures emerging in the Anthropocene. The talk was titled *Marine Social-Ecological Systems, Resilience, and Global Change* and an interview with Carl Folke was published in the 2012 ICES Annual Report.



Silver-Throated Tanager (Tangara icterocephala). Research shows that birds boost yields and income on coffee farms that retain ribbons and patches of tropical forest by eating pest insects on the coffee bushes. An example of how ecosystem services can be made visible.



The future state of sustainability

By Sturle Hauge Simonsen

The Worldwatch Institute has published its annual State of the World Report for 25 years. The 2013 report asks the fundamental and somewhat uncomfortable question: What is the future of sustainability? Has the concept sustainability played its part?

“Everyday, we are presented with a range of “sustainable” products and activities—from “green” cleaning supplies to carbon offsets—but with so much labelled “sustainable”, is it time to abandon the concept altogether, or can we find an accurate way to measure sustainability? If so, how can we achieve it? And if not, how can we best prepare for the coming ecological decline?” the report asks.

Reconnecting to the biosphere

To help clarify and put things in perspective, Beijer Institute director Carl Folke contributed with a chapter on the need to respect planetary boundaries and reconnect to the biosphere.

“The biosphere, the part of the Earth’s crust, waters and atmosphere where life dwells, is the global ecological system all humans and societies depend on. For too long we have looked at the environment as an externality for economic progress, a handy and limitless stock of resources for human exploitation,” was part of his message.

In his contribution, Folke describes how humans have rapidly become the single most dominant force on Earth, capable of changing the trajectory of Earth’s future.

“It is indeed a remarkable achievement for a single species to become this dominant, and it has to a large extent been enabled by the human ability to draw on the functioning of the biosphere.”



Cover design: Maureen Gately, courtesy of Island Press
Cover photos: Binoculars Reflecting the Sky ©iStockphoto.com/Jill Fromer and Rain clouds, vertical ©iStockphoto.com/Adrian Assalve

Collaborations

By Carl Folke

Science and Art exercise during an SRC theme leader meeting

PHOTO: STURLE HAUGE SIMONSEN

Stockholm Resilience Centre

The collaboration with Stockholm Resilience Centre (SRC) has been intense, exciting and very productive, with joint projects and grants, workshops and several publications.

The Beijer Institute's competence in ecological economics is of great value for the development and activities of SRC, while Beijer researchers and fellows benefit greatly from participating in the dynamic SRC journey. The synergies are numerous and of great significance. The communication, outreach and policy engagements of the Beijer Institute are substantially magnified through the close collaboration with SRC and Albaeco.

Positive outcome of evaluation

The research of SRC takes an integrated view of people and nature as social-ecological systems, aiming at achieving a deeper understanding of human-environment interactions and the resilience of ecosystem services for human well-being. The SRC was inaugurated in 2007 and in spring 2013 it was time for a major international evaluation of progress made so far. The conclusions and recommendations section of the international panel report to SRC's core funder, Mistra, stated that:

"Since its inception in 2007 the Stockholm Resilience Centre (SRC) has become a world leading research centre advancing interdisciplinary research on the dynamics of interconnected social-ecological

systems [...] The scientific contributions of SRC [...] are impressive in both quality and quantity. The establishment of 'resilience thinking' as an integrating umbrella concept has been of great value. The diversity of approaches taken under this umbrella is large, and is growing in response to various scientific and social-ecological challenges. The SRC has also made significant contributions to international policymaking processes [...] The SRC has thus fulfilled and exceeded the original expectations of Mistra and has established itself as a world leader in resilience and sustainability research."

Beijer Institute researchers and fellows were deeply involved in developing the SRC Progress Report and Action Plan for the evaluation, collaborating and serving as SRC theme leaders, advisory committee members and board members. Resilience thinking grew out of the Beijer Institute's research programmes leading to the Resilience Alliance and later to the SRC. And now the collaboration is in full bloom.



Långsjö Theatre Group showing an excerpt of a play created together with SRC researchers, at an event at SRC in May. Building loosely on the Grimm saga the Fisherman and his wife, the play reflects on the state of the Baltic Sea.



Beatrice Crona will lead the Erling Persson Academy Programme on Global Economic Dynamics and the Biosphere



Workshop for theme leaders of the SRC

Global Economic Dynamics and the Biosphere

It is exciting to witness the establishment of the Family Erling Persson Academy Programme on Global Economic Dynamics and the Biosphere. We envision that this programme will become a significant conduit for syntheses and synergies between the Beijer Institute and SRC, particularly performing exciting work in relation to research on global change and on marine stewardship, seafood and aquaculture.

It is a five-year programme on the challenges of global economic change and stewardship of our life-supporting biosphere in the new era of the Anthropocene. Early career economists are collaborating with researchers engaged with social-ecological systems for a better understanding of complex interactions at the global level and across scales to the local for managing and

governing critical ecosystem services like climate amelioration, rainfall variability and seafood production. Beatrice Crona serves as executive director. Beatrice, Carl Folke, Anne-Sophie Crépin and Victor Galaz form the steering group. As of now, Eny Buchary, Johan Gars, Marc Sanctuary and James Watson are engaged in the programme and Gretchen Daily is the first visiting professor. The research group is supported part-time by two senior economists, Jim Wilen and Jeroen van den Bergh, and by two research assistants. The advisory committee includes several Beijer fellows; Ken Arrow, Scott Barrett, Steve Carpenter, Jane Lubchenco, Steve Polasky, Marten Scheffer. Sofia-Kristin Kokinelis and Agneta Sundin are the critical support staff.

The Resilience Alliance

A central network for collaboration is the Resilience Alliance (RA). RA is an international consortium of leading research groups and their organisations that collaborate to explore the dynamics of social-ecological systems and seek novel ways to integrate science and policy in order to discover foundations for sustainability (www.resilience.org).

The RA and the focus on social-ecological systems emerged out of research programmes at the Beijer Institute in the 1990s, in particular the Resilience

Network, and the Beijer Institute is an active member. The Beijer Institute works with RA on central issues such as the Arctic resilience assessment and it is active in the organisations of the International Resilience Conferences, as with the upcoming Montpellier conference in late spring 2014. The journal *Ecology and Society* is owned by the Resilience Alliance, with Beijer Director Carl Folke the editor-in-chief together with Lance Gunderson.

The South American Institute for Resilience and Sustainability Studies

The Beijer Institute is engaged in the South American Institute for Resilience and Sustainability Studies (SARAS). SARAS is an interdisciplinary research institute based in Montevideo, Uruguay, designed to catalyse high-impact science that serves to enhance South America's long-term resilience and sustainable development.

SARAS works towards a regional centre cooperating closely with scientific communities and related funding

agencies in several of the South American countries and with an established set of international key scientists. The SARAS building under construction in Uruguay will provide facilities for workshops, courses and sabbaticals. The Science Board includes Beijer fellows Steve Carpenter and Marten Scheffer and Beijer Institute Director Carl Folke. The Beijer Institute hosted two SARAS workshops in spring 2013, one on global coastal fisheries in South America and one on rangelands as social-ecological systems.

NorMER – Nordic Centre of Excellence

Through collaboration with Stockholm Resilience Centre, Beijer researchers participate in a Nordic Centre of Excellence on Climate Change Effects on Marine Ecosystems and Resource Economics (NorMER).
The Beijer Institute Director serves as co-chair of the programme, with Professor Nils Christian Stenseth from the Centre for Ecological and Evolutionary Synthesis at the University of Oslo as the chair. The five-year programme is exploring the biological, economic and

societal risks and opportunities of global climate change related to fisheries resources across the Nordic region. Through post-doc posts and PhD studentships, there are internationally collaborative projects between the participating partners in the Nordic countries. The Top-level Research Initiative of Nordforsk is funding the programme. Beijer Fellow Simon Levin serves on the Advisory Panel for NorMER.

The Nereus Programme – predicting the future ocean

Over-exploitation of the world’s fish resources has caused serious declines in fish populations, and there is widespread concern that the world’s oceans will be unable to supply fish products for future generations.
Given the importance of marine fisheries for food security throughout the world, this poses a serious threat for coming generations. The Nereus Programme was launched to provide scientific advice on these issues. It is an international research and outreach network with five leading academic institutions as

partners. The focus is on understanding the status of the global ocean and how we can ensure that there will continue to be fish products and a healthy ocean for future generations to enjoy. The researchers of the programme are based at the University of British Columbia, Princeton University, Duke University, WCMC/ Cambridge University, Stockholm Resilience Centre and the Beijer Institute. The Nippon Foundation is providing financial support for a nine-year period.

Ebba och Sven Schwartz Stiftelse

The Swedish Foundation Ebba och Sven Schwartz Stiftelse supports the Beijer Institute and Stockholm Resilience Centre through a career grant to three skilled researchers, 2011-2013, with possibilities for extension.
The overall focus of the grant is to find ways to allow people to take account of ecosystem support and

services in decision making. The projects concern economic theory, regime shifts and well-being; freshwater, agriculture and ecosystem services; and adaptive governance of social-ecological systems in dynamic landscapes and seascapes.



Australian Research Council, centre of excellence for coral reef studies

The Beijer Institute serves as a partner investigator in Programme 5 of the ARC Centre - Resilience of Linked Social-ecological Systems.
The objective of the programme is to provide new solutions to managing resilience and coping with change, uncertainty, risk and surprise in complex social-ecological systems. The overall aim is to improve the governance and management of natural systems and enhance their capacity to sustain human and natural capital and the programme combines expertise on

coral reef biology, management, governance, economics and social sciences. A major outcome is to develop information, guidelines and tools for coral reef managers and planners on climate change risks and adaptation options. The scope of this programme is global.
The collaboration and workshops have generated new insights on the management and governance of coral reefs and other coastal social-ecological systems and have influenced policy.

Supporting environmental economics networks

By Agneta Sundin, Jeff Vincent and Tasos Xepapadeas



PHOTO: TOM HERMANSSON / NICKARS/AZOTE

The Beijer Institute cooperates with four regional networks on environmental economics in Africa (CEEPA/RANESA), Asia (EEPSEA, SANDEE) and Latin America (LACEEP).

All but one of these networks (EEPSEA) were initiated and developed in collaboration with the Beijer Institute under the leadership of former director Karl-Göran Mäler. The networks strive to strengthen the local capacity for economic analysis of environmental problems and to conduct research on the inter-linkages between economic development, poverty and environmental change, with the aim of providing sound advice to policy makers. Researchers

connected to the Beijer Institute support the networks with activities such as participating in workshops organised in the network regions, evaluating research proposals, tutoring research and teaching short courses, with financial support from the Swedish international development cooperation agency (Sida).

Activities

Beijer fellow Jeff Vincent and Beijer Institute board member Aart de Zeeuw together with Christina Leijonhufvud administer the Beijer Institute's support to the regional networks in environmental economics, including the application process for the Mäler Scholarships. During the past year, Professor Vincent participated in SANDEE's biannual research workshops and

EEPSEA's annual research conference, where he delivered a keynote lecture; completed an evaluation of CEEPA's research grants program for Sida and IDRC; and taught in SANDEE's annual Summer School in Environmental and Resource Economics. Former Beijer director Karl-Göran Mäler and Beijer Fellow Partha Dasgupta also taught in the SANDEE course, and recent Mäler Scholar Dr. Saudamini Das gave a guest lecture. The five EEPSEA-SANDEE country studies on climate change and migration that Professor Vincent supervised were presented in October 2012 at EAERE's 2nd Conference on Environment and Natural Resources Management in Developing and Transition Economies in France, and papers from most of the studies have been submitted to Environment and Development Economics.

Professors de Zeeuw and Vincent and Anne-Sophie Crépin began planning a two-day course to be held in conjunction with the 5th World Congress of Environmental and Resource Economists (Istanbul, June 2014). The current plan is for the course to be a sequel to a course on the economics of environmental regime shifts organized by the Beijer Institute at the 19th Conference of the European Association of Environmental and Resource Economists (Prague, June 2012). The provisional topic is Applied tools for studying environmental regime shifts in social-ecological systems. Like the previous courses, the new one will target researchers from developing regions, especially ones connected to CEEPA, EEPSEA, LACEEP, and SANDEE.

Professors de Zeeuw and Vincent and Anne-Sophie Crépin also continued discussions with the University of Gothenburg about a prospective new interdisciplinary research program on ecosystem services, to be implemented collaboratively by the two institutions. The program would extend the Beijer Institute's and Gothenburg University's capacity-building initiatives in developing countries beyond purely environmental economics. The next step will be a planning meeting in October, 2013 in Cape Town, South Africa, immediately

following the annual conference of Gothenburg's Environment for Development (EfD) programme. This meeting will include representatives from the Beijer Institute, Gothenburg University, the regional networks, the EfD centers, and the Stockholm Resilience Centre.

The Mäler Scholarship

Again with support from Sida, the Beijer Institute introduced the Mäler Scholarship 2009, intended for researchers from the networks to come and spend time at the Beijer Institute. Through this, the Beijer Institute wishes to support the networks in creating increased capacity in their respective regions in using economics for analysing resource problems and essential environmental issues.

During the past year, the Beijer Institute was pleased to receive Dr. Rawadee Jarungrattanapong from Thailand (EEPSEA). She is a researcher at Thailand Development Research Institute (TDRI). Her research interest is Environmental and Natural Economics including cost-benefit analysis, environmental valuation, climate change adaptation and payment for ecosystem services. Her current research focuses on behavioral economics and environmental management.

Former Beijer Institute Director Karl-Göran Mäler teaching at a SANDEE course.



PHOTO: SANDEE

Dr. Jarungrattanapong stayed in Stockholm between March and May 2013 and will return for a second visit in October. She explains why she applied to the Mäler Scholarship:

“I learned about the Mäler Scholarship when attending the course on the Economics of Environmental Regime Shifts organized by the Beijer Institute of Ecological Economics in Prague in 2012. I did not hesitate to apply for this scholarship since it is a great opportunity for me to work with professional researchers on behavioural economics, which was the topic for my latest EEPSEA project. Luckily, I was accepted and had the opportunity to work with Dr. Therese Lindahl who has expertise in experimental and behavioral economics.”

During Dr. Jarungrattanapong’s first visit to the Beijer Institute, Dr. Lindahl assisted her in developing her manuscript on “Altruism, Cooperation and Trust: Other-regarding Behavior and Collective Actions in Thailand”. The collaboration with Dr. Lindahl is planned to continue. They have initiated a joint project and if they manage to receive funding for this project they will perform field experiments together in Thailand to investigate how local fishermen cope with potential regime shifts and their inherent uncertainties.

The next Mäler Scholar has been selected. Dr. Matías Piaggio (LACEEP), who received his PhD in June 2013 from Universitat Autònoma de Barcelona and is currently employed by Instituto de Economía, Universidad de la Republica, Uruguay, will come to Stockholm during spring 2014.

Environment and Development Economics

The journal Environment and Development Economics (EDE) was founded by, and is published in association with, the Beijer Institute. It is edited by Anastasios Xepapadeas, board member and former Chairman of the Beijer Institute board.

Environment and Development Economics is positioned at the intersection of environmental resource and development economics. The Editor and Associate Editors, supported by a distinguished panel of advisors from around the world, aim to encourage submissions from researchers in the field in both developed and developing countries.

Over the past five-year period, submissions to the journal have doubled. This continuous increase has substantially increased the workload of the Editor’s team. In order to maintain the quality of the review process, a decision was made to increase the number of Associate Editors from nine to sixteen.

The (Thompson Reuters) impact factor for the journal showed a slight increase over the last year (Figure 1). EDE tries to balance the objective of having a respectable impact factor with the journal’s role with regard to capacity building and providing a publishing outlet for scientists from the developing regions of the world. Special issues play an important role in achieving this balance.

Performance

There were a total of 232 manuscripts submitted to Environment and Development Economics in 2012, marking the fifth consecutive year of increases. Based on the submissions for the first six months of 2013, total



Mäler Scholar Rawadee Jarungrattanapong.

submissions for the current year are projected to be slightly higher than those for 2012.

There is an increasing trend for Africa, Latin America and Asia. In contrast, the percentage of total submissions from the USA and Canada and Western Europe has dropped significantly; however the absolute number of submissions from these regions has remained fairly constant. There has been a small increase in submissions from the Middle East, Eastern Europe, and Australia, although submissions from these three areas represent a small fraction of total papers submitted. Given the increasing competition for space in the journal, it is of interest to look at the geographical breakdown of manuscripts that were accepted for publication in the journal. Of the 106 papers that were published in 2010, 2011 and 2012, just under half were from the developing regions. Here again EDE tries to strike a balance. Although one of the main objectives of the journal is to serve as a publication outlet for developing world authors, the papers submitted and published from the developed world constitute an important contribution to the quality of the journal and also provide a clear indication of the journal’s reputation and acceptance as a high quality publication. The current

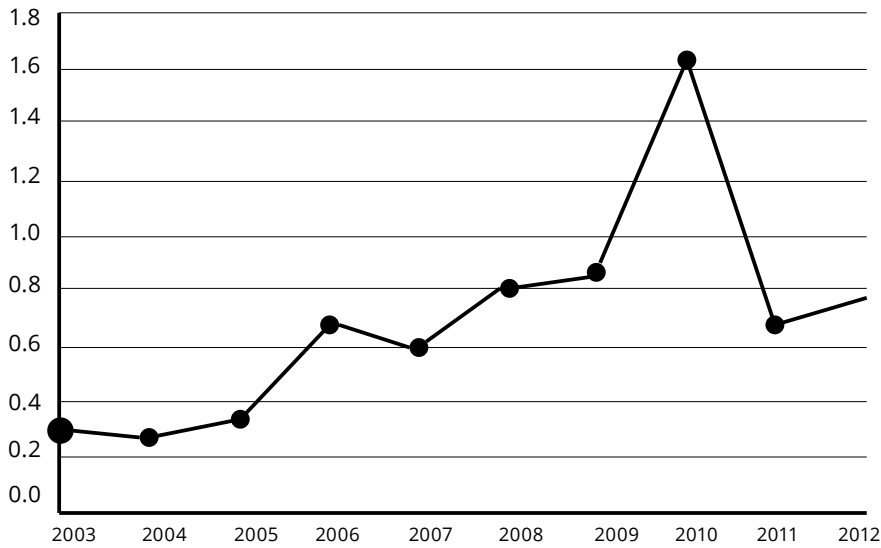
balance between developed and developing world manuscripts could therefore be considered satisfactory.

During the past 12 months the journal published two special issues. The first, which appeared in August 2012, was “Seed supply in local markets: policies to support sustainable use of crop genetic resources” (Guest Editors Paul Winters, Romina Cavatassi, and Leslie Lipper). The second was “Global and international environmental issues” (Guest Editors Ariel Dinar and Georges Zaccour). Another four special issues are currently in progress.

Future targets

The journal continues to focus on three areas: encouraging high quality theoretical and empirical research in environment and development economics; providing capacity building in developing countries related to these issues; and publishing special issues on areas of current research and policy interest which combine environmental and resource economics with development considerations.

Figure 1. Impact factor for EDE, 2003 – 2012



New faces



J. MARTY ANDERIES

joined the Beijer Institute as Programme Director for the Behaviour, Economics and Nature Network

(BENN) in January 2013. At the next board meeting, he will also become a member of the board. He is an Associate Professor with joint appointment in the School of Human Evolution and Social Change and the School of Sustainability at Arizona State University, USA. Marty received his PhD in Applied Mathematics from the University of British Columbia. In 2010 he spent part of his sabbatical at the Beijer Institute and Stockholm Resilience Centre and he is also involved in the Global Dynamics and Resilience Programme. His research focuses on developing an understanding of how ecological, behavioural, social and institutional factors affect the robustness and vulnerability characteristics of coupled social-ecological systems. His work combines qualitative insights from present-day, historical and archaeological case studies of social-ecological systems with formal mathematical modelling and experiments with human subjects. It explores how individual decision-making processes interact with governance regimes to influence social and environmental outcomes.



SOFIA-KRISTIN KOKINELIS

was employed in May 2013 jointly by the Beijer Institute and the Family Erling Persson Academy

Programme as Finance and Human Relations administrator. After initiating her studies in Greece, she went on to take a Master's degree in Business Administration and Economics at Stockholm University. Her previous work in the private sector included positions as marketing coordinator and finance assistant and, for the last six years, as lead accountant.



NIKOLINA ORESKOVIC

joined the Beijer Institute March 2013 as a Research Assistant for the BENN research programme.

Nikolina has a BSc in Biology and she is a former student of the Master's Programme Ecosystems, Resilience and Governance at Stockholm Resilience Centre, with focus on urban social-ecological systems.



MARK SANCTUARY

is a PhD student in Economics at Stockholm University's Department of Economics, expecting to defend his

thesis during Autumn 2013. Mark joined the Beijer Institute in September 2012. His PhD research is on environmental economics with particular focus on international economics, industrial organisation and the study of regulation and policy. Apart from his own research, Mark is also Programme Director of ENTWINED, a long-term research initiative funded by Mistra, which brings together the disciplines of economics, political science and international law to examine the trade and environment nexus. Before moving to Sweden, Mark worked at the United Nations Environment Programme's Economics and Trade Branch in Geneva. Originally from Canada, Mark has a Bachelor of Engineering from McGill University, a Master of Science in Economics from the Stockholm School of Economics and is also affiliated with the Swedish Environmental Research Institute IVL.



Board meeting 2012. Back row: Tasos Xepapadeas, Steve Polasky, Marten Scheffer, Scott Barrett, Carl Folke, Eric Lambin and Staffan Normark. Front row: Steve Carpenter, Anne-Sophie Crépin, Scott Taylor, Terry Chapin, Karine Nyborg and Roz Naylor

PHOTO: CECILIA NORDSTRAND

Board of directors

Board members of the Beijer Institute of Ecological Economics are appointed by the Royal Swedish Academy of Sciences for a three-year period, and should not be re-elected more than once, according to the standing instructions for the Beijer Institute approved by the Royal Swedish Academy of Sciences on 5 June 1991.

The first Board of Directors was elected on 5 June 1991. The 22nd annual board meeting was held at the Royal Swedish Academy of Sciences on 7th September 2012.

Professor Stephen Polasky from the University of Minnesota, USA, and Professor Marten Scheffer from Wageningen University, The Netherlands, reached the end of their term. They have been on the board since 2007 and the Beijer Institute wishes to express its warmest gratitude for their great efforts for the Institute over the years.

BOARD OF DIRECTORS 2012-2013

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SCOTT BARRETT

Professor, Columbia University, USA

Ex-officio members

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Director, the Beijer Institute, Sweden

STAFFAN NORMARK*

Professor, Permanent Secretary of the Royal Swedish Academy of Sciences, Sweden

ANNE-SOPHIE CRÉPIN

PhD, Deputy Director, the Beijer Institute, Sweden

Members

STEPHEN CARPENTER*

Professor, University of Wisconsin, USA

STUART "TERRY" CHAPIN

Professor, University of Alaska, USA

ERIC LAMBIN

Professor, University of Louvain, Belgium

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KARINE NYBORG

Professor, University of Oslo, Norway

M. SCOTT TAYLOR

Professor, University of Calgary, Canada

AART DE ZEEUW

Professor, Tilburg University, the Netherlands

ANASTASIOS XEPAPADEAS Professor, University of Athens, Greece

* member of the Royal Swedish Academy of Sciences

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Professor, Director
- ANNE-SOPHIE CRÉPIN**
PhD, Deputy Director
- J. MARTY ANDERIES**
Professor, Programme Director
- JOHAN COLDING**
Associate Professor, Researcher
- GUSTAV ENGSTRÖM**
PhD, Researcher
- JOHAN GARS**
PhD, Researcher
- MATTEO GIUSTI**
MSc, Research Assistant
- ÅSA GREN**
PhD, Researcher
- SOFIA-KRISTIN KOKINELIS**
MSc, Finance and HR Administrator
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PhD, Researcher
- CHRISTINA LEIJONHUFVUD**
BA, Administrator
- CHUAN ZHONG LI**
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- THERESE LINDAHL**
PhD, Researcher
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Professor emeritus, former Director, Research Associate
- NIKOLINA ORESKOVIC**
BSc, Research assistant
- STEPHEN POLASKY**
Professor, Programme Director
- MARK SANCTUARY**
PhD candidate, Researcher
- CAROLINE SCHILL**
PhD candidate, Researcher

- AGNETA SUNDIN**
Communications Officer and Financial Controller
- MAX TROELL**
Associate Professor, Researcher
- JEFFREY VINCENT**
Professor, Senior Advisor
- BRIAN WALKER**
PhD, Programme Director
- AART DE ZEEUW**
Professor, Programme Director

Visiting Scientists and graduate students

- JEFFREY VINCENT**
Professor, Duke University, 29 July–18 August, 2012
- ERIC NAEVDAL**
PhD, Oslo University, 14–16 August, 2012
- JIM WILEN**
Professor, University of California Davis, 5–11 September, 2012
- LANCE GUNDERSON**
Professor, Emory University, Atlanta, 26 September–21 November, 2012
- DIETER GRASS**
PhD, Vienna University of Technology, 3 October–2 November, 2012
- EFTHYMIA KYRIAKOPOULOU**
PhD, Gothenburg University, 26–30 November, 2012
- RAWADEE JARUNGRATTANAPONG**
Phd, Mäler Scholar, 1 March–21 May, 2013
- TED GROVES**
Professor, University of California San Diego, 4–8 March, 2013
- JIM WILEN**
Professor, University of California Davis, 14–21 March, 2013

- JINHUA ZHAO**
Professor, Michigan State University, 28 April–9 May, 2013
- EFTHYMIA KYRIAKOPOULOU**
PhD, Gothenburg University, 12–31 May, 2013
- FRANCES WESTLEY**
Professor, University of Waterloo, 13 May–3 July, 2013
- TIMON MCPHEARSON**
Assistant Professor, the New School, New York, 25 May–1 June 2013
- AART DE ZEEUW**
Professor, Tilburg University, 8–16 June, 2013

Administration

- The Beijer Institute is located in a wing of the early 20th century building of the Royal Swedish Academy of Sciences at Frescati, a science and university area about 2 km north of Stockholm City.
- The area is situated in one of Stockholm’s green belts, Ekoparken, which also includes some of the inlets of the Baltic Sea. Ekoparken has been declared a ‘national city park’ by the Swedish parliament. The Institute’s visiting address is Lilla Frescativägen 4, Stockholm.
- The Institute’s administration is partly carried out by, or coordinated with, the Royal Swedish Academy of Sciences, for example accounting and maintenance of premises and computers. Other administrative procedures are performed independently by the Institute.
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CHRISTINA LEIJONHUFVUD
was responsible for the administration of the Board and Askö meetings in September 2012

and she organised the joint seminar with the Korean Academy of Sciences and the Royal Swedish Academy of Sciences: “*Global Change and Resilience Building of Cities*” on November 29. In May, 2013 she organised the Beijer Young Scholars (BYS) second workshop: “*Cross-scale dynamics of food production and consumption*”, as well as the workshop “*Global dynamics and social-ecological resilience in the face of multiple shocks*”, May 27–29. She is responsible for administration of the Mäler Scholarships and other guest research posts. As of January 2013, Christina is also coordinator for the Volvo Environment Prize.



AGNETA SUNDIN
is communications officer and financial controller. Her responsibilities include developing and editing the website, administering the Beijer Publication Series and editing the Annual Report. As financial controller she handles budgetary and accounting issues for the Beijer Institute. A member of Stockholm Resilience Centre Communications team, Agneta is involved in activities arranged jointly by the SRC, Beijer and Albaeco, for example the Stockholm Seminars series. She was co-organiser of the Beijer Young Scholars (BYS) second workshop in May: “*Cross-scale dynamics of food production and consumption*”, the workshop “*Global dynamics and social-ecological resilience in the face of multiple shocks*”, May 27–29, and the workshop “*Perspectives on growing and shrinking human habitats*”, 11–13 June.

Funding

- Core funding for the Beijer Institute is provided by the Kjell and Märta Beijer Foundation.
- Funding for the Beijer Institute’s research activities between 1 July 2012 and 30 June 2013 was also provided by:
- The Brothers Jacob and Marcus Wallenberg Memory Foundation
 - The Crafoord Foundation
 - The European Commission
 - The Ebba and Sven Schwartz Foundation
 - The Foundation for Strategic Environmental Research, MISTRA
 - The Research Council of Norway
 - The Riksbankens Jubileumsfond, The Swedish Foundation for Humanities and Social Sciences
 - The Royal Swedish Academy of Sciences
 - The Swedish International Development Cooperation Agency, Sida
 - The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, FORMAS
 - Western Indian Ocean Marine Science Association, WIOMSA

Teaching and training

The Beijer Institute serves as a link between university departments and institutions working with ecological economics issues, and PhD students are involved in its research programmes and projects. The Institute organises training workshops and international research seminars on the environment and development and international training programmes.

- PhD Course*
The Economics of the Environment
This course is held biannually by the Beijer Institute in collaboration with the Department of Economics at Stockholm University and gives an overview of the field of Environmental Economics, as well as a deeper understanding of a few selected areas. It covers basic theories and addresses how the complexity of the socio-ecological environment alters these theories.
- The Economics of the Environment course was held 30 November–13 December 2012 at the Beijer Institute and the Academy and lectures were given by many Beijer Institute researchers. Focus was mainly on resource economics, particularly when regime shifts can occur. Issues of policy and applied welfare theory were also addressed.

- PhD Course*
Ecology and Economic Management
This course aims to provide students in Environmental Economics with an understanding of the complexity and functions of interlinked social-ecological systems, and the implications this has for governance. The course is aimed at PhD students participating in the SIDA-funded PhD programme in Environmental Economics at Gothenburg University and it is held at the Beijer Institute every second year. The PhD programme was established by the Beijer Institute and the Environmental Economics unit at Gothenburg University in 1997. The purpose of the programme is to strengthen the capacity in developing countries to teach environmental economics at university level, and to establish a firm basis for research that can be used for policy advice pertaining to environmental economics and sustainable development.

The Stockholm seminars:
**Frontiers in Sustainability
Science and Policy**

The Stockholm Seminars are arranged by the Beijer Institute, Stockholm Environmental Institute, IGBP (the International Geosphere Biosphere Programme) and Stockholm Resilience Centre, along with Albaeco. They cover a broad range of perspectives on sustainability issues and focus on the need for a sound scientific basis for sustainable development policy.

The seminars are given at the Royal Swedish Academy of Sciences and are attended by a large audience, including scientists, students, media and policy makers in the public and private sector.

Between July 2012 and June 2013, the following seminars were held at the Royal Swedish Academy of Sciences:

2012

10 September:
PROF. SCOTT BARRETT
Climate negotiations and approaching catastrophes

14 September:
DR. VILLY CHRISTENSEN
Ecological networks
– from who did it to future food webs

28 September:
DR. CINDI KATZ
Resilience in a social field
– response to transition

2 October:
PROF. ANANTHA DURAIAPPAH
Inclusive Wealth Report:
Transition to sustainability

8 November:
PROF. CHARLES HALL
Improving real productivity

12 November:
PROF. LANCE GUNDERSON
Obstacles and opportunities
for building adaptive capacity

20 November:
DR. BRIGITTE BAPTISTE
Governance of biodiversity and
ecosystem services in Colombia

2013
15 January:
DR. THORSTEN KIEFER
A region-by-region temperature
history of the Common Era

29 January:
DR. SHELLEY CLARKE
China’s conduct in fishing, seafood
production and consumption

19 March:
DR. BENJAMIN PLANQUE
Ecosystems modelled from the outside

7 May:
PROF. JINHUA ZHAO
Economics of adaptation to global climate
change: Past lessons and future strategies

20 May:
**DR. RICHARD STEDMAN
AND DR. KEITH TIDBALL**
Positive resource dependency in urban
systems: Applying urgent biophilia
and restorative
topophilia

30 May:
**PROF. JOERN
FISCHER**
Local
development
risks and
opportunities:
Insights from
Southern
Transylvania,
Romania

Brown Bag Lunch Seminars

The Brown Bag Lunch Seminars are a joint initiative between the Beijer Institute, Stockholm Resilience Centre, Stockholm Environment Institute and Albaeco. The seminars aim to provide a platform for staff, students and visitors at the institutions that together form Stockholm Resilience Centre, to share their work in an informal manner with ample time for discussion. The Brown Bag Seminars have proven to be a success and often attract a large audience.

The Askö Meeting

Since 1993, the Beijer Institute has organised an annual meeting in September for informal discussions between ecologists and economists at the Stockholm Centre for Marine Research at Askö, a Swedish island in the Baltic Sea. The Askö meetings have generated unique cooperation between these disciplines and each meeting has resulted in a consensus document, often published in a leading scientific journal.

The theme of Askö 2012 was Diversity, Simplification, and Tipping Points – Efficiency versus Security in Global Food Production. This meeting is described more under Global Dynamics and Resilience in this report.



Therese Lindahl presenting at a
Brown Bag Lunch Seminar.

Staff members’
publications
and activities

Staff members’ research activities are presented at events such as conferences, workshops and seminars. To stimulate interaction between staff members at the Beijer Institute and Stockholm Resilience Centre, joint internal seminars take place regularly. Below is a selection of staff members’ publications and activities during 2012/2013.



JOHAN COLDING
Associate
Professor,
researcher

Research focus:
Urban social-
ecological systems

Publications during the period:

Barthel, S., J. Parker, C. Folke and J. Colding. 2012. Urban gardens – Pockets of social-ecological memory. Tidball, K.G., and M.E. Krasny (eds.). In *Greening in the Red Zone: Disaster, Resilience, and Urgent Biophilia*. Springer, Dordrecht, Netherlands.

Bendt, P., S. Barthel and J. Colding. 2013. Civic greening and environmental learning in public-access community gardens in Berlin. *Landscape and Urban Planning* 109:18–30.

Colding, J. Local assessment of Stockholm – Revisiting the Stockholm Urban Assessment. In: Elmqvist, T., M. Fragkias, J. Goodness, B. Güneralp, P. J. Marcotullio, R. I. McDonald, S. Parnell, M. Schewenius, M. Sendstad, K. C. Seto and C. Wilkinson (eds.). *Urbanization, Biodiversity and Ecosystem Services:*

Challenges and Opportunities. A Global Assessment. Springer Open. In press.

Colding, J. and S. Barthel. 2013. The potential of ‘Urban Green Commons’ in the resilience building of cities. *Ecological Economics* 86:156–166.

Colding, J., S. Barthel, P. Bendt, R. Snep, W. van der Knaap and H. Ernstson. 2013. Urban green commons: Insights on urban common property systems. *Global Environmental Change*. In press.

Wilkinson, C., T. Saarne, G.D. Peterson and J. Colding. 2013. Strategic spatial planning and the ecosystem services concept – an historical exploration. *Ecology and Society* 18(1):37.

Policy reports:

Colding, J., L. Marcus, S. Barthel, E. Andersson, Å. Jansson and S. Borgström. 2013. *Ekosystemtjänster I Stockholmsregionen: Ett underlag för diskussion och planering (Ecosystem Services in the Stockholm Region: A Basis for Discussion and Planning)*. Rapport 5:2012. Stockholms Läns Landsting, Tillväxt, miljö- och regionplanering, Stockholm, Sweden.

Ekologigruppen (Ecology group); Colding, J., L. Marcus, S. Barthel, E. Andersson, Å. Jansson, S. Borgström et al. 2012. Gröna Svaga Samband i Stockholms Gröna Kilar (*Weak Green Links in Stockholm’s Green Wedges*). Stockholms Läns Landsting, Tillväxt, miljö- och regionplanering, Stockholm, Sweden.

**Conferences, workshops
and presentations:**

Global Change and Resilience Building of Cities, KAST seminar, KVA, Stockholm, November 2012. Organiser, host and presentation: *Urban challenges in the anthropocene*.

Seminar on Albano Sustainable Campus (with researchers at Aalto University,

Finland), Stockholm Resilience Centre, Stockholm, April 2013. Presentation: *Albano development*.

Workshop on Green Wedges (Rösjökilen och Angarn-Bogesundskile), Täby, Stockholm, April 2013. Presentation: *Ecosystem services: Barriers and accessibility*.

Perspectives on Growing and Shrinking Human Habitats, workshop, KVA, Stockholm, June 2013. Organiser, host and presentation: *Perspectives on urban green commons*.

Ecosystem Services in the Stockholm Region, Swedish Museum of Natural History, Stockholm, June 2013. Presentation of report: *Ekosystemtjänster i Stockholmsregionen: ett underlag för diskussion och planering (Ecosystem Services in the Stockholm Region: A Basis for Discussion and Planning)*.

Teaching and training:

Main supervisor of PhD student Cathy Wilkinson (Department of Systems Ecology, Stockholm University, thesis defence in September 2012, Social-ecological Resilience and Planning: An Interdisciplinary Exploration); Co-supervisor of PhD student Caroline Schill (Stockholm Resilience Centre, Stockholm University).



ANNE-SOPHIE CRÉPIN

PhD, Deputy Director

Research focus:

Regime shifts and economics, global

dynamics and resilience, economic consequences of climate change in the Arctic Ocean, modelling social-ecological systems with the focus on interactions between ecology and economics.

Publications during the period:

Carpenter, S.R., K.J. Arrow, S. Barrett, R. Biggs, W.A. Brock, A.-S. Crépin, G. Engström, C. Folke, T. Hughes, N. Kautsky, C.-Z. Li, G. McCarney, K. Meng, K.-G. Mäler, S. Polasky, M. Scheffer, J. Shogren, T. Sterner, J. Vincent, B. Walker, A. Xepapadeas and A. de Zeeuw. 2012. General resilience to cope with extreme events. *Sustainability* 4:3248–3259.

Crépin, A.-S., R. Biggs, S. Polasky, M. Troell and A. de Zeeuw. 2012. Regime shifts and management. *Ecological Economics* 84:15–22.

Crépin, A.-S., R. Biggs, S. Polasky, M. Troell and A. de Zeeuw. 2013. Regime shifts and management. In: Shogren, J.F. (ed.). *Encyclopedia of Energy, Natural Resource, and Environmental Economics*, Vol. 2. Elsevier, Amsterdam, The Netherlands. Pp. 339–348.

Levin, S., T. Xepapadeas, A.-S. Crepin, J. Norberg, A. de Zeeuw, C. Folke, T.P. Hughes, K.J. Arrow, S. Barrett, G. Daily, P. Ehrlich, N. Kautsky, K.-G. Mäler, S. Polasky, M. Troell, J. Vincent and B.H. Walker. 2013. Social-ecological systems as complex adaptive systems: Modeling and policy implications? *Environment and Development Economics* 18:111–132.

Walker, B.H., S.R. Carpenter, J. Rockstrom, A.-S. Crépin and G.D. Peterson. 2012. Drivers, “slow” variables, “fast” variables, shocks, and resilience. *Ecology and Society* 17(3):30.

Conferences, workshops and presentations:

ACCESS annual meeting, Barcelona, Spain, March 2013. Organiser and facilitator.

Global Dynamics and Resilience workshop, Beijer Institute and Stockholm Resilience Centre, KVA, Stockholm, May 2013. Organiser and presentation: *Global dynamics, multiple shocks, and resilience; planetary stewardship, catastrophic shifts and the earth system – overview of the research programme*.

The 20th Ulvön Conference on Environmental Economics, Ulvön, Sweden, June 2013. Session organiser and presentation: *Price vs. quantity for complex ecosystems – Dealing with non-convexities*.

Teaching and training:

Lecturer, PhD course *Bioeconomics* (within the NORMER programme), Helsinki, Finland, October 2012.

Course leader and lecturer, PhD course *The economics of the environment*, Beijer Institute and Department of Economics, Stockholm University, December 2012.

Module leader, lecturer and examiner Master’s level course *Challenges for environmental decision making*, Stockholm Resilience Centre, Stockholm University, spring 2013.

Lecturer, undergraduate course *Ekologisk Ekonomi (Ecological economics)*, Stockholm University, April 2013.

Co-supervisor of PhD students Gustav Engström (Department of Economics, Stockholm University, thesis defence in September 2012) and Caroline Schill

(Stockholm Resilience Centre, Stockholm University); Main supervisor of Master’s student Jasmina Munteanu (Swedish University of Agricultural Sciences, Ultuna, Sweden).

Commissions:

Council member, Stiftelsen för Internationella Institutet för Industriell Miljöekonomi vid Lunds Universitet (Foundation for the International Institute of Industrial Environmental Economics at Lund University), Lund, Sweden, July 2010 – June 2013.

Member of the scientific committee, 2013 EARE conference, Toulouse, France, June 2013.

Steering Committee member, ACCESS, EU FP7 research programme coordinated by University Pierre et Marie Curie, Paris, France, 2011–2015.

Theme leader, Global and cross-level dynamics, Stockholm Resilience Centre, Stockholm University.

Reviewer for several journals.

Other:

Newspaper article: Troell, M., L. Deutsch, T. Lindahl, A.-S. Crépin, P. Henriksson and M. Metian. Köttätande inte vars och ens ensak (Meat consumption not each person’s business), 3 February 2013, *Uppsala Nya Tidning*, Sweden.



GUSTAV ENGSTRÖM

PhD, researcher

Research focus:

Main area of interest is macroeconomic

models of climate change. Focus to date on integrating climate models developed by climate scientists with models of optimal economic growth. Other recent interests include aspects of income distribution related to environmental decision making. Other activities involve the development of a housing market database for use in environmental valuation studies.

Publications during the period:

Brock, W.A., G. Engström and A. Xepapadeas. 2013. Spatial climate-economic models in the design of

optimal climate policies across locations. *European Economic Review*. In press.

Carpenter, S.R., K.J. Arrow, S. Barrett, R. Biggs, W.A. Brock, A.-S. Crépin, G. Engström, C. Folke, T. Hughes, N. Kautsky, C.-Z. Li, G. McCarney, K. Meng, K.-G. Mäler, S. Polasky, M. Scheffer, J. Shogren, T. Sterner, J. Vincent, B. Walker, A. Xepapadeas and A. de Zeeuw. 2012. General resilience to cope with extreme events. *Sustainability* 4:3248–3259.

Engström, G. 2012. *Essays on Economic Modeling of Climate Change*. Department of Economics, Stockholm University, Stockholm, Sweden (PhD thesis).

Conferences, workshops and presentations:

The Macroeconomics of Climate Change, conference, London School of Economics, UK, December 2012. Presentation: *Structural and climatic change*.

Global Dynamics and Resilience workshop, Beijer Institute and Stockholm Resilience Centre, KVA, Stockholm, May 2013. Presentation: *Economic EBCMs and economics of Daisyworld*.

The 20th Ulvön Conference on Environmental Economics, Ulvön, Sweden, June 2013. Presentation of paper.

Teaching and training:

Lecturer, PhD course *The economics of the environment*, Beijer Institute and Department of Economics, Stockholm University, December 2012.

Lecturer, Master’s level course *Governance and management of social-ecological systems: Principles of economic decision making*, Stockholm Resilience Centre, Stockholm University, Spring 2013.



JOHAN GARS

PhD, researcher

Research focus:

Macroeconomics of climate change, renewable

resources, uncertainty and thresholds.

Conferences, workshops and presentations:

Cost-Benefit Appraisal of Climate Action, Örebro University, Sweden, August 2012. Presentation of paper: *The role of the nature of damages*.

The Macroeconomics of Climate Change, conference, London School of Economics, UK, December 2012. Participant.

The 20th Ulvön Conference on Environmental Economics, Ulvön, Sweden, June 2013. Presentation of paper: *Tragedy of the commons versus the love of variety* (co-authored with Daniel Spiro, Oslo University).

2013 EAERE conference, Toulouse, France, June 2013. Presentation of paper: *Tragedy of the commons versus the love of variety* (co-authored with Daniel Spiro, Oslo University).

Teaching and training:

Lecturer, Master’s level course *Social-ecological systems: Challenges and approaches*, Stockholm Resilience Centre, Stockholm University, October 2012.

Lecturer, PhD course *The economics of the environment*, Beijer Institute and Department of Economics, Stockholm University, December 2012.



CARL FOLKE
Professor, Director

Research focus:
Social-ecological systems, resilience thinking, adaptive governance, life-supporting

ecosystems and stewardship of ecosystem services in a global context, transformations for reconnecting to the biosphere.

Publications during the period:

Anderies, J.M., C. Folke, B.H. Walker and E. Ostrom. 2013. Aligning key concepts for global change policy: Robustness, resilience, and sustainability. *Ecology and Society* 18(2):8.

Carpenter, S.R., K.J. Arrow, S. Barrett, R. Biggs, W.A. Brock, A.-S. Crépin, G. Engström, C. Folke, T. Hughes, N. Kautsky, C.-Z. Li, G. McCarney, K. Meng, K.-G. Mäler, S. Polasky, M. Scheffer, J. Shogren, T. Sterner, J. Vincent, B. Walker, A. Xepapadeas and A. de Zeeuw. 2012. General resilience to cope with extreme events. *Sustainability* 4:3248–3259.

Ebbesson, J. and C. Folke. Scales of law and social-ecological contexts. In: Garmestani, A., and C. Allen (eds.). *Social-Ecological Resilience and Law*. Columbia University Press, New York, USA. In press.

Folke, C. 2012. Respecting planetary boundaries and reconnecting to the biosphere. In: Prugh, T. (ed.). *State of the World 2013*. Worldwatch Institute, Washington DC, USA. Pp. 19–27.

Folke, C. and L. Gunderson. 2012. Reconnecting to the biosphere: A social-ecological renaissance. *Ecology & Society* 17(4):55.

Levin, S., T. Xepapadeas, A.-S. Crépin, J. Norberg, A. de Zeeuw, C. Folke, T.P. Hughes, K.J. Arrow, S. Barrett, G. Daily,

P. Ehrlich, N. Kautsky, K.-G. Mäler, S. Polasky, M. Troell, J. Vincent and B.H. Walker. 2013. Social-ecological systems as complex adaptive systems: Modeling and policy implications? *Environment and Development Economics* 18:111–132.

Österblom, H. and C. Folke. 2013. Emergence of global adaptive governance for stewardship of regional marine resources. *Ecology and Society* 18(2):4.

Österblom, H., A. Merrie, M. Metian, W.J. Boonstra, T. Blenckner, J. Watson, R. Rykaczewski, Y. Ota, J. Sarmiento, V. Christensen, S. Birnbaum, B. Gustavsson, C. Humborg, C.-M. Mörtz, B. Müller-Karulis, M. Schlüter, S. Birnbaum, B.G. Gustavsson, C. Humborg, C.-M. Mörtz, B. Müller-Karulis, M.T. Tomczak, M. Troell and C. Folke. Modeling social-ecological scenarios in marine systems. *BioScience*. In press.

Rockström, J., M. Falkenmark, C. Folke, M. Lannerstad, J. Barron, E. Enfors, L. Gordon, J. Heinke, H. Hoff and C. Pahl-Wostl. *Water Resilience for Human Prosperity*. Cambridge University Press, Cambridge, UK. In press.

Westley, F., O. Tjörnbö, L. Schultz, P. Olsson, C. Folke, B. Crona and Ö. Bodin. A theory of transformative agency in linked social-ecological systems. *Ecology and Society*. In press.

Conferences, workshops and presentations:

RAYS workshop, Stockholm Resilience Centre, Stockholm, August 2012. Introductory presentation.

Safeguarding Water Resilience for Food Security in the Anthropocene, Stockholm Water Week Symposium, August 2012. Invited speaker: *Transformations of water governance: Implications of putting the bloodstream perspective in operation*.

Stockholm Meeting 2012, Naturvetarna, IVA, September 2012. Invited speaker: *Creative environments and collaborative learning platforms*.

ICES Annual Science Conference, Bergen, Norway, September 2012. Keynote speaker: *Marine social-ecological systems, resilience, and global change*.

Early-warning Signals for Critical Transitions: Bridging the Gap Between Theory and Practice, KNAW (Royal Netherlands Academy of Arts and Sciences) and SparcS (the Synergy Program for Analyzing Resilience and Critical transitionS), Amsterdam, The Netherlands, October 2012. Participant and presentation: *Social-ecological transformations*.

Urban theme meeting, Stockholm Resilience Centre and Beijer Institute, KVA, Stockholm, October 2012. Speaker: *Urban challenges*.

Ebba and Sven Schwartz Foundation, Stockholm, October 2012 and May 2013. Presentations.

Resilience Dialogues, Stockholm Resilience Centre, Stockholm, 14 October 2012, 30 May 2013.

Innovations for a Resilient SHIFT, November 2012. Keynote speaker.

Reconnecting to the Biosphere through Ecosystem Services, KVA, Stockholm, November 2012. Organiser.

Grassland-forest Transitions Workshop, SARAS, Maldonado, Uruguay, December 2012. Invited speaker: *The new global context for transitions*.

Coral Reefs as Social-ecological Systems, Stockholm Resilience Centre, Beijer Institute, Saltsjöbaden, Sweden, January 2013. Participant.

Trade and Seafood Workshop, Stockholm Resilience Centre, Stockholm, January 2013. Presentation: *The SRC marine framework and focus*.

Seminar for the Government Commission Making visible the value of ecosystem services, Miljöforskningsberedningen, Ministry of the Environment, March 2013. Presenter.

Comparative Marine Ecosystem Management/PECS workshop, Stockholm Resilience Centre, Beijer Institute, Saltsjöbaden, Sweden, March 2013. Participant.

Artisanal Shell fisheries South America workshop, SARAS, Beijer Institute, Persson, Stockholm Resilience Centre, Saltsjöbaden, Sweden, March 2013. Organiser and speaker: *Latin American shellfisheries*.

Social-ecological Grass-woodland Transitions, Beijer-SARAS, May 2013. Organiser and participant.

Beijer Young Scholars Workshop, KVA, Fejan, Stockholm, May 2013.

Global Dynamics and Resilience Workshop, Beijer Institute and Stockholm Resilience Centre, KVA, Stockholm, May 2013. Participant.

Transformations in a Changing Climate Conference, Oslo University and Stockholm Resilience Centre, Oslo, Norway, June, 2013. Keynote speaker: *Reconnecting to the biosphere*.

Beijer Foundation, KVA, Stockholm, June 2013. Presentation.

Teaching and training:

Lecturer at undergraduate and Master's level courses at Stockholm University.

Co-supervisor of two PhD students in Sustainability Science, Stockholm Resilience Centre, Stockholm University. Cibele Quieroz defended her thesis *Managing for Biodiversity and Ecosystem Services in a context of Farmland Abandonment* in May 2013.

Commissions:

Director of Science and Founder, Stockholm Resilience Centre: Research

for Governance of Social-Ecological Systems, since 2007.

Board member, Stockholm Environment Institute, 2004–2013.

Founding and Board Member of the Resilience Alliance, since 1999.

Member of the Royal Swedish Academy of Sciences, since 2002.

Member of the Environmental Research Committee, the Royal Swedish Academy of Sciences, since 2003.

Editor-in-Chief, *Ecology & Society*, since 2002.

Advisory and Editorial Board member of 13 journals including: *Ambio, Ecological Economics, Environment, Environmental Conservation, Environment and Development Economics, Environmental Innovation and Societal Transitions, Frontiers in Ecology and the Environment, Global Environmental Change, Letters in Spatial and Resource Sciences, Resilience: International Policies, Practices and Discourses, Reviews in Ecological Economics, Sustainability Science*.

Fellow of the Synergy programme on resilience and critical transitionS (SparcS), Wageningen, The Netherlands, since 2012.

Scientific Committee member, Programme on Ecosystem Change and Society (PECS), ICSU, since 2009.

Scientific Advisory Board member, SARAS (South American Institute for Resilience and Sustainability Studies), Montevideo, Uruguay, since 2007.

Scientific Advisory Board member, STEPS, since 2010.

Member of the International Scientific Advisory Council of the Waterloo Institute for Complexity and Innovation (WICI), University of Waterloo, since 2012.

Scientific Advisory Board member, Swedish Secretariat for Environmental

Earth System Sciences (SSEESS), since 2010.

Scientific Committee member, Volvo Environment Prize, since 2008, chair since 2012.

Associate Faculty member, Earth System Governance Project, IHDP, since 2009.

Advisory Board member, The International Network of Research on Coupled Human and Natural Systems (CHANS-Net), since 2009.

Principal investigator, The Family Erling Persson's Academy Program on the Ecological Economics of Global Change, since 2012.

Co-principal investigator of two Centre of Excellence research projects: *Nordic Centre for the Study of Climate Change Effects on Marine Ecosystems and Resource Economics* of The Top-level Research Initiative (TRI), a joint Nordic research and innovation initiative (NC Stenseth PI); and *Regime Shifts in the Baltic Sea Ecosystem - Modelling Complex Adaptive Ecosystems and Governance Implications*, Formas (C. Humborg PI).

Partner investigator, The ARC Centre of Excellence for Coral Reef Studies, JCU, Australia, since 2005.

Steering Committee member, Nereus Program – Predicting the Future Ocean, UBC, Canada, since 2010.

Steering Committee member, ESRC, Centre for Climate Change Economics and Policy, London School of Economics and University of Leeds, UK, since 2008.

Steering Committee member, BEAM (Baltic Ecosystem Adaptive Management), Stockholm University.

Advisor to the Swedish Government Commission *Making visible the value of ecosystem services*, 2012–2013.



ÅSA GREN
PhD, researcher

Research focus:

Sustainable urban development, quantification and valuation of ecosystem services and biodiversity.

Publications during the period:

Gómez-Baggethun, E., Å. Gren, D. N. Barton, J. Langemeyer, T. McPhearson, P. O'Farrell, E. Andersson, Z. Hamstead and P. Kremer. Urban ecosystem services. In: Elmqvist, T., M. Fragkias, J. Goodness, B. Güneralp, P. J. Marcotullio, R. I. McDonald, S. Parnell, M. Schewenius, M. Sendstad, K. C. Seto and C. Wilkinson (eds.). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities. A Global Assessment*. Springer Open. In press.

Gren, Å. 2013. Reaching for a sustainable, resilient urban future using the lens of ecosystem services. *Ecological Economics* 86:285–291.

Conferences, workshops and presentations:

ECO SUMMIT, Columbus, Ohio, USA, September 2012. Presentation: *Quantifying biodiversity using functional diversity as a proxy*.

Reconnecting to the Biosphere through Ecosystem Services, Seminar, KVA, Stockholm, November 2012. Presentation: *Urban ecosystem services for sustainable development – from local to global*.

ACCESS annual meeting, Barcelona, Spain, March 2013. Discussion leader: *Integrating ecosystem services into fisheries and tourism in the Arctic*.

City planning days, Nacka, Sweden, April 2013. Invited keynote speaker: *Ecosystem services – something to count on?*

Global future Panel, Stockholm Resilience Centre, Stockholm, March 2013. Invited speaker: *The role of demographics in a changing world*.

Ecosystem Services in the Stockholm Region, Swedish Museum of Natural History, Stockholm, June 2013. Invited speaker: *Measuring resilience through functional diversity*.

Perspectives on Growing and Shrinking Human Habitats, workshop, KVA, Stockholm, June 2013. Coordinator and presentation: *Quantifying urban resilience through functional diversity*.

Teaching and training:

Co-supervisor of Bachelor student Elin Sellnäs (Systems Ecology, Stockholm University).

Teaching and training:

Course coordinator, Master's level course *Environmental economics for non-economists*, University of Gothenburg, Sweden, Autumn 2012.

Lecturer, PhD course *Environmental economics and policy instruments*, University of Gothenburg, Sweden, Autumn 2012.

Lecturer, Master's level course *Environmental economics and international issues*, University of Gothenburg, Sweden, Autumn 2012.

Lecturer, Master's level course *Environmental policy instruments*, Chalmers University of Technology, Gothenburg, Sweden, Spring 2013.

Course Coordinator, undergraduate course *Environmental and resource economics*, University of Gothenburg, Sweden, Spring 2013.

Commissions:

Organiser of General Economics Seminar Series, Department of Economics, University of Gothenburg, Sweden, Sept. 2012 – Sept. 2013.



EFTHYMIA KYRIAKOPOULOU

PhD, visiting researcher

Research focus:

Environmental economics, environmental policy instruments, urban economics

Publications during the period:

Kyriakopoulou, E. and T. Sterner. 2012. (The economics of) Discounting: Unbalanced growth, uncertainty and spatial considerations. *Annual Review of Resource Economics* 4:285–301.

Kyriakopoulou, E. and A. Xepapadeas. 2013. Environmental policy, first nature

advantage and the emergence of economic clusters. *Regional Science and Urban Economics* 43:101–116.

Kyriakopoulou, E. and A. Xepapadeas. 2013. Beijer Discussion Paper 242: Spatial policies and land use patterns: Optimal and market allocations. *Beijer Discussion Paper Series*.

Conferences, workshops and presentations:

Optimal Management of Dynamic Systems of the Economy and the Environment, research workshop, Athens University of Economics and Business, Athens, Greece, September 2012. Presentation: *Spatial policies and land use patterns: Optimal and market allocations*.

Environmental Seminar Series, University of Gothenburg, Sweden, April 2013. Presentation: *Environmental policy and the size distribution of firms*.

Beijer Seminar Series, Beijer Institute, Stockholm, May 2013. Presentation: *Environmental policy and the size distribution of firms*.

Beijer Young Scholars Workshop, KVA, Fejan, Stockholm, May 2013. Participant.

Global Dynamics and Resilience Workshop, Beijer Institute and Stockholm Resilience Centre, KVA, Stockholm, May 2013. Participant.

2013 EAERE conference, Toulouse, France, June 2013. Presentation: *Environmental policy and the size distribution of firms*.



CHUAN-ZHONG LI

Professor, researcher

Research focus:

Green accounting and sustainability measurement, ecosystem resilience studies, stochastic growth with natural resource and environmental assets.

Publications during the period:

Carpenter, S.R., K.J. Arrow, S. Barrett, R. Biggs, W.A. Brock, A.-S. Crépin, G. Engström, C. Folke, T. Hughes, N. Kautsky, C.-Z. Li, G. McCarney, K. Meng, K.-G. Mäler, S. Polasky, M. Scheffer, J. Shogren, T. Sterner, J. Vincent, B. Walker,

A. Xepapadeas and A. de Zeeuw. 2012. General resilience to cope with extreme events. *Sustainability* 4:3248–3259.

Li, C.-Z. and K.G. Löfgren. 2012. Genuine saving under stochastic growth. *Letters in Spatial and Resource Sciences* 5:167–174.

Li, C.-Z. and K.G. Löfgren. 2012. Growth, pollution, and money-metric welfare in imperfect markets. *Environmental Economics* 3:1–14.

Conferences, workshops and presentations:

Annual China Economic Society Conference, Chengdu, China, June 2013. Presentation: *Energy structure, carbon emissions and industrial productivity: Evidence from firm-level data in China*.

Teaching and training:

Lecturer, PhD course *The economics of the environment*, Beijer Institute and Department of Economics, Stockholm University, December 2012.

Lecture on *Ecological traps and economic sustainability*, School of Economics, Sichuan University, China, June 2013.

Commissions:

Programme committee member, EAERE, since 2008.

Board of directors, PACE: Professional Association of China's Environment, Beijing, China, since April 2013.



THERESE LINDAHL

PhD, researcher

Research focus:

Behavioural aspects of natural resource management, the influence of complex ecosystem dynamics (e.g. threshold effects, uncertainty, resources interdependencies) on resource

users' strategies for exploitation and cooperation and the implications for the management of common-pool resources.

Publications during the period:

Lindahl, T. 2013. Miljöekonomi och Beteendevetenskap (Environmental economics and behavioural science). In: Stavlöt, U. (ed.). *Nationalekonomi för Miljöintresserade (Economics for Environmentally Interested)*. Ivrig Förlag, Stockholm, Sweden. In press.

Lindahl, T. 2013. Beijer Discussion Paper 240: Reducing non-point source pollution through auctions: some lessons learned from a laboratory experiment. *Beijer Discussion Paper Series*.

Lindahl, T., Ö. Bodin and M. Tengö. 2013. Beijer Discussion Paper 241: Governing complex commons – the role of communication for experimental learning and coordinated management. *Beijer Discussion Paper Series*.

Conferences, workshops and presentations:

Seminar, Department of Economics, University of Tromsø, Norway, November 2012. Presentation of paper: *Managing resources with potential regime shifts: Using experiments to explore social-ecological linkages in common resource systems.*

2013 ASSA conference, San Diego, USA, January 2013. Invited presenter: *Managing resources with potential regime shifts: Using experiments to explore social-ecological linkages in common resource systems.*

Workshop on laboratory and field experiments on social-ecological systems, Centre for the Study of Institutional Diversity (CSID), ASU, Phoenix, USA, March 2013. Participant and presentation of paper: *Regime shifts in common-pool resource systems.*

2013 EAERE conference, Toulouse, France, June 2013. Chair of session and presentation of paper: *The impact of uncertain threshold effects on exploitation*



CAROLINE SCHILL
PhD candidate, researcher

Research focus:
Interactions between ecosystem

dynamics and human behaviour in social dilemmas, with particular interest in the implications of abrupt ecosystem changes and environmental and social uncertainties for collective action in common-pool resource systems.

and cooperation in commons dilemmas: Evidence from a laboratory experiment.

Teaching and training:

Lecturer, undergraduate level course *Världens Eko*, Stockholm Resilience Centre, Stockholm University, November 2012.

Course organiser and lecturer, PhD course *The economics of the environment*, Beijer Institute and Department of Economics, Stockholm University, December 2012.

Lecturer, Master's level course *Governance and management of social-ecological systems: Principles of economic decision making*, Stockholm Resilience Centre, Stockholm University, Spring 2013.

Lecturer, Master's level course *Governance and management of social-ecological systems: Drama of the commons*, Stockholm Resilience Centre, Stockholm University, Spring 2013.

Main supervisor of PhD student Caroline Schill (Stockholm Resilience Centre, Stockholm University).

Conferences, workshops and presentations:

Urban theme workshop, Stockholm Resilience Centre and Beijer Institute, KVA, Stockholm, October 2012. Presentation: *Exploring human behaviour for sustainable commons management – what is unique about urban green commons?*

Workshop on Laboratory and Field Experiments on Social-ecological Systems, Centre for the Study of Institutional Diversity (CSID), ASU, Phoenix, USA, March 2013. Participant.

The 20th Ulvön Conference on Environmental Economics, Ulvön, Sweden, June 2013. Presentation: *The influence of threshold uncertainty on group behaviour in commons dilemmas: Evidence from a laboratory experiment.*

Mentor of Mäler Scholar Rawadee Jarungrattanapong (PhD, Thailand).

Commissions:

Discussant and examiner for the Licentiate thesis of PhD student Martin Lindqvist, Department of Economics, Swedish University of Agricultural Sciences, Ultuna, Sweden, 2013.

Discussant at the half-time seminar of PhD student Emelie Lindqvist, Stockholm Resilience Centre, Stockholm University, June 2013.

Reviewer for *Ecological Economics*, June 2013.

Other:

Newspaper article: Troell, M., L. Deutsch, T. Lindahl, A.-S. Crépin, P. Henriksson and M. Metian. Köttätande inte vars och ens ensak (Meat consumption not each person's business), 3 February 2013, *Uppsala Nya Tidning*, Sweden.

Maternity leave during the year: 15%.

Teaching and training:

Lecture in combination with a laboratory experiment, SIT study abroad programme (undergraduate level), Garðarshólmur, Húsavík, Iceland, July 2012.

Teaching assistant, undergraduate level course *Världens Eko*, Stockholm Resilience Centre, Stockholm University, November 2012.

Other:

Performance of laboratory experiments, Beijer Institute; and pilot field experiment with Arctic fishermen in Senjahopen, Norway (November 2012).

Vice-chair of PhD student council, Stockholm Resilience Centre, Stockholm University, since March 2013.



MARK SANCTUARY
PhD candidate, researcher

Research focus:

Environmental economics with particular focus on international economics, industrial organisation and the study of regulation and policy.

Conferences, workshops and presentations:

The 20th Ulvön Conference on Environmental Economics, Ulvön, Sweden, June 2012. Presentation: *Heterogeneous effects of a domestic electricity price increase on the structure of intermediate inputs.*



MAX TROELL
Associate Professor, researcher

Research focus:

Environmental impacts and sustainability of aquaculture, governance of coastal and marine ecosystems, ecosystem services, ecosystem functions, biodiversity, resilience, regime shifts, food security, integrated aquaculture.

Publications during the period:

Beveridge, M.C.M., S.H. Thilsted, M. Phillips, M. Metian, M. Troell and S.J. Hall. Meeting the food and nutrition needs of the poor: The role of fish and the opportunities and challenges emerging from the rise of aquaculture. *Journal of Fish Biology*. In press.

Crépin, A.-S., R. Biggs, S. Polasky, M. Troell and A. de Zeeuw. 2012. Regime shifts and management. *Ecological Economics* 84:15–22.

Crépin, A.-S., R. Biggs, S. Polasky, M. Troell and A. de Zeeuw. 2013. Regime shifts and management. In: Shogren, J.F. (ed.). *Encyclopedia of Energy, Natural Resource, and Environmental Economics*, Vol. 2. Elsevier, Amsterdam, The Netherlands. Pp. 339–348.

Jonell, M., M. Phillips, P. Rönnbäck and M. Troell. 2013. Eco-certification of farmed seafood: Will it make a difference? *AMBIO* (Published online: 23 April 2013).

Levin, S., T. Xepapadeas, A.-S. Crépin, J. Norberg, A. de Zeeuw, C. Folke, T.P. Hughes, K.J. Arrow, S. Barrett, G. Daily, P. Ehrlich, N. Kautsky, K.-G. Mäler, S. Polasky, M. Troell, J. Vincent and B.H. Walker. 2013. Social-ecological systems as complex adaptive systems: Modeling and policy implications? *Environment and Development Economics* 18:111–132.

Nyström, M., A.V. Norström, T. Bleckner, M. de la Torre Castro, J.S. Eklöf, C. Folke, H. Österblom, R.S. Steneck, M. Thyresson and M. Troell. 2012. Confronting feedbacks of degraded marine ecosystems. *Ecosystems* 15:695–710.

Österblom, H., A. Merrie, M. Metian, W.J. Boonstra, T. Blenckner, J. Watson, R. Rykaczewski, Y. Ota, J. Sarmiento, V. Christensen, S. Birnbaum, B. Gustavsson, C. Humborg, C.-M. Mörtz, B. Müller-Karulis, M. Schlüter, S. Birnbaum, B.G. Gustavsson, C. Humborg, C.-M. Mörtz, B. Müller-Karulis, M.T. Tomczak, M. Troell and C. Folke. Modeling social-ecological scenarios in marine systems. *BioScience*. In press.

Troell, M., N. Kautsky, M. Beveridge, P. Henriksson, J. Primavera, P. Ronnback and C. Folke. 2013. Aquaculture. In: Levin, S.A. (ed.). *Encyclopedia of*

Biodiversity, second edition. Elsevier, New York, USA. Pp. 189–201.

Troell M., P. Rönnbäck and M. Jonell M. 2013. Hållbart vattenbruk – potential och utmaningar (Sustainable aquaculture – potential and challenges). In: Johansson, B. (ed.). *Havsbruk som håller i längden (Sustainable Seafood Production)*. Forskningsrådet Formas, Stockholm, Sweden. Pp. 229–246.

Conferences, workshops and presentations:

Chinese Aquaculture and Forage Fish Workshop, Center on Food Security and the Environment, Stanford University, USA, June 2012. Participant.

Sustaining Aquaculture, seminar at World Water Week, Stockholm, August 2012. Session organiser and presentation: *Challenges and prospects for a sustainable aquaculture trajectory.*

AQUA 2012 – Global Aquaculture Securing Our Future, Prague, Czech Republic, September 2012. Presentation: *Aquaculture development – implications from environmental pollution and contaminant* (co-authored with Metian, M., and A.G.J. Tacon).

Ecosystem Services – identification of a framework for Sweden, Swedish Environmental Protection Agency, Stockholm, September 2012. Invited expert.

Interception and Resource Mobilization workshop, WIOMSA, Mombasa, Kenya, September 2012. Invited expert.

Sustainable Natural Resource Management – Is Resilience a Valuable Tool?, workshop, September 2012, Uppsala, Sweden. Participant.

Sustainable Management of Ecosystem Services for Long-Term Aquaculture Production in the Mekong Delta, An Giang University, Long Xuyen, Vietnam, October 2012. Presentation/expert review: *An ecosystem approach to aquaculture development in the Mekong Delta*.

First Seafood LCA Sweden workshop, SIK, Gothenburg, Sweden, December 2012. Participant.

Bridging Demand and Supply of Seafood: Sustainable Aquaculture in a Changing World, AAAS, Boston, USA, February 2013. Co-author.

ACCESS annual meeting, Barcelona, Spain, March 2013. Presentation: *Aquaculture in the Arctic*.

The Effects of Global Markets on Small-Scale Fisheries, workshop, Stockholm, March 2013. Participant.

FORMAS Press Release, Sustainable Seafood, Formas, Stockholm, April 2012. Presentation: Book chapter.

ICES-SGSA Workshop, Newcastle, April 2013. Participant.

Global Dynamics and Resilience Workshop, Beijer Institute and Stockholm Resilience Centre, KVA, Stockholm, May 2013. Presentation.

Teaching and training:

Lecturer, Master’s level course *Management of aquatic resources in the tropics (tropical aquaculture)*, Department of Ecology, Environment and Plant Sciences, Stockholm University, March 2012.

Main supervisor of post-doc Marc Metian (Stockholm Resilience Centre, Stockholm University), 2012–2013.

Co-supervisor of PhD student Malin Jonell (Department of Ecology, Environment and Plant Sciences, Stockholm University, *Sustainability Indicators and Eco-labelling of Seafood*, Licentiate in June 2013) and David Mirera (Linnaeus University, Sweden and Kenya Marine and Fisheries Research Institute (KMFRI), Kenya, *Small-scale Aquaculture of Mud Crabs (Scylla serrata) and Its Effects on Community Livelihood Along the Kenyan Coast*).

Supervisor of Master’s student V. Lundgren (Department of Ecology, Environment and Plant Sciences, Stockholm University, *Fishprint – Tracing the True Fish Consumption*).

Commissions:

Member of expert group on Ecosystem Services, Swedish Environmental Protection Agency, Stockholm, since 2012.

Member of ICES Study Group on Socio-Economic Dimensions of Aquaculture (SGSA), since 2011.

Member of the MASMA Programme Committee (Marine Science for Management), Programme within the Western Indian Ocean Marine Science Association (WIOMSA) (Funded by Sida/ SAREC), since 2007.

Review editor, *Aquaculture Environment Interactions (AEI)*, since 2009.

Reviewer for *Aquaculture, Journal of Applied Phycology, Journal of Aquaculture Environment Interactions, PNAS, AMBIO, Ecology & Society*.

Expert reviewer/advisor Aquaculture Initiative, The Swedish Foundation for Strategic Environmental Research (Mistra), presentation/interview, Stockholm, October 2012.

MASMA Programme Committee, Research evaluation meeting, Johannesburg, South Africa, March 2013.

Leader Aquaculture and sustainable seafood programme, Beijer Institute; Co-leader Marine Governance Theme, Stockholm Resilience Centre.

Other:

Contribution to: Brummett, R. 2013. Growing aquaculture in sustainable ecosystems. *Agriculture and Environmental Services Department Notes No. 5*. World Bank, Washington DC, USA.

Newspaper article: Troell, M., L. Deutsch, T. Lindahl, A.-S. Crépin, P. Henriksson and M. Metian. Köttätande inte vars och ens ensak (Meat consumption not each person’s business), 3 February 2013, *Uppsala Nya Tidning*, Sweden.

Rebuttal to SVT correspondent programme *True story about crab farming in east Africa*, April 2013.

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E-Print Series 2013

376. Growth, pollution, and money-metric welfare in imperfect markets. Li, C.-Z. and K.G. Löfgren (2012). *Environmental Economics* 3:1–14.

375. Regime shifts and management. Crépin, A.-S., R. Biggs, S. Polasky, M. Troell, and A. de Zeeuw (2013). In: Shogren, J.F. (ed.). *Encyclopedia of Energy, Natural Resource, and Environmental Economics, Vol. 2.*, Elsevier, Amsterdam, The Netherlands. pp. 339–348.

374. Genuine saving under stochastic growth. Li, C.-Z. and K.G. Löfgren (2012). *Letters in Spatial and Resource Sciences* 5:167–174.

373. The potential of ‘Urban Green Commons’ in the resilience building of cities Colding. J. and S. Barthel (2013). *Ecological Economics* 86:156–166.

372. Strategic spatial planning and the ecosystem services concept – an historical exploration. Wilkinson, C., T.

Saarne, G.D. Peterson, and J. Colding (2013). *Ecology & Society* 18(1): 37.

371. (The economics of) Discounting: Unbalanced growth, uncertainty and spatial considerations. Sterner, T. and E. Kyriakopoulou (2012). *Annual Review of Resource Economics* 4:285–301

370. Environmental policy, first nature advantage and the emergence of economic clusters. Kyriakopoulou, E. and A. Xepapadeas (2013). *Regional Science and Urban Economics* 43:101–116.

369. Respecting planetary boundaries and reconnecting to the biosphere. Folke, C. (2012). In: Prugh, T. (ed.). *State of the World 2013*. WorldWatch Institute, Washington DC, USA. pp. 19–27.

368. Aligning key concepts for global change policy: Robustness, resilience, and sustainability Anderies. J. M., C. Folke, B. Walker, and E. Ostrom (2013). *Ecology and Society* 18(2): 8.

367. Emergence of global adaptive governance for stewardship of regional marine resources. Österblom, H. and C. Folke (2013). *Ecology & Society* 18(2): 4.

366. Eco-certification of farmed seafood: Will it make a difference? Jonell, M., M. Phillips, P. Rönnbäck, and M. Troell (2013). *Ambio* 42.

365. Confronting feedbacks of degraded marine ecosystems. Nyström, M., A.V. Norström, T. Bleckner, M. de la Torre Castro, J.S. Eklöf, C. Folke, H. Österblom, R.S. Steneck, M. Thyresson, and M. Troell (2012). *Ecosystems* 15:695-710.

364. Transforming innovation for sustainability. Leach, M., J. Rockström, P. Raskin, I. Scoones, A.C. Stirling, A. Smith, J. Thompson, E. Millstone, A. Ely, E. Arond, C. Folke, and P. Olsson (2012). Transforming Innovation for Sustainability. *Ecology and Society* 17 (2):11. <http://dx.doi.org/10.5751/ES-04933-170211>

363. (Un)observed scientific advice, social-ecological feedbacks and the North Sea cod stock. Villasante, S., D. Rodríguez-González, and M. Antelo (2013). *Sustainability* 5:1

362. Aquaculture. Troell, M., N. Kautsky, M. Beveridge, P. Henriksson, J. Primavera, P. Rönnbäck, and C. Folke (2013). In: Levin S.A. (ed.) *Encyclopedia of Biodiversity, second edition*. Volume 1. pp. 189-201. Waltham, MA: Academic Press.

361. Towards ‘green growth’: Measuring the trade-off between conservation of protected areas and hydel power generation in an ecologically fragile hill state of Northern India. Das, S. and K. Chopra (2013). *Economic & Political Weekly* XLVII (51): 59-68.

360. Life Cycle Assessments and their applications to aquaculture production systems. Henriksson, P., N. Pelletier, M. Troell, and P. Tyedmers (2012). *Encyclopedia of Sustainability Science and Technology*. Meyers, Robert A. (Ed.) 1st Edition, (2012), 10500 p.

359. Social-ecological systems as complex adaptive systems: modeling and policy implications. Levin, S., T. Xepapadeas, A.-S. Crepin, J. Norberg, A. de Zeeuw, C. Folke, T.P. Hughes, K.J. Arrow, S. Barrett, G. Daily, P. Ehrlich, N. Kautsky, K.-G. Mäler, S. Polasky, M. Troell, J. Vincent, and B.H. Walker (2013). *Environment and Development Economics*.

2012

358. Regime shifts and management. Crépin, A.-S., R. Biggs, S. Polasky, M. Troell, and A. de Zeeuw (2012). *Ecological Economics* 84:15–22.

357. General resilience to cope with extreme events. Carpenter, S.R, K.J. Arrow, S. Barrett, R. Biggs, W.A. Brock, A.-S. Crépin, G. Engström, C. Folke, T.P. Hughes, N. Kautsky, C.-Z. Li, G. McCarney, K. Meng, K.-G. Mäler, S. Polasky, M. Scheffer, J. Shogren,

T. Sterner, J.R. Vincent, B. Walker, A. Xepapadeas, and A. de Zeeuw. (2012). *Sustainability* 4, 3248-3259

356. Civic greening and environmental learning in public-access community gardens in Berlin. Bendt, P., et al. (2012). *Landscape and Urban Planning*.

355. Drivers, "slow" variables, "fast" variables, shocks, and resilience. Walker, B.H., S.R. Carpenter, J. Rockstrom, A.-S. Crépin, and G.D. Peterson. (2012). *Ecology and Society* 17(3): 30.

354. Rebuilding fish stocks and changing fisheries management, a major challenge for the Common Fisheries Policy reform in Europe. Villasante S. et al. (2012). *Ocean & Coastal Management*.

353. Buffalo hunt: International trade and the virtual extinction of the North American bison. M. Scott Taylor. (2011). *The American Economic Review* 101 (7).

352. Environmental crises: Past, present and future. M. Scott Taylor. (2009) *Canadian Journal of Economics* 42 (4).

351. Reciprocal insurance among Kenyan pastoralists. Dixit, A.K., S.A. Levin, and D.I. Rubenstein. (2012). *Theoretical Ecology*.

350. Sustainability of deep-sea fish species under the European Union Common Fisheries Policy. Villasante, S., et al. (2012). *Ocean & Coastal Management*.

349. Environmental and economic analysis of application of water hyacinth for eutrophic water treatment coupled with biogas production. Wang, Z. and M.M. Calderon. (2012). *Journal of Environmental Management* 110: 246-253.

348. Urban gardens, agriculture, and water management: Sources of resilience for long-term food security in cities. Barthel, S. and C. Isendahl. (2012). *Ecological Economics*.

Discussion Papers

242. Spatial policies and land use patterns: Optimal and market allocations. Efthymia Kyriakopoulou and Anastasios Xepapadeas. 2013.

241. Governing complex commons – the role of communication for experimental learning and coordinated management. Therese Lindahl, Örjan Bodin, Maria Tengö. 2013.

240. Reducing non-point source pollution through auctions: Some lessons learned from a laboratory experiment. Therese Lindahl. 2013.

239. A spatial approach to energy economics. Juan Moreno-Cruz and M. Scott Taylor. 2013.

238. Coping with global warming under stock growth uncertainty in marine social-ecological systems: The European sardine fishery. José-María Da-Rocha, María-José Gutiérrez, Sebastian Villasante. 2012.

237. Credible enforcement policies: The role of ITQs in marine social-ecological systems. José María Da Rocha, Sebastian Villasante, Rafael Trelles González. 2012.

236. Back to the future of green powered economie. Juan Moreno Cruz and M. Scott Taylor. 2012.

