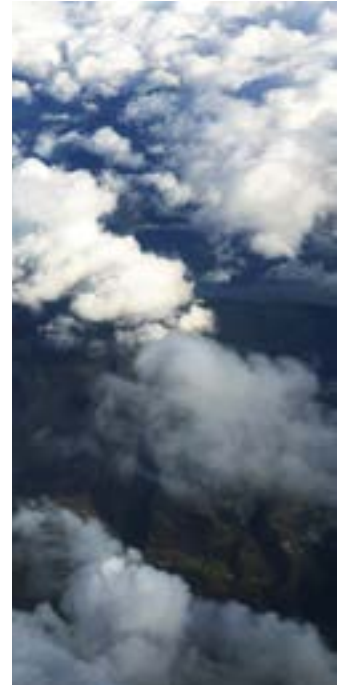


THE BEIJER INSTITUTE OF
ECOLOGICAL ECONOMICS

ANNUAL REPORT 2013/2014



THE
BEIJER
INSTITUTE
OF ECOLOGICAL ECONOMICS



KUNGL.
VETENSKAPS-
AKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES



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The Beijer Institute of Ecological Economics

ANNUAL REPORT

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Director's column

HUMANITY is interacting with the dynamics of the Biosphere – the thin living part of the outermost layer of our planet – in new ways. We have expanded from being a small human world on a large planet to a large human world on a small planet. Environmental issues are no longer just about saving the environment, but about prosperous human development, recognising that humans are part of, and fundamentally dependent on, the capacity of the biosphere to sustain development.

This new situation calls for new understanding, new integrated approaches and collaboration across disciplines. A great example is the article *Climate engineering reconsidered* that recently appeared in *Nature Climate Change*. This is a result of the latest Askö meeting and is without doubt a new record in fast publication, impressively conducted by Scott Barrett, Columbia University, the Chairman of the Beijer Board. The article reflects challenges of the Anthropocene – a planet shaped by human actions – challenges raised and analysed in all Beijer Institute research programmes and activities.

Leading scholars, predominantly economists and ecologists, gather under the umbrella of the Beijer Institute in our research programmes to tackle fundamental and applied problems in relation to sustainability. Beijer Fellows act as advisors and are also engaged in the programmes. I am impressed by the advances made during the year and the focus of my colleagues in progressing research to new frontiers. A sign of this is the very positive evaluation we got this spring on our now finalised Formel-Exc Centre of Excellence research.

The Urban programme, with research on urban green commons, urban form, diversity and ecosystem services, spearheaded by Johan Colding and colleagues, is leaving imprints. This was clearly visible at the Resilience 2014 conference in Montpellier and its findings are moving into practice, policy and planning. A new book, *Principles of Social-Ecological Urbanism*, was launched in December 2013.

The Behaviour, Economics and Nature Network programme has taken off, under the lead of board member Marty Anderies, Arizona State University, and Therese Lindahl. Thank you for a most exciting workshop in June combining neuroscience, behavioural science and sustainability science – new fertile ground for a deeper understanding of the Anthropocene. Behavioural experiments in relation to thresholds in common pool resources have been conducted and research on behaviour in relation to food, health and sustainability has been initiated as part of the collaboration with the EAT Forum, Stockholm Resilience Centre (SRC) and the GreenNudge organisation. Food is also the focus of the *Aquaculture and sustainable seafood* programme, under the leadership of Max Troell. Among the exciting work is a paper accepted in PNAS on the role of aquaculture for the resilience of the global food

“We have expanded from being a small human world on a large planet to a large human world on a small planet.”

system, a result of the Askö meeting 2011. Another paper is submitted on the effect of China's aquaculture on global fish resources, both with appreciated engagement of board member Roz Naylor, Stanford University.

Viewing the world as complex systems is spreading across the sciences, whether social, natural or the humanities. This has long been a Beijer Institute trademark and was consolidated into theory in the workshop on the Economics of Complex Systems in April, organised by board member Aart de Zeeuw, Tilburg University, Li Chuan-Zhong and Karl-Göran Mäler. It is strongly visible in our research programme on *Global dynamics and resilience*, orchestrated by Anne-Sophie Crépin, which addresses interacting global feedbacks of people and the biosphere, many surprising and others unrecognised. Several of the working groups have published or are finalising work on synchronised and pathological global dynamics and progress is being made in the EU project *ACCESS - Arctic Climate Change Economy and Society*.

The benefits of the now established Global Economic Dynamics and the Biosphere Programme (GEDB), funded by the Family Erling Persson Foundation through a grant to the Academy, are materialising. Beatrice Crona, executive director, has done tremendous work in setting it up and the collaboration is in full swing with Beijer Institute staff, colleagues at SRC and international collaborators. I am most thankful to the Academy for letting us expand into new premises to allow for the successful integration of the GEDB and the Beijer Institute activities. The collaboration focuses on macroeconomic models that explicitly consider and integrate the biosphere; Trade in, and consumption of, marine resources and the effects on social-ecological systems; and interactions between financial markets and the biosphere. Professors Jim Wilen, University of California, Davies, and Gretchen Daily, Stanford University, are heavily involved. It is wonderful to have Gretchen with us for another year and Jim as visiting professor for a few weeks per year. We have had exciting meetings with friends in the Natural Capital Project and SRC, exposing and discussing concepts and approaches of our teams for improved stewardship of ecosystem services. A high level research, business and policy event on natural capital and social-ecological resilience is being planned for Stockholm in May 2015, in collaboration with Stanford University and the Natural Capital Project.

A new platform has been created – Changing Planet



(www.changingplanet.se), combining the competencies of the Beijer Institute and the GEDB global research programmes with the global dynamics theme and the planetary boundaries network of the SRC. This platform fits well with Future Earth, a new international research initiative aimed at developing knowledge for responding effectively to the risks and opportunities presented by global environmental change. Quoting the Academy's Annual Report "The Academy has together with groupings from all over the world worked intensively during the year to draw up a forward-looking and innovative application for a decentralised Future Earth Secretariat with a strong Swedish presence. The Beijer Institute and various other groups (MISTRA EviEM, SSEESS, IGBP, the RSAS' Energy Committee and Environmental Committee) currently provide a considerable mass of competence to tackle the challenges in a globalised world where societal issues and economic considerations interlink with technological and scientific solutions for a sustainable planet. In addition, the RSAS programme Global Economic Dynamics and the Biosphere, funded by the Erling-Persson Family Foundation, has been set in motion during the year, thereby further strengthening the Academy's profile towards issues of global sustainability".

The close collaboration with the SRC continues to bloom, with Beijer researchers engaged as theme leaders and in teaching and supervision of PhD and Master's students, and we have had great research assistants employed. The Beijer Institute (Gustav Engström and Johan Gars), with the SRC

“I am impressed by the advances made during the year and the focus of my colleagues in progressing research to new frontiers.”

and the Earth Institute, is developing a dynamic integrated framework of planetary boundaries and the economy as input to the work on Sustainable Development Goals (SDGs). The Beijer Young Scholars published a commentary in *Nature* on the SDGs and a full-length article in *Ecology and Society*. A major book, *Water Resilience for Human Prosperity*, has been published with Cambridge University Press.

Our activities to support the environmental economics networks are in a good shape thanks to a planning grant received this year to prepare for a new Sida programme in collaboration with Professor Thomas Sterner's group at Gothenburg University and SRC. Deep appreciation to Jeff Vincent, who has helped greatly in the complex process. At the World Congress of Environmental and Resource Economics in Istanbul, we organised a popular environment and development economics course, we host Måler Scholars and continue to be involved with the *Environment and Development Economics* journal.

I am very pleased that our experiments in ArtScience with e.g. Marten Scheffer continue, through the SARAS Institute in Uruguay. Other ArtScience examples include the photo book *Reflections On People and the Biosphere* released in June and involvement in events celebrating the Swedish King's 40 years on the throne. Beijer and GEDB researchers also participated in a full day of lectures on sustainability for the Swedish Crown Princess Victoria.

There is interest in Beijer Institute's achievements, reflected in research and citations, as well as much collaboration with practice and policy. However, I was taken by surprise to find that researchers on the history of science from France, the Netherlands and Sweden, visited us during the year to study the Beijer imprint. How can this be possible? It is due to all the amazing individuals involved with the Beijer Institute over the years and the work that has been accomplished, and to the fantastic engagement by the Stockholm staff orchestrating our activities. It is indeed a privilege to be Director of the Beijer Institute! The professional support and engagement of the Academy is strongly appreciated and we are most grateful to Anders Wall and the members of the Beijer Foundation for the continuous commitment and long-term investment in the Beijer Institute, it is unique and fundamental.

July 9, 2014



Carl Folke
Director

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.

Urban social-ecological systems

Programme director: Johan Colding

THE KEY mission for the Beijer Institute's Urban social-ecological systems research programme is to broaden understanding of how urban systems can better account for ecosystem services to improve the resilience of cities. Cities are viewed as integrated social-ecological systems and resilience is therefore not only dependent on good social and economic conditions, but ultimately depends on the capacity of ecosystems to support such conditions. Rapid global urbanisation will lead to ever greater demands on land inside and outside cities, particularly on ecosystem services that provide so many benefits to humans, not least by buffering harmful climate change effects. Given that the built mass on Earth is predicted to double by the year 2030, the challenge of shaping this change in constructive ways is considerable and needs to be tackled in scientifically informed ways.

The Urban group and its partners are striving to take the lead in research that will have a direct impact in reconnecting humans to the conditions required by the biosphere in order to sustain desirable life foundations. With a focus on urban form, ecosystem services, institutions and resilience science, the aim is to translate such research insights into new urban planning principles, management policies and landscape designs that could make a real difference.

How sustainable are dense cities?

Within the project *Moving from urban form to social-ecological form*, a publication on city densification that potentially will have great policy relevance is near completion. In the political debate and urban planning, urban sprawl has been synonymous with an increase in greenhouse gas emissions and the unnecessary loss of ecosystems and farmlands.

Smart growth (SG), also called city compaction, a concept advocating dense, compact urban development, has therefore become the standard design model to counteract urban sprawl and increase sustainability. The paper includes an analysis of to what extent and in what ways the environmental benefits of SG outweigh negative effects. A systematic review of the scientific literature dealing with SG suggests that what the concept entails is very loosely defined and that there is little empirical evidence for the environmental benefits of SG. The article will point out several sustainability aspects overlooked in the SG concept that need to be included when planning sustainable cities.

Partner

The School of Architecture and the Built Environment, KTH Royal Institute of Technology, Stockholm.



Dense neighbourhoods in Tokyo. The concept of "Smart growth" is being investigated in a project of the Urban social-ecological systems programme. Photo: André Maslennikov/Azote

Pollinators as tool to evaluate resilience

As part of the *Urbes* project, a study has been initiated based on the idea that it is critical to create high-quality conditions for several types of species pollinating the same type of crop in order to increase resilience. It draws on the notion that different pollinators are affected differently by climate change. A key ingredient of this study will be to evaluate resilience in economic terms, but also to look at it from an insurance perspective in connection with the loss of habitats and essential resources for pollinators in an urban development perspective, i.e. how to insure development against potential risk.

Another project underway is an investigation of landscape designs based on mapping and evaluating landscape requirements for pollinators, birds and people – an integrated social-ecological landscape analysis with implications for urban planning. In the analysis, three ecosystem services (pollination, seed dispersal and human recreation) will be studied based on field data, space syntax modelling and geographic information systems (GIS) mapping.

Partners

Barcelona University, Spain; Humboldt University, Germany; Drift, the Netherlands; New School, New York; and University of Salzburg, Austria. Funding: Biodiversa

Initiatives to broaden collaboration

A pre-study agreement to investigate possibilities for long-term collaboration in research and practice has been reached with the Gothenburg-based international centre for sustainable urban development, Mistra Urban-Futures (MURF). MURF offers an arena for the development and transmission of knowledge, in cooperation with business, interest groups and the general public. The centre has five regional platforms in Cape Town, Kisumu, Gothenburg, Manchester and Shanghai. The aim of the pre-study is to investigate how to establish a Stockholm node for MURF comprising the Beijer Institute, SRC and KTH.

Find out more at

www.mistraurbanfutures.org/en

Partners

The School of Architecture and the Built Environment, KTH Royal Institute of Technology, Stockholm; and Stockholm Resilience Centre, Stockholm University



Extreme temperatures and weather events are occurring with increasing frequency, but the restoration and re-development of green space and urban water corridors, also called 'blue' and 'green' infrastructure, could help to reduce the impact of such events and simultaneously increase the value of the land. The Beijer Urban programme will take part in the activities of the Nordic Centre for Blue-Green Solutions Stockholm node of a European project led by Imperial College in London, which will be headquartered at KTH. The Nordic Centre aims to stimulate and coordinate research around how vegetation and water combined can make cities more livable, building on experiences from the Nordic countries.

Find out more at

www.climate-kic.org/projects/blue-green-dream/

Partner

The School of Architecture and the Built Environment, KTH Royal Institute of Technology, Stockholm

Together with other urban researchers, landscape architects and planners from Stockholm municipality, the Beijer Institute's Urban group will also take part in a research project focusing on developing principles and measures for closer integration of civil society in the planning and design of urban development projects. The aim is to develop a social-ecological index as a tool for communicating the relationship between social and ecological systems, enhancing citizen dialogues.

Partners

The School of Architecture and the Built Environment, KTH Royal Institute of Technology, Stockholm; Stockholm Resilience Centre; LovelyLandskap AB; and the Municipality of Stockholm. Initial funding by: Vinnova

Spreading the word on urban solutions

The project *Albano Resilient Campus*, a new academic neighbourhood on the border between Stockholm city centre and the National Urban Park has been presented in earlier annual reports. The project shows how urban development can interact with ecosystems to support local ecosystem services and has created a model for sustainable urban development drawing on social-ecological resilience principles. The book *Principles of Social-ecological Urbanism*, which was released in December 2013, brings together the principles of urban planning developed in the project.

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As a way to inspire local city residents, urban planners and decision makers to adopt and spread common property initiatives in cities, the film series *Urban Green Commons: Bringing Nature into Cities* is under production, with the first two of six films almost ready for screening. The film series is presented in the Science in Society section of this report.

The report *Ecosystem Services in the Stockholm Region (Ekosystemtjänster i Stockholmsregionen)* presented in last year's Annual Report is in great demand and has been widely distributed in municipalities around Sweden. The report is the first Swedish hands-on deliverable on ecosystem services to be used in urban comprehensive planning and serves to inform civic society, planners and policy makers how to account for and plan for such services in an expanding Stockholm region. A further report with the working title: *Building Resilience in the Stockholm Region* is now planned to be produced in collaboration with the Stockholm Office of Regional Planning (TMR), with potential publication towards the end of 2015.

Aquaculture and sustainable seafood production

Programme director: Max Troell

TODAY around 50 percent of the seafood consumed globally comes from aquaculture. The overarching focus of this programme relates to sustainable food production in a changing world and specifically the role that aquaculture can play. At the larger-scale level it asks whether, and how, aquaculture can add resilience to the global food portfolio. Using a social-ecological systems perspective, the programme analyses consequences from resource allocation to aquaculture and its environmental and social effects. It also investigates how aquaculture production can be made more sustainable in the future. Within these broader perspectives, the programme specifically examines the following areas:

- » Resource use – how crop resources are used in aquaculture production and how these resources also relate to agricultural animal production. How increased usage of small fish in aquaculture feed poses challenges for resource efficiency and food safety - especially investigating the role of China's expanding aquaculture. Consequences from aquacultures dependence on wild fish fry and larvae, as this still forms the basis for some aquaculture systems.
- » Sustainability tools and frameworks – the application and adaptation of life cycle analysis (LCA) for aquaculture. If such a cradle-to-grave approach is used, it is easier to make well-informed decisions on policy and future directions and if the results are passed on via labelling they have the potential for making it easier for consumers to choose sustainable products.

Enhancing resilience in aquaculture

A paper from the 2011 Askö meeting addressed the resilience of aquaculture by analysing feed dependencies that



A juvenile bluefin tuna held in captivity in a sea cage, Japan. Photo: Marc Metian

tightly connect the different food systems and also how global change might affect food systems differently. This information is important for food policy strategies and the paper is in press as a Perspective paper in PNAS. In relation to this, an article in *Ecosphere* addresses how resilience thinking can be applied to production ecosystems, including aquaculture.

Investigating bluefin tuna farming

Another recent focus area of the programme has been tuna farming. An article in *Reviews in Fisheries Science & Aquaculture* shows that catching juvenile bluefin tuna and farming (ranching) them on giant farms raises a number of sustainability concerns. Tuna is a very resource-demanding species to farm and the article sheds light on direct and indirect interactions with wild fish stocks. While most captured bluefin tuna enter the global seafood market directly, an increasing proportion of the live catch is used for aquaculture. As the article points out, there are confounding uncertainties related to how much wild tuna is being caught for farming in so-called “sea ranches”, what the future trend might be and also uncertainties with respect to statistics for farmed volumes.

The effects of Chinese aquaculture on global fisheries

A collaboration with Stanford University on the effects of China's aquaculture on global fisheries has resulted in a paper submitted to *Nature*. This work shows how China's extensive multi-species fishing industry and its increasing demand for fish lower down in the pelagic system (so-called “low value fish” or “trash fish”) in aquafeeds can have a negative impact on future global fisheries. China is the world's largest aquaculture producer and consumer with the largest demand for fishmeal, and it is also the world's largest fish trader, rapidly becoming a net seafood importer.

Equity aspects

Aquaculture's role from a distributional and equity perspective is addressed in a paper on aquaculture and food security in the *Journal of Fisheries*. A collaboration with Worldfish, it outlines some challenges for aquaculture's contribution to poverty alleviation and nutritional health (see separate article in this Annual Report). Within the same theme and with a focus on the “people-policy gap” in aquaculture development, a paper written by the ICES Socio-Economic Aquaculture group has been submitted to the *Journal of Aquaculture*.

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Behaviour, Economics and Nature Network - BENN

Programme director: J. Marty Anderies
Programme manager: Therese Lindahl

THERE is mounting scientific evidence that human actions have become the main driver of global environmental change. Furthermore, if the impacts of human activities cross a critical threshold, 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 achievement of a good 'fit' between human behaviour, the biophysical environment and governance.

Does the threat of environmental collapse change our behaviour?

Many natural resources, such as fishing and grazing grounds, are managed collectively, which often results in over-exploitation. Ecological research shows that if an ecosystem, for example pastureland used for grazing, is grazed too hard and reaches a certain threshold, it can quickly change to another state, in this case a desert. The ecosystem has undergone a regime shift. Such

shifts can have serious impacts on human wellbeing and threaten local livelihoods, especially in poorer regions where people may depend heavily on local ecosystems and the goods and services derived from them.

The risk of regime shifts can affect people's commitment to caring for their common resource. In the project *Regime shifts in common pool resource systems*, this issue has been explored in laboratory experiments (see last year's annual report). Thanks to a new grant from the Swedish research council Formas, a project to perform corresponding experiments in the field was launched in January 2014. It will test how fishermen in Thailand and Colombia respond to potential abrupt changes in fish stocks. The aim is to obtain results to support the formulation of policies that protect local livelihoods and the ecological functions on which they depend, through a better understanding of social mechanisms underlying regime shifts in ecosystems.

Project members

Therese Lindahl, Caroline Schill, Anne-Sophie Crépin, the Beijer Institute; Juan Carlos Rocha, SRC; and former Mäler Scholar Rawadee Jarunggrattanapong, Sukhothai Thammathirat Open University, Thailand

What triggers communication in common pool resources?

Behavioural economics experiments on common pool resource dilemmas, such as those described above, have highlighted the importance of communication between users to achieve sustainable use of common resources. However, the ways in which this communication is initiated and developed and the aspects that are most relevant for it are still poorly understood. In this project, we aim to develop an agent-based model through a series of laboratory common pool resource experiments in order to identify possible factors and aspects of human decision making and behaviour in relation to communication that can explain the observed outcomes of the experiments.

Project members

Therese Lindahl and Caroline Schill, the Beijer Institute; and Maja Schlueter and Nanda Wijermans, SRC

Nudging sustainable diets

A diet change towards eating more meat, dairy products and luxury food is a global trend and also one of the most important drivers of environmental degradation, such as greenhouse gas emissions, land use changes and loss of biodiversity. However, from a policy perspective,



Fishing boats in Phuket, Thailand, where BENN field experiments will be performed.
Photo: Rawadee Jarunggrattanapong

changing food consumption behaviours is challenging and sometimes even impossible to target through conventional instruments such as regulations, taxes and subsidies. The entry point of this project will therefore be to investigate the potential of ‘nudges’ for promoting sustainable food consumption choices – a method for enticing people to behave in certain ways, without using coercion or force but by changing small aspects of the decision-making-environment or *choice architecture*. BENN researchers are currently collaborating with one of the major food retailers in Sweden and will during the year implement and evaluate a specific nudge tailored to reduce meat consumption.

Project members

Linda Lindström, Master's student, SRC; and
Therese Lindahl, the Beijer Institute

Nature versus money and the effect on behaviour

One intriguing factor behind people's engagement in pro-environmental behaviour was tested in a Master's project supervised by programme manager Therese Lindahl. In so-called taboo trade-offs, people make a choice between ‘sacred’ and ‘secular’ options, for example choosing between saving a human life and receiving a monetary bonus. It has been shown in the past that when people are confronted with such choices, even if they just think about making them, it affects their immediate behaviour. It makes them aware of the moral aspects of choosing, in turn arousing feelings of wanting to cleanse themselves or to do good. In the project, this effect was tested and confirmed, including when the sacred option was nature-orientated, supporting protection of a national park versus getting a monetary reward. It was found that people confronted with such trade-offs, and afterwards given the opportunity to donate their fee for taking part in the experiment to an environmental charity, did so more often than people who were confronted with a non-taboo trade-off. These results provide new insights into the literature on determinants

Thesis name

Thou shall not sell nature: A study on how taboo trade-offs affect our pro-environmental behaviour.

Project members

Britt Stikvoort, Master's Student, SRC; and
Therese Lindahl, the Beijer Institute



Group exercise during the BENN workshop. Andreas Olsson, J. Marty Anderies, Juan Camilo Cárdenas, Anne-Sophie Crépin and Juan Carlos Rocha. Photo: Agneta Sundin

of pro-environmental behaviour. The Master's thesis will be developed in the coming year and the aim is to publish at least one scientific article on the topic.

BENN workshops

In addition to facilitating research activities, a key feature of the BENN programme is to host topical workshops to bring together leading scientists to address cutting edge research and policy challenges. This year, BENN hosted a workshop titled *Emerging Linkages Between Neuroscience, Environmental Behavior, and Policy*, on June 2-5 at the Swedish Academy of Sciences. The fields of behavioural neuroscience and behavioural economics are growing rapidly and the workshop focused on exploring potential intersections between them. Three speakers from each field were invited to present their latest work, while at the same time reflecting on how the knowledge generated by their work might benefit from a better understanding of work in economics/neuroscience and vice versa. They were also asked to speculate on how they might collaborate with researchers who employ techniques from neuroscience/economics to develop environmental policies. In addition to the invited speakers, 15 other international

participants were invited to help push emerging ideas forward.

The workshop was very successful and produced two key outputs:

1. Identification and development of a position paper that articulates key questions and fruitful research trajectories at the intersection of behavioural neuroscience and behavioural economics. The manuscript explores the notion in economic theory of ‘homo economicus’, relying on the latest research in behavioural neuroscience and behavioural economics to illustrate the circumstances in which people's behaviour approximates that of a rational, self-interested actor and the circumstances in which it does not.

2. Identification of a collaborative research project combining technologies developed by behavioural neuroscience and behavioural economics to answer questions regarding environmental decision making

In summary, the 2014 BENN workshop was extremely productive and is helping to lay the foundations for future collaborative research at the intersection of human behaviour and the natural environment. Financial support for this workshop by the Anna-Greta and Holger Crafoord Foundation is gratefully acknowledged.

Global dynamics and resilience

Programme directors: Anne-Sophie Crépin, Steve Polasky and Brian Walker

THIS research programme explores the following research questions: What are the critical unrecognised, ignored or missing social-ecological links and feedbacks at the global scale, and what kinds of governance structures can create long-term conditions/positive trajectories for human development?

New research platform formed in Stockholm

This year marks the start of a new period for the Global dynamics and resilience programme. It was born five years ago during a memorable workshop at the Royal Swedish Academy of Sciences. Since then, we have organised four large workshops and several smaller meetings and events. During these five years several initiatives have been launched in Stockholm on related issues: the Global Dynamics theme at Stockholm Resilience Centre (SRC), the Planetary Boundaries Research Initiative at SRC and the Global Economics Dynamics and the Biosphere programme (GEDB) at the Royal Swedish Academy of Sciences. While these initiatives each have a different focus, they all deal with global dynamics and their interactions with human activities. Therefore, we have started a process to better use the synergies of these activities under a unifying umbrella.

This new initiative, called Changing Planet, will be launched in August 2014. It creates a new platform for developing knowledge about global dynamics and social-ecological interactions. Through this platform, the different methodologies and research topics used under the four contributing programmes can be combined effectively to create new knowledge. Changing Planet can also help coordinate the involvement of international top-class researchers from our different networks.

Executive team for Changing Planet

Anne-Sophie Crépin, the Beijer Institute; Beatrice Crona, GEDB; Sarah Cornell, Planetary Boundaries Research Initiative, SRC; and Victor Galaz, Global Dynamics theme, SRC.

For more information please visit www.changingplanet.se

Global lens on Beijer Institute programmes

The Global dynamics and resilience programme also nurtures links with other Beijer research programmes. For example, we investigate whether regime shifts can occur at the global scale and if so, the nature of the underlying mechanisms that could lead to these changes. We also aim to study how individual behaviour can multiply and have global-scale impacts, how urbanisation affects global dynamics and how trade in marine resources and aquaculture products principally affects and is affected by global dynamics.

During 2013-2014 we received a planning grant from Sida



Fish market in Nuuk, Greenland. Photo: A. Stammler-Grossmann, Arctic Centre

for a joint application with Gothenburg University and SRC for funding dedicated to capacity building and research relating to these topics in developing countries.

Arctic Climate Change Economy and Society (ACCESS)

The Arctic region is rapidly changing due to global climate change. Due to the substantial geophysical climatic feedbacks between the Arctic and the rest of the world, this region plays an important role in global dynamics. Hence, the European Union's Seventh Framework Programme project ACCESS, in which the Beijer Institute is a partner, is directly relevant for global dynamics and resilience. ACCESS is now entering its final year and much progress has been made towards integration of project results and their analysis across sector activities.

Beijer Institute researchers have been key actors in pushing forward the synthesis work together with partners from the University of Southampton. In March 2014, the Beijer Institute was instrumental in the delivery of the project's first indicators report on sustainable development in the Arctic fisheries sector, which also served as a pilot for the whole project. The report identifies a series of indicators that represent essential aspects of sustainability with regard to social, economic and environmental dimensions in the Arctic fisheries and aquaculture sector. It consists of a section explaining the methods used for selecting the set of indicators, followed by a list of indicators including a definition, calculation methods and other essential data for each indicator.

Similar reports will follow with the focus on sustainability indicators for transportation and tourism, as well as for natural resource extraction in the Arctic. They will build on the same approach as was developed for this first report and serve as the base for a policy-orientated report on indicators for sustainable development in the Arctic, to be presented to the EU as an essential part of the ACCESS results.

Project members

Anne-Sophie Crépin, Gustav Engström, Åsa Gren, Therese Lindahl and Max Troell.

“This new initiative, called Changing Planet, will be launched in August 2014.”



Fishing harbour in Lofoten, northern Norway. Photo: Sven-Erik Arndt/Azote

Climate geoengineering focus for the Askö meeting

Geoengineering as a means to curb climate change was the topic of the 21st Askö meeting, a gathering of world-leading economists and ecologists on the island of Askö, south-east of Stockholm, which was hosted by the Beijer Institute on 14-16 September 2013. The group investigated the pros and cons of the controversial, but frequently suggested, methods included in the term geoengineering, in discussions orchestrated by Chairman of the Beijer board Scott Barrett, Columbia University. Focusing more specifically on the injection of sulphate particles into the atmosphere to scatter sunlight, the meeting resulted in an article already published in *Nature Climate Change* and described more closely later in this report.



Alessandro Tavoni, Antony Millner and Scott Barrett, three of the lead authors of the article in *Nature Climate Change*. Here with Anne-Sophie Crépin on the boat to Askö. Photo: Agneta Sundin



The Askö group 2013. Back row: Terry Chapin, Anastasios Xepapadeas, Nils Kautsky, Lena Kautsky, Scott Barrett, Stephen Carpenter, Alessandro Tavoni, Anne-Sophie Crépin, Marty Anderies, Stephen Polasky, Aart de Zeeuw, Victor Galaz, Agneta Sundin, Eric Lambin, Antony Millner, Christina Leijonhufvud, Paul Ehrlich, Terry Hughes. Front row: Marten Scheffer, Carl Folke, Karine Nyborg, Jim Wilen, Roz Naylor, Gretchen Daily, Timothy Lenton. Photo: The Beijer Institute

New articles 2013-2014

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Complex systems

Program directors: Aart de Zeeuw and Chuan-Zhong Li

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.

Since a complex systems perspective underlies most of the work of the Beijer Institute, the programme is closely linked to the other Beijer programmes and collaborates with the Global Economic Dynamics and Biosphere Programme of the Academy. We are focusing on efforts to clarify, synthesise, consolidate and identify future challenges of the implications of a complex systems approach in economics and in relation to social-ecological systems.

A first workshop on the economics of complex systems

Since 1992, the Beijer Institute has organised several workshops on complex social-ecological systems with different focuses each time. Over the past ten years, scientific research in this

“We are focusing on efforts to clarify, synthesise, consolidate and identify future challenges.”

programme, in particular the economics of complex systems, has expanded dramatically and the time is ripe to summarise current achievements and highlight the prospect of future research on this sub-area. We thus organised a first workshop on the Economics of Complex Systems on 28-29 April 2014 at the Academy, inviting about thirty Swedish and international experts. Eighteen papers were on the table, classified into three broadly defined categories - climate change, natural resource and environmental management, and emerging issues.

Climate change

Frederick van der Ploeg used a theoretical growth framework to clarify

how economic elements such as precautionary savings, an optimal carbon tax, risk aversion and intergenerational inequality relate to the hazard of a climate catastrophe. Gustav Engström showed how climate policy models are

affected when including regime shifts and illustrated how potentially irreversible climate change affects fossil fuel use over time. Thomas Lontzek presented a model with multiple climate-related tipping point elements, including the abrupt

loss of Arctic summer sea ice, irreversible meltdown of the Greenland ice sheet and the disintegration of the West Antarctic ice sheet. Jinhua Zhao compared adaptation decisions under different assumptions on the frequency and severity of climate change. Tatiana Kiseleva described how people's various beliefs about the causes and extent of global warming affect local mitigation and adaptation strategies and thereby global climate dynamics. Mark Sanctuary examined how border carbon adjustment, a measure to avoid so-called carbon leakage, i.e. increased carbon emissions in one country or region as an indirect and unintended consequence of emission reduction measures in another country or region, affects government

incentives to regulate emissions and trade. Discounting has been a hot issue in the recent literature on climate change economics, but in the face of unknown thresholds Eric Nævdal concluded that optimal carbon stabilisation targets are only negligibly affected by discounting. Antony Millner proposed new ideas for combining diverse opinions on discount rates into a single “representative” rate for public decision making.

Natural resource and environmental management

Exploitation influences the capacity of natural resources to withstand environmental stress, and may increase their vulnerability to extreme conditions that could trigger abrupt changes. Yacov Tsur has modelled how threats of abrupt and catastrophic events, such as species extinction, ecosystem collapse and disease outbreaks, can affect optimal resource management in different situations. Steve Polasky presented an analysis of when the threat of a potential regime shift causes management to be more aggressive or more precautionary. Chuan-Zhong Li analysed how the risk of fishery collapse would influence harvesting rules and corrective tax in the Argentinean hake fishery. Anastasios Xepapadeas reported on how to analyse natural resource changes over time and space under deep uncertainty and presented robust control methods for improving management of environmental resources under these conditions. Anne-Sophie Crépin compared taxes and quotas as means to regulate systems with potential regime shifts. She showed that in these systems they are not always interchangeable, in particular when a regime shift is needed to reach the desired situation. For example, when one wants to restore a system that has already shifted. Therese Lindahl's work is attempting to test whether or not users of natural resources cooperate and how users respond to changes in the resource stock.

Emerging issues

Florian Wagener is looking at providing ways for solving climate and environmental problems involving dynamic strategic interactions between people that are difficult to solve analytically. He presented alternative methods for solving these problems involving computer



Participants in the workshop. Back row: Karl-Göran Mäler, Gustav Engström, Anastasios Xepapadeas, Johan Gars, Efthymia Kyriakopoulou, Antony Millner, Thomas Lontzek, Yacov Tsur, Florian Wagener, Dieter Grass, Chuan-Zhong Li, Therese Lindahl, Rick van der Ploeg, Tatiana Kiseleva, Mark Sanctuary, Aart de Zeeuw. Front row: Bob Scholes, Eric Nævdal, Catarina Roseta-Palma, Jinhua Zhao, Stephen Polasky, Anne-Sophie Crépin. Photo: Christina Leijonhufvud

“Ecosystem collapse and disease outbreaks, can affect optimal resource management in different situations.”

simulations. Catarina Roseta Palma has reviewed the literature regarding how people's preferences and behaviour are modelled and discussed among other things the environmental impact of social norms and identity in consumer decisions. Bob Scholes also focused on decision theory that departs from the standard utility theory. He illustrated different ways to support individual and group decisions, when consumers cannot make perfect trade-offs.

Dieter Grass discussed communication of regime shifts modelling to non-scientific readers. He showed how multimedia technology using animations of the dynamics of fish,

algae, corals, predators and fishermen provides a powerful tool.

Future steps

Apart from being a good forum to update each other and discuss the current research in the field, a special issue will be produced for the journal *Environmental and Resource Economics* based on selected papers from our spring workshop on the economics of complex systems.

In the coming academic year, we will also develop small-scale economic models on the optimal trade-offs between mitigation and adaptation under the risk of extreme events.

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Shelter from the storm

By Sturle Hauge Simonsen and Agneta Sundin

IT IS well known that mangrove forests can protect lives and property from storms and earthquakes by buffering the impacts of storm surges and tsunamis. A Beijer Institute article now shows that mangrove forests also dampen wind velocity and provide protection from damage caused by wind.

Mangrove forests are areas with woody trees or shrubs in tropical and subtropical tidelands. Rich in biodiversity, mangrove leaves and roots provide nutrients to the water and many commercially attractive fish species reproduce in its waters. Half of the world's mangrove forests have disappeared since the middle of the last century. Conversion of the waters for shrimp-farming constitute 25 percent of the loss, wood extraction, industrial development and tourism are other major drivers.

Former Mäler Scholar Saudamini Das, now at Institute of Economic Growth, India, and Beijer Institute researcher Anne-Sophie Crépin constructed a theoretical model in order to investigate whether mangroves can slow down wind velocity and thereby provide protection. They calibrated

it to simulate wind damage caused by a storm that hit the state of Odisha in 1999, and ran the model looking for a relation between mangroves and damage caused by wind.

The model showed indeed that the presence of mangrove forests along the coastline served to decrease the amount of damage from wind to houses.

"We found that in villages that were protected by mangroves there was also significantly less damage to houses caused by wind, the forests along the coast seem to break wind velocity so much that we see a clear pattern where villages located behind the forests were not as hard hit," explains Anne-Sophie Crépin.

Using empirical data from records of the storm in Odisha, the authors were able to test the accuracy of the predictions given by the model, finding that they provided an accurate representation of what happened in real-life.

"We could see that the damage that was simulated in the model matched the damage that was recorded after the storm quite accurately. This validates the model and tells us that we have calibrated it in a good way, to get the most realistic results," explains Crépin.

Even in villages located relatively far

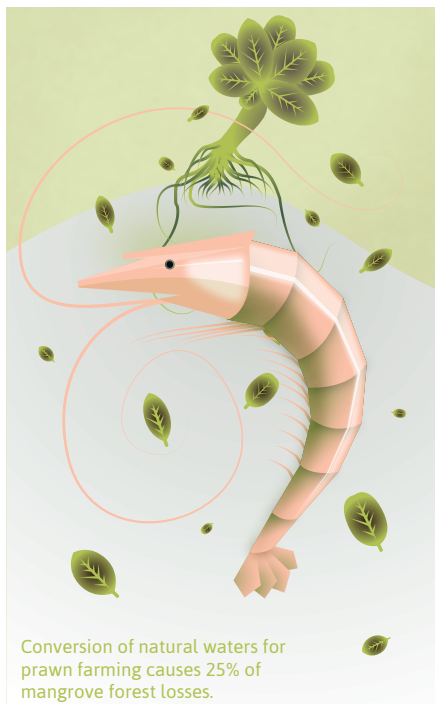
"We found that in villages that were protected by mangroves there was also significantly less damage to houses caused by wind."

from the coastline and the mangroves, the authors found that there was significantly less damage to houses compared to similarly located villages with no mangrove protection.

The authors also calculated the monetary value and based on avoided reconstruction costs, each mangrove protected family saved around USD 23 making the economic value for wind attenuation services of one hectare of mangrove USD 177.

"These results add to the knowledge we have of the important roles that mangroves play. This is another reason to invest in keeping or reconstructing mangrove forests," Anne-Sophie Crépin concludes.

Mangrove forest in the region of Odisha, India.
Photo: Saudamini Das



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Challenges in getting farmed fish to the poor

By Sturle Hauge Simonsen

FISH farming is big business and the aquaculture industry is growing, but is not yet a saviour for the hungry poor. Today, more than 40% of all fish consumed derives from farming, but its distribution is skewed and the nutrition levels could be improved. The contribution of aquaculture to global food security is a dual issue of where the production occurs and what is being produced.

In an article in the *Journal of Fish Biology*, Beijer researcher Max Troell, together with partners from Stockholm Resilience Centre and the organization WorldFish, looked at the contribution of farmed fish to food security and the nutritional needs of poor consumers. They found that fish farming is largely absent from those parts of the world where it is most needed. Even sub-Saharan Africa, where the soil and climate are favourable, falls short when it comes to required production. The demand for aquaculture products is growing more quickly than the aquaculture industry.

“In sub-Saharan Africa the undeveloped aquaculture sector is dominated by smallholder, subsistence-type operations where access to the small amounts of fish produced is largely limited to producer households and their neighbours,” Max Troell explains.

The authors argue that aquaculture has radically changed the availability of certain food-fish types, species and nutrients consumed via fish. However, for aquaculture to fulfil its potential as a major provider of food and nutrition, factors such as availability and costs must be considered. Production of smaller-size fish is one pathway to increase access to farmed fish among poor communities, as it is more energy efficient and cheaper to produce. It can be an excellent source of animal protein but because of species, size and rearing methods, it is often inferior to small wild fish species as a source of essential fatty acids and micronutrients.

“The point is not how much fish is

eaten, but that fish consumption should fulfil its potential to help meet nutritional needs,” says Max Troell.

From this perspective, oily fish and small fish that are eaten whole are superior in terms of nutrition. The problem is that they are generally not farmed, but more commonly used as animal and aquaculture feed.

The authors conclude that more research is needed to identify small species that might be suitable for culture and that the feed sector must continue to seek alternative feedstuffs that do not compromise the nutritional quality of farmed fish.

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Family-based, low intensity aquaculture in Bangladesh.
Photo: Karim Manjural, WorldFish



Climate engineering reconsidered

By Fredrik Moberg

THERE are several ways to respond to the current climate change crisis. One is to limit combustion of fossil fuels and move towards a renewable energy system, but that has proven to be a slow endeavour.

Amid this international collaborative impotence, there are increasing calls for ways to engineer our way out of the crisis. One way could be to scatter sunlight through the injection of sulphate particles into the atmosphere. The technique is even mentioned in the Intergovernmental Panel on Climate Change's 2013 Summary for Policymakers.

Neither effective nor feasible?

In the current issue of *Nature Climate Change*, an international team of scientists who gathered at the annual Askö meeting, organised by the Beijer institute in September 2013, concluded that this kind of geoengineering is unlikely to be the game-changer some people expect it to be.

"Our main conclusion is that, when the use of geoengineering is politically feasible, the intervention may not be effective; and that, when the use of geoengineering might be effective, its deployment may not be politically feasible," write the authors, led by Scott Barrett, chairman of the Beijer board.

Simply put, the many problems associated with geoengineering, including its inability to address every climate emergency, the many possible negative environmental side-effects and the geopolitical problems that would be triggered, suggest that the need to address the root causes is as strong as ever.

"If anything, the prospect of geoengineering should strengthen resolve to tackle climate change by limiting atmospheric concentrations of greenhouse gases".

Helping some, harming others

Injecting sulphate aerosols into the stratosphere to scatter sunlight could very well reduce the temperature in the lower atmosphere in a relatively quick and inexpensive way. It could even be done unilaterally, without the need for

international cooperation. This might sound uncomplicated, but that is ironically also one of geoengineering's major problems. While it might limit global warming and help some countries it is likely to harm others, for example by altering the pattern of monsoons.

"While it might limit global warming and help some countries it is likely to harm others."



"The use of stratospheric aerosols poses a number of huge challenges for governance. Even if 'losers' were to be compensated for their losses, it would be more or less impossible to attribute particular changes to climate engineering rather than to natural variation," the authors write.

Geoengineering would also have a range of environmental side-effects unrelated to the climate. A planet disturbed by both elevated CO₂ concentrations and geoengineering would no doubt be very different. The effects on ecosystems would be complex and spatially variable, with implications for food production, freshwater supplies and human health, creating both winners and losers.

For example, even though the yields of certain agricultural crops might increase on a global scale, the local effects would probably be highly variable, with implications for land-use change, crop selection and food prices.

The risk of addiction

In the article, the use of geoengineering as a 'stop-gap' is also discussed. This would involve deploying stratospheric aerosol injection while more effort is put into reducing emissions. Once concentrations return to 'safe' levels, geoengineering could be scaled back and eventually stopped. If, however, such geoengineering were used over a number of decades, and greenhouse gases concentrations continued to rise, turning geoengineering off abruptly would cause rapid climate change.

"The bigger risk to using geoengineering, we believe, is not that countries will turn it off abruptly but that, having begun to use it, they will continue to use it and may even become addicted to it," the authors say.

Such 'addiction' could mean that societies adapt to the combined effects of

both climate change and geoengineering, for example by liming sea water to protect sensitive coral ecosystems from ocean acidification and genetically engineering crops to benefit both from higher CO₂ concentrations and more diffuse light.

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When organic isn't enough

FOR MANY people around the world, coffee is an indispensable part of their breakfast menu and daily routine. However, together with other popular food items such as bananas and grapes, coffee is also a permanent fixture on blacklists of crops involving very high use of pesticides, with associated health hazards for the environment, coffee workers and consumers. As part of his PhD thesis in economics, Mark Sanctuary looked at why, despite this, market share for certified coffee is not higher. He found that even to the most pro-organic coffee buyers, taste and brand matter more.

In his thesis, Mark also studied the relationship between international trade and environmental protection.

Many people claim to be willing to buy organically labelled products, even if such products are more expensive. Despite these stated intentions, the market for organic labelled products remains relatively small. The estimated market share of organic coffee in Germany and Italy, Europe's largest and second largest coffee markets, was only 3% and around 0,5%, respectively, in 2012.

In their study, Mark Sanctuary and co-author Richard Friberg, Stockholm School of Economics, used data covering coffee consumption by 3000 Swedish households over three years, 2007-2009. Sweden is one of the top per capita coffee consumers in the world. The participating households filled in questionnaires and answered whether they tried to buy organic products as much as possible when shopping. Their answers were then compared against what they actually bought. It emerged that only 22% of the coffee bought by even the most enthusiastic organic consumers was in fact organic. There were several possible explanations, such as price, access and a limited range of choice.

"Shoppers buying organic may be keen to manage their own exposure to pesticides and may also be concerned about environmental impacts. By providing information to consumers,



By Mark Sanctuary
and Agneta Sundin

"It emerged that only 22% of the coffee bought by even the most enthusiastic organic consumers was in fact organic."

organic labelling can result in better shopping choices. Increasing market share of these products could help complement environmental policy objectives, so we wanted to find out why this gap between what consumers say and do was so great", explains Mark Sanctuary.

Using econometric methods to estimate the demand system, they found that the main reason was that these organic enthusiasts valued other coffee characteristics higher, so if they could not find an organic alternative e.g. for the brand or roast they preferred, they bought the non-organic product.

"This was the greatest constraint we found, although price and general availability were also constraining factors. To really get these consumers to buy more organic, the products need to be designed in a way that appeals to them, just being organic isn't enough", says Mark Sanctuary.



Coffee workers in Vietnam, the world's second largest coffee exporter. Photo: Björn Kristersson/Azote

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Urban lessons learned from Stockholm

by Fredrik Moberg

URBAN planning strategies need to acknowledge ecological and social synergies. This has been a message from the Urban Research group for a long time, particularly since two-thirds of the world's population will soon live in cities.

In an article published in *Ambio*, Beijer Institute and Stockholm Resilience Centre researchers summarised no less than 15 years of research in the Stockholm urban region. The article demonstrates how 'novel' ecosystems, such as gardens, cemeteries, brownfield sites and even golf courses, deserve to be acknowledged for their biodiversity and

ecosystem services, which can contribute significantly to urban resilience.

"Our work in Stockholm has helped reveal green areas and ecosystem services not previously perceived in urban planning and clarified mismatches between institutions, governance and urban ecosystems for human well-being," the authors write.

Although the most well-known link between green spaces and human well-being in cities is their provision of so-called cultural services, such as recreation and health, research in the Stockholm region has focused more on regulating ecosystem services, such as

seed dispersal, pest regulation and pollination. These services are generated by complex interactions between humans and nature and not by ecosystems alone.

Moreover, these regulating services tend to transcend habitat boundaries and also affect the surrounding landscape, implying that a landscape perspective on management and planning for urban ecosystem services is often necessary.

"Our research has, for example, revealed that the preservation of the highly valued recreational oak-dominated landscapes of the city's national urban park benefits from seed-dispersing

"Novel ecosystems such as gardens, cemeteries, brownfield sites and even golf courses deserve acknowledgement for their biodiversity and ecosystem services."



Photo: Kjell Tjensvoll © Flickr

birds that also need coniferous forest outside the park,” explains lead author Erik Andersson.

Participation key

Another insight is that local stewards, such as allotment garden owners, are critical and that land-use planning and management seldom account for their role in the generation of urban ecosystem services.

This could be further aggravated by the global trend of privatisation of public land in cities, which tends to restrict local people’s ability to engage practically with urban ecosystems. In contrast, this article recommends developing participatory management approaches where a diversity of skills and knowledge can be applied.

The authors recognise that empirical work from one particular city set in a certain context has its limits, but believe that their results are relevant to other cities and can inspire important further research and discussions that also relate to cities in low- and middle-income countries.

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Photo: Ulf Bodin © Flickr

Social change vital to sustainability goals

by Agneta Sundin

IN ADDITION to enhancing the role of natural capital and ecosystem services in a framework of economic development and poverty reduction, the UN’s sustainable development goals (SDGs) ought also take into account social change. This is the argument put forward by the researchers of the Beijer Young Scholars (BYS) network in the Correspondence section of the journal *Nature*.

“It will be essential to motivate, guide and support social change towards sustainable practices at all scales

of governance — globally, nationally and individually. Simply setting ambitious goals will not generate these changes: their formulation must include details of the processes needed to achieve them. For example, SDG targets should take into account ideologies, religious beliefs and institutions, including formal and informal rules and customs,” according to the BYS scholars.

A full article by the BYS group on this subject is in press in *Ecology and Society*, and will be presented in next year’s annual report.

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EAT – a new platform for linking food, health and sustainability

EAT is a new global long-term initiative with the overall objective of integrating food, health and sustainability, three tightly interdependent areas essential for human prosperity, which are often disconnected in policy, practice and science. On 26-27 May 2014, the first EAT Stockholm Forum was organised as a high-level event, with the aim of initiating collaboration and exchange of knowledge, experience and ideas. The forum, which was co-organised by the Stordalen Foundation and Stockholm Resilience Centre (SRC), was the first global initiative to integrate knowledge on the food system, health and sustainability.

From H.R.H. The Prince of Wales to President Bill Clinton, via a wide array of experts on nutrition, non-communicable diseases and sustainable business strategies, the message was clear: what you eat not only determines your health, but also the health of our planet.

However, the forum was just as much about creating a triple helix which merged science, business and policy with the aforementioned issues. A general consensus was that we have the knowledge and now is the time to act. Furthermore, given the powerful role of the business society, it should also show more responsibility.

Beijer Institute researchers were involved in several parts of the EAT Stockholm Forum process, from writing background papers to leading and reporting on several of the small workshops called Competence Forums. Beijer Director Carl Folke serves on the advisory board of EAT. On 3 June a Post-EAT Science Workshop was arranged at the Academy by Beatrice Crona, GEDB, Line Gordon, SRC, and Therese Lindahl, the Beijer Institute.

www.eatforum.org

Urban Green Commons – Bringing Nature into Cities

THE FILM series *Urban Green Commons: Bringing Nature into Cities*, funded by Formas and the Beijer Institute, is intended to inspire city residents, urban planners and decision makers to adopt and spread common property initiatives in cities. Urban Green Commons can be important public arenas in cities with the potential to reconnect urban inhabitants to the Biosphere.

The series is directed and produced by *Seven Frames Production*. Beijer Institute programme director Johan Colding initiated the project and contributed the scientific expertise, as the films build largely on research from the Institute's programme Urban social-ecological systems. The six films in the series show what can happen when local residents themselves

get a chance to dig into the soil and are given the opportunity to care for and manage green areas in cities. As the films demonstrate, Urban Green Commons could be used in city designs not only to boost ecosystem services, but also to promote socio-cultural benefits in local neighbourhoods and city districts, fostering cultural and intergenerational integration.

Two films in the series, portraying a community garden in Berlin and one in Stockholm, have now been finalised and will be shown at an SRC/Beijer venue in autumn 2014. Discussions about screening them on Swedish television are underway. They can be viewed at the Urban Green Commons website: www.urbangreencommons.com



Former US President Bill Clinton at the EAT Stockholm Forum. Photo: EAT



'The garden on the track' in Stockholm is one of the public access community gardens portrayed in the film series. Photo: Johan Colding

Freedom of choice

ONE APPROACH for influencing and changing human behaviour that can be a useful complement to current public policies is to rely on so-called nudges. Nudging is about making small changes in people's environment to steer behaviour in a specific direction. The British government has created a Behavioural Insights Team (known as the "Nudge Unit") to implement the concept for shaping public policies, for example to increase organ donations. There is also growing interest in using nudges for environmental purposes, a research area in the Beijer Institute programme BENN. In a seminar at the Academy on 29 April 2014, Cass R. Sunstein, Harvard Professor and former advisor to President Obama, presented the science behind the concept and arguments for using it. The seminar, co-arranged by the Beijer Institute and GreeNudge, was followed by a panel discussion with Cass R. Sunstein, Therese Lindahl, the Beijer Institute and Steffen Kallbekken, GreeNudge and CICERO, moderated by Agneta Sundin, the Beijer Institute.

Agneta Sundin, Therese Lindahl, Cass R. Sunstein and Steffen Kallbekken during the panel discussion.



OECD report launch

THE OECD regularly appraises the environmental policy of its member countries. Its appraisal of Sweden's environmental policy was presented at a seminar on Wednesday 11 June 2014 at the Swedish Government's headquarters in Rosenbad. It evaluates Sweden's progress towards sustainable development and green growth, while also examining the reduction in greenhouse gas emissions and management of marine ecosystem services. Anne-Sophie Crépin was invited to be part of the panel and to give a research perspective on the content of the report.

She pointed out in her address that neither the report nor the policy did tackle the current conditions where human-driven changes have global impacts and environmental problems can trigger development problems. She also provided some concrete advice for improvement.



Swedish minister for the environment, Lena Ek, Simon Upton, OECD, Anne-Sophie Crépin and Per Engdahl, Högåns AB, at the launch of the OECD Environmental Policy Report for Sweden. Photo: Jens Persson, Government Offices of Sweden

Our future in the Anthropocene

BEGINNING on a large scale with the industrial revolution, humanity is now influencing every aspect of the Earth and the Biosphere on a scale that matches the great forces of nature. A growing number of scientists think we have entered a new geological era – the Anthropocene.

In a seminar at the Academy on 27 November 2013, speakers set out to explore different challenges in the context of the Anthropocene for societal development and human well-being, addressed within the Future Earth initiative. Future Earth is an emerging international research programme that aims to develop the knowledge for responding effectively to the risks and opportunities of global environmental change in this new era. It seeks to mobilise thousands of scientists while strengthening partnerships with policy-makers and other stakeholders to provide sustainability options and solutions. The main speaker, glaciologist and climate scientist Prof. Qin Dahe, Volvo Environment Prize Laureate 2013, is part of the scientific committee of this initiative.

The seminar was arranged by the Beijer Institute in collaboration with the Volvo Environment Prize, the Environment Committee and SSESS of the Academy and SRC.

Speakers

Professor Qin Dahe, Cold and Arid Regions Environment and Engineering Research Institute, Lanzhou • Professor Melissa Leach, STEPS Centre, University of Sussex • Dr Elisabet Lindgren, Karolinska Institutet and Stockholm Resilience Centre • Professor Garry Peterson, Stockholm Resilience Centre • Professor Johan Rockström, Stockholm Resilience Centre • Professor Will Steffen, Australian National University Climate Change Institute • Moderator: Agneta Sundin, the Beijer Institute

Resilience and Development – Mobilising for Transformation

ON 4-8 MAY 2014, the third international conference on resilience took place in Montpellier, France. More than 900 researchers, practitioners and students from around the world gathered to discuss resilience, transformation, development and conservation under the heading *Resilience and Development: Mobilising for Transformation*.

Beijer Fellow and plenary speaker Brian Walker argued that we should consider where we don't want to go and try to steer social-ecological systems in trajectories that will avoid what he called 'undesirable states'. This led to discussions throughout the conference about who gets to define what is desirable or undesirable. The plenaries also triggered questions concerning "resilience of what and for whom?"

Several researchers from the Beijer Institute were active in planning sessions and gave speeches at the conference. A group of students including the Beijer Institute's Caroline Schill and Daniel Ospina Medina, received praise for its special session which included an interactive theatre play around opportunities and challenges for the new generation of interdisciplinary scholars.

www.resilience2014.org

The final wrap-up of the conference where a group of PhD-students interpreted the concept of transformation through rhythm and melody. Photo: Robert Kautsky/Azote



Ikebana artist Judit Katkits created two Japanese flower installations specifically for this event, interpreting the theme of the seminar using local and seasonal plants mixed with reusable material. Photo: Agneta Sundin

Reflections – On People and the Biosphere

By Carl Folke

IN THE SUMMER of 2009, Lars Hall, a good friend and art director renowned for his simple, clear and timeless graphic design, presented me with a set of amazing photos from the archipelago north of Stockholm. Lars asked if I could write text to the photos about humanity and the biosphere. The book *Reflections – on People and the Biosphere* (*Speglingar – om människan och biosfären*) is the result. We present the art-science project in the book as follows.

“The photos from the very same spot on the island Grillskäret in the Baltic Sea capture an essential feature of life – resilience – the capacity to persist in the face of change, to continue to develop with ever-changing environments. Three decades of persistence are documented here through the pictures, reflecting diverse impressions and changing environments. The pictures are complemented with music quotes and texts from thirty years of developing sustainability science and resilience thinking in relation to the Biosphere. However, resilience cannot be taken for granted. Humanity faces a major resilience challenge, as the Biosphere provides our life foundation. Globally interconnected societies have become a significant force in the operation of the Biosphere, altering its resilience and the future of people on Earth. It is

high time to reconnect minds, hearts and actions to our Biosphere foundation, to augment human capacity and creativity in this direction. The archipelago outside Stockholm is an amazing place, which holds a sense of place for us, the authors of *Reflections*. It is our hope that the book will inspire and provide space for contemplation about this critical relationship, and help reconnect the reader to the Biosphere and to essential conditions for the continued existence of humanity.”

The book was released in mid-June 2014 at the Academy and presented with music by Philip Glass. It will be exhibited at various art venues in Stockholm during the coming year.

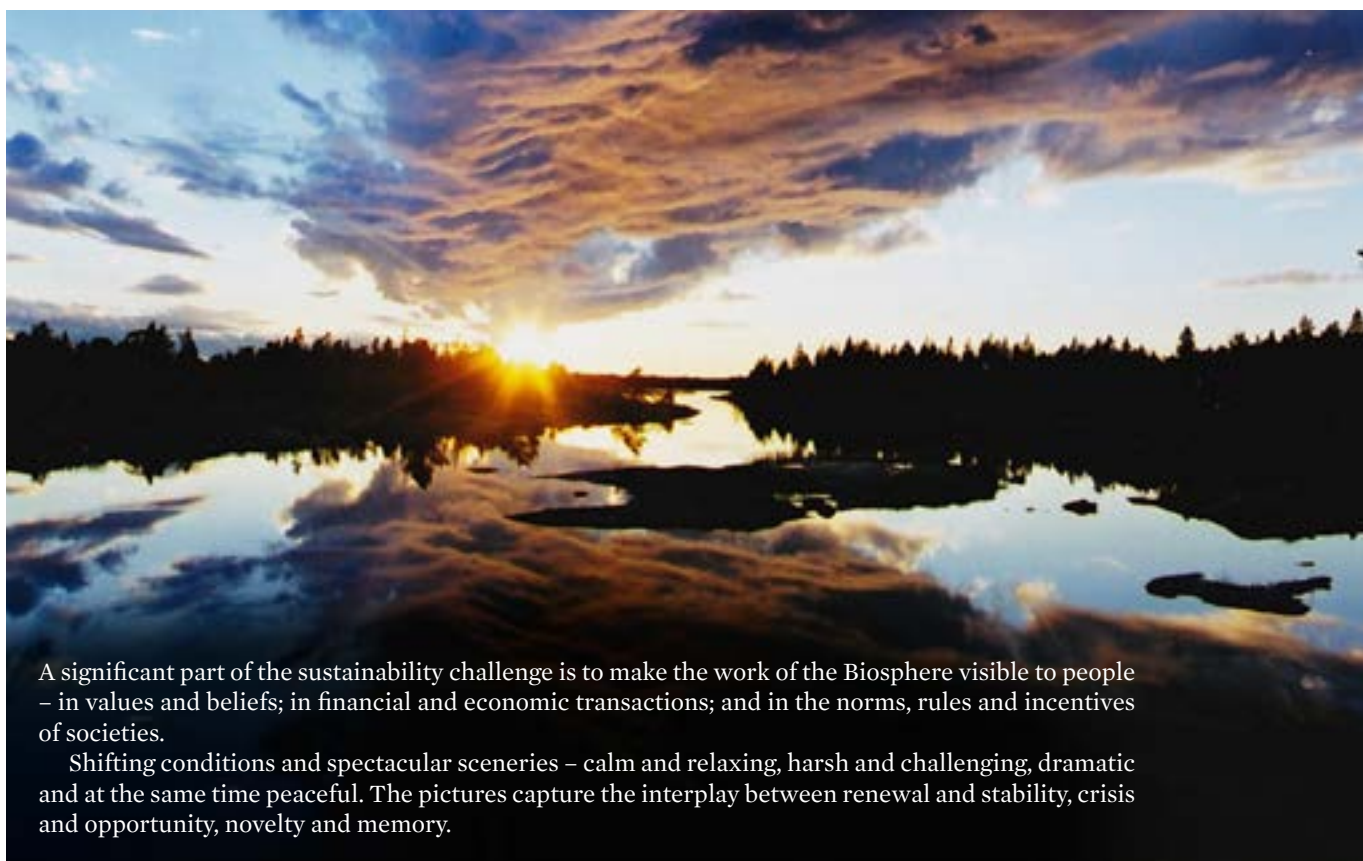


Lars Hall. Photo: Private



Lars Hall and Anders Wall, chairman of the Beijer Foundation, at the book launch. Photo: Christina Leijonhufvud





A significant part of the sustainability challenge is to make the work of the Biosphere visible to people – in values and beliefs; in financial and economic transactions; and in the norms, rules and incentives of societies.

Shifting conditions and spectacular sceneries – calm and relaxing, harsh and challenging, dramatic and at the same time peaceful. The pictures capture the interplay between renewal and stability, crisis and opportunity, novelty and memory.

Ecosystems, ecosystem services and economics

By Max Troell

THE BEIJER Institute has for many years collaborated with the Environmental Economics unit at the University of Gothenburg, where four full doctoral scholarships are offered every year to graduate students from developing countries. The PhD programme is funded by the Swedish International Development Cooperation Agency, Sida. The Beijer Institute's role is to provide input to its broader theme on the economic and environmental implications of natural resource management.

This year's PhD course *Ecosystems, Ecosystem Services and Economics*, held at the Academy 10-14 March 2014, attracted 20 students from Africa, Asia and Latin America. As usual, the course leader was Max Troell. To increase the

students' understanding of the complexity and functions of interlinked social-ecological systems and the related implications for governance, lecturers from both the Beijer Institute and

Stockholm Resilience Centre contributed to the course. Professor Gretchen Daily also gave a special lecture presenting interesting cases from China on how ecosystem services can be operationalised at larger scales. It was an intense week for the students, with lectures both in the morning and afternoon during which they were exposed to many new concepts and extensive reading material, but they all still managed to keep focused.



Beijer Institute's Gustav Engström with course participants Muuz Hadush, Ma Shexiao and Laura Villalobos-Fiatt.
Photo: Agneta Sundin

Challenges of environmental decision making

By Gustav Engström

DURING spring 2014, Anne-Sophie Crépin, Therese Lindahl and Gustav Engström planned and taught a specially designed three-week course in environmental economics to students taking the Master's programme in Social-Ecological Resilience for Sustainable Development at Stockholm Resilience Centre. The title of the course was *Challenges of Environmental Decision-making*.

The objective of the course was to help the students understand a broad spectrum of challenges associated with decision making and how these are typically tackled within economics. Particular emphasis was given to the complexities involved when these challenges are coupled to environmental issues. The aim throughout the course was to introduce and teach the students about economic approaches to decision making that incorporate both uncertainty and complex dynamics, including regime shifts, behavioural biases, climate change and international trade. Lecturers and students together explored alternative approaches for analysing how people make choices individually and collectively, in order to best manage

“The questionnaire revealed that the students were not only highly sceptical of economics, but also constantly confused the topic of economics with the economy.”

social-ecological systems and the consequences and trade-offs these choices involve.

Teaching economics to students with varying background knowledge can be challenging. At the outset, we wanted to get an idea of the students' general perception of economics. This was done by handing out an anonymous questionnaire where the students were given the opportunity to reflect about economics and why the topic might be useful in dealing with future challenges facing humankind. The questionnaire revealed that the students were not only highly sceptical of economics, but also that they were constantly confusing the topic of 'economics' with 'the economy'. This provided us with information

about the topics that students perceived as most stressful and complicated and helped us shape the coming lectures to address these issues.

Besides the lectures by the organisers, Johan Gars and Mark Sanctuary lectured on the economics of climate change and international trade. The class consisted of 16 students and during the course two individual assignments were required and at the end a written exam on the whole course was given. All students completed their assignments and managed to pass the final exam. The participants had acquired considerable knowledge about the many challenges involved in economic and environmental decision making.

Regime shifts in social-ecological systems

By Jeff Vincent and Aart de Zeeuw

AFTER the successful courses that were organised in conjunction with the World Congress of Environmental and Resource Economists in Montreal in 2010 and the European Meeting in Prague in 2012, another two-day course was organised by the Beijer Institute in Istanbul, immediately before the World Congress 2014, on 27-28 June. The course title was *Applied Methods Related to Regime Shifts in Social-Ecological Systems*. Participants from developing countries were invited, primarily from the networks in environmental economics, and the purpose of the course was twofold. First, it provided an overview of research in an area that is part of the research agenda of the Beijer Institute and which is relevant for future research in developing countries. Second, the participants were given the opportunity to stay for the World Congress to present a paper or a poster, or just to learn about recent developments in the field.

The theme of this course was regime shifts in social-ecological systems, the same as for the previous. However, the evaluations of the last course (which was mainly based on theory) had shown that there was a need for practical applications. Therefore, this year it focused on applied methods. All the participants had software installed so that they could actually run some applications.

Since there were a number of newcomers, Beijer Fellow Aart de Zeeuw, Tilburg University, opened with an overview of theory on optimal management and common property issues in the presence of potential regime shifts in ecological systems. He was followed by ecologist Saskia Otto, University of Hamburg, who introduced statistical methods for the identification of tipping points and regime shifts in data sets on ecological system behaviour. Afterwards, the participants were able to run some of these applications themselves.

On the second day Therese Lindahl, the Beijer Institute, introduced experimental methods to test human behaviour in the presence of thresholds and regime shifts. The participants were also challenged, in groups of five, to design an experiment on a topic of their interest, which led to some interesting research proposals. The final part of the course was led by Anne-Sophie Crépin, who lectured on the Regime Shifts database of Stockholm Resilience Centre, with many well-documented regime shifts in ecological systems.

The whole course was designed and moderated by Beijer Fellow Jeff Vincent, Duke University. All practical arrangements were taken care of by Christina Leijonhufvud, with help from the local organisers of the World Congress, Professor Ozgur Kayalica, Istanbul Technical University, and Mr. Kubilay Sahin, Dekon Congress & Tourism. Among the total of 26 participants, we had 21 from 19 different countries in Latin-America, South-East-Asia, South-Asia and Africa, and five from the host country, Turkey. Financial support was provided by the Canadian International Development Research Centre, the European Association of Environmental and Resource Economists and the Beijer Institute.



Course designer and moderator Jeff Vincent with lecturer Anne-Sophie Crépin during a coffee break. Photo: Christina Leijonhufvud

Course participants of the Beijer Institute course *Applied Methods Related to Regime Shifts in Social-Ecological Systems* from 19 different countries in Latin-America, South-East-Asia, South-Asia and Africa, and five from the host country, Turkey. Photo: Christina Leijonhufvud



Stockholm Resilience Centre

RESILIENCE thinking grew out of the Beijer Institute's research programmes, leading to the formation of the Resilience Alliance and later Stockholm Resilience Centre (SRC). The collaboration with the SRC continues to be intense, exciting and very productive, with many joint projects, grants, workshops and publications, as is evident in this Annual Report. Beijer Institute researchers play an active role as theme leaders and contribute to the scientific content and research direction of the SRC.

The collaborative research takes an integrated view of people and nature, aiming at a deeper understanding of human-environment interactions and the well-being, resilience and stewardship of social-ecological systems, from local to global level. Both organisations benefit greatly from the collaboration and our joint Centre of Excellence five-year project *Resilience and sustainability – integrating research on social-ecological systems*, which is funded by Formas, was subject to a final evaluation this spring. The international evaluation panel wrote that “the Resilience and Sustainability project has produced outstanding results and developed new conceptual approaches in dealing with nature-society interactions that contributed to moving the scientific frontier of understanding”. Based on a bibliometric analysis of Formas, the panel concluded that the Resilience and Sustainability project scored outstanding in every aspect of the analysis and that results from the project have proven highly relevant for a variety of stakeholders involved in ecosystem management.

SRC was inaugurated in 2007 with core funding from Mistra lasting through to 2018. The communication, outreach and policy engagements of the Beijer Institute are substantially enhanced through the close collaboration with the skilful communication team of SRC and its partner Albaeco.

www.stockholmresilience.su.se
www.albaeco.se



In celebration of H. M. King Carl XVI Gustaf's 40 years on the throne, the Royal Dramatic Theatre in collaboration with SRC and other partners set up a stage performance on 23 November 2013, highlighting some important moments within the development of environmental issues. This picture shows Carl Folke and the director of the Royal Dramatic Theatre, Marie-Louise Ekman, in a public discussion preparing for the event, led by SRC researcher Lisen Schultz. Photo: Agneta Sundin



As part of her active engagement in environmental issues, H. R. H Swedish Crown Princess Victoria spent an entire day at the SRC to learn more about social-ecological systems and the challenges and opportunities associated with living in an increasingly anthropogenic world. The Crown Princess received an introduction to the latest scientific insights on these issues by SRC researchers including Beijer Director Carl Folke. Photo: Kungliga Hovstaterna

“The Resilience and Sustainability project has produced outstanding results and developed new conceptual approaches in dealing with nature-society interactions that contributed to moving the scientific frontier of understanding.”

Future Earth

– Research for Global Sustainability

FUTURE Earth is a new international research initiative aimed at developing knowledge for responding effectively to the risks and opportunities presented by global environmental change. The Academy has played a central role in the development of a decentralised Future Earth Secretariat with a strong Swedish presence. The Beijer Institute and the Global Economic Dynamics and the Biosphere programme are key in the Academy's profile towards issues of global sustainability in tight collaboration with SRC. The critical role of SRC will be instrumental for the success of a Future Earth Secretariat in Sweden. The Beijer Institute is active in the Future Earth Programme on Ecosystem Change and Society (PECS), chaired by Beijer Fellow Steve Carpenter, with the International Programme Office hosted by the SRC. In November 2013, together with SRC and the Academy's Environmental Committee, SSEESS and IGBP, we organised the seminar 'Our Future in the Anthropocene' in connection with the Volvo Environment Prize and laureate Qin Dahe, a member of the Future Earth science committee.

www.icsu.org/future-earth

Global Economic Dynamics and the Biosphere

– The Erling-Persson Family Academy Programme

THE ERLING-PERSSON FAMILY Academy Programme on Global Economic Dynamics and the Biosphere (GEDB) is now up and running. Beatrice Crona, the executive director of the programme, has performed in an excellent fashion and the list of competent staff is inspiring. Gretchen Daily of Stanford University, a Beijer Fellow, is visiting professor for two years. Beijer Fellow James Wilen, Professor of Economics at the University of California, Davis, visits Stockholm several times a year and takes part in research, guiding and mentoring young scholars within the programme and providing senior academic expertise in economics. The GEDB is structured into three parts: *Macroeconomic models that explicitly consider and integrate the biosphere; Trade in, and consumption of, marine resources and the effects on social-ecological systems; and Interactions between financial markets and the biosphere.* There is an advisory board, with several Beijer fellows and researchers engaged in the Beijer Institute providing synergies. As we envisioned, this programme has become a significant cohesive agent for research, syntheses and synergies between the Beijer Institute and the SRC.

www.kva.se/gedb



Workshop participants from the Natural Capital Project and the SRC on the boat to Sandhamn, Stockholm Archipelago. Photo: Agneta Sundin

Stanford University

– the Natural Capital Project

ACOLLABORATION between SRC, GEDB, the Beijer Institute and Stanford University, more specifically its Natural Capital project, is underway, enabled through the two-year visit to Stockholm by Beijer Fellow Gretchen Daily.

Awareness of the vital roles of natural capital and resilience, concepts developed early on at the Beijer Institute and then SRC, has spread like wildfire in the past decade. These ideas are now apparent in current thinking about agriculture, water, energy, health, fisheries, forestry, mining, cities and the infrastructure supporting these and other vast sectors. They are also increasingly apparent in the ways communities, corporations, governments and other institutions frame decisions.

It is important to develop the knowledge foundations and implement actions to increase the uptake and influence of natural capital and resilience approaches by decision-makers worldwide, whether in governments, businesses, development banks or NGOs. Therefore, a first workshop was convened in Stockholm on 3-6 February 2014, with researchers mainly from Natural Capital project, the Beijer Institute, GEDB and SRC. It opened with a background session on the deep, shared roots and missions of these institutions, followed by short briefings on current research objectives. The main part of the meeting was organised around achieving tangible initial outcomes, new research and real-world engagement through tools, policy and practice.

The collaboration brings together young leaders with diverse and complementary strengths, in understanding social-ecological systems as well as in moving that understanding into real-world action. The first task is to organize research networks around a high level event in Stockholm 2015 that showcase examples of integrate natural capital and resilience thinking into key decision contexts.

SARA(S)²

– The South American Institute for Resilience and Sustainability Studies

THE SOUTH American Institute for Resilience and Sustainability Studies SARA(S)² is an interdisciplinary research institute based in Maldonado, Uruguay, designed to catalyse high-impact science that can strengthen South America's long-term resilience and sustainable development. SARA(S)² is a regional centre cooperating closely with scientific communities and funding agencies in several South American countries and with international key scientists. The SARA(S)² workshop in Uruguay in December 2013 focused on education for innovative thinking and brought artists and scientists together to share experiences and explore the subject. The Science Board of SARA(S)² includes Beijer Fellows Steve Carpenter, Marten Scheffer and Beijer Director Carl Folke.

The Voyaging Canoe, the Viking Ship, the Ark – icons of human exploration in times of change, embedded in stories, beliefs and deep values of diverse cultures. At a 2013 SARA(S)² workshop, *Reconnecting with the Ark* was performed in a beautiful part of the SARA(S)² grounds as a poetic way of capturing the essence of the resilience and sustainability challenge. It was created by researchers Carl Folke, Mariana Meerhoff and Marius Bakken and sculptor Francisco Gazitua.

www.saras-institute.org



Photo: Francisco Gazitua



Photo: Andrés Richero

NorMER

– Nordic Centre of Excellence and the new GreenMAR programme

THROUGH collaboration with Stockholm Resilience Centre, Beijer Institute researchers contribute to the Nordic Centre of Excellence on Climate Change Effects on Marine Ecosystems and Resource Economics (NorMER). Carl Folke serves as co-chair of the programme, with Professor Nils Christian Stenseth, University of Oslo, as 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 international collaborative projects between the participating partners in the Nordic countries. It is funded by the Top-level Research Initiative of Nordforsk. NorMER has generated a spin-off project – GreenMAR – Green growth based on marine resources:

ecological and social-economic constraints, also funded by Nordforsk. The GreenMAR network aims at understanding to what extent the ecological and social components of complex marine systems are capable of adapting to growing stress factors, such as fishing or climate change. The goal is to provide management recommendations that can ensure green growth. Beijer Fellow Simon Levin serves on the Advisory Panel for NorMER and participates in GreenMAR, representing its Princeton node. Beijer Fellows Jim Wilen and Partha Dasgupta are on the advisory board of GreenMAR and Carl Folke is the leader of the Stockholm node.

www.normer.uio.no
www.greenmar.uio.no

The Ebba and Sven Schwartz Foundation

THE SWEDISH Ebba and Sven Schwartz Foundation supported the Beijer Institute and Stockholm Resilience Centre through a career grant to three researchers during 2011-2013. Happily, the Foundation has decided to continue this support until the end of 2015. 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.

www.schwartzstiftelse.wordpress.com

The Resilience Alliance

A CENTRAL network for collaboration is the Resilience Alliance (RA), an international consortium of leading research groups and their organisations that collaborate to explore the dynamics of social-ecological systems. RA seeks novel ways to integrate science and policy in order to discover foundations for sustainability. RA and its focus on social-ecological systems emerged out of research programmes at the Beijer Institute in the 1990s. The Beijer Institute is an active member and works with RA on central issues such as the Arctic resilience assessment and the organisation of the very successful Resilience Conference in Montpellier, France, May 2014. The journal *Ecology and Society* is owned by the Resilience Alliance, with Carl Folke as the editor-in-chief together with Lance Gunderson.

www.resilience.org

Nereus

– *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 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 involved in 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.

www.nereusprogram.org



Nereus: 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.

Supporting Environmental Economics Networks

By Agneta Sundin, Jeff Vincent and Anastasios Xepapadeas

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 in research and teaching short courses, with financial support from the Swedish international development cooperation agency (Sida).

Activities

As in past years, Beijer fellow Jeffrey Vincent and Beijer Institute board member Aart de Zeeuw, together with Christina Leijonhufvud, administered the Beijer Institute's support to the regional networks in environmental economics. Two of the support activities, the Mäler Scholars Programme and a two-day course held in Istanbul in June

2014, are described elsewhere in this report. This section highlights other support activities.

Most of the other activities focused more on the networks in Asia (EEPSEA, SANDEE). Professor Vincent participated in SANDEE's biannual research workshops in Kathmandu, Nepal, in December 2013, and Thimpu, Bhutan in June, 2014, serving as lead discussant on approximately six proposals and six progress or final reports at each workshop. He also delivered a plenary lecture on *Willingness to pay for Amazon forest preservation* at the Kathmandu workshop and served as advisor on seven research projects from five countries (Bhutan, India, Maldives, Pakistan, Sri Lanka) over the course of the year. Beijer Fellow Partha Dasgupta taught in SANDEE's annual Summer School in Environmental and Resource Economics in May 2014. In the case of EEPSEA, Prof. Vincent served as a proposal reviewer and as advisor on an EEPSEA research project in China and arranged for the lead fisheries economist at the World Bank, Dr. James Anderson, to deliver a keynote lecture at the annual EEPSEA meeting in May 2014. Furthermore, he arranged for the EEPSEA director to be added to the Policy and Technical Expert Committee for the World Bank's Wealth Accounting and Valuation of Ecosystem Services programme, in which the directors of SANDEE and LACEEP

already participated. Prof. Dasgupta arranged for representatives of all four networks to participate as observers at a high-level conference titled *Sustainable Humanity, Sustainable Nature* held at the Vatican in May, 2014, where Prof. Vincent, former Beijer Institute director Karl-Göran Mäler and several Beijer fellows participated and gave lectures.

Professors de Zeeuw and Vincent and Anne-Sophie Crépin continued discussions with the University of Gothenburg and Stockholm Resilience Centre about a new interdisciplinary research programme in developing countries. With collaborators at the other two institutions, they organised a planning meeting in October, 2013 in Cape Town, South Africa, and recruited representatives from the regional networks to participate in the meeting. They organised a follow-up meeting in Istanbul in June, 2014, again with representation by the regional networks. The proposal for the programme is due at the end of 2014. If funded, it will strengthen collaboration by economists in the regional networks with economists in Gothenburg's Environment for Development (EfD) centres and ecologists from local institutions in the regions.

The Mäler Scholarship

This year's Mäler Scholar was Matías Piaggio from Uruguay (LACEEP), who completed his PhD in applied economics from the Universitat Autònoma de Barcelona, Spain, in 2013 and now holds a position at Universidad de la República, Uruguay. Matías visited the Beijer Institute from 26 January to 6 June 2014. Under supervision by Therese Lindahl, he analysed the role of power asymmetries between individuals when exploiting a common pool resource, using experimental economics methods. Together, they also worked on linking this framework to analysis of how individuals behave when they are exposed to abrupt changes in the resource. The experimental designs developed during his stay were presented at the WOW5 Conference in June 2014 at Indiana University, where valuable feedback to



Beijer Fellow Sir Partha Dasgupta (to the left of the Pope) with Pope Francis and participants of the conference *Sustainable Humanity, Sustainable Nature* in the Vatican, May 2014. Photo: Sara Aniyar



The city of Thimphu, capital of Bhutan, venue for a SANDEE workshop in June 2014. Photo: Superkimbo © Flickr

“Together, these experiences greatly enhanced my understanding of how people cooperate to create knowledge.”



Måler Scholar Matías Piaggio with Carl Linnaeus (Carl von Linné) one of the founders of the Royal Swedish Academy of Sciences.
Photo: Agneta Sundin

improve and validate the experimental designs was received.

This is how Matías summarises in his own words what the Måler Scholarship meant to him:

“My time in Stockholm was extremely rewarding, not only because of the great academic support and feedback, but also because of the whole environment and opportunities that the Beijer Institute provides. First, its very comfortable installations and support in all the administration allowed me to concentrate exclusively on the academic tasks. Second, all the Beijer Institute

staff are very friendly and they included me in all their activities. This was very important, because it allowed me to get great feedback on my work and to find out about how people conduct their research, and also how to organise staff meetings and other activities. I am grateful to Therese and colleagues that they so generously accepted me into their group and extended their framework to fit my interests. Third, the Beijer Institute has a tight linkage with Stockholm Resilience Centre (SRC), and I was encouraged to take part in activities there. This opened up

a world of knowledge to me, giving me the opportunity to get acquainted with researchers from different topics and disciplines, take part in fruitful discussions and learn how they make it possible to work in such an integrated, multi-disciplinary way. Fourth, I had the opportunity to participate in the Behaviour, Economics and Nature Network (BENN) workshop. This was an academic event where top level researchers from primarily neuroscience and behavioural economics met to explore the potential intersections between these disciplines. This was very beneficial to my work, as I not only had the opportunity of meeting all these people, but also saw them in action together. Together, these experiences greatly enhanced my understanding of how people cooperate to create knowledge.”

With support from Sida, the Måler Scholarship, which is intended for researchers from the networks to come and spend time at the Beijer Institute, was introduced. Through this, the Beijer Institute aims to support the networks in creating increased capacity in their respective regions in using economics for analysing resource problems and essential environmental issues.

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 and encourages submissions from researchers in the field in both developed and developing countries.

General

In recent years, submissions of manuscripts to the journal have increased substantially and peaked at a record level of 232 in 2012. The unusually large number of papers submitted in 2012 can be partly attributed to the fact that several special issues were initiated during that year. In 2013 submissions returned to what can be considered the more “normal” level of 203; submissions for 2014 are running at about the same level.

The journal relies heavily on its Associate Editors in order to carry out its objective of capacity building in the developing world. The Editor and Associate Editors carefully consider the scientific potential of each manuscript at every stage of the review process, making a special effort to work with authors from the developing world whose manuscripts show potential. In addition, the Assistant Editor provides additional assistance to authors from the developing world who may be less familiar with the review process, or who may encounter special problems due to lack of infrastructure.

Performance

A total of 203 manuscripts were submitted to *Environment and Development Economics* in 2013.

The increasing trend of submissions from developing regions continues. Submissions from developed areas comprise about 42% and those from the developing areas about 58%. The journal is very pleased with this breakdown, which reflects a strong presence in both the developing and the developed world.

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.

The release of the Thompson Reuters impact factor was delayed this year for technical reasons and is not yet available. Informal in-house calculations at CUP indicate a slight increase in the journal's impact factor relative to last year. EDE strives to maintain a balance between its special mission of capacity building and the need for a respectable impact factor. The journal's Editorial Board has been unwavering in its support of these dual objectives. The Board has also played an active role in the development of special issues, which help to maintain this balance.

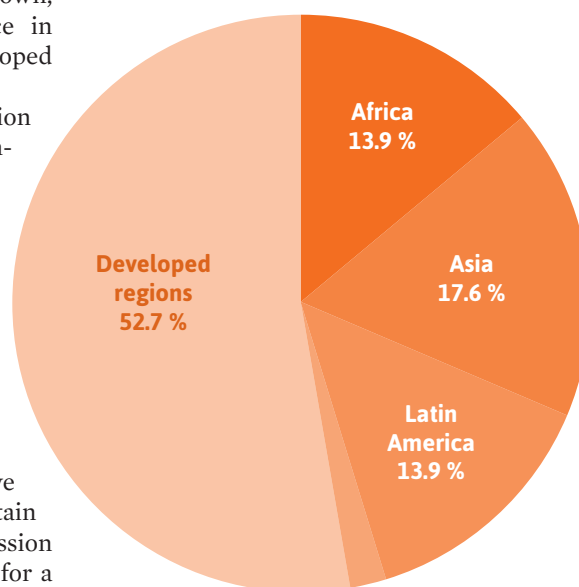
During the past 12 months, the journal published three special issues. The first, which appeared in August 2013, was *Small Island Developing States* (Guest Editors Sonja S. Teelucksingh, Paulo Nunes and Charles Perrings), the second, which appeared in February 2014, was *China's Environmental Policy* (Guest Editors Jintao Xu and Peter

Berck) and the third, which appeared in June 2014, was the *20th Anniversary Issue*. Another two special issues are currently in progress.

EDE future

The current editor Tasos Xepapadeas has announced that his term will expire at the end of 2014 and that Eswaran Somanathan, Professor in the Economics and Planning Unit of the Indian Statistical Institute, Delhi, who has served as Associate Editor for EDE for the last 9 years, has been chosen as the new Editor.

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.



Geographical distribution of published manuscripts, 2010-2014.

The Swedish secret shared

By Marten Scheffer

DURING the years that I have been involved with the research network surrounding the Beijer Institute, I have learned a great deal. My background is ecology, but I now know more about economics and more broadly about social sciences. As a board member and later a Beijer fellow and friend, I had the privilege to be part of the combined forces in the diverse Beijer network, trying to craft a science that encompasses the entire social-ecological system. A daunting but absolutely essential enterprise if we as scientists want to help carve the best future for humanity. It requires thinking along entirely new pathways, which is easier said than done. Unwillingly, we are all unavoidably trapped to some extent in our past ways of thinking.

Perhaps the most important thing I have taken on board is how to manage for the emergence of new thinking. In many ways, our role model for such social engineering has been C. S. (Buzz) Holling. In his Resilience Network, he pulled together small but diverse groups of social scientists and ecologists for workshops on islands. One of the secrets to his success was that he really hand-picked people who were 'good on islands'. Of course there were no guarantees of success until the island session was over, and indeed a few explosive meetings are still remembered. But this was a calculated risk and most workshops produced deep insights, as well as life-long friendships. In Sweden, Carl Folke has mastered to perfection the art of selecting exactly the right people and that is perhaps the secret to the success of both the Beijer Institute and Stockholm Resilience Centre (SRC). However, people are not the only component needed for success, since the right conditions to nurture a process of interactively developing new concepts are also essential. Again, Buzz Holling led the way, by always planning lots of unstructured time and good food in the isolated places he chose. This pattern is followed in Sweden too, with the Beijer people inviting us to the island of Askö each year after the board meeting. Check the list of publications that have come out of the Askö meetings and you will see just how productive these short breaks involving the board and new and old friends have been.

Now, I am using the many things I learned in my time at the Beijer Institute to organise my own workshops and to run my Wageningen science group, the SparcS programme on critical transitions and the South American Institute for Resilience and Sustainability Studies. None of those skills can really be gleaned from textbooks, but mostly require tacit knowledge that has to be encountered in practice. It is, therefore, great to know that an entire new generation of scientists is growing up

at the Beijer Institute and SRC and acquiring all these skills at first-hand. Not that we ever know how to do everything of course, we are all still learning. This is as it should be, because once you think you know how the world works, you have become useless when it comes to creating novel science.

One of the exciting new things we are investigating now is how to team up with the Arts. Again, great precursors for such ventures can be found in the sessions organised by SRC and the Beijer Institute. Now Carl Folke and I are joining forces with artist Tone Bjordam from Norway in a dazzling new project called *Reconnecting to the Biosphere*.

Science and Arts, the two giants of the mind; can they dance together? We think they can and if things work out well, our complementary ways of thinking and expressing may not only produce powerful new insights, but also communicate them in ways that speak to the hearts and intuition of people. Surely that is important, as humans hardly decide on important things rationally. It is telling that at the Beijer Institute BENN workshop in June 2014 – during which we were working with brain scientists – we produced a manuscript tentatively entitled 'Goodbye Homo economicus'. This is not to discredit the insights we gained from economic theory, but to celebrate the broader understanding we are developing when it comes to the drivers of our own behaviour as parts of the web of life.

The Swedish Secret really is an ongoing adventure, and the best news is: it's going viral. Long may it last!



Photo: Cecilia Nordstrand



Stuart "Terry" Chapin and Marten Scheffer entertaining at Askö.
Photo: Agneta Sundin

Board of Directors



Rosamond Naylor, Scott Barrett, Carl Folke, Stephen Carpenter, Aart de Zeeuw, Anne-Sophie Crépin, J. Marty Anderies, Eric Lambin, Stuart "Terry" Chapin and Anastasios Xepapadeas. Missing: Karine Nyborg and M. Scott Taylor. Photo: Agneta Sundin

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 for the new Institute was elected on 5 June 1991. The 23rd annual board meeting was held at the Royal Swedish Academy of Sciences on 13 September 2013.

BOARD OF DIRECTORS 2013-2014

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Scott Barrett
Professor, Columbia University, USA

Ex-officio members

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Professor, Director, the Beijer Institute, Sweden

Staffan Normark*
Professor, Permanent Secretary of the Royal Swedish Academy of Sciences, Sweden

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Aart de Zeeuw
Professor, Tilburg University, the Netherlands

Anastasios Xepapadeas
Professor, University of Athens, Greece

*member of the Royal Swedish Academy of Sciences

Staff news

Gretchen Daily

Long-term Beijer Fellow and friend, former board member Professor Gretchen Daily, Stanford University, arrived in Stockholm with her family in July 2013 to spend two years in Stockholm as a visiting scholar. Her work spans scientific research, teaching, public education and working with leaders to create innovative and practical approaches to environmental challenges. Gretchen received her PhD in Biological Sciences from Stanford University and her research is on predicting biodiversity change; harmonising biodiversity conservation and agriculture; quantifying the production and value of ecosystem services; and new policy and finance mechanisms for integrating conservation and human development. She is co-founder of *The Natural Capital Project*, an international partnership whose goal is to improve the well-being of people and the environment by mainstreaming the values of nature into major resource decisions globally. Gretchen is employed primarily within the Global Economic Dynamics and the Biosphere programme of the Academy and is partly funded by the Beijer Institute. Taking advantage of the research cluster in Stockholm, Gretchen is spending her time here trying to bring together and advance natural capital and resilience concepts, tools, policy and governance approaches, and apply them in real-world decision making. A high level research policy event in spring 2015 in Stockholm is under planning.

Britt Stikvoort

Britt Stikvoort is employed as a research assistant within the BENN programme since July 2013. She has been writing a review paper on green nudges with Therese Lindahl and assisting with experiments. During autumn 2014, Britt and Therese will write a more policy-orientated review on nudging, collaborating with the Swedish think-tank Fores. Britt has an MSc in Applied Communication from Wageningen University of Life Sciences, with particular focus on social psychology, learning and environmental communication. In June 2014 she completed her second MSc within the Social-Ecological Resilience for Sustainable Development programme of Stockholm Resilience Centre. Her thesis is described under the BENN section of this report.



Daniel Ospina

Daniel Ospina joined the Beijer Institute in May 2014 as a research assistant for the synthesis phase of the ACCESS project, and for the preparation of the second ACCESS Summer School, to be held in Stockholm in September 2014. He will also help with the creation of a platform, entitled *Changing Planet*, to enhance co-ordination of global research programmes at the Beijer Institute, the Royal Swedish Academy of Sciences and Stockholm Resilience Centre. Daniel has an undergraduate degree in Ecology and obtained his MSc from the Ecosystems, Resilience and Governance programme at Stockholm Resilience Centre (SRC), Stockholm University in 2012, for which he wrote a thesis focused on regime shifts in land systems.

Anneli Sundin

Anneli Sundin was employed as a research assistant within the Global Dynamics and Resilience programme between September 2013 and June 2014. In the past year, she explored the role of humans as mediators of change in global ecosystem dynamics. One focus area was on foreign land investments, aiming to understand what is driving these types of investments and how they are tied to local, national and global governance structures. A scientific paper is currently being generated on these issues. In addition to this, Anneli assisted in the creation of *Changing Planet*, the new research platform on global change research mentioned above, including setting up a website. She has a Master's degree from the SRC programme Social-Ecological Resilience for Sustainable Development.



Gretchen Daily Photo: Cecilia Nordstrand • Daniel Ospina, Britt Stikvoort, Anneli Sundin Photo: Agneta Sundin

Staff members

Carl Folke, Professor, Director
Anne-Sophie Crépin, PhD, Deputy Director
J. Marty Anderies, Professor, Programme Director
Erik Andersson, PhD, Researcher
Johan Colding, Associate Professor, Researcher, Programme Director
Gretchen Daily, Professor, visiting Researcher
Gustav Engström, PhD, Researcher
Åsa Gren, PhD, Researcher
Sofia-Kristin Kokinelis, MSc, Finance and HR Administrator
Efthymia Kyriakopoulou, PhD, Researcher
Christina Leijonhufvud, BA, Administrator
Chuan Zhong Li, Professor, Programme Director
Therese Lindahl, PhD, Researcher, Programme Manager
Megan Meacham, MSc, Research Assistant
Karl-Göran Mäler, Professor emeritus, former Director, Research Associate
Nikolina Oreskovic, MSc, Research Assistant
Daniel Ospina, MSc, Research Assistant
Stephen Polasky, Professor, Programme Director
Mark Sanctuary, PhD, Researcher
Caroline Schill, PhD-candidate, researcher
Britt Stikvoort, MSc, Research Assistant
Agneta Sundin, Communications Officer
Anneli Sundin, MSc, Research Assistant
Max Troell, Associate Professor, Researcher, Programme Director
Jeffrey Vincent, Professor, Senior Advisor
Brian Walker, PhD, Programme Director
Aart de Zeeuw, Professor, Programme Director

Visiting scientists

Jim Wilen, Professor, University of California, Davis, 13-23 September 2013; 15-22 January 2014; and 11-21 May, 2014

Rawadee Jarungrattanapong, PhD, Mäler Scholar, 22-31 October 2013
Yannick Mahrane, Centre Koyré d'Hist. des Sciences et Techniques, 25-30 November 2013
Eric Naevdal, PhD, Oslo University, 8-9 January 2014
Larry Karp, Professor, University of California Berkeley, 23-24 January 2014
Matias Piaggio, PhD, Mäler Scholar, 25 January-6 June 2014
Xiangping Liu, PhD, Gothenburg University, 24-26 February 2014
Dieter Grass, PhD, Vienna University of Technology, 26 April-13 May 2014
Saudamini Das, Associate Professor, Institute of Economic Growth, India, 25 May-1 June 2014
Timon McPhearson, Assistant Professor, The New School, New York, 15 May-30 June 2014

Administration

Office location

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.

Organisation

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.



Sofia-Kristin Kokinelis

Sofia-Kristin is Finance and HR Administrator for both the Beijer Institute and Global Economic Dynamics and the

Biosphere Programme (GEDB). More specifically, she is responsible for accounting issues and budgeting and provides support and financial information to researchers about their projects. She also prepares staff contracts and assists staff members with different issues.



Christina Leijonhufvud

Christina was responsible for the administration of the Board and Askö meetings in September 2013. In October, she co-ordinated a planning meeting in Cape Town for a joint Sida application with Gothenburg University. She organised the workshop *Natural Capital & Resilience: Frontiers in Research, Tools, Policy and Practice* on 3-6 February 2014 and *The Economics of Complex Systems* on 28-29 April. Furthermore, she helped organise the workshop on *Emerging Linkages between Neuroscience, Environmental Behaviour and Policy* on 2-4 June, and the course on *Applied Methods Related to Regime Shifts in Social-Ecological Systems* in Istanbul on 27-28 June. She is responsible for administration of the Mäler Scholarships and other guest research posts.



Agneta Sundin

Agneta is communications officer, now dividing her part-time employment between the Beijer Institute and its partner, the Global Economic Dynamics and the Biosphere Programme (GEDB) of the Academy, working 40% of a full-time post for each institution. In September 2013, she handed over her former duties as Finance Administrator to Sofia-Kristin Kokinelis. Agneta's responsibilities include developing and editing the website, the annual report and administering the Beijer publication series, as well as taking part in organising workshops and other events. A member of Stockholm Resilience Centre

(SRC) Communications team, Agneta is involved in activities arranged jointly by SRC, Beijer and Albaeco, for example the Stockholm Seminars series. Among other things, she co-organised two half-day seminars: *Our future in the Anthropocene* in November 2013 and *Freedom of Choice – How a gentle nudge can change our behaviour* in April 2014, for both of which she was also moderator, and the workshop *Emerging Linkages between Neuroscience, Environmental Behaviour and Policy* on 2-4 June.

Funding

Core funding for the Beijer Institute is provided by the Kjell and Märta Beijer Foundation, founded in 1974 through a donation from Kjell and Märta Beijer. The Foundation's purpose is to support research and education, as well as supporting culture, especially design and interior decoration, but also music and literature. The Beijer Institute is its single largest beneficiary, but the Kjell and Märta Beijer Foundation also makes large donations to research in genetic science, neuroscience and pharmaceutical research at Uppsala University and dairy cattle research at the Swedish University of Agricultural Studies.

Kjell Beijer was a Swedish business man who met his wife Märta when she was working in the furniture and design store Svenskt Tenn in Stockholm, which is renowned for classical designs and high quality. This store was later bought by the Kjell and Märta Beijer Foundation and the profits go to the Foundation.

Funding for the Beijer Institute's research activities between 1 July 2013 and 30 June 2014 was also provided by:

- » The Canadian International Development Research Centre, IDRC
- » The Crafoord Foundation
- » The European Association of Environmental and Resource Economics, EAERE
- » The European Commission
- » The Ebba and Sven Schwartz Foundation
- » The Foundation for Strategic Environmental Research, MISTRA
- » The French Agricultural Research Centre for International Development, CIRAD
- » The Riksbankens Jubileumsfond, The Swedish Foundation for Humanities and Social 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 Beijer Institute organises international workshops and seminars.

Courses given by the Beijer Institute in the past year are listed under 'Education' earlier in this report.

The Stockholm Seminars: Frontiers in Sustainability Science and Policy

The Stockholm Seminars are arranged by the Beijer Institute, Stockholm Environment Institute, IGBP 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 attended by a large audience, including scientists, students, media and policy-makers in the public and private sector.

Between July 2013 and June 2014, the following seminars were held:

2013

- » **23 September:** Dr. Michael Raupach *Resilience and vulnerability in the coupled carbon-climate-human system*
- » **27 September:** Prof. Bina Agarwal *Gender and forest governance: Does women's presence make a difference?*
- » **3 October:** Prof. Mike Elliot *Bottlenecks, showstoppers and train wrecks - How can we manage the seas and estuaries?*
- » **11 October:** Mr. Paul Holthus *Science-industry collaboration for solutions to sustainable seas*

2014

- » **31 January:** Dr. Greg Ayers *Environmental observations for environmental intelligence*

- » **21 March:** Prof. Steve Evans *Where does industry fit into a sustainable future?*
- » **1 April:** Dr. Stuart Kininmonth *Reefs in peril: understanding the plight of the world's coastal treasures*
- » **24 April:** Mr. Han Qunli *Post-2015: the new research agenda of UNESCO's Man and the Biosphere Programme*

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 proved 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 2013 was *Geoen-gineering, Thresholds and the Anthropocene*. This meeting and the publication derived from it are described more closely earlier in this report.

Staff members' publications and activities

STAFF members' research activities are presented at events such as conferences, workshops and seminars. To stimulate interaction between staff at the Beijer Institute and Stockholm Resilience Centre, joint seminars take place regularly. Below is a selection of staff members' publications and activities during 2013/2014.



Erik Andersson
PhD, researcher

Research focus

Functional landscapes and the spatial and mental framework that influences human interactions with nature. On a more theoretical level, this includes the spatial reality of ecosystem service generation, not least of cultural ecosystem services, landscape management and resilience, and the use of functional profiling to characterise and assess multifunctional landscapes.

Publications during the period

- » Andersson, E., S. Barthel, S. Borgström, J. Colding, T. Elmqvist, C. Folke, and Å. Green. 2014. Reconnecting cities to the biosphere: stewardship of green infrastructure and urban ecosystem services. *Ambio* 43(4):445–453.
- » Andersson, E., and J. Colding. 2014. Understanding how built urban form influences biodiversity. *Urban Forestry & Urban Greening* 13(2):221–226.
- » Gomez-Baggethun, E., Å. Gren, D. Barton, T. McPhearson, P. O'Farrell, E. Andersson, Z. Hampstead, and P. Kremer. 2013. Urban ecosystem services. In: Elmqvist, T. et al. (eds.). *Urbanization, Biodiversity, and Ecosystem Services: Challenges and Opportunities*. Springer Open. Pp. 175–251.
- » Haase, D., N. Larondelle, E. Andersson, M. Artmann, S. Borgström, J. Breuste, E. Gomez-Baggethun, Å. Gren, Z. Hampstead, R. Hansen, N. Kabisch, P. Kremer, J. Lange-meyer, E. L. Rall, T. McPhearson, S. Pauleit, S. Qureshi, N. Schwarz, A. Voigt, D. Wurster, and T. Elmqvist. 2014. A quantitative review of urban ecosystem service assessments: concepts, models, and implementation. *Ambio* 43(4):413–433.

Conferences, workshops and presentations

- » Mini-symposium: Insect Diversity of Grassland Habitats, Helsinki, Finland, August 2013. Presentation/public lecture: *Pollinator landscapes: support for food production in and near cities*.
- » Study day for co-operation on green wedges – related to ecosystem services, access and barriers. (Studiedag för grönkilssamverkan inom Rösjö-, Angarn- och Bogesundskilarna – tema ekosystemtjänster, tillgänglighet och barriärer), Upplands-Väsby, Sweden, September 2013. Presentation.

- » SURE-1st Congress of the Society for Urban Ecology, Berlin, Germany, July 2013. Presentation and session chair: *What does it take to ensure generation of and access to ecosystem services?*
- » Urban Productivity and Resilience: A Case for Global Sustainable Development Goals (SDGs), Potsdam, Germany, October 2013. Panellist.
- » Framtidsveckan, Värmdö, Sweden, September 2013. Public lecture: *Vad är ekosystemtjänster för något? (What are ecosystem services?)*.
- » Training session organised by ICLEI, Barcelona, Spain, November 2013. Presentation and panellist.
- » Ekosystemtjänster av urban grönska, Gothenburg, Sweden, November 2013. Presentation and Panellist: *Biologisk mångfald och ekosystemtjänster för städer – Urbes*.
- » Visit (workshop) from University of Tokyo, Stockholm, December 2013. Organiser.

Teaching and training

- » Lecturer, undergraduate course *Hållbar samhällsutveckling (Sustainable Societal Development)*, Department of Physical Geography and Quaternary Geology, Stockholm University, autumn 2013.
- » Lecturer, Master's level course *Ecology and Management of Urban Green Space*, Helsinki University, Finland, *Biodiversity ab*, autumn 2013.
- » Co-supervisor of PhD student Julie Goodness (Stockholm Resilience Centre, Stockholm University) and main supervisor (together with Åsa Gren) of Master's student Felicia Sjösten, ITM, Stockholm University.



Johan Colding
Associate Professor, researcher

Research focus

Urban social-ecological systems.

Publications during the period

- » Andersson, E., S. Barthel, S. Borgström, J. Colding, T. Elmqvist, C. Folke, and Å. Green. 2014. Reconnecting cities to the biosphere: stewardship of green infrastructure and urban ecosystem services. *Ambio* 43(4):445–453.
- » Andersson, E., and J. Colding. 2014. Understanding how built urban form influences biodiversity. *Urban Forestry & Urban Greening* 13(2):221–226.
- » Barthel, S., J. Colding, H. Erixon, S. Grahn, C. Kärsten, L. Marcus, J. Torsvall. 2013. Principles of *Social-Ecological Urbanism - Case Study: Albano Campus, Stockholm*. Tri-ta-ARK Forskningspublikationer 2013:3.
- » Colding, J. 2013. Revisiting the Stockholm Urban Assessment. In: Elmqvist, T. et al. (eds.). *Urbanization, Biodiversity, and Ecosystem Services: Challenges and Opportunities*.

Springer Open. Pp. 313-336.

- » 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* 23(5):1039-1051.
- » Colding, J. 2014. Resilience practice: Building capacity to absorb disturbance and maintain function. Review. *Ecological Restoration* 32:214-215
- » Kronenberg, J., A. Tezer, D. Haase, and J. Colding. 2013. Regional assessment of Europe. In: Elmqvist, T. et al. (eds.). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Springer Open. Pp. 275-278.

Conferences, workshops and presentations

- » Study day for co-operation on green wedges – related to ecosystem services, access and barriers. (Studiedag för grönilssamverkan inom Rösjö-, Angarn- och Bogesundskilarna – tema ekosystemtjänster, tillgänglighet och barriärer), Upplands-Väsby, Sweden, September 2013. Presentation.
- » Seminar on ecosystem services, RUS (Regional Utveckling och Samverkan i Miljömålssystemet), the County administrative boards and the Swedish forest agency, Stockholm, November 2013. Presentation: *Ekosystemtjänster i Stockholmsregionen (Ecosystem services in the Stockholm region)*.
- » Utomhus-Miljö 2013, conference, Stockholm, November 2013. Presentation: *Ekosystemtjänster och Grön Planering i Staden (Ecosystem services and urban planning)*.
- » Breakfast seminar, Upplands-Väsby municipality, Sweden, April 2014. Presentation of research insights: *Ekosystemtjänster och Grön Planering i en Vaxande Stockholmsregion (Ecosystem services and green urban planning)*.
- » Workshop, Planning compact, low traffic, green cities, SEED, KTH, Stockholm, May 2014. Participant.

Teaching and training

- » Lecturer, undergraduate course *Hållbar samhällsutveckling* (Sustainable Societal Development), Department of Physical Geography and Quaternary Geology, Stockholm University, autumn 2013.
- » Co-supervisor of PhD student Caroline Schill (Stockholm Resilience Centre, Stockholm University).

Commissions

- » Council member, the city planning group for Albano sustainable campus, Stockholm, since 2010.
- » Examiner of Master's thesis by Nikolina Oreskovic, Stockholm Resilience Centre, Stockholm University, November 2013.
- » Consultation and expert opinion on Stockholm Regional Development Plan RUF 2010 (regarding applicability and relevance), Office for Regional Growth, Environment, and Regional Planning, Stockholm County Council, December 2013.

Other

International media coverage: Turtles flourishing in golf course ponds. *National Geographic Daily News*. July 9, 2013. Interview with J. Colding as part of a special National Geographic News series on global water issues. Available at: <http://news.nationalgeographic.com/news/2013/07/130710-golf-courses-turtle-habitat-eco-friendly-environment/>



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 emphasis on interactions between ecology and economics.

Publications during the period

- » Barrett, S., T. M. Lenton, A. Millner, A. Tavoni, S. Carpenter, J. M. Anderies, F. S. Chapin III, A.-S. Crépin, G. Daily, P. R. Ehrlich, C. Folke, V. Galaz, T. P. Hughes, N. Kautsky, E. Lambin, R. Naylor, K. Nyborg, S. Polasky, M. Scheffer, J. Wilen, A. Xepapadeas, and A. de Zeeuw. 2014. Climate engineering reconsidered. *Nature Climate Change* 4:527-529.
- » Das, S., and A.-S. Crépin. 2013. Mangroves can provide protection against wind damage during storms. *Estuarine, Coastal and Shelf Science* 134:98-107.
- » Lindahl, T., A.-S. Crépin, and C. Schill. 2014. Beijer Discussion Paper 244: Potential disasters can turn the tragedy into success. *Beijer Discussion Paper Series*.

Reports

- » Cornell, S. E., B. C. Forbes, D. McLennan, U. Molau, M. Nuttall, P. Overduin, P. Wassman, E. Carmack, A.-S. Crépin, T. Heleniak, E. Jeppesen, M. Johansson, T. Jorgenson, T. Koivurova, A.E. Nilsson, R.O. Rasmussen, and O. Young. 2013. Thresholds in the Arctic. In: Nilsson, A., K. Axelsson, M. Carson, S. E. Cornell, U. Molau, and C. Wilkinson (eds.). *Arctic Resilience - Interim Report 2013*. Stockholm Environment Institute/Arctic Council. Sweden. Pp. 36-70.
- » Crépin, A.-S., S. Petrick, E. Morgenroth, M. André, A. Eide, Ø. Hermansen, J. Isaksen, T. Lindahl, A. Stammli-Gossman, and M. Troell. 2014. *Indicators for Sustainable Development in the Arctic Fisheries Sector*. Deliverable D3.71 of the European Union FP7 (project no. 265863), Arctic Climate Change Economy and Society.

Conferences, workshops and presentations

- » Askö 2013 meeting on Geoengineering, Askö and KVA, Stockholm, September 2013. Participant.
- » ACCESS General Assembly, Cambridge, UK, March 2014. Participant.
- » Seminar, Department of Economics, University of Umeå, October 2013, Keynote speaker: *An experimental programme to assess human behaviour under conditions of collective action and potential regime shifts*.
- » The Economics of Complex Systems workshop, Beijer Institute, Stockholm, April 2014. Presentation of paper: *Price vs. quantity for complex ecosystems: Dealing with non-convexities*.
- » Behaviour, Economics and Nature Network (BENN) workshop *Emerging Linkages Between Neuroscience, Environmental Behaviour, and Policy*, Beijer Institute, Stockholm, June 2014.

- » 5th World Congress of Environmental and Resource Economists (WCERE), Istanbul, Turkey, June 2014. Organiser and presentation: *Some empirical methods for studying regime shifts*.
- » Dialogue on the OECD's Environmental Performance Review of Sweden, Swedish Ministry of the Environment, Rosenbad, Stockholm, June 2014. Panellist.

Teaching and training

- » Course leader and lecturer, *Master's level course Governance and Management of Social-Ecological Systems: Challenges for Environmental Decision Making*, Stockholm Resilience Centre, Stockholm University, spring 2014.
- » Course leader and lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2014.
- » Co-supervisor of PhD student Caroline Schill (Stockholm Resilience Centre, Stockholm University).
- » Lecturer, PhD course *Applied Methods to Regime Shifts in Social-ecological Systems*, pre-conference course at 5th WCERE, organised by the Beijer institute, Istanbul, Turkey, June 2014.

Commissions

- » Scientific Committee member, Resilience 2014 conference, Montpellier, France, 2013-2014.
- » Scientific Committee member, 2014 EAERE conference, Istanbul, Turkey, June 2014.
- » Steering Committee member, ACCESS, EU FP7 research programme coordinated by University Pierre et Marie Curie, Paris, France, 2011-2015.
- » Theme leader, Global Dynamics, Stockholm Resilience Centre, Stockholm University, since 2010.
- » Reviewer for several journals.



Gretchen Cara Daily
Visiting Professor

Research focus

Work oriented around three broad questions: i) Given the projected intensification of human impacts on the biosphere, the kinds of species and ecosystems that will exist over the coming decades and centuries; ii) the critical species that most merit protection from scientific and societal standpoints; and iii) strategies to effect the deep, global transformation needed to bring human impacts into balance with what the biosphere can sustain.

At the Royal Swedish Academy of Sciences, work to integrate knowledge on system dynamics and resilience into the Natural Capital Project's tools and approaches, from biophysical, social and governance perspectives.

Publications during the period

- » Barrett, S., T. M. Lenton, A. Millner, A. Tavoni, S. Carpenter, J. M. Anderies, F. S. Chapin III, A.-S. Crépin, G. Daily, P. R. Ehrlich, C. Folke, V. Galaz, T. P. Hughes, N. Kautsky,

- E. Lambin, R. Naylor, K. Nyborg, S. Polasky, M. Scheffer, J. Wilen, A. Xepapadeas, and A. de Zeeuw. 2014. Climate engineering reconsidered. *Nature Climate Change* 4:527-529.
- » Karp, D. S., C. D. Mendenhall, R. F. Sandí, P. R. Ehrlich, E. A. Hadly, and G. C. Daily. 2013. Forest bolsters birds, pest control, and coffee yield. *Ecology Letters* 16(11):1339-1347.
- » Karp, D. S., and G. C. Daily. 2014. Cascading effects of insectivorous birds and bats in tropical coffee plantations. *Ecology* 95(4):1065-1074.
- » Liang, Y., S. Li, J. Li, M. W. Feldman, and G. C. Daily. *Sustainable Livelihoods and Development in Rural China: A Microeconomic Perspective*. Social Sciences Academic Press, Beijing. In press.
- » Mendenhall, C. D., L. Frishkoff, G. Santos-Barrera, J. Pacheco, E. Mesfun, F. Mendoza Quijano, P. R. Ehrlich, G. Ceballos, G. C. Daily, and R. M. Pringle. 2014. Countryside biogeography of a neotropical herpetofauna. *Ecology* 95: 856-870.
- » Mendenhall, C. D., D. S. Karp, C. F. J. Meyer, E. A. Hadly, and G. C. Daily. 2014. Predicting biodiversity change and averting collapse in agricultural landscapes. *Nature* 509:213-217.
- » Miller, A. E., B. J. Brosi, K. Magnacca, G. C. Daily, and L. Pejchar. Pollen carried by native and non-native bees in large-scale forest restoration in Hawai'i: implications for pollination. *Pacific Science*. In press.
- » Ruckelshaus, M., E. McKenzie, H. Tallis, A. Guerry, G. C. Daily, P. Kareiva, S. Polasky, T. Ricketts, N. Bhagabati, S. Wood, and J. Bernhardt. Notes from the field: Lessons learned from using ecosystem services to inform real-world decisions. *Ecological Economics*. In press.
- » Zheng, H., B. E. Robinson, Y. Liang, S. Polasky, D.-C. Ma, F.-C. Wang, M. Ruckelshaus, Z. Ouyang, and G. C. Daily. 2013. The benefits, costs, and livelihood implications of a regional PES (Payment for Ecosystem Service) program. *PNAS* 110(41):16681-16686.

Conferences, workshops and presentations

- » Stockholm Water Week – Symposium by the CGIAR, Stockholm, September 2013. Keynote presentation: *Mainstreaming ecosystem services into decision-making*.
- » Sweden Green Building Conference, Kistamässan, Stockholm, September 2013. Keynote presentation: *Valuing nature in real-world decisions*.
- » Volvo Research Days, Eskilstuna, Sweden, September 2013. Keynote presentation: *Investing in natural capital for sustainable cities*.
- » Canopy Palo Alto, California, USA, September 2013. Keynote presentation: *The power of trees*.
- » Unilever, Milton Keynes, UK, October 2013. Keynote presentation: *Ecosystem services and resilience: An overview*.
- » The Humanitas Inaugural Lectureship, Cambridge University, UK, October 2013. Four keynote presentations: *Mainstreaming Natural Capital into Decision-Making*, *Frontiers in Research and Policy*, *Nature's Competing Values*, and *Feeding the World and Security Biodiversity*.
- » KSLA, KVA, Stockholm, November 2013. Keynote presentation: *Harmonizing people and nature: a new business model*.
- » US Department of Defense, Washington, D.C., USA, November 2013. Keynote presentation: *Mainstreaming Natural Capital into Government Agencies*.
- » Naturskyddsforeningen (Nature Conservation Agency),

Stockholm, November 2013. Keynote presentation: *Valuing nature in real-world decisions*.

- » World-Wide Fund for Nature, Ulriksdal, Sweden, November 2013. Keynote presentation: *Integrating ecosystem services into conservation*.
- » The Nature Conservancy All Science Meeting, San Jose, CA, USA, December 2013. Moderator of keynote session *Smart Infrastructure Investment*.
- » Stockholm Resilience Centre and Natural Capital Project workshop, Stockholm, February 2014. Organiser and opening speaker: *Where we've come from and the opportunity ahead*.
- » Natural Capital Project Annual Meeting, Stanford, USA, March 2014. Host and speaker.
- » Meeting of the Papal Academies of Social and Natural Sciences, Vatican City, Italy, April 2014. Speaker: *Valuing nature in decisions*.
- » Design meeting for the Natural Capital and Resilience Platform, Stockholm, June 2014. Organiser.
- » Cambridge University, Cambridge, UK, June 2014. Speaker: *The Earth Genome project*.

Teaching and training

- » Main supervisor of PhD students Luke Frishkoff, Danny Karp and Chase Mendenhall (Biology, Stanford University, USA).
- » Co-supervisor of PhD students Rachelle Gould and Greg Bratman (Interdisciplinary Program in Environment and Resources, Stanford University, USA) and Maike Hamman (Stockholm University, Stockholm University). Co-supervisor of Master's student Matilda Lenell, (Stockholm Resilience Centre, Stockholm University).

Commissions

- » Board Member, Stockholm Resilience Centre, Sweden, since 2012.
- » Board Member, The Nature Conservancy, Arlington, VA, USA, since 2006.
- » Steering Committee Member, CGIAR – Water, Land and Ecosystems, since 2012.



Gustav Engström
PhD, researcher

Research focus

Macroeconomic models of climate change, particularly integrating climate models developed by climate scientists with models of optimal economic growth. Recent interests include the tipping points of the climate system and aspects of income distribution related to climate policy. Other research activities involve urban economic and ecological issues and how these can be addressed using a housing sales database.

Publications during the period

- » Brock, W. A., G. Engström, D. Grass, and A. Xepapadeas. 2013. Energy balance climate models and the spatial

structure of optimal mitigation policies. *Journal of Economic Dynamics and Control* 37(12):2371–2396.

- » Brock, W. A., G. Engström, and A. Xepapadeas. 2014. Spatial climate-economic models in the design of optimal climate policies across locations. *European Economic Review* 69:78–103.
- » Norström, A. V., M. Metian, M. Schlüter, L. Schultz, A. Dannenberg, G. McCarney, M. Milkoreit, F. Diekert, G. Engström, J. Gars, M. Sanctuary, R. Fishman, E. Kyriakopoulou, M. Sjöstedt, V. Manoussi, K. Meng, and M. Schoon. 2013. Social change vital to sustainability goals. *Nature Correspondence* 498:299.
- » Norström, A. V., A. Dannenberg, G. McCarney, M. Milkoreit, F. Diekert, G. Engström, R. Fishman, J. Gars, E. Kyriakopoulou, V. Manoussi, K. Meng, M. Metian, M. Sanctuary, M. Schlüter, M. Schoon, L. Schultz, and M. Sjöstedt. 2014. Three necessary conditions for establishing effective sustainable development goals in the Anthropocene. *Ecology and Society*. In press.
- » William A. Brock, G. Engström, and A. Xepapadeas. Energy balance climate models, damage reservoirs and the time profile of climate change policy. In: Bernard, L., and W. Semmler (eds.). *The Oxford Handbook of the Macroeconomics of Global Warming*. Oxford University Press, New York, USA. In press.

Conferences, workshops and presentations

- » ACCESS General Assembly, Cambridge, UK, March 2014. Presentation: *Ecosystem-based management as a tool for sustainable development in the Arctic under climate change*.
- » Seminar, Department of Economics, University of Gothenburg, Sweden, May 2014. Presentation of paper: *Optimal extraction of a non-renewable resource in a climate-economy growth model with potential regime shifts*.
- » The Economics of Complex Systems workshop, Beijer Institute, KVA, Stockholm, April 2014. Presentation: *Optimal extraction of a non-renewable resource in a climate-economy growth model with potential regime shifts*.
- » 5th World Congress of Environmental and Resource Economists (WCERE), Istanbul, Turkey, June 2014. Presentation: *Structural and climatic change*.

Teaching and training

- » Lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Ecosystem Support for Humanity*, Stockholm Resilience Centre, Stockholm University, autumn 2013.
- » Lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Challenges for Environmental Decision Making*, Stockholm Resilience Centre, Stockholm University, spring 2014.
- » Lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2014.



Carl Folke

Professor, Director

Research focus

Social-ecological systems, resilience thinking, life-supporting ecosystems and stewardship of ecosystem services in a global context, transformations reconnecting development to the biosphere.

Publications during the period

- » Andersson, E., S. Barthel, S. Borgström, J. Colding, T. Elmqvist, C. Folke, and Å. Green. 2014. Reconnecting cities to the biosphere: stewardship of green infrastructure and urban ecosystem services. *Ambio* 43(4):445–453.
- » Barrett, S., T. M. Lenton, A. Millner, A. Tavoni, S. Carpenter, J. M. Anderies, F. S. Chapin III, A.-S. Crépin, G. Daily, P. R. Ehrlich, C. Folke, V. Galaz, T. P. Hughes, N. Kautsky, E. Lambin, R. Naylor, K. Nyborg, S. Polasky, M. Scheffer, J. Wilen, A. Xepapadeas, and A. de Zeeuw. 2014. Climate engineering reconsidered. *Nature Climate Change* 4:527–529.
- » Barthel, S., J. Parker, C. Folke, and J. Colding. 2013. Urban gardens: pockets of social-ecological memory. In: Tidball, K., and M. Krasny (eds.). *Greening in the Red Zone: Disaster, Resilience and Community Greening*. Springer, Dordrecht, Netherlands. Pp. 145–158.
- » Bennett, E. M., S. R. Carpenter, L. J. Gordon, N. Ramankutty, P. Balvanera, B. Campbell, W. Cramer, J. Foley, C. Folke, L. Karlberg, J. Liu, H. Lotze-Campen, N. D. Mueller, G. D. Peterson, S. Polasky, J. Rockström, R. J. Scholes, and M. Spirenborg. Toward a more resilient agriculture. *Solutions*. In press.
- » Ebbesson, J., and C. Folke. 2014. Matching scales of law with social-ecological contexts to promote resilience. In: Garmestani, A., and C. Allen (eds.). *Social-Ecological Resilience and Law*. Columbia University Press, New York, USA. Pp. 265–292.
- » Elmqvist, T., M. Fragkias, J. Goodness, B. Güneralp, P. J. Marcotullio, R. I. McDonald, S. Parnell, M. Schewenius, M. Sendstad, K. Seto, C. Wilkinson, M. Alberti, C. Folke, D. Haase, M. Katti, J. Niemelä, K. Tidball, H. Nagendra, S. Pickett, and C. Redman. 2013. Stewardship of the biosphere in the urban era. In: Elmqvist, T., et al. (eds.). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Springer, New York, USA. Pp. 719–746.
- » Folke, C., and L. Hall. 2014. *Reflections On People and the Biosphere (Speglingar Om Människan och Biosfären)*. Bokförlaget Langenskiöld, Stockholm, Sweden.
- » Folke, C. Forword. In: Biggs, R., M. Schlüter, and M. L. Schoon (eds.). *Principles for Building Resilience: Sustaining Ecosystem Services in Social-Ecological Systems*. Cambridge University Press, Cambridge, UK. In press.
- » Kotschy, K., R. Biggs, T. Daw, C. Folke, and P. West. Maintain diversity and redundancy. In: Biggs, R., M. Schlüter, and M. L. Schoon (eds.). *Principles for Building Resilience: Sustaining Ecosystem Services in Social-Ecological Systems*. Cambridge University Press, Cambridge, UK. In press.
- » Österblom, H., A. Merrie, M. Metian, W. J. Boonstra, T. Blenckner, J. R. Watson, R. R. Rykaczewski, Y. Ota, J. L. Sarmiento, V. Christensen, S. Birnbaum, B. Gustavsson, C. Humborg, C.-M. Mörrth, B. Müller-Karulis, M. Schlüter, M. T. Tomczak, M. Troell, and C. Folke. 2013. Modeling social-ecological scenarios in marine systems. *BioScience* 63:735–744.
- » Österblom, H., and C. Folke. Globalization, marine regime shifts and the Soviet Union. *Philosophical Transactions of the Royal Society London, Biological Sciences*. In press.
- » Queiroz, C., R. Beilin, C. Folke, and R. Lindborg. 2014. Farmland abandonment: threat or opportunity for biodiversity conservation? A global review. *Frontiers in Ecology and the Environment* 12:288–296.
- » Rockström, J., M. Falkenmark, C. Folke, M. Lannerstad, J. Barron, E. Enfors, L. Gordon, J. Heinke, H. Hoff, and C. Pahl-Wostl. 2014. *Water Resilience for Human Prosperity*. Cambridge University Press, Cambridge, UK.
- » Von Heland, J., and C. Folke. 2014. A social contract with the ancestors: culture and ecosystem services in Southern Madagascar. *Global Environmental Change* 24:251–264.
- » Westley, F., O. Tjörnbo, L. Schultz, P. Olsson, C. Folke, B. Crona, and Ö. Bodin. 2013. A theory of transformative agency in linked social-ecological systems. *Ecology and Society* 18(3):27.

Conferences, workshops and presentations

- » PECS workshop, Vår Gård, Saltsjöbaden, Sweden, September 2013. Host and participant.
- » Sustainability Science: Promoting Integration and Cooperation. UNU, IR3S, ICSS, UNESCO, Paris, September 2013. Keynote speaker: *Sustainability Science: Integrating Resilience, Adaptability and Transformability*.
- » Askö 2013 meeting on Geoengineering, Askö and KVA, Stockholm, September 2013.
- » Global Economic Dynamics and the Biosphere research visioning workshop, Stockholm, September 2013. Speaker and co-organiser.
- » NorMer and GreenMar, Reykjavik, Iceland, September 2013.
- » Preparation for the Dramaten event The King of Sweden 40 years on the throne, Museum of Ethnography, Stockholm, September 2013. Presentation: *Människan och Biosfären (Humanity and the Biosphere)* and ArtScience dialogue with Marie-Louise Ekman.
- » Theme-leader workshop, Stockholm Resilience Centre, October 2013. Co-organiser.
- » Cross-scale workshop, Stockholm Resilience Centre, October 2013.
- » Ebba and Sven Schwartz Foundation, Stockholm, October and November 2013, March 2014.
- » Grönt ljus på konsten (Green Light on Arts), Konst och vetenskap (Art and Science), Stockholm municipality, Liljevalchs, Stockholm, November 2013. Presentation: *Återkoppla till Biosfären (Reconnect to the biosphere)*.
- » Social-ecological resilience for human wellbeing in the Anthropocene, full day meeting with Crown Princess Victoria, Stockholm Resilience Centre, November 2013.
- » Our Future in the Anthropocene, Royal Swedish Academy of Sciences, Beijer Institute, SRC, and Volvo Environment

Prize, Stockholm, November 2013. Organiser.

- » Presentation of the installation Reconnecting with the Ark, SARA(S)², Maldonado, Uruguay, December 2013.
- » University of Maldonado, Uruguay, December 2013. Public lecture: *Reconnecting to the biosphere*.
- » SARAS Board and ArtScience meeting, Maldonado, Uruguay, December 2013.
- » Natural Capital and Resilience Workshop, Stanford, Beijer, SRC, KVA, Stockholm, February 2014. Co-organiser.
- » The Economics of Complex Systems Workshop, Beijer Institute, Stockholm, April 2014. Introductory presentation.
- » PECS workshop, Moureze, France, May 2014. Participant and presentation: *The history and legacy of PECS*.
- » Resilience and Development: Mobilizing for Transformation, Resilience 2014 conference, Montpellier, France, May 2014. Participant in two panels.
- » Resilience Alliance Science Meeting, Montpellier, France, May 2014. Participant.
- » Speed Talks, SRC, Stockholm, March 2014: Reflections – on people and the biosphere and May 2014: *Contagious Exploitation of Marine Resources*.
- » EAT Food Forum, Stockholm, May 2014. Participant and chair of competence forum EAT Science.
- » Breaking the Silos: Towards an Integrative Research Agenda on the Health and Sustainability Dimensions of Food, EAT Science Workshop, Stockholm, May 2014. Presentation: *The Anthropocene challenge*.
- » Behaviour, Economics and Nature Network (BENN) workshop *Emerging Linkages Between Neuroscience, Environmental Behaviour, and Policy*, Beijer Institute, Stockholm, June 2014.
- » Release of the ArtScience book *Reflections On People and the Biosphere*, KVA, Stockholm, June 2014. Presentation.

Teaching and training

- » Lecturer in undergraduate and Master's level courses at Stockholm University.
- » Co-supervisor of one PhD student in Sustainability Science, Stockholm Resilience Centre, Stockholm University.

Commissions

- » Director of Science and Founder, Stockholm Resilience Centre, since 2007.
- » Director, the Erling-Persson Family Academy Programme on Global Economic Dynamics and the Biosphere since 2012.
- » Director, Programme on Ecosystem Change and Society (PECS), Future Earth/ICSU, since 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 of the Royal Swedish Academy of Sciences, since 2003.
- » Editor-in-Chief, *Ecology and Society*, since 2002.
- » Advisory and Editorial Board member: *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, The Synergy programme on resilience and critical transitions (SparcS), Wageningen, The Netherlands, since 2012.
- » Scientific Advisory Board member, SARAS (South American Institute for Resilience and Sustainability Studies), Montevideo, Uruguay, since 2007.
- » Scientific Advisory Board member, STEPS, University of Sussex, Brighton, UK, since 2010.
- » Member of the International Scientific Advisory Council, The Waterloo Institute for Complexity and Innovation (WICI), University of Waterloo, Canada, since 2012.
- » Scientific Advisory Board member, Swedish Secretariat for Environmental Earth System Sciences (SSEESS), since 2010.
- » Advisory Board member, EAT Forum, since 2013.
- » Advisory Board member, The International Network of Research on Coupled Human and Natural Systems (CHANS-Net), since 2009.
- » Associate Faculty member, Earth System Governance Project, Future Earth, since 2009.
- » Board member, UNU Institute for the Advanced Study of Sustainability, Tokyo, Japan, since 2014.
- » Board member, Stockholm Environment Institute, 2004-2013.
- » Scientific Committee member, Volvo Environment Prize, since 2008, chair since 2012.
- » Selection Committee member, The Kenneth Boulding Award, International Society for Ecological Economics, since 2013.
- » Co-principal investigator of the Centre of Excellence research project: *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).
- » 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, BEAM (Baltic Ecosystem Adaptive Management), Stockholm University.
- » Scientific Committee member, Resilience 2014 conference, Montpellier, France, 2013-2014.

**Åsa Gren**

PhD, researcher

Research focus

Sustainable development through quantification and valuation of ecosystem services and the importance of biodiversity for building resilience, especially in an urban landscape context. More recently, operationalising the concept of resilience through the use of functional and response diversity and implementation of the ecosystem service perspective into urban planning and design.

Publications during the period

- » Andersson, E., S. Barthel, S. Borgström, J. Colding, T. Elmqvist, C. Folke, and Å. Green. 2014. Reconnecting cities to the biosphere: stewardship of green infrastructure and urban ecosystem services. *Ambio* 43(4):445–453.
- » Gomez-Baggethun, E., Å. Gren, D. Barton, T. McPhearson, P. O'Farrell, E. Andersson, Z. Hampstead, and P. Kremer. 2013. Urban ecosystem services. In: Elmqvist, T. et al. (eds.). *Urbanization, Biodiversity, and Ecosystem Services: Challenges and Opportunities*. Springer Open. Pp. 175–251.
- » Haase, D., N. Larondelle, E. Andersson, M. Artmann, S. Borgström, J. Breuste, E. Gomez-Baggethun, Å. Gren, Z. Hamstead, R. Hansen, N. Kabisch, P. Kremer, J. Lange-meyer, E. L. Rall, T. McPhearson, S. Pauleit, S. Qureshi, N. Schwarz, A. Voigt, D. Wurster, and T. Elmqvist. 2014. A quantitative review of urban ecosystem service assessments: Concepts, models, and implementation. *Ambio* 43(4):413–433.

Conferences, workshops and presentations

- » Seminar on ecosystem services, RUS (Regional Utveckling och Samverkan i Miljömålssystemet), the County administrative boards and the Swedish forest agency, Stockholm, November 2013. Presentation: *Ekosystemtjänster i Stockholmsregionen (Ecosystem services in the Stockholm region)*.
- » ACCESS General Assembly, Cambridge, UK, March 2014. Presentation: *Ecosystem-based management as a tool for sustainable development in the Arctic under climate change*.
- » Seminar: What are ecosystem services? Täby municipality, Sweden, March 2014. Keynote speaker: *What are ecosystem services in the context of sustainable municipal planning and development?*
- » URBES workshop, New York, USA, April 2014. Participant and presentation: *Update of ongoing work within the URBES project. Work on synthesis and future work*.

Teaching and training

- » Lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2014.
- » Main supervisor (together with Erik Andersson) of Master's student Felicia Sjösten, ITM, Stockholm University.

**Efthymia Kyriakopoulou**

PhD, researcher

Research focus

Urban economics, environmental policy and trade models, spatiotemporal analysis of economic models.

Publications during the period

- » Kyriakopoulou, E., and A. Xepapadeas. 2014. Beijer Discussion Paper 247: Atmospheric pollution in rapidly growing urban centers: Spatial policies and land use patterns. *Beijer Discussion Paper Series*.
- » Norström, A. V., M. Metian, M. Schlüter, L. Schultz, A. Dannenberg, G. McCarney, M. Milkoreit, F. Diekert, G. Engström, J. Gars, M. Sanctuary, R. Fishman, E. Kyriakopoulou, M. Sjöstedt, V. Manoussi, K. Meng, and M. Schoon. 2013. Social change vital to sustainability goals. *Nature Correspondence* 498:299.
- » Norström, A. V., A. Dannenberg, G. McCarney, M. Milkoreit, F. Diekert, G. Engström, R. Fishman, J. Gars, E. Kyriakopoulou, V. Manoussi, K. Meng, M. Metian, M. Sanctuary, M. Schlüter, M. Schoon, L. Schultz, and M. Sjöstedt. Three necessary conditions for establishing effective sustainable development goals in the Anthropocene. *Ecology and Society*. In press.

Conferences, workshops and presentations

- » 12th Conference on Research on Economic Theory and Econometrics, Naxos, Greece, July 2013. Presentation of paper: *Environmental Policy and the Size Distribution of Firms*.
- » International Workshop on Natural Resources, Environment, Urban Economics, International Trade and Industrial Organization, St. Petersburg, Russia, October 2013. Presentation of paper: *Environmental Policy and the Size Distribution of Firms*.
- » Environmental Economics Seminar, Paris School of Economics, France, November 2013. Invited presenter: *Spatial Policies and Land Use Patterns: Optimal and Market Allocations*.
- » Seminar, Natursvårdsverket (Swedish Environmental Protection Agency), Stockholm, January 2014. Invited presenter: *Environmental Policy in a Spatial Context*.
- » Sustainable Transport Seminar Series, Chalmers University of Technology, Gothenburg, Sweden, March 2014. Invited presenter: *Environmental Policy and Transportation*.
- » 5th World Congress of Environmental and Resource Economists (WCERE), Istanbul, Turkey, June 2014.

Teaching and training

- » Lecturer, Master's level course *Environmental and Resource Economics* (for non-economists), Department of Economics, University of Gothenburg, autumn 2013.

- » Course leader and lecturer, PhD course *Natural Resource Economics*, Beijer Institute and Gothenburg University, February–March 2014.
- » Lecturer, Master's level course *Environmental Policy Instruments*, Chalmers University of Technology, Gothenburg, spring 2014.
- » Main supervisor of Bachelor students Linus Eiderström Swahn, Elma Durakovic, Gustav Ronnert and Gustav Thungren and co-supervisor of Bachelor students Martin Andersson and Lisa Höglind, Department of Economics, University of Gothenburg.

Commissions

- » Referee for *Energy Journal*, *Environmental and Resource Economics*, *Journal of Public Economic Theory*, *Journal of Environmental Management*, *Regional Science and Urban Economics*, *Resource and Energy Economics*.



Chuan-Zhong Li
Professor, researcher

Research focus

Economic growth and the environment, green accounting and sustainability analysis, resilience research, energy economics.

Publications during the period

- » Li, C. Z., and K.-G. Löfgren. 2014. The water and diamond paradox and green NNP as a welfare indicator. *Environmental Economics* 5(2):30–36.
- » Yu, H., and C. Z. Li. 2014. Economic growth and welfare under global environmental thresholds. In: Yu, H. *Essays on Environmental and Energy Economics*. Uppsala Economic Studies 146, Uppsala University, Uppsala, Sweden (PhD thesis).

Conferences, workshops and presentations

- » Conference on China's Environmental Challenges: a Global Perspective, Shanghai, China, March 2014. Presentation of paper: *Energy structure, carbon emissions and industrial productivity in Chinese manufacturing enterprises: Evidence from firm level data*.
- » The Economics of Complex Systems Workshop, Beijer Institute, KVA, Stockholm, April 2014. Organizer and presentation of paper: *Threshold and resilience in modern fisheries management: The case of Argentinean hake fishery*.

Teaching and training

- » Supervisor of PhD student Yu Haishan (Department of Economics, Uppsala University).

Commissions

- » Director of the Board, Professional Association of China's Environment (PACE), Beijing, China, since 2013.
- » Reviewer, 5th World Congress of Environmental and Resource Economists (WCERE), Istanbul, Turkey, June 2014.



Therese Lindahl
PhD, researcher

Research focus

Behavioural aspects of natural resource management and pro-environmental behaviour, including the influence of complex ecosystem dynamics (e.g. threshold effects, uncertainty and resource interdependencies) on resource users' strategies for exploitation and cooperation and the implications for the management of common-pool resources; the exploration of alternative approaches to environmental policy that rests on psychological insights.

Publications during the period

- » Lindahl, T., A.-S. Crepin, and C. Schill. 2014. Beijer Discussion Paper 244: Potential disasters can turn the tragedy into success. *Beijer Discussion Paper Series*.
- » Lindahl, T., and B. Stikvoort. 2014. Beijer Discussion Paper 248. Nudge for environmental protection. *Beijer Discussion Paper Series*.

Conferences, workshops and presentations

- » Seminar with Cass. R. Sunstein, Freedom of Choice: How a Gentle Nudge can Change our Behaviour, Beijer Institute, Royal Swedish Academy of Sciences, Stockholm, April 2014. Organizer and presentation: *The potential for green nudges in Sweden*.
- » The Economics of Complex Systems Workshop, Beijer Institute, Stockholm, April 2014. Presentation of paper: *Regime shifts and policy - Evidence from a CPR laboratory experiment*.
- » ACCESS General Assembly, Cambridge, UK, March 2014. Participant.
- » Behaviour, Economics and Nature Network (BENN) Workshop, Emerging Linkages Between Neuroscience, Environmental Behaviour, and Policy, Beijer Institute, Stockholm, June 2014. Organizer.
- » EAT Food Forum, Stockholm, May 2014. Participant in competence forum EAT Consumer.
- » EAT science workshop, SRC, Royal Swedish Academy of Sciences, Stockholm, May 2014. Organizer.
- » 5th World Congress of Environmental and Resource Economists (WCERE), Istanbul, Turkey, June 2014. Participant.

Teaching and training

- » Lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Ecosystem Support for Humanity*, Stockholm Resilience Centre, Stockholm University, autumn 2013.
- » Lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Challenges for Environmental Decision Making*, Stockholm Resilience Centre, Stockholm University, spring 2014.
- » Lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Drama of the Commons*,

Stockholm Resilience Centre, Stockholm University, spring 2014.

- » Lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2014.
- » Lecturer, PhD course *Applied Methods to Regime Shifts in Social-ecological Systems*, pre-conference course at 5th WCERE, organised by the Beijer institute, Istanbul, Turkey, June 2014.
- » Main supervisor of PhD student Caroline Schill and of Master's student Britt Stikvoort (Stockholm Resilience Centre, Stockholm University).
- » Mentor of Mäler Scholars Rawadee Jarungrattanapong (Thailand) and Matias Piaggio (Uruguay).

Commissions

- » Managing Editor for Special Feature: Advancing the understanding of behavior in social-ecological systems: Results from lab and field experiments, *Ecology and Society*, spring 2014.
- » Reviewer for *International Journal of the Commons*, *Nature Climate Change*, *Ecological Economics*.

Other

- » Maternity leave during the period: 10%



Mark Sanctuary
PhD, researcher

Research focus

International trade and the environment.

Publications during the period

- » Norström, A. V., M. Metian, M. Schlüter, L. Schultz, A. Dannenberg, G. McCarney, M. Milkoreit, F. Diekert, G. Engström, J. Gars, M. Sanctuary, R. Fishman, E. Kyriakopoulou, M. Sjöstedt, V. Manoussi, K. Meng, and M. Schoon. 2013. Social change vital to sustainability goals. *Nature Correspondence* 498:299.
- » Norström, A. V., A. Dannenberg, G. McCarney, M. Milkoreit, F. Diekert, G. Engström, R. Fishman, J. Gars, E. Kyriakopoulou, V. Manoussi, K. Meng, M. Metian, M. Sanctuary, M. Schlüter, M. Schoon, L. Schultz, and M. Sjöstedt. 2014. Three Necessary Conditions for Establishing Effective Sustainable Development Goals in the Anthropocene. *Ecology and Society*. In press.
- » Sanctuary, M. 2013. Essays on trade and environment. Department of Economics, Stockholm University, Stockholm, Sweden (PhD thesis).

Conferences, workshops and presentations

- » The Economics of Complex Systems Workshop, Beijer Institute, KVA, Stockholm, April 2014. Presentation: *Exhaust tariff adjustments in the WTO before implementing border carbon tariffs*.

Teaching and training

- » Lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Challenges for environmental decision making*, Stockholm Resilience Centre, Stockholm University, spring 2014.

Other

- » Parental leave from end of April 2014.



Caroline Schill
PhD candidate, researcher

Research focus

Interactions between human behaviour and ecosystem dynamics in social dilemmas. In particular, implications of abrupt ecosystem changes, and social and environmental uncertainties for collective action in commons dilemmas with explicit social-ecological feedbacks.

Publications during the period

- » Lindahl, T., A.-S. Crepin, and C. Schill. 2014. Beijer Discussion Paper 244: Potential disasters can turn the tragedy into success. *Beijer Discussion Paper Series*.

Conferences, workshops and presentations

- » Resilience and Development: Mobilizing for Transformation, Resilience 2014 conference, Montpellier, France, May 2014. Presentation: *The value-added of behavioral experiments for the study of social-ecological regime shifts* and co-organiser of session: *Students' perspectives on sustainability science research - are we moving towards un-disciplinarity?*
- » Behaviour, Economics and Nature Network (BENN) workshop Emerging Linkages Between Neuroscience, Environmental Behaviour, and Policy, Beijer Institute, KVA, Stockholm, June 2014. Participant.
- » Workshop on the Ostrom Workshop, WOW5, The Vincent and Elinor Ostrom Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, USA, June 2014. Presentation of paper: *Exploring human behavior in commons dilemmas under the risk of ecosystem regime shifts - An experimental approach*.

Teaching and training

- » Teaching assistant, Master's level course *Governance and Management of Social-Ecological Systems: Ecosystem Support for Humanity*, Stockholm Resilience Centre, Stockholm University, fall 2013.

Other

- » EAT Food Forum, Stockholm, May 2014. Rapporteur for competence forum EAT Consumer (Supporting Consumer Choice, Preferences and Behaviour for a Healthier Population and Planet).
- » Performance of laboratory experiments, Beijer Institute.
- » Vice-chair of PhD student council, Stockholm Resilience Centre, Stockholm University, since March 2013.



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. 2013. 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* 83(4):1067-1084.
- » Metian, M., S. Pouil, A. M. Boustany, and M. Troell. 2014. Farming of bluefin tuna – reconsidering global estimates and sustainability concerns. *Reviews in Fisheries Science & Aquaculture* 22(3):184-192.
- » Moksnes, P.-O., D. O. Mirera, E. Björkvik, M. I. Hamad, H. M. Mahudi, D. Nyqvist, N. Jiddawi, and M. Troell. 2014. Stepwise function of natural growth for *Scylla serrata* in East Africa: a valuable tool for assessing growth of mud crabs in aquaculture. *Aquaculture Research* online first.
- » Österblom, H., A. Merrie, M. Metian, W. J. Boonstra, T. Blenckner, J. R. Watson, R. R. Rykaczewski, Y. Ota, J. L. Sarmiento, V. Christensen, S. Birnbaum, B. Gustavsson, C. Humborg, C.-M. Mörtz, B. Müller-Karulis, M. Schlüter, M.T. Tomczak, M. Troell, and C. Folke. 2013. Modeling social-ecological scenarios in marine systems. *BioScience* 63:735-744.
- » Rist, L., A. Felton, M. Nyström, M. Troell, R. A. Sponseller, J. Bengtsson, H. Österblom, R. Lindborg, P. Tidåker, D. G. Angeler, R. Milestad, and J. Moen. 2014. Applying resilience thinking to production ecosystems. *Ecosphere* 5(6):73.

Conferences, workshops and presentations

- » Eighth WIOMSA Scientific Symposium, Maputo, Mozambique, October 2013. Chair for session: *Dealing with global change*.
- » The Swedish Agency for Marine and Water Management (SwAM), Rosenbad conference centre, Stockholm, January 2014. Invited speaker: *Global trends in fisheries governance – improving sustainability*.
- » ACCESS WP meeting, Aquaculture in the Arctic, Tromsø, Norway, March, 2014.
- » BHI (Baltic Health Index) workshop, Stockholm Resilience Centre, May, 2014.
- » EAT Food Forum, Stockholm, May 2014.
- » World Aquaculture Society Conference, Adelaide, Australia, June 2014. Co-author (M. Beveridge, M. Phillips, D. Beare, and S. Castine) presentation: *Aquaculture environment, biodiversity and climate change*.

Teaching and training

- » Course leader and lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2014.
- » Lecturer, Master's level course *Tropical Ecology; Management of Aquatic Resources in the Tropics*, Department of Ecology, Environment and Plant Sciences, Stockholm University, March 2014.
- » Main supervisor of post-doc Marc Metian (Stockholm Resilience Centre, Stockholm University).
- » Co-supervisor of PhD student Malin Jonell (Department of Ecology, Environment and Plant Sciences, Stockholm University, *Sustainability Indicators and Eco-labelling of Seafood*) and David Mirera (Linnaeus University, Sweden and Kenya Marine and Fisheries Research Institute (KM-FRI), *Small-scale Aquaculture of Mud Crabs (Scylla serrata) and its Effects on Community Livelihood along the Kenyan Coast*, thesis defence February 2014.
- » Supervisor of Master's student V. Lundgren (Department of Ecology, Environment and Plant Sciences, Stockholm University, *Fishprint - Tracing the True Fish Consumption*).
- » Supervisor of M. Nicolini (Department of Fisheries, Yangon, Myanmar, *Overview of Crab-related Activities in Myanmar - Observations from the Ayeyarwaddy Delta*), Worldfish Intern report, October 2013).

Commissions

- » WIOMSA Member, ICES Study Group on Socio-Economic Dimensions of Aquaculture (SGSA), since 2011.
- » Advisory Board Member, IDREEM (Increasing Industrial Efficiency in European Mariculture), FP7 EU Project, since 2012.
- » Member of the MASMA Programme Committee (Marine Science for Management), Programme within the Western Indian Ocean Marine Science Association (WIOMSA), since 2007.
- » Review Editor, *Aquaculture Environment Interactions (AEI)*, since 2009.
- » Reviewer for *Aquaculture Research*, *Journal of Aquaculture Environment Interactions*, *PNAS*.
- » Evaluation committee member (main discussant), Licentiate of N. Hedberg *Is the Solution to Pollution Location? - Drivers behind South East Asian Sea Cage Aquaculture Site Selection and its Impact on Coral Reefs*, Stockholm University, 2014.
- » Evaluation committee member, PhD defence by S. Hornborg *Integrated Environmental Assessment of Fisheries Management Using a Life Cycle Approach*, Gothenburg University, April 2014.
- » Leader Aquaculture Programme, Beijer Institute, and co-leader Marine Governance Theme, Stockholm Resilience Centre.

Other

- » IDREEM (Increasing Industrial Efficiency in European Mariculture), Advisory Board meeting, Santa Margherita Ligure, Italy, October 2013.
- » MASMA Programme Committee, research evaluation meeting, Gothenburg, Sweden, July 2013 and Nairobi, Kenya, May 2014.

The Beijer Publication Series

SCIENTIFIC papers by Beijer staff or Beijer fellows, published in refereed journals or in books that have undergone review, are published in the BEIJER E-PRINT SERIES in order to facilitate the dissemination of research results. Some of the E-prints may have appeared earlier as discussion papers. The total number of E-prints since 1991 is at present 400, of which 24 were published on our website 2013/2014. The BEIJER DISCUSSION PAPER SERIES constitutes a forum for unpublished scientific papers with content that should be subject to discussion and comments. They can be downloaded from the Beijer website. 248 discussion papers have been produced since 1991.

E-Print Series

2014

- » **400.** Farmland abandonment: threat or opportunity for biodiversity conservation? A global review. Queiroz, C., R. Beilin, C. Folke, and R. Lindborg (2014). *Frontiers in Ecology and the Environment* 12:288–296.
- » **399.** Matching scales of law with social-ecological contexts to promote resilience. Ebbesson, J., and C. Folke (2014). In: Garmestani, A., and C. Allen (eds.). *Social-Ecological Resilience and Law*. Columbia University Press, New York, USA. Pp. 265–292.
- » **398.** Spatial climate-economic models in the design of optimal climate policies across locations. Brock, W. A., G. Engström, and A. Xepapadeas (2014). *European Economic Review* 69:78–103.
- » **397.** Climate engineering reconsidered. Barrett, S., T. M. Lenton, A. Millner, A. Tavoni, S. Carpenter, J. M. Anderies, F. S. Chapin III, A.-S. Crépin, G. Daily, P. Ehrlich, C. Folke, V. Galaz, T. Hughes, N. Kautsky, E. Lambin, R. Naylor, K. Nyborg, S. Polasky, M. Scheffer, J. Wilen, A. Xepapadeas, and A. de Zeeuw (2014). *Nature Climate Change* 4:527–529.
- » **396.** The water and diamond paradox and green NNP as a welfare indicator. Li, C. Z., K.-G. Löfgren (2014). *Environmental Economics* 5(2):30–36.
- » **395.** A quantitative review of urban ecosystem service assessments: Concepts, models, and implementation. Haase, D., N. Larondelle, E. Andersson, M. Artmann, S. Borgström, J. Breuste, E. Gomez-Baggethun, Å. Gren, Z. Hamstead, R. Hansen, N. Kabisch, P. Kremer, J. Langemeyer, E. L. Rall, T. McPhearson, S. Pauleit, S. Qureshi, N. Schwarz, A. Voigt, D. Wurster, and T. Elmqvist (2014). *Ambio* 43(4):413–433.
- » **394.** Understanding how built urban form influences biodiversity. Andersson, E., and J. Colding (2014). *Urban Forestry & Urban Greening* 13(2):221–226.
- » **393.** Reconnecting cities to the biosphere: Stewardship of green infrastructure and urban ecosystem services. Andersson, E., S. Barthel, S. Borgström, J. Colding, T. Elmqvist, C. Folke, and Å. Gren (2014). *Ambio* 43(4):445–453.
- » **392.** Stepwise function of natural growth for *Scylla serrata* in East Africa: a valuable tool for assessing growth of mud crabs in aquaculture. Moksnes, P.-O., D. O. Mirera, E. Björkvik, M. I. Hamad, H. M. Mahudi, D. Nyqvist, N. Jiddawi,

and M. Troell (2014). *Aquaculture Research* 1–16.

- » **391.** Applying resilience thinking to production ecosystems. Rist, L., A. Felton, M. Nyström, M. Troell, R. A. Sponseller, J. Bengtsson, H. Österblom, R. Lindborg, P. Tidåker, D. G. Angeler, R. Milestad, and J. Moen (2014). *Ecosphere* 5(6):73.
- » **390.** Farming of Bluefin tuna – reconsidering global estimates and sustainability concerns. Metian, M., S. Pouil, A. M. Boustany, and M. Troell (2014). *Reviews in Fisheries Science & Aquaculture* 22(3):184–192.
- » **389.** Valuing insurance services emerging from a gene bank: The case of the Greek Gene Bank. Xepapadeas, A., P. Ralli, E. Kougea, S. Spyrou, N. Stavropoulos, V. Tsiaousi, and A. Tsivelikas (2014). *Ecological Economics* 97:140–149.

2013

- » **388.** Social change vital to sustainability goals. Norström, A. V., M. Metian, M. Schlüter, L. Schultz, A. Dannenberg, G. McCarney, M. Milkoreit, F. Diekert, G. Engström, J. Gars, M. Sanctuary, R. Fishman, E. Kyriakopoulou, M. Sjöstedt, V. Manoussi, K. Meng, and M. Schoon (2013). *Nature Correspondence* 498:299.
- » **387.** Regional assessment of Europe. Kronenberg, J., A. Tezer, D. Haase, and J. Colding (2013). In: Elmqvist, T. et al. (eds.). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Springer, New York, USA. Pp. 275–278.
- » **386.** Stewardship of the biosphere in the urban era. Elmqvist, T., M. Fragkias, J. Goodness, B. Güneralp, P. J. Marcotullio, R. I. McDonald, S. Parnell, M. Schewenius, M. Sendstad, K. Seto, C. Wilkinson, M. Alberti, C. Folke, D. Haase, M. Katti, J. Niemelä, K. Tidball, H. Nagendra, S. Pickett, and C. Redman (2013). In: Elmqvist, T. et al. (eds.). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Springer, New York, USA. Pp. 719–746.
- » **385.** Energy balance climate models and the spatial structure of optimal mitigation policies. Brock, W. A., G. Engström, D. Grass, and A. Xepapadeas (2013). *Journal of Economic Dynamics and Control* 37(12):2371–2396.
- » **384.** Urban ecosystem services. Gomez-Baggethun, E., Å. Gren, D. Barton, T. McPhearson, P. O'Farrell, E. Andersson, Z. Hampstead, and P. Kremer. (2013) In: Elmqvist, T. et al. (eds.). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Springer, New York, USA. Pp. 175–251.
- » **383.** Urban green commons: Insights on urban common property systems. Colding, J., S. Barthel, P. Bendt, R. Snep, W. Van der Knaap, and H. Ernstson (2013). *Global Environmental Change* 23(5):1039–1051.
- » **382.** Revisiting the Stockholm Urban Assessment. Colding, J. (2013). In: Elmqvist, T. et al. (eds.). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Springer, New York, USA. Pp. 313–336.
- » **381.** A theory of transformative agency in linked social-ecological systems. Westley, F., O. Tjörnbo, L. Schultz, P. Olsson, C. Folke, B. Crona, and Ö. Bodin (2013). *Ecology and Society* 18(3):27.

- » **380.** A social contract with the ancestors—Culture and ecosystem services in southern Madagascar. Von Heland, J., and C. Folke (2013). *Global Environmental Change* 24:251-264.
- » **379.** Modeling social-ecological scenarios in marine systems. Österblom, H., A. Merrie, M. Metian, W. J. Boonstra, T. Blenckner, J. R. Watson, R. R. Rykaczewski, Y. Ota, J. L. Sarmiento, V. Christensen, M. Schlüter, S. Birnbaum, B. Gustafsson, C. Humborg, C.-M. Mörrth, B. Müller-Karulis, M. T. Tomczak, M. Troell, and C. Folke (2013). *BioScience* 63(9):735-744.
- » **378.** Mangroves can provide protection against wind damage during storms. Saudamini, D., and A.-S. Crépin (2013). *Estuarine, Coastal and Shelf Science* 134:98-107.
- » **377.** Meeting the food and nutrition needs of the poor: the role of fish and the opportunities and challenges emerging from the rise of aquaculture. Beveridge, M. C. M., S. H. Thilsted, M. J. Phillips, M. Metian, M. Troell, and S. J. Hall (2013). *Journal of Fish Biology* 83(4): 1067-1084.

Discussion Papers

- » **248.** Nudge for environmental protection. Therese Lindahl and Britt Stikvoort. 2014.
- » **247.** Atmospheric pollution in rapidly growing urban centers: Spatial policies and land use patterns. Efthymia Kyriakopoulou and Anastasios Xepapadeas. 2014.
- » **246.** Climate tipping and economic growth: Precautionary saving and the social cost of carbon. Frederick van der Ploeg and Aart de Zeeuw. 2014.
- » **245.** Developing a diagnostic approach for adaptive co-management and considering its implementation in biosphere reserves. Ryan Plummer, Lisen Shultz, Derek Armitage, Örjan Bodin, Beatrice Crona and Julia Baird. 2014.
- » **244.** Potential disasters can turn the tragedy into success. Therese Lindahl, Anne-Sophie Crépin and Caroline Schill. 2014.
- » **243.** Mitigation and solar radiation management in climate change policies. Vasiliki Manousi and Anastasios Xepapadeas. 2013.

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All photos by Agneta Sundin, except 2 and 5 by Christina Leijonhufvud and 6. Victoria Henriksson.

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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.

Humanity is embedded in the Biosphere and shape it from local to global scales, from the past to the future. At the same time humanity is fundamentally dependent on the capacity of the Biosphere to sustain development.

The major objectives of the Beijer Institute are to carry out research and stimulate scientific cooperation 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 programmes, dissemination of results, the science-policy interface and collaborative communication.

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