

# The Beijer Institute of Ecological Economics

Annual Report  
2011/2012





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

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# Director's column

**AT THE TIME** when ecological economics started a few decades ago, many ecologists in their work acted as though humans do not exist and economists acted as though nature does not exist. Nowadays scholars recognise that the environment in all corners of the earth is shaped by people and that people at the same time are fundamentally dependent on the work of nature for wellbeing. It has become obvious that our economies and societies are embedded parts of the biosphere and that the resilience of the earth system in sustaining our own development is at stake – stewardship reconnecting social-ecological systems to the biosphere is essential for prosperous societal development.

In this spirit, we organised the first set of workshops in our new Beijer Young Scholars programme, here in Stockholm in May, at the Academy and in the archipelago. A carefully selected and excellent group of about twenty young scientists, economists, ecologists, and political scientists, participated. A few introductory lectures by Beijer Fellows set the stage for a most successful week and important programme. We intend to continue with this inspiring endeavour supporting a new generation collaborating across the disciplines on profound issues.

It is with fond memories we remember Lin Ostrom, a true source of inspiration, who passed away in June this year. She was a dear friend and had an exemplary engagement with young people, supporting their pathways with trust and grounded scholarship, and always open for new ideas with never ending curiosity. In addition to the many obituaries of Lin, it has been rewarding when the sad news reached us to follow the appreciation and reflections of Beijer Fellows on Lin, her friendship, her cooperative spirit, and amazing achievements. She has been instrumental for the Beijer Institute and the Stockholm Resilience Centre. Lin inspired,

interacted and collaborated with many colleagues here in Stockholm engaged in our interdisciplinary research on social-ecological systems, resilience and governance. Lin communicated and worked to the very end. There are collaborative manuscripts with Lin to appear, she wrote the preface to our recent book on Adapting Institutions, and co-authored one of the articles of last year's Nobel Laureate Symposium on Global Sustainability, published in *Ambio*.

Well over 30 publications have appeared during the last year in our publication series, in renowned journals, including an article in *Science* and two new books. A few of those are highlighted in this Annual Report. Many Stockholm Seminars have been held and there have been several workshops and meetings at the Beijer and the Academy as part of the efforts of our five dynamic and progressive research programmes. We have received grants for these activities and also for research positions, as well as the Askö meetings. There are intense collaborations with the Stockholm Resilience Centre, our joint institute with Stockholm Environment Institute and Stockholm University. A special thanks to the programme directors and to my deputy Anne-Sophie Crépin for their efforts in building networks, organising activities, bringing in young researchers and raising critical funds. We have secured new funds for supporting the environmental economics networks, the journal *EDE* and a new round of Mäler Scholarships. This funding from Sida also allows us to run important and appreciated courses in relation to international conferences. In addition, the Royal Swedish Academy of Sciences, in collaboration with the Beijer Institute, has received a significant grant "*The Family Erling Persson Academy Programme on the Ecological Economics of Global Change*", with the Beijer director as principal investigator.

We are really happy with the recruitment of two economics post-docs, Johan Gars and Marc Sanctuary, and we are very pleased that Caroline Schill has been accepted to do her PhD in natural resource management at the Beijer Institute and Matteo Giusti's work as research assistant in the urban programme. Warmly welcome!

Karine Nyborg, Scott Barrett, Steve Polasky, Brian Walker, and Aart de Zeeuw spent time with us during the year and we were delighted to have Efi Kyriakopoulou as visiting researcher and Saudamini Das and Zixin Wang as Mäler Scholars. Fantastic that Stuart (Terry) Chapin III has accepted to join the Beijer Board now when Terry Hughes is leaving. Thanks tremendously Terry for your help in supporting the Beijer direction and for immensely valuable contributions and collaboration that will continue with the Beijer Institute. Finally, Johan Colding was successfully evaluated for associate professor (docent) – warmest congratulations to Johan!

The Beijer Institute is a small institute in terms of staff but with a network of hundreds of respected scholars worldwide. The work of the Beijer Institute has contributed to reconnecting knowledge generation to the planet we live on and are dependent on. Concepts like ecosystem services, natural capital, the green economy, inclusive wealth, resilience, social-ecological systems are now widely spreading in science, policy and practice. Examples during the year include the report *"Resilient People, Resilient Planet – A Future worth Choosing"* of the UN Secretary General's High Level Panel on Global Sustainability, the recent UNEP Report on the Inclusive Wealth Index and the establishment of the IPBES, the Intergovernmental Platform on Biodiversity and Ecosystem Services.

The key focus of the Beijer remains to promote a deeper understanding of the interplay between eco-



PHOTO: CECILIA NOROSTRAND

logical systems and social and economic development and stimulate collaborative research between economists and ecologists and related disciplines on fundamental and applied problems in relation to resilience and sustainability. There is a lot of unbroken ground to be explored and understood for improved knowledge to guide policy and action. We hope to contribute to a better understanding of social-ecological systems for human wellbeing. We are most grateful to Anders Wall and the members of the Beijer Foundation for their continuous commitment to the Beijer Institute and its activities. The core funding from the Kjell and Märta Beijer Foundation to the Academy for the long-term investment in the Beijer Institute is unique and fundamental.

*Carl Folke*

Stockholm, 2 July 2012

# In memory of Elinor Ostrom

by Carl Folke

**IT IS WITH FOND MEMORIES** we mourn Elinor (Lin) Ostrom who died on 12 June from pancreatic cancer at the age of 78.

Lin was a true pioneer in interdisciplinary science for sustainability, and worked in a robust and systematic fashion with a deep and burning commitment to further knowledge and understanding. Although trained as a social scientist, Lin was willing to tackle problems with a diversity of qualitative and quantitative methods from disciplines across the sciences. The research question determined which methods would be most appropriate.

Through grounded scholarship that required lots of hard work she combined theory, field studies and laboratory experiments, and demonstrated that people are capable of creating rules-in-use, institutions that allow for sustainable and equitable management of shared natural resources. Lin contributed solutions to many problem areas with new insights on topics ranging from the effectiveness of urban police departments to the management of groundwater basins, irrigation systems, pasture lands, forests and fisheries. She also clearly demonstrated that we have to move beyond the con-





ventional to capture the essence of institutions and social-ecological systems and how they relate to stewardship of natural resources and ecosystems.

She was instrumental in the development of the International Association for the Study of the Commons, and her work on common pool resource management has been deeply influential with the well known 1990 book *"Governing the Commons: the Evolution of Institutions for Collective Action"* as a prominent example of her numerous publications; the author of hundreds of articles and chapters and more than two dozen books.

As a result of a lifetime of pioneering perseverance she was the first woman to be awarded the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel. Her award in 2009 was "for her analysis of economic governance, especially the commons" and her groundbreaking research on the ways that people organise themselves to manage resources. In April 2012, she was included in the Time 100, Time magazine's annual list of the 100 most influential people in the world. She received numerous international awards, including honorary doctorates from universities in India, France, Germany, Sweden, Canada, the Netherlands, Switzerland, Norway and the United States, and she was a member of the American Academy of Arts and Sciences, the US National Academy of Sciences and the American Philosophical Society.

Lin was deeply engaged in collaborative research on social-ecological systems and resilience thinking,

expanding frameworks and understanding across the sciences, always open for new findings and thinking. Lin's cooperative spirit, enthusiasm, engagement and her intellectual sharpness combined with curiosity and excitement about new ideas was simply unique. She inspired, interacted and collaborated with numerous colleagues throughout the world and her true interest and engagement with young people supporting their pathways is exemplary.

It has been an immense privilege and great pleasure for us to have Lin as a close colleague and supporter. Lin's engagement with the Beijer Institute started with our research programme on property rights and natural resource systems in the early 1990s, and she interacted with us since then developing great friendship and trust. She has been a true source of inspiration. She served on the Beijer Board for six years and more lately at our Stockholm Resilience Centre. She inspired, interacted and collaborated with many colleagues here in Stockholm and was deeply engaged in research on social-ecological systems, robustness and resilience thinking with critical involvement in various phases of the Resilience Alliance. Her insights offer hope – that people actually can collaborate to solve environmental challenges, urgently needed in the era of the anthropocene and global change. Her imprint will continue to inspire, influence and guide researchers and decision-makers world wide. ■

The Beijer Young Scholars

# A new network for innovative research

by Agneta Sundin

**A NEW NETWORK** of young scientists conducting research related to social-ecological systems has been initiated by the Beijer Institute. The Beijer Young Scholars (BYS) programme, launched with a workshop 20–25 May at the Royal Swedish Academy of Sciences and at the island of Fejan in the Stockholm Archipelago, gathers early career researchers with a background in economics, ecology, political science and related disciplines from eight different countries. In its work the Beijer Institute has seen the need for a platform to stimulate the emergence of new research pathways and new ways of cooperating across disciplines for the global challenges fac-

ing humanity. Our hope is that the Beijer Young Scholars programme can fill that gap.

The aim of the first workshop was to trigger collaboration between young scientists with different disciplinary backgrounds, supporting them in creating their own research networks with strong links to the Beijer Institute's and the Stockholm Resilience Centre's network of researchers and institutes. The group discussed the topic '*How can we stimulate social innovation and steer technological progress to promote desirable and resilient futures for humanity*', and is now in the process of preparing a scientific paper on the issue.

"Our ambition is to create a neutral space where ambitious early career researchers can meet and inspire each other to undertake innovative research.

▼ **Participants of the Beijer Young Scholars Workshop.** *Back row:* Ram Fishman, Kyle Meng, Johan Gars, Geoff McCarney, Gustav Engström, Florian Diekert, Carl Folke, Mark Sanctuary, Marc Metian, Martin Sjöstedt. *Front row:* Christina Leijonhufvud, Lisen Schultz, Anne-Sophie Crépin, Vassiliki Manoussi, Michael Schoon, Maja Schlüter, Manjana Milkoreit, Astrid Dannenberg, Efthymia Kyriakopoulou, Scott Barrett.



PHOTO: AGNETA SUNDIN



PHOTO: MANJANA MILKOREIT

▼ Sunset at the island of Fejan in the Stockholm Archipelago, venue of the first Beijer Young Scholars workshop.

▼► As part of the workshop the group visited the exhibition Tipping Point – the world's biggest opportunity, co-organised by the Stockholm Resilience Centre and to a large part building on Beijer and SRC research.

We hope that bringing people together and allowing them to work intensively in a pleasant and relaxed environment helps create trust and triggers creative cooperation over disciplinary boundaries to better address the global challenges we are facing”, says Anne-Sophie Crépin, Deputy Director of the Beijer Institute and one of the senior resource personnel for the group. Other resource personnel were Beijer Director Carl Folke; Scott Barrett, Columbia University and Chairman of the Beijer board; Victor Galaz, Stockholm Resilience Centre; and Beijer Fellow Steve Polasky, University of Minnesota.

Within the BYS programme, the Beijer Institute has future plans to host post docs, young faculty and advanced PhD students and to offer support to working groups and workshops. This first workshop has proved a big success with many of the par-

ticipants testifying as to how fruitful it is to interact with scholars outside their own field and to collaborate on a common challenge. Efthymia Kyriakopoulou, a Greek economist is doing her post-doc at Gothenburg University and commented:

“Taking part in interdisciplinary group work was a completely new experience for me. After this productive and inspiring week that helped us to get to know each other and develop a better idea of how people from different disciplines think, the next step is to combine our knowledge and study the global challenges related to social – ecological systems in depth.”

The BYS workshop was funded by the Kjell and Märta Beijer Foundation and the Anna-Greta and Holger Crafoord Foundation. ■



PHOTO: MANJANA MILKOREIT



PHOTO: AGNETA SUNDIN



# Research

Humans and societies are integral parts of nature and the biosphere – the Earth system. We shape it and at the same time depend on it for social and economic development and well-being. With this overall perspective, 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.

## **Aquaculture and sustainable seafood production**

LED BY MAX TROELL  
AND CARL FOLKE

## **Behavioural economics and nature network (BENN)**

LED BY JASON SHOGREN  
AND THERESE LINDAHL

## **Complex systems**

LED BY AART DE ZEEUW  
AND CHUAN-ZHONG LI

## **Global dynamics and resilience**

LED BY ANNE-SOPHIE CRÉPIN,  
STEPHEN POLASKY AND BRIAN WALKER

## **Urban social-ecological systems**

LED BY JOHAN COLDING  
AND ÅSA GREN

# Aquaculture and sustainable seafood production

by Max Troell



PHOTO: ISTOCKPHOTO/THINKSTOCK

▲ Koi Carp fish farm.

**IN THIS RESEARCH** programme we are analysing aquaculture development and its interplay with fisheries and coastal and marine ecosystems. The main focus is on opportunities for sustainable and equitable use of global food resources and ecosystem services, and how aquaculture can contribute to food production, economic development and poverty alleviation in a changing world.

## The Askö meeting

This was the theme for the 2011 Askö meeting held at Askö Marine Laboratory off the Swedish east coast on 17–19 September 2011. Specially invited aquaculture experts – Malcolm Beveridge (Worldfish), Roz Naylor (Stanford), Peter Tyedmers (Dalhousie University) and Marc Metian (Stockholm Resilience Centre) –

joined the core group of internationally leading ecologists and economists to discuss and analyse links and tradeoffs between agriculture food production systems and the rapidly growing aquaculture industry.

The discussion started with the recent rapid increase in food prices, triggered by a series of short-term local events in different parts of the world that have collectively exposed the underlying vulnerability of the global food production system. Emerging trends of increased aquaculture production with higher demand for agricultural crops, together with increasing meat consumption and crop biofuel production, are adding further complexity and challenges in governing the interconnected global food systems. A database on agriculture resource usage by aquaculture has been devel-





PHOTO: THE BEIJER INSTITUTE

▲ **Askö group 2011.** *Back row:* Paul Ehrlich, Roz Naylor, Carl Folke, Marten Scheffer, Steve Polasky. *Middle row:* Åsa Gren, Marc Metian, Aart de Zeeuw, Anne-Sophie Crépin, Simon Levin, Malcolm Beveridge, Peter Tyedmers, Max Troell, Nils Kautsky, Scott Barrett. *Front row:* Brian Walker, Henrik Österblom, Scott Taylor, Ken Arrow, Agneta Sundin, Tasos Xepapadeas, Karine Nyborg, Christina Leijonhufvud, Lena Kautsky.

▼ Sorting of small fish from catches in the Mekong river – a resource increasingly being used in aquaculture instead of for human consumption.

oped in close collaboration with Marc Metian, employed within the Nereus programme at Stockholm Resilience Centre. A paper based on the Askö meeting discussions is in progress.

This year the Askö meeting was financed with additional support from the Brothers Jacob and Marcus Wallenberg Memory Foundation.



PHOTO: MAX TROELL

## New policy framework

The Beijer Institute hosted the second meeting of the International Council for the Explorations of the Sea (ICES) study group on “Socio-Economic Dimensions of Aquaculture” 24–26 March 2012. Besides a report, the group also drafted a policy note to be submitted to Nature or Science. The paper proposes a framework for how aquaculture can contribute to sustainable and equitable use of global food resources and ecosystem services. In line with this work, a paper was also presented as a keynote item at the 2012 World Fisheries Congress in Edinburgh. The paper, “Meeting the food and nutrition needs of the poor: the role of fish and the opportunities and challenges emerging from the rise of aquaculture” has been submitted to the *Journal of Fish Biology*.

Work within the Mistra-funded initiative on “Reaching sustainable natural resource management – is resilience science a valuable tool?”, where fisheries and aquaculture are included, has resulted in a draft paper. A final workshop is scheduled for the autumn. The Beijer Institute is also a member of a working group that has applied for funds from the Socio-Environmental Synthesis Centre for hosting a series of workshops on the implications of the global seafood trade for marine ecosystems and their services. ■



# Behavioural economics and nature network – BENN

by *Therese Lindahl and Caroline Schill*



PHOTO: THE BEIJER INSTITUTE

**THE OVERALL PURPOSE** of BENN is to serve as a clearing house for behavioural research around the world in economics, ecology and other disciplines for improved stewardship of our life-supporting ecosystems. Over the last two decades, behavioural economics has emerged to challenge the traditional economic model for human decision making by documenting how people deviate from the theory of rational choice. However, the behavioural connection to complex systems, e.g. the relationship to nature's goods and services and the global challenges we face today, is inadequate. This year, a new Beijer research project was launched under the umbrella of BENN in order to help fill this gap.

## Using experiments to explore social-ecological linkages

Natural goods and services stem from ecosystems with complex dynamics involving temporal and spatial scales, multiple species interactions, and non-linear dynamics. This means that they can have multiple stable states (regimes) with separate domains of attraction. A typical feature of such ecosystems is that they can undergo sudden changes, so-called regime shifts, and flip from one regime to another. For example, due to intense grazing, grasslands can flip from a grass-dominated to a woody shrubs-dominated state or may even become a dry desert.

These features complicate resource management and especially resource systems that are already

exposed to management challenges, such as common pool resource systems, for instance a group of herdsmen sharing a common grazing grassland pasture. In order to develop relevant management strategies and policies for these common pool resources, it is crucial to explore the linkages between ecological characteristics and human behaviour. One way of doing so, which was also our approach, is to rely on experiments.

Based on laboratory experiments, we tested how endogenously driven regime shifts, in our case manifested as an abrupt negative change in the renewal of resources (i.e. the re-growth of grass in the example above) and various forms of uncertainty related to such changes influenced strategies for cooperation and exploitation of the common resource. We let groups of three to four individuals harvest a renewable resource during an unknown number of rounds in which they were allowed to communicate. Overall, we performed 72 experimental sessions in which a total of 266 persons participated.

### Regime shifts influence behaviour

We found that when there was no risk of facing an abrupt drop in the resource dynamics, overexploitation emerged in 62% of cases. However, groups that faced resource dynamics with a known critical threshold (where an abrupt drop in renewal of the resource occurred) were more careful and more successful in their management and overexploitation emerged in only 10% of cases. We concluded

that the threat of reaching such a threshold triggered more efficient communication within the group, enabling both commitment for cooperation and knowledge sharing about the development of the resource, which together can explain why these groups performed better. We also tested how participants behaved when there was a 50% risk of a regime shift occurring. We found that they responded to the uncertainty, and in a precautionary manner, resulting in significantly less overexploitation. Preliminary results from experiments where we introduced “true uncertainty”, in the sense that regime shifts occurred as a complete surprise, show that among these groups three types of behaviour arose: One type remained cooperative and managed to overcome the disturbance, one type remained cooperative but did not manage to overcome the disturbance and one type did not manage to remain cooperative or overcome the disturbance.

### Future steps

These experiments have definitely resulted in new insights, but in order to build an empirically grounded theoretical framework we need to conduct more research on the topic and some has already been planned. This is necessary not only to capture individual behavioural responses related to other various aspects of regime shifts, but also to analyse whether and what kind of informal institutional arrangements emerge and what policy implications they have. ■

▼ Caroline Schill  
leading an experimental session at  
the Beijer Institute.



PHOTO: AGNETA SUNDIN



# Complex systems

by Chuan-Zhong Li



PHOTO: ISTOCKPHOTO/THINKSTOCK

▲ Rice terraces in Yunnan Province, China.

**THE BEIJER INSTITUTE** is one of the pioneers in the research area of complex systems. Soon after its establishment in the early 1990s, the institute organised an international workshop on complex systems and brought together renowned economists, ecologists and scientists from other disciplines interested in the area. This has marked the start of the current research programme. In contrast to other science areas with simple system assumptions, this programme explicitly recognises the complexity of multiple interacting components involving, among other things, threshold effects, fast and slow processes, non-convexities, non-linear feedbacks, and stochastic influences.

Our aim is to develop an ecological economic understanding and theory for improving the man-

agement of social-ecological systems. By employing small-scale integrated models, we explore the essential links, feedbacks and thresholds in complex systems, and their implications for ecosystem management. To the extent where empirical data is available, we also conduct econometric analysis in order to arrive at quantitative conclusions.

## Regime Shifts and Resilience Values

In a simple dynamic emission benefit and pollution stock damage model, Aart de Zeeuw and Amos Zemel have studied the optimal emission policy under the risk of a sudden rise in a damage coefficient. The results imply prudent behaviour due to uncertainty, which differs from the ambiguous outcomes reported in earlier literature. The framework is used to analyse

optimal adaptation and mitigation strategies. The paper entitled “Regime Shifts and Uncertainty in Pollution Control” has been accepted for publication in the *Journal of Economic Dynamics and Control*.

Using laboratory experimental methods, Therese Lindahl, Anne-Sophie Crépin and Caroline Schill have analysed how appropriators in a common pool dilemma react to potential sudden changes in the renewal of an ecosystem service. They find that people who face a resource dynamic with a threshold are more careful and more successful in their resource management. The threat of reaching the threshold triggers more efficient personal communication, cooperation and knowledge sharing, which in turn leads to improved management decisions.

In a paper on “Economic growth and social welfare under global environmental thresholds”, Haishan Yu and Chuan-Zhong Li have derived general formulas for resilience valuation in a stylised growth model. The direct effect of a potential regime shift on utility and the indirect effects induced through capital and productivity losses are examined. The analysis also extends to the case of double and interdependent stochastic thresholds. In another paper, Chuan-Zhong Li, Sebastián Villasante and Xueqin Zhu have studied the Argentinean Hake management problem by taking into account a stochastic threshold for fishery collapse. They use time series data to estimate the fish stock dynamics and study the loss in social surplus due to the ignorance of the threshold for fishery collapse in comparison to the optimal value function. A corrective state-dependent tax is proposed for improving the fishery management practice.

Anne-Sophie Crépin, Eric Nævdal and Johan Gars have made advances through the project ‘Managing Threshold Effects in Environmental and Resource Economics’, which is a collaboration between the Frisch centre in Norway and the Beijer Institute. For this project Nævdal spent one week at Beijer to work with Crépin on a joint article aiming at comparing approaches to modelling threshold effects in resource economics. The paper aims to unify two strands of models used to represent ecosystem thresholds that exist in the literature. This leads to the analysis of a new class of dynamic threshold problems not previously analysed in the economic literature. In addition Gars has been working on an article aiming at studying management of natural systems subject to Brownian motion in the presence of threshold effects.

## Green Accounting and Sustainability

In July 2011, Karl-Göran Mäler, the former director of the Beijer Institute, gave a keynote speech on “Accounting prices and ecosystem services” at the first PACE international symposium on environmental economics and policy in China. Chuan-Zhong Li who served as one of the organisers of the symposium lectured on “The economics of ecological resilience”. A Mäler Scholar of 2011, Dr. Zixin Wang, who was on leave from Yunnan University, also presented a paper on “The feasibility of utilising water hyacinth for the phytoremediation of eutrophic lake coupled with biogas production in China”.

A book with a collection of 36 classical papers on “Green National Accounting and Sustainability”, edited by Karl-Gustaf Löfgren and Chuan-Zhong Li, is published in the series of books “The International Library of Critical Writings in Economics” by Edward Elgar Publishing Limited. The authors have written an introduction which offers a comprehensive overview of the literature both from a historical and a formal theoretical perspective. The contributors include, among others, G. Chilchilnisky, P. Dasgupta, J.M. Hartwick, J.R Hicks, K.-G. Mäler, W.D. Nordhaus, P.A. Samuelson, J.E. Stiglitz, and M.L. Weitzman.

In a recent empirical economics paper, Chuan-Zhong Li and Gunnar Isacson studied a hedonic wage and rent model for urban air quality and transport accessibility in Sweden. From the spring of 2012, Beijer researchers Gustav Engström and Åsa Gren have, as work package leaders, joined the Pan-European research project on urban biodiversity and ecosystem services, together with a group of Stockholm Resilience Centre researchers.

Their idea is to use a similar hedonic pricing framework to study the implicit values of urban green areas with more detailed spatial information.

Together with Dr. Ranjula Swain at Uppsala University, Chuan-Zhong Li has started a new research project on accounting prices, resilience and sustainability in South Africa. Rapid population growth, increased water demand and slower recharge to ground water resources due to geological factors etc. may lead to considerable water shortages in the near future, and climate changes would further aggravate the problem. In this project, we will use detailed spatial data to study the resilience values of ground water resources in South Africa and explore their implications for sustainability studies. ■



# Global dynamics and resilience

by Anne-Sophie Crépin



PHOTO: AGNETA SUNDIN

▲ Participants of the third workshop of the Global Dynamics and Resilience Program, September 2011 at the Royal Swedish Academy of Sciences.

**HUMAN ACTIVITY IS GENERATING** serious, interlinked challenges that include climate change, ocean acidification, declining fisheries, emerging diseases, antibiotic resistance and recurrent energy, food and water crises that interact with economic, social and political change. Their interactions are likely to cause nonlinear, and perhaps irreversible, shifts in the behaviour of the Earth system upon which we humans depend. In addition, the world lacks institutions capable of addressing these challenges on a global scale. In this programme we are exploring critical unrecognised or ignored social-ecological interactions and feedbacks. We are looking at the kind of governance structures that can be developed to avoid catastrophic shifts in the Earth system and to transform societal development towards global sustainability.

This research programme is a joint collaboration with Stockholm Resilience Centre.

## Activities

On 20–21 September 2011 we held the third workshop of this programme. The objectives were to:

1. Identify a set of known interactions and feedbacks and develop a conceptual framework that will represent these dynamics and their linkages, and likely consequences.
2. Analyse this set of feedbacks (and others) to develop a framework/procedure that will allow us to identify other significant feedbacks in global dynamics that have yet to be identified.

During the workshop the participants took serious steps towards answering these both questions. A possible approach for continued activities could include for example conceptual and empirical data-driven modelling activities. Causal loop diagram exercises will be further developed, aiming to identify potentially interesting linkages between different sectors of importance.

On 20–25 May 2012 the first Beijer Young Scholars workshop was held as part of the global dynamics and resilience research programme (see separate article).

During 2011–2012, Gustav Engström devoted most of his time to finishing his PhD thesis, in which several articles originating from the programme will appear. Gustav will defend his thesis on 28 September 2012, with Beijer fellow Michael Hoel as opponent.

## Green light for Arctic Resilience Report

At the Arctic Council meeting in Luleå, Sweden, on 8–9 November 2011, the Senior Arctic Officials approved the Arctic Resilience Report as an Arctic Council project. This project will provide a science-based assessment of the risks of crossing such disastrous tipping points in the Arctic. The project will also identify strategies for governments and communities to adapt and transform in the face of change, and this connection between knowledge about the Arctic and decision making will be a critical element in the process.

The origin of the proposal for the Arctic Resilience Report that was presented to the Arctic Council was an initiative from Stockholm Resilience Centre at Stockholm University and Stockholm Environment

Institute in collaboration with the Resilience Alliance, with Anne-Sophie Crépin and Brian Walker on the scientific advisory team. This was further developed in dialogue with the Swedish chairmanship of the Arctic Council and the Swedish Ministry of the Environment. An important part of the preparation was a scoping workshop at the Royal Swedish Academy of Sciences 26–28 September 2011.

## Steps ahead

Besides a substantial amount of articles related to the planetary boundaries framework, the programme has now produced draft articles dealing for example with modelling issues or classifications of inconvenient feedbacks and global dynamics. The next steps for the programme will be to reinforce the coordination capacity with one to two members of staff at the Beijer Institute and Stockholm Resilience Centre in order to speed up the production of results. In addition, we will organise a conference in spring 2013 where preliminary results can be presented and discussed with a wider audience. ■

## Manuscripts that have emerged to date within the Global dynamics and resilience program include:

- Anderies, J. M., S. Carpenter, W. Steffen and J. Rockström. *Non-Linear Dynamics and Planetary Boundaries*.
- Anderies, J. M., C. Folke, B. Walker and E. Ostrom. *Robustness, Resilience and Sustainability: Moving Global Change Policy Forward*.
- Bennett, E., N. Ramankutty and S. Carpenter. *Building a Resilient Agriculture in a Changing World based on the January 2011 meeting “Agriculture and the Planetary Boundaries”*.
- Van den Bergh, J., C. Folke, S. Polasky, M. Schaffer and W. Steffen. *“Cheap or Expensive Energy impact of energy-climate solutions on planetary boundaries.”*
- Biggs O., A-S. Crépin, V. Galaz and G. Peterson. *Pathological Dynamics in Global Environmental Problems*
- Brock W. A., G. Engström and A. Xepapadeas. *Energy balance climate models and the economics of climate change*,
- Engström, G. and A. Xepapadeas. *Solow meets Lovelock – Economic growth in Daiseworld*,
- Homer Dixon et al. *The Architecture of global crises*.



PHOTO: ISTOCKPHOTO/THINKSTOCK



# Urban social-ecological systems

by Johan Colding



PHOTO: JOHAN COLDING

▲ Prinzessinnengärten in Berlin, example of a public access communal garden, studied within the SUPER-project.

**URBAN REGIONS ARE HUBS** of services, knowledge, capital and innovation that offer solutions for humans and the environment, but they also create great demands for resources and ecosystem services and generate large volumes of waste. The continuous increase in the number and size of urban regions and the ensuing transformation of landscapes pose challenges to ensuring human welfare and a liveable, sustainable environment. This research programme aims at promoting resilient urban development through integrated research on ecosystem services generation, social dynamics, governance networks and the built environment.

## Research programme updates

The efforts put into research in the project *Moving from urban form to social-ecological form: Knowledge for urban resilience building (Urban Form)*, conducted as a joint effort with the Royal College of Technology, KTH, is proceeding according to plan. The project has so far generated eight publications, with an additional number of articles in progress. The Urban Form project has broadened its collaboration to include the Department of History at Stockholm University through mutual workshops and seminars, as well as a joint 15 million SEK funding application to FORMAS entitled *Urban Food Security Insights from History for the Future- Organizations, Social Movements and Built*



▲ Film directors Pehr Arte and Stig-åke Nilsson filming in Berlin for the documentary on urban gardening within the SUPER-project.

*Form as Carriers of Resilience*. Much of this activity is being led by Stephan Barthel.

The ongoing project *SUPER – Sustainable Urban Planning for Ecosystem services and Resilience* has over the year generated six new publications that are currently in revision or in review. The Beijer Institute co-organised a 3-day SUPER workshop at Istanbul Technical University in October 2011. The workshop participants agreed to deliver a synthesis report of the major insights generated in the programme, to be delivered as a monograph with potential publication in the journal *Progress in Planning*.

The *urban social-ecological* theme of Beijer Institute has been engaged throughout 2011 and 2012 in a series of workshops with city planners at the Stockholm Office of Regional Planning (TMR). The purpose has been to help establish a framework for resilience planning based on ecosystem services. As a SUPER deliverable in collaboration with affiliates at SRC and KTH this has now led to the upcoming report on weak green links in the Stockholm Green Wedge System (*Gröna svaga samband*), through a special section devoted to ecosystem services. This collaboration has led to an upcoming major report on ecosystem services and regional spatial planning in Stockholm (*Att planera med ekosystemtjänster i en växande Stockholmsregion*) to be delivered to policy- and decision-makers

as well as regional and local planners in Stockholm County. The report is a practical, hands-on manual and the first attempt to implement the notion of ecosystem services and resilience thinking as a tool in Stockholm regional spatial planning, with expected publication in the end of 2012.

### A Super Film Deliverable

The SUPER project was fortunate enough to secure partial funding (490 000 SEK) from FORMAS for a documentary film on urban gardening, with on-going negotiations for further project film funding with Swedish Television. The film has the working title *Urban Green Commons – Bringing nature into cities for people*, and is directed and produced by *Seven Frames Production* (<http://www.sevenframes.se/>). A focal area in the SUPER project involves understanding how different property rights arrangements in cities influence the organisation and management of ecosystem services. Drawing on theories related to natural resource management in common property rights systems, SUPER has generated new knowledge on civic management of urban ecosystems with case studies in Sweden, the Netherlands, Germany and South Africa. These studies focus on urban green areas that are collectively managed by people in networks that hold legal management rights to land. Given that public land is becoming increasingly privatised in urban-



ising regions, opportunities for civic land management are becoming increasingly limited. Nevertheless, research within SUPER demonstrates that common property management systems (i.e. urban commons) could become a viable alternative to privatisation of public land, since they offer multiple ecological and social benefits that can be of instrumental value for urban planners in making cities more sustainable. A prime motive behind the film is therefore to convey the full range of societal opportunities that urban commons offer in cities through a special focus on city gardening.

The film will be completed in the beginning of 2013. We foresee the film being screened at upcoming international documentary events, on Swedish Television, and at scientific forums. We also envision the film serving as a ready-to-use deliverable within the European Research Area Network (ERANET) initiative. The film directors, Pehr Arte and Stig-Åke Nilsson, represent some of Sweden's most prominent moviemakers, with a number of documentary and corporate films to their credit. Johan Colding is serving as the initiator of the film, contact person and scientific advisor.

## New Project – Urban Biodiversity and Ecosystem Services (URBES)

URBES is a transdisciplinary collaboration project between nine top European research institutes with the aim of bridging the knowledge gap on urbanisation processes and urban ecosystem services, as underpinned by biodiversity. The project started in 2012 and will run until 2014.

URBES in a nutshell:

- ✦ Will address significant scientific knowledge gaps on the role of urban biodiversity and ecosystem services for human wellbeing and be of importance for building capacity in European cities to adapt to climate change and reduce ecological footprints

- ✦ Will pioneer the development of the TEEB approach in an urban context and be innovative in integrating monetary and non-monetary valuation techniques, explore their governance implications and develop guidelines for implementation in urban landscapes
- ✦ Consists of eleven top research institutes in Europe and New York, being well placed to take on the challenging interdisciplinary tasks of URBES
- ✦ Will develop a professional communication and training programme together with ICLEI and IUCN
- ✦ Will actively link to important policy mechanisms and contribute to global partnerships with e.g. CBD, TEEB, IPBES, as well as with EU on the post-2010 EU Biodiversity Strategy, and the Thematic Strategy on the Urban Environment, and with nations through input to national biodiversity strategies and environmental objectives (e.g. in Sweden).

Åsa Gren is project leader at the Beijer Institute and other Beijer Institute researchers involved are Chuan-Zhong Li and Gustav Engström.

## Selected activities

The Beijer Institute hosts two former SRC Master students, Matteo Giusti and Caroline Schill. Matteo is presently synthesizing a study on how the psychological man-nature relationship develops in relation to the biophysical environment. Strongly transdisciplinary, Matteo's research is based on social and cognitive understanding of space, the evolutionary theory of Biophilia and environmental psychology. Caroline will start her doctoral studies after the summer, partially financed by the SUPER-project. Her PhD-project is entitled *Social-ecological linkages in urban green commons*. ■

# Unravelling climate change impacts on the Arctic Ocean

by Anne-Sophie Crépin

**DURING THE PAST YEAR** the Beijer Institute was deeply involved in two large scale FP7 European Union research programmes about the impacts of climate change on the Arctic Ocean. These two research programmes are examples of activities that span over several Beijer Institute research programmes.

## Arctic Tipping points

Arctic Tipping points (ATP) was launched in February 2009 with the ambition to: "Identify the elements of the Arctic marine ecosystem likely to show

abrupt changes in response to climate change; Establish the levels of the corresponding climate drivers inducing the regime shift for these tipping elements; and Evaluate the consequences of crossing those tipping points, and the associated risks and opportunities for economic activities dependent on the Arctic marine ecosystem."

This project, with 13 research partners in 11 countries, came to its end in January 2012 with a final meeting in Tromsø and the launch of a Special issue of *Ambio* ("The Arctic in the Earth System Perspective – The Role of Tipping Points", 41(1), February 2012). The project's five scientific work pack-

▼ Images of the Arctic.

PHOTO: MARTIN ALMQVIST/AZOTE



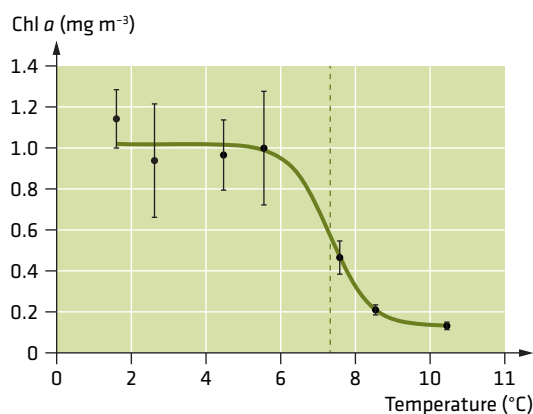
PHOTO: STEVEN ZEFF/AZOTE



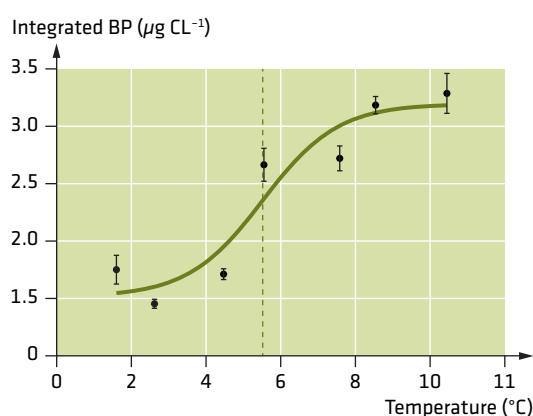
PHOTO: MARTIN ALMQVIST/AZOTE







**Figure 1** Response of phytoplankton to increasing temperatures



**Figure 2:** Response of bacterial production to increasing temperatures

ages explored Arctic climate change and future projections and scenarios in regard to: Arctic ecosystem trajectories; Validation of climatic thresholds on organisms; Future trajectories of Arctic ecosystems; and socioeconomic opportunities and risks emerging from climate driven impacts.

The project used multiple methods to collect data and analyse it. Besides analysing existing datasets, own ecosystem data was collected (mainly on algae and microorganisms) along the east coast of Greenland. Experiments on microorganisms sampled from the Arctic Sea were performed to test how they react to changes in temperature and CO<sub>2</sub> levels. In addition Beijer researchers Therese Lindahl and Anne-Sophie Crépin together with the masters student Caroline Schill gathered experimental data to explore how people could be expected to react to potentially abrupt changes in the dynamics of the resources they exploit. Finally, existing ecosystem models were used and refined to produce simulated data for several future scenarios of climate change in the Arctic. Besides usual methods for data analysis, the project also focused on methods that aim to detect potential tipping points.

Despite the multitude of data analysed and methods used, the project delivered surprisingly coherent results, showing a risk of hitting several ecosystem tipping points in the Arctic Ocean for a range of temperature increase in the Arctic of around 4–6 degrees, as illustrated in figure 1 and 2. This change in temperature corresponds to relatively moderate scenarios, as temperature increase in the Arctic is expected to be much higher than the global average.

The Beijer institute has been involved in work package (WP) 6, through Anne-Sophie Crépin (project leader), Aart de Zeeuw, Dieter Grass, Therese Lindahl and Caroline Schill that dealt with the implications for the European Arctic of socio-economic changes resulting from major and rapid climate driven changes in ecosystems. We used our expertise to model the links between ecosystem thresholds and economics and analysed the dynamics of the resulting systems. Given the lack of knowledge about the specific features of tipping points in the Arctic ocean, we focused more on how to deal with tipping points in general, aiming for three distinct types of works:

1. Synthesis of work related to the economic consequences of tipping points and regime shifts. This resulted, for example, in a synthesis article on “Regime shifts and management” (Crépin, Biggs, Polasky, Troell and de Zeeuw) which is now being reviewed and an article for the *Encyclopedia of Energy, Natural Resource and Environmental Economics?*, (edited by Jason Shogren).
2. Experimental work to unravel how people could be expected to react to abrupt changes. This resulted in a manuscript (Lindahl, Crépin and Schill, 2012, Managing resources with potential regime shifts: Using experiments to explore social-ecological linkages in common resource systems. Beijer Discussion Paper 232.) presented at the EAERE conference in Prague, June 2012.
3. Mathematical exploration of controlled systems with potential regime shifts. This work was initiated during the one year stay of Dieter Grass at the Institute and has resulted in a publication by Grass in the Journal of Economic Dynamics and Control and a joint manuscript by Grass and Crépin.



▲ The first annual meeting of ACCESS, held at the Royal Swedish Academy of Sciences, March 2012.

## Arctic Climate Change Economy and Society (ACCESS)

The Beijer Institute's participation in the Arctic tipping points project led to the involvement in another FP7 EU program, ACCESS, where we play a more central role, with Anne-Sophie Crépin as co-leader of WP5 and several other Beijer researchers working on the project. ACCESS aims to explore the socio-economic implications of climate change in the Arctic Ocean. The project consists of five research work packages (WPs), where the first focuses on putting together relevant climate change information and monitoring appropriate data. WP 2-4 focus on the consequences of Arctic climate change on sectors such as transportation, tourism, fisheries and oil, gas and minerals exploitation, whereas the fifth is dedicated to governance issues and synthesis exercises. ACCESS has a high ambition to produce integrated research results and WP5 plays a particularly important role in this respect.

Beijer Institute researcher Max Troell is exploring the consequences of climate change on aquaculture activities, focusing mainly on the Barents Sea, work tightly linked to the research programme Aquaculture and Sustainable Seafood Production. Therese Lindahl together with Anne-Sophie Crépin explores how people can be expected to react to

abrupt changes in their resource supply due to climate or policy changes. This work is a substantial part of the BENN program (see separate article). Anne-Sophie Crépin will synthesise the results and link them to results from other work packages, using indicators amongst a battery of other tools. Aiming to build a framework for integrated ecosystem-based management of the Arctic Ocean, Åsa Gren is exploring how economic activities in the Arctic, like fisheries, transportation and resource exploitation may impact on the functioning of the Arctic Ocean ecosystems. Her work will be useful for Anne-Sophie Crépin's and Gustav Engström's mapping of essential linkages that drive the dynamics of the Arctic Ocean social-ecological system.

The Beijer Institute organised and hosted a WP5 meeting in January 2012 and the first annual meeting of the whole programme from 7-10 March 2012. Christina Leijonhufvud and Anne-Sophie Crépin worked tightly with the management group of ACCESS to successfully organise the annual meeting in which around 70 people participated. Besides presentations of scientific outcomes to the general assembly of ACCESS, as well as some stakeholders and the advisory board, the annual meeting provided a good opportunity to tighten links between ACCESS researchers with different backgrounds, in order to facilitate successful information sharing, a crucial part of the programme and an essential ingredient for the success of the project. ■

# Selected events

by Max Troell, Anne-Sophie Crépin and Agneta Sundin

## High level meeting on the future of wild fisheries

▼ HRH the Prince of Wales, founder of the International Sustainability Unit and Beijer Institute researcher Max Troell.

There is growing concern for the future of the world's wild fisheries, which are declining largely due to overexploitation. The scarcity of high-value fish species has been followed by a higher pressure on fish with lower market value for human consumption (so called 'trash fish') and small pelagic fish. While some of these fish go directly to local human consumption, the remainder generally finds

their way into the production of fishmeal and fish feed, threatening regional food security.

## Transition towards sustainability complex but beneficial

International fisheries experts alongside leading international companies buying fishmeal gathered at St. James's Palace, London, in December 2011 to discuss the sustainability challenges facing Asian fishmeal fisheries. The meeting was arranged by the International Sustainability Unit (ISU) and attended by its



PHOTO: PAUL BURNS PHOTOGRAPHY LTD.



founder HRH the Prince of Wales. The Beijer Institute was represented by theme leader Max Troell.

“The Prince of Wales is well aware of the complex landscape we have to navigate through to reach resilient food production and his reflections showed a genuine interest and passion for these challenging issues”, said Max Troell. “The transition of overexploited fisheries towards sustainability can yield significant benefits such as more profitable fishing industries, improved food security, poverty alleviation and the provision of long-term secure employment. Companies buying fishmeal can play a critical role in helping fisheries with this transition through their influence of the supply chain”, he continued.

### Principle outcomes

The participating international companies undertook to ensure that Asian fishmeal inputs in their supply chains are responsibly sourced. It was

agreed that brands need to make long-term commitments with suppliers and assist them to be more responsible. This work will be broadened to include agriculture partners and other Asian fishmeal users, to prevent spread of the problems. ISU will support this process by convening key meetings and in a first step will draft a plan together with two of Britain’s largest food chains.

#### SYMPOSIUM:

### Arctic futures

anne-Sophie Crépin was invited to present preliminary results relating to the experiments conducted within the Arctic Tipping Points and ACCESS project (see further details in the BENN section of this report). The presentation entitled “Managing Arctic resources with potential regime shifts: Using experiments to explore social-ecological linkages in common resource systems” was given at a sym-

▼ Reindeer herders  
– stakeholders in the  
future of the Arctic.



PHOTO: ANNETTE LÖF/AZOTE

posium on “Arctic Futures: Increasing Knowledge in Social Sciences and the Humanities” held on 27 March at the Canadian Embassy in Stockholm. By giving an overview of ongoing Swedish Arctic research within the field of social sciences and the humanities, the symposium aimed to highlight the important role played by research for stakeholders in the Arctic region. Stakeholders from various sectors, among them representatives for the indigenous population and for an oil company, also commented on how the research related to their main concerns regarding development in the Arctic region.

The symposium was organised within the Stockholm Polar Week by the Embassy of Canada in collaboration with the Mistra Arctic Futures in a Global Context research programme and the Swedish Polar Research Secretariat.

## Environmental economics and policy in china

China’s first international conference on Environmental Economics, *PAGE2011 International Symposium on Environmental Economics and Policy in China*, 12–16 July 2012, was co-organised by Beijer Institute researcher Professor Chuan-Zhong Li, Dr. Wang Hua at the World Bank, professor He Jie at the University of Sherbrooke, and the Vice chancellor professor Shen Manhong at Zhejiang Sci-Tech University. Around 80 Chinese and 20 international environmental economists gathered at the Qiandao (the thousand islets) lake, an artificial lake in the province of Hangzhou. Former Beijer director Karl-Göran Mäler opened the conference with his keynote speech *Accounting prices and ecosystem services*. Chuan-Zhong Li, chaired the opening session and held a presentation on *The Economics of Ecosystem resilience*.

“Resilience is an emerging concept in Chinese economic and ecological research”, said Chuan-Zhong



▲ Karl-Göran Mäler, former director of the Beijer Institute opening the conference PACE2011 International Symposium on Environmental Economics in China, July 2012.

Li. “Many Chinese researchers can only read Chinese but in recent years younger researchers have written review articles on resilience research in Chinese, spreading the knowledge. However, they are finding the word resilience impossible to translate into Chinese and instead they have to use the Chinese sign *tán xìng*, which means elasticity and flexibility”, he continued.

The Chinese Academy of Land Use and Planning is applying the concepts to analyse the carrying capacity and resilience on a regional scale in China, using a multi-attribute index including aspects such as water supply, land use, forest cover and geological conditions.

Although Chinese research is mostly very policy-orientated according to Chuan-Zhong Li, he sees advantages for Beijer Institute and Stockholm Resilience Centre researchers wanting to collaborate with Chinese colleagues: “Feedback from the experience of Chinese research projects and access to many large data sets could be very useful”, he said. ■

# Science to policy imprints

by Carl Folke

▼ Economist Klas Eklund, Gunilla Carlsson, Swedish Minister for International Development Cooperation and Johan Rockström, SRC, at the launch in Stockholm of the UN-report *Resilient People, Resilient Planet – A Future worth Choosing*. Moderator Johan Kuylenstierna, SEI. Gunilla Carlsson emphasised the importance of the 3<sup>rd</sup> Nobel Laureate Symposium, for the outcome of the report.

**THE BEIJER INSTITUTE** performs research and stimulates international research collaboration for a deeper understanding of the interplay between ecological systems and social and economic development. The work we do is reaching out, influencing mind sets and actions globally, from university curricula and research areas to on-the-ground-practice and international policy. Here we report on a few UN-related science policy activities this year with a strong Beijer legacy and imprint.

## Positive impacts of 3<sup>rd</sup> Nobel Laureate Symposium

As reported in last year's Annual Report, the Beijer Institute played a key role in the 3<sup>rd</sup> *Nobel Laureate Symposium on Global Sustainability – Transforming the World in an Era of Global Change* held at the Academy in May 2011 in collaboration with SRC and SEI and the Potsdam Institute for Climate Impact Research (PIC). Three scientific

background documents, which have now appeared in Ambio, and a Stockholm Memorandum – Tipping the Scales towards Sustainability – were produced. The latter was handed over by the Academy's Permanent Secretary, Staffan Normark, to the co-chair of the UN High Level Panel on Global Sustainability, Finland's President Tarja Halonen. Now the UN Panel's report has been released, and it is rewarding to read the report and reflect on the work during the last two decades of the Beijer Institute and SRC and our collaborators such as the Resilience Alliance. This new "Brundtland Report" has the title *Resilient People, Resilient Planet – A Future Worth Choosing*. It was launched in January 2012 and served as a major input to the Rio+20 event in June 2012.

The momentum of the Stockholm Nobel Laureate Symposium has been maintained and its key messages conveyed. A high level dialogue was organised by the SRC and collaborators during the UNFCCC COP17 climate negotiations in Durban, South Africa, in December 2011, with political lead-

PHOTO: AGNETA SUNDIN







▲ South African President Jacob Zuma addresses participants in the High-level Dialogue, held in Durban, December 2011 at COP17, as a follow up to the 3<sup>rd</sup> Nobel Laureates Symposium.

▲► Swedish Minister for the Environment, Lena Ek, was part of the panel at the High-level dialogue at COP17 in Durban.

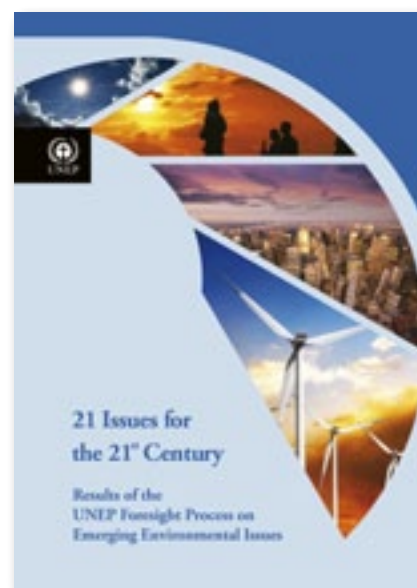
ers, scientists and policy experts. On 17 June 2012 the 3<sup>rd</sup> Nobel Laureate Symposium on Global Sustainability was followed up in Rio de Janeiro with a meeting focusing on the scientific support for policy action and in particular for the actions contained in the General Secretary's High-level Panel final report. Nobel Laureates, members of the UN Secretary General's High-level Panel on Global Sustainability and members of The Elders together with scientists wrote and signed a declaration entitled *The Future We Choose*.

## 21 Issues for the 21<sup>st</sup> Century

The report *21 Issues for the 21<sup>st</sup> Century: Results of the UNEP Foresight Process on Emerging Environmental Issues* was released in February 2012. The Beijer Director was engaged in this work, along with some twenty researchers in the UNEP (United Nations Environment Program) Expert Foresight Panel. The purpose of the Foresight Process is to produce a careful and authoritative ranking of the 21 most important emerging issues related to the global environment for human wellbeing.

The significance of the report is framed within the context of global social-ecological change (Box 2, page 3 of the Foresight report). The framing mir-

rors the work of the Beijer Institute and the SRC: "Today human actions have become major forces in the operation of the earth system. They increasingly challenge the system boundaries of the planet, which will result in fundamental, unprecedented and unpredictable changes in the earth system. This is a new situation. It calls for a fundamental shift in perspectives and world views as well as a new paradigm to guide action. It calls for reconnecting human development and progress to the capacity of the earth system to sustain our own development. It requires planetary stewardship... Decision-makers need to recognize people and societies as integrat-



ed parts of the biosphere, depending on its functioning and life-support while shaping it globally... The pursuit of resilience – the capacity to deal with the interplay of gradual and rapid change and continue to develop – in a setting marked by high levels of uncertainty coupled with the turbulent behaviour of large social-ecological systems is emerging as an overriding concern... Our comprehensive role in changing the earth system calls for a new, more comprehensive and cross-cutting perspective. We must reinvent policies and governance systems to foster stewardship of our future, as humans in collaboration with the biosphere.”

UNEP is using the report to inform the UN and the wider international community on a timely basis about these critical issues, as well as to provide input to its own work programme and that of other UN agencies. The issues and their ranking are listed on the UNEP website and in the report.

## Measuring progress towards sustainability

Inclusive wealth is a concept and approach to environmental accounting developed at the Beijer Institute by Professors Karl-Göran Mäler and Partha Dasgupta. The IWR 2012 was developed on the notion that current economic production indicators such as gross domestic product (GDP) and the Human Development Index (HDI) are insufficient, as they fail to reflect the state of natural resources or ecological conditions, and focus exclusively on the short term, without indicating whether national policies are sustainable.

The Inclusive Wealth Report (IWR) is the first of a biennial series of reports on the sustainability of countries. The report looks at the productive base of economies, based on capital assets – produced or manufactured capital; human capital; and natural capital. The IWR offers policy-makers a practical framework for assessing the state of a country’s productive base. It can also provide guidance on the forms of capital investment that should be made to ensure sustainable development. More broadly, the report will be of use to scholars and practitioners working in economics, development studies, environmental and other fields.

The main objectives of the IWR are: **1** to undertake a preliminary analysis of whether countries are



on a sustainable path and provide national governments with a metric to assess transitions towards the so-called “Green Economy”; **2** to carry out a comprehensive analysis of the various components of wealth by country and their link to economic development, highlighting in particular the importance of natural capital; **3** to become an indicator of progress towards sustainable development with the production of biennial reports monitoring the well-being of countries. In the long-term, inclusive wealth is expected to become an important criterion in assessments of societal progress; **4** to help countries formulate and stimulate policies based on the notion of asset portfolio management, wherein nations follow plans to comprehensively manage diverse assets – natural, manufactured, and human – to create productive and sustainable economic bases for the future, and emphasise how an inclusive wealth report can be used by nations to guide their investment strategies for sustainability; and **5** to highlight where extra research is needed to make the Inclusive Wealth Index and the report a useful tool for economic, environmental and social planning.

Results show changes in inclusive wealth from 1990 to 2008, and include a long-term comparison to Gross Domestic Product (GDP) for an initial group of 20 countries worldwide, which represent 72% of world GDP and 56% of the global population.

The Inclusive Wealth Report 2012 is a joint initiative by UNU-IHDP and UNEP and was launched at the Rio+20 Conference in Brazil. It is published by Cambridge University Press. Several Beijer Fellows contributed to the report, predominantly Sir Partha Dasgupta as scientific advisor to the



report and author along with Charles Perrings, Steve Polasky and Ed Barbier, with fellows Aart de Zeeuw, Jeff Vincent and Rashid Hassan of the CEEPA/RANESA Africa environmental economics network as referees.

## Cities and biodiversity outlook

The “Cities and Biodiversity Outlook” (CBO) is linked to the Convention on Biological Diversity (CBD) and the establishment of such an outlook was endorsed by the Nagoya meeting in 2010. The CBO is a global assessment of the links between urbanisation, biodiversity and ecosystem services. It consists of two parts; the CBO Action and Policy report and the CBO Scientific Analyses and Assessments. The former was presented at Rio+20 in June 2012 and the latter will include in-depth analyses and undergo a careful peer-review process and will be published in 2013.

The CBO Scientific Analyses and Assessments synthesise relevant studies on links between urbanisation and biodiversity and the impacts of urbanisation on ecosystem services. Professor Thomas Elmqvist, from the Natural Resource Management Group and Stockholm Resilience Centre, is leading the report and Beijer Institute researchers serve as co-authors. Combining science and policy, sci-

entists from around the world are analysing how urbanisation and urban growth can affect biodiversity and ecosystems, delivering key messages on the conservation and sustainable use of natural resources to decision-makers.

The CBO has four missions:

- ✦ Serving as the first and seminal global analysis of how urbanisation and urban growth affect biodiversity and ecosystem dynamics in terrestrial, freshwater and marine systems
- ✦ Providing an overview, analysis and response to knowledge gaps in our understanding of urbanisation processes and urban social-ecological systems
- ✦ Addressing how urban biodiversity and ecosystems could be used, restored and created in innovative ways to reduce vulnerability and enhance resilience, and how cities could move from being just consumers to also generating ecosystem services and reducing footprints (redefining the function of cities)
- ✦ Serving as reference for decision- and policy-makers of the Convention on Biological Diversity and its Parties on the complementary roles of national, sub-national and local authorities for implementation of the UN Strategic Plan on Biodiversity 2011–2020. ■

▼ Urban garden in Chicago.

PHOTO: ISTOCKPHOTO/THINKSTOCK



# A selection of publications

by MaxTroell, Carl Folke and Johan Gars



PHOTO: MAX TROELL

▲ Small Chinese fishing fleet.

## Call for better stewardship of global seafood trade

In a new book on ecosystem services and global trade in natural resources, Beijer researcher Max Troell and colleagues write about the implications of global trade for marine ecosystems and their services. They discuss the effects of unsustainable use of fisheries resources and marine ecosystem services and suggest changes needed to make the fisheries industry more sustainable.

### Growing demand for seafood

Fisheries represent one of the last major wild extractive resources endeavours undertaken at a global scale. According to FAO, three-quarters of the

world's fisheries are already fished maximally or over-exploited. Fisheries are highly globalised and over 40% of marine landings enter the international seafood market, at an estimated trade value of approx. USD 90 billion, somewhat higher than that of all other animal meat commodities combined.

Global trade opportunities, market institutions that are decoupled from ecosystem dynamics and a growing population that is hungry for fish, both for food and for animal feed, are the key drivers. Many consider aquaculture the most viable option for meeting increasing demands for seafood. However, although aquaculture has provided economic and nutritional benefits for millions of people, there are concerns that an unconstrained sector expansion would make matters worse for the world's marine ecosystems.



## Current market institutions mask the problems

Technological developments have made it possible to efficiently connect the economic part of food producing systems worldwide, but have not connected the ecological factors to the same extent. Ecosystem signals such as fish stock declines due to over-harvesting, or environmental degradation caused by aquaculture, can pass unnoticed on a global level.

Because of the scale and speed at which the global commodity chain operates, it can mask a seemingly obvious ecosystem signal such as the collapse of a local fish population. Market supply can remain constant as fishers deplete one resource and then move to another.

A global market is a highly efficient mechanism for supplying goods and services otherwise unavailable to a large proportion of the world's population and for providing producers with access to consumers worldwide. However, the very traits that make the international market so economically efficient contribute to the decoupling of consumers and producers from the resource base.

## Recommendations for more sustainable fisheries

1. Reduce over fishing by reducing fleet capacity and removing government subsidies that encourage excess fishing.
2. Continue efforts to reduce use of fisheries resources in aquaculture and investigate how these resources can be used most efficiently, including direct use for human consumption. Encourage consumption of sustainable seafood products. Labelling systems may facilitate changes in behaviour.
3. Include ecologically relevant indicators in the market system. For prices to be right, environmental costs need to be included in production costs.
4. Develop appropriate rules and institutions at all levels. International trade institutions that maintain nature's life-support capacity are needed to encourage countries to develop environmental production standards.

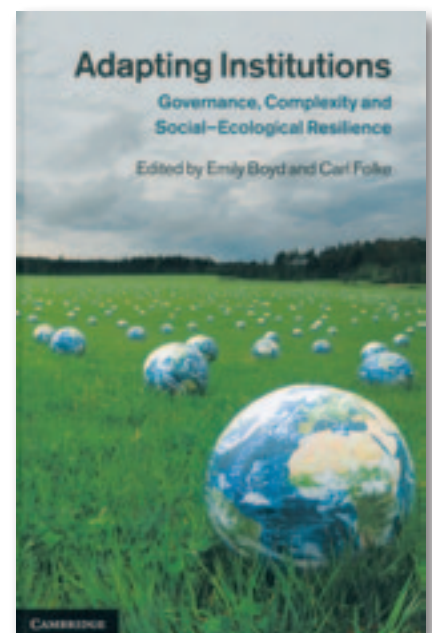
DEUTSCH, L., TROELL, M., LIMBURG, K., HUITRIC, M. 2011. GLOBAL TRADE OF FISHERIES PRODUCTS: IMPLICATIONS FOR MARINE ECOSYSTEMS AND THEIR SERVICES. IN: T. KÖLLNER (ED.), ECOSYSTEM SERVICES AND GLOBAL TRADE OF NATURAL RESOURCES: ECOLOGY, ECONOMICS AND POLICIES. ROUTLEDGE, LONDON, UK. 304 PP.

## Governance, complexity and social-ecological resilience

What can we learn about the governance of uncertainty and change? How can we adapt and even transform existing institutions towards social-ecological resilience? While theories about governance continue to evolve, the context of global environmental change poses unique challenges to the management of networked ecosystems, cities, organisations and institutions.

Adapting institutions, as defined in the book, concerns the capacity of people, from local groups and private actors, to the state, to international organisations, to deal with complexity, uncertainty and the interplay between gradual and rapid change. Some of the responses may be about coping with complexity and change in the short term; others may be about adaptability in a general sense or even maladaptive responses from a longer-term sustainability perspective. The purpose is to explore and understand features involved in adaptations that may help societies move towards global sustainability.

In particular, the book is about the challenge of how to match the social with the ecological to improve stewardship of ecosystem services for human wellbeing and sustainability. Through a set of case studies, it focuses on the social-science dimension of ecosystem management in the context of global change in a move to bridge existing gaps between resilience, sustainability and social science. Among the twelve contributions, there are several written by Beijer Institute and SRC researchers.



The late Elinor Ostrom wrote in her foreword: “One of the most important lessons to be learned from this book is that contemporary scholars should not reject the analysis of complex systems on the incorrect notion that good science is a method for simplifying systems, and thus efforts to represent complexity analytically are not scientific. I will assert that the widespread presumption among many social scientists, that one cannot do good scientific work unless one reduces all systems to the simple interplay of a few variables, is a dangerous approach. Oversimplification reduces our resilience in coping with changes in our complex world”.

BOYD, E., AND C. FOLKE (EDS.). 2011. *ADAPTING INSTITUTIONS: GOVERNANCE, COMPLEXITY AND SOCIAL-ECOLOGICAL RESILIENCE*. CAMBRIDGE UNIVERSITY PRESS, CAMBRIDGE, UK.

## Transforming the world in an era of global change

The special feature of *Ambio* is based on three working papers that provided the scientific foundation for the global sustainability symposium dialogues. The first paper *Reconnecting to the Biosphere* (Folke et al. 2011) calls for a shift in mind set, clarifying that people shape the Earth System and are at the same time fundamentally dependent on the capacity of its biosphere to sustain social and economic development. Incentives, institutions and governance for building social-ecological resilience to deal with an interconnected and fluctuating global system become a priority.

The second paper *The Anthropocene: From global change to planetary stewardship* (Steffen et al. 2011) deals with the great acceleration into a human dominated geological epoch of the Earth System, the Anthropocene, and on identifying the Earth's safe operating space for societal development. In the new era planetary stewardship is emerging to help fundamentally alter our relationship with the planet we inhabit.

The third paper *Tipping towards sustainability: Emerging pathways of transformation* (Westley et al. 2011) is about links between agency, institutions and the new concept of social-ecological innovation and how they relate to large-scale transformations towards global sustainability. What conditions are necessary to shift away from current lock-in in development? Promising social and technical innovations generating planetary opportunities need to be connected to broad institutional resources and responses.



The Stockholm Memorandum: Tipping the scales towards sustainability, developed at the symposium and handed over to the UN High-Level Panel on Global Sustainability is also part of the *Ambio* special feature.

FOLKE, C., AND J. ROCKSTRÖM (EDS.). 2011. 3<sup>RD</sup> NOBEL LAUREATE SYMPOSIUM ON GLOBAL SUSTAINABILITY: TRANSFORMING THE WORLD IN AN ERA OF GLOBAL CHANGE. *AMBIO* 40(7).

## The macroeconomics of climate change

In June 2012 Beijer Institute researcher Johan Gars defended his doctoral thesis at Department of Economics, Stockholm University, with three essays on the Macroeconomics of climate change.

There is a two way interaction between the climate and the economy. The burning of fossil fuels causes climate change and the changing climate changes the conditions for the economy. This interaction is typically studied using Integrated Assessment Models (IAMs) of the climate and the economy. Many of the existing IAMs are complicated models that can only be approached by numerical methods, making it difficult to know which assumptions are important for generating some outcome of interest. The approach in this thesis is instead to use tractable models to carefully study the involved mechanisms and critical assumptions, adopting the philosophy of the macroeconomic modeling project of the Mistra SWedish research programme on Climate, Impacts and Adaptation (Mistra-SWECIA), within which the work with the thesis was carried out.

## Technological Trends and the Intertemporal Incentives for Fossil-Fuel Use

One version of the much debated Green Paradox says that expectations about an improvement in the future state of the technology for alternative energy generation can in fact lead to more fossil-fuel use in the short run. The intuition behind this is that fossil-fuel resources are finite and fossil fuel resource owners are faced with the decision of when to extract it. This means that if technological change makes future extraction of fossil fuel less profitable, current extraction will increase. In this essay the analysis is extended to include many different kinds of technologies. The conclusion is that improvements in the future state of most technologies will tend to increase fossil-fuel use in the short run. Robustness checks suggest that the really important model assumption that determines the effects of expected changes in technology is how the fossil-fuel supply is modeled. Often, and in most of the current essay, the scarcity of fossil fuels is assumed to be the main determinant of the amount of fossil fuel extracted. Then the short run response of fossil fuel use seems robust (e.g. the increase as described in the Green Paradox). If, however, the extraction costs are an important determinant of the supply decisions, the short run responses of fossil-fuel use are weakened and may even be reversed (eg the Green Paradox does not occur.)

## The Role of the Nature of Damages

This essay looks at to what extent it matters in what way the negative effects of climate change on the economy are introduced into an IAM. Climate change will manifest itself in many different ways and its effects on the economy can therefore be modeled in different ways. Two common ways of modeling the effects on the economy are to assume that climate change affects productivity or welfare directly. In this essay capital destruction due to, e.g., floods and storms, is also taken into account. The difference, in terms of model behavior, between the different types of damages is analyzed in two ways. Firstly, it is shown that under some simplifying assumptions a relatively simple formula for the optimal tax on fossil-fuel use can be derived, where the different types of damages that the tax should internalize can be added up. Secondly, the way that fossil-fuel use responds to different kinds of damages, under more general assumptions, is stud-

ied. If climate change makes the future look worse, people will want to prepare for this by transferring resources from the present to the future. This can be done in different ways, e.g. by investing more in capital or by saving fossil fuel. The attractiveness of different ways of saving for the future will depend on the type of effects that climate is expected to have. It turns out that the responses in terms of fossil-fuel use will be qualitatively different if climate is expected to cause capital destruction compared to if it is expected to decrease productivity or have negative direct effects on welfare. Furthermore, the responses depend on whether the modeling of the fossil-fuel extraction decisions emphasizes scarcity or extraction costs.

## Indirect Effects of Climate Change

Countries are interconnected in many ways and effects in one country may affect other countries. For example flooding in a country like Bangladesh can affect the textile industry, thereby affecting other countries trading in textiles. This essay looks at how the direct effects of climate change in one country have indirect effects on other countries, focusing on the interconnectedness through trade in goods and financial instruments (eg. stocks and bonds). The indirect effects can make agreements on reductions of emissions of greenhouse gases more or less difficult to reach, since it can make countries' interests more or less aligned. The general principle is that climate effects that increase the world market prices of goods and financial instruments, benefit the sellers and hurt the buyers. The opposite holds for decreases in world market prices. A two country example suggests that trade in goods should tend to make countries' interests more aligned while trade in financial instruments should tend to make countries' interests less aligned. The assumption underlying this is that the poorer country will be more severely affected by climate change than the rich country. Assuming that rich and poor countries produce different goods, decreased productivity in the poor country will decrease the supply of goods that the rich country wants to buy. Conversely, if the poor country wants to buy insurance against negative climate related events and if the rich country is a seller of such instruments, then climate change will tend to increase the demand for the insurance that the rich country sells. ■

GARS, J. 2012. *ESSAYS ON THE MACROECONOMICS OF CLIMATE CHANGE*. IIES MONOGRAPH SERIES NO. 74. INSTITUTE FOR INTERNATIONAL ECONOMIC STUDIES, STOCKHOLM UNIVERSITY (PHD THESIS).

# Supporting ecological economics in developing countries

by Agneta Sundin, Aart de Zeeuw, Jeffrey 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 ecologically informed economic analysis of environmental challenges and to conduct research on the inter-linkages between economic development, poverty and environmental change, with the aim of providing sound advice to policy makers. Researchers connected to the Beijer Institute support the networks with activities such as participating in workshops organised in the network regions, evaluating research proposals, tutoring research and teaching short courses, with financial support from the Swedish International Development Cooperation Agency (Sida).

## Activities

Beijer fellow Jeff Vincent and Beijer Institute board member Aart de Zeeuw together with Christina Leijonhufvud administer the Beijer Institute's support to the regional networks in environmental economics, including the application process for the Mäler Scholarships. The main activity during the past year was a short course on regime shifts held in conjunction with the 2012 annual conference of the European Association of Environmental and Resource Economists (EAERE). In addition, Professor Vincent participated in biannual research workshops organized by CEEPA, SANDEE, and EEPSEA, where he delivered a keynote lecture; evaluated CEEPA's research grants program for SIDA and IDRC; and taught in SANDEE's annu-

al environmental economics course. Former Beijer director Karl-Göran Mäler and former Beijer board chair Partha Dasgupta also taught in the SAND-EE course. The five EEPSEA-SANDEE country studies on climate change and migration that Professor Vincent supervised have been completed and will be presented in October 2012 at EAERE's 2nd Conference on Environment and Natural Resources Management in Developing and Transition Economies in France. Professors de Zeeuw and Vincent and Anne-Sophie Crépin initiated discussions with the University of Gothenburg about a prospective new interdisciplinary research program on ecosystem services, which would extend the Beijer Institute's and Gothenburg's capacity-building initiatives in developing countries beyond purely environmental economics.

### SHORT COURSE:

## Economics of environmental regime shifts

back-to-back with the 19th Conference of the European Association of Environmental and Resource Economists in Prague in June 2012, former Beijer board member Jeff Vincent, board member Aart de Zeeuw and administrator Christina Leijonhufvud organised a two-day course on 26–27 June for a selected group of researchers from developing regions. The aim was threefold. First, contacts were established between researchers from the four regional networks CEEPA, EEPSEA, LACEEP and SANDEE. Second, the Beijer Institute was able to continue with its mission to contribute to capacity building in developing regions in the area environment and development economics. Third, by organising the course back-to-back with the major international conference, participants in the



course were able to benefit from the conference, and vice versa, with little extra cost.

The theme this time was environmental regime shifts and implications for economic management, and three economists and one ecologist lectured. Board members Steve Polasky and Anastasios Xepapadeas and deputy director Anne-Sophie Crépin were the economic lecturers and Reinette (Oonsie) Biggs from Stockholm Resilience Centre lectured on regime shifts in ecological systems. The origin of the participants showed a nice spread: 5 from Africa, 6 from South-East Asia, 4 from Latin America, 7 from South Asia and 3 from our host institution in Prague, which was very helpful in organising the course. The selection of participants was done in close cooperation with the regional coordinators. Financial support by SIDA, the Swedish International Development Cooperation Agency, is gratefully acknowledged. One of the founders of the regional networks, Sir Partha Dasgupta, spoke some inspiring words at the course dinner.

The lectures of Steve Polasky focused on the uncertainty of tipping points or, to put it differently, on optimal management in case of the possibility of a regime shift.

Oonsie Biggs lectured on concepts and a general modelling framework for regime shifts in ecological systems. Some regime shifts, such as eutrophication of lakes, were carefully explained. It is clear that it is very important that economists have understanding of the physical processes and the way these processes can be modelled.

In her lectures Anne-Sophie Crépin focused on modelling slow and fast dynamics in ecological systems and the implications for optimal management. This is important to prevent policy concentrating on fast dynamics only being taken by surprise by variables that change slowly. Applications were developed, for example, in coral reef systems where coral changes slowly compared with fish and algae.

Anastasios Xepapadeas lectured on common property management which requires a differential game approach. Concepts and techniques of differential games, such as “open-loop” and “feedback” solutions, were explained and applied to the game of international pollution control. Tipping points in the eutrophication of lakes lead to non-convexities.

This set of lectures gave a good overview of regime shifts and economic management challenges that arise in the presence of regime shifts. Regime shifts appears not only in ecological systems but also in

▼ Participants and lecturers of the short course Economics of Environmental Regime Shifts held in Prague, June 2012, organised by the Beijer Institute.

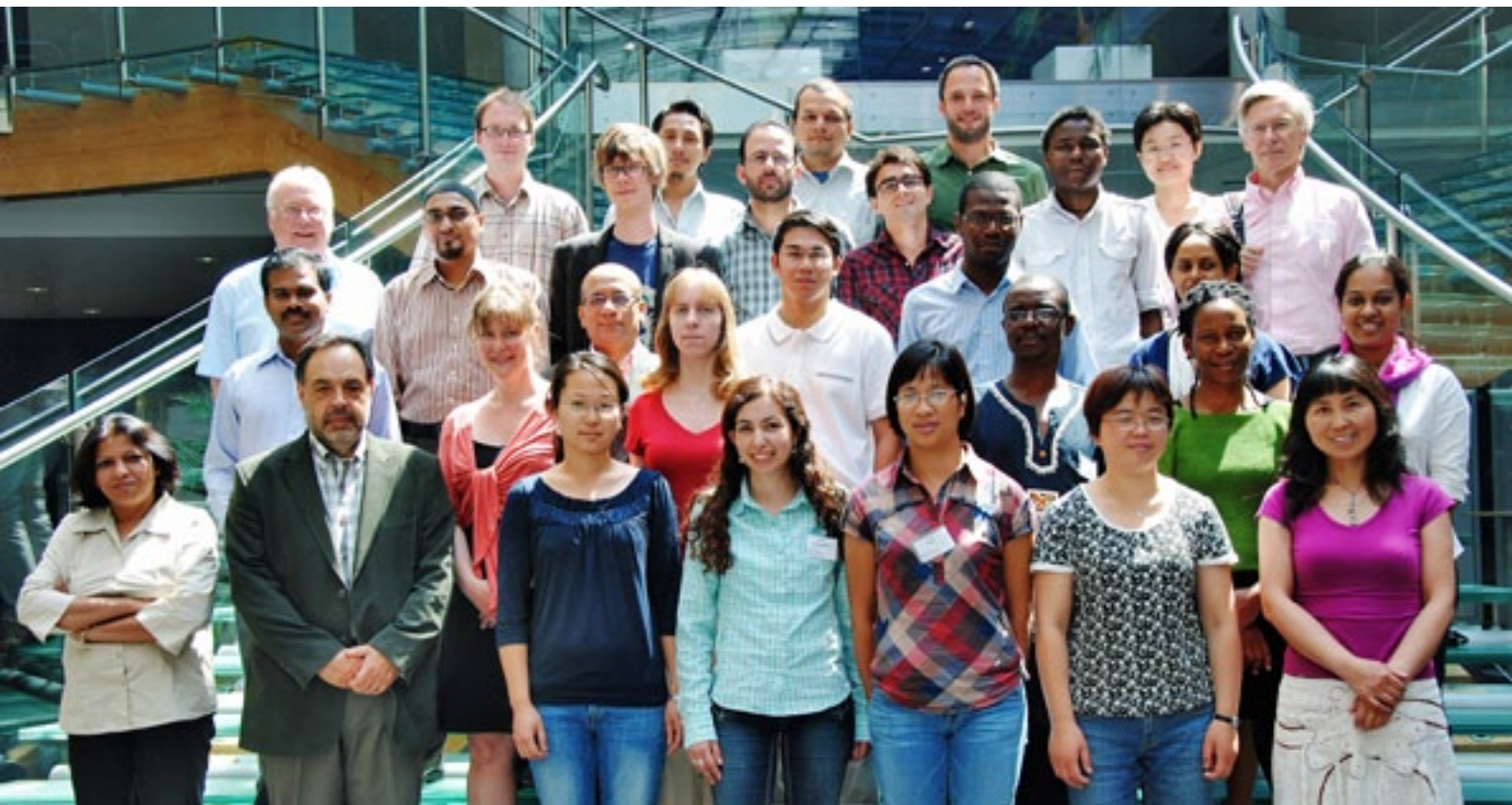


PHOTO: CHRISTINA LEIJONHUFVUD.



▲ Mäler Scholars Saudamini Das and Zanxing Wang in front of a portrait of Alfred Nobel at the Royal Swedish Academy of Sciences.

social systems. Much more research is needed in order to get a better understanding and to improve management. The hope is that this line of research will take off now in developing regions as well.

At the end of the course, ideas were investigated for courses in the future. The plan is to give a course every two years, back-to-back with the major international conference. It was suggested to focus next time on either empirical analysis of regime shifts or on experimental economics.

## The Mäler Scholarship

Again with support from Sida, the Beijer Institute introduced the Mäler Scholarship, intended for researchers from the networks. Through this, the Beijer Institute wishes to support the networks in creating increased capacity in their respective regions in using ecological economics for analysing environment and development issues.

During the past year, the Beijer Institute was pleased to receive two Mäler Scholars:

**Zanxin Wang** from China (EEPSEA), Associate Professor at the School of Development Studies, Yunnan University, completed his scholarship with a second visit, two months during autumn 2011.

Within his scholarship Dr Wang investigated (1) the economic feasibility and optimal management of the utilisation of water hyacinth as a phytoremediation plant coupled with biogas production; (2) the sustainability of second generation biodiesel. This research is described in more detail in last year's Annual Report.

The first part of his research was completed during his stay and resulted in two articles. One of these, entitled "Environmental and economic analysis of application of water hyacinth for eutrophic water treatment coupled with biogas production", was submitted to the "Journal of Environmental Management", and it is now under review. The other article, entitled "The effect of harvesting water hyacinth on the state of eutrophic water body", is under revision.

With help of the academic resources at the Beijer Institute, Dr. Wang completed the research framework and literature review for research on the sustainability of second generation biodiesel, laying a solid foundation for his further studies. Partly based on the literature review, he wrote a chapter, entitled "Producing *Jatropha* biodiesel in China: Policies, performance and challenges" for the book "Compendium of Bioenergy Crops", which is edited by M. Sujatha, B. Bahadur and N. Carels and will be published by Science Publishers, USA.

Based on his research at the Beijer Institute, Dr. Wang gave a presentation, titled "Economic analysis of utilizing water hyacinth as a phytoremediation plant coupled with biogas production in China", at the "PACE2011 Symposium of Environmental Economics and Policy in China" in July 2011.

Asked to summarise his time as a Mäler Scholar, Zanxin Wang reflects:

"At the Beijer Institute, I learnt the frontiers of ecological economics, for example resilience assessment, and the methods of dynamic analysis. The experience and what I learnt at the Beijer Institute will have an important impact on my future professional growth."

**Saudamini Das** from India (SANDEE), Associate Professor, Institute of Economic Growth, Delhi, spent six months in autumn-winter 2011/2012 studying the extent to which mangrove forests provide protection from cyclonic winds. Building on a previously collected data set from India, Dr. Das also



examined the extent to which fragmented mangrove forests can provide wind protection services. With six months having passed since her stay, Dr. Das was asked to share her thoughts about what the Mäler Scholarship has meant to her.

**What made you apply for the Mäler Scholarship?**

*The most alluring reason was the opportunity to spend six months at the Beijer Institute and a chance to work with some of the researchers over there. I had heard so much about the positive work from my mentors and seniors at the Institute of Economic Growth and at SANDEE meetings that it was almost a dream to get a chance to spend some time there. The Mäler scholarship provided this chance.*

**What did you work with during your stay?**

*I wanted to work with Anne-Sophie Crépin to write a paper from my mangrove and to learn the technique of simulation. I was glad that I could do both. We wrote a joint paper on the topic “Do mangroves reduce wind damages of a storm?” and this paper is based on both econometric and simulation exercises.*

*I also prepared a manuscript with Prof Kanchan Chopra on the topic “Towards Green Growth: Measuring the trade-off between conservation of protected areas and hydel power generation in an ecologically*

*fragile hill state of Northern India” which was selected for presentation at the International Society for Ecological Economics Conference at Rio de Janeiro on 16–19 June 2012 and has also been published in Economic and Political Weekly, one of the top ranking journals in India.*

**What did the Mäler scholarship mean to your research?**

*On reflection, I feel my stay at the Beijer Institute has been one of the most productive times of my career. Being a Mäler scholar, I received international recognition as well as respect in my own country. I learnt new techniques of research and gained exposure to a different life style, social system, social values etc. that made me a mature researcher with a broader outlook. The Mäler scholarship also helped me to get a new job as Associate Professor at the Institute of Economic Growth, Delhi.*

**How do you regard your stay on a personal level?**

*It was full of extremes. Being from a tropical area, I was scared to death just thinking of life in Stockholm with snow and sub-zero temperature, but to my surprise those winter months turned out to be the most fantastic days of my stay in Stockholm. Taking a walk over the frozen Baltic Sea, or beholding*

▼ Mangrove forest. In her research, Mäler scholar Saudamini Das shows that mangroves not only offers protection from storm surge but also reduces wind damages from storms.

PHOTO: ISTOCKPHOTO/THINKSTOCK



*the snow-clad city dazzling under a bright sun are unforgettable experiences.*

*Spending the winter at the Beijer Institute gave me a chance to meet the Nobel Laureates of 2011 and experience the sophisticated Swedish cultural celebrations surrounding Christmas and Lucia. I formed many new friendships and contacts, I especially cherish the warmth received from the Beijer staff and the chance to share and discuss my work with them and the Institute's extended scientific network.*

## Environment and development economics

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

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

The journal is divided into two main sections: Theory and Applications, which includes regular academic papers, and Policy Options, which includes papers that may be of interest to the wider policy community. Environment and Development Economics also publishes Policy Fora (discussions based on a focal paper) and Book Reviews. From time to time, the journal publishes special issues based on a particular theme.

### General

During this twelve-month period, total submissions to the journal continued to increase. More significantly, the proportion of manuscripts which were submitted from the developing regions of the world also continued to show an increasing trend. This indicates the journal's effectiveness in addressing one of its primary objectives, capacity building in developing areas of the world.

The challenge of providing careful consideration of the scientific potential of each manuscript continues to be competently handled by the journal's

Associate Editors. At the same time, the Assistant Editor works to process the submissions and keep the review process on schedule for the growing number of manuscripts.

### Performance

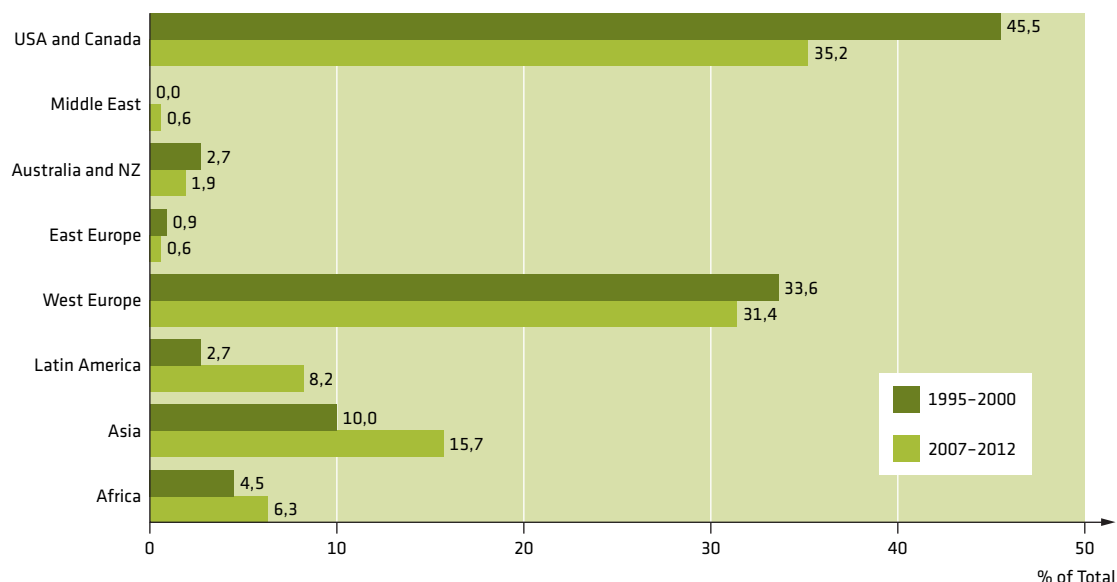
There were a total of 200 manuscripts submitted to *Environment and Development Economics* in 2011, a sizeable increase over the 171 manuscripts submitted in 2010. Based on the submissions for the first six months of 2012, total submissions for the current year are projected to be slightly higher than those for 2011.

Figure 1 provides information on the geographical breakdown of manuscripts that were accepted for publication in the journal, drawing a comparison between the first years of the journal's operation and the most recent years, in order to pick up the trend. As the diagram shows, the percentage of accepted papers from the developing regions has increased in recent years (lighter-coloured bars). This indicates that one of the journal's primary objectives, to provide a publication outlet to scientists in developing areas, is being successfully addressed.

The Thompson Reuters impact factor for the journal, which showed a huge increase last year, dropped back down this year. Last year's rise was due in large part to citations from the special issue on "Payment for Ecosystem Services", guest-edited by Erwin Bulte and David Zilberman, which was very well received. The journal has several special issues currently in progress, as mentioned below.

The journal works hard to move papers quickly through the review process, but it also allows some promising papers to pass through several revisions before reaching their final form. In this context, the journal would like to express appreciation to the large number of knowledgeable and dedicated reviewers who assist the journal in evaluating the submitted manuscripts in a timely way.

During the past 12 months the journal published two special issues. The first, which appeared in August 2011, was "Emissions from Deforestation and Forest Degradation (REDD)", guest-edited by Valentina Bosetti and Steven Rose. The second was a special Symposium feature which appeared in the June 2012 issue. This featured an article, "Sustainability and the measurement of wealth," by Kenneth J. Arrow, Partha Dasgupta, Lawrence H. Goulder, Kevin J. Mumford and Kirsten Oleson,



**Figure 1.** Geographical distribution of manuscripts published in the journal *Environment and Development Economics* in 2011.

with related commentaries by economists who have made contributions in this area of research.

### Future activities and targets

Nearing completion are special issues on: “Small Island Developing States” (guest editors Charles Perrings, Paolo Nunes and Sonja Teelucksingh), “Seed Supply in Local Markets: Policies to Support Sustainable Use of Crop Genetic Resources” (guest editors Paul Winters, Romina Cavatassi, and Leslie Lipper), and “Global and International Envi-

ronmental Issues” (guest editors Ariel Dinar and Georges Zaccour).

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. ■

ANASTASIOS XEPAPADEAS, EDITOR OF EDE AND MEMBER OF THE BEIJER INSTITUTE'S BOARD OF DIRECTORS



# The Beijer Institute and Stockholm Resilience Centre

by Carl Folke

**AGAIN THIS YEAR** there has been intense collaboration with Stockholm Resilience Centre (SRC). Integrative research was carried out with several joint grants, projects and workshops during the year. Beijer Institute researchers and fellows serve as SRC theme leaders, advisory committee members and board members. The communication and outreach of the Beijer Institute is substantially magnified through the close collaboration with SRC and Albaeco, and research results, workshops and events are highlighted on the SRC website.

Research at SRC takes an integrated view of people and nature as social-ecological systems. Framed by the recognition that people are part of, and dependent on, the biosphere, the curiosity-driven, problem-orientated and often explorative research aims for a deeper understanding of human-environment interactions. There is a focus on complex adaptive and truly interwoven social-ecological systems, cross-scale interactions, from local to global, from history to the future; not solely but predominantly applying the resilience lens. The interplay between periods of gradual change and periods of abrupt change, the ability to reorganise and develop in the face of change and how to turn crises into new opportunities for sustainability are being investigated. Particular emphasis is placed on understanding the risks and opportunities of social-eco-

**Stockholm Resilience Centre** is an international centre that advances research for governance and management of social-ecological systems to secure ecosystem services for human wellbeing and resilience for long-term sustainability. The advancements in research are applied and further developed within practice, policy and academic training. SRC is a joint initiative of the Beijer Institute, the Royal Swedish Academy of Sciences, Stockholm Environment Institute and Stockholm University.  
[www.stockholmresilience.su.se](http://www.stockholmresilience.su.se)



logical tipping points and regime shifts, and on developing management and governance strategies to steer free from these and adapt or even transform to improved situations. The hope is to generate understanding that will contribute to improved stewardship of ecosystem services for human wellbeing.

The six research themes of the SRC involve scholars from the natural and social sciences and the humanities, within SRC, in Sweden and internationally. The Beijer Institute's competence in ecological economics is of great significance for the development and activities of SRC and three themes are led by members of the Beijer Institute.

## Research Insights

During the year, a new series called Research Insights was launched at SRC, with major inputs by Beijer researchers. The Insights are based on peer-reviewed publications from researchers at SRC, the Beijer Institute and SEI, combining and compiling individual publications into co-authored

documents that contribute to a broader understanding of social-ecological dynamics and resilience thinking. They clarify research perspectives, present new propositions and identify emerging research fronts. These research achievements are synthesised for the purposes of teaching and training and for broader communication.

## Programme on Ecosystem Change and Society

In 2011, the international office of the Programme on Ecosystem Change and Society (PECS) was established at Stockholm Resilience Centre. PECS, an interdisciplinary scientific programme, is jointly sponsored by ICSU and UNESCO. The PECS vision is a world where human actions have been transformed toward stewardship of social-eco-

logical systems for global sustainability. PECS will provide coordination, an overarching framework and a focus for research projects that investigate the resilience and dynamics of social-ecological systems and ecosystem services in landscapes and seascapes globally. A comparative, place-based approach is at the core of PECS research. PECS is chaired by Beijer fellow Steve Carpenter, and Beijer board member and fellow Steve Polasky is on the board, while Beijer director Carl Folke has been serving as director of PECS since spring 2011. PECS is a scientific follow-up programme of the *Millennium Ecosystem Assessment* (MA), in particular the sub-global assessments, and with solid scientific knowledge may provide input to the recently established *Intergovernmental Platform on Biodiversity and Ecosystem Services* (IPBES). ■

▼ HM Carl XVI Gustaf of Sweden and HRH The Prince of Wales enjoy a cup of tea together with SRC director Johan Rockström and SEI researcher Fiona Lambe, during a visit to SRC in March 2012. The tea was made from an ethanol fuelled cooking stove which reduces environmentally harmful fuelwood consumption.



PHOTO: STOCKHOLM RESILIENCE CENTRE/SEI

# My Beijer experience – reflections of a Beijer Fellow

by Gretchen C. Daily

In connection with the 2011 board meeting, the Beijer Institute celebrated its 20th anniversary with a boat ride from the Academy's botanical garden to Director Carl Folke's home in Lidingö, where the annual board dinner was held. To give a snapshot of its activities over the years, former board member and long term Beijer collaborator and Fellow since the start of the Beijer Institute in 1991, Gretchen Daily, shares experiences of her involvement with the Beijer Institute.



PHOTO: THE BEIJER INSTITUTE

▲ Gretchen Daily

**MY LIFE HAS BEEN** powerfully shaped by the Beijer Institute of Ecological Economics, and I can hardly overstate my debt to its core members and many international participants. Nowhere else have I encountered such an extraordinary mix of intellectual openness, energy, and inspiration. Moreover, at the Beijer this intellectual atmosphere – focused on understanding the world better – is cultivated together with a commitment to making the world better. The warm, personal hospitality fosters a camaraderie that helps sustain the spirits and efforts of all involved. Altogether, the Beijer offers an unsurpassed blend of the finest scholarship, real-world problem solving, and collegiality and friendship.

Although my relationship with the Beijer has proved wonderful, I have to say that my first encounter was utterly terrifying. The invitation sounded very promising... to join in the discussions of July/August 1992 on the ecological economics of

biodiversity, a topic that I have pursued ever since. Just before then, I had started getting to know Partha Dasgupta, Ken Arrow, Larry Goulder, David Starrett and other economics colleagues, during Partha's sabbatical at Stanford. But the prospect of discussing ecology and economics with so many heroes – especially those about whose work I still knew embarrassingly little – was intimidating. I did not even have my doctorate yet (though ink had just been put to the necessary forms) and felt thoroughly unqualified.

What made matters infinitely worse was that my thesis mentor, Paul Ehrlich, had been invited to give an opening plenary address – and in a characteristically generous but uncharacteristically quiet gesture, he shifted the job to me without telling anyone else! I stuttered my way through a talk, under the gaze of the Royal Swedish Academy's finest scientists, their portraits hanging above me in the main hall around crystal chandeliers, and barely managed not to faint when challenged on a number of points.

After that, breathing became steadily easier and fast-forwarding to now. I was given the pleasure of a couple more meetings in Stockholm and soon began pouring my research and teaching life into Beijer Institute causes. Like many, I am repaying my life debt by engaging large numbers of colleagues and students, so that the influence of the Beijer Institute is extending well beyond those directly involved.

Early in the course of Askö meetings, I was invited to lead two papers: one on population, food security and the environment<sup>1</sup> and the other on valu-

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<sup>1</sup> Daily, GC, P Dasgupta, B Bolin, P Crosson, J du Guerny, PR Ehrlich, C Folke, AM Jansson, B-O Jansson, N Kautsky, A Kinzig, S Levin, K-G Mäler, P Pinstrup-Andersen, D Siniscalco, and B Walker. 1998. *Food production, population growth, and the environment*. Science 281: 1291–1292.





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- 1 Former and current chairman of the board – **Tasos Xepapadeas** and **Scott Barrett** Beijer 20<sup>th</sup> anniversary.
- 2 **Marc Metian**, **Karine Nyborg** and **Simon Levin** at work during the 2011 Askö meeting.
- 3 **Scott Barrett** and **Aart de Zeeuw** at Beijer 20<sup>th</sup> anniversary.
- 4 **Scott Taylor** and **Roz Naylor** at Beijer 20<sup>th</sup> anniversary.
- 5 **Simon Levin**.
- 6 **Max Troell**, **Carl Folke** and **Marc Metian** on the boat to Askö 2011.
- 7 **Caroline Schill** and **Saudamini Das** at Beijer 20<sup>th</sup> anniversary.
- 8 Beijer Institute board and staff gathering to celebrate the Beijer 20<sup>th</sup> anniversary.



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ing nature<sup>2</sup>. Both cases were a tremendous learning experience, first in the rich and wide-ranging discussions; then in the wonderful meals and afternoon walks; a bit later during the cheerful evenings; and finally in process of distilling from all this learning a compelling and coherent story. The “training” I received benefited me enormously, in all of its serious and not-serious respects, and is something I would love to see extended to other junior participants today. I’m very excited by the new Beijer Young Fellows Program, which has the potential for major impact on future generations of scholars.

These discussions and collaborations fueled my research, which has focused heavily on the nexus of my first two Askö papers. But the pragmatic approach of the Beijer to making the world a better place also influenced me deeply. I remember finding the mix of participants in some of the early meetings absolutely exhilarating – academics from many fields rolling up their sleeves with those putting ideas to the test in the real world, from influential positions in government agencies, development organizations, and NGOs. I also remember a Stockholm-based training program, through which government statisticians from many countries learned principles of green accounting, while informing academics of the real-world challenges of implementation and ways around them. And I’ve always been especially impressed with the capacity building in ecological economics research, elegantly conducted in regions throughout the world. It is very difficult to quantify the impact of such efforts, but my sense is that they have been extremely effec-

tive, as is reflected in the thriving regional networks and the brilliantly designed and managed journal *Environment and Development Economics*.

With the intellectual foundations and pragmatic approach of the Beijer Institute, I co-founded the Natural Capital Project, an international partnership aiming to mainstream the values of natural capital into major decisions ([www.naturalcapitalproject.org](http://www.naturalcapitalproject.org))<sup>3</sup>. Through this effort and numerous others, the seeds of the Beijer are now generating advances in interdisciplinary science, practical tools, real-world policy design and implementation, and engaging of leaders worldwide. The efforts span a wide range of scales and a powerful array of stakeholders necessary to drive change, including leaders in local communities, and at all scales of government, the private sector, and NGOs.

From a scholarly perspective, perhaps what has inspired me most about the Beijer approach is moving from knowledge to action, both at the highest levels of influence and also one person at a time. Each Beijer program I’ve gotten to know is thoughtfully and strategically designed, from research planning through to execution, communication (to a wide range of audiences), capacity building, and engaging leaders to foster change.

From a personal perspective, the Beijer has helped me and many, many others reach for dreams that would seem too wild and daunting to chase were it not for the warmth, courage, and spirit of camaraderie fueling the collective efforts of everyone the Beijer has touched. ■

<sup>2</sup> Daily, GC, T Söderqvist, S Aniyar, K Arrow, P Dasgupta, P Ehrlich, C Folke, A-M Jansson, B-O Jansson, N Kautsky, S Levin, J Lubchenco, K-G Mäler, D Simpson, D Starrett, D Tilman, and B Walker. 2000. *The value of nature and the nature of value*. Science 289: 395–396.

<sup>3</sup> Kareiva, PK, H Tallis, TH Ricketts, GC Daily, and S Polasky, Eds. 2011. *Natural Capital: Theory & Practice of Mapping Ecosystem Services*. Oxford University Press, Oxford.



## Board of Directors

▼ **Beijer Institute Board 2011.** *Back row:* Steve Polasky, Marten Scheffer, Karine Nyborg, Scott Barrett, Aart de Zeeuw. *Front row:* Scott Taylor, Rosamond Naylor, Anne-Sophie Crépin, Anasztasios Xepapadeas, Carl Folke, Staffan Normark.

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 21<sup>st</sup> annual board meeting was held at the Royal Swedish Academy of Sciences on 16 September 2011.

With the latest board meeting Terry Hughes, Professor at James Cook University, Queensland, Australia, reached the end of his term. He has been on

the board since 2006 and the Beijer Institute wishes to express its warmest gratitude for his great efforts for the Institute over the years.

### Board of Directors 2011–2012

#### CHAIRMAN

**Scott Barrett**

Professor, Columbia University, USA

#### EX-OFFICIO MEMBERS:

**Carl Folke**

Director, the Beijer Institute, Sweden



PHOTO: CECILIA NORDSTRAND



## NEW BOARD MEMBERS 2011



**Eric Lambin** is a Professor and shares his time between the Department of Environmental Earth System Science at Stanford University, USA, and the Department of Geography at the University of Louvain, Belgium. Eric's research aims at providing a better understanding of land change and human-environment interactions in land systems. He has been involved in the Beijer Institute's Global Dynamics and Resilience programme.

PHOTO: CECILIA NORDSTRAND



**Rosamond Naylor** is Professor of Environmental Earth System Science and the Director of the Center on Food Security and the Environment at Stanford University, USA. Her research focuses on economic and biophysical dimensions of food security and environmental impacts of crop and animal production. At Stanford, Rosamond teaches courses on the World Food Economy, Human-Environment Interactions, and Sustainable Agriculture.

PHOTO: CECILIA NORDSTRAND



**Karine Nyborg** is a Professor at the Department of Economics, University of Oslo, Norway. Karine's research interests are within environmental economics, economic analysis of social and moral norms, and behavioural economics. She is the current President of the European Association of Environmental and Resource Economists. Besides her research career, she is also a published fiction writer.



PHOTO: CECILIA NORDSTRAND

**M. Scott Taylor** is a Professor and holder of the Canada Research Chair in International, Energy and Environmental Economics at the University of Calgary, Alberta. He is also a Research Associate at the National Bureau of Economic Research. Scott's research focuses on the interaction of international markets and environmental outcomes. He is a Beijer Fellow and has been involved in the Institute's Global Dynamics and Resilience programme.

## 2012



PHOTO: CHRISTINA LEIJONHUFVUD

**Stuart "Terry" Chapin** is a Professor at the Institute of Arctic Biology and the Department of Biology and Wildlife, University of Alaska, USA. Terry's background is in plant physiological ecology and ecosystem ecology, with current interests in the resilience of social-ecological systems. Terry has been involved with the Beijer Institute since 2004, when he attended the Askö meeting in Abisko on Resilience in Arctic Areas.

### Staffan Normark\*

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

### Anne-Sophie Crépin

Deputy Director, the Beijer Institute, Sweden

### MEMBERS

### Stephen Carpenter\*

Professor, University of Wisconsin, USA

### Eric Lambin

Professor, University of Louvain, Belgium

### Rosamond Naylor

Professor, Stanford University, USA

### Karine Nyborg

Professor, University of Oslo, Norway

### Stephen Polasky

Professor, University of Minnesota, USA

### Marten Scheffer

Professor, Wageningen University, the Netherlands

### M. Scott Taylor

Professor, University of Calgary, Canada

### Aart de Zeeuw

Professor, Tilburg University, the Netherlands

### Anastasios Xepapadeas

Professor, University of Athens, Greece

\* member of the Royal Swedish Academy of Sciences

## STAFF NEWS



**Caroline Schill** joined the Beijer Institute in September 2011 as a research assistant in the BENN research project “Managing resources with potential regime shifts – using experiments to explore social-ecological linkages in common pool resource systems” (see separate article). Within the scope of this project, she also wrote her

Master’s thesis in the Stockholm Resilience Centre Master’s programme, *Ecosystems, Resilience and Governance*. Caroline, who has a background in business management and economics from the University of Mannheim in her native Germany, successfully defended her thesis in June 2012. In August 2012 she was accepted as a PhD candidate at Stockholm University, with her PhD studies funded by and based at the Beijer Institute and with Carl Folke as main supervisor and Johan Colding and Therese Lindahl serving as assistant advisors. Within her PhD studies, Caroline wants to further investigate how users of a common-pool resource respond to more or less predictable abrupt ecosystem changes, and how such changes affect institutions. The core methods will be behavioural laboratory and field experiments. Acknowledging the rapid rate of urbanisation, parts of her studies will have a distinct urban angle, answering questions like: What kind of human-ecosystem interactions are special to urban green commons and what role could they play in reconnecting humans to the biosphere?



**Johan Gars** joined the Beijer Institute in September to work as a researcher and his research interests include the economics of renewable resources and the economics (mostly macro) of climate change. His undergraduate qualifications consist of a Bachelor’s degree in economics from

Stockholm University and a Master of Science degree in Engineering Physics from the Royal Institute of Technology in Stockholm. In June 2012 he defended his PhD thesis “Essays on the Macroeconomics of Climate Change” (see separate article) and thereby obtained his PhD in economics at the Institute for International Economic Studies, Stockholm University. Given his research interests and combined social and natural science background, joining the Beijer Institute seems like a perfect match. As part of the Institute, Johan hopes to expand his research focus by including other global environmental challenges besides climate change.



In May 2012, **Johan Colding** was promoted to Associate Professor in Natural Resource Management at Stockholm University. Johan has been working at the Beijer Institute since 1995 and is leading the Urban Social-Ecological Systems programme.

PHOTOS: CECILIA NORDSTRAND

## Staff members

**Carl Folke**, Professor, Director

**Anne-Sophie Crépin**, PhD, Deputy Director

**Erik Andersson**, PhD, Researcher

**Stephan Barthel**, PhD, Researcher

**Johan Colding**, Associate Professor, Researcher

**Gustav Engström**, PhD candidate, Researcher

**Johan Gars**, PhD, Researcher

**Matteo Giusti**, MSc, Research Assistant

**Åsa Gren**, PhD, Researcher

**Christina Leijonhufvud**, BA, Administrator

**Chuan Zhong Li**, Professor, Programme Director

**Therese Lindahl**, PhD, Researcher

**Karl-Göran Mäler**, Professor emeritus, former Director, Research Associate

**Stephen Polasky**, Professor, Programme Director

**Caroline Schill**, MSc, Research assistant

**Jason Shogren**, Professor, Programme Director

**Agneta Sundin**, Communications officer and financial controller

**Max Troell**, Associate Professor, Researcher

**Brian Walker**, PhD, Programme Director

**Aart de Zeeuw**, Professor, Programme Director

## Visiting Scientists

**Zanxin Wang**, Dr, Yunnan University, September–October 2011

**Saudamini Das**, Dr, University of Delhi, September 2011–February 2012

**Christopher Hill**, Research Assistant, December 2011

**Dieter Grass**, PhD, Vienna University of Technology, January 2012

**Karine Nyborg**, Professor, University of Oslo, February 2012

**Eric Naevdal**, Dr, University of Oslo, February 2012

**Efthymia Kyriakopoulou**, Dr, Gothenburg University, May–June 2012

## 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.

#### Christina Leijonhufvud

Christina was responsible for the administration of the Board and Askö meetings in September 2011 and she organised the workshop *'Inconvenient feedbacks in Global Dynamics III'* on 20–21 September 2011. She was on leave October–December 2011 (in New York). In 2012 she organised the ACCESS General Assembly in March and the Beijer Young Scholars (BYS) first workshop in May: *How can we stimulate social innovation and steer technological progress to promote desirable and resilient futures for humanity?*, as well as helping to organise the PhD course *"Ecology and Management"* in March and the ICES SGSA 2012 Annual Meeting in April. She is responsible for administration of the Mäler Scholarships and other guest research posts. Christina was also administrator for the course *"Economics of Environmental Change"* held in Prague on 26–27 June 2012.

#### Agneta Sundin

Agneta is communications officer and financial controller. Her responsibilities include developing and editing the website, administering the Beijer Publication Series and editing the Annual Report. As financial controller she handles budgetary and accounting issues for the Beijer Institute. A member of Stockholm Resilience Centre Communications team, Agneta is involved in activities arranged

jointly by the SRC, Beijer and Albaeco, for example the Stockholm Seminars series. She was co-organiser of the first Beijer Young Scholars (BYS) workshop in May.

## Funding

Core funding for the Beijer Institute is provided by the Kjell and Märta Beijer Foundation. Funding for the Beijer Institute's research activities between 1 July 2011 and 30 June 2012 was also provided by:

- ✦ The Brothers Jacob and Marcus Wallenberg Memory Foundation
- ✦ The Crafoord Foundation
- ✦ The European Commission
- ✦ The Ebba and Sven Schwartz Foundation
- ✦ The Foundation for Strategic Environmental Research, MISTRA
- ✦ The Research Council of Norway.
- ✦ The Royal Swedish Academy of Sciences
- ✦ The Swedish International Development Cooperation Agency, Sida
- ✦ The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, FORMAS
- ✦ Western Indian Ocean Marine Science Association, WIOMSA

## Collaborations

### Australian Research Council, Centre of Excellence for Coral Reef Studies

The Beijer Institute serves as a partner investigator in Programme 5 of the ARC centre – Resilience of Linked Social-ecological Systems ([www.coralcoe.org.au](http://www.coralcoe.org.au)). The objective of the programme is to provide new solutions to managing resilience and coping with change, uncertainty, risk and surprise in complex social-ecological systems. The overall aim is to improve the governance and management of natural systems and enhance their capacity to sustain human and natural capital. This represents a major new programme of innovative multi-disciplinary research, which combines expertise on coral reef biology, management, governance, economics and



social sciences. A major outcome is to develop information, guidelines and tools for coral reef managers and planners on climate change risks and adaptation options. The scope of this programme is global.

The collaboration and workshops have generated new insights on the management and governance of coral reefs and other coastal social-ecological systems and have influenced policy. Publications over the years of collaboration include three papers in *Science*, two in *PNAS*, two in *TREE*, and one each in *Nature*, *Ecology and Society*, *Conservation Biology* and *Ambio*.

### **The Resilience Alliance**

A central network of collaboration is the Resilience Alliance (RA), an international consortium of leading research groups and organisations that collaborate to explore the dynamics of social-ecological systems and seek novel ways to integrate science and policy in order to discover foundations for sustainability ([www.resalliance.org](http://www.resalliance.org)). The RA and the focus on social-ecological systems emerged out of research programmes of the Beijer Institute in the 1990s, including the Resilience Network, and the Beijer Institute is an active member of the Alliance. The journal *Ecology and Society* is owned by the Resilience Alliance, with Beijer Director Carl Folke as one of the editors-in-chief.

### **The SARAS collaboration**

The Beijer Institute is engaged in the South American Institute for Resilience and Sustainability Studies (SARAS), an interdisciplinary research institute designed to catalyse high-impact science that serves to enhance South America's long-term resilience and sustainable development. It was launched in December 2007 in Montevideo, Uruguay.

SARAS works towards a regional centre cooperating closely with scientific communities and related funding agencies in several of the South American countries and with an established set of international key scientists. The SARAS building will be located on the coast of Uruguay and will provide facilities for workshops, courses and sabbaticals. The Beijer Institute and Stockholm Resilience Centre are strongly engaged in SARAS. There is a Science Board, members of which include Beijer fellows Steve Carpenter and Marten Scheffer and also Carl Folke. An exciting workshop on coastal fisheries in South America was organised in December 2011.

### **NorMER – Nordic Centre of Excellence**

Through collaboration with Stockholm Resilience Centre, Beijer researchers participate in a *Nordic Centre of Excellence on Climate Change Effects on Marine Ecosystems and Resource Economics* (NorMER). The Beijer Director serves as co-chair of the programme with Professor Nils Christian Stenseth from the Centre for Ecological and Evolutionary Synthesis at the University of Oslo. The five-year programme explores the biological, economic and societal risks and opportunities of global climate change on fisheries resources across the Nordic region, with Atlantic cod as the primary focus. Through post-doc posts and PhD studentships, there are internationally collaborative projects between the participating partners in the Nordic countries. The Top-level Research Initiative of Nordforsk funds the programme. Beijer Fellow Simon Levin serves on the Advisory Panel for NorMER.

### **The Nereus Programme**

Over-exploitation of the world's fish resources has caused serious declines in fish populations, and there is widespread concern that the world's oceans will be unable to supply fish products for future generations. Given the importance of marine fisheries for food security throughout the world, this poses a serious threat for coming generations, and we must ask if there will be sufficient fish products for our children and grandchildren. The Nereus Programme was launched to provide scientific advice on these very issues. It is an international research and outreach network with five leading academic institutions as partners. It is focused 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 our children and grandchildren to enjoy. The researchers of the programme are based at the University of British Columbia, Princeton University, Duke University, WCMC/Cambridge University, Stockholm Resilience Centre and the Beijer Institute. The Nippon Foundation is providing financial support for a nine-year period.

### **The Erling-Persson Family Academy Programme on the Ecological Economics of Global Change**

Research on global sustainability in the anthropocene is urgently needed, with ongoing redirection and restructuring of international research efforts to

generate knowledge and understanding for human progress and wellbeing. The new five-year programme at the Royal Swedish Academy of Sciences, funded by the Erling-Persson Family Foundation, will support a collaborative platform for early career economists and researchers in the natural sciences to generate a better understanding about the preconditions and opportunities for sustainable social and economic development within the capacity of the biosphere. There will be six positions for researchers and post-docs as well as visiting professors. The programme will officially start in 2013, led by the Director of the Beijer Institute, and will benefit from and collaborate with scholars of the Beijer Institute and Stockholm Resilience Centre.

### **Ebba och Sven Schwartz Stiftelse**

The Swedish Foundation Ebba och Sven Schwartz Stiftelse supports Stockholm Resilience Centre and the Beijer Institute through a career grant to three skilful researchers, 2011–2013, with possibilities for extension. The overall focus of the grant is to find ways to allow people to take account of ecosystem support and services in decision making. The projects concern economic theory, regime shifts and wellbeing; freshwater, agriculture and ecosystem services; and adaptive governance of social-ecological systems in dynamic landscapes and seascapes.

▼ Students and lecturers of the Ecology and Management Course, organised by Max Troell at the Beijer Institute March 2012.

▼► Huifan Tian and Hang Yin during a course group exercise.

## **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 proj-

ects. The Institute organises training workshops and international research seminars on environment and development and international training programmes.

### **The Economics of the Environment**

This PhD-course is held by the Beijer Institute biannually and gives an overview of the field of Environmental Economics, as well as a deeper understanding of a few selected areas. It covers basic theories and addresses how the complexity of the socio-ecological environment alters these theories.

The objective of the course is to provide students with an introduction to environmental economics, as well as a deeper understanding of a few selected areas. The course covers basic theories and provides deeper knowledge about how the complexity of the socio-ecological environment alters these theories. The focus areas include resource economics, international environmental agreements, informal solutions to resource management problems and valuation, including green accounting.

### **Ecology and Economic Management**

This PhD-course aims to provide students in Environmental Economics with an understanding of the complexity and functions of interlinked socio-ecological systems, and the implications this has for governance. The course is aimed at PhD students participating in the SIDA-financed PhD programme in Environmental Economics at Gothenburg University and it is held at the Beijer Institute every second year. The PhD programme was established by the Beijer Institute and the Environment



PHOTO: AGNETA SUNDIN



PHOTO: AGNETA SUNDIN

Economics unit at Gothenburg University in 1997. The purpose of the programme is to strengthen the capacity in developing countries to teach environmental economics at university level, and to establish a firm basis for research that can be used for policy advice pertaining to environmental economics and sustainable development.

The course was held at the Beijer Institute March 12–23, 2012 with ten students from six different countries (Ethiopia, Bangladesh, China, Tanzania, Colombia and Sweden). There were ten lecturers involved, originating from the Beijer Institute, Stockholm Resilience Centre, Stockholm University, and Uppsala University.

## The Stockholm Seminar: Frontiers in Sustainability Science and Policy

The Stockholm Seminars are arranged by the Beijer Institute, Stockholm Environmental 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.

During 2011/2012, the following seminars were held at the Royal Swedish Academy of Sciences:

### 2011

**15 December:** Prof. Claude Henry  
*Dealing with uncertainty in science and decision-making*

### 2012

**3 February:** Dr. Tim Lynam  
*Making sense of climate change and adaptation*

**9 February:** Prof. Karine Nyborg  
*The ethics and politics of environmental cost-benefit analysis*

**21 February:** Dr. Henrik Österblom  
*Save a third for the birds*

**7 March:** Prof. Oran Young  
*The effectiveness of international regimes*

**18 April:** Dr. John Ingram  
*Food security and planetary boundaries*

**26 April:** Prof. Jean-Marc Jancovici  
*Going carbon-free, a mere joke?*

**11 May:** Prof. Mark Swilling  
*Rapidly developing economies  
Is a just transition possible? – a southern perspective*

**21 May:** Dr. Rolph Payet  
*Low-lying coastal areas and small island states  
Climate change and sea level rise: can we adapt?*

**23 May:** Dr. John Tanzer  
*Integrated marine resource management  
Institutional entrepreneurs and the emergence of international institutions for ecosystem stewardship*

**29 May:** Prof. Robert Costanza  
*Future sustainable well-being  
Solutions for a sustainable and desirable future*

**31 May:** Prof. Steve Lansing  
*Genetic discontinuity  
Did a butterfly effect change the history of the Pacific?*

**7 June:** Prof. Marianne Krasny  
*Civic ecology  
Social-ecological innovations in cities*

**12 June:** Dr. Francois Bousquet  
*Dialogues on social-ecological systems  
Collective action and conservation of identities*

## Brown Bag Lunch Seminars

The Brown Bag Lunch Seminars are a joint initiative between the Beijer Institute, Stockholm Resilience Centre, Stockholm Environment Institute, Albaeco and the Natural Resource Management group at the Department of Systems Ecology. 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 2011 was "Food Security and Aquaculture Development in a Globalized World – Links and Tradeoffs between Marine and Terrestrial Production Systems". The meeting is described in more detail earlier in this Annual Report, under the section "Aquaculture and Sustainable Seafood Production".

## Staff members' publications and activities

Staff members' research activities are presented at events such as conferences, workshops and seminars. To stimulate interaction between staff members at both the Beijer Institute and Stockholm Resilience Centre, joint internal seminars take place regularly. Below is a selection of staff members' publications and activities during 2011/2012.

### Erik Andersson

PhD, researcher

#### Research focus:

Urban ecology

#### Teaching and training:

- ❖ Lecturer, undergraduate level course: *Hållbar samhällsutveckling (Sustainable Societal Development)*, Department of Physical Geography and Quaternary Geology, Stockholm University, autumn 2011.

#### Seminars and symposium presentations:

- ❖ IALE World Congress, Beijing, China, August 2011. Presentation: *Practical tool for landscape planning? An empirical investigation of network based models of habitat fragmentation.*

### Stephan Barthel

PhD, researcher

#### Research focus:

- 1 Urban ecosystem services, resilience, green architecture, urban gardens, social-ecological memory.
- 2 History and bio-cultural diversity in landscapes of food production.

#### Publications during the period:

- ❖ Barthel, S., J. Parker, C. Folke, and J. Colding. 2012. *Urban gardens: Pockets of social-ecological memory*. In: Tidball, K.G., and M.E. Krasny (eds.). *GREENING IN THE RED ZONE: DISASTER, RESILIENCE AND COMMUNITY GREENING*. Springer, Dordrecht, Netherlands, in press.
- ❖ Barthel, S., and C. Isendahl. 2012. *Urban gardens, agriculture and water management: Sources of resilience for long-term food security in cities*. *ECOLOGICAL ECONOMICS*, in press.
- ❖ Bendt, P., S. Barthel, and J. Colding. 2012. *Civic greening and environmental learning in public-access community gardens in Berlin*. *LANDSCAPE AND URBAN PLANNING*, in press.

#### Seminars and symposium presentations:

- ❖ Launch of the environmental research centre Garðarshólmur, Húsavík, Iceland, July 2011. Stockholm University representative and Key-note speaker.
- ❖ Seminar on Social-Ecological Urban Design and Sustainable Development, Kulturhuset, Stockholm, May 2012. Keynote speaker.
- ❖ Seminar: *Svaga samband i Stockholmsregionens gröna kilar (Weak links for green wedges in the Stockholm region)*, Office of Regional Growth, Environment and Planning (TMR), Stockholm, June 2012. Keynote speaker.

#### Teaching and training:

- ❖ Invited lecturer, Department of History, Department of Law, and Department of Geography at Stockholm University; Department of Architecture at Royal Institute of Technology, Stockholm; Department of Archaeology at Uppsala University.
- ❖ Course leader and main lecturer, undergraduate level course: *Hållbar samhällsutveckling (Sustainable Societal Development)*, in collaboration with the Department of Physical Geography and Quaternary Geology, Stockholm University, autumn 2011, spring 2012.
- ❖ Course leader and main lecturer, Master's level and ERASMUS course: *Urban Environmental History*, Department of History, Stockholm University, autumn 2011.
- ❖ Lecturer: *Bebyggelse och bostadspolitik i mina drömmars stad (Housing development and poli-*

*tics in urban utopia*), open lecture series, Stockholm University, September 2011. Webcast and shown on TV (science channel).

- ❖ Main supervisor of Master's students (Stockholm Resilience Centre) Christopher Hill, Thomas Saarne, Matteo Guisti and Ella Grosse.

#### Commissions:

- ❖ Reviewer, *Ecology and Society*, *Global Environmental Change*, *Environmental Science and Policy*, *Landscape and Urban Planning*, *the International Journal of the Commons*, *Ecological Economics*, *Transactions of the Institute of British Geographers*, *Progress in Human Geography*, and *Conservation Biology*.
- ❖ Expert advisor to Stadsbyggnadskontoret (City Planning Office) Stockholm during the planning process of a new campus area.

### Johan Colding

Associate Professor, researcher

#### Research focus:

Urban social-ecological systems

#### Publications during the period:

- ❖ Barthel, S., J. Parker, C. Folke, and J. Colding. 2012. *Urban gardens: Pockets of social-ecological memory*. In: Tidball, K.G., and M.E. Krasny (eds.), *GREENING IN THE RED ZONE: DISASTER, RESILIENCE AND COMMUNITY GREENING*. Springer, Dordrecht, Netherlands, in press.
- ❖ Bendt, P., S. Barthel, and J. Colding. 2012. *Civic greening and environmental learning in public-access community gardens in Berlin*. *LANDSCAPE AND URBAN PLANNING*, in press.
- ❖ Colding, J. 2011. *Ekosystem sliter i städer (Ecosystems work hard in cities)*. FORMAS TIDNING MILJÖFORSKNING Nr 9. Available at: <http://miljoforskning.formas.se/sv/Nummer/Oktober-2011/Innehall/Temaartiklar/Ekosystem-sliter-i-stader/>.
- ❖ Marcus, L., and J. Colding. 2011. *Towards a spatial morphology of urban social-ecological systems*. Conference proceedings for the 18th International conference on urban form, ISUF2011, August 26–29, 2011, Concordia University, Montreal, Canada.

#### Seminars and symposium presentations:

- ❖ Stockholm County Administrative Board, Stockholm, September 2011. Presentation: *Ekosystemtjänster och grön planering för städer (Ecosystem services and green planning for cities)*.
- ❖ Conference: *Forskning för Miljömålen (Research for the Environmental Goals)*. Swedish Environmental Protection Agency, Stockholm, October 2011. Presentation: *Ekosystemtjänster och grön planering för städer (Ecosystem services and green planning for cities)*.
- ❖ Seminar: *Golfbanan: En arena för idrott, friluftsliv och naturvård (The golf course: An arena for sports, outdoor recreation and nature conservation)*. Stockholm University, May 2012. Presentation: *Golfbanor och biologisk mångfald (Golf courses and biodiversity)*.
- ❖ Seminar: *Hållbar utveckling – kommunernas främsta utmaning (Sustainable development – prime challenge for municipalities)*. Organized by the Institute of Urban History, Stockholm University, May 2012. Presentation: *Urbana samfälligheter: Äganderättens betydelse för naturen i stadsrummet (Urban commons: The importance of property rights for urban nature)*.
- ❖ Lecture for approval as Associate Professor in Natural Resource Management, Department of Systems Ecology: *Insights from the applicant's research on resilience building of social-ecological systems*, Stockholm University, May 2012.

#### Teaching and training:

- ❖ Main supervisor of PhD student Catherine Wilkinson, *Social-ecological resilience and planning: an interdisciplinary exploration*, Department of Systems Ecology, Stockholm University, expected PhD defence in September 2012.

#### Commissions:

- ❖ Advisor to the Office of Regional Growth, Environment and Planning (TMR) for the report *Gröna svaga samband (Weak Green Links)*, several meetings and workshops during 2011.
- ❖ Advisor to the Ministry of the Environment on the strategy for developing a national plan for the valuation of ecosystem services, together with Albacco/Stockholm Resilience Centre, Ministry of the Environment, Stockholm, June 2012.

- ❖ Subject editor and Editorial Board member of *Ecosystems* and *Ecology and Society*.

## Anne-Sophie Crépin

PhD, Deputy Director, researcher

### Research focus:

Regime shifts and economics, global dynamics and resilience, economic consequences of climate change in the Arctic Ocean, modelling social ecological systems.

### Publications during the period:

- ❖ Crépin, A.-S., R. Biggs, S. Polasky, M. Troell, and A. de Zeeuw. *Regime shifts and management*. In: Shogren, J. (ed.). *ENCYCLOPAEDIA OF ENERGY, NATURAL RESOURCE AND ENVIRONMENTAL ECONOMICS*. Elsevier Science, Oxford, UK, in press.
- ❖ Das, S., A.-S. Crépin. 2012. Beijer Discussion Paper 233: *Do mangroves provide storm protection from wind damages of a storm?* BEIJER DISCUSSION PAPER SERIES.
- ❖ Folke, C., Å. Jansson, J. Rockström, P. Olsson, S.R. Carpenter, F.S. Chapin, A.-S. Crépin, G. Daily, K. Danell, J. Ebbesson, T. Elmqvist, V. Galaz, F. Moberg, M. Nilsson, H. Österblom, E. Ostrom, Å. Persson, G. Peterson, S. Polasky, W. Steffen, B. Walker, and F. Westley. 2011. *Reconnecting to the Biosphere*. *AMBIO* 40(7):719–738.
- ❖ Lindahl, T., A.-S. Crépin, and C. Schill. 2012. Beijer Discussion Paper 232: *Managing resources with potential regime shifts: Using experiments to explore social-ecological linkages in common resource systems*. BEIJER DISCUSSION PAPER SERIES.

### Seminars and symposium presentations:

- ❖ Steering Committee and Work Package 5 meeting of the EU project ACCESS, Southampton, UK, August 2011.
- ❖ Askö meeting 2011: *Food security and aquaculture development in a globalized world – links and tradeoffs between marine and terrestrial production systems*. Askö Marine Station, Sweden, September 2011.
- ❖ Global Dynamics and Resilience workshop, Stockholm, September 2011. Organizer.

- ❖ Scoping meeting for the Arctic Resilience Report, Stockholm, September 2011.
- ❖ Work Package 5 meeting of the EU project ACCESS, Stockholm, January 2012. Host.
- ❖ Final meeting of the EU project *Arctic Tipping Points*, Tromsø, Norway, January 2012. Presentation: *Socio-economic implications of tipping points in natural resources: Expected economic impacts, policy implications and expected human reactions*.
- ❖ Yearly meeting of the EU project ACCESS, Stockholm, March 2012. Presentation: *ACCESS Work Package 5: Governance, Sustainable Development and Synthesis*, together with Lindsay Parson (National Oceanography Centre, Southampton).
- ❖ Mistra Arctic Futures stakeholders meeting, Canadian embassy, Stockholm, March 2012.
- ❖ Stockholm Arctic Seminars: *Mistra Arctic Futures*. Stockholm, May 2012. Presentation: *Tipping points and resilience in the Arctic – are they relevant for social science?*, together with Annika E. Nilsson (Stockholm Environment Institute).

### Teaching and training:

- ❖ Lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2012.
- ❖ Module leader, lecturer and examiner, Master's level course *Governance and Management of Social-Ecological Systems: Principles of Economic Decision making*, Stockholm Resilience Centre, Stockholm University, spring 2012.
- ❖ Lecturer and examiner, Master's level course: *Ecological Economics*, Department of Physical Geography and Quaternary Geology, Stockholm University, spring 2012.
- ❖ Co-supervisor of PhD student Gustav Engström (Stockholm Resilience Centre and Department of Economics SU); Master's student Caroline Schill (Stockholm Resilience Centre); Mäler Scholar Zanxin Wang (EPSEA, China); Mäler Scholar Saudamini Das (SAND-EE, India).



#### Commissions:

- ❖ Scientific Committee member, 2012 conference of the European Association of Environmental and Resource Economists (EAERE), Prague, Czech Republic.
- ❖ Council member, Stiftelsen för Internationella Institutet för Industriell Miljöekonomi (foundation for the International Institute for Industrial Environmental Economics), Lund University.
- ❖ Council member, Expertgruppen för miljöstudier (expert group for environmental studies), a committee under the Department of Finance in Sweden, up to and including April 2012.
- ❖ Council member, the European Association of Environmental and Resource Economists (EAERE), up to and including December 2011.
- ❖ Examination Committee member for the PhD thesis of Scott Cole, SLU Umeå, Sweden, May 2012.

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### Gustav Engström

PhD candidate, researcher

#### Research focus:

General research interest in the analysis of dynamic systems exploring the interaction between the economy and the environment. During 2011, research primarily focused on economic growth models in connection to climate change policy. On September 28 he will defend his thesis, which also focuses on the interaction between the macroeconomy and climate change. Other topics of interest, also in the pipeline, include e.g. hedonic pricing models assessing the value of green space, a fishery model of the Baltic Sea, and also issues concerning the planetary boundaries and how these can be modelled within an economic framework.

#### Publications during the period:

- ❖ Brock, W., G. Engström, and A. Xepapadeas. 2012. *Beijer Discussion Paper 231: energy balance climate models and the spatial structure of optimal mitigation policies*. BEIJER DISCUSSION PAPER SERIES.
- ❖ Engström G. 2012. *Beijer Discussion Paper 235: Structural change in a two-sector model of the climate and the economy*. BEIJER DISCUSSION PAPER SERIES.

#### Seminars and symposium presentations:

- ❖ 2012 EAERE conference, Prague, Czech Republic, June 2012. Presentation of paper: *Energy balance climate models and the spatial structure of optimal mitigation policies*.

#### Teaching and training:

- ❖ Lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2012.
- ❖ Lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Principles of Economic Decision making*, Stockholm Resilience Centre, Stockholm University, spring 2012.

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### Carl Folke

Professor, Director

#### Research focus:

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

#### Publications during the period:

- ❖ Adger, W.N., K. Brown, D. Nelson, F. Berkes, H. Eakin, C. Folke, K. Galvin, M. Goulden, L. Gunderson, K. O'Brien, J. Ruitenbeek, and E. Tompkins. 2011. *Resilience implications of policy responses to climate change*. WIREs CLIMATE CHANGE 2:757–766.
- ❖ Barthel, S., J. Parker, C. Folke, and J. Colding. 2012. *Urban gardens: Pockets of social-ecological memory*. In: Tidball, K.G., and M.E. Krasny (eds.). *GREENING IN THE RED ZONE: DISASTER, RESILIENCE AND COMMUNITY GREENING*. Springer, Dordrecht, Netherlands, in press.
- ❖ Biermann, F., K. Abbott, S. Andresen, K. Bäckstrand, S. Bernstein, M.M. Betsill, H. Bulkeley, B. Cashore, J. Clapp, C. Folke, A. Gupta, J. Gupta, P.M. Haas, A. Jordan, N. Kanie, T. Kluvánková-Oravská, L. Lebel, D. Liverman, J. Meadowcroft, R.B. Mitchell, P. Newell, S. Oberthür, L. Olsson, P. Pattberg, R. Sánchez-Rodríguez, H. Schroeder, A. Underdal, S. Camargo Vieira, C. Vogel, O.R. Young, A. Brock, and R. Zondervan. 2012. *Navigating the Anthropocene: Improving Earth System Governance*. SCIENCE 335:1306–1307.

- ❖ Biermann, F., K. Abbott, S. Andresen, K. Bäckstrand, S. Bernstein, M.M. Betsill, H. Bulkeley, B. Cashore, J. Clapp, C. Folke, A. Gupta, J. Gupta, P.M. Haas, A. Jordan, N. Kanie, T. Kluvánková-Oravská, L. Lebel, D. Liverman, J. Meadowcroft, R.B. Mitchell, P. Newell, S. Oberthür, L. Olsson, P. Pattberg, R. Sánchez-Rodríguez, H. Schroeder, A. Underdal, S. Camargo Vieira, C. Vogel, O.R. Young, A. Brock, and R. Zondervan. 2012. *Transforming governance and institutions for global sustainability: key insights from the Earth System Governance Project*. CURRENT OPINION IN ENVIRONMENTAL SUSTAINABILITY 4(1):51–60.
- ❖ Biggs, R., T. Blenckner, C. Folke, L. Gordon, A. Norström, M. Nyström, and G. Peterson. 2012. *Regime shifts*. In: Hastings, A., and L. Gross (eds.). ENCYCLOPEDIA OF THEORETICAL ECOLOGY. University of California Press, Berkeley, CA, USA. Pp. 609–616.
- ❖ Boyd, E., and C. Folke (eds.). 2011. ADAPTING INSTITUTIONS: GOVERNANCE, COMPLEXITY AND SOCIAL-ECOLOGICAL RESILIENCE. Cambridge University Press, Cambridge, UK.
- ❖ Boyd, E., and C. Folke. 2011. *Adapting institutions, adaptive governance and complexity: an introduction*. In: Boyd, E., and C. Folke (eds.). ADAPTING INSTITUTIONS: GOVERNANCE, COMPLEXITY AND SOCIAL-ECOLOGICAL RESILIENCE. Cambridge University Press, Cambridge, UK. Pp. 1–8.
- ❖ Boyd, E., and C. Folke. 2011. *Conclusions: adapting institutions and resilience*. In: Boyd, E., and C. Folke (eds.). ADAPTING INSTITUTIONS: GOVERNANCE, COMPLEXITY AND SOCIAL-ECOLOGICAL RESILIENCE. Cambridge University Press, Cambridge, UK. Pp. 264–280.
- ❖ Carpenter, S.R., C. Folke, A. Norström, O. Olsson, L. Schultz, B. Agarwal, P. Balvanera, B. Campbell, J.C. Castilla, W. Cramer, R. DeFries, P. Eyzaguirre, T. Hughes, S. Polasky, Z. Sanusi, R. Scholes, and M. Spierenburg. 2012. *Program on ecosystem change and society: an international research strategy for integrated social-ecological systems*. CURRENT OPINION ON ENVIRONMENTAL SUSTAINABILITY 4(1):134–138.
- ❖ Costanza, R., S. van der Leeuw, K. Hibbard, S. Aulenbach, S. Brewer, M. Burek, S. Cornell, C. Crumley, J. Dearing, C. Folke, L. Graumlich, M. Hegmon, S. Heckbert, S.T. Jackson, I. Kubiszewski, V. Scarborough, P. Sinclair, S. Sörlin, and W. Steffen. 2012. *Developing an Integrated History and future of People on Earth (IHOPE)*. CURRENT OPINION IN ENVIRONMENTAL SUSTAINABILITY 4(1):106–114.
- ❖ Folke, C., and J. Rockström (eds.). 2011. 3rd Nobel Laureate Symposium on Global Sustainability: *Transforming the World in an Era of Global Change*. AMBIO 40(7).
- ❖ Folke, C., and J. Rockström. 2011. Editorial – 3rd Nobel Laureate Symposium on Global Sustainability: *Transforming the World in an Era of Global Change*. AMBIO 40(7):717–718.
- ❖ Folke, C., Å. Jansson, J. Rockström, P. Olsson, S.R. Carpenter, F.S. Chapin, A.-S. Crépin, G. Daily, K. Danell, J. Ebbesson, T. Elmqvist, V. Galaz, F. Moberg, M. Nilsson, H. Österblom, E. Ostrom, Å. Persson, G. Peterson, S. Polasky, W. Steffen, B. Walker, and F. Westley. 2011. *Reconnecting to the Biosphere*. AMBIO 40(7):719–738.
- ❖ Folke, C., J.M. Anderies, L. Gunderon, and M.A. Janssen. 2012. *An uncommon scholar of the commons*. ECOLOGY AND SOCIETY, in press.
- ❖ Galaz, V., F. Biermann, C. Folke, M. Nilsson, and P. Olsson (eds.). 2012. *Global environmental governance and planetary boundaries: An introduction*. ECOLOGICAL ECONOMICS 81:1–3.
- ❖ Galaz, V., B. Crona, H. Österblom, P. Olsson, and C. Folke. 2012. *Polycentric systems and interacting planetary boundaries: Emerging governance of climate change – ocean acidification – marine biodiversity*. ECOLOGICAL ECONOMICS 81:21–32.
- ❖ Galaz, V., F. Biermann, B. Crona, D. Loorbach, C. Folke, P. Olsson, M. Nilsson, J. Allouche, Å. Persson, and G. Rieschl. 2012. *‘Planetary boundaries’ – exploring the challenges for global environmental governance*. CURRENT OPINION IN ENVIRONMENTAL SUSTAINABILITY 4(1):80–87.
- ❖ Gunderson, L., and C. Folke. 2011. *Tricky times*. ECOLOGY AND SOCIETY 16(4):31.
- ❖ Leach, M., J. Rockström, P. Raskin, I. Scoones, A.C. Stirling, A. Smith, J. Thompson, E. Millstone, A. Ely, E. Arond, C. Folke, and P. Olsson. *Transforming innovation for sustainability*. ECOLOGY AND SOCIETY 17(2):11.

- ❖ Nyström, M., A.V. Norström, T. Bleckner, M. de la Torre Castro, J. Eklöf, C. Folke, R.S. Steenack, H. Österblom, M. Thyresson, and M. Troell. 2012. *Confronting Feedbacks of Degraded Marine Ecosystems*. ECOSYSTEMS 15(5):695–710.
- ❖ O'Brien, K., A. Patwardhan, M. Pelling, S. Hallegatte, A. Maskrey, T. Oki, U. Oswald-Spring, T. Wilbanks, and P.Z. Yanda, with contributing authors F. Berkhaut, R. Biggs, H.G. Brauch, K. Brown, C. Folke, L. Harrington, H. Kunreuther, C. Lacambra, R. Leichenko, R. Mechler, C. Pahl-Wostl, V. Przyluski, D. Satterthwaite, F. Sperling, L. Sygna, T. Tanner, P. Tschakert, K. Ulsrud, and V. Vigié. 2012. *Toward a Sustainable and Resilient future*. In: Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.). MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION. A SPECIAL REPORT OF WORKING GROUPS I AND II OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA. Pp. 437–486.
- ❖ Steffen, W., Å. Persson, L. Deutsch, J. Zalasiewicz, M. Williams, K. Richardson, C. Crumley, P. Crutzen, C. Folke, L. Gordon, M. Molina, V. Ramanathan, J. Rockström, M. Scheffer, H.J. Schellnhuber, and U. Svedin. 2011. *The Anthropocene: From global change to planetary stewardship*. AMBIO 40(7):739–761.
- ❖ Troell, M., N. Kautsky, N. Beveridge, P. Henriksson, J. Primavera, P. Ronnback, and C. Folke. 2013. *Aquaculture*. In: Levin, S.A. (ed.). ENCYCLOPEDIA OF BIODIVERSITY. Second Edition. Elsevier Science, New York, USA, in press.
- ❖ Westley, F., P. Olsson, C. Folke, T. Homer-Dixon, H. Vredenburg, D. Loorbach, J. Thompson, M. Nilsson, E. Lambin, J. Sendzimir, B. Banarjee, V. Galaz, and S. van der Leeuw. 2011. *Tipping towards sustainability: Emerging pathways of transformation*. AMBIO 40(7):762–780.
- Seminars and symposium presentations:**
  - ❖ EuroMAB conference 2011, Sharing Sustainable Futures, Lundsbrunn, Sweden, July 2011. Key-note speaker.
  - ❖ Comparative Marine Ecosystem workshop, Saltsjöbaden, Sweden, August 2011.
  - ❖ Stockholm Water Symposium 2011, Laureate Seminar, Stockholm, August 2011. Lecturer.
  - ❖ Resilience Dialogues on research insights, Stockholm Resilience Centre, September 2011, November 2011, January 2012, March 2012, May 2012.
  - ❖ Coral Guardians Concert and Seminar, Royal Swedish Academy of Music, Stockholm, October 2011. Panel member.
  - ❖ The Futura Foundation, Stockholm, October 2011. Lecturer.
  - ❖ NorMER workshop, Oslo, Norway, October 2011. Speaker.
  - ❖ Ebba and Sven Schwartz Foundation, Stockholm, November 2011, January 2012, May 2012. Presenter.
  - ❖ Adaptive Governance workshop, Saltsjöbaden, Sweden, November 2011.
  - ❖ Volvo Environmental Prize Ceremony, Royal Swedish Academy of Music, Stockholm, November 2011. Presenter of the Price Winner's work, John Schellnhuber.
  - ❖ Symposium in honour of Malin Falkenmark, Royal Swedish Academy of Sciences, Stockholm, November 2011. Presenter.
  - ❖ Small-scale Fisheries workshop, SARAS, Montevideo, Uruguay, December 2011. Lecturer.
  - ❖ Public lecture for politicians and researchers, SARAS, Montevideo, Uruguay, December 2011.
  - ❖ Resilience Alliance meeting, Camargue, France, January 2012.
  - ❖ SAPECS (South African PECS) workshop, Stellenbosch, South Africa, February 2012. Presenter.
  - ❖ Linacre Lecture on Environmental Governance and Resilience, Linacre College, University of Oxford, UK, February 2012.
  - ❖ Madagascar Music and Sustainability seminar, Stockholm Resilience Centre, March 2012.
  - ❖ The Royal Professors' Symposium on Global Sustainability, "Faith in the Future", The Royal Palace, Stockholm, March 2012.



- ❖ Round table discussion, visit of His Royal Highness The Prince of Wales, Stockholm Resilience Centre, March 2012.
- ❖ PECS Scientific Committee meeting, London, March 2012.
- ❖ ICES/HELCOM workshop, Stockholm Resilience Centre, March 2013. Presenter.
- ❖ Baltic PECS workshop and Global Scenarios workshop, Stockholm Resilience Centre, May 2012.
- ❖ How do we value nature? Comments on TEEB, “Global Utmaning” (Global challenge), Kulturhuset, Stockholm, May 2012.
- ❖ Beijer Young Scholars workshop, Stockholm, May 2012. Lecturer.
- ❖ BiodivERsA Programme and funders, World Trade Centre, Stockholm, June 2012. Lecturer.
- ❖ SEED-Magazine Resilience Master Class, June 2012.
- ❖ Marine Global Change and Challenge workshop, Beijer Institute, Stockholm, June 2012.

#### Teaching and training:

- ❖ Lecturer, undergraduate and Master’s level courses, Stockholm University.
- ❖ Supervisor of PhD student Jacob von Heland, who defended his thesis *Rowing Social-Ecological Systems: Morals, Culture and Resilience* in November 2011.
- ❖ Co-supervisor of three PhD students in Natural Resource Management, Department of Systems Ecology, Stockholm University.

#### Commissions:

- ❖ Director of Science and founder, Stockholm Resilience Centre: Research for Governance of Social-Ecological Systems, a joint centre of Stockholm University, Beijer Institute/Royal Swedish Academy of Sciences, and Stockholm Environment Institute since 2007.
- ❖ Board member, Stockholm Environment Institute, since 2004.
- ❖ Founding and Board member, Resilience Alliance, since 1999.
- ❖ Member of the Royal Swedish Academy of Sciences, since 2002.

- ❖ Environmental Research Committee member, Royal Swedish Academy of Sciences, since 2003.
- ❖ Editor-in-Chief, *Ecology & Society*, [www.ecologyandsociety.org](http://www.ecologyandsociety.org), since 2002.
- ❖ Advisory and Editorial Board member of 13 journals including: *Ambio*, *Ecological Economics*, *Environment*, *Environmental Conservation*, *Environment and Development Economics*, *Environmental Innovation and Societal Transitions*, *Frontiers in Ecology and the Environment*, *Global Environmental Change*, *Letters in Spatial and Resource Sciences*, *Reviews in Ecological Economics*, *Sustainability Science*.
- ❖ Director of the International Programme Office, Programme on Ecosystem Change and Society (PECS), ICSU, since 2011.
- ❖ Scientific Advisory Board member, SARAS (South American Institute for Resilience and Sustainability Studies), Montevideo, Uruguay, since 2007.
- ❖ Scientific Advisory Board member, STEPS, since 2010.
- ❖ Scientific Advisory Board member, Swedish Secretariat for Environmental Earth System Sciences (SSEESS), since 2010.
- ❖ Scientific Committee member, Volvo Environment Prize, since 2008.
- ❖ Partner investigator, The ARC Centre of Excellence for Coral Reef Studies, JCU, Australia, since 2005.
- ❖ Associate Faculty member, Earth System Governance Project, IHDP, since 2009.
- ❖ Advisory Board member, The International Network of Research on Coupled Human and Natural Systems (CHANS-Net), since 2009.
- ❖ Steering Committee member, ESRC Centre for Climate Change Economics and Policy, London School of Economics and University of Leeds, UK, since 2008.
- ❖ Principal investigator, The Family Erling Persson’s Academy Program on the Ecological Economics of Global Change, since 2012.
- ❖ Co-principal investigator of two *Centre of Excellence* research projects: “Nordic Centre for the Study of Climate Change Effects on Marine Ecosystems and Resource Economics” of The

Top-level Research Initiative (TRI), a joint Nordic research and innovation initiative (NC Stenseth PI); and “Regime Shifts in the Baltic Sea Ecosystem – Modelling Complex Adaptive Ecosystems and Governance Implications”, Formas (C. Humborg PI).

- ❖ Steering Committee member, Nereus Program – Predicting the Future Ocean, UBC, Canada, since 2010.
- ❖ International Scientific Advisory Council member, Waterloo Institute for Complexity and Innovation (WICI), University of Waterloo, since 2012.
- ❖ Member of the Search Committee for a new Director of the Stockholm Environment Institute, 2011.
- ❖ Steering Committee member, BEAM (Baltic Ecosystem Adaptive Management), Stockholm University.

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## Johan Gars

PhD candidate, researcher

### Research focus:

- ❖ Modelling the interaction between the economy and the environment. In particular, integrating models of the climate with macroeconomic models, and considering issues of management of renewable resources.

### Publications during the period:

- ❖ Gars, J. 2011. *Moving Ahead*. FORES STUDY 2011:3. Available at: [http://fores.se/assets/494/WEB\\_Fores-movingahead.pdf](http://fores.se/assets/494/WEB_Fores-movingahead.pdf).
- ❖ Gars, J. 2012. *Essays on the Macroeconomics of Climate Change*. IIES MONOGRAPH SERIES no. 74. Institute for International Economic Studies, Stockholm University (PhD thesis).

### Seminars and symposium presentations:

- ❖ FORES seminar, Stockholm, October 2011. Presentation of study: *Moving Ahead*.

### Teaching and training:

- ❖ Lecturer, Master's level course *Social-ecological Systems: Challenges and Approaches*, Stockholm Resilience Centre, Stockholm University, autumn 2011.

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## Åsa Gren (formerly Jansson)

PhD, researcher

### Research focus:

Quantification and valuation of ecosystem services, urban sustainability, effects of climate change on Arctic ecosystems and ecosystem service generation, quantification of the role of biodiversity and ecosystem service generation.

### Publications during the period:

- ❖ Folke, C., Å. Jansson, J. Rockström, P. Ols-son, S.R. Carpenter, F.S. Chapin, A.-S. Crépin, G. Daily, K. Danell, J. Ebbesson, T. Elmqvist, V. Galaz, F. Moberg, M. Nilsson, H. Österb-lom, E. Ostrom, Å. Persson, G. Peterson, S. Polasky, W. Steffen, B. Walker, and F. West-ley. 2011. *Reconnecting to the Biosphere*. *AMBIO* 40(7):719–738.
- ❖ Jansson, Å. 2012. *Reaching for a sustainable, resilient urban future using the lens of ecosystem services*. Introductory chapter for special issue on sustainable urban futures. *ECOLOGICAL ECO-NOMICS*, in press.

### Seminars and symposium presentations:

- ❖ Annual meeting of the EU project ACCESS, Stockholm, March 2012. Presentation: *Quantifi-cation of ecosystem services within the fisheries and oil and gas industries in the Arctic*.
- ❖ Seminar, “Beyond GDP – indicators for future policy-making”, Framtidskommissionen (Com-mission on the future of Sweden), chaired by Fredrik Reinfeldt (the Prime Minister of Swe-den), Stockholm, June 2012. Presentation: *Valu-ation of Ecosystem Services*.

### Teaching and training:

- ❖ Lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2012.
- ❖ Lecturer, Master's level course *Nature and Soci-ety*, Stockholm Resilience Centre, Stockholm University, autumn 2011.

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## Chuan-Zhong Li

Professor, researcher

**Research focus:**

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

**Publications during the period:**

- ❖ Gren, I.M., and C.Z. Li. 2011. *Enforcement of environmental regulation: Inspection costs in Sweden*. ENVIRONMENTAL ECONOMICS 2(2):50–58.
- ❖ Li, C.Z., and G. Isacsson. 2012. *Valuing urban accessibility and air quality in Sweden: A regional welfare analysis*. EMPIRICAL ECONOMICS 42(3):881–898.
- ❖ Li, C.Z., and K.G. Löfgren. 2012. *Genuine saving under stochastic growth*. LETTERS OF SPATIAL AND RESOURCE SCIENCES, in press.
- ❖ Löfgren, K.G., and C.Z. Li. 2011. *Green National Accounting and Sustainability*. THE INTERNATIONAL LIBRARY OF CRITICAL WRITINGS IN ECONOMICS SERIES 257. Edward Elgar Publishing Ltd, Cheltenham, UK.

**Seminars and symposium presentations:**

- ❖ PACE 2011, International Symposium on Environmental Economics and Policy in China, Qiandao Lake, Hangzhou, China, July 2011. Lecture: *The economics of ecosystem resilience*.
- ❖ International Conference on Sustainable Development and Policy Decision of Mineral Regions, Beijing, China, spring 2012. Presentation of paper: *Genuine savings measurement under uncertainty and its implications for depletable resource management*.

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**Therese Lindahl**

PhD, researcher

**Research focus:**

Research focus is broadly on environmental and resource economics and on behavioural aspects of natural resource management. Currently, specific focus on how complex ecosystem dynamics influence resource users' strategies for exploitation and cooperation and the implications for the management of common-pool resources.

**Publications during the period:**

- ❖ Lindahl, T., and T. Söderqvist. 2011. *Who wants to save the Baltic Sea when the success is uncertain?* REGIONAL ENVIRONMENTAL CHANGE 11(1):133–147.

- ❖ Lindahl, T. 2012. *Coordination problems and resource collapse in the commons – Exploring the role of knowledge heterogeneity*. ECOLOGICAL ECONOMICS 79:52–59.
- ❖ Lindahl, T., A.-S. Crépin, and C. Schill. 2012. Beijer Discussion Paper 232: *Managing resources with potential regime shifts: Using experiments to explore social-ecological linkages in common resource systems*. BEIJER DISCUSSION PAPER SERIES.

**Seminars and symposium presentations:**

- ❖ Final meeting of the EU project Arctic Tipping Points, Tromsø, Norway, January 2012. Presentation: *Managing resources with tipping points: Using experiments to explore social-ecological linkages in common resource systems*.
- ❖ Annual meeting of the EU project ACCESS, Stockholm, March 2012. Presentation: *Managing resources with tipping points: Using experiments to explore social-ecological linkages in common resource systems*.
- ❖ 2012 EAERE conference, Prague, Czech Republic, June 2012. Presentation of paper: *Managing resources with potential regime shifts: Using experiments to explore social-ecological linkages in common resource systems*.
- ❖ Brown Bag Lunch, Stockholm Resilience Centre, March 2012. Presentation: *Disentangling intangible social-ecological systems*, together with Örjan Bodin and Maria Tengö (Stockholm Resilience Centre).

**Teaching and training:**

- ❖ Lecturer, PhD course *Ecology and Economic Management*, Beijer Institute and Gothenburg University, March 2012.
- ❖ Organizer and lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Principles of Economic Decision making*, Stockholm Resilience Centre, Stockholm University, spring 2012.
- ❖ Lecturer, Master's level course *Governance and Management of Social-Ecological Systems: Drama of the Commons*, Stockholm Resilience Centre, Stockholm University, spring 2012.



- ❖ Lecturer, Master's level course *Nature and Society*, Stockholm University, spring 2012.
- ❖ Lecturer, undergraduate level course *Världens Eko*, Stockholm University, autumn 2011.
- ❖ Main supervisor of Master's student Caroline Schill (Stockholm Resilience Centre), examination of thesis in June 2012.

#### Commissions:

- ❖ Scientific Advisory Council member, FORES (Forum for Reforms, Entrepreneurship and Sustainability), Stockholm, Sweden.
- ❖ Book chapter for FORES: *Beteendevetenskap och Miljöekonomi (Behavioral Sciences and Environmental Economics)*.
- ❖ Referee for journal *Ecosystems*, ESF (European Science Foundation) and FORES.

#### Other:

- ❖ Participation in pilot web-TV show: Crosstalks, "Why don't I do as I say", together with Professor Martin Ingvar (KI) and Professor Torun Lindholm (SU). Producer: Tomas Axelsson, February 2012.
- ❖ Maternity leave during the year: July 100%; August-September 50%; October-November 40%; February-June 20%.

### Caroline Schill

MSc, research assistant

#### Research focus:

The influence of complex ecosystem dynamics on resource users' strategies for exploitation and cooperation and the implications for the management of common-pool resources.

#### Publications during the period:

- ❖ Lindahl, T., A.-S. Crépin, and C. Schill. 2012. Beijer Discussion Paper 232: *Managing resources with potential regime shifts: Using experiments to explore social-ecological linkages in common resource systems*. BEIJER DISCUSSION PAPER SERIES.

#### Other:

- ❖ Teaching assistant, undergraduate level course *Världens Eko*, Stockholm University, autumn 2011.

- ❖ Administration and performance of laboratory experiment sessions.
- ❖ Defence of Master's thesis in Ecosystems, Resilience and Governance (ERG): *Identifying Factors Influencing Exploitation Strategies and Cooperation in Commons Dilemmas Under Threshold Uncertainty: Evidence from a Laboratory Experiment*, Stockholm Resilience Centre, Stockholm University, June 2012.

### Max Troell

Associate Professor, researcher

#### Research focus:

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

Main interests: Investigating global sustainability aspects of aquaculture development including; identifying linkages between capture fisheries and aquaculture; identifying resource dependence and environmental and social externalities; identifying and estimating ecological basis for valuation with special focus on mangrove ecosystems; analyzing and developing aquaculture techniques built on ecological engineering; studying biodiversity and resilience in temperate coastal habitats and the generation of ecosystem goods and services.

#### Publications during the period:

- ❖ Crépin, A.-S., R. Biggs, S. Polasky, M. Troell, and A. de Zeeuw. *Regime shifts and management*. In: Shogren, J. (ed.). *ENCYCLOPAEDIA OF ENERGY, NATURAL RESOURCE AND ENVIRONMENTAL ECONOMICS*. Elsevier Science, Oxford, UK, in press.
- ❖ Eriksson, H., G. Robinson, M. Slater, and M. Troell. 2012. *Sea cucumber aquaculture in the Western Indian Ocean – Challenges for sustainable livelihood and stock improvement*. *AMBIO* 41(2):109–121.
- ❖ Henriksson, P., N. Pelletier, M. Troell, and P. Tyedmers. 2012. *Life cycle assessment and its application to aquaculture production systems*. In: Meyers, R.A. (ed.). *ENCYCLOPAEDIA OF SUSTAINABILITY SCIENCE AND TECHNOLOGY*. Springer, in press.

- ❖ ICES. 2012. Report of the Study Group on Socio-Economic Dimensions of Aquaculture (SGSA), 24–26 April 2012, Stockholm, Sweden. ICES CM 2012/SSGHIE:10. 41 pp. Available at: <http://www.ices.dk/reports/SSGHIE/2012/SGSA12.pdf>.
- ❖ Nyström, M., A.V. Norström, T. Bleckner, M. de la Torre Castro, J. Eklöf, C. Folke, R.S. Steenack, H. Österblom, M. Thyresson, and M. Troell. 2012. *Confronting feedbacks of degraded marine ecosystems*. ECOSYSTEMS 15(5):695–710.
- ❖ Sarà, G., G. Reid, A. Rinaldi, V. Palmeri, M. Troell, and S.A.L.M. Kooijman. 2012. *Growth and reproductive simulation of candidate shellfish species at fish cages in the Southern Mediterranean: Dynamic Energy Budget (DEB) modelling for integrated multi-trophic aquaculture*. AQUACULTURE 324–325:259–266.
- ❖ Troell, M., T. Chopin, G. Reid, S. Robinson, and G. Sara. 2011. *Letter to the Editor*. AQUACULTURE 313:171–172.
- ❖ Troell, M., N. Kautsky, N. Beveridge, P. Henriksson, J. Primavera, P. Ronnback, and C. Folke. 2013. *Aquaculture*. In: Levin, S.A. (ed.). *ENCYCLOPAEDIA OF BIODIVERSITY*. Second Edition. Elsevier Science, New York, USA, in press.
- ❖ Expert meeting International Sustainability Unit (ISU), “Fishmeal: Opportunities and Risks of a Critical Commodity – Influencing the sustainability of fishmeal supply from Asia”, attended by His Royal Highness The Prince of Wales, London, UK, December 2011.
- ❖ ISU Marine Programme Launch Event, London, UK, February 2012. Specially invited.

#### Teaching and Training:

- ❖ Course leader and lecturer, PhD course *Ecology and Economic Management*, the Beijer Institute and Gothenburg University, March 2012.
- ❖ Lecturer, PhD courses in Climate and Environmental Economics, Gothenburg University, spring 2012.
- ❖ Lecturer and supervisor, Master’s level course *Tropical Ecology; Management of Aquatic Resources in the Tropics*, Department of Systems Ecology, Stockholm University, February 2012.
- ❖ Lecturer, undergraduate level course *Hållbar samhällsutveckling (Sustainable Societal Development)*, Department of Physical Geography and Quaternary Geology, Stockholm University, autumn 2011.
- ❖ Examiner for Master’s thesis of Daniel Meyer, *Transitions and Resilience in the Frozen Commons: Linking Aquaculture, Krill Fishery, Governance and Ecosystem Change in the Scotia Sea, Southern Ocean*, Stockholm Resilience Centre, September 2011.
- ❖ Member of evaluating committee for Licentiate in Philosophy of Sara Fröcklin, *The Role of Women in the Seascape of Zanzibar – Identifying Needs, Problems and Interests for Improved Marine Resource Management and Sustainable Livelihoods*, Stockholm University, October 2011.
- ❖ Supervisor of post-doc Marc Metian within the Nereus Programme, Stockholm Resilience Centre.
- ❖ Supervisor of PhD student M. Jonell (Department of Systems Ecology, Stockholm University), *Sustainability Indicators and Eco-labelling of Seafood*; PhD student D. Mirera (Linnaeus University, Sweden and Kenya Marine and Fisheries Research Institute (KMFRI), Kenya), *Small-scale Aquaculture of Mud Crabs (Scylla serrata) and its Effects on Community Livelihood*.

#### Seminars and symposium presentations:

- ❖ 6th World Fisheries Congress, “Sustainable Fisheries in a Changing World”, Edinburgh, UK, May 2012: *Meeting the food and nutrition needs of the poor: the role of fish and the opportunities and challenges emerging from the rise of aquaculture* (co-author keynote presentation); *Aquaculture certification – will it make a difference?* (co-author poster); *Resilience of a social-ecological system integrating aquaculture production: An exploratory case study from Thailand* (co-author poster presentation).
- ❖ AquaNOR FORUM, “Up-scaling Aquaculture Systems”, European aquaculture Society, Trondheim, Norway, August 2011. Moderator and scientific coordinator.
- ❖ Askö meeting 2011, “Food security and aquaculture development in a globalized world – links and tradeoffs between marine and terrestrial production systems”, Askö Marine Station, Sweden, September 2011. Organiser and scientific facilitator.

*Along the Kenyan coast*, and Master's student V. Lundgren (Department of Systems Ecology, Stockholm University), *Fishprint – Tracing the True Fish Consumption*.

#### Commissions:

- ❖ Expert Group member on Ecosystem Services, Swedish Environmental Protection Agency (first meeting in Stockholm, May 2012).
- ❖ ICES Study Group member, Socio-Economic Dimensions of Aquaculture (SGSA).
- ❖ MASMA Programme Committee Member (Marine Science for Management), Programme within the Western Indian Ocean Marine Science Association (WIOMSA) (funded by Sida/SAREC), since 2007.
- ❖ Review Editor, Journal of Aquaculture Environment Interactions (AEI) ([www.int-res.com/journals/aei/](http://www.int-res.com/journals/aei/)), since 2009.
- ❖ Reviewer, *Journal of Aquaculture*, *Journal of applied Phycology*, *Journal of Aquaculture Environment Interactions*, *Global Environmental Change*, *Environmental Management*.
- ❖ Evaluation Committee member for grant applications, IFS (International Foundation for Science).
- ❖ Theme leader "Coastal and Marine Governance", Stockholm Resilience Centre.
- ❖ Evaluator of multidisciplinary PhD research applications, "Graduate school in marine environment", Gothenburg University, Gothenburg Centre for Marine Research, December 2011.
- ❖ Opponent of PhD Thesis of A. Handå, Norwegian University of Science and Technology, Trondheim, Norway, April 2012.
- ❖ Evaluator, WIOMSA/MASMA Grantees meeting, Kenya, October 2011.
- ❖ Technical Advisor, "Community-based crab aquaculture in East Africa", Marine Science for Management/WIOMSA, 2009–2012.

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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 347, of which 24 were published on our website 2011/2012. 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. 235 Discussion Papers have been produced since 1991.

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## 2011

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## Discussion Papers

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