Annual Report 2007/2008

The Beijer Institute of Ecological Economics






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The Directors' column

by *Carl Folke*, Director, the Beijer Institute and
Aart de Zeeuw, Co-director, the Beijer Institute

LAST YEAR STARTED with a series of intense small scale workshops close together and ended in the aftermath of the first large scale conference on resilience.

Brian Walker at the Resilience Conference in Stockholm.

PHOTO: JERKER LOKRANTZ/AZOTE.SE

Crawford "Buzz" Holling speaking at the Resilience Conference in Stockholm.

The theme of the first workshop was accounting and valuation of ecosystem services. This area is clearly very important for policy purposes and requires knowledge from both economists and ecologists. It therefore perfectly fits in the mission of the Beijer Institute, and has been on the agenda ever since the start of the Biodiversity Programme back in 1991. We are most happy to announce that Steve Polasky will spend his sabbatical in the next academic year at the Beijer Institute so that these research activities can get new inputs from his experience in this field.

The theme of the second workshop was managing the global commons. It was the kick-off workshop in a programme initiated by Simon Levin at the European Science Foundation. The idea is to compare ideas and models that are developed in different disciplines on the possibilities of emergence of cooperation. It was exciting to find out later that at the same time in the same building one of the participants, Eric Maskin, was put forward for the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.

Simultaneously, there was a third workshop on regime shifts and spatial resilience with Terry Hughes, Marten Scheffer, Steve Carpenter and Swedish researchers expanding on earlier work on phase shifts and the resilience of coral reefs in dynamic seascapes, followed by a meeting at the ARC Coral Reef Centre of Excellence in Australia on social and economic benefits in coral reef systems, in early December.

The forth workshop was the yearly Askö meeting that discussed the implications of a complex adaptive systems approach for economics and ecology

on the basis of a starting note by Simon Levin and Tasos Xepapadeas. This is again a significant area where knowledge from different disciplines is needed to be able to move ahead.

Many other initiatives and activities have taken place during the year as summarized in this report and researchers and staff have also been engaged in the start-up phase of the Stockholm Resilience Centre, of which the Beijer Institute is one of the happy founding fathers and owners. The Resilience conference in April was an impressive event, bringing together around six hundred researchers with different disciplinary backgrounds but all interested in the resilience challenge. A large part of the year was devoted by Beijer staff on the preparation and the organization of this major event, with Christina Leijonhufvud serving as project leader, professionally performing as always, in collaboration with the Stockholm Resilience Centre and the Resilience Alliance. It also gave the opportunity to honour Brian Walker who has been instrumental in keeping the Resilience Alliance going and developing in such a dynamic fashion for many years. It is inspiring to watch the widespread diffusion of Buzz Holling's resilience legacy and Beijer's achievements in this area, and it was a great pleasure to learn that Buzz will receive the Volvo Environment Prize 2008 for his important contributions.

The Beijer Institute has been renovated, that is in a physical sense with new carpets and new paint. In another sense the Beijer Institute has basically not changed, simply because there is no need for drastic changes. It continues to be important to provide a home where economists and ecologists can meet and interact and perform research with a sincere interest in what the other discipline can offer. And teaching and policy become part of this effort to learn and share new understanding, like the PhD-course on the economics of the environment held at Stockholm University this spring and the SEI hosted Research and Forum on the Economics of Climate Change, with ten leading Chinese economists involved in China's economic reform policies, and international experts on China's macroeconomic and financial structure, together with Karl-Göran Mäler and Aart de Zeeuw from Beijer. The Beijer Institute also continues to support the environmental economics networks in developing regions, the PhD programme in Göteborg and the journal Environment and Development Economics. But of course new initiatives are needed as well, either because of societal concerns like a possible relationship between bio-fuels, food prices and food security, or challenges of global environmental change to the world economy or because of new developments like the rise of behavioural economics.

We are confident that the Beijer Institute is on the right track and can continue to play an important role, in association with the Royal Swedish Academy of Sciences and the Stockholm Resilience Centre. We are extremely grateful to our fellows all over the world for the active participation in our mission.

Calle and Aart

In memory of Bert Bolin

BERT BOLIN HAS left us at the age of 82. He died of stomach cancer in late December 2007, but remained active until the very end. Apart from being a pioneering Swedish climate scientist and the first Chairman of the Intergovernmental Panel on Climate Change (IPCC) – which received the Nobel Peace Prize 2007 – he was a very important person for the Beijer Institute. Bert Bolin was a member of the Board of Directors from 1997 to 2002 and participated in a great number of the Askö meetings and in several of our publications. We will remember Bert for his extraordinary gift to communicate, his warm personality and his great wisdom.

Resilience, adaptation and transformation in turbulent times

The first resilience conference, Stockholm April 14–17, 2008

by Brian Walker, Dr, CSIRO Sustainable Ecosystems, Canberra, Australia

THIS FIRST INTERNATIONAL conference focusing specifically on resilience was hosted by the Resilience Alliance, the Royal Swedish Academy of Sciences and ICSU (The International Council for Science) and organized by the Stockholm Resilience Centre, the Beijer Institute, Stockholm Environment Institute in collaboration with the Resilience Alliance, The Royal Swedish Academy of Sciences, International Council for Science (ICSU) and the Royal Swedish Academy of Fine Arts.

And by all accounts it was a great success, attracting nearly 600 participants who overwhelmingly gave the conference the thumbs up.

The core science part of the week was all about complex systems dynamics with limits and challenges to the capacity to deal with change and continue to develop, at all scales, from individual people through social-ecological systems to the globe. There was doubtless an element of the curate's egg

Sealed Protoype by Gunilla Bandolin and Sverker Sörlin, at Changing Matters – the Resilience Art Exhibition.

PHOTO: ROBERT KAUTSKY/AZOTE.SE

PHOTO: ROBERT KAUTSKY/AZOTE.SE

Dr. Kasper Kok leading a Speed talk, a popular feature of the Resilience 2008 conference.

Policy debate at the Resilience 2008 conference. Panel: Sverker Sörlin, Elinor Ostrom, Buzz Holling, Uno Svedin, Line Gordon and Carole Crumley.

in regard to quality of papers, but from my sampling of the presentations (and subsequent webviewing) the standard was gratifyingly high. The science part was bracketed by a wonderful multimedia art exhibition that opened just before the conference, and by a 'policy' day at the end.

The art exhibition was both a lot of fun and thought provoking. For me, some of the individual pieces were surprising and puzzling. I'm still trying to work out the meaning of a Volvo car wrapped in cows' intestines. But taken together, after working my way through the 12 exhibits, I could see how they reflected the description of resilience. I hope the exhibition will be available for on-line viewing.

PHOTO: JERKER LOKRANTZ/AZOTE.SE

The spirit of the art exhibition continued through the week with different kinds of musical interludes – folk, jazz and impromptu jam sessions. The highlight was a beautiful, evocative concert by Marten Scheffer and his group, where they launched their new CD "Critical Transitions". (It should be noted, though, that some younger people rated Carl Folke's late night jam session rendition of Neil Young's 'Rockin' in the Free World' as 'awesome').

The policy dialogue day began with a number of parallel sessions exploring the consequences of resilience ideas and closed with a general plenary in which members of governments, the EU Parliament , business leaders and other central actors together with scientists discussed the implications of emerging resilience findings for policy, at all levels. This was an impressive and heartening session, highlighting how far influential people in Europe have come, in a short time, in regard to their ideas about sustainable pathways into the future. The rest of the world needs to catch up, and it is a challenge for the Beijer Institute to bring mainstream economics and the messy, non-linear dynamics of

natural resource systems together, in ways that can assist policy development.

There were a number of associated events and meetings, and one I'll mention was the inaugural meeting of the 'Resilience Alliance Young Scholars' (RAYS) group. This group of some 30+ Post-Docs and PhD students, from all 15 members of the Resilience Alliance around the world, is an active, self-organising, high-performing group of young scientists who are developing strong synergies in projects of their own. It will be interesting to see where and how they grow.

Finally, a few overall impressions:

- There is now a much greater emphasis on the science of resilience in social systems, both on their own and as a component of linked social-ecological systems. Including foresight and

To what extent are human societies adapting their capacity for learning and foresight to deal with new global challenges? How can prosperous pathways of societal development be stimulated to emerge in the light of these challenges? These questions were central at Resilience 2008.

The main themes of the conference were:

- Resilience, global change, and globalization (drivers of change; management of resilience; shocks and social-ecological security).
- Traps, regime shifts and transformations (collapse and renewal; poverty traps and critical transitions; tipping points).
- Adaptations and sources of resilience for dealing with change (resilience challenges of vulnerable peoples and places; sources for adaptation and transformation; practice and policy of social-ecological resilience).
- Knowledge management and social-ecological learning (social learning and transition arenas; new modes of knowledge production; future scenarios, and models).
- Adaptive governance and multilevel challenges (adaptive management; social networks; evolution of norms, multi-level institutions; governing complexity).
- Complex systems, resource management and economic development (biodiversity and human wellbeing; regime shifts and changes in ecosystem services; complexity, spatial dynamics and economic policy).
- Urban social-ecological system challenges.
- Freshwater, food and ecosystem services in production landscapes.
- Coastal and marine social-ecological challenges.

The conference gathered close to 600 participants from a broad set of disciplines. Morning plenary sessions were followed by parallel sessions with invited speakers and sixty contributed papers selected through a blind review process, performed by an international review committee of thirty-five scholars of the Resilience Alliance. The afternoon featured a Science Fair, providing diverse ways of interacting, with speed talks, panel discussions, poster sessions, and also musical performances by scientists in the breaks.

Speed talks were much appreciated by presenters and participants. In the first part of a speed talk session five speakers were given five minutes each to present their work and key insights, followed by a second part where presenters stationed themselves at separate tables for dialogue with people of the audience interested in learning more about their work. There were over twenty exciting panel sessions and a poster competition. All and all we invited 25 speakers, received 425 abstracts and accepted 170 for presentations in contributed sessions, speed talks and poster sessions. Many of the presentations at the conference were filmed and made accessible through collaboration with the streaming company Qbrick, immediately on the Internet; they can still be seen at www.resilience2008.org.

Music and art were integrated parts of the conference to further stimulate new ways of thinking, enrich and inspire. Twelve invited artists, with work selected by a jury among over two hundred submissions, interpreted the notion of resilience in *Changing Matters – The Resilience Art Exhibition*. There were dialogues between artists and scientists after the morning plenaries drawing on the resilience art exhibition. The last day of the conference was devoted to a high level policy dialogue.

The Beijer Institute played a central role in the organization of the Resilience Conference with Christina Leijonhufvud serving as Head of the Conference Secretariat, supported by Anna Sundbaum, and Christina Schaffer, Ellika Hermansson-Török, Lisen Schultz, Cajsa Martinsson, Line Gordon of the Resilience Centre, Fredrik Moberg of Albaeco and Henrik Österblom and Anette Löf arranging the policy day. Carl Folke served as Head of the Steering Committee, supported by Beijer Fellows Brian Walker, Steve Carpenter, Thomas Rosswall and Johan Rockström. The art exhibition was a unique collaboration between the Royal Swedish Academy of Fine Arts, through Mejan Labs and the Royal Swedish Academy of Sciences, through the Beijer Institute. The Jury consisted of Olle Granath, Charlotte Gyllenhammar, Johan Scott and Peter Hagdahl from the art side, and Buzz Holling, Frances Westley and Carl Folke from the science side, with Frida Cornell serving as project manager. There was a lot of attention around the conference, including several television and radio interviews/programs and more than 40 press clippings. The Art exhibition was seen by an estimated 45 000 visitors.

PHOTO: ROBERT KAUTSKY/AZOTE.SE

Young visitor at Changing Matters – the Resilience Art Exhibition.

PHOTO: JERKER LOKRANTZ/AZOTE.SE

The concert by Marten Scheffer and his band was one of the highlights of the Resilience 2008 conference.

reflexivity adds to the difficulty that ecosystem scientists have been dealing with. The challenge to move from largely descriptive to analytical accounts of resilience in social systems is an exciting one.

- There is a lot of interest in resilience at the global scale. All of our theories about resilience, however, have been developed at scales well below this (mostly patch to landscape scales). We know that we can't just scale them up linearly and so incorporating new, scale-dependent processes as we rise to the global scale is another important challenge.
- I was rather disappointed by the small number of economists who participated and the limited debate about economics – both on the role of economics in the resilience of systems, and the resilience of the economy itself. The few who were there made excellent contributions, but there's a gap between economists and the social / ecological scientists that needs to be bridged.
- Resilience has 'escaped' from the realms of science. The term is now widely used by politicians and bureaucrats and the dangers in that are showing – all sorts of interpretations without being made clear, and some people (who feel a bit left out) beginning to make negative comments about the concept. Some already refer to it as a 'buzz word' (which has a special irony, given the origins of its development as a field of science). It may well turn out to be something like 'sustainability', which underwent a period of strong negativity before the realization that it is so important that it must remain a priority topic and area of science, anyway. The best thing that scientists, at Beijer and elsewhere, can do is to continue to do good science in this field and to make it known as widely as possible.

Innovative science for sustainable use of coral reefs

The ARC centre of Excellence for Coral Reef Studies

by *Terry Hughes*, Director, ARC Centre of Excellence for Coral Reef Studies

THE AUSTRALIAN RESEARCH Council (ARC) Centre of Excellence for Coral Reef Studies was established in July 2005, and it has now grown to a membership of almost 200 people, including well over 100 PhD students from around the world. Headquartered at James Cook University (JCU), the ARC Centre has collaborative links to colleagues and institutions in 36 countries. Major research themes undertaken by the Centre include the biology of climate change, managing biodiversity, fisheries biology, design of marine parks, social and ecological resilience, adaptive governance and

Field work carried out by the ARC centre of Excellence for Coral reef studies.

coastal management – in short, research that underpins the sustainable delivery of goods and services from the world's coral reefs. The Centre's Director, Terry Hughes, is a Beijer Fellow and member of the Beijer Institute's Board of Directors and Carl Folke and the Beijer Institute has served as a partner investigator in the ARC centre of excellence since its start. In 2007 the ARC Centre signed a Memorandum of Understanding with the Beijer Institute's newly established Stockholm Resilience Centre to cooperate and collaborate in areas of mutual interest in research. Both Centres have a focus on transdisciplinary research of social-ecological systems, with a special emphasis on resilience – the ability to deal with change and continue to develop. As part of the agreement, Jon Norberg and Per Olsson from the Stockholm Resilience Centre have recently spent sabbaticals in Australia, while Terry Hughes and Josh Cinner paid multiple visits to Stockholm in 2007 and early 2008 (co-funded by the Australian Academy of Science). A range of other joint activities have been established, including working groups jointly funded by both organizations.

A team of eight researchers from the Centre recently undertook a large-scale fish-exclusion experiment to explore the role of herbivorous fishes in bolstering the resilience of corals to global warming. The experiment tracked the recovery of corals following severe bleaching, in areas of reef where fish were experimentally excluded, and on adjacent areas within a no-fishing zone. In a paper published in *Current Biology* in February 2007, the team concluded that maintaining intact fish populations will be vital to successfully managing the resilience of tropical coral reefs from the impacts of climate change and other human activity. The study is already being widely used by reef managers to justify the establishment of no-take areas as tools for managing biodiversity and ecological resilience. Terry Hughes was recently asked by US Congressional advisors to provide a definition of "coral reef resilience" that has been incorporated into the Coral Reef Conservation Amendments Act, which was passed by the Congress on October 22nd, 2007.

A 2-year project undertaken in Australia by Per Olsson, Carl Folke and Terry Hughes has analyzed the strategies and actions that enable transitions towards ecosystem-based management, using the recent governance changes of the Great Barrier Reef Marine Park as a case study. The study, published in *Proceedings of the National Academy of Sciences* in July 2008, focuses on the interplay between individual actors, organizations, and institutions, particularly the Great Barrier Reef Marine Park Authority. This agency was instrumental in the transformation of the Reef's governance regime and provided leadership throughout the recent re-zoning process. The strategies identified in this study involved internal reorganization and management innovation, leading to an ability to coordinate the scientific community, to increase public awareness of environmental issues and problems, to involve a broader set of stakeholders, and to manoeuvre the political system for support at critical times. The transformation process was triggered by increased pressure on the Great Barrier Reef (from terrestrial run-off, over-harvesting, and global warming) that triggered a new sense of urgency to address these challenges. It shifted the focus of governance from protection of selected individual reefs to stewardship of the larger-scale seascape. The study emphasizes the significance of stewardship that can change patterns of interactions among key actor and allow for new forms of management and governance to emerge in response to environmental change.

In October 2007, the ARC Centre launched a new working group entitled "Connectivity and population resilience – sustaining coral reefs during the coming century", in Townsville. The working group is a partnership between the ARC Centre of Excellence and the connectivity projects of the World Bank GEF Targetted Research and Capacity Building for Management Project. Twenty-eight of the world's leaders in the field of coral reef connectivity, from 7 different countries, participated. A major focus was the impact that rapid climate change will have on connectivity in coral reef ecosystems. These changes have important implications for the management of coral reef ecosystems, especially for the design and placement of marine protected areas.

The ARC Centre hosted 72 international visitors from 22 countries in 2007. In September, the Centre held the *Townsville Forum on Sustainable Development of Pacific Coastal Resources*, with co-funding from AusAid (the Australian equivalent of SIDA). The forum was a collaboration between the Centre, Pacific Island nations and the French and Australian Governments, with the key objective to

PHOTO: CARL FOLKE

PHOTO: CARL FOLKE

improve networking, scientific co-operation, and capacity-building in Pacific nations. It was attended by senior government officials and experts from 13 Pacific Island countries: Cook Islands; Federated States of Micronesia; Fiji; Kiribati; Palau; Papua New Guinea; Samoa; Solomon Islands; Tokelau; Tonga; Tuvalu; Vanuatu; and New Caledonia and French Polynesia. The Forum was a platform to discuss research, management and governance of coral reefs and other coastal ecosystems in the Pacific, to improve networking, enhance scientific co-operation, build capacity and explore solutions to common problems. The Forum examined Pacific capacity and identified both key issues and best practice solutions under the four key themes; Marine Protected Area management; integrated coastal management; economic development options; and governance to develop actions.

In October 2007, the ARC Centre's membership and distinguished guest speakers gathered in Canberra to hold a 2-day *Coral Reef Futures Forum*, which was co-sponsored by the Australian Academy of Science. Over 130 delegates from the private sector, state and commonwealth government departments and agencies and universities registered to hear the latest science on issues such as climate change, fisheries management, conservation planning, capacity building, ecosystem-based management and adaptive governance. You can listen to 21 of these seminars online at http://www.coralcoe.org.au/events/webseminar/iyorwebseminar.html. Also in October, the ARC Centre extended its network overseas by convening a workshop on "Coral Reef Indicators of Land-Based Pollution" in Mombasa, Kenya. Twenty-two scientists and reef managers from eight countries (Australia, Comoros, Italy, Kenya, Netherlands, Tanzania, UK, and the USA) presented talks. Given the setting in East Africa, special attention was focused on the challenges that developing nations have in protecting reef resources.

In December, Visiting Fellow Jon Norberg convened a working group of ecologists, economists, social scientists and modellers in Cairns. The meeting focused on how to sustain the social and economic benefits of coral reef systems, and on the interplay between different actors (whose activities occur at different organizational and spatial scales). The general goal is developing appropriate economic as well as institutional tools that can motivate actors towards sustainable and equitable behaviours leading to increased social welfare. Participants included the Beijer co-director Aart de Zeeuw, and Magnus Nyström from the Department of Systems Ecology at Stockholm University, as well as leading Australian researchers.

In January 2008, the Centre convened a new working group, entitled *Emerging paradigms for adaptive governance of marine ecosystems*, in Santiago, Chile. It was co-hosted by Terry Hughes and Juan Carlos Castilla, and the participants included leading scientists from South America, as well as Carl Folke, Per Olsson, and Beijer Fellows Marten Scheffer and Lance Gunderson. The group focused on multi-scale dynamics, and on the interface between societies, economies, and the ecosystems that sustain them, themes that are richly illustrated by the Chilean coastal social-ecological system.

Highlights for 2008 will include the 11th International *Coral Reef Symposium* in Florida, where the ARC Centre will be presenting more than 150 talks and poster presentations. The Centre will be co-chairing eight sessions, including one on social-ecological resilience in collaboration with Magnus Nyström and Per Olsson from Stockholm. Later in the year, we will be hosting an international forum in Townsville, as part of the Australian Government's contribution to the emerging *Coral Triangle Initiative* on coral reefs, fisheries and food security. This initiative is unprecedented in scale, and will support people-based conservation, sustainable development and poverty reduction in East Timor, Indonesia, Papua New Guinea, Malaysia, the Solomon Islands, and the Philippines.

The ARC Centre of Excellence for Coral Reef Studies produced 149 research publications in 2007, which you can link to at http://www.coralcoe.org.au/

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The first year of the Stockholm Resilience Centre and the Formas Centre of Excellence

by *Carl Folke*, Director, the Beijer Institute and
Scientific Director, the Stockholm Resilience Centre

THE BEIJER INSTITUTE has been strongly engaged in the first year of operation of the new Stockholm Resilience Centre (SRC). The mission of Stockholm Resilience Centre is to take on the challenge of advancing the understanding of complex social-ecological systems and generating new and elaborated insights and means for the development of governance and management practices in relation to ecosystem services and long-term sustainability. SRC is intended to achieve its mission through;

- internationally recognized inter- and transdisciplinary research that integrates social science, the humanities and natural sciences
- by fostering an international arena for science, practice and policy dialogues
- by providing academic programmes and high quality inputs in academic curricula and training
- through strategic communication for improved policy and decision support

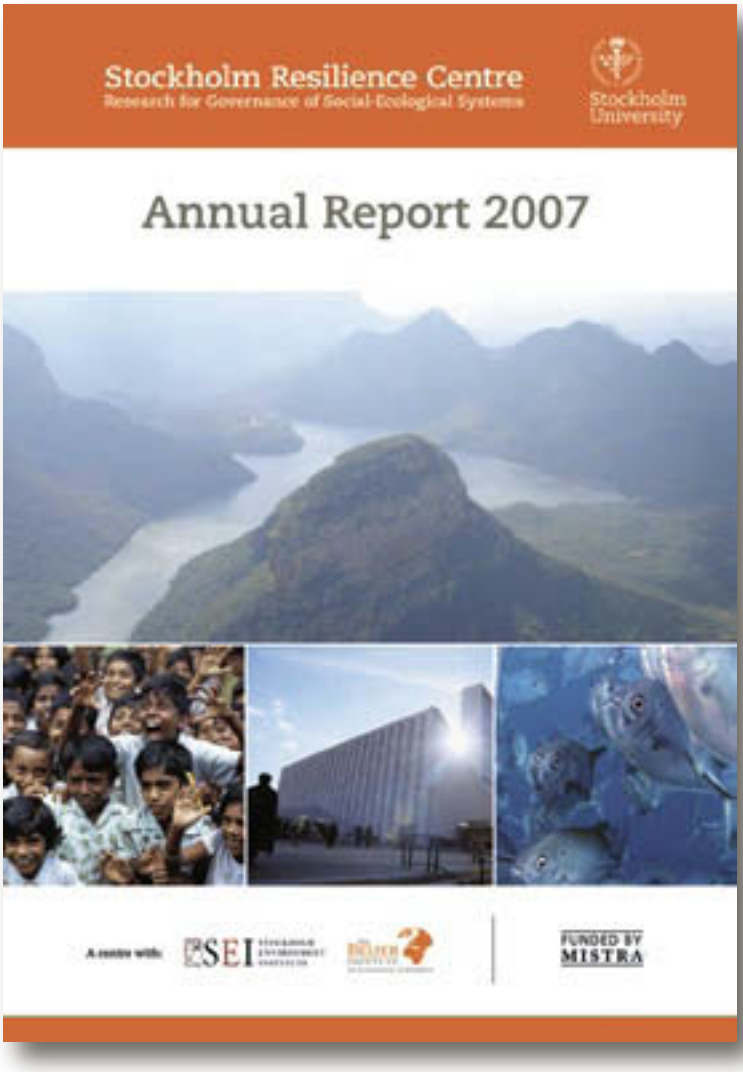
PHOTO: JERKER LOKRANTZ/AZOTE.SE

The Stockholm Resilience Centre hosted a much appreciated Open house evening during the Resilience 2008 conference.

Basically, everyone at the Beijer Institute has played essential roles in building the new transdisciplinary centre; serving on the advisory board, as theme leaders, taking part in communication strategies and other collaborative functions. The collaborative organization of the Resilience 2008 conference was a nice platform of the process. New possibilities for Beijer activities continuously emerge on this dynamic arena and the synergies are numerous.

The Research Framework

The research framework of SRC is defined and guided by three boundary conditions: *firstly*, that society and nature represent truly interdependent social-ecological systems; *secondly*, social-ecological systems are complex adaptive systems, which mean that governance has to be adaptive to unexpected change; and *thirdly*, cross-scale interactions in time and space cause social-ecological feedbacks and pose new challenges for governance and management. This framework sets a particular focus on the dynamic evolution of societies and nature, characterised by long periods of apparent limited change followed by periods of rapid and abrupt change, and on the ability to reorganise and develop in the face of change, i.e., on social and ecological resilience. A particular focus is on understanding the risk for social-ecological tipping points and regime shifts, and strategies to steer free from them, adapt and even transform to improved situations.



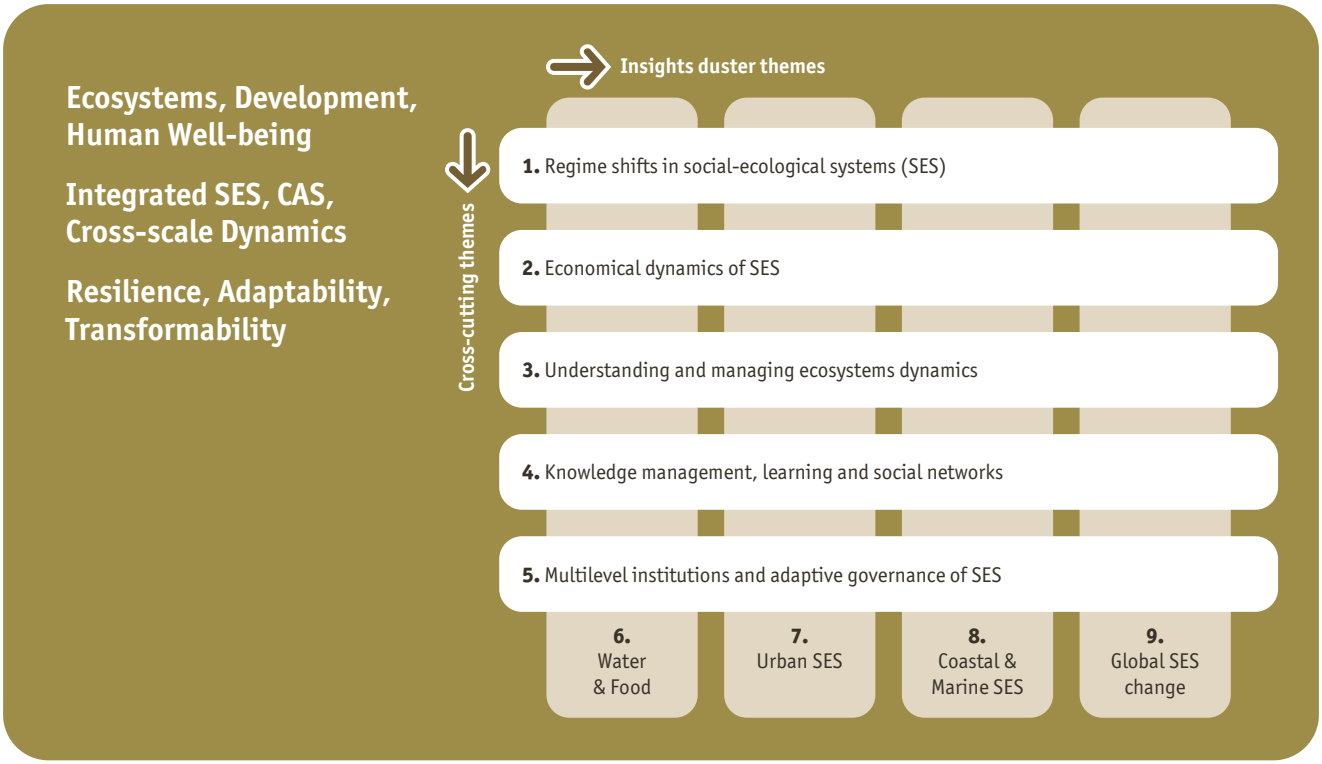
Currently, research activities are structured in nine themes, each coordinated by 2-3 theme leaders. Five of these advance theory and methods, covering broad areas of research, from understanding ecosystem dynamics, regime shifts and a new welfare economics, to social learning and multilevel and adaptive governance. Four themes are thematic, more applied and on the ground, covering water and food, urban dynamics, coastal and marine systems and global social-ecological change. The themes feed into each other through an ongoing dynamic process of inductive-deductive science, practice and theory with active involvement of scholars from the natural and social sciences and the humanities, within the centre, in Sweden and internationally. The Beijer's competence in ecological economics is of great significance in the development and activities of the SRC.

Another important part of the centre is a strong emphasis on policy dialogues, capacity development and communication. This broad mandate – from science to change – is made possible through the incredibly strong support from the three founding institutions of the Centre. Through the Beijer Institute, the SRC is a collaboration of the Royal Swedish Academy of Sciences, Stockholm University and Stockholm Environment Institute, funded by MISTRA, the Foundation for Strategic Environmental Research.

The communication and outreach of the Beijer Institute is substantially magnified through the close collaboration with SRC and research results, workshops and events are regularly highlighted at the SRC website.

Centre of Excellence – a glue in the collaboration

We are in the third year of the project the *Resilience and Sustainability: Integrated Research on Social-Ecological Systems*, a five year Swedish Centre-of-Excellence project provided by FORMAS – the Swedish Research Council for the Environment,



Research focus and themes of the Stockholm Resilience Centre.

Agricultural Sciences and Spatial Planning. This grant, evolving to a large extent from earlier Beijer research programs and collaborations within the Resilience Alliance, has been significant for the Beijer Institute and instrumental in the start-up phase of the Resilience Centre. The focus of the research serves as a core for the Centre's research agenda:

- What are basic processes and sources of resilience in social-ecological systems and features behind loss of resilience and how do they interact across temporal and spatial scales?
- How can governance systems be shaped and stimulated to emerge across spatial and temporal scales in order to cope with uncertainty, surprise and vulnerability in social-ecological systems? What are the lessons from past experience and history?
- To what extent is there a need to revise current approaches to economic policy, indicators of wealth, and governance in the light of complex systems and cross-scale interactions? In particular, is it possible to assess the value of resilience so as to include it in an accounting framework?

We argue that because of positive feedbacks causing non-linear dynamics and regime shifts in social-ecological systems a resilience approach will be required for guiding management and policy towards sustainability. The project, a predecessor to the SRC, is a joint effort of the Beijer Institute, Stockholm University and SEI with a strong focus on complex systems, regime shifts and resilience.

The achievements of the Stockholm Resilience Centre during its first year of operation are presented in the SRC Annual Report 2007 and further information is provided at the website www.stockholmresilience.su.se

Behavioral Economics & Nature Network (BENN) – a new Beijer network

by *Jason Shogren*, Stroock Professor of Natural Resource Conservation & Management , University of Wyoming, organizer

ECONOMICS HAS RELIED on rational choice theory to help guide environmental policy. Behavioral economics, however, has challenged this conventional mindset by showing how people frequently make choices and state values that deviate from the presumption of rationality, referred to as "behavioral failures" in economics jargon.

We are proposing to create a new network of research that explores the potential of behavioral economics to advance environmental and resource economics as well as ecological economics: Behavioral Economics & Nature Network (BENN). The Beijer Institute will act as the home for this new network. The network will include life scientists and social scientists, including economists, psychologists, behavioral scientists, anthropologists, biologists, and ecologists.

Researchers involved in BENN will examine different aspects of the basic question: *How does behavioral economics affect thinking about environmental and resource policy and management of ecosystem services*? But this does not mean anomalous behavior is non-existent; nature's goods and services frequently lack the active market-like arbitrage needed to encourage consistent and rational choice. We believe it is important to identify the economic circumstances, institutional designs, governance frameworks and social contexts in which rational choice theory works and those where it fails to capture observed behavior.

BENN will work on three structural elements:

- BENN will create a network of scholars interested in the field of behavioral economics and ecosystems. This will be open to anyone wishing to join. We will create an advisory group of 6 scholars (2 economists, 2 behavioral scientists, 2 biologists/ecologists), who can help us guide the network and expand its scope.
- BENN will facilitate a working paper series to help establish the network as a source for useful and high level scholarly output in behavioral economics and ecosystems. The goal will be to get out about 10 papers per year, to start from a selected set of scholars. Other scholars who want to have the papers included will be encouraged to submit papers. BENN advisory group will screen the outside papers for quality control.
- BENN will hold an annual meeting at the Beijer Institute for an invited set of scholars within and outside BENN. The goal of the workshop is to facilitate the exchange of ideas and the promotion of top level publications that can help make good environmental policy better and prevent bad policy from getting worse.

HIV/AIDS – the true tragedy of the commons?

Exploring the effects of the HIV/AIDS epidemic on common-pool resource management.

by *Ingela Ternström*, Researcher, the Beijer Institute

THE AIDS EPIDEMIC started in the mid 80's in Africa and has since then developed into a global crisis. In the most severely hit areas, 10 to 40 percent of the adult population is infected. HIV/AIDS is different from other diseases and causes of death in that it targets mainly the productive part of the population, leaving the young and the old to take on the tasks of providing food, and governing resources.

Although initially regarded as a health problem, HIV/AIDS is increasingly recognized to have much wider implications, on all levels of society. There are dramatic decreases in the size of the labour force, rural households suffer doubly as infected urban relatives move back to the villages and income from remittances is lost and the burden of care increases, medical bills and funer-

PHOTO: © MATTON IMAGES

al costs increase. The economic consequences are dramatic. For the rural population, the short-term solution includes an increased dependence on gifts and loans, which places the social fabric of affected communities under severe stress, and an increased use of local natural resources as a source of food and income. Among the more long-term effects are changes in the social fabric of norms, rules, traditions and customs.

Analyses of existing empirical studies show that local natural resource use is intensified and social structures are modified as a result of HIV/AIDS. The literature on common-pool resource management and on resilience clearly shows that sustainable resource use is dependent on a well-functioning institutional structure, which is embedded in the social structure. Linking these sources of knowledge strongly suggests that the HIV/AIDS pandemic is affecting the institutions that control local natural resource use. At the same time, other aspects of the pandemic are working to increase the demand for local natural resources as an important source of food and income.

The purpose of this project is to use knowledge about common-pool resource management to explore the effects of the HIV/AIDS pandemic on the way that local non-agricultural natural resources are used and managed. The analysis is carried out by applying a common-pool resource perspective on the social effects of the pandemic, thereby linking changes in customs, norms and traditions to disruptions of institutions (rules, norms, traditions) that ensure an efficient use of local natural resources. The motivation for undertaking this analysis is that this is an area that has been largely ignored but has a potentially huge effect on people's livelihoods. If local natural resources are deteriorated, the situation for people that rely on them for their subsistence will also deteriorate, adding to the burden already put on them by the epidemic.

A number of links between the direct effects of HIV/AIDS (such as reduced labour force, loss of leadership, changed customs and migration) and the institutions that govern the use of local natural resources are examined. Initial results show that there are a number of different ways in which HIV/AIDS is likely to affect local natural resources use and management. Some of these work via changes in the demand for the resources, some via changes in the cost/benefit structure of using the resources and some via changes in the institutional structures governing their use and management. The main conclusions so far are that this is an alarmingly under-researched area and that there is a serious risk that HIV/AIDS will become the true Tragedy of the Commons, making the already harsh conditions for victims of the pandemic even worse.

SARAS – a new research institute of South America

by *Marten Scheffer*, Professor, Wageningen University, the Netherlands

The Scientific advisory group of the new SARAS institute, with Beijer Director Carl Folke, flanked by Steve Carpenter and Marten Scheffer of the Beijer Board, and Frances Westley of the Stockholm Resilience Centre Board.

SOUTH AMERICAN SCIENCE has been developing strongly over the past years. This is well illustrated by an analysis by Holmgren and Schnitzer in PLoS Biology (2004) entitled 'Science on the rise in developing countries'. The authors show that the scientific output per dollar spent in Latin America is now higher than in North America, and that the trend in Latin America is upwards, whereas in North America it is downwards. On the other hand, Latin American science tends to reach lower impact journals and citation scores. The time is ripe for an institute that could catalyze a development towards high impact science that serves to enhance the region's long term sustainable development; an institute that would help the network of scientific cooperation within South America, and strengthen the links to an international network of excellent scientists.

SARAS – The South American Institute for Resilience and Sustainability Studies is an interdisciplinary research institute designed to catalyze high impact science that serves to enhance the region's long term resilience and sustainable development, launched in December 2007 in Montevideo, Uruguay. It will be a significant node for South American sustainability science. The institute is an initiative of the Universidad de la Republica of Uruguay and founding organizers are Néstor Mazzeo, Universidad de la Republica, Uruguay and Beijer Fellow Marten Scheffer. It is supported and will receive basic funding from the federal government of Uruguay.

SARAS will be a regional center cooperating closely with scientific communities and related funding agencies in Argentina, Brazil and Chile, and seeking structural cooperation with an established set of international key scientists. Contacts have been established with sister-institutes such as the Santa Fe Institute, NCEAS, the Resilience Alliance, Beijer Institute and Para Limes and at the moment cooperation is being developed with Wageningen University, the University of Wisconsin, and Stockholm University and its Resilience Centre.

Rather than having a permanent scientific staff it will provide facilities for workshops, courses and sabbaticals. It will be a Foundation, led by a Board of Trustees and a Science Board, in which Beijer Fellows Steve Carpenter and Marten Scheffer and also Carl Folke are part. The SARAS building will be located at the coast of Uruguay.

The vision for SARAS is as follows – a place where paradigm shifts in thinking about resilience and a sustainable future are triggered. In its atmosphere brilliant minds will find peace to think deeply. At the same time, the kind and intense interaction at SARAS will shape a new generation of broad visionary scientists. While respected for its cutting edge science, SARAS is also to be known for its capacity to link the powers of science and arts to policy.

As revealed by the recent UN millennium assessment of ecosystems, the structure of the world's ecosystems changed more rapidly in the second half of the twentieth century than at any time in recorded human history, and virtually all of Earth's ecosystems have been significantly transformed through human actions. The most rapid changes in ecosystems are now taking place in developing countries. Ecosystem services, particularly food production, timber and fisheries, are important for employment and economic activity. However, while intensive use of ecosystems often produces the greatest short-term advantage, excessive and unsustainable use can lead to losses in the long term.

The impacts of human actions on ecosystems are often slow to become apparent. Also, some changes are difficult to predict, because they are gradual only until they reach a certain threshold, at which large changes occur suddenly. Examples of abrupt changes include the start of epidemics, the collapse of a fish population, and shifts of lakes from a clear to a turbid state. On a larger scale, regional climate systems and also social systems may change abruptly if a tipping point is reached. Recent scientific advances have demonstrated that in the vicinity of such tipping points, complex systems such as societies, ecosystems and climate systems may gradually lose resilience. They become increasingly fragile, to the point that small perturbations may trigger an irreversible shift to another state. Scientists across a range of disciplines have now turned their focus for sustainability studies on resilience, defined as the ability of a system to maintain its essential functions in the face of perturbations. The reason for this is that while perturbations such as earthquakes or droughts cannot be controlled or managed, resilience usually can. The challenge thus is to find out what determines the resilience of different complex systems. This is a scientific field in development, in which interaction of disciplines is obviously required. Better case studies, experiments, theories and models are needed to understand the links between ecosystem change and impacts on human well-being and to assess the economic consequences of ecosystem change.

Latin American and Caribbean Environmental Economics Program (LACEEP)

by *Francisco Alpízar*, Program Director, LACEEP

LACEEP workshop in Costa Rica, spring 2008, with LACEEP Director Francisco Alpízar, centre of the back row, and the Beijer Institute's Sara Aniyar, front row, third from the right.

LACEEP IS THE Latin American and Caribbean Environmental Economics Program, established in 2005. With the continuous support of the International Development Research Centre, IDRC, and SIDA/SAREC, LACEEP has since then provided grants to researchers that come with real, urgent questions framed in research proposals that are both policy relevant and solidly rooted in strong economic theory and methods. LACEEP provides much more than financial support and participants get the opportunity to meet with peers from inside and outside Latin America, close advice and supervision by specifically appointed scientists, formal training in special topics, access to sources of infor-

Karl-Göran Mäler of the Beijer Institute, holding the course "The economics of Ecosystem Services", at a LACEEP workshop in Chile, fall 2007.

mation, publication outlets and opportunities for comparative research.

LACEEP is hosted by CATIE (Spanish acronym for Tropical Research and Higher Education Center). CATIE is an internationally recognized institution for knowledge management on sustainable development.

LACEEP's development goal is to introduce coming generations to a new paradigm; one that acknowledges that resources are limited, one that recognizes the need to use those resources in the most efficient way to be able to use them long into the future, one that acknowledges the importance of providing and protecting public environmental goods, and finally, one that realizes that there is a pervasive link between natural resource degradation and increased poverty – intensifying the use of natural resources might not increase the well-being of the poor, not even in the short run. Dealing with these issues is precisely the task of an environmental economist which is also why the creation of competence and the consolidation of a permanent discussion forum in this important field are of utmost importance.

Ultimately we hope to create an active and dynamic community that supports capacity building of environmental economics researchers, with global standards of excellence; creating alliances regionally and internationally, contributing to state of the art and relevant policy dialogue from the perspective of Latin America and the Caribbean.

During the first three years of execution, LACEEP has received 208 preliminary proposals and 111 full proposals. Within the five workshops organized during this period, 61 new applicants have been invited to present their research proposals and 30 grants have been approved. Six LACEEP policy briefs have been published and the LACEEP Working Paper Series is currently being prepared for launch. Just during the past year, five of our grant holders completed their research projects.

Research projects completed this year:

Enrique Sanjurjo: The use of stated preference techniques for valuing the environmental attributes of a jungle boat ride with multiple characteristics in the Northern Coast of Nayarit, Mexico

Hugo Cardona: Decentralization and environmentally sound decision making: Policy implications

Carlos Orihuela: Estimating genuine investment for the Peruvian mining sector during 1992-2005

Carlos A. Saldarriaga: Evaluation of the Fuel Conversion Program in Vehicles in the Aburrá Valley (Colombia)

Peter Edwards: Estimating the economic value of coral reefs in the Montego Bay Marin Park, Jamaica: implications for resource management and sustainable development

A key component of LACEEP's activities is the series of biannual workshops in which invited applicants are able to present their proposals in front of a carefully selected panel of experts. Moreover, these experts are available throughout the workshop for informal discussions and advice. A series of short courses on key topics in environmental economics, ranging from basic research and analytical tools to techniques for the valuation of environmental goods and services and environmental policy design are given as part of the two annual workshops.

LACEEP's IV Workshop took place in Talca, Chile, (from September 29 to October 2, 2007) immediately after the Latin American Association of Environmental and Resource Economists (ALEAR); during this event, the short course was titled "The economics of Ecosystem Services" and taught by Professor Karl-Göran Mäler.

The V Workshop was carried out in Heredia, Costa Rica (from March 31 to April 4, 2008). Professor Richard Woodward was in charge of the short course titled : "Topics in Environmental Economics".

Last January, a new modality of longer courses began to create and strengthen capacity in environmental economics. LACEEP will continue to carry out these courses in environmental economics once a year and will continue facilitating short courses in coordination with the workshops. The First Environmental and Resource Economics Training Course titled "Environmental Policy and Resource Economics Course" took place in CATIE, Turrialba, Costa Rica from January 4 -12, 2008 with the participation of 25 students. Prof. Dale Whittington (University of North Carolina at Chapel Hill), Prof. Nancy Olewiler (Simon Fraser University) and Prof. Alexander Pfaff (Duke University) gave lectures during 7 days on a series of topics in Environmental and Resource Economics. Professor Alexander Pfaff discussed "Deforestation, Conservation and Environmental Auditing". Professor Olewiler's lectures dealt with "Public Policy Analysis for Environmental Research". Professor Dale Whittington's course addressed "Water and Health Economics". The Second Training Course will be focused on Valuation and Household Surveys and taught by Fredrik Carlsson, University of Gothenburg and Dale Whittington, University of North Carolina, Chapel Hill, and was carried out from July 28th to August 11th, 2008 in Costa Rica.

The Beijer Institute's continuous support during this last year has been pivotal to LACEEP's success. Not only was Prof. Mäler one of our lecturers, but also Prof. Sara Aniyar is a very active member of our Advisory Committee. Both Mäler and Aniyar have been involved in supervision of grant holders. Still, the most important input of the Institute into our program is the professional weight it provides. As expected, with four courses and 2 workshops per year and with approximately 80 external revisions of new proposals per year, LACEEP is a program hungry for contacts and networks. The Beijer Institute of Ecological Economics, with its broad network of highly respected academics, is in that sense the perfect partner.

Centre for Environmental Economics and Policy in Africa (CEEPA) and the Resource Accounting Network for Eastern and Southern Africa (RANESA)

by *Rashid Hassan*, Program Director, CEEPA/RANESA

THE CENTRE FOR Environmental Economics and Policy in Africa (CEEPA) at the University of Pretoria, South Africa, continues to lead and support various research and training activities in environemental economics and policy analysis. Most important of its activities is the program for supporting regional capacity in environmental economics, funded by SAREC/Sida. The Sida-CEEPA capacity support program continued to offer research grants that includes theoretical and hands-on training and close mentorship and supervision by international experts in the field, at its Biannual research workshops. During its third year (07-08), CEEPA organized its fourth and fifth Biannual workshops under this program in Dar es Salaam (November 2007) and Pretoria (May 2008). Five new grants have been awarded to researchers from Africa this year. During the past year two training of trainers workshops have been offered. The first one on GAMS & CGE for environmental management, taught by Professor Rob Delink of IVM Free University, Amsterdam, in Dar es Salaam (November 2007). A second training workshop on econometric techniques for non-market environmental valuation was taught by Dr. Hala Abou Ali of Cairo University in Pretoria (May 2008). More than 15 particpants from African universities and research centres benefited from these training workshops.

CEEPA also supported visits by three international scholars (Professor Karl-Göran Mäler from Sweden, Professor Greg Hretzler from Australia and Professor G. Farovanti from Italy) during 2008. The program also funded four new PhD scholarships for African students at CEEPA in Pretoria. The program continued to provide support to libraries of participating African universities. A new book co-published by CEEPA and EarthScan on the work on impacts of and adaptation to climate change in African agriculture completed under CEEPA leadership in 11 African countries with funding from the GEF and the World Bank.

Support to environmental accounting work under RANESA continued. During the fourth year (2007-2008) of its third phase of operations, RANESA has continued its support to new countries in the eastern and southern Africa region using funding from Sida Sweden. RANESA also continued to support environmental accounting activities in South Africa, Namibia and Botswana, with special focus on consolidating the institutionalisation of National Resource Accounting (NRA) within government structures and its use for improved policy design and management of natural resources. A concluding workshop for this project took place as a Pre-conference workshop at the ISEE Conference in Nairobi (August 8, 2008). This will lead to a publication of another book on CEEPA's environmental accounting work in Africa.

The South Asian Network for Development and Environmental Economics (SANDEE)

Meeting the challenge of climate change

by *Pranab Mukhopadhyay*, Environmental Economist, SANDEE and *Priya Shyamsundar*, Program Director, SANDEE

SANDEE training workshop in Nepal, attended by, among others, Karl-Göran Mäler, Pranab Mukhopadhyay, SANDEE, first from the left in the second row, and SANDEE Director Priya Shyamsundar, middle of front row.

WITH THE EMERGENCE of indisputable scientific evidence of global Climate Change and its impending adverse impacts in this part of the world where large sections of the population face high risk and vulnerability, SANDEE has begun to focus its training and research activities to meet this challenge. In this note for Beijer's readers, we thought it would be most useful to report on our response to climate change. As background, SANDEE is an environmental economics capacity-building network that works with scholars across South Asia and has enjoyed many years of partnership with the Beijer Institute.

Our first foray in terms of climate change was through a training workshop. We felt that we really

Attendants of SANDEE training course in Nepal. Among others, Beijer fellow Sir Partha Dasgupta and Pranab Mukhopadhyay, SANDEE.

needed to understand the issues ourselves and our researchers were very keen on the idea. In December 2006, in order to update our researchers of the current state of knowledge on climate change, we invited Sir Partha Dasgupta (Cambridge University), Satya Priya (RMSI, New Delhi), V. Ramanathan (University of California, San Deigo), Will Steffen (Australian National University), and Jeff Vincent (University of California, San Deigo), to lecture at an advanced training workshop in AIT, Bangkok. This was followed by introducing a new set of research guidelines related to climate change in SANDEE's bi-annual research grant competition.

In January 2008, to push for a more region-specific focus, about a dozen scientists from all over South Asia were invited to brain storm along with SANDEE advisors and researchers.[1] This discussion we hoped would also provide an opportunity to: a) choose a set of researchable themes, and, b) initiate multi-disciplinary research between climate scientists and economists.

An increase in temperatures and precipitation in South Asia is a certainty even though the predictions on the extent and variability differ. At this juncture South Asia's contribution to climate change is considered relatively small but the fear is that this will grow and compound the global dilemma on climate change policy needs. Given this background, three broad themes were identified as a research agenda for climate change in South Asia: understanding impacts, mitigation and adaptation options. Outlined below are a set of more specific research themes that SANDEE will follow over the next several years.

[1] For a full list of participants and presentations please visit http://www.sandeeonline.org

Research Options

a. **Valuation and Distribution:** It is important to examine the benefits, costs and distributional impacts of adaptation or mitigation policies whether it is energy generation, urban construction or municipal waste management. The distributional effects of proposed policy changes need to be understood. Bio-energy, for example, is becoming a much discussed response to climate change. Will it have any impacts on South Asia's food security?

b. **Macro-models and CGE:** Polices and instruments related to climate change may have a variety of sectoral and regional effects. These, when used

conjunctively with other development policies, would have economy wide impacts that are different from those that emerge from partial equilibrium analyses. Computable General Equilibrium or other variants of macro models that test the efficacy of carbon taxes or examine the effects of increased agricultural shocks, taking into account farmer responses, would be examples.

c. **International instruments and climate change negotiations:** There are various international instruments that have emerged from climate change related negotiations. For example, the Clean Development Mechanism was created to finance climate mitigation in developing countries through corporate support. Why has it had limited success? Forest conservation to sequester carbon, crop changes to reduce methane, or biogas technologies to reduce energy consumption need economic analyses. What would incentivize South Asian countries to undertake mitigation given that the price of carbon will continue to increase?

d. **Links between local environmental solutions and regional climate change:** Haze and black carbon have local and regional impacts. Technology and policy to reduce these could be achieved outside the context of global negotiations. These solutions will have robust short term benefits in terms of health outcomes and improvements in natural capital, which would make costs of mitigation and adaptation more palatable.

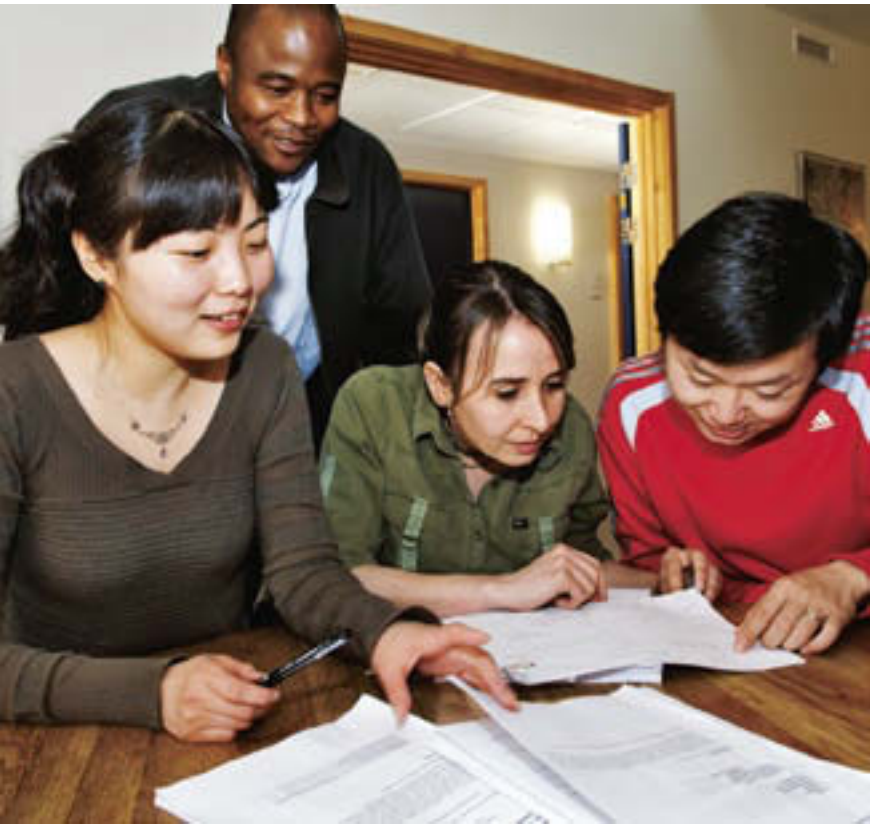
e. **Increase in frequency of extreme events.** South Asia is likely to see an increase in floods and drought with implications for food security, health, biodiversity and migration. There can be many forms of responses to climate driven disasters: increasing natural barriers that offer storm protection services in coastal areas, flood and other forms of 'disaster' insurance, changes in agricultural cropping patterns, communitarian rapid response systems, increased government intervention in the aftermath of disasters etc. All of these adaptation 'instruments' would require careful economic scrutiny.

Where are we today with our climate change research? We would say that we are making slow progress. Some of the climate change related issues are as old as development and no different from the other work that has been on-going in SANDEE; but newer ideas are harder to develop without all the data on hand. SANDEE studies tend to be local studies and there are no climate models that give us local details. The work on adaptation is interesting and important but there are so many uncertainties that researchers are stretched. Testing policy instruments that mitigate climate change may be more feasible in the immediate future. We will keep you informed as we learn more.

PhD program in Environmental Economics 2007

by *Thomas Sterner*, Professor, Department of Economics,
University of Gothenburg

THE DEPARTMENT OF Economics, University of Gothenburg, has a long history of supporting PhD candidates from developing countries. The PhD program in environmental economics is supported by the Swedish International Development Cooperation Agency (Sida) and includes collaboration with the Beijer Institute and Resources for the Future. It encompasses one year of general economics courses, one year of specialization courses, two-three years of data collection and thesis writing. Besides training in economics and environmental economics, the program emphasizes links with other sciences such as natural sciences and other social sciences.



Phd course students Ping Qin, Kofi Vondolia, Clara Villegas and Haoran He.

The purpose of the PhD program is to strengthen the capacity in developing countries to teach environmental economics at the university level, and to establish a firm basis for research that can be used for policy advice pertaining to environmental economics and sustainable development. We strive to encourage our graduate students to do good publishable research on important resource and environmental issues related to poverty alleviation in their home countries.

The PhD program is at the core of the capacity building program which is carried out by the Environmental Economics Unit and besides doctoral studies comprehends joint environmental economics projects and post-doc training, as well as Helpdesk services for Sida. The PhD program has now received international reputation for its high quality and steady output of well trained environmental economists from developing countries. More than 30 persons have completed their PhD theses in environmental economics at our department and 15 of them have been financed with stipends from Sida.

During 2007 14 PhD candidates were enrolled in the program under the agreement between Sida and the Environmental Economics Unit for the period 2007 – 2009. The output was very good. Four candidates successfully defended their PhD thesis. One student had the final seminar before PhD defense.

EEU staff has also given two PhD specialization courses during 2007: Public Economics, and Environmental Valuation. In addition we have initiated a training course on Policy Advice which aims

at improving the policy advisory understanding and skills of the PhD candidates. Seventy students applied to our specialization courses. Ten external students were selected and participated in the courses with funding from the program.

Six students within the program and one Postdoc connected to the program attended the course "Ecology and Economic Management" given at The Beijer Institute. The aim of this specialized course is mainly to increase the understanding of the complexity and functions of ecological systems. It is anticipated that the students will gain an appreciation of ecology as a science and its role in understanding the man-nature interaction, as well as obtaining deeper insight into how non-linearity, uncertainty, and dramatic changes make ecosystems unpredictable and challenging to manage.

Brief description of theses 2007

Jorge Garcia, Essays on asymmetric information and environmental regulation through disclosure.

The thesis looks into different aspects of a relatively new policy approach for industrial pollution control: the public dissemination of information by regulators regarding the environmental performance of firms. These schemes are sometimes referred to as regulation through disclosure or informational regulation. A large part of the thesis is an empirical evaluation of a well-structured disclosure program, Indonesia's PROPER. The main result is that the disclosure program resulted in a rapid and significant reduction in emissions intensity. The findings of the thesis strengthen the belief that thin markets and other sluggish mechanisms are the results of imperfect information and also indicate that informational regulation is a promising strategy to tackle industrial pollution in the presence of weak institutions.

Mintewab Bezabih, Essays on land lease markets, productivity, biodiversity, and environmental variability.

Some of the most poor and vulnerable people in the world live in Ethiopia. This thesis looks at poor small-farm households in Ethiopia, in particular at female-headed households and assesses the link between land leasing behavior and productivity differentials between male and female-headed households. What is found is that female household heads have lower enforcement ability and that tenure insecurity is a significant negative determinant of productivity. However, the results show no support for a lower likelihood of contract renewal by female-headed households or for a significant impact of contract renewal on productivity. Furthermore, a unique data set from Ethiopia is used to look at the role of risk and time preferences, and transaction costs for the choice of land contracts. The results show that the tenant characteristics are more important than those of landlords in explaining contract choice. The results do not support the risk-sharing hypothesis of the agency theory as a motivation for contract choice while there is some support that discount rates and transaction costs affect contract choice. The results also indicate that the land lease market serves as a resource pooling mechanism by bringing poorer landlords and tenants into sharing arrangements.

Martine Visser, Fairness, reciprocity and inequality.

What affects people´s willingness to collaborate regarding common resources such as forests, the atmosphere, or fish in the ocean? How is this affected by economic inequality and the possibility to punish people who do not collaborate? In order to answer these questions, Martine Visser conducted economic experiments in nine fishing

I really enjoyed the course in Ecology and Economic management offered at the Beijer institute. The possibility of understanding the complexity and functions of the ecosystems made the course a very interesting and worthy experience in my academic process as a PhD student in Economics. Very often decision-makers in charge of environmental management of ecosystems face a lack of information that impedes on the process of policy design and its implementation. In my opinion there are two main cornerstones necessary to design and implement environmental management policies for strategic ecosystems.

First, a good understanding of the complexity, functioning and adaptation of ecosystems. Second, an analysis of the way in which human beings make use of ecosystems, transform them and the consequences of such transformations. In some countries, at best, these kinds of studies are conducted separately, implying that the management of ecosystems is not integrated into an interdisciplinary approach as the study of environmental services would require. The course at Beijer Institute helped me to understand the complexity of the systems that we are making decisions about, and the need to look for an integrated approach between ecology and economics in order to develop better management strategies of ecosystems.

Clara Villegas, student in the PhD program in Environmental Economics, Gothenburg University

Phd course students Precious Zikhali, Yonas Alem and Ping Qin, together with Professor Thomas Sterner.

communities in South Africa and with schoolchildren from four schools in Cape Town. In the fishing communities, groups with even income distribution were compared with groups with uneven income distribution. Surprisingly, the results show that groups with uneven income distribution collaborate more, and poor people contribute a higher share of their income. One explanation could be that poor people are more dependent on the common resources. In line with previous research in Behavioral Economics, the thesis shows that human behavior is not only governed by a will to maximize the economic outcome. Social norms, reciprocity, and trust are important aspects in economic decision-making. Many poor countries with uneven income distribution lack formal institutions that take care of common resources. It is therefore important to understand how norms and individual behavior affects collaboration regarding common resources.

Marcela Ibáñez Díaz, Social dilemmas: The role of incentives, norms and institutions.

In Colombia poor farmers cultivate coca in their fields, otherwise they are not able to support their children. Others do it for the massive profit. Coca cultivation is extremely profitable for the private individual, but simultaneously contributes to environmental devastation and a society characterized by violence and a large number of fatalities. In the face of this social dilemma – what influences people's choice? And how can knowledge of this help the Colombian authorities to better combat coca cultivation and the cocaine trade? To answer these questions Marcela Ibáñez Díaz interviewed Colombian farmers and also had them participate in an experiment. The study has been carried out in the areas where cocaine cultivation is a well-established tradition and is the first of its kind that is based on individual data. The results show that people's decisions on whether to grow coca or not, are not only based on financial incentives but are also influenced by norms, belief in what is right or wrong, on social pressure, social acceptance, and the degree of respect for societal institutions. Colombia is the world's largest cocaine producer. The authorities in Colombia are applying two principal strategies to combat cultivation, partly spraying the coca fields with pesticide, partly creating programs to improve the opportunities for alternative sources of income. The research shows that both strategies reduce cocaine cultivation, but also that there are other ways. In addition to give people financial incentives the authorities should invest in educational campaigns that raise people's awareness of the negative effects of coca cultivation on society, but also work to promote increased faith in society's institutions. The research results have already been presented to the UNDCP, United Nations Drug Control Program.

Environment and Development Economics (EDE)

by *Anastasios Xepapadeas*, Editor, EDE and
Chairman of the Beijer Institute's Board of Directors

General

The past year was a busy and productive one for *Environment and Development Economics*. In the fall of 2007, the Editorial Office relocated from Crete to Athens, reflecting a change in affiliation of the Editor. The transition was smooth, with no disruption to the processing of papers or other operations of the journal.

Editorial Matters

Associate Editors

In late 2007, Associate Editors Erwin Bulte, Phoebe Koundouri, Margaret Chitiga Mabugu, Bernardo Mueller, Gerald Shively and Eswaran Somanathan were joined by Jintao Xu from Peking University. Jintao offers a solid background in natural resource economics, and expertise in one of the most important countries in the developing world. The Associate Editors, whose commitment to the capacity-building goals of the journal continues to be outstanding, are widely distributed geographically, as shown in figure 1.

Figure 1. Geographical location of Associate Editors.

Editorial and Policy Boards

The terms of all the Editorial Board members except two, and four of the members of the Policy Board, expired at the end of 2007. The journal is extremely grateful for the support provided by the outgoing Board members, many of whom were with the journal from its inception. In recruiting new members to the Editorial Board, emphasis was placed on scientists who are active in the area of environment and development, and who bring geographical diversity to the Board. A total of 20 new members were appointed to the Editorial Board. In addition, six new appointments were also made to the Policy Board. These members are scientists who have made internationally-recognized contributions to the field, and have strong management experience as well. The members of the newly constituted Boards are listed below.

EDE Editorial Board (as of January 1, 2008)

Francisco Alpizar, CATIE, Costa Rica

Lucas Bretschger, ETH Zurich

Robert Cairns, McGill University

Juan-Camilo Cardenas, Universidad de los Andes, Bogotá

Kanchan Chopra, Institute of Economic Growth, Delhi

Maria Cunha, Universidade Nova de Lisboa

Hossein Farzin, University of California, Davis,

Quentin Grafton, Australian National University

Michael Harris, University of Sydney

Jikun Huang, Chinese Academy of Sciences

Jane W. Kabubo-Mariara, University of Nairobi

Katrin Millock, Université Paris 1 Panthéon-Sorbonne

Juan-Pablo Montero, Pontificia Universidad Católica de Chile

Keijiro Otsuka, FASID, Tokyo

Unai Pascual, University of Cambridge

Eustáquio Reis, IPEA, Rio de Janeiro

Eftichis Sartzetakis, University of Macedonia

Bob Scholes, CSIR, Pretoria

Jim Shortle, Pennsylvania State University

Priya Shyamsundar, SANDEE, Bangkok

Jeff Vincent, Duke University

David Zilberman, University of California, Berkeley

EDE Policy Board (as of January 1, 2008)

Kenneth Arrow, Stanford University

Edward B. Barbier, University of Wyoming

Jagdish Bhagwati, Columbia University

Partha Dasgupta, Cambridge University

Carl Folke, the Beijer Institute

Rashid Hassan, University of Pretoria

Michael Hoel, University of Oslo

Karl-Göran Mäler, the Beijer Institute

Charles Perrings, Arizona State University

Rüdiger Pethig, University of Siegen

Mordechai Shechter, University of Haifa

V. Kerry Smith, Arizona State University

Hirofumi Uzawa, University of Tokyo

Aart de Zeeuw, Tilburg University, the Beijer Institute

Incremental Publishing

Early in 2008 the journal began the transition to incremental publishing, through which accepted articles are published online – and thus made available for citation – prior to being printed in a specific volume and issue of the journal. The switch over to incremental publishing is expected, when fully operational, to reduce the length of time from acceptance to publication of an article from the current one year to approximately one month.

At present, about 40 articles are in various stages of production, ranging from copy editing to typesetting to proofs or revised proofs. The processing of already accepted articles is expected to be completed within the next several months, after which each newly accepted article will go directly into production without delay. This system is being adopted by more and more journals, and benefits both the authors and the wider scientific community.

Editorial Board Meeting

During the 16th annual conference of the European Association of Environmental and Resource Economists which took place in Gothenburg, Sweden in late June 2008, *EDE* held an Editorial Board meeting. The meeting was attended by 18 people, including members of the Editorial Board and the Policy Board, Associate Editors, the Editor, the Assistant Editor, and Patrick McCartan of Cambridge University Press.

Table 1: Status of manuscripts, 1995 to 2008*, by geographical area.

	Africa	Asia	Latin America	UK	West Europe	East Europe	Australia and NZ	Middle East	USA & Canada	Total
Submitted	75	252	51	77	301	26	46	16	388	1232
Accepted	17	57	10	22	93	3	10	2	175	389
Rejected	48	167	35	44	176	20	31	13	180	714
Withdrawn	10	18	4	8	15	1	3	0	22	81
Pending	0	11	2	2	19	2	2	0	10	48

*Statistics for 2008 are from January 1 – June 30.

Because the members of the journal's editorial team are so widely spread, the annual EAERE conference provides an excellent opportunity for a group discussion of operational and policy issues related to the journal, and helps to strengthen the links between those working with the journal. One of the decisions taken at the Editorial Board meeting was to explore the possibility of publishing a special issue on Critical Environmental and Development Issues in Latin America. Francisco Alpizar and Juan Pablo Montero agreed to act as Guest Editors.

An additional meeting among the Co-Director of the Beijer Institute Aart de Zeeuw, Patrick McCartan, the Editor Tasos Xepapadeas, and the Assistant Editor Joan Stefan was held, in order to review a number of operational and logistical issues relating to the journal.

Performance

Submissions

In January 2008 the journal completed 12 years of publication. Over that period of time, more than 1200 articles have been submitted to the journal, and 389 have been accepted (table 1).

Table 2 provides a breakdown of submissions by both year and geographical area, since the inception of the journal, while figure 2 graphically presents the geographical breakdown of submissions for the past 2-1/2 years (January 1, 2006 – June 30, 2008).

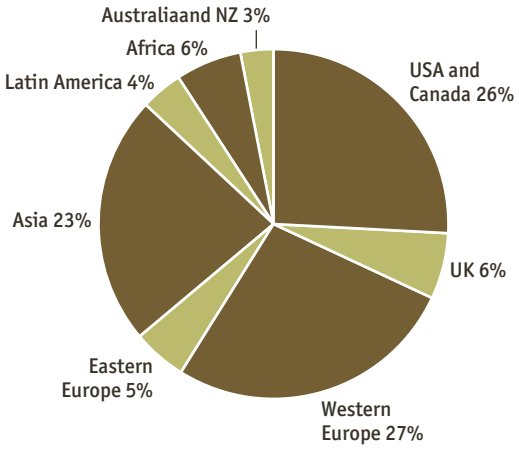


Figure 2. Geographical distribution of submissions, 1995 – 2008.

When the statistics for this recent period of time are compared with the cumulative statistics for the journal, some changing trends emerge. Most notably, submissions from the US/Canada now represent 26% of the total, compared to 32% for the total period of the journal's operation. In contrast, submissions from Europe (Eastern and Western) now total 32%, compared to 26% for the overall period. Submissions from Asia have risen in the recent time period from 21% to 23%. The rest of the geographical areas remained more or less the same.

Annual submissions to the journal reached a high of 143 in 2006; the large number of submissions was due partly to a number of submissions related to the preparation of several special issues which were

Table 2: Total submissions, 1995 – 2008, by geographical area.

Year	Africa	Asia	Latin America	UK	West Europe	East Europe	Australia and NZ	Middle East	USA and Canada	Total
1995	5	11	8	6	10	0	0	0	18	58
1996	5	5	1	3	11	0	3	1	22	51
1997	3	7	1	4	19	2	4	0	35	75
1998	3	13	3	8	26	0	4	1	29	87
1999	1	7	3	5	9	2	3	1	28	59
2000	9	15	5	7	21	0	4	4	21	86
2001	1	26	4	5	19	0	3	1	28	87
2002	7	13	3	7	21	1	8	1	29	90
2003	8	24	2	4	27	1	2	1	28	97
2004	3	35	7	4	21	3	3	5	34	115
2005	12	27	3	6	33	2	3	0	34	120
2006	11	31	4	10	38	1	0	1	47	143
2007	6	24	4	4	30	5	5	0	23	101
2008*	1	14	3	4	16	9	4	0	11	62

*January 1 – June 30, 2008

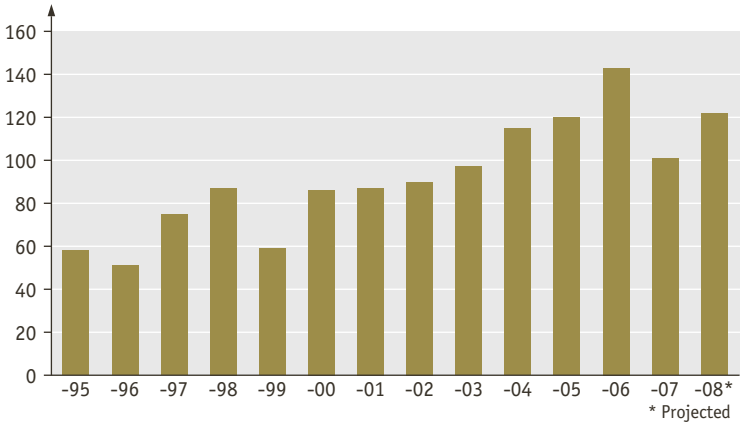


Figure 3: Total submissions, 1995 – 2008.

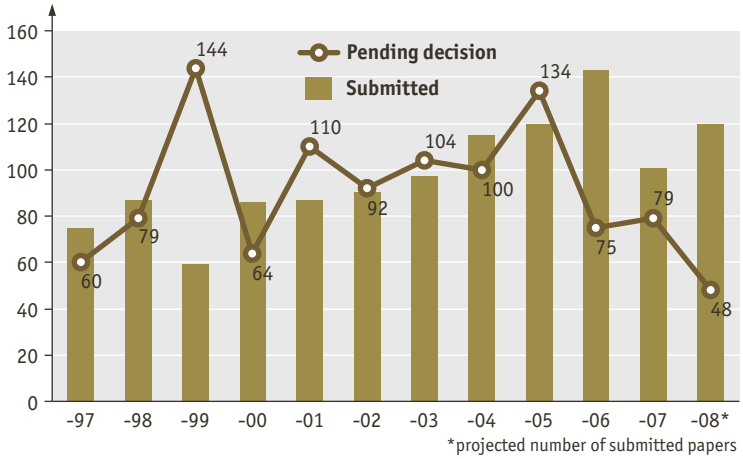


Figure 4: Papers pending decision on June 30, 2008.

in the initial stages. Total submissions dipped in 2007, but are projected to reach about 120 for 2008. Manuscript submissions for the first six months of 2008 reflect a 29% increase over the corresponding period in 2007 (figure 3).

At the same time, the number of manuscripts pending a final decision has dropped to 48, the lowest in the journal's history (figure 4). This reflects a concerted effort to speed up the review and the decision making processes. The offering of complimentary one-year electronic subscriptions for timely reviews has likely played an important role in reducing the review time.

Rejection Rate

The cumulative rejection rate stands at 67% for the entire period of the journal's existence, but ranges from 53 to 79%, depending on the geographical area (figure 5). The rejection rate for the last several years is higher than the cumulative rejection rate, reflecting the fact that more papers are rejected as the number of submissions increases.

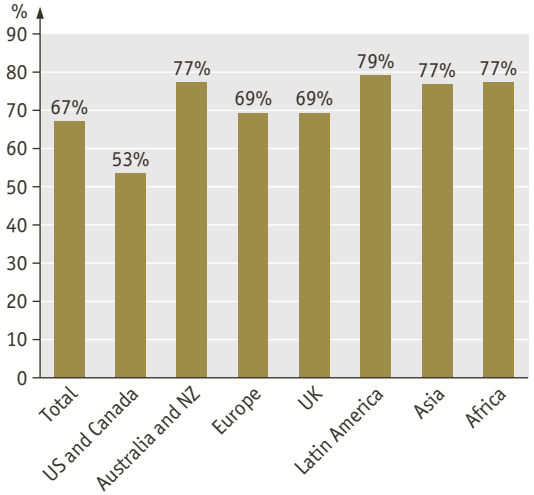


Figure 5. Cumulative rejection rate, 1995 – 2008, by geographical area.

Impact Factor

The journal's impact factor rose significantly in 2006, increasing from 0.323 in 2005 to 0.681 for 2006. In 2007 the impact factor decreased slightly to 0.595.

Production

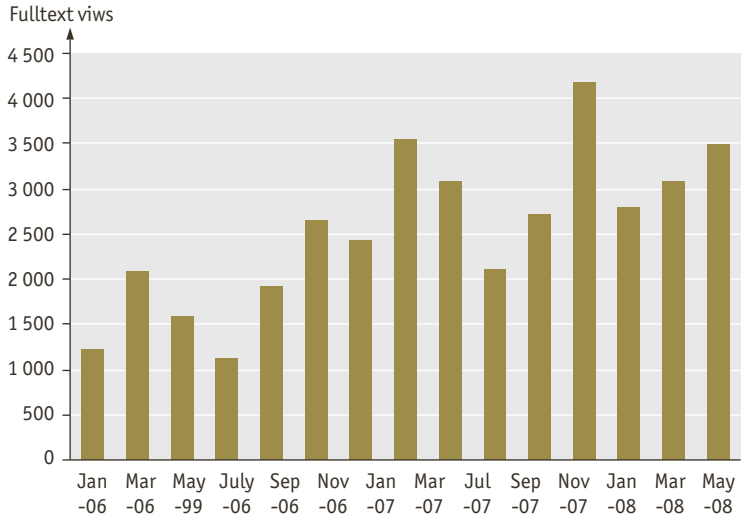
During the previous 12 months, the journal produced 6 issues, two of which were special issues.

The October 2007 issue was a special issue on *Infectious Diseases*, guest edited by Simon Levin and Anastasios Xepapadeas, and included papers on 'Optimal disease eradication' (Scott Barrett and Michael Hoel), 'A cost analysis of alternative culling strategies for the eradication of classical swine fever in wildlife' (Luca Bolzoni and Giulio A. de Leo), 'Optimal harvesting during an invasion of a sublethal plant pathogen' (Holly Gaff, Hem Raj Joshi, and Suzanne Lenhart), 'Infectious disease, development, and climate change: a scenario analysis' (Richard Tol, Kristie Ebi, and Gary Yohe) and 'Economic incentives and mathematical models of disease' (Christopher A. Gilligan, Eili Klein, Ramanan Laxminarayan, and David L. Smith).

The June 2008 issue was a special issue on *Payment for Ecosystem Services*, guest edited by Erwin H. Bulte and David Zilberman. It included the following articles: 'Payments for ecosystem services and poverty reduction: concepts, issues and empirical perspectives' (Erwin H. Bulte, Leslie Lipper, Randy Stringer, and David Zilberman), 'When could payments for environmental services benefit the poor?'(David Zilberman, Leslie Lipper, and Nancy McCarthy), 'Payments for environmental

services and the poor: concepts and preliminary evidence' (Sven Wunder), 'Can the poor participate in payments for environmental services? Lessons from the Silvopastoral Project in Nicaragua' (Stefano Pagiola, Ana R. Rios, and Agustin Arcenas), 'Agricultural carbon sequestration, poverty and sustainability' (John M. Antle and Jetse J. Stoorvogel), 'Poverty, risk and the supply of soil carbon sequestration' (Joshua Graff-Zivin and Leslie Lipper), 'The role of deforestation risk and calibrated compensation in designing payments for environmental services' (Jennifer Alix-Garcia, Alain De Janvry, and Elisabeth Sadoulet), 'Elephants or onions? Paying for nature in Amboseli, Kenya' (Erwin H. Bulte, Randall B. Boone, Randy Stringer, and Philip K. Thornton), and 'Wildlife conservation payments to address habitat fragmentation and disease risks' (Richard D. Horan, Jason F. Shogren, and Benjamin M. Gramig).

Figure 6: Electronic Usage, January 2006 – May 2008 .



The February 2008 issue of the journal included an article by Paul R. Ehrlich, 'Key issues for attention from ecological economists', based on his keynote address to the EAERE 2007 conference, as well as comments by Aart de Zeeuw and Stephen Polasky. The article and the comments generated a great deal of interest as shown by the large number of electronic viewings.

Usage

Marketing figures supplied by Cambridge University Press showed a slight increase in total subscriptions for 2008, similar to the pattern shown by comparable journals. Electronic access to full text versions of journal articles increased in the first five months of 2008 by 10% over 2007 and 113% over 2006 (figure 6).

Reflections from the Chairman

by *Anastasios Xepapadeas*, Chairman of the Board of Directors

SINCE ITS BEGINNING as an institute of Ecological Economics in June 1991, the Beijer Institute has managed to carry out a remarkable, and very likely unique, list of achievements.

It has managed to accomplish the formidable task of bringing together top scientists from Biology/Ecology on the one hand, and Economics on the other. In doing so, the Beijer Institute has not only helped to develop a common interdisciplinary forum for communication, but has also created ideal cooperative conditions for the development of new, interesting and mostly interdisciplinary research in the field of ecological economics.

The Beijer Institute, in addition to creating conditions for the development of innovative and valuable research, has also been successful in capacity building programmes all over the developing world. Beijer's commitment to these programmes is helping to train scientists capable not only of original research, but also of addressing the pressing environmental problems that the developing world is facing.

In a world where some of the issues that Beijer has brought to the scientific agenda – such as nonlinearities, thresholds and regime shifts, spatiotemporal dynamics governing economic and ecological systems, inclusive wealth, complex adaptive systems in economy and ecology – are becoming increasingly more relevant for the understanding of socioeconomic systems and ecosystems in the real world, the work that Beijer carries out, initiates or inspires, acquires ever greater significance.

For me personally, it has been a great honour and a great pleasure to serve first as a member and then as chairman of the Beijer Institute Board of Directors. I am sure that the legacy of Karl-Göran Mäler's pioneering leadership, followed by the current inspired direction by Carl Folke and Aart de Zeeuw, the support of the current board of directors, and the continuous and high quality effort of the scientific and administrative staff of the Institute, will continue to provide the necessary impetus for the Beijer Institute to maintain its level of excellence and its path breaking role.

Tasos Xepapadeas
August, 2008

Appendix

Board of Directors

Board members of the Beijer Institute of Ecological Economics are appointed by the Royal Swedish Academy of Sciences for a three-year period, and should not be re-elected more than once, according to the standing instruction for the Beijer Institute approved by the Royal Swedish Academy of Sciences on June 5, 1991. The first Board of Directors for the new Institute was elected on June 5, 1991. The fifteenth annual board meeting was held at the Institute, September 7th, 2007.

Board of Directors 2007-2008

CHAIRMAN

Anastasios Xepapadeas

Professor, University of Athens, Greece

EX-OFFICIO MEMBERS:

Gunnar Öquist*

Professor, Permanent Secretary of the Royal Swedish Academy of Sciences

Carl Folke*

Director, the Beijer Institute, Sweden

Aart de Zeeuw

Co-Director, the Beijer Institute, Sweden

MEMBERS

Scott Barrett

Professor, John Hopkins University, USA

Stephen Carpenter*

Professor, University of Wisconsin, USA

Kanchan Chopra

Professor, Environmental Economics Unit, Institute of Economic Growth, New Delhi, India

Beijer Board 2007: Back row: Aart de Zeeuw, Marten Scheffer, Jeff Vincent, Steve Polasky and Gretchen Daily. Front row: Carl Folke, Scott Barrett, Tasos Xepapadeas, Terry Hughes and Steve Carpenter.

Gretchen Daily

Associate Professor, Department of Biological Sciences, Stanford University, USA

Terry Hughes

Professor, James Cook University in Queensland, Australia

Stephen Polasky

Professor, University of Minnesota, USA

Marten Scheffer

Professor, Wageningen University, the Netherlands

Jeffrey Vincent

Professor, Duke University, USA

Photo: Board 2007

Staff members

Carl Folke, Professor, Director

Aart de Zeeuw, Professor, Co-Director

Sara Aniyar, Professor emerita (Economist), Universidad de Zulia, Venezuela

Johan Colding, PhD (Ecologist), Researcher

Anne-Sophie Crépin, PhD (Economist), Researcher

Åsa Jansson, PhD (Ecologist), Researcher

Christina Leijonhufvud, BA, Office manager

Therese Lindahl, PhD (Economist), Researcher

Karl-Göran Mäler, Professor emeritus, former Director, Researcher

Marmar Nekoro, MSc (Biologist), Administrator

Ingela Ternström, PhD, Researcher

Max Troell, Associated Professor, Researcher

Anna Sundbaum, MSc, Office manager and Financial controller

Visiting scientists and graduate students

Stuart (Terry) Chapin, Professor, Department of Biology and Wildlife, Institute of Arctic Biology, University of Alaska, January and April 2008

Joshua Cinner, Phd, James Cook University, May 2008

Sheila Walsh, PhD Student, Center for Marine Biodiversity and Conservation, Scripps Institution of Oceanography, University of California-San Diego, September 2007

Li Chuang Zhong, Professor, Department of Economics, Uppsala University, from April 2008

Several of our Beijer Fellows visited the Institute in connection with The Resilience Conference in April 2008.

Administration

Office location

The 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 include some of the inlets of the Baltic Sea. Ekoparken is declared as a "national city park" by the Swedish parliament. The Institute's visiting address is Lilla Frescativägen 4, Stockholm.

Organization

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 routines are designed independently by the Institute.

Christina Leijonhufvud

Christina Leijonhufvud is Office Manager. During 2007 /2008 she has been responsible for the administration of the Board and Askö meetings in September 2007. The greater part of the year she has worked with coordinating and managing the conference "Resilience 2008 – Resilience, Adaptation and Transformation in Turbulent Times" which took place in Stockholm April 14-17, 2008.

Anna Sundbaum

Anna Sundbaum is communication officer and responsible for the Beijer Publication Series; Beijer Reprint Series, Beijer Discussion Series, Beijer Occasional Series and editor for the annual report as well as web master. She is also involved in

* member of the Royal Swedish Academy of Sciences

the communication group at the Stockholm Resilience Centre. Since 2007 she is also responsible for the budgetary and accounting issues for the Institute. During 2007/2008 Anna has been involved in organizing the Askö meeting and the international conference "Resilience 2008 – Resilience, Adaptation and Transformation in Turbulent Times". She has also developed a new website for the Institute that was launched in September 2007. Anna holds a MSc in Biology with focus on corporate social responsibility.

Pontus Englund has worked part time with administrative matters.

Funding

Core funding of the Institute has been provided by the Kjell and Märta Beijer Foundation. Funding for the Institute's activities between 1 July 2007 – 30 June 2008 has also been provided by:

- The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS)
- Foundation for Strategic Environmental Research (MISTRA)
- The Swedish Environmental Protection Agency
- The Swedish International Development Cooperation Agency (Sida)
- The European Commission
- The Christensen Fund
- Östersjöstiftelsen, The Foundation for Baltic and East European Studies

A summary of Beijer activities

Collaborative Networks and Research Programmes

In order to stimulate transdisciplinary work the Institute initiates, takes part in and organizes international research collaborations, run as networks, involving up to 50 scholars in ecology, economics and related disciplines. Graduate students also participate in the research. Each collaborative network consists of a number of different, but related, research projects. These projects are carried out by teams consisting of ecologists as well as economists and researchers from other disciplines. Participants of the collaborative networks are generally invited to workshops at the Institute to report on the progress being made and to discuss the results. Sometimes these networks are organized into research programmes that run for a couple of years. The new *BENN* network and the *Formas Centre of Excellence* described elsewhere in the Annual Report are examples of such programmes and new programmes are in the pipeline. Scholars of networks and research programmes spend working periods at the Institute. The collaborative networks are briefly presented in this section.

Autralian Research Council, Centre of Excellence for Coral Reef Studies

The Beijer Institute serves as a partner investigator of program five of the ARC centre – resilience of linked social-ecological systems (www.coralcoe.org.au). The objective of the program is to provide new solutions to managing resilience and coping with change, uncertainty, risk, and surprise in complex social-ecological systems. The 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 program of innovative multi-disciplinary research which will combine expertise on coral reef biology, management, governance, economics and social sciences.

The collaboration and workshops have generated new insights on the management and governance of coral reefs and coastal areas and has influenced policy. Publications over the years of collaboration include three papers in Science, two in TREE, and in Nature, PNAS, Ecology and Society and Ambio and currently with papers in preparation and review for Science and Frontiers in Ecology and the Environment. A small workshop on spatial dynamics and coral reef resilience was held at Beijer September 5-6, 2007, with Terry Hughes, Marten Scheffer, Steve Carpenter, Egbert van Nes, Magnus Nyström, Carl Folke, Albert Norström, and Jerker Lokrantz. The productive collaboration is further presented in this Annual Report by Terry Hughes.

Inclusive Wealth and Accounting Prices (IWAP)

In this research programme, we attempt to test whether it would be possible to estimate accounting prices for ecological systems. The methods

Participants in IWAP-workshop. Back row. Bob Scholes, Max Troell, Jean-Louis Weber, Brian Walker, Kerry Smith. Front row: Henrik Scharin, Sara Aniyar, Rashid Hassan, Glenn-Marie Lange, Steve Polasky, Ed Barbier.

developed for estimating the accounting prices can be applied to large scale systems, in order to assess the sustainability of the joint economic – ecological systems. An international workshop was organized by Karl-Göran Mäler, Åsa Jansson and Sara Aniyar at the Academy, September 3-6, 2007, jointly by Beijer and the Stockholm Resilience Centre on "Accounting for Ecosystem Services" with economists and ecologists and Beijer Fellows and collaborators like Edward Barbier, Rashid Hassan, Michael Hoel, Glenn-Marie Lange, Steve Polasky, Bob Scholes, Kerry Smith, Jeff Vincent, Brian Walker and Tasos Xepapadeas. The theory of inclusive wealth and accounting prices has to a large extent been developed at the Beijer Institute. A book on accounting for ecosystems has been developed during the year and there are articles in preparation and in press, for example as part of a special feature of PNAS on ecosystem services, edited by Beijer Fellow Gretchen Daily and Pamela Matson, Stanford. The programme was reviewed in more detail in last years Annual Report.

The Resilience Alliance

A central network of collaboration is the Resilience Alliance (RA), an international consortium of leading research groups and organizations who collaborate to explore the dynamics of social-ecological systems and seek novel ways to integrate science and policy in order to discover foundations to sustainability (www.resalliance.org). The RA and the focus on social-ecological systems emerged out of research programmes of the Beijer Institute in the 1990's and the Beijer Institute is an active member of the alliance. The new Executive Committee is chaired by Carl Folke, with Beijer Fellows Terry Chapin, Steve Carpenter and Terry Hughes serving on the committee. As reported earlier in the Annual Report the Beijer Institute with the Stockholm Resilience Centre were the local organizers of the first major Resilience Alliance conference held in April in Stockholm. The journal Ecology and Society is owned by the Resilience Alliance with the Beijer Director as one of the editors in chief.

The Surprise Project

The Surprise Project is a collaborative project of the Resilience Alliance with Beijer Fellows Buz Brock, Steve Carpenter, Marten Scheffer, Frances Westley and Carl Folke. This small project has three main questions (1) What do we know about the probability distributions of big important changes in social-ecological systems? (2) What are the characteristics of unpredictable changes in social-ecological systems? (3) How can diverse forms of knowledge be integrated to ask the questions that evoke resilience thinking? To address these questions, we are evaluating case studies, analyzing models of extreme nonlinear and stochastic events, and exploring new approaches for integrating knowledge. Knowledge integration methods include quantitative and qualitative techniques, as well as approaches for education and training that help people combine knowledge from multiple diverse sources to ask new and different kinds of questions. There have been three meetings so far and two articles are in review.

Baltic STERN

During the year the Beijer Institute has served as the main host organization for the start-up phase of the Baltic Systems Tool for Ecologic-Economic evaluation: a Refined Nest-model. The programme is a Stern-like review for the Baltic Sea region. This start-up phase was funded by the organization Baltic Sea 2020. The program will aim at developing useful scientific knowledge and tools for integrated assessment and include participants from all Baltic Sea countries, drawing on previous work of the decision support system – Baltic Nest (www.nest.su.se). Baltic Nest was set up to provide data and information from the entire Baltic drainage basin and the entire Baltic Sea. It links measures on land with effects to the sea and has been developed mainly to provide basis for decision-making at international negotiations. The Baltic Stern program plan developed during the year consists of six core activities: 1) development of the eutrophica-

tion component in Baltic Nest, 2) development of a fish/fisheries component in Baltic Nest, 3) incentive structures for individuals and firms, 4) benefits of an improved quality of the Baltic Sea, 5) overall systems analysis and 6) program management and communication.

Initiated by Karl-Göran Mäler and Fredrik Wulff, it is a collaborative program of the Beijer Institute, Baltic Nest and Stockholm Resilience Centre and Dept. Systems Ecology, Stockholm University, coordinated by Tore Söderqvist and with Tomasz Zylicz (Warsaw University) as proposed program director.

A first workshop was held in Stockholm on 19-20 September 2007. The purpose of this general workshop was to gather people that was identified either as potentially suitable participants in the planned research program or could help identifying such participants. All Baltic Sea countries were represented at the workshop. A second workshop was held in Stockholm on 22-23 November 2007, focusing on topic 2) and a third workshop was held in Stockholm 17-18 January 2008, focusing on issues related to 3) and 4). Cooperation has been established with the Swedish Environmental Protection Agency, which is responsible for the project *Economic Marine Information*, funded by the Swedish government. The full project proposal is now assessed by various funding organization.

Other Research Projects

Besides the projects that constitute the Institute's research programmes, the Institute's staff is involved in a number of other research projects. A selection of initiated, ongoing and terminated projects during 2007/2008 is listed below.

Integrated culture of abalone and seaweed in landbased systems (Financed by SIDA)

The overall objective of the core research is to develop and test the bioengineering concept of an integrated land-based abalone and seaweed culture unit.

Link: http://www.beijer.kva.se/max/absea

The implementation of re-circulation systems in abalone farming, and the benefits of seaweeds and seaweed-based products in the diet of South African abalone (Financed by SIDA)

Objectives of the project are to implement three methods of re-circulating systems at a working abalone farm and then attempt to optimize the functioning for ecological/economic performance.

Governing Social-Ecological Transformation: Adapting to the Challenge of Global Environmental Change.

This book addresses the factors and features of society's abilities to adapt its institutions to governance of ecosystem management and explores institutional changes that are taking place as a response to increasing global environmental pressures at local, national, and international levels and the structural barriers and the opportunities for change through innovation and transformations, where they are occurring or not, and why. A number of case studies cut across important social and political issues in key problems areas, including terrestrial, coastal and marine, climate, food production, and urban settings. Emily Boyd and Carl Folke are editing the book for Cambridge University Press.

Consumption of fish resources in aquaculture production: implications for supplies of low cost nutritious food for poor consumer groups and its overall socio-economic impact

The general objective is to investigate how the aquaculture sector need for fish resources affects fish protein availability for poor people. Study area is Andhra Pradesh, India. A Sida/Sarec financed project. Dr. Max Troell, Prof. Erri D. Babu, Dr. Tore Söderqvist.

Peri-Urban Mangrove Forests as Filters and Potential Phytoremediators of Domestic Sewage in East Africa (PUMPSEA)

This EU project evaluates four different management options for mangroves and sewage treatment: i) natural mangroves; (ii) deforested areas; (iii) mangroves exposed to sewage; and (iv) a constructed test mangrove wetland used for sewage remediation.

Link: http://www.pumpsea.icat.fc.ul.pt/main.php

Sharing natural resources with complex dynamics – strategic interaction across temporal and spatial scales with policy implications

Natural resource degradation is traditionally imputed to ill-defined property rights. Many natural resources are the common property of several users. While some users cooperate in order to secure future consumption possibilities for the whole group, others rather foster own personal short-

term gains at the expense of their rivals. The tension between the individual and the group is often referred to as the tragedy of the commons and is typically associated with over-exploitation.

Many policy instruments are designed to overcome such resource degradation but most instrument design presumes resource bases with relatively simple dynamics. In contrast, recent research shows many examples of resources with complex dynamics involving ecological feedbacks, multiple species interactions, multiple stable states and so-called threshold effects. For example, above some critical level of grazing pressure, healthy grasslands may suddenly become degraded. Similarly due to overloads of nutrients a lake with clear water and preferred fish species can undergo a regime shift to an alternate state associated with turbid water, oxygen deficiency and less preferred fish species. The complexity of ecosystem dynamics has thus huge management implications as even marginal changes can cause radical ecosystem transformations. Hence resource degradation could also be imputed to such threshold effects.

To fully understand the over-exploitation problem and properly design policy instruments that overcome them, we believe one must combine relevant ecological characteristics with relevant institutional structure. We do so to answer the following specific questions; how can institutions respond to a complex environment, involving discontinuities, thresholds and uncertainty? Within such institutions, how do people interact strategically in the presence of complex dynamics and uncertainty? How can we improve management of complex ecosystems and to what extent is there a need to revise economic policies?

Some preliminary results; Grasslands used for domestic livestock host complex ecosystem dynamics. They are often the common property of several owners. By accounting for complex dynamics within this setting, we challenge conventional results from the common pool literature. Although we do identify situations where the standard result holds – a tragedy of the commons unless farmers cooperate – we also find examples where a tragedy is exacerbated due to ecosystem dynamics as well as cases where a non-cooperative regime under-exploit the grassland compared to the first best outcome. We show that the outcome depends not only on grassland characteristics and institutional structure but also on other economic factors, planning period, and history.

Efficient Use of Local Natural Resources – Individual Actions and Cooperation in a Changing World (supported by FORMAS).

The objective of this project is to improve the understanding of how different factors affect cooperation among the users of common-pool resources. The focus is on cooperation and on what controls the individuals' actions. The project combines theoretical analysis and empirical analysis of data collected in farmer managed irrigation systems in Nepal. It has resulted in several interesting insights, such as the high importance of leaders, the effect of wealth on cooperation and the way disturbances are dealt with in practice.

The next step is to analyze new information about various aspects of leadership and leaders in the irrigation systems previously examined, and to analyze data collected in poorly functioning irrigation systems. Project leader: Ingela Ternström.

Leadership and Common-Pool Resource Management

Although empirical evidence shows that leadership is crucial to successful management of common-pool resources, leadership is given relatively little room in the theoretical literature on common-pool resource management. Economic theory tends to focus on ownership or control over resources as the source of power, but in common pool resources we are looking at informal cooperation between individuals who are co-owners or co-users of common resources. This project aims at providing a theoretical explanation for why there are leaders in such groups and how these leaders are appointed. Project leader: Ingela Ternström.

HIV/AIDS – The True Tragedy of the Commons? The effects of HIV/AIDS on management and use of local natural resources (funded by Sida).

This project is described previously in the Annual Report

Teaching and training

The Institute serves as a catalyst between university departments and institutions working with ecological economic issues, and PhD students are involved in both research programmes and projects. The Institute organizes training workshops and international research seminars on environment and development, and international training programmes.

PhD Course: the Economics of the Environment

During the spring of 2008 the Beijer Institute organised a PhD level course for students at the Stockholm Doctoral Course Program in Economics, Econometrics and Finance (SDPE). The course was attended by eight PhD students from the Stockholm School of Economics, Stockholm University and the Royal Institute of Technology.

The aim of the course was to highlight some of the most prominent problems typically associated with natural resource management, while being problem-oriented in its approach by illustrating the different topics by applying them to the problems associated with climate change.

The course was organised by Anne-Sophie Crépin, Therese Lindahl and Ingela Ternström at the Beijer Institute. Lecturers were Carl Folke, Aart de Zeeuw, Anne-Sophie Crépin, Therese Lindahl and Ingela Ternström at the Beijer Institute, Rob Hart from the Swedish University of Agricultural Sciences (SLU) and Tore Söderqvist from Enveco.

PhD programme in Environmental Economics

The Beijer Institute and the Environmental Economics Unit at University of Gothenburg established a PhD programme in environmental economics in 1997. The purpose of the programme is to strengthen the capacity in developing countries and in particular the capacity to teach environmental economics at the university level. The programme is supported by SAREC. The PhD programme is described in more detail previously in the Annual Report.

The Stockholm Seminars: Frontiers in Sustainability Science and Policy

This seminar series started in August 2000. It is a series cosponsored by the Beijer Institute, Centre for Transdisciplinary Environmental Research (CTM) at Stockholm University, the International Geosphere-Biosphere Programme (IGBP) at the Royal Swedish Academy of Sciences, the Swedish Biodiversity Centre at the Swedish University of Agricultural Sciences and Uppsala University, (CBM) the Stockholm Environment Institute (SEI), Stockholm International Water Institute (SIWI) and the International Foundation for Science (IFS). The series present lectures from a wide variety of perspectives on sustainability and is focused on the need for a sound scientific basis for sustainable development policy. The series is arranged to make use of the knowledge of visiting researchers and to increase the interactions in the scientific community and between the scientific community and the rest of the society. In the series, the latest research will continuously be presented. The series is primarily for researchers, students, policymakers and media.

During 2007/2008 the following seminars were held at the Royal Swedish Academy of Sciences:

2007

21/8 Mr. Jon Day
"Moving towards ecosystem-based management – the role of science, public participation and political support in rezoning Australia's Great Barrier Reef"

4/9 Prof. Marten Scheffer
"Thresholds for catastrophic shifts in nature and society"

6/9 Prof. Terry Hughes
"Gilded traps, phase-shifts and fisheries"

14/9 Prof. Carole L. Crumley
"Historical Ecology: Integrated Thinking at Multiple Temporal and Spatial Scales"

26/9 Prof. Steve Lansing
"The Neutral Theory Comes to Anthropology"

26/9 Prof. Bo Rothstein
"The Dynamics of Social Trust"

24/10 Ms. Janet Ranganathan,
Mr. Anantha Kumar Duraiappah
"Getting Millennium Assessment into Policy"

30/10 Prof. Will Steffen
"Surviving the Anthropocene: The Great Challenges of the 21st Century"

16/11 Prof. Arild Vatn
"Explaining cooperative behaviour"

2008

17/1 Prof. Douglas Webster
"Urban Land Use Efficiency in China: Implications for Sustainability"

28/1 Prof. Dr. Susanne Stoll-Kleemann
"Success Factors of Protected Area Management and Governance"

21/2 Dr. Chris Reij

"Linking adaptation to climate change, poverty reduction and sustainable development: some lessons from the poorest country in the world (Niger)"

22/2 Dr. Nick Winder

"Life after Linnaeus: Systematics and System Dynamics in a Complex World"

29/5 Dr. Ilan Chabay

"If the Answer is Sustainable Practices, what are the Questions about Public Learning, Understanding, and Use of Science?"

The Askö Meeting

Since 1993 the Beijer Institute has organized 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. Each meeting has resulted in a consensus document. The theme for the 15th Askö Meeting (8-10th of September 2007) was "Implications of a complex adaptive systems approach for economics and ecology in relation to policy."

The marine field station on the island of Askö, where the annual Askö meetings are held.

PHOTO: LEIF W. LINDGREN

Staff members' publications and activities

Staff members' research activities are presented at, for example, conferences, workshops and seminars. To stimulate interaction between the staff members regular internal presentations take place at the Institute. Below is a selection of the staff members' publications and activities during 2007/2008.

Sara Aniyar

Researcher (Economics)
Titular professor at the University of Zulia, Maracaibo, Venezuela

Research focus:

Economic Analysis of Ecosystems
Accounting of Ecosystem Services
Green Accounting
Sustainable Development

At Beijer since: Fall 1998

Since January 2004 member of the research team responsible for the study: "Accounting Prices of the Stockholm County's Inclusive Wealth"

Since January 2008 working on accounting for marine ecosystem services in Zanzibar, Tanzania

Publications:

Published:

Mäler, K-G., Aniyar, S. and Å. Jansson (2008) *Accounting for ecosystem services as a way to understand the requirements for sustainable development*, PNAS Vol. 105 No. 28 pp 9502-9506

Accepted for publication:

Mäler, K-G., Aniyar, S. and Å. Jansson (2008) *Accounting for Ecosystems*, Journal of Environmental and Resource Economics

In process of being submitted:

Human Capital: accounting price and estimates in the Stockholm County. Co-authored with Karl-Göran Mäler

Accounting price of the Stockholm County's Manufactured Capital. Co-authored with Karl-Göran Mäler

Capital Gains, non-autonomous resource allocation mechanisms and inclusive wealth with applications to Venezuela. Co-Authored with Karl-Göran Mäler. Discussion paper, Beijer Institute

Seminars and symposium presentations:

- ALEAR, Chile, 2007
- EAERE, Gothenburg, 2008
- ISEE, Nairobi, 2008

Commissions and other activities:

- Member of the Advisory Committee of LACEEP (the Latin American and Caribbean Environmental Economics Program for research promotion and training)
- Participation in the V LACEEP meeting of the advisory committee, October 2007, in Talca, Chile
- Participation in the VI meeting of the advisory committee, Mars 2008 San José, Costa Rica

Johan Colding

Researcher, PhD (Ecology)

Research focus:

Institutions and biological conservation; Social-ecological system analyses, Urban ecology

At Beijer since: 1995

Publications:

Jansson, Å. and Colding. J. 2007. *Tradeoffs between environmental goals and urban development: The case of nitrogen load from the Stockholm County to the Baltic Sea*. AMBIO Vol. 36(5). 2007.

Folke, C., L. Pritchard, F. Berkes, J. Colding, and U. Svedin. 2007. *The problem of fit between ecosystems and institutions: ten years later*. Ecology and Society 12(1): 30. [online] URL: http://www.ecologyandsociety.org/vol12/iss1/art30/

Folke, C., Colding, J., Olsson, P. and Hahn.,T. 2007. *Interdependent Social-Ecological Systems and Adaptive Governance for Ecosystem Services*. Chapter 37 in Sage Handbook on Environment and Society, Edited by Jules Pretty, Andy Ball, Ted Benton, Julia Guivant, David Lee, David Orr, Max Pfeffer and Hugh Ward, forthcoming.

Elmqvist, T., Alfsen, C., Colding, J. 2007. *Urban systems*. In: Jorgensen, S.E. (Ed.), Encyclopedia of Ecology. Elsevier, Oxford (G.B.). In press.

Colding, J. *Creating incentives for increased public engagement in ecosystem management through urban commons*. Chapter 13 in Adapting institutions: meeting the challenge of global environmental change. Boyd, E. and Folke, C. (Eds). Cambridge University Press. In press.

Colding, J., Lundberg, J. Lundberg, S. and Andersson, E. *Golf courses and wetland fauna support*. Ecological Applications, in review.

Colding, J. and Folke, C. *The role of golf courses in biodiversity conservation and ecosystem management*. ECOSYSTEMS, in review.

Barthel, S., Folke, C. and Colding, J. *Social-ecological memory for management of ecosystem servcies*. Manuscript for Human Ecology.

Commissions:

- Received the award of Stiftelsen Kung Carl XVI Gustafs 50-årsfond for his PhD-thesis in 2002 for studies of linked social-ecological systems.
- Served as a research coordinator for The Millennium Ecosystem Sub-Global Assessment.
- Member of the Resilience Alliance.
- Serves in the editorial board for Ecology and Society and ECOSYSTEMS.
- Theme leader for the urban theme, Stockholm Resilience Centre.

Anne-Sophie Crépin

Researcher, Phd (Economics)

Research focus:

Resource economics with focus on resources with complex dynamics due to diversity, species richness, the interplay of fast and slow variables, threshold effects or spatial dynamics. Common property resources.

At Beijer since: 1998

Publications:

Crépin & Lindahl, *Grazing Games*, accepted with minor revisions in Environmental and Resource Economics.

Seminars and symposium presentations:

Crépin, Norberg & Mäler, "Management of complex human-nature systems: the role of biodiversity". EAERE 2008 in Gothenburg.

Other:

- Maternity leave July 2007- March 2008.
- Council member of the European Association of Environmental and Resource Economists
- Organizer (together with Therese Lindahl and Ingela Ternström) of the PhD course *The Economics of the Environment*, The Stockholm Doctoral Course Program in Economics, Econometrics and Finance (SDPE), spring 2008.
- Lecturer at the PhD course *The Economics of the Environment*, The Stockholm Doctoral Course Program in Economics, Econometrics and Finance (SDPE), spring 2008.
- Consultative work for the CGIAR/Sida.
- Referee work for Journal of Environmental Economics and Management.

Aart de Zeeuw

Co-Director, the Beijer Institute

Research focus:

Environmental economics, more specifically economics of ecological systems and international environmental agreements

At Beijer since: February 1, 2007

Publications:

Key issues for attention from ecological economists: A comment, Environment and Development Economics, 13(1), 21-24

Social cost benefit analysis for environmental policy making, Report, Dutch Ministry of Housing, Spatial Planning and the Environment (with D. van Soest and J. de Jong)

Dynamic effects on the stability of international environmental agreements, Journal of Environmental Economics and Management 55(2), 163-174

Feedback Nash equilibria for non-linear differential games in pollution control, forthcoming in the Journal of Economic Dynamics and Control 32(4), 1312-1331 (with G. Kossioris, M. Plexousakis, A. Xepapadeas and K.-G Mäler)

Seminars and symposium presentations:

- Seminar, NBER Harvard/MIT, Cambridge, USA, July 23, 2007
- Presentation, Workshop, *Sustaining ecological-economic norms for a sustainable environment*, Stockholm, September 5-7, 2007
- Seminar, Ministry of Housing, *Spatial Planning and Environment*, den Haag, the Netherlands, September 13, 2007
- Seminar, SLU, Uppsala, October 3, 2007
- Seminar, Netherlands Environmental Assessment Agency, Bilthoven, the Netherlands, October 23, 2007
- Presentation, Workshop, *Understanding social and economic benefits in coral reef systems*, Cairns, Australia, December 3-7, 2007
- Seminar, Rotary, Tilburg, the Netherlands, December 17, 2007
- Presentation, Workshop, *Social cost benefit analysis for environmental policy making*, den Haag, the Netherlands, January 17, 2008
- Seminar, Algemene Rekenkamer, den Haag, the Netherlands, January 24, 2008
- Seminar, Stockholm School of Economics, February 8, 2008
- Presentation, Workshop, *Dynamic Games in Management Science*, Montreal, Canada, May 2-3, 2008
- Seminar, Concordia University, Montreal, Canada, May 7, 2008
- Presentation, Workshop, *Natural Resources and Environmental Economics*, Montreal, Canada, May 9, 2008

- Presentation, Conference, *European Association of Environmental and Resource Economists*, Göteborg, June 26-28, 2008

Commissions:

- Co-editor Journal of Environmental Economics and Management
- Editorial Board, Environmental & Resource Economics
- Editorial Board, Resource and Energy Economics
- Editorial Board, Environment and Development Economics
- Advisory committee to the Stockholm Resilience Centre
- Advisory council to the Dutch government for research on spatial planning, nature and the environment (RMNO)
- Adviser to the Netherlands Environmental Assessment Agency

Other:

A father

Carl Folke

Director, the Beijer Institute

Research focus:

Integrated social-ecological systems, ecosystem services, dynamics and management, resilience, adaptive governance

At Beijer since: Director from 2007, Deputy Director 1991-1996, associated with the Beijer Institute since it started in 1991.

Publications:

Chapin, F.S, III, G.P. Kofinas and C. Folke (eds.). *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World*. Springer Verlag, New York. In press.

Chapin, F.S. III, K. Danell, T. Elmqvist, C. Folke, and N. Fresco. 2007. *Managing Climate Change Impacts to Enhance the Resilience and Sustainability of Fennoscandinan Forests*. Ambio 36:528-533.

Chapin, F.S., III, G.P. Kofinas, C. Folke, S.R. Carpenter, P. Olsson, N. Abel, R. Biggs, R.L. Naylor, E. Pinkerton, D.M. Stafford Smith, W. Steffen, B. Walker and O.R. Young. *Resilience-Based Stewardship: Strategies for Navigating Sustainable Pathways in a Changing World*. In: Chapin, F.S, III, G.P. Kofinas and C. Folke (eds.). Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World. Springer Verlag, New York.

Chapin, F.S., III., C. Folke and G. Kofinas. *A Framework for Understanding Change*. In: Chapin, F.S, III, G.P. Kofinas and C. Folke (eds.). Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World. Springer Verlag, New York.

Deutsch, L., M. Falkenmark, L.J. Gordon, J. Rockström and C. Folke. 2008. *Water-Mediated Ecological Consequences of Intensive Livestock Production*. In: Steinfeld, H., H. Mooney, and F. Schneider (eds.). Livestock in a Changing Landscape: Drivers, Consequences and Responses. Eds. Livestock, Environment and Development Initiative – LEAD at FAO, SCOPE program on Consequences of Industrialized Animal Production Systems, and the Swiss College of Agriculture.

Folke, C. and J. Rockström. 2008. *Turbulent Times*. Global Environmental Change. Online publication July 2008

Folke, C., F.S. Chapin, III and P. Olsson. *Transformations in Ecosystem Stewardship*. In: Chapin, F.S, III, G.P. Kofinas and C. Folke (eds.). Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World. Springer Verlag, New York.

Folke, C., J. Colding, P. Olsson and T. Hahn. 2007. *Integrated Social-Ecological Systems and Adaptive Governance of Ecosystem Services*. In: Pretty, J., A. Ball, T. Benton, J. Guivant, D. Lee, D. Orr, M. Pfeffer and H. Ward (eds). Sage Handbook on Environment and Society, Chapter 37: 536-552. Sage Publications, London.

Galaz, V., T. Hahn, P. Olsson, C. Folke and U. Svedin. 2008. *The Problem of Fit among Biophysical Systems, Environmental Regimes and Broader Governance Systems: Insights and Emerging Challenges*. In: Young, O., L.A. King and H. Schroeder (eds). Institutions and Environmental Change: Principal Findings, Applications, and Research Frontiers. MIT Press, Cambridge, Boston.

Gunderson, L., and C. Folke. 2008. *The Buzz*. Ecology and Society 13(1):42. [online] URL: http://www.ecologyandsociety.org/vol13/iss1/art42/.

Gunderson, L., C. Folke, and M. A. Janssen. 2007. *Reflective practice*. Ecology and Society 12(2): 40. [online] URL: http://www.ecologyandsociety.org/vol12/iss2/art40/

Hahn, T., L. Schultz, C. Folke and P. Olsson. 2008. *Social Networks as Sources of Resilience in Social-Ecological Systems*. In: Norberg, J. and G. Cumming (eds.). Complexity Theory for a Sustainable Future, Columbia University Press, New York.

Hughes T.P., L. Gunderson, C. Folke, A. Baird, D. Bellwood, F. Berkes, B. Crona, A. Helfgott, H. Leslie, J. Norberg, M. Nystrom, P. Olsson, H. Österbloom, M. Scheffer, H. Schuttenberg, R.S. Steneck, M. Tengö, M. Troell, B. Walker, J. Wilson, and B. Worm. 2007. *Adaptive management of the Great Barrier Reef and the Grand Canyon World Heritage Areas*. Ambio 36:586-592.

Liu, J., T. Dietz, S.R. Carpenter, C. Folke, M. Alberti, C.L. Redman, S.H. Schneider, E. Ostrom, A.N. Pell, J. Lubchenco, W.W. Taylor, Z. Ouyang, P. Deadman, T. Kratz and W. Provencher. *Coupled Human and Natural Systems*. Ambio 36:639-649.

Liu, J., T. Dietz, S.R. Carpenter, M. Alberti, C. Folke, E. Moran, A.C. Pell, P. Deadman, T. Kratz, J. Lubchenco, E. Ostrom, Z. Ouyang, W. Provencher, C.L. Redman, S.H. Schneider, W.W. Taylor. 2007. *Complexity of Coupled Human and Natural Systems*. Science 317:1513-1516.

McCook L.J., P. Marshall, C. Folke, T. Hughes, M. Nyström, D. Obura and R. Salm. 2007. *Ecological Resilience, Climate change and the Great Barrier Reef*. In: Vulnerability of the Great Barrier Reef to Climate Change. The Great Barrier Reef Marine Park Authority (GBRMPA) and the Australian Greenhouse Office.

Olsson, P., C. Folke and T.P. Hughes. 2008. *Navigating the Transition to Ecosystem-Based Management of the Great Barrier Reef, Australia*. Proceedings National Academy of Sciences, USA 105:9489-9494.

Österblom, H., S. Hansson, U. Larsson, O. Hjerne, F. Wulff, R. Elmgren and C. Folke. 2007. *Human-induced Trophic Cascades and Ecological Regime Shifts in the Baltic Sea*. Ecosystems 10:877-889.

Selected seminars and symposium presentations:

- Chair of the organizing committee of the Resilience 2008 conference; *Resilience, Adaptation and Transformation in Turbulent Times*, April 14-17. Chairman of the Jury for *Changing Matters: The Resilience Art Exhibition*, April 11- September 7. Participating in meetings in Uruguay with SARAS and the Surprise Group, and in Chile with the Marine Resilience Group.
- Several invited presentations and plenary talks during the year including at a Stern-report seminar with the Academy, the conference *Adaptive Integrated Water Management*, CAIWA, a *Colloquium on Vulnerability and Resilience*, the Resilience 2008 conference, UNESCO General conference side event on Biosphere Resilience, UNEP Millennium Ecosystem Assessment follow up meeting with the Swedish Ministry of the Environment, Global boundaries and tipping points workshop, Tällberg, a science and arts dialogue at the Royal Academy of Fine Arts, talks for leadership of Sida and Swedish EPA, the Swedish Government's Globalisation Council, the Minister for the Environment and Beijer presentations for the Academy including the Royal families of Luxembourg and Sweden.
- Given lectures at undergraduate and master level courses at Stockholm University and a Swedish Institute course for East European scientists.

Commissions:

- Science Director, Stockholm Resilience Centre: Research for Governance of Social-Ecological Systems, Stockholm University
- Editor-in-Chief, Ecology & Society www.ecologyandsociety.org
- Advisory and editorial boards of 15 journals including: Ambio, Conservation Biology, Ecological Economics, Environment, Environmental Conservation, Environment and Development Economics, Frontiers in Ecology and the Environment, Global Environmental Change, Letters in Spatial and Resource Sciences, Sustanability Science
- Founding member, Chair of the Executive Committee of the Resilience Alliance

- Member of the Royal Swedish Academy of Sciences since 2002
- Member of the Environmental Research Committee of the Royal Swedish Academy of Sciences since 2003
- Board member, Stockholm Environment Institute, since 2004
- Scientific Advisory Board, SARAS (South American Institute for Resilience and Sustainability Studies), Montevideo, Uruguay, since 2007
- Steering Committee, ESRC Centre for Climate Change Economics and Policy at London School of Economics and University of Leeds, UK, since 2008
- Partner investigator, The ARC Centre of Excellence for Coral Reef Studies, JCU, Australia, since 2005
- Project leader, Centre of Excellence (FormelExc), a grant out of five from the Swedish Research Council, Formas, for a five year period that started 2006.
- Supervisor of four PhD-students in Natural Resource Management, Dept. Systems Ecology, Stockholm University (Stephan Barthel, Jacob von Heland, Cibele Quieroz, Lisen Schultz)

Åsa Jansson

Researcher, PhD (Ecology)

Research focus:

Quantification of ecosystem services in a spatial landscape context

At Beijer since: 2004

Publications:

Mäler, K-G, Aniyar, S. and Jansson, Å. 2008. *Accounting for ecosystem services as a way to understand the requirements for sustainable development.* PNAS, vol 105 no 28 9501-9506

Jansson, Å and Colding, J. 2008. *Tradeoffs between environmental goals and urban development: The case of nitrogen load from the Stockholm County to the Baltic Sea*. Ambio.

Accepted for publication:

Mäler, K-G., Aniyar, S. and Å. Jansson (2008) *Accounting for Ecosystems*. Journal of Developmental and Resource Economics

Therese Lindahl

Researcher, Phd (Economic)

Research focus:

My research focus is broadly on environmental and resource economics, but more specifically on social dynamics in natural resource dilemmas. I am especially interested in improving the understanding of the interplay of knowledge, learning and norms. I am also addressing the implications of complex ecosystem dynamics for individual decision-making and for management in natural resource dilemmas.

At Beijer since: July 2005
July 2007- February 2008 on maternity leave (100%), March 2008 – May 2008 on maternity leave (60%)

Publications:

Lindahl, T and Johannesson M, *Bargaining over a Common Resource with Private Information*, resubmitted, Scandinavian Journal of Economics.

Lindahl, T., *Ignorant Exploitation of a Common Resource*, under revision, Journal of Environmental Economics and Management.

Crépin, A-S. and Lindahl T., *Grazing Games*, accepted after minor revisions, Environmental and Resource Economics.

Commission:

- Member of the Scientific Advisory Council of FORES (Forum for Reforms, Entrepreneurship and Sustainability), Stockholm, Sweden.

Other:

- Organizer (together with Anne-Sophie Crépin and Ingela Ternström) of the PhD course *The Economics of the Environment*, The Stockholm Doctoral Course Program in Economics, Econometrics and Finance (SDPE), spring 2008.
- Lecturer at the PhD course *The Economics of the Environment*, The Stockholm Doctoral Course Program in Economics, Econometrics and Finance (SDPE), spring 2008.
- Lecturer at the PhD course, *Ecology and Economic Management*, spring 2008.

Karl-Göran Mäler

Researcher, former Director

Rearch focus:

Resource and environmental economics.

Option values and irreversible environmental changes.
Cost benefit analysis of the environment and in particular to acid rains.
Environment and development.
International environmental problems.

At Beijer since: 1991

Selected Publications

Mäler, K.G., C.-Z. Li, and G. Destouni (2007) *Pricing resilience in a dynamic economy-environment system: a capital theorethical approach*, Beijer Discussion Paper Series # 208, to be submitted to Journal of Environmental Economics and Management.

Walker B., Pearson, L., Harris, M., Mäler, KG., Li, CZ., and R. Biggs (2007) *Incorporating Resilience in the assessment of Inclusive Wealth: An example from South East Australia*, Beijer discussion paper 209, to be submitted to Environmental and Resource Economics.

Mäler, K.-G., S. Aniyar, and Å. Jansson (2008), *Accounting for ecosystem services as a way to understand the requirements for sustainable development* (2008), accepted for publication in PNAS (Proceeding of the National Academy of Science

Mäler, K.-G., S. Aniyar, and Å. Jansson (2008), *Accounting for ecosystems* (2008), accepted for presentation at EAERE annual conference in June, and will after that be submitted to ERE.

Mäler, K.-G. 2008. *Sustainable Development and Resilience in Ecosystems*, Environmental and Resource Economics 39:17-24

Mäler, K.-G. and S. Aniyar in prep. *Accounting for ecosystems*. Book manuscript.

Memberships in professional associations and other activities:

- Swedish Economic Association
- American Economic Association
- European Economic Association
- European Association of Environmental and Resource Economists
- Member of the Committee on the Prize in Economic Sciences in Memory of Alfred Nobel 1981 -1994
- Past member of the Swedish Council of Economic Advisers
- Member of the Scientific Advisory Council of the foundation Baltic Sea 2020 (Björn Carlsons Östersjöstiftelse)

Seminars and symposium presentations

- K.-G. Mäler gave a keynote speech at a meeting beginning of September 2008, on environment and economics in Copenhagen, initiated by the Danish Council of Economic Advisers and with participation of several government members, on sustainability and ecosystems.
- K.-G. Mäler is invited to give a talk on management of ecological services at the first larger meeting the French government is organizing after they take over the chair of EU. The meeting will be in Paris, in the end of September

Other:

- K.-G. Mäler has been asked to write an overview of trade and ecosystem services for the Swedish government's commission on globalisation. The report will be finalised in September 2008.
- K.-G. Mäler has taught a PhD course for graduate students at the University of Pretoria during spring 2008.
- Visiting scientist at University of Pretoria, South Africa, during spring 2008.

Ingela Ternström

Researcher, PhD (Economics)

Research focus:

My research focuses on the way relatively small groups of people manage shared natural resources, especially in response to change and especially regarding the institutional structures that control their behaviour, such as:

- Institutional aspects of common-pool resource management, with theoretical and empirical analyses of factors that affect cooperation among resource users (e.g. leadership, group composition, income level and income distribution).
- Understanding how informal groups respond to external disturbances, with special focus on the role of leadership in developing and maintaining institutions.
- The effect of HIV/AIDS on local natural resource management.

At Beijer since: August 2002

Seminars and symposium presentations:

- RESILIENCE 2008, Stockholm April 14-17, 2008, poster presentation: *Leadership in common-pool resource systems: Why, who and how?*
- Nordic Conference in Development Economics, Stockholm June 16-17, 2008, paper presentation: *Leadership and Coordination in Common-Pool Resource Management.*
- 16th Annual Conference of the European Association of Environmental and Resource Economists (EAERE), Gothenburg June 25 – 28, 2008, paper presentation: *Leadership and Coordination in Common-Pool Resource Management.*
- 12th Biennial Conference of the International Association for the Study of Commons (IASC), two papers presented: i) *Leadership, Coordination and Cooperation in Common-Pool Resource Management*, ii) *HIV/AIDS – The True Tragedy of the Commons? Exploring the Effects of HIV/AIDS on Management and Use of Local Natural Resources.*

Commissions:

- External reviewer for Sustainable Development Policy Institute's research report series.
- External reviewer for the Journal of Institutional Economics.
- External reviewer for SANDEE.

Other:

- Organizer (together with Therese Lindahl and Anne-Sophie Crépin) of the PhD course The Economics of the Environment, The Stockholm Doctoral Course Program in Economics, Econometrics and Finance (SDPE), spring 2008.
- Lecturer at the PhD course The Economics of the Environment, The Stockholm Doctoral Course Program in Economics, Econometrics and Finance (SDPE), spring 2008.

Max Troell

Researcher, Associated Professor (Ecology)

Research focus:

Key words: Environmental impacts and sustainability of Aquaculture, Coastal Ecosystems, Ecosystem Services, Ecosystem Functions, Biodiversity, Resilience, Integrated Aquaculture, Mangroves.

Main interests: Investigate linkages between capture fisheries and aquaculture; identifying resource dependence and externalities associated with aquaculture production; estimate ecological basis for valuation of mangrove ecosystems, with special emphasis on the interaction with shrimp aquaculture; develop aquaculture techniques built on ecological engineering; studying biodiversity and resilience in temperate coastal habitats and the generation of ecosystem goods and services.

At Beijer since: 1998

Publications:

Robertson-Andersson, D.V., M. Potgieter, J. Hansen, J. Bolton, M. Troell, R.J. Anderson, C. Halling, T. Probyn (2008). *Integrated seaweed cultivation on an abalone farm in South Africa*. Journal of Applied Phycology. 1573-5176 (Online)

Soto, D., J. Aguilar-Manjarrez, J. Bermudez, C. Brugere, D. Angel, C. Bailey, K. Black, P. Edwards, B. Coste-Pierce, T. Cchopin, S. Deudero, S. Freeman, J. Hambrey, N. Hishamunda, D. Knowler, W. Silvert, N. Marba, S. Mathe, R. Norambuena, F. Simard, P. Tett, M. Troell, A. Wainberg (2008). *Applying an ecosystem-based approach to aquaculture: principles, scales and some management measures*. In: FAO Fisheries and Aquaculture Proceedings 11, Soto, D. (Ed). FAO.

Buschmann, A.H., T. Chopin, A. Neori, C. Halling, M. Troell, M. C. Hernández-González, C. Aranda (2008) *Ecological engineering in aquaculture: towards a better waste management in Western World mariculture.* In: Encyclopedia of Ecology, Jorgensen, S.E. and Fath. B. (Eds.), Amsterdam. Elsevier, 3120 p.

Chopin, T., S.M.C. Robinson, M. Troell,, A. Neori, A. Buschmann, and J.G. Fang (in press) *Ecological Engineering: Multi-Trophic Integration for Sustainable Marine Aquaculture*. In: Encyclopedia of Ecology, Jorgensen, S.E. and Fath. B. (Eds.), Amsterdam. Elsevier, 3120 p

Troell, M. 2008. *Integrated Mariculture in the tropics*. In: Soto, D. (Ed.) Integrated mariculture: global reviews. FAO Fisheries Technical Paper.

Rönnbäck, P., N. Kautsky, L. Pihl, T. Söderqvist, M. Troell and H. Wennhage. (2007). *The importance of ecosystem services and biodiversity – a Swedish coastal perspective*. Ambio, 36(7): 534-544.

Hughes, T. P., L. H. Gunderson, C. Folke, A, H. Baird, D. Bellwood, F. Berkes, B. Crona, A. Helfgott, H. Leslie, J. Norberg, M. Nyström, P. Olsson, H. österblom, M. Scheffer, H. Schuttenberg, R. S. Steneck, M. Tengö, M. Troell, B. Walker, J. Wilson, B. Worm (*2007) Coping with ecological uncertainty: Adaptive Management of Natural Resources*. Ambio, 36(7): 586-592.

Rönnbäck, P., N. Kautsky and M. Troell. 2007. *Ecosystem services – free of cost but priceless in worth. Food, raw materials and energy: A knowledge journey in the spirit of Linnaeus*. pp 71-81. FORMAS

Neori, A. and M. Troell (2007). *Ecologically balanced aquaculture for the rehabilitation of Asian fisheries*. World Aquaculture Magazine, 38(4), December 2007.

Seminars and symposium presentations:

- Presentation *Ecological and socio-economic trade-off analysis and comparison of status quo, conventional sewage treatment, constructed mangrove wetlands for sewage remediation and strategic reforestation/conservation*. Within PUMPSEA- Peri-urban mangrove forests as filters and potential phytoremediators of domestic sewage in East Africa. EU- SIXTH FRAMEWORK PROGRAMME PRIORITY.

Commissions:

- Examiner Master Thesis: Berggren, A. 2007. *Aquaculture in Sweden – towards a sustainable future?* Natural Resource Management, Governance and Globalisation, CTM, SU.
- Referee work during the report period: Journal of Aquaculture, Journal of applied Phycology, The Western Indian Ocean Journal of Marine Sciences
- Member of the evaluation committee for grant applications for IFS (International Foundation for Science).
- Swedish coordinator for joint bilateral research programme: Integrated culture of abalone and seaweed in land-based systems. Sida/SAREC.
- Member of the MASMA Programme Committee (Marine Science for Management), Programme within the Western Indian Ocean Marine Science Association (WIOMSA) (Funded by Sida/SAREC).
- Member Editorial Board for journal "Reviews in Aquaculture", Blackwell Publishing.

Teaching and Training:

- Course leader and lecturer at *Ecological systems for economic management*, a 5 credit course held 4 weeks in May at Beijer Institute. Run within the Sida financed cooperation with Gothenburg University.
- Teaching and supervising students- 10 credit C-level graduate course (Tropical ecology; Management of aquatic resources in the tropics) Dep. of Systems Ecology, Stockholm University and Uppsala University
- Supervision of PhD students and Master students at Department of Systems Ecology, Stockholm University; Cape Town University, South Africa.
- Lecturer at *Tropical coastal resource management*, Swedish University of Agricultural Sciences, Uppsala, 2007.
- Lecturer at *Systemekologi och naturresursförvaltning*. Within the program Hållbar samhällsutveckling (HSU) (Sustainable Development), Stockholm University, 2007.

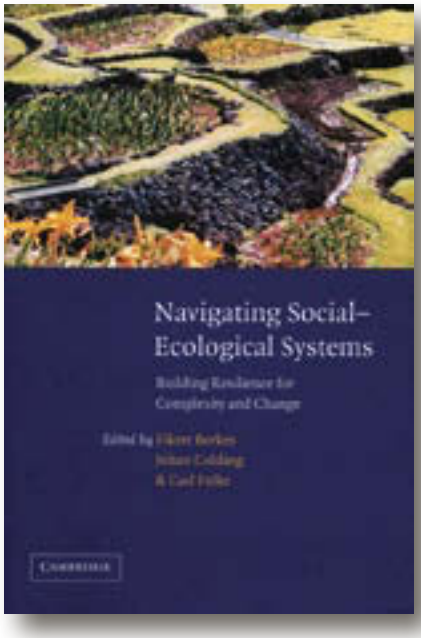
Publications

Books

During the year a new textbook for Natural Resource Management, Resource Conservation and Ecosystem Management, as well as other related or more specialized courses, has been finalized. The book *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World* is edited by Terry Chapin, Gary Kofinas and Carl Folke for Springer Verlag, with additional contributions from Nick Abel, Robert Ahrens, Fikret Berkes, Oonsie Biggs, Steve Carpenter, Morgan Grove, Roz Naylor, Per Olsson, Evelyn Pinkerton, Mark Stafford Smith, Will Steffen, Fred Swanson, Brian Walker, Carl Walters, and Oran Young.

Most textbooks on natural resource and ecosystem management are dominated by a steady-state view that interprets change as gradual and incremental and disregards interactions across scales. The purpose of the Principles of Ecosystem Stewardship textbook is to provide a new framework

for resource management—a framework based on the necessity of managing ecosystem services in a world dominated by uncertainty and directional change. The book links recent advances in the theory of resilience, sustainability, and vulnerability with practical issues of ecosystem management.



The Beijer book *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by Fikret Berkes, Johan Colding and Carl Folke has been released in paper this spring 2008, by Cambridge University Press.

Two new books are in preparation, *Governing Social-Ecological Systems: Adapting to the Challenge of Global Environmental Change*, edited by Emily Boyd (Oxford University) and Carl Folke for Cambridge University Press, and *Accounting for Ecosystems* by Karl-Göran Mäler and Sara Aniyar.

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